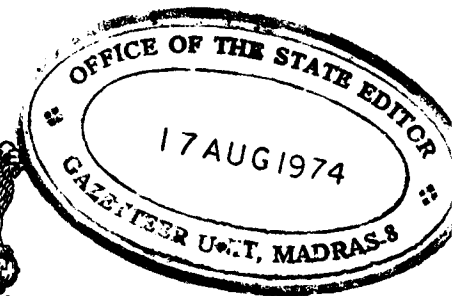


MAHARASHTRA STATE GAZETTEERS

FAUNA

MAHARASHTRA STATE GAZETTEERS



Government of Maharashtra

FAUNA

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CONTENTS

	PAGE
PREFACE	
INTRODUCTORY NOTE	i
CHAPTER 1 : FISHES	1
CHAPTER 2 : MARINE INVERTEBRATES ..	67
CHAPTER 3 : INSECTS	119
CHAPTER 4 : SPIDERS	295
CHAPTER 5 : BIRDS	307
CHAPTER 6 : MAMMALS	351
CHAPTER 7 : REPTILES	371
CHAPTER 8 : AMPHIBIA	389
CHAPTER 9 : LAND AND FRESH WATER INVERTEBRATES	395
INDEX	425

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PREFACE

THE HERITAGE OF FAUNA OF MAHARASHTRA as that of India is dwindling over the passage of time. Knowledgeable persons have expressed fears about the impending extermination of a number of wonderful wild animals in the State such as tiger, leopard, blackbuck, spotted deer, sambar and some other genera of carnivores. This has mainly been due to the clash of human interest with that of wildlife. Shri G. V. Bedekar has very aptly and fervently opined in the Introductory Note that :

‘ Man has power to conserve as well as to destroy. Are we to lose for ever these wonderful creatures for no fault of theirs, when with some effort it is possible to avoid their extermination and at some cost it is possible to ensure their continuance in numbers? Any person having to deal with any aspect of fauna, cannot fail to be disturbed by the destruction of wildlife that is going on and the grim prospect of extermination of many species. The world has already lost by extinction scores of species, and enough is known at the present time regarding the manner of damage to wildlife and the measures for conservation of wildlife to enable us to preserve it.’

It is therefore of considerable interest to study the variegated wildlife in the State in several aspects. It was with this intention that this department decided to publish this Volume which is the second in the General State Series. In the nature of things the Bombay Natural History Society was requested to prepare the entire write-up of the Volume. The Chairman of the Society accepted the work and completed it within a short period. It is needless to say that the scholar associates of the Society have contributed valuable

knowledge in this branch of science. I have no doubt that experts and students of this subject as also knowledgeable citizens will appreciate this scholarly work which has also opened scope for further studies.

I may add here that the Index of only the Family names has been prepared chapterwise.

I am very much thankful to all the scholar associates of the Bombay Natural History Society who have contributed various articles for this Volume and who were associated with every stage in the printing and publication of this Volume, including proof correction, etc. I am particularly indebted to Shri G. V. Bedekar, I.C.S. (Retd.), who co-ordinated and supervised the work, and also wrote the Introductory Note. I am also thankful to the Joint Editor Shri K. K. Chaudhari, M.A.; the Statistical Officer, Dr. V. N. Gurav, M.A., Ph.D., as also Sarvashri M. H. Ranade and P. N. Narkhede and other members of the staff of this department, for the assistance rendered by them in the various stages of the publication.

My thanks are also due to Shri S. A. Sapre, Director, Government Printing and Stationery and Shri R. B. Alva, Manager, and other staff of the Government Central Press, Bombay, for execution of the printing work.

Bombay
June 2, 1974

B. G. KUNTE
Executive Editor and Secretary

INTRODUCTORY NOTE

THE MAIN OBJECT OF THIS NOTE is to introduce to the reader the Fauna Volume, which is a special feature of the current series of Maharashtra State Gazetteers. The usual arrangement of the India as well as State Gazetteers has been to devote the initial volumes to general topics and to follow these with a series of alphabetical volumes in case of India and district volumes in case of the State Gazetteers. Thus the subject of fauna forms Chapter 5 of Volume I of the 1965 edition of the Gazetteer of India, relating to 'country and people'. In the 1909 edition of that Gazetteer, the first volume was designated 'descriptive' and Chapter 5 was headed 'zoology'. For the revised edition of the Maharashtra State Gazetteers, it was proposed originally to publish general State volumes on these subjects: Botany, Geography, History, People and their Culture, Language and Literature, Public Administration. The Fauna Volume was added subsequently.

2. *Genesis of the volume.*—It was a happy decision taken by the Editorial Board of the Maharashtra District Gazetteers (Revision) in October 1964 to bring out a volume of about five hundred pages on the Fauna of Maharashtra. When the Secretary of the Editorial Board approached the Bombay Natural History Society in October 1964 with an inquiry whether the Society would undertake the compilation of this volume, the Society readily agreed to the proposal in principle; and in December 1964 it was provisionally decided to have eight parts devoted to different animal groups, and to request contributors (whose names were suggested) to undertake the work. The Executive Committee of the Society entrusted to the writer the work of general supervision of the compilation. Eventually, a meeting of the proposed contributors to the Fauna Volume was held in March 1965, when a scheme for compilation of the various parts was approved along with the revised list of contributors and the tentative allocation of approximate pages to each part. The number of parts was increased from eight to nine, and the general scheme of each part was also indicated. The first contribution to be received was the part on Spiders which, however, far exceeded the pages allocated, and involved a great deal of condensation and editing. The next part received in the middle of 1967 was that on fishes and as the arrangement of this part seemed admirable, it was suggested to the other contributors to draft their parts on the same lines. A meeting of contributors was held in February 1968, to review progress and to consider the question of illustrations.

As the work progressed, numerous difficulties became apparent. The available material was scattered over many books and journals, and there was no time to undertake fresh surveys or inquiries for this volume.

3. *Mode of presentation.*—In the India Gazetteer 60 to 70 pages are devoted to the Chapter on 'Zoology' or 'Fauna'. The references

to fauna in the general State volumes of Bombay, Central Provinces and Hyderabad were somewhat limited; and so were the references in most district volumes. In presenting this volume, it is realised that there are many gaps in our knowledge of the Fauna of Maharashtra, and that there are many errors and omissions in the material. The main purpose has, however, been to present to the reader without undue delay all the material that could be readily collected, so that readers may draw attention to the lacuna and suggest improvements. Each part dealing with a group of animal life is arranged broadly into three sections: the first being introductory, the second giving the taxonomic list of the animal forms and the third giving short notes on some important species found in the State of Maharashtra. As regards Marathi names, some have been given but as is to be expected, there are no Marathi names for many species, and among names that are current, there is a great deal of confusion, because the same species is known by different names and the same Marathi word may be used to denote different species in different areas. In order to avoid confusion, Latin names have been used in the text. In the introduction to his book 'A CLASSIFICATION OF LIVING ANIMALS' Lord Rothschild states that innumerable examples could be given of "confusion by the use of vernacular as opposed to Latin names. Where I live, the hedgehog, *Erinaceus*, is sometimes called an urchin. Where I often work, an urchin is called *Echinus*. But members of the order *Echinoida* (sea urchins), to which *Echinus* belongs, are also called sea hedgehogs, egg urchins, sea eggs, egg-fish, buttonfish, sea thistles, needle shells, chestnuts, burrs, spikes, zarts, porcupines and whore's eggs". It is however useful to the general reader to know the Marathi names of the more common species, and it is for this purpose that Marathi names should be given by either adopting apt names out of those current or framing suitable words.

The Bombay Natural History Society would be grateful to receive from readers, particularly teachers and students of universities in Maharashtra, suggestions for improvement of the material furnished in this volume, and precise information as to animal form, name of the village, taluka and district, and the time of the year along with the local name if known. (Communications may be addressed to the Curator of the Society, Hornbill House, Bombay-400 001). There is considerable scope for identification and detailed studies of the genera and species included in the volume and others, and the publication of this volume may be taken as an opportunity to teachers and students and citizens interested in the fauna of Maharashtra to check the species and the information available about them with the view to building up precise records.

4. *Number of species in Maharashtra.*—Before giving a description of the geography of the State, it would be interesting to know the approximate number of various animal forms of Maharashtra, as

compared to those of India and the world. A few figures are given below by way of illustration :

Animal form	World Total	Indian Total	Maharashtra Total
Mammals ..	4,500	320	85
Reptiles ..	5,000	440	100
Birds ..	8,600	1,200	500
Insects ..	7,00,000	50,000	30,000
Fishes ..	23,000	1,400	600

5. *Revenue and Forest Divisions.*—Maharashtra State was formed on 1st May 1960, as a result of bifurcation of the composite Bombay State that itself was created in 1956 by adding, to the old Bombay State, the territories of Saurashtra, Kutch, Vidarbha (from Central Provinces) and Marathwada (from Hyderabad State), and by excluding four districts of the old Bombay State, namely, Belgaum, Dharwar, Karwar (North Kanara) and Bijapur (which went to Mysore State). The present State of Maharashtra has 26 Revenue Districts, divided broadly into three regions — (i) Western Maharashtra Region with four Konkan Districts (Thana, Greater Bombay, Kolaba and Ratnagiri), six above-Ghat Districts (Nasik, Ahmednagar, Poona, Satara, Sangli and Kolhapur), two Tapti Valley Districts of Dhulia and Jalgaon (formerly known as West and East Khandesh), and the thirteenth plains District of Sholapur; (ii) Vidarbha Region, comprising the four 'Berar' Districts of Buldhana, Akola, Amravati and Yeotmal and four eastern Districts of Wardha, Nagpur, Bhandara and Chandrapur (former Chanda), and (iii) Marathwada Region comprising five Districts of Aurangabad, Bhil and Osmanabad, in the west and Parbhani and Nanded in the east. Each revenue district forms usually a Forest Division except that such districts as have little or no forest have no separate forest divisions, and the districts with good forests may each have two or more forest divisions. The 26 Revenue Districts have thus 36 territorial forest divisions. Three Revenue Districts without a forest division are, Greater Bombay, Sholapur and Sangli, while the five Marathwada Districts have only two forest divisions (Nanded and Aurangabad). Nine districts having one forest division each are : Kolaba, Ratnagiri (Sawantwadi forest division), Ahmednagar, Satara, Kolhapur, Nagpur, Wardha, Akola and Buldhana. The remaining nine Revenue Districts have 25 forest divisions as shown in brackets: Thana (3), Nasik (2), Dhulia (2), Jalgaon (2), Poona (3), Bhandara (2), Amravati (3), Yeotmal (2) and Chandrapur (6).

The details of forest divisions are relevant as habitat of wild animals that can live only in forest areas. A reference is requested to the attached maps of Maharashtra State showing revenue and forest divisions.

6. *Physiography and rainfall.*—The State of Maharashtra has an area of about 1,20,000 sq. miles or 3,00,000 sq. km which is just over 10 per cent of the area of the Indian Union. The State forms a major part of Peninsular India with Arabian Sea in the west, the

States of Gujarat and Madhya Pradesh (M.P.) in the north; M.P. in the east, and Goa, Mysore and Andhra Pradesh in the south. The State lies between 15.5° and 22° of north latitude and 72.6° and 81° of east longitude. The actual sea coast extends from the Goa border at Terekhol Creek in the south to about 10 km north of Dahanu (or 130 km north of Bombay) i.e. roughly from 15.6° to 20.2° of north latitude, giving a seaboard (on the Arabian Sea) of about 4.6° or a distance of about 600 km (which with the creeks and estuaries would go up to about 700 km). The main physical feature of the State is the range of mountains called the Western Ghats (Sahyadri) which runs north-south, almost parallel to the coast at a distance of 50 to 80 km, and which has an average elevation of about 900 metres. The road and rail passes in this range, such as on Bombay-Agra and Bombay-Poona rail lines and roads, are at a height of about 600 to 700 metres, but there are peaks rising to 1,500—1,640 metres (Kalsubai 1640 m). At right angles to the Western Ghats, i.e. running west-east are four ranges of hills; first the Satpura range (between Narbada and Tapi basins) which forms the northern boundary of Dhulia and Jalgaon Districts of the State. The second is the Ajanta hills range, which lies to the south of the Tapi basin, and north of the Godavari basin. The third range is the Balaghat range, which lies to the south of the Upper Godavari basin and to the north of Bhima River basin. Last is the Mahadeo Hills range which separates the Bhima basin from the Upper Krishna River basin. Except for portions of the plains District of Sholapur, all districts of the State have hills, large and small, and the river basins are not large alluvial plains, but valleys mostly narrow. The Deccan plateau slopes gradually away from the Western Ghats and is made of basaltic rock overlaid with lavas.

The rainfall pattern can be best represented by means of strips of land running north-south, with varying east-west width. The first strip is the coastal area of Konkan which has a rainfall of 200 to 250 cm; to its east is the second strip that includes the mountain range of Western Ghats with a rainfall of 375 cm at places like Igatpuri, Lonavla and Helwak situated on the road passes from the Konkan to the Deccan plateau. The plateau of Mahabaleshwar which is at a height of about 1,350 metres, and is not far from the Arabian Sea as the crow flies has a rainfall of about 600 cm. The next, i.e., third strip of land adjoins the Western Ghats on the east where the paddy crop is raised and where the rainfall decreases from 375 cm to about 100 cm as one goes east, within a distance of 30 to 40 km. The fourth strip includes Poona and has a rainfall of 60 to 80 cm. Thus within a distance of about 65 km from Lonavla to Poona the rainfall drops sharply from 375 cm to about 60 cm. The last or fifth strip is that of "rainfall shadow", which includes scarcity areas of Ahmednagar, Poona and Satara Districts, and has a rainfall of only about 50 cm on an average. Some pockets in this shadow zone have still less rainfall. As we go eastward from this zone the rainfall increases: first in the zone of

50-70 cm of rainfall which includes Aurangabad; next in the 80-100 cm rainfall zone which includes Parbhani and Nanded Districts; and lastly, the 100-200 cm rainfall zone which includes Nagpur, Bhandara, Wardha and Chandrapur Districts of Vidarbha, that have excellent forests.

7. *Forests and wild life.*—The rainfall pattern determines the extent and nature of the forests. The Western Ghats have moist deciduous forests, the best forests of this class being in Sawantwadi, south of Ratnagiri. This forest belt is bounded on east and west by dry deciduous forests e.g. in Thana, Nasik, Satara and Kolhapur Districts. Beyond the belt of dry deciduous forests are the thorn or scrub forests, which at one time covered the eastern parts of the above-Ghat Districts but which have recently yielded to extension of cultivation in most areas; or to grazing by cattle and browsing by sheep and goats. The Satpura forests are in the northern areas of Dhulia and Jalgaon Districts, while the Melghat forests are in the north of Amravati District. The best forests are in Chandrapur District (formerly Chanda); with rich forest wealth including teak, bamboo, anjan, tembhurni and several vegetations of commercial and medicinal value.

The area of forests in Maharashtra State is roughly 61,000 sq. km or 21 per cent of the State's surface area, which is less than the optimum. In the present context, forests provide home for wild animals, particularly the deer, antelope, and wild pig, and the carnivores which live on the former. The best forests in Yeotmal-Chandrapur area of Vidarbha also have plentiful wild life. The forests of the Western Ghats and of the Satpura range are of some importance for forest purpose, but have little wild life left. The forests of the Western Ghats have perhaps been denuded almost completely of wild life. Reference to the District Gazetteers issued in the 19th century and the Hyderabad State Gazetteer issued in 1909, will show that a large variety of wild life existed in almost all the districts, and areas which constitute the present Maharashtra State. The first volume of the India Gazetteer of 1965 mentions, in Chapter 5, the reduction or disappearance of the Crocodile (p. 254), the Pinkheaded Duck (p. 258), the Great Indian Bustard (p. 261), the Cheetah (p. 273), the Asiatic or two-horned Rhinoceros (p. 274) and the Kashmir Stag (p. 275). The revised editions of the Gazetteers of Poona and Satara Districts, published in 1954 and 1963, point out that the Tiger which was once plentiful in these districts, particularly in the Ghat areas, and on the Mahabaleshwar Plateau, has become rare. The leaflet issued by the Forest Department of the Maharashtra Government on the occasion of the wild life week in October 1968 points out that the larger wild animals have suffered in the last decade a serious reduction, and that the number of tigers is reduced to such an extent that there is anxiety about its total disappearance. It is stated in the leaflet that during 1966 and 1967 only 22 and 19 permits were issued, respectively, for shooting tigers, but actually many more must have been killed. It is also stated in the leaflet that Nilgai and Blackbuck

have practically disappeared from all parts of the State, and that Sambar, Chousinga and Chinkara which were plentiful at one time have become rare in several parts of the State. It is necessary to analyse and study the factors that threaten the survival of birds and animals in order to obtain an idea of their quantitative effect. The factors may be enumerated serially as under :

- (1) Extension of cultivation, and reduction of forest areas and grasslands.
- (2) Misuse of crop protection guns for killing of birds and animals.
- (3) Large scale poaching for meat, skins, feathers, etc. by villagers and for organised trade.
- (4) Disturbance of wild life in their natural habitat owing to increased human activities for collection of firewood, leaves, forest produce, etc.
- (5) Use of pesticides and poisons.
- (6) VIP shoots, shoots on permits and their consequences.

The first factor, namely, extension of cultivation due to pressure of population has been accepted in the past as both inevitable and inexorable; but time has now come to consider if reduction of forest areas should be halted altogether and reliance be placed on intensive cultivation rather than on extension of it by destruction of forest areas (actual and potential).

The second factor is of vital importance in the villages adjoining forests and — with modern means of transport — in all villages and towns within motoring distance. It cannot be denied that crop protection guns, licences for which have been issued by thousands in the last two decades, are used for illicit killing of birds and animals, mainly for obtaining meat. There is no restriction in the licence about the time and the place for carrying these weapons; nor the manner in which they may be used. They are carried and used at all times of the year irrespective of the fact that there is no crop to be protected. They are entrusted to any person who is able to use them, and are carried to forests in the neighbourhood. Illicit arms also come out to form a line with licit guns. Parties of villagers are formed to track down and kill wild animals, and even a solitary wild boar or sambar cannot escape from such parties which may chase the animal for hours and days. The common deer, antelope and birds generally fall a prey to these guns, and there is no control over them. When the forest staff is off duty or having a holiday, these guns are brought out and used in forest areas. Most of the havoc caused in whatever forests remain after extension of tillage, can be ascribed to these guns. Apart from misuse of guns issued for crop protection, on the dwindling wild life left in forests, large scale poaching for meat, feathers and skins, is carried on — broadly by two agencies. The first is the agency of those who set up traps and nets or attack game at drinking places for private gain ; this includes those who traditionally follow these practices. The increase in population of the

country has been reflected in increased poaching by this agency, which also threatens game in so-called game reserves or wild life sanctuaries. The number of village people who live in forest villages or hamlets or clusters of huts in the heart of forests constitute a serious threat to wild life ; so do people who enter forests for collection of leaves, dry wood, minor forest produce, etc. Their number has increased to such an extent that wild life in forests is seriously disturbed. Such disturbance cannot but affect adversely breeding and particularly the care and survival of young ones. Organised trade in skins creates the other agency of poachers. The price of tiger skins has in the last two decades shot up ten times and though there is a ban on commercial export of tiger skins, it is not very difficult for visitors to purchase tiger or panther skins and to take them away as part of their baggage.

The increasing use of pesticides for protection of agricultural crops has some repercussion on animal life. The pesticides used are generally quite potent and destroy not only the insects against which they are aimed but also surrounding life such as rodents, reptiles, frogs and fishes which may absorb the poison through food or water or otherwise. The chemical and other factories located on creeks and river banks usually discharge their effluent into the nearby waters; and rarely care is taken to ensure that the effluent is harmless to aquatic life. Whenever a carnivore like the lion or tiger or panther clashes with interests of man or tries to live on his livestock such animal is doomed: it is destroyed sooner or later — either being declared vermin and openly shot or being poisoned quietly as revenge by owners of the livestock. There is no dearth of potent poisons for the purpose, and little can be done to save such carnivores.

Lastly come the organised shoots for dignitaries and VIPs as well as shoots allowed on permits. In case of the former, the dignitary himself may be content with a modest bag that complies with the game rules but the occasion may well be utilised by the entourage and others to take full advantage of the facilities provided and to bag as many trophies as possible. In case of shoots on permits, too, the same effect can be in evidence occasionally; and more animals would be shot than indicated by the records. In every such case, however, the villagers living in the neighbourhood who witness the shoots (for V.I.P.s or on permits) cannot help feeling why they should be deprived of the sport or trophies, merely because they are not rich or prominent and it is certain from experience that several animals are killed by people who see organised shoots, but cannot participate in them and who make their own arrangements for their share of trophies, human nature being what it is.

All in all, wild life is having a trying time, and fears have been expressed by knowledgeable persons about the impending extermination of such wonderful wild animals of India as the Tiger and the Panther. Already blackbuck, spotted deer, sambar and wild pig have been wiped

out in large areas of Maharashtra State, and the carnivores whose natural food is formed by them are bound to go the same way either directly or after clashing with human interests in some form or other.

8. *Wonders of wild life.*—It would be a sad day when wild life becomes rare or ceases to exist in Maharashtra State. Surely, human beings are not the only living creatures with rights upon this earth. Wild life once exterminated cannot ever be replaced; forests can be replanted, ruined buildings, palaces and temples can be restored or rebuilt, but it is beyond human power to replace extinct species. The generations to come will certainly blame those of their forefathers who allowed the great beauty and excitement of wild animals to disappear. Some wonderful features of wild life may be of interest to the general reader, to know what is at stake.

In the scale of creation of living beings, life has existed on this planet for about 3,000 million years and mammals have existed for 200 million years against man's span of less than a quarter million years. There are over one million species of animals and 3,500 of mammals, and the range of weight is from the Shrew of 10 gm to the Blue-Whale of 130 tonnes. Many marvellous faculties of animal life have been observed and described. It is known that in case of lions and elephants an 'auntie' may help at the birth of cub or calf and also remain present to take care of the young ones when the mother is away. Elephants are known to help not only the younger ones, but also comrades who have been wounded. The marvellous eyesight of eagles, vultures and falcons, is well known. An eagle can detect a fish from a distance of over 4 km. and a falcon is known to swoop on a small bird from a distance of over 2 km. Vultures have an uncanny way of detecting dead animals while hovering hundreds of metres high in the sky.

To equal these feats, man would need an eyesight that can read a newspaper headline at a distance of hundred metres. The power of smell of certain animals is phenomenal. It is reported that a polar bear scents seal blubber from a distance of 20 km. Elephants have a power of scent that can operate at 3 km. A Shark can detect by smell blood diluted to the extent of one part of blood in 50 million parts of water. The scenting powers of police dogs are well known. Dogs are also known to have a very acute sense of hearing, and can detect at some distance the sound of the engine of the master's automobile from amongst hundreds of similar motors. The homing instinct of dogs and cats is known to many people, but that of salmon and other fishes is wonderful. One can only guess how migratory birds travelling thousands of Kilometres over vast continents in our hemisphere are able to reach the same southern haunts for wintering and return to their usual abodes for nesting in summer. A human child has no such instinct whatsoever, and can get lost at a small exhibition or in a crowd. Many birds have a biological clock inside that enables them to know precisely when the sun is going to rise, and to start their activities accordingly. The thrift, planning and

co-operative living of ants, bees and wasps are models for any human community. The toughness of certain forms of animal life is noteworthy; man can live only a few days without water and only a few weeks without food. Camels can live without water for a month. A rattle snake is known to live without food for one year. Wild animals such as blackbuck in the Runn of Cutch — even bulky animals like the lion — are known to adapt themselves to arid conditions, and to live without water altogether or from one spell of rains to the next. The firefly produces light almost without heat, and man has not yet been able to achieve anything even approaching it. The spider's thread can be as thin as a millionth of one centimetre, and several strands have to be brought together before they become visible to the human eye. The strength and agility of wild cats is proverbial. A tiger of about 200 kg weight can without a start jump vertically about 6 metres and across about 12 metres; his own length without the tail being less than 3 metres. Such feats are just impossible for human beings. The tiger is known to have moved the carcass of a 550 kg bull a distance of more than 400 metres over rough ground, while a leopard has been known to put a 140 kg giraffe (killed by it) high up in a tree. The speeds reached by animals are no exception to their other powers; a lion can reach in his charge a speed of 80 km (50 M.P.H.) per hour, and bulky animals like the buffalo and rhinoceros weighing around a tonne can reach speeds of 40 km per hour (25 M.P.H.). Even the sloth-bear can run at about 50 km per hour (30 M.P.H.) for a short distance and a porpoise can exceed the same speed in water without difficulty. The wolf is noted for its stamina, and can move at 25 to 30 km per hour (15 to 20 M.P.H.) for 12 hours during the night. Finally, a hawk diving for its prey may reach a speed of 400 km per hour.

Man has power to conserve as well as to destroy. Are we to lose for ever these wonderful creatures for no fault of theirs, when with some effort it is possible to avoid their extermination and at some cost it is possible to ensure their continuance in numbers? Any person having to deal with any aspect of fauna, cannot fail to be disturbed by the destruction of wild life that is going on and the grim prospect of extermination of many species. The world has already lost by extinction scores of species, and enough is known at the present time regarding the manner of damage to wild life and the measures for conservation of wild life to enable us to preserve it.

9. *Tiger in Maharashtra State.*—Let us consider the case of survival of the tiger in Maharashtra State. The area comprising every district of the present Maharashtra (with the exception of Sholapur and Osmanabad) had, about a century ago, plenty of tigers. They were known to occur in large numbers in certain mountains and hilly areas. Today they have totally disappeared from such districts as Thana, Kolaba, Nasik, Ahmadnagar, Poona, Satara and Kolhapur. A tiger census in Maharashtra State during 1961-62 showed a total of 467 animals, comprising

329 males, 101 females and 37 cubs. There has been reduction in tigers in recent years as conceded in the wild life week leaflet of October 1968. In fact, a recent inquiry shows that tigers exist in small numbers only in a few areas viz. Sawantwadi Region of Ratnagiri District, Kinwat Taluka of Nanded District and in Bhandara, Yeotmal and Chandrapur Districts. Stray animals might be reported from or might be rumoured to exist in some other areas, but such reports and rumours need to be discounted in the context of regular survival of the tiger. The following extracts from old district gazetteers (year of publication and page) will throw light not only on tiger population of different areas, but on a number of connected matters :

(a) *Ratnagiri and Sawantwadi* (1880, p. 44) — Tiger is scarce and is seen only in dense cover of Sahyadri.

(b) *Kolaba and Janjira* (1883, p. 35) — There are always one or two tigers in the district. The Sahyadri range has almost always a tiger.

(c) *Thana* (1882, p. 44) — Though becoming rare, the tiger is found at all seasons in the forests on the slopes and valleys of the Sahyadri and the principal detached ranges and hills, e.g. Tungar, Mahuli and Takmak. About 1774 the Salsette hills were infested with tigers which sometimes became man-eaters. Before the B.B.C.I. (now Western) railway company constructed the lines and fences, tigers were common in the mangrove swamps of Dahanu and Mahim (Palghar) and the Karand — covered plains near Boisar. Man-eating tigers were common because boys tending cattle tried to drive off tigers attacking cattle and were themselves seized. During the five years ended 1878-79, 53 human beings and 935 heads of cattle were killed by tigers and 99 tigers were slain.

(d) *Khandesh* (1880, p. 30) — In 1822, wild beasts killed 500 human beings and 20,000 heads of cattle. Within 3 months of 1823, 60 tigers were killed. Upto 1860 Khandesh was the largest stronghold of tigers. A special tiger destruction unit assisted the police. Owing to spread of tillage and increase in population the tiger is no longer found in the plains. But he still roams in all the hilly tracts. Even there the numbers are declining. During the five years ended 1879, 16 human beings and 391 heads of cattle were killed by tigers and the 'return' shows that the number of tigers slain annually declined from 15 in 1866-70 to 10 in 1871-80.

(e) *Nasik* (1883, p. 21) — The tiger was within the last twenty years common in Baglan, Malegaon and in the west of the district along the line of the Sahyadri hills. In the rains, tigers still move among the hills. But in the other parts of the district, the thinning of the forests, the spread of tillage and destruction of his natural food pig and sambar, have almost entirely driven the tiger away. During the five years ending 1879, only 13 tigers were killed.

(f) *Ahmednagar* (1884, p. 27) — Big game is almost unknown. About twenty years ago, a bison (gava) was shot in the forest above Igatpuri in Nasik. An occasional tiger is heard of in the hills about Harishchandragad.

(g) *Poona* (1884, p. 69) — The spread of tillage and the increase in population constantly reduce the number of wild animals. The tiger is found only in the Sahyadris and even there in small numbers. During the eight years ending 1882, 4 human beings and 175 cattle were killed by tigers and 15 tigers were slain, for which rewards were given by government.

(h) *Satara* (1885, p. 38) — In the west, chiefly in Koyna valley, . . . is found the tiger. It is not so numerous as to do much damage, though occasionally man-eating tigers appear Of late years bison have increased in the forests on Mala pass hills. A bull bison was shot on Mahabaleshwar in 1873.

(i) *Kolhapur* (1886, p. 31) — The tiger is found in the hills of . . . , in Bhudargad, in Panhala and . . . in Vishalgad. About two tigers on an average are slain every year. During the five years ending 1881, loss due to tigers was 83 human beings and 2,138 cattle.

(j) *Yeotmal* (1908, p. 10) — The Berar Gazetteer of 1870 states "Tigers are so numerous that it is dangerous to travel on foot at night through three-fourths of the district." Tigers though no longer numerous are found in most of the largest reserves; they live largely on sambar, chital and nilgai.

(k) *Wardha* (1906, p. 6) — Tigers are now only heard of on the Chanda border, where they occasionally kill cattle during the rains. The forests of Wardha are isolated and do not afford sufficient harbour for these animals.

(l) *Buldhana* (1910, p. 16) — The tiger is found though not frequently in the Satpura and rarely in Ajantha hills.

(m) *Akola* (1910, p. 8) — Now (1909) cultivation has spread so much that wild animals have become scarce. A tiger may be found sometimes near old forts in the north.

(n) *Aurangabad* (Hyderabad State Gazetteer, 1909, p. 194) — Tigers are occasionally found.

(o) *Parbhani* (*ibid.*, p. 215) — In the jungles of Jintur, Hingoli and Kalamnuri tigers are found.

(p) *Nanded* (*ibid.*, p. 224) — In Hadgaon, tigers are found.

(q) *Bhir* (*ibid.*, p. 233) — Tigers are occasionally met with in some of the wooded hills.

The above extracts clearly establish the causes of reduction of tigers during the nineteenth century. The extract at (c) will indicate that the area that now forms Greater Bombay had in the eighteenth century its share of tigers, including man-eaters. The extract at (h), which

mentions Koyna valley as a haunt of tigers, underlines another cause of reduction of wild life; the valley is now a lake due to construction of the Koyna dam. Such storage reservoirs, in remote forest areas, have also led to depletion of wild life, but this is inevitable.

10. *Tiger population.*—Let us consider statistically the variation of a tiger population, and the factors involved. It is obvious that the only addition to a given tiger population in an isolated region can occur solely by survival of cubs; and that over a period of years, the population will decrease if the number of deaths from all causes exceeds the number of cubs surviving to adulthood. Normally tigresses start to breed at the age of 3 years and may breed every other year, until about the age of 13 years. It is known that after the age of about 14 years, wild lions do not survive, because having blunt teeth and/or lacking the strength to hunt or having other infirmity, they are killed by hyenas wild dogs etc. The same upper age limit may reasonably be held to apply to tigers also. A tigress which in season seeks the male, would thus breed, during her reproductive age about 4 or 5 times, assuming no dearth of male tigers for mating. The number of cubs in a litter is usually 3 to 4 but cub mortality is high, due to hyenas, wild dogs, birds of prey and even ants, apart from disease, and poachers. The size and frequency of litters of course depend on stress of living and availability of food and must be affected by 'disturbance' referred to in para. 7 above. Two cubs may thus reach adulthood safely, and start hunting on their own. Even at this stage, casualties occur, owing to inexperience or ineptitude of the probationer and a young tiger may suffer death when trying to kill formidable animals like the wild boar, buffalo, etc. It may be assumed that one tigress in course of her reproductive life span of 10 years will make an addition of not more than about 10 cubs, i.e. the average addition is not more than one cub per year per tigress of reproductive age. On the debit side we have to take account of many factors such as disease, disabling injuries, in addition to the tigers killed by poachers or poisoned, shot on permits or by V.I.Ps. and dignitaries and the ancillary loss connected with such shoots, as stated earlier. It will thus be clear that the odds are heavy against an increase in the number of tigers in a restricted or isolated area. It may be mentioned as a matter of the writer's personal knowledge that the Tungar hill range near Bassein in Thana District (which at one time had several tigers) was reported to contain only one tigress and two cubs about the year 1945, and that these three animals disappeared from the scene by about 1947 just as the other tigers had done previously. The tiger is a solitary animal and one of the most important factors leading to its extinction is its isolation and its attachment to an area of forest. Should the forest area be cut off from other forest areas or hills by extension of cultivation or removal of cover or by construction of railway or highways and heavy traffic, all the tigers imprisoned in a pocket like the Tungar or Mahuli or Takmak hills in Thana District or Lonavla-Khandala area in Poona District or

the Mahabaleshwar Plateau in Satara District are doomed, and are bound to be exterminated within a few years. There will be no addition to the population from surrounding areas because of the intervening cultivation or highways and traffic; the animals trapped in the pocket would not be able to leave for other forests and safe places. The tigers in most of the districts of Maharashtra where they were plentiful at one time and are now known to be non-existent have disappeared in this manner. By way of comparison, the case of lions can be considered. The lion is a social animal living in prides of 10 to 15 or more animals. In the Gir forest a compact area of some 1,500 sq. km is the home of the Indian lion, and the lion population has varied from a dangerous low of 20 or so in the year 1913, to about 220 in the year 1949 and about 300 in 1955. Recent reckoning of the population in 1963 and 1968 is reported to have disclosed populations of about 290 and 180 respectively. In a population 150 lions of both sexes and all ages living together in a compact area like the Gir the number of lionesses of reproductive age would be about 50 and in the absence of special reasons, an average addition of 50 cubs per year may be expected, of which some 30 to 40 may survive to adult stage. It is assumed that roughly half of the cubs will be of each sex. If the mortality from all other causes and old age does not exceed 20 or 25 a year there is every reason to believe that the lion population will increase. An important consideration must be noticed in this discussion. In an isolated tiger population, or in a lion population that has fallen below the viable limit owing to adverse conditions, mortality rate would be disproportionately high since the number of animals lost on account of poaching, poisoning, etc., may continue at the old level or may even increase. In these circumstances, a small 'big-cat' population of say below 100 may not under modern conditions of poaching and wardening be able to survive, although the survival of a small group of 20 or 30 lions was witnessed more than fifty years ago when conditions were different, pressure of human population was less, jeeps and powerful flash lamps were unknown, the rifles used were not of latest design, and last but not the least the ruler's writ was strictly enforced and implicitly obeyed. Once a population falls below the danger or survival level, its extermination becomes more rapid than otherwise. Numerically, the females of reproductive age are of vital importance. With a population of 100 of a given species like lion, tiger or elephant the reproductive age range and next the number of females in that range must be determined. Assuming equal sex ratio at birth (in absence of information to the contrary) 50 out of 100 would be females and of these, excluding immature females, those of reproductive age may be 25 or 30. Next we have to consider the number of cubs born on an average and the frequency or spacing of litters and mortality of cubs. This would give the addition per cent of population per year. Deducting the mortality (known or assumed) one gets the net increase if any, or decrease or a stationary population.

A study of wild elephants under normal conditions shows a yearly birthrate of 9 per cent. of which not more than six survive beyond one year. Against this addition of 5 or 6 per cent. the adult death rate is about 1.6 per cent. giving a survival rate of 4 per cent. to 5 per cent. i.e. doubling of the population within 20 years or so. Similar statistics for lions can be made available but little is known about tigers, and in view of the rapid decline in tiger population it seems necessary to err on the safe side.

11. *Conservation of wild life.*—If interference with human interests or by man is to be avoided — and this is *sine qua non* for survival of most species of wild life, it is obvious that only national parks will serve the purpose of conservation — parks in which no human beings are allowed except game wardens (and under strict control a few tourists) with the duty to conserve wild life in the park, and in which wild life can live in natural surroundings, with adequate natural food, water, prey, predators and the whole cycle of nature in a harmonious or balanced operation. The optimum area required for conserving any given species, and the resulting balance of nature over that area will have to be studied carefully; but it seems the time has come for initiating such studies with the object of preventing the total extermination of several species of wild animals (including the tiger) in Maharashtra State. Let us hope that requisite studies will be undertaken and all steps necessary to preserve at least the more important species of our wild life will be taken before it is too late.

G. V. BEDEKAR

Bombay, 3rd July 1969

FAUNA

CHAPTER I — FISHES

FISH HAS FEATURED IN THE LIFE OF INDIANS since ancient times, when Lord Vishnu, in his first incarnation, the 'Matsyavatara' assumed the form of a fish to retrieve the Vedas and warn the wise man Manu of the impending flood in the mythological era. Leaving aside the legend, fishes as part of the animal fauna of Maharashtra have, from times immemorial, been an important source of protein food to its people.

According to science of classification, fishes are included in a group technically called Pisces. They are backboned (vertebrate) aquatic animals having gills persisting throughout life for aquatic respiration and having paired extremities in the form of fins of non-pentadactylus character. They, in general, comprise seven classes, covering all the fishes of the world both living and extinct. But the living fishes of Maharashtra, so far recorded, belong to two main classes, Elasmobranchii and Teleostomi, to which most of the living fishes of the world also belong.

The class Elasmobranchii are cartilaginous fishes. They are characterised by possession of gristly or cartilaginous skeleton, strengthened by calcification (except teeth which are horny) and by having several gill apertures or clefts, 5 to 7 in number, opening separately on each side of the body. The class Teleostomi as the name implies (teleosts means completely bony) are bony fishes, wherein the gill clefts of the Elasmobranchii are replaced by a more advanced single gill chamber or cavity protected by a cover (opercle) on each side. Besides these main features, there are other differences between the two classes for which reference is invited to books on ichthyology, the science of fishes.

These two classes (Elasmobranchii and Teleostomi) are further divided into groups having similar characteristics, namely orders, families, genera and finally the species. Another grouping is based on environment, i.e. the type of water such as marine (saline), estuarine (brackish) and fresh water in which the fish live. The estuarine fish frequent the coastal sea also and, therefore, both these are included in marine category, whereas fresh water forms remain separate. Both these

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CHAPTER 1

Fishes

CHAPTER 1

Fishes

categories are dealt with in this chapter separately. However migratory fish like Hilsa or Palla appear in both.

Incidentally, it may be mentioned that although animals like prawns, lobsters, oysters, bivalves etc. are considered as fishery products in common parlance, they are excluded from this chapter as they cannot scientifically be classed as fishes or Pisces. Only the above-mentioned two classes of fishes are, therefore, listed below, arranged according to their orders, families etc. Marine fishes are listed first and fresh water fishes listed thereafter.

Classification of fishes followed in this chapter is the same as indicated by the Russian author L. S. Berg.¹ As regards scientific names, there have been considerable changes from time to time according to international rules of nomenclature and also on account of more detailed knowledge about our fishes being available through recent observations and research. For this reason, the latest and comparatively prevalent names are given wherever possible but along with these, the names adopted by Day² are also given as equivalents, because his book is yet the only available standard taxonomic book on Indian fishes. Apart from names, even in the case of spellings of names, there is disagreement among authors. For example, Day had called a genus of sharks, *Charcharias*; Misra³ thought it fit to alter it to *Carcharhinus* but Smith⁵ preferred to keep it as *Carcharinus* whereas Munro⁴ gave a different name for the genus namely, *Eulamia*. Similarly, a well-known name like *Hilsa* is changed to *Tenulosa*. There are several such cases. The changes may be on account of rules of nomenclature, but this creates confusion. On account of this situation, comparatively more conventional names and spellings are retained in this section.

As regards total number of fishes, it can be stated that the entire world has about 21,000 species of fishes. Out of these, India has more than 1,600, though Day² has recorded 1,300 and Misra³ only 402. In Maharashtra there are more than 600 species but in the present compilation only 582 have been recorded, 414 being marine and 168 fresh water forms.

The aforesaid list includes indigenous varieties of small fishes which are used for aquarium purposes but does mention several exotic aquarium fishes which are often found in small aquarium tanks maintained in the houses of aquarists. These are either bred by the aquarists and distributed to their fellow workers or they are imported from outside as and when required. This population thus not being stable and not found in natural waters does not find place in the present compilation.

1. Berg, L. S. — 1940 .. Classification of Fishes, Recent and fossil. Inst. Zool. Acad. Sci., Leningrad, U. S. S. R.

2. Day, F. — 1878 — 88 .. The fishes of India, London.

CHAPTER 1

Fishes

3. Misra, K. S. — 1951 .. An aid to the identification of Fishes of India. Rec. Ind. Mus. Vol. XLIX.
4. Munro, I. S. R. — 1955 .. The marine and freshwater fishes of Ceylon. Dept. of Ext. Affairs, Canberra.
5. Smith, J. L. B. — 1953 .. The Sea fishes of Southern Africa. Central News Agency, S. Africa.

Section II—Taxonomic List of Marine Fishes of Maharashtra

Serial No.	Scientific name	Popular English name	Marathi name
	Series	: PISCES	
	Class	: ELASMOBRANCHII	
	Sub-class	: SELACHII (SELACHOIDEI)	
	Order	: LAMNIFORMES	
Family : Orectolobidae			
1	Chiloscyllium griseum (Muller and Henle)	Dog fish	Baravla.
	=Day : Chiloscyllium griseum.		
2	Chiloscyllium indicum (Gmelin).	Banded dog fish	Baravla.
	=Day : Chiloscyllium indicum.		
3	Nebrius ferrugineum (Lesson)	Rusty shark	Sunera.
	=Day : Ginglymostoma mulleri.		
4	Rhincodon typus Smith	Whale shark	Deomushi, Karanj, Bahiri.
	=Day : Rhinodon typicus		
5	Stegostoma varium (Seba)	Zebra shark	Shinavla.
	=Day : Stegostoma tigrinum		
6	Stegostoma fasciatum	....	....
Family : Odontaspidae			
7	Carcharias tricuspidatus Day	Shark	Waghir.
	=Day : Odontaspis tricuspidatus		
Family : Carcharhinidae			
8	Physodon mulleri (Muller and Henle).	Shark	Mushi.
	=Day : Charcharias mulleri		
9	Scoliodon palasorrah (Cuvier)	Grey-dog shark	Mori.
	=Day : Charcharias acutus		
10	Scoliodon sorrakowah (Cuvier)	Yellow-dog shark	Sonmushi.
	=Day : Characharias laticaudus		
11	Scoliodon walbeehmi Bleeker	Sharp-nosed shark	Mushi.
	=Day : Charcharias walbeehmii.		
12	Scoliodon ceylonensis Setna and Sarangdhar.	Shark	Mushi.
13	Hypoprion macloiti (Muller and Henle).	Shark	Mushi.
	=Day : Charcharias macloiti.		
14	Carcharhinus bleekeri (Dumeril)	Shark	Mushi.
	=Day : Charcharias bleekeri.		
15	Carcharhinus dussumieri (Muller and Henle).	White-cheeked shark.	Mushi.
	=Day : Charcharias dussumieri.		

CHAPTER 1

Fishes

Serial No.	Scientific name	Popular English name	Marathi name
16	<i>Carcharhinus gangeticus</i> (Muller and Henle). = Day : <i>Charcharias gangeticus</i> .	Gangetic Shark	.. Mushi.
17	<i>Carcharhinus limbatus</i> (Muller and Henle). = Day : <i>Charcharias limbatus</i> .	Shark	.. Balda or Pisori.
18	<i>Carcharhinus melanopterus</i> (Quoy and Gaimard). = Day : <i>Charcharias melanopterus</i> .	Black-finned shark	Khada.
19	<i>Carcharhinus menisorrhah</i> (Muller and Henle). = Day : <i>Charcharias menisorrhah</i> .	Shark	.. Ghari Mushi.
20	<i>Carcharhinus sorrah</i> (Muller and Henle). = Day : <i>Charcharias sorrah</i> .	Shark	.. Khirwa.
21	<i>Carcharhinus watu Setna</i> and Sarangdhar.	Shark	.. Watu.
22	<i>Carcharhinus temminckii</i> (Muller and Henle). = Day : <i>Charcharias temminckii</i> .	Shark	.. Mushi.
23	<i>Galeocerdo arcticus</i> (Faber). = Day : <i>Galeocerdo tigrinus</i> .	.. Tiger shark	.. Waghbeer.
24	<i>Hemigaleus balfouri</i> Day. = Day : <i>Hemigaleus balfouri</i> .	.. Shark	.. Chichundri.
25	<i>Hemipristis pingali</i> Setna and Sarangdhar.	Shark	.. Pingal.
26	<i>Murmille mustellus</i> (Linnaeus).	.. Shark	.. Mushi.
Family: Sphyrnidae			
27	<i>Sphyrna blochii</i> (Cuvier). = Day : <i>Zygaena blochii</i> .	.. Hammer-head shark.	Kanar.
28	<i>Sphyrna tudes</i> (Valenciennes). = Day : <i>Zygaena tudes</i> .	.. Hammer-head shark.	Kanmushi.
29	<i>Sphyrna zygaena</i> (Linnaeus). = Day : <i>Zygaena malleus</i> .	.. Hammer-head shark.	Boot.
Sub-class: BATOIDEI			
Order: RAJIFORMES			
Family: Rhinobatidae			
30	<i>Rhinobatos armatus</i> (Gray). = Day : <i>Rhinobatus granulatus</i> .	Skate	.. Lanj.
31	<i>Rhinobatos granulatus</i> (Cuvier). = Day : <i>Rhinobatus granulatus</i> .	.. Skate	.. Lanj.
32	<i>Rhinobatos obtusus</i> (Muller and Henle). = Day : <i>Rhinobatus halavi</i> .	Skate	.. Lanj.
33	<i>Rhinobatos thoumi</i>		
34	<i>Rhynchobatus djiddensis</i> (Forskäl). = Day : <i>Rhynchobatus djiddensis</i> .	.. Shovelnose skate	.. Ranja, Pok, Lanj.
35	<i>Rhina ancylostomus</i> Bloch and Schneider. = Day : <i>Rhynchobatus ancylostomus</i> .	Bow-mouthed skate.	

CHAPTER

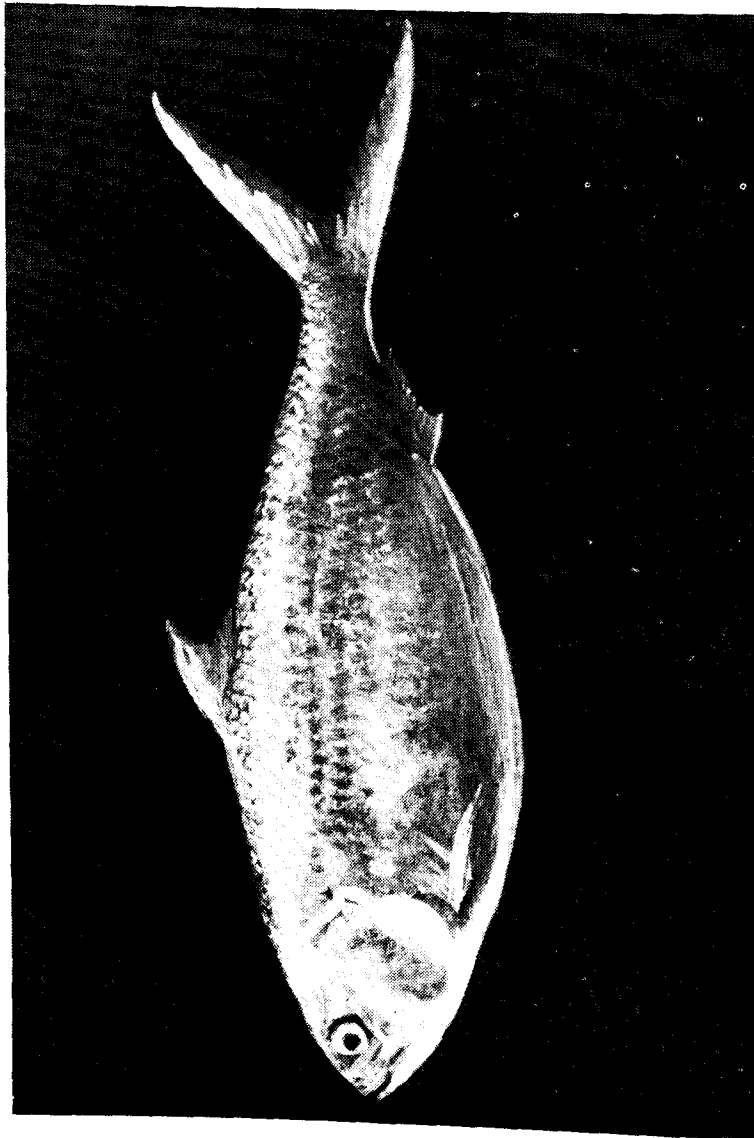
Fishes

Serial No.	Scientific name	Popular English name	Marathi name
Family: Pristidae			
36	<i>Pristis cuspidatus</i> Latham. = Day : <i>Pristis cuspidatus</i> .	.. Saw fish	.. Nali.
37	<i>Pristis microdon</i> Latham. = Day : <i>Pristis perrotteti</i> .	.. Saw fish	.. Win, Khandere.
Family: Trygonidae			
38	<i>Dasyatis</i> (Himantura) <i>bleekeri</i> (Blyth). = Day : <i>Trygon bleekeri</i> .	Whiptail stingray.	Chamli.
39	<i>Dasyatis</i> (Himantura) <i>uarnak</i> (Forskäl). = Day : <i>Trygon uarnak</i> .	Banded whiptail stingray.	Waghya Pakat.
40	<i>Dasyatis</i> (Himantura) <i>uarnak</i> <i>verigatus</i> (Annandale).	Whiptail stingray.	Waghya Pakat.
41	<i>Dasyatis</i> (Himantura) <i>alcocki</i> (Annandale).	Ray	.. Goras.
42	<i>Dasyatis</i> (Himantura) <i>gerrardi</i> (Gray).	Ray	.. Goras.
43	<i>Dasyatis</i> (Himantura) <i>walga</i> (Muller and Henle). = Day : <i>Trygon walga</i> .	Ray	.. Pakat.
44	<i>Dasyatis</i> (Pastinachus) <i>sephen</i> (Forskäl). = Day : <i>Trygon sephen</i> .	Cow-tail ray	.. Goval Pakat.
45	<i>Dasyatis</i> (Amphotistius) <i>imbricata</i> (Bloch and Schneider). = Day : <i>Trigon imbricata</i> .	Scaly stingray	.. Pakat.
46	<i>Dasyatis</i> (Amphotistius) <i>kuhlii</i> (Muller and Henle). = Day : <i>Trygon kuhlii</i> .	Stingray	.. Pakat.
47	<i>Dasyatis</i> (Amphotistius) <i>zugei</i> (Muller and Henle). = Day : <i>Trygon zugei</i> .	Pale-edged stingray.	Pakat.
48	<i>Gymnura</i> (Gymnura) <i>poecilura</i> (Shaw). = Day : <i>Pteroplatea micrura</i> .	Butterfly ray	.. Randgi, Shevta.
Family: Myliobatidae			
49	<i>Aetomyealus milvus</i> (Muller and Henle).	Eagle ray	.. Bolad.
50	<i>Aetomyealus nicholfii</i> (Bloch and Schneider). = Day : <i>Myliobatis nieuhoftii</i> .	Eagle ray	.. Bolad.
51	<i>Aetomyealus maculatus</i> (Gray). = Day : <i>Myliobatis maculata</i> .	.. Mottled eagle ray	.. Bolad, Wagli.
52	<i>Aetobatus flagellum</i> (Schneider). = Day : <i>Aetobatis narinari</i> .	Spotted eagle ray	.. Bolad, Wagli.
53	<i>Taeniura melanospilos</i> (Bleeker).	.. Black stingray	.. Kali Balad

CHAPTER 1

Fishes

Serial No.	Scientific name	Popular English name	Marathi name
Family: Rhinopteridae			
54	Rhinoptera javanica Muller and Henle. = Day : Rhinoptera javanica.	Gow-nosed ray	Bolad, Wagli.
Family: Mobulidae			
55	Mobula diabolus (Shaw) = Day : Dicerobatis eregoodoo.	Devil ray	Shing Pakat.
56	Mobula mobular (Bonnaterre)	Devil ray	Shing Pakat.
Order : TORPEDINIFORMES			
Family: Torpedinidae			
57	Narcine indica Henle = Day : Narcine timlei.	Electric ray	Zinzina.
58	Torpedo marmorata Risso	Electric ray	Bijali, Zinzina.
59	Narke dipterygia (Bloch and Schneider). = Day : Astrape dipterygia.	Numb fish	Zinzina.
60	Torpedo zugmayeri Engelhart Class : Teleostomi Sub-class : Actinopterygii Order : Clupeiformesi	Electric ray	Zinzina.
Family: Elopidae			
61	Elops saurus (Linnaeus) = Day : Elops saurus.		Dandeli, Shonas.
Family : Megalopidae			
62	Megalops cyprinoides (Broussonet) = Day : Megalops cyprinoides.	Indian Tarpon	Chirai, Vadas.
Family: Dussumieridae.			
63	Dussumieria acuta Valenciennes = Day : Dussumieria acuta	Common Sprat rainbow sardine.	Tok.
64	Dussumieria hasselti Bleeker = Day : Dussumieria hasselti.	Common Sprat rainbow sardine.	Tok.
Family: Clupeidae			
65	Harengula punctata (Ruppel) = Day : Clupea klunzei.	Spotted herring	....
66	Sardinella fimbriata (Valenciennes) = Day : Clupea fimbriata.	White sardine	Pedwa.

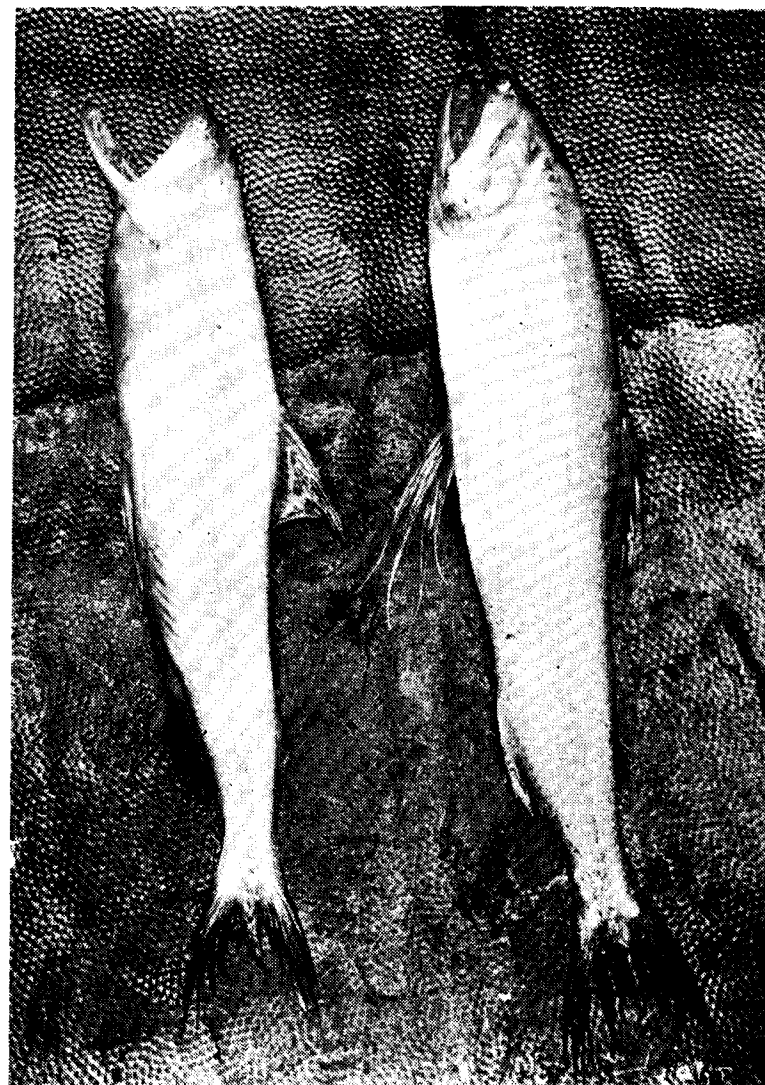
Giant Herring (Marathi : Bhing) (*Hilsa sinensis*)

Serial No.	Scientific name	Popular English name	Marathi name
67	<i>Sardinella longiceps</i> Valenciennes = Day : <i>Clupea longiceps</i> .	Oil sardine	.. Tarli, Haid.
68	<i>Sardinella melanura</i> (Cuvier) = Day : <i>Clupea atricauda</i> .	.. Black-tipped sardine.	..
69	<i>Sardinella sindensis</i> (Day) = Day : <i>Clupea sindensis</i> .	.. Sardine	.. ....
70	<i>Sardinella dayi</i> Regan = Day : <i>Clupea dayi</i> .	.. Sardine	.. ....
71	<i>Hilsa ilisha</i> (Hamilton) = Day : <i>Clupea ilisha</i> .	.. Indian shad	.. Palla.
72	<i>Hilsa kelee</i> (Cuvier) = Day : <i>Clupea kanagurta</i> .	.. Indian shad	.. ....
73	<i>Hilsa sinensis</i> (Linnaeus) = Day : <i>Clupea toli</i> .	.. Giant herring	.. Bhing.
74	<i>Kowala coval</i> (Cuvier) = Day : <i>Clupea life</i> .	.. Whiting	.. Bhiljee.
75	<i>Ilisha brachysoma</i> (Bleeker) = Day : <i>Pellona brachysoma</i>.	.. ....	Gubar.
76	<i>Ilisha filigera</i> (Valenciennes) = Day : <i>Pellona filigera</i> .	.. Jewelled shad	.. Gubar.
77	<i>Pellona indica</i> (Swainson) = Day : <i>Pellona indica</i>.	.. ....	Gubar.
78	<i>Pellona megaloptera</i> (Swainson)	..	
79	<i>Opisthopterus tartoor</i> (Cuvier) = Day : <i>Opisthopterus tartoor</i>	.. Long-finned herring.	Palfurda.
80	<i>Raconda russelliana</i> Gray = Day : <i>Raconda russelliana</i> .	.. Smooth-backed herring.	.. ....
81	<i>Nematalosa nasus</i> (Bloch) = Day : <i>Chatoessus nasus</i>.	.. ....	.. ....
82	<i>Anodontostoma chacunda</i> (Hamilton) = Day : <i>Chatoessus chacunda</i>.	.. ....	.. ....
Family : Engraulidae			
83	<i>Coilia dussumieri</i> Valenciennes = Day : <i>Coilia dussumieri</i> .	Golden anchovie	.. Mandeli.
84	<i>Anchoviella tri</i> (Bleeker) = Day : <i>Engraulis tri</i> .	.. Anchovie	.. Dindus.
85	<i>Anchoviella indica</i> (van Hasselt) = Day : <i>Engraulis indicus</i> .	.. Anchovie	.. Dindus.
86	<i>Thrissocles dussumieri</i> (Valenciennes) = Day : <i>Engraulis dussumieri</i> .	Anchovie	.. Kati.
87	<i>Thrissocles malabaricus</i> (Bloch) = Day : <i>Engraulis malabaricus</i> .	.. Malabar anchovie.	.. Kati.
88	<i>Thrissocles mystax</i> (Bloch and Schneider). = Day : <i>Engraulis mystax</i> .	Anchovie	.. Dandetar.
89	<i>Thrissocles purava</i> (Hamilton) = Day : <i>Engraulis purava</i> .	.. Anchovie	.. Khavli.
90	<i>Thrissocles setirostris</i> (Broussonet) = Day : <i>Engraulis setirostris</i> .	Anchovie	.. Dandetar.

CHAPTER 1

Fishes

Serial No.	Scientific name	Popular English name	Marathi name
91	<i>Thrissocles hamiltonni</i> = Day : <i>Engraulis hamiltonni</i> .	.. Anchovie	.. Khavli.
92	<i>Stolephorus malabaricus</i> (Day) = Day : <i>Spratelloides malabaricus</i>	.. White bait	.. Katali.
Family : Chirocentridae			
93	<i>Chirocentrus dorab</i> (Forskål) = Day : <i>Chirocentrus dorab</i> .	.. Silver bar	.. Karli.
Family : Chanidae			
94	<i>Chanos chanos</i> (Forskål) = Day : <i>Chanos salmoneus</i>	.. Milk fish.	....
Order : SCOPELIFORMES			
Family : Synodidae			
95	<i>Harpodon nehereus</i> (Hamilton) = Day : <i>Harpodon nehereus</i> .	.. Bombay duck	.. Bombil.
96	<i>Saurida tumbil</i> (Bloch) = Day : <i>Saurida tumbil</i> .	.. Lizard fish	.. Chor Bombil.
97	<i>Trachinocephalus myops</i> (Bloch & Schneider). = Day : <i>Saurus myops</i> .	.. Lizard fish	.. Chor Bombil.
Order : CYPRINIFORMES			
Family : Plotosidae			
98	<i>Plotosus anguillaris</i> (Bloch) = Day : <i>Plotosus arab</i> .	.. Cat-fish eel	.. Nal shingali.
99	<i>Plotosus canius</i> Hamilton-Buchanan = Day : <i>Plotosus canius</i> .	.. Cat-fish eel	.. Nal shingali.
Family : Tachysuridae			
100	<i>Osteogeneosus militaris</i> (Linnaeus) = Day : <i>Osteogeniosus militaris</i> .	.. Soldier cat-fish	.. Shingala.
101	<i>Tachysurus sumatranus</i> (Bennett) = Day : <i>Arius sumatranus</i> .	.. Cat-fish	.. Shingala.
102	<i>Tachysurus caelatus</i> (Valenciennes) = Day : <i>Arius caelatus</i> .	.. Engrava cat-fish	.. Shingala.
103	<i>Tachysurus nenga</i> (Hamilton) = Day : <i>Arius nenga</i>	.. Cat-fish	.. Shingala.
104	<i>Tachysurus maculatus</i> (Thunberg) = Day : <i>Arius maculatus</i> .	.. Spotted cat-fish	.. Shingala.
105	<i>Tachysurus sagor</i> (Hamilton) = Day : <i>Arius sagor</i> .	.. Cat-fish	.. Shingala.
106	<i>Tachysurus dussumieri</i> (Valenciennes) = Day : <i>Arius dussumieri</i> .	.. Cat-fish	.. Shingala.

Bombay Duck (Marathi : Bombil) (*Harpodon nehereus*)



Common Eel (Marathi : Vam)
(*Muraenesox talabon*)

Serial No.	Scientific name	Popular English name	Marathi name
107	<i>Netuma thalassinus</i> (Ruppell) = Day : <i>Arius thalassinus</i> .	Giant cat-fish	Shingala
108	<i>Hexanematichthys sona</i> (Hamilton-Buchanan) = Day : <i>Arius sona</i> .	Dusky cat-fish	Shingala
109	<i>Pseudarius Jella</i> (Day) = Day : <i>Arius jella</i> .	Small eye cat-fish.	Shingala
110	<i>Netuma serratus</i> (Day) = Day : <i>Arius serratus</i> .	Saw-edged cat-fish.	Shingala

Order : ANGUILLIFORMES

Family : Muraenidae

111	<i>Muraena pseudothyrsoidea</i> Bleeker = Day : <i>Muraena pseudothyrsoidea</i> .	Moray eel	Killis.
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Family : Muraenesocidae

112	<i>Muraenesox cinereus</i> (Forskål) = Day : <i>Muraenesox cinereus</i>	Silver eel.	Vam.
113	<i>Muraenesox talabon</i> (Cuvier) = Day : <i>Muraenesox talabon</i> .	Common eel	Vam.
114	<i>Neechelys buitendijke</i> Weeber de Beaufort		
115	<i>Muraenichthys gymnopterus</i> (Bleeker)		
116	<i>Thyrsoidea macrurus</i> (Bleeker)		
117	<i>Muraena</i> (Gymnothorax) <i>picta</i> Ahl.		
118	<i>Muraena</i> (Gymnothorax) <i>meleagris</i> Shaw.		
119	<i>Muraena</i> (Gymnothorax) <i>flavaginea</i> (Bloch and Schndr.)		
120	<i>Muraena</i> (Gymnothorax) <i>tessellata</i> .		
121	<i>Muraena</i> (Gymnothorax) <i>undulata</i> (Lacepede).		

Family : Congridae

122	<i>Ariosoma anago</i> (Schlegel) = Day : <i>Congromuraena anago</i>	Sea conger	Vam.
123	<i>Uroconger lepturus</i> (Richardson) = Day : <i>Uroconger lepturus</i>	Slender conger eel	Vam.

Family : Ophichthyidae

124	<i>Pisoodonophis boro</i> (Hamilton) = Day : <i>Ophichthys boro</i>	Sand eel	Munderi.
125	<i>Pisoodonophis cancrivorus</i> (Richardson)		
126	<i>Ophichthys caphalogona</i> (Bleeker)		
127	<i>Ophichthys apicalis</i> (Bennet)		

CHAPTER 1

Fishes

Serial No.	Scientific name	Popular English name	Marathi name
Order : BELONIFORMES			
Family : Belonidae			
128	<i>Strongylura crocodilus</i> (Lesueur)	Fork-tail gar fish	Tol.
	= Day : <i>Belone choram</i> .		
129	<i>Strongylura strongylurus</i> (Van Hasselt).	Round-tail gar fish.	Tol.
	= Day : <i>Belone strongylura</i> .		
130	<i>Strongylura choram</i> (Forskål)	Gar fish	Tol.
	= Day : <i>Belone choram</i> .		
131	<i>Thalassosteus appendiculatus</i> (Klunzinger).		
Family : Hemirhamphidae			
132	<i>Hemirhamphus far</i> (Forskål)	Half-beak	Sumb, Toli.
	= Day : <i>Hemirhamphus far</i>		
133	<i>Hemirhamphus gaimardi</i> Valenciennes.	Half-beak	Sumb, Toli.
	= Day : <i>Hemirhamphus limbatus</i> .		
134	<i>Hemirhamphus georgii</i> Valenciennes.	Long billed half-beak.	Sumb, Toli.
	= Day : <i>Hemirhamphus georgii</i> .		
135	<i>Hemirhamphus xanthopterus</i> (Valenciennes).	Red-tipped half beak.	Sumb, Toli.
	= Day : <i>Hemirhamphus xanthopterus</i> .		
136	<i>Hemirhamphus cantori</i> Bleeker	Half-beak	Sumb, Toli.
	= Day : <i>Hemirhamphus cantori</i> .		
137	<i>Zenarchopterus buffonis</i> (Valenciennes).	Half-beak	Sumb.
	= Day : <i>Hemirhamphus buffonis</i> .		
138	<i>Zenarchopterus dispar</i> (Valenciennes).	Viviparous half beak.	Sumb.
	= Day : <i>Hemirhamphus dispar</i>		
Family : Exocoetidae			
139	<i>Parexocoetus brachypterus</i> (Richardson)	Flying fish	Pakharu masa.
	= Day : <i>Exocoetus mento</i> .		
140	<i>Exocoetus volitans</i> Linnaeus	Flying fish	Pakharu masa.
	= Day : <i>Exocoetus evolans</i> .		
141	<i>Cypselurus altipennis</i> (Valenciennes)	Flying fish	Pakharu masa.
	= Day : <i>Exocoetus altipennis</i> .		
142	<i>Cypsilurus poecilopterus</i> (Cuvier and Valenciennes).	Flying fish	Pakharu masa.
	= Day : <i>Exocoetus poecilopterus</i> .		
Order : GADIFORMES			
Family : Bregmacerotidae			
143	<i>Bregmaceros atripinnis</i> Tickell	Little cod	Tenali or Khada.

CHAPTER 1

Fishes

Serial No.	Scientific name	Popular English name	Marathi name
Order : SYNGNATHIFORMES			
Family : Fistularidae			
144	<i>Fistularia villosa</i> Klunzinger	Flute mouth.	
	= Day : <i>Fistularia serrata</i> .		
Family : Solenostomidae			
145	<i>Solenostomus cynopterus</i> (Bloch)	False pipe fish.	
Family : Syngnathidae			
146	<i>Hippocampus trimaculatus</i> Leach	Sea horse	Ghoda Masa.
	= Day : <i>Hippocampus trimaculatus</i> .		
147	<i>Hippocampus kuda</i> Bleeker	Sea horse	Ghoda Masa.
	= Day : <i>Hippocampus kuda</i> .		
148	<i>Syngnathus intermedius</i> (Kaup)		
Order : CYPRINODONTIFORMES			
Family : Horaichthyidae			
149	<i>Horaichthys setnai</i> Kulkarni	Thready Top-minow	Anu, Motake
Order : BERYCIFORMES			
Family : Holocentridae			
150	<i>Holocentrus rubrum</i> (Forskål)	Red soldier fish.	
	= Day : <i>Holocentrum rubrum</i>		
Order : MUGILIFORMES			
Family : Sphyraenidae			
151	<i>Sphyraena acutipinnis</i> Day	Pointed fin barra-cuda.	Badvi, Tanvar.
	= Day : <i>Sphyraena acutipinnis</i>		
152	<i>Sphyraena jello</i> Cuvier	Giant barracuda	Badvi.
	= Day : <i>Sphyraena jello</i> .		
153	<i>Sphyraena obtusata</i> Cuvier	Blunt jawed barracuda.	Badvi.
	= Day : <i>Sphyraena obtusata</i>		
Family : Mugilidae			
154	<i>Mugil cephalus</i> Linnaeus	Gray mullet	Boi, Mangan, Pilsa.
	= Day : <i>Mugil oeur</i>		
155	<i>Liza parsia</i> Hamilton-Buchanan	Gold spot mullet	Boi.
	= Day : <i>Mugil parsia</i> .		
156	<i>Mugil dussumieri</i>		
	= Day : <i>Mugil dussumieri</i> .		
157	<i>Mugil Kelaartii</i> Gunther	Mullet	Boi, Bhadvi.
	= Day : <i>Mugil kelaartii</i> .		
158	<i>Mugil carinatus</i> Cuvier and Valenciennes.	Mullet	Boi.
	= Day : <i>Mugil carinatus</i> .		

CHAPTER 1

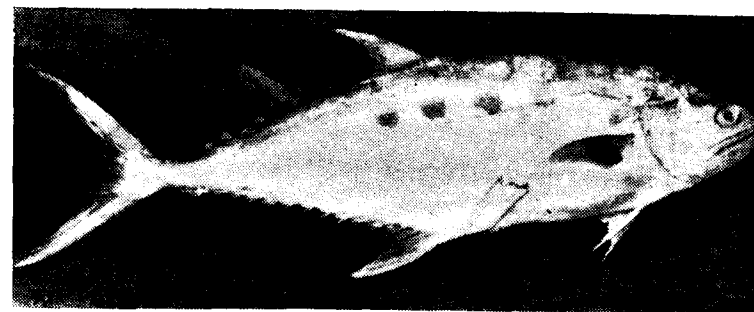
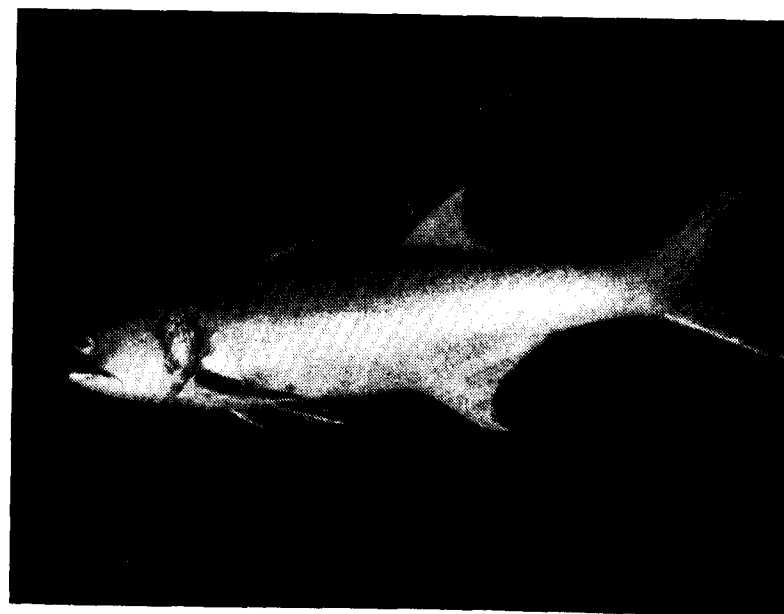
Fishes	Serial No.	Scientific name	Popular English name	Marathi name
	159	Mugil cunnesius Cuvier and Valenciennes. = Day : Mugil cunnesius.	Mullet	.. Boi.
	160	Mugil speigleri Bleeker = Day : Mugil speigleri.	Mullet	.. Boi.
	161	Chelon waigiensis (Quoy and Gaimard). = Day : Mugil waigiensis.	Diamond scaled mullet.	Boi.
	162	Chelon oligolepis (Bleeker) = Day : Mugil oligolepis.	Large scaled mullet.	Boi.
Family : Atherinidae				
	163	Atherina forskalii (Ruppell)	Hardy-head	.. ....
Order: POLYNEMIFORMES				
Family : Polynemidae				
	164	Eleutheronema tetradactylus (Shaw) = Day : Polynemus tetradactylus	Indian salmon, Bamin.	Rawas.
	165	Polydactylus indicus (Shaw) = Day : Polynemus indicus	Monk fish, Giant thread fin.	Dadha, Dara.
	166	Polydactylus sextarius (Schneider) = Day : Polynemus sextarius	Black spot thread fin.	Shende.
	167	Polydactylus plebeius (Broussonet) = Day : Polynemus plebeius	Thread fin	.. Do.
	168	Polynemus paradiseus Linnaeus = Day : Polynemus paradiseus	Paradise thread fin.	
	169	Polynemus heptadactylus Cuvier	Seven thread fin.	
Order: PERCIFORMES				
Family : Latidae				
	170	Lates calcarifer (Bloch) = Day : Lates calcarifer.	Cock up' Bakti	.. K h a j u r a , J i t a d a , Khajari
Family : Ambassidae				
	171	Ambassis commersonii (Cuvier) = Day : Ambassis commersonii	Glass fish	.. Kachki.
	172	Ambassis thomassi Day = Day : Ambassis thomassi	Glass fish	.. Kachki.
Family : Apogonidae				
	173	Apogon fasciatus (White) = Day : Apogon fasciatus.	Cardinal fish	.. Kombada.
	174	Apogon frenatus Valenciennes = Day : Apogon frenatus	Cardinal fish	.. Kombada.
	175	Apogon macropterus (Cuvier and Valenciennes). = Day : Apogon macropterus.	Cardinal fish	.. Kombada.
	176	Apogon kalosoma Bleeker = Day : Apogon kalosoma.	Cardinal fish	.. Kombada.
	177	Apogonichthys ellioti		

CHAPTER 1

Serial No.	Scientific name	Popular English name	Marathi name	Fishes
Family : Serranidae				
178	Epinephelus diacanthus (Valenciennes) = Day : Serranus diacanthus	Six barred grouper	H e k a r u , Gobra.	
179	Epinephelus lanceolatus (Bleeker) = Day : Serranus lanceolatus.	Yellow grouper	H e k a r u , Gobra.	
180	Epinephelus sonnerati (Cuvier) = Day : Serranus sonnerati.	Grouper	H e k a r u , Gobra.	
181	Epinephelus tauvina (Forskål) = Day : Serranus salmoides.	Giant grouper	H e k a r u , Gobra.	
182	Epinephelus undulosus (Quoy and Gaimard). = Day : Serranus undulosus.	Brown lined grouper.	H e k a r u , Gobra.	
183	Epinephelus malabaricus (Bloch and Schneider). = Day : Serranus malabaricus.	Speckled grouper	H e k a r u , Gobra.	
184	Epinephelus maculatus (Bloch) = Day : Serranus maculatus.	Spotted grouper	H e k a r u , Gobra.	
185	Epinephelus boenack (Bloch) = Day Serranus boenack.	Grouper	H e k a r u , Gobra.	
Family : Theraponidae				
186	Therapon jarbua (Forskål) = Day : Therapon jarbua.	Target perch	Naveri.	
187	Therapon puta (Cuvier) = Day : Therapon puta.	Small scaled perch.	Naveri.	
188	Therapon theraps (Cuvier) = Day : Therapon theraps.	Large scaled perch.	Dadadada.	
189	Therapon quadrilineatus (Bloch) = Day : Therapon quadrilineatus.	Trumpeter perch.		
Family : Priacanthidae				
190	Priacanthus hamrur (Forskål)	Bullseye.		
Family : Sillaginidae				
191	Sillago sihama (Forskål) = Day : Sillago sihama.	Lady Fish	Renvi, Mudadi.	
Family : Lactariidae				
192	Lactarius lactarius (Schneider) = Day : Lactarius delicatulus.	Big jawed jumper	S a u n d a l a .	
Family : Carangidae				
193	Atropus atropus (Bloch) = Day : Caranx atropus.	Horse mackerel	Kat bangada.	
194	Alectis ciliaris (Bloch) = Day : Caranx ciliaris.	Horse mackerel	Kat bangada.	
195	Alectis indicus (Ruppell) = Day : Caranx gallus.	Thread fin	Bhagat.	

CHAPTER 1

Fishes	Serial No.	Scientific name	Popular English name	Marathi name
	196	<i>Decapterus russellii</i> (Ruppell) = Day : <i>Caranx kurra</i> .	Thread fin	Shitap.
	197	<i>Megalaspis cordyala</i> Linnaeus = Day : <i>Caranx rottleri</i>	Thread fin	K a r k a t a Bangada.
	198	<i>Selar crumenophthalmus</i> (Bloch) = Day : <i>Caranx crumenophthalmus</i> .	Thread fin	Do.
	199	<i>Gnathanodon speciosus</i> (Forskål) = Day : <i>Caranx speciosus</i> .	Golden Horse mackerel.	
	200	<i>Selar boops</i> (Cuvier) = Day : <i>Caranx boops</i> .	Horse mackerel	Shitap.
	201	<i>Selar djeddaba</i> (Forskål) = Day : <i>Caranx djeddaba</i> .	Horse mackerel	Do.
	202	<i>Selar kalla</i> (Cuvier) = Day : <i>Caranx kalla</i> .	Horse mackerel	Kala bangada.
	203	<i>Selar mate</i> (Cuvier) = Day : <i>Caranx affinis</i> .	One finlet Horse mackerel.	Lalbi bangada.
	204	<i>Citula armata</i> (Forskål) = Day : <i>Caranx armatus</i>	Armed horse mackerel.	Kat bangada.
	205	<i>Citula malabaricus</i> (Schneider) = Day : <i>Caranx malabaricus</i> .	Malabar horse mackerel.	Kat bangada.
	206	<i>Citula oblongus</i> (Cuvier) = Day : <i>Caranx oblongus</i> .	Oblong horse mackerel.	Kat bangada.
	207	<i>Caranx carangus</i> (Bloch) = Day : <i>Caranx carangus</i>	Horse mackerel	Shitap.
	208	<i>Caranx sexfasciatus</i> Quoy and Gaimard.	Six banded horse mackerel.	
	209	<i>Caranx sansun</i> (Forskål) = Day : <i>Caranx jarra</i> .	Horse mackerel.	
	210	<i>Caranx chrysophrys</i> (Cuvier & Valenciennes). Day : <i>Caranx chrysophrys</i>		
	211	<i>Caranx melampygus</i> Cuvier = Day : <i>Caranx melampygus</i> .	Block tipped horse mackerel	Shitap.
	212	<i>Elagatis bipinnulata</i> (Quoy and Gaimard). = Day : <i>Seriolichthys bipinnulatus</i>		
	213	<i>Seriola nigrofasciatus</i> (Ruppell) = Day : <i>Seriola nigrofasciatus</i> .		
	214	<i>Scomberoides lysan</i> (Forskål) = Day : <i>Chorinemus lysan</i> .	Port hole fish	Dagol.
	215	<i>Scomberoides sanctipetri</i> (Cuvier) = Day : <i>Chorinemus sanctipetri</i> .	Port hole fish	Dagol
	216	<i>Scomberoides tala</i> (Cuvier) = Day : <i>Chorinemus tala</i> .	Port hole fish	Dagol.
	217	<i>Scomberoides tol</i> (Cuvier) = Day : <i>Chorinemus moadetta</i> .	Port hole fish	Dagol.
	218	<i>Trachinotus baillonii</i> (Lacepede) = Day : <i>Trachinotus baillonii</i> .	Pseudo pomfret, pampano	Ladagoo..
	219	<i>Trachinotus blochii</i> (Lacepede) = Day : <i>Trachinotus blochii</i> .	Pseudo pomfret,	Ladagoo.
	220	<i>Trachinotus russellii</i> Cuvier = Day : <i>Trachinotus russellii</i> .	Pseudo pomfret pampano	Ladagoo.

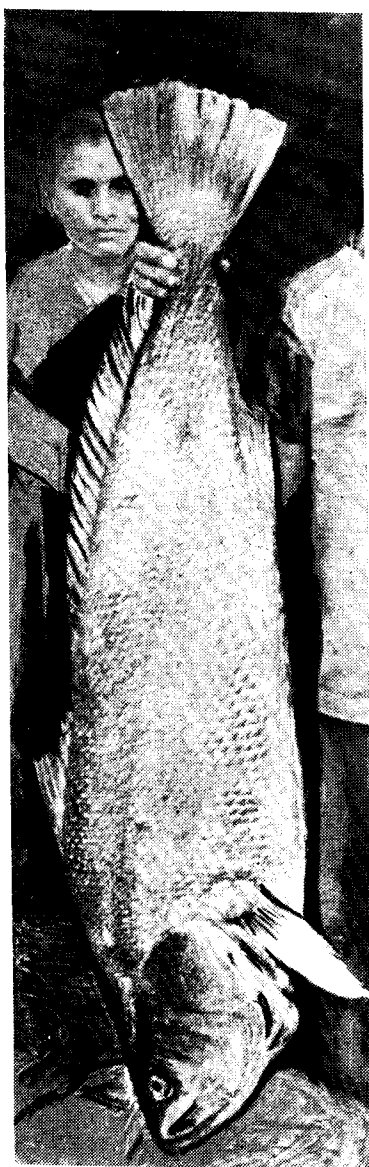
Dagol—Porthole fish (*Scomberoides tala*) (Cuvier)Rawas—Bamin or Indian Salmon (*Eleutheronema tetradactylus*) (Shaw)

Serial No.	Scientific name	Popular English name	Marathi name
Family : Rachycentridae			
221	Rachycentron canadus (Linnaeus) = Day : Elacate nigra	.. Black kingfish, Butter fish.	Modusa, Sakta.
Family : Menidae			
222	Mene maculata (Bloch) = Day : Mene maculata.	.. Moon fish	.. Chandva.
Family : Coryphaenidae			
223	Coryphaena hippurus Linnaeus = Day : Coryphaena hippurus	.. Dolphin fish	.. Abanoos.
Family : Lutianidae			
224	Lutianus argentimaculatus (Forsk&l) = Day : Lutianus argentimaculatus	Red snapper	.. Tamb.
225	Lutianus johnii (Bloch) = Day : Lutianus johnii	.. Snapper	.. Chavri tamb.
226	Lutianus lutianus Bloch = Day : Lutianus madras.	.. Rosy snapper	.. Tamb
227	Lutianus rivulatus (Cuvier) = Day : Lutianus rivulatus.	.. Blue lined snapper.	Tamb.
228	Lutianus sanguineus (Cuvier) = Day : Lutianus annularis.	.. Blood red snapper.	Tamb.
229	Lutianus waigiensis (Quoy and Gaimard. = Day : Lutianus marginatus.	Snapper	.. Tamb.
230	Lutianus chrysotaenia (Bleeker) = Day : Lutianus chorysotaenia.	.. Snapper	.. Tamb.
231	Lutianus quinquelineatus (Bloch) = Day : Lutianus quinquelineatus.	.. Snapper	.. Tamb.
232	Lutianus reseus Day	.. Rosy snapper	.. Tambusa.
Family : Nemipteridae			
233	Nemipterus bleekeri Day = Day : Synagris bleekeri.	..	
234	Nemipterus japonicus (Bloch) = Day : Synagris japonicus.	.. ....	.. Bamni.
Family : Lobotidae			
235	Lobotes surinamensis Bloch	.. ....	.. ....
Family : Leiognathidae			
236	Leiognathus blochii (Valenciennes) = Day : Equula blochii.	.. Pony fish	.. Kap.
237	Leiognathus fasciatus (Lacepede) = Day : Equula fasciata.	.. Pony fish	.. Kap.

CHAPTER 1

Fishes

Serial No.	Scientific name	Popular English name	Marathi name
238	<i>Leiognathus lineolatus</i> (Valenciennes). = Day : <i>Equula lineolata</i> .	Pony fish	.. Kap.
239	<i>Leiognathus ruconius</i> (Hamilton) = Day : <i>Equula ruconius</i> .	.. Pony fish	.. Kap.
240	<i>Leiognathus insidiator</i> (Bloch) = Day : <i>Equula insidiator</i> .	.. Pony fish	.. Kap.
241	<i>Leiognathus brevisrostris</i> (Valenciennes) = Day : <i>Equula brevisrostris</i> .	Pony fish	.. Kap.
242	<i>Leiognathus bindus</i> (Valenciennes) = Day : <i>Equula bindus</i> .	.. Pony fish	.. Kap.
243	<i>Leiognathus splendens</i> (Cuvier) = Day : <i>Equula splendens</i> .	.. Pony fish	.. Kap.
244	<i>Gazza minuta</i> (Bloch) = Day : <i>Gazza minuta</i> .	.. Pony fish	.. Kap.
Family : Gerridae			
245	<i>Gerres filamentosus</i> Cuvier = Day : <i>Gerres filamentosus</i> .	.. Silver bellies	.. Charbat.
246	<i>Gerres oblongus</i> Cuvier = Day : <i>Gerres oblongus</i> .	.. Silver bellies	.. Charbat.
247	<i>Gerres poeti</i> Cuvier = Day : <i>Gerres poeti</i> .	.. Silver bellies	.. Charbat.
248	<i>Gerres setifer</i> (Hamilton) = Day : <i>Gerres setifer</i> .	.. Silver bellids	.. Charbat.
249	<i>Gerres abbreviatus</i> Bleeker = Day : <i>Gerres abbreviatus</i> .	.. Silver bellies	.. Charbat.
Family : Pomadasysidae			
250	<i>Pomadasys furcatus</i> (Schneider) = Day : <i>Pristipoma furcatum</i> .	.. Grunter	.. Karkara.
251	<i>Pomadosys hasta</i> (Bloch) = Day : <i>Pristipoma hasta</i> .	.. Silver grunter	.. Karkara.
252	<i>Pomadosys maculatus</i> (Bloch) = Day : <i>Pristipoma maculatum</i> .	.. Spotted grunter	.. Karkara.
Family : Scolopsidae			
253	<i>Scolopsis vosmeri</i> (Bloch) = Day : <i>Scolopsis vosmeri</i> .	.. Monocle Bream	.. Karkara.
254	<i>Scolopsis leucotaenia</i> (Bleeker) = Day : <i>Scolopsis leucotaenia</i> .	.. Monocle Bream	.. Karkara.
Family : Plectorhynchidae			
255	<i>Plectorhynchus niger</i> (Cuvier) = Day : <i>Diagramma crassispinum</i>	.. Black sweet lip	.. Harvil.
256	<i>Plectorhynchus picta</i> (Thunberg) = Day : <i>Diagramma pictum</i> .	.. Painted sweet lip	.. Harvil.



Dori (Marathi: Koth)
(*Otolithoides brunneus*)

Serial No.	Scientific name	Popular English name	Marathi name
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- 257 *Plectorhynchus schotaf* (Forskål) .. Gray sweet lip .. Harvil.
= Day : *Diagramma griseum*.
- 258 *Plectorhynchus cinctum* Temm. and Schlegel.
= Day : *Diagrama cinctum*.

Family : Sciaenidae

- 259 *Sciaena dussumieri* (Valenciennes). Jew fish .. Dhoma.
= Day : *Sciaena dussumieri*.
- 260 *Sciaena russelli* (Cuvier) .. Jew fish .. Dhoma.
= Day : *Sciaena russelii*.
- 261 *Pseudosciaena axillaris* (Cuvier) .. Jew fish .. Dhoma.
= Day : *Sciaena axillaris*.
- 262 *Pseudosciaena diacanthus* (Lacépède). Jew fish .. Ghol.
= Day : *Sciaena diacanthus*.
- 263 *Pseudosciaena coibor* (Hamilton) .. Jew fish .. Ghol.
= Day : *Sciaena albida*.
- 264 *Pseudosciaena sina* (Cuvier) .. Jew fish .. Ghol.
= Day : *Sciaena sina*.
- 265 *Pseudosciaena soldado* (Lacépède) .. Jew fish .. Ghol.
= Day : *Sciaena miles*.
- 266 *Johnius belengeri* (Cuvier) .. Jew fish .. Dhoma.
= Day : *Sciaena belengeri*.
- 267 *Johnius carutta* Bloch .. Jew fish .. Dhoma.
= Day : *Sciaena carutta*.
- 268 *Johnius dussumieri* (Cuvier) .. Jew fish .. Ghol.
= Day : *Sciaena glaucus*.
- 269 *Johnius osseus* (Day) .. Jew fish .. Dhoma.
= Day : *Sciaena osseus*.
- 270 *Johnius semiluctosus* (Cuvier) .. Jew fish .. Dhoma.
= Day : *Sciaena semiluctuosa*.
- 271 *Johnius bleekeri* Day .. Jew fish .. Dhoma.
= Day : *Sciaena bleekeri*.
- 272 *Pama pama* (Hamilton) .. Jew fish .. Dhoma.
= Day : *Sciaenoides pama*.
- 273 *Otolithoides brunneus* (Day) .. Dori .. Koth.
= Day : *Sciaenoides brunneus*.
- 274 *Otolithus argenteus* Cuvier .. Croaker .. Dhoma.
= Day : *Otolithus argenteus*.
- 275 *Otolithus maculatus* Cuvier .. Croaker .. Dhoma.
= Day : *Otolithus maculatus*.
- 276 *Otolithus ruber* (Bloch and Schneider) Croaker .. Dhoma.
= Day : *Otolithus ruber*.

Family : Lethrinidae

- 277 *Lethrinus miniata* .. Pig face Bream ..

CHAPTER 1

Fishes	Serial No.	Scientific name	Popular English name	Marathi name
Family : Mullidae				
	278	<i>Upeneus sulphureus</i> Cuvier = Day : <i>Upeneoides sulphureus</i> .	Goat fish	Chidi.
	279	<i>Upeneus vittatus</i> (Forskål) = Day : <i>Upeneoides vittatus</i> .	Goat fish	Chidi.
Family : Psettidae				
	280	<i>Monodactylus argenteus</i> (Linnaeus). = Day : <i>Psettus argenteus</i> .	Silver angel fish	Chandluk.
	281	<i>Monodactylus falciformis</i> Lacépède = Day : <i>Psettus falciformis</i> .	Silver angel fish	Chandluk.
Family : Sparidae				
	282	<i>Argyrops spinifer</i> (Forskål) = Day : <i>Pagrus spinifer</i> .	Long spined bream.	Palu.
	283	<i>Sparus berda</i> Forskal = Day : <i>Chrysophrys berda</i> .	Black bream	Khadak paalu.
	284	<i>Sparus datnia</i> (Hamilton) = Day : <i>Chrysophrys datnia</i> .	Gray bream	Palu.
	285	<i>Sparus sarba</i> (Forskål) = Day : <i>Chrysophrys sarba</i> .	Silver bream	Palu.
	286	<i>Sparus cuvieri</i> (Day).		
Family : Pempheridae				
	287	<i>Pempheris moluca</i> Cuvier = Day : <i>Pempheris moluca</i> .	Moluccan sweeper.	
Family : Ephippidae				
	288	<i>Ephippus orbis</i> (Bloch) = Day : <i>Ephippus orbis</i> .	Spade fish	Chandwa.
Family : Platacidae				
	289	<i>Platax pinnatus</i> (Linnaeus) = Day : <i>Platax teira</i> .	Bat fish	Kawla.
Family : Drepanidae				
	290	<i>Drepane punctata</i> (Linnaeus) = Day : <i>Drepane punctata</i> .	Moon fish	Chand.
Family : Scatophagidae				
	291	<i>Scatophagus argus</i> (Linnaeus) = Day : <i>Scatophagus argus</i> .	Hundred eye fish, Scat, Argush.	Wada.

CHAPTER 1

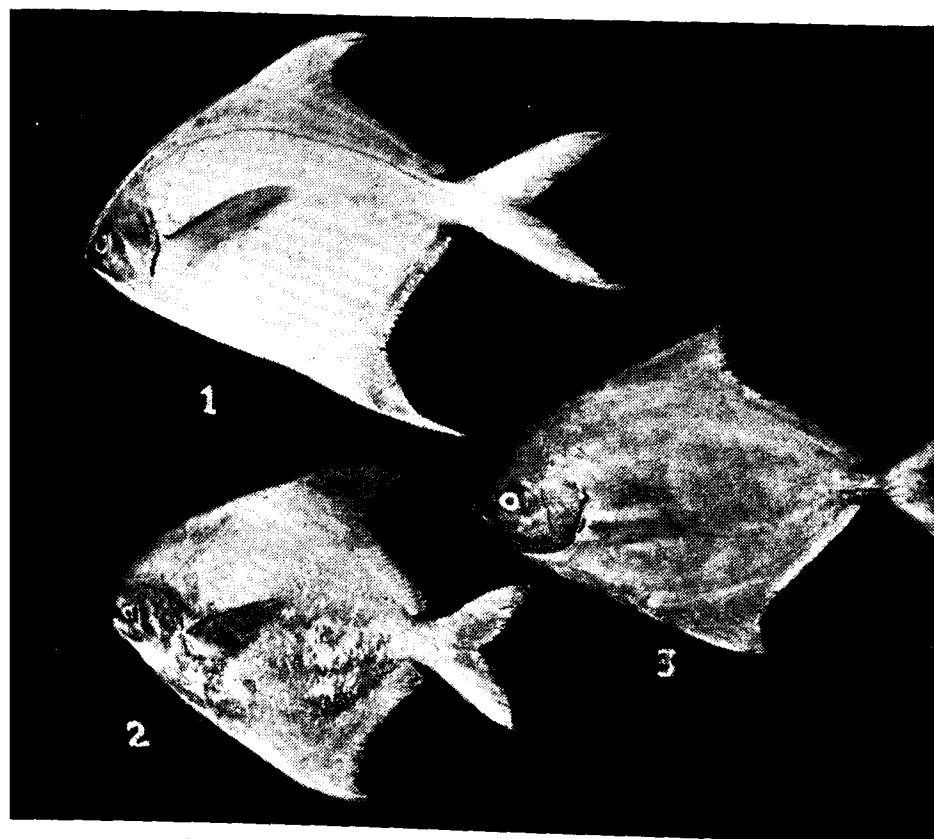
Fishes	Serial No.	Scientific name	Popular English name	Marathi name
Family : Pomacanthidae				
	292	<i>Pomacanthodes annularis</i> (Bloch) = Day : <i>Holacanthus annularis</i> .	Blue ring butterfly fish.	Dand pattu.
Family : Chaetodontidae				
	293	<i>Heniochus acuminatus</i> (Linnaeus) = Day : <i>Heniochus marcopidotus</i> .	Pennant coral fish.	
	294	<i>Chaetodon vagabundus</i> Linnaeus = Day : <i>Chaetodon vagabundus</i> .	Butterfly fish	Paradeshi.
	295	<i>Chaetodon auriga</i> (Forskål) = Day : <i>Chaetodon auriga</i> .	Butterfly fish	Paradeshi.
	296	<i>Chaetodon collaris</i> (Bloch) = Day : <i>Chaetodon collaris</i> .	Butterfly fish	Paradeshi.
	297	<i>Chaetodon (rhabdophorus) xanthocephalus</i>		
	298	<i>Chaetodon (chaetodontopus) lunula</i>		
	299	<i>Anisochaetodon (oxychaetodon) lineolatus</i> .		
Family : Cichlidae				
	300	<i>Eetroplus suratensis</i> (Bloch) = Day : <i>Eetroplus suratensis</i> .	Pearl spot	Kalundar.
	301	<i>Eetroplus maculatus</i> (Bloch) = Day : <i>Eetroplus maculatus</i> .	Orange chromid	
	302	<i>Tilapia mossambica</i> (Peters)	Tilapia	Tilapia.
Family : Cepolidae				
	303	<i>Cepola abbreviata</i> Valenciennes. = Day : <i>Celpola abbreviata</i> .		
Family : Pomacentridae				
	304	<i>Abudefduf saxafilis vaigiensis</i> (Quoy and Gaimard). = Day : <i>Glyphidodon caelestinus</i> .	Sergeant major	Kavandal.
	305	<i>Abudefduf sordidus</i> (Forskål) = Day : <i>Glyphidodon leucopleura</i> .	Sergeant major	Kavandal.
	306	<i>Dascyllus trimaculatus</i> (Ruppell)	Demoiselle fish.	
	307	<i>Pomacentrus tripunctatus</i> Cuvier	Demoiselle fish.	
Family : Labridae				
	308	<i>PlatyGLOSSUS dussumieri</i> (Cuvier and Valenciennes). = Day : <i>PlatyGLOSSUS dussumieri</i> .	Parrot fish	Popat.
	309	<i>PlatyGLOSSUS kawarin</i>		
	310	<i>Callyodon dussumieri</i> Day		
	311	<i>Callyodon fasciatus</i> (Valenciennes)	Parrot fish	Popat.
	312	<i>Callyodon revalatus</i> (Kuhl and Van Hass)		
	313	<i>Fissilabrus dimidiatus</i> (Valenciennes) = Day : <i>Labroides dimidiatus</i> .	Doctor fish	
	314	<i>Ichthyoscopus lebeck</i> (Bloch) = Day : <i>Ichthyoscopus inermis</i> .	Star gazer	Vardolya.

CHAPTER 1

Fishes	Serial No.	Scientific name	Popular English name	Marathi name
Family : Blenniidae				
	315	<i>Petroscirtes punctatus</i> (Cuvier and Valenciennes).	..	..
		= Day : <i>Petroscirtes punctatus</i> .		
	316	<i>Salarius dussumieri</i> (Cuvier and Valenciennes).	..	..
		= Day : <i>Salarius dussumieri</i> .		
Family : Callionymidae				
	317	<i>Callionymus sagitta</i> Pallas ..	Dragonet	Sutera
		= Day : <i>Callionymus sagitta</i> .		
Family : Siganidae				
	318	<i>Siganus javus</i> (Linnaeus) ..	Rabbit fish	Kuwar.
		= Day : <i>Teuthis java</i> .		
	319	<i>Siganus oramin</i> (Bloch and Schneider) ..	Rabbit fish	Kutri.
		= Day : <i>Teuthis oramin</i> .		
	320	<i>Siganus Vermiculatus</i> (Valenciennes) ..	Jigsaw puzzle fish.	Thavus.
		= Day : <i>Teuthis vermiculatus</i> .		
	321	<i>Siganus margaritifera</i> (Cuvier and Valenciennes) ..	Rabbit fish	Dhagvir.
		= Day : <i>Teuthis margaritifera</i> .		
	322	<i>Siganus marmorata</i> (Quoy and Gaimard) ..	Rabbit fish	Dhagvir.
		= Day : <i>Teuthis marmorata</i> .		
Family : Zanclidae				
	323	<i>Zanclus cornutus</i> (Linnacus) ..	Moorish idol.	
Family : Acanthuridae				
	324	<i>Acanthurus gahm</i> (Forsk.) ..	Surgeon fish	Suraiya.
		= Day : <i>Acanthurus mata</i> .		
Family : Trichiuridae				
	325	<i>Trichiurus lepturus</i> Linnaeus ..	Ribbon fish	Bala.
		= Day : <i>Trichiurus haumela</i> .		
	326	<i>Lepturacanthus savala</i> (Gray) ..	Ribbon fish	Wagti.
		= Day : <i>Trichiurus savala</i> .		
	327	<i>Eupleurogrammus muticus</i> (Gray) ..	Ribbon fish	Wagti.
		= Day : <i>Trichiurus muticus</i> .		
Family : Scombridae				
	328	<i>Rastrelliger kanagurta</i> (Cuvier) ..	Mackerel	Bangada.
		= Day : <i>Scomber microlepidotus</i> .		
Family : Scomberomoridae				
	329	<i>Scomberomorus commersoni</i> Lacépède ..	Seer fish	Iswan, Surmai, Towar.
		= Day : <i>Cybius commersonii</i> .		
	330	<i>Scomberomorus guttatus</i> (Bloch and Schneider) ..	Seer fish	Iswan, Surmai, Towar.
		= Day : <i>Cybius guttatum</i> .		
	331	<i>Scomberomorus lineolatus</i> (Cuvier) ..	Seer fish	Iswan, Surmai, Towar.
		= Day : <i>Cybius lineolatus</i> .		



Seer Fish (Marathi : Surmai)
(*Scomberomorus commersoni*)



1 Silver Pomfret (Marathi : Saranga) (*Pampus argenteus*)
 2 Grey Pomfret (Marathi : Khalwad) (*Pampus chinensis*)
 3 Black Pomfret (Marathi : Halwa) (*Parastromateus niger*)

Serial No.	Scientific name	Popular English name	Marathi name
Family : Katsuwonidae			
332	<i>Auxis thazard</i> (Lacépède)	.. Frigate mackerel ..	Gedri.
333	<i>Euthynnus alletteratus affinis</i> (Cantor) = Day : <i>Thynnus thunnina</i> .	.. Little tuna ..	Biblya, Kuppa.
334	<i>Katsuwonus pelamis</i> (Linnaeus) = Day : <i>Thynnus pelamys</i> .	.. Oceanic skip-jack ..	Gedar, Kuppa.
Family : Thunnidae			
335	<i>Kishinoella tonggol</i>	.. Blue fin tuna ..	K h a v a l y a g e d a r, Kuppa.
336	<i>Neothunnus macropterus</i> (Schlegel) = Day : <i>Thynnus macropterus</i> .	.. Yellow fin tuna ..	Pimp.
Family : Istiophoridae			
337	<i>Istiophorus gladius</i> (Bloch) = Day : <i>Histiophorus gladius</i> .	.. Sail fin fish ..	T a d m a s a
338	<i>Tetrapturus brevirostris</i> (Playfair) = Day : <i>Histiophorus brevirostris</i> .	.. Marlin ..	T a d m a s a.
Family : Eleotridae			
339	<i>Butis butis</i> (Hamilton and Buchanan) = Day : <i>Eleotris amboinensis</i> .	Gudgaon ..	..
340	<i>Butis fusca</i> (Schneider) = Day : <i>Eleotris fusca</i> .	.. Schneider ..	..
341	<i>Parioglossus taeniatus</i> Regan	.. Marine pencil fish.	..
342	<i>Parioglossus rainfordi</i> Me Cull	.. Marine pencil fish.	..
Family : Stromateidae			
343	<i>Pampus argenteus</i> (Euphrasen) = Day : <i>Stromateus cinereus</i> .	.. Silver pomfret ..	S a r a n g a, Paplet.
344	<i>Pampus chinensis</i> (Euphrasen) = Day : <i>Stromateus sinensis</i> .	.. Grey pomfret ..	Khalwad, Kafarisaranga.
345	<i>Parastromateus niger</i> (Bloch) = Day : <i>Stromateus niger</i> .	.. Black pomfret ..	Halwa.
Family : Gobiidae			
346	<i>Acentrogobius viridipunctatus</i> (Valenciennes). = Day : <i>Gobius viridipunctatus</i> .	Goby ..	Kharbi.
347	<i>Acentrogobius dayi</i>	..	..
348	<i>Acentrogobius griseus</i> (Day)	..	..
349	<i>Acentrogobius masani</i> (day)	..	..
350	<i>Acentrogobius cynomos</i>	..	..
351	<i>Acentrogobius ornatus</i> (Ruppell)	..	..
352	<i>Acentrogobius reichei</i>	..	..
353	<i>Acentrogobius neilli</i> (Day)	.. Goby ..	Kharbi.
354	<i>Awaous stamineus</i> (Valenciennes) = Day : <i>Gobius striatus</i> .	.. Goby ..	Kharbi.
355	<i>Parachaeturichthys ocellatus</i> (Day) = Day : <i>Gobius ocellatus</i> .	.. Goby ..	Kharbi.
356	<i>Ctenogobius criniger</i> Cuvier and Valenciennes. = Day : <i>Gobius criniger</i> .	Goby ..	Kharbi.

CHAPTER 1

Fishes

Serial No.	Scientific name	Popular English name	Marathi name
357	<i>Parachaeturichthys polynema</i> (Bleeker)		
358	<i>Smilogobius inexplicatus</i> ..		
359	<i>Oxyurichthys microlepis</i> (Bleeker) ..		
360	<i>Oligolepis cylindriceps</i> (Hora) ..		
361	<i>Barbatogobius asanai</i> Kaumans ..		
362	<i>Quisquilius eugenius</i> Iordama Evermann.		
363	<i>Stigmatogobius javanicus</i> (Bleeker) ..		
364	<i>Bathygobius fuscus</i> (Ruppell) ..		
365	<i>Mugilogobius valigouva</i> (Deraniyagala).		
366	<i>Glossogobius biocellatus</i> (Valenciennes).		
Family : Periopthalmidae			
367	<i>Periopthalmodon scholsseri</i> (Pallas) ..	Mud skipper	.. Nivti.
	= Day : <i>Periopthalmus schlosseri</i> .		
368	<i>Boleopthalmus dussumieri</i> (Cuvier and Valenciennes)	Mud skipper	.. Nivti.
369	<i>Boleopthalmus boddaerti</i> (Pallas) ..	Mud skipper	.. Nivti.
Family : Trypauchenidae			
370	<i>Trypauchen vagina</i> (Bloch and Schneider).	Burrowing Gobi.	
	= Day : <i>Trypauchen vagina</i> .		
Family : Scorpaenidae			
371	<i>Pterois russelli</i> Bennett ..	Turkey fish	.. Kombada.
	= Day : <i>Pterois russelli</i> .		
372	<i>Scorpaenopsis roseus</i> (Day) ..	Scorpean fish	.. Kombada.
	= Day : <i>Scorpaenopsis rosea</i> .		
373	<i>Scorpaenopsis cirrhosus</i> (Thunberg).	Scorpean fish	.. Kombada.
	= Day : <i>Scorpaenopsis oxycephala</i> .		
	<i>Scorpaenopsis bleekeri</i> Day.		
Family : Platycephalidae			
374	<i>Platycephalus indicus</i> Bloch ..	Flat head fish	.. Mench
	= Day : <i>Platycephalus insidiator</i> .		
375	<i>Platycephalus macracanthus</i> (Bleeker)	Flat head fish	.. Mench.
	= Day : <i>Platycephalus macracanthus</i> .		
376	<i>Platycephalus punctatus</i> (Tilesius)	Flat head fish	.. Mench.
	= Day : <i>Platycephalus punctatus</i> .		
Order : DACTYLOPTERIFORMES			
Family : Dactylopteridae			
377	<i>Dactylopterus orientalis</i> (Cuvier) ..	Flying Gurnard.	
Family : Psettodidae			
378	<i>Psettodes erumei</i> (Bloch) ..	Indian halibut	.. Bhakas.
	= Day : <i>Psettodes erumei</i> .		

CHAPTER 1

Fishes

Serial No.	Scientific name	Popular English name	Marathi name
Family : Bothidae			
379	<i>Pseudorhombus arsius</i> (Hamilton) ..	Large toothed flounder.	Lep.
	= Day : <i>Pseudorhombus arsius</i> .		
380	<i>Pseudorhombus javanicus</i> (Bleeker) ..	Javanese flounder ..	Lep.
	= Day : <i>Pseudorhombus javanicus</i> .		
381	<i>Pseudorhombus triocellatus</i> (Schneider).	Three spot flounder.	Lep.
	= Day : <i>Pseudorhombus triocellatus</i> .		
Family : Soleidae			
382	<i>Solea ovata</i> Richardson ..	Oval sole	.. Lep.
	= Day : <i>Solea ovata</i> .		
383	<i>Brachirus albomaculata</i> (Kaup) ..	Sole	.. Lep.
	= Day : <i>Synaptura albomaculata</i> .		
384	<i>Brachirus orientalis</i> (Schneider) ..	Oriental sole	.. Lep.
	= Day : <i>Synaptura orientalis</i> .		
385	<i>Brachirus zebra</i> (Kaup) ..	Zebra sole	.. Lep.
	= Day : <i>Synaptura zebra</i> .		
386	<i>Brachirus cornuta</i> (Kaup) ..	Horned sole	.. Lep.
	= Day : <i>Synaptura cornuta</i> .		
Family : Cynoglossidae			
387	<i>Paraplagusia bilineata</i> (Bloch) ..	Two lined tongue sole.	Lep.
	= Day : <i>Plagusia marmorata</i> .		
388	<i>Cynoglossus brachycephalus</i> (Bleeker)	Short headed tongue sole.	Lep.
	= Day : <i>Cynoglossus brevirostris</i> .		
389	<i>Cynoglossus brevis</i> Gunther ..	Tongue sole	.. Lep.
	= Day : <i>Cynoglossus brevis</i> .		
390	<i>Cynoglossus semifasciatus</i> Day ..	Sole	.. Lep.
	= Day : <i>Cynoglossus semifasciatus</i> .		
391	<i>Cynoglossus lingua</i> Hamilton and Buchanan.	Long tongue sole ..	Lep.
	= Day : <i>Cynoglossus lingua</i> .		
392	<i>Cynoglossus dispar</i> Day ..	Sole	.. Lep.
	= Day : <i>Cynoglossus dispar</i> .		
393	<i>Cynoglossus bilineatus</i> (Lacépède) ..	Sole	.. Lep.
	= Day : <i>Cynoglossus sindensis</i> .		
394	<i>Cynoglossus macrolepidotus</i> (Bleeker)	Sole	.. Lep.
	= Day : <i>Cynoglossus macrolepidotus</i> .		
Order : ECHENEIFORMES			
Family : Echeneidae			
395	<i>Echeneis naucrates</i> Linnaeus ..	Sucker fish	.. Lachuk.
	= Day : <i>Echeneis naucratus</i> .		
396	<i>Remora remora</i> (Linnaeus) ..	Sucker fish	.. Lachuk.
	= Day : <i>Echeneis remora</i> .		

CHAPTER 1

Fishes	Serial No.	Scientific name	Popular English name	Marathi name
Order : TETRODONTIFORMES				
Family : Tricanthidae				
	397	<i>Triacanthus brevirostris</i> Schlegel .. = Day : <i>Triacanthus brevirostris</i>	.. Tripod fish	.. Bail masa.
	398	<i>Paramonacanthus choirocephalus</i> (Bleeker). = Day : <i>Monacanthus choirocephalus</i> .	File fish.	
	399	<i>Paramonacanthus monoceros</i> Day .. = Day : <i>Monacanthus monoceros</i> .		
Family : Ostraciontidae				
	400	<i>Lactoria cornuta</i> (Linnaeus) .. = Day : <i>Ostracion cornutus</i> .	Cow fish, Box fish.	Gai.
	401	<i>Ostracion lentiginosa</i> ..		
Family : Lagocephalidae				
	402	<i>Torquigener oblongus</i> (Bloch) .. = Day : <i>Tetrodon oblongus</i> .	Blow fish	.. Kend.
	403	<i>Gastrophysus lunaris</i> (Bloch) .. = Day : <i>Tetrodon lunaris</i> .	Globe fish	.. Kend.
	404	<i>Chelonodon patoca</i> (Hamilton and Buchanan). = Day : <i>Tetrodon patoca</i> .	Globe fish	.. Kend.
	405	<i>Arothron immaculatus</i> (Bloch) .. = Day : <i>Tetrodon immaculatus</i> .	Globe fish	.. Kend.
	406	<i>Arothron reticularis</i> (Bloch) .. = Day : <i>Tetrodon reticularis</i> .	Globe fish	.. Kend.
	407	<i>Arothron hispidus</i> . = Day : <i>Tetrodon hispidus</i> .		
	408	<i>Arothron stellatus</i> ..	<i>Ostracion lentiginosa</i>	
Family : Balistidae				
	409	<i>Abalistis stellaris</i> (Schneider) .. = Day : <i>Balistis stellatus</i> .	Trigger fish.	
	410	<i>Abalistis mitis</i> .. = Day : <i>Balistis mitis</i> .	Trigger fish.	
Family : Diodontidae				
	411	<i>Diodon hystrix</i> (Linnaeus) .. = Day : <i>Diodon hystrix</i> .	Porcupine fish.	
Order : BATRACHOIDIFORMES				
Family : Batrachoididae				
	412	<i>Batrachus grunniens</i> (Linnaeus) .. = Day : <i>Batrachus grunniens</i> .	Frog fish	.. Gongcha.
Order : LOPHIFORMES				
Family : Antennariidae				
	413	<i>Antennarius hispidus</i> (Bloch) .. = Day : <i>Antennarius hispidus</i> .	Angler fish.	
	414	<i>Histrio histrio</i> (Linnaeus) .. = Day : <i>Antennarius marmoratus</i> .	Angler fish.	

MARINE FISHES

CHAPTER 1

Fishes

Fishes enumerated in the foregoing taxonomic list are usually referred to, in common parlance, under the group-names, such as sharks, mullets, sardines etc., each group containing species of similar characters and habits. In some cases even a single species may have special characteristics worth mentioning. These characteristics, either species-wise or group-wise are furnished in the following short notes :—

CLASS : ELASMOBRANCHII (Cartilaginous fishes)

The sharks, skates and rays together constitute this group called *Selachii*, represented in Maharashtra waters by two super-orders *Selachioidei* (the true sharks) and *Batoidei* (the rays) including 11 families, 26 genera and 57 species. The fishes are greatly variable in size and shape, ranging from 2 feet to varitable monsters of 52 feet or more in length and all are marked by possession of cartilage in place of bones.

(1) SHARKS (*Selachioidei*)

The word shark is generally associated with apprehensions of sleek and sinister monsters, waiting to grab anything by their mouth, lined by sharp and formidable teeth. In reality, amongst the several species found in Maharashtra waters, only a few are really dangerous to man.

To scientists, they are of great biological significance for they represent the group of fishes, which have survived unchanged since remote geological times and can, therefore, be called as "living fossils".

Sharks are found in all the seas of the world and at different depths. They are necessarily marine in habitat, though some ascend rivers and one species, not represented in Maharashtra, is a permanent resident of fresh water (river Ganga).

Feeding habit of sharks is essentially that of a predatory scavenger. With its mouth on the under side, the shark goes about picking up any item of food on the bottom, as it comes in its way. With poor eyesight, the food detection is believed to be accomplished by its highly developed sense of smell; by sight, it may not detect even at a distance of 10 yards. Experiments conducted on sharks by plugging their nostrils with cotton, have shown that they do not care for food at a short distance, but when plugs are removed, food is immediately detected and attacked.

Sharks are of considerable commercial importance. Unlike other fishes, most of the parts of sharks can be profitably utilised. The shark fins are dried and mainly exported for making soup, a great delicacy in many countries; flesh is eaten and skin can be processed to make Shagrin leather, for hand-bags etc. Liver of sharks yields oil rich in Vitamin A to the extent of about 25,000 litres per annum in Maharashtra.

CHAPTER 1

Fishes

Although considered primitive otherwise, in the method of reproduction sharks are more advanced, suggesting that they form a curious mixture of ancient and modern creatures. Fertilization is internal; in some species females lay horny capsules, called "mermaid's purse" of different shapes, containing 2 to 4 eggs, and in others there is a noteworthy adaptation for bringing fourth young ones as in mammals, by the formation of a special "foetal chamber" and also a placenta through which the developing embryos feed on the nutritive fluids produced by the mother. Their average production (catch) together with rays, is about 600 tonnes every year in Maharashtra.

THE WHALE SHARK (*Rhincodon typus* Smith)

The whale shark known in Bombay as Karanj enjoys the reputation of being the largest fish in the world. This shark grows to a size of 70 feet in length and several tons in weight. Despite its monstrosity in size and appearance, it is one of the most harmless sharks, feeding on small crustaceans and planktonic creatures, with its wide terminal mouth. Its liver is small and yields oil but the oil is poor in vitamin potency. The fish is also known as basking shark because of its habit of swimming near the surface of water.

THE TIGER SHARK (*Galeocerdo arcticus*)

The fish has earned its name because of its colour pattern resembling that of a tiger particularly in young specimens which tends to disappear with age. In Marathi it is known as 'Waghbeer'. It grows to a length of about 20 feet and is reported to attack human beings. Amongst sharks, Tiger shark is a prolific breeder, giving birth to as many as a record of 57 young ones at a time. Its liver yields comparatively large quantity of oil but it is not very rich in vitamin potency.

BLUE SHARK (Genus *Carcharhinus*)

This genus comprises many species and is characterized by the absence of spiracles and by the presence of a pit at the root of the caudal fin. The members of this genus have uniform bluish-gray colour and streamlined bodies. Their fierce nature and voracious feeding habit have earned them a name as "hungry dogs" or "wolves of the sea". These are the sharks mainly sought for by commercial fishermen.

HAMMER-HEAD SHARKS (Genus *Sphyrna*)

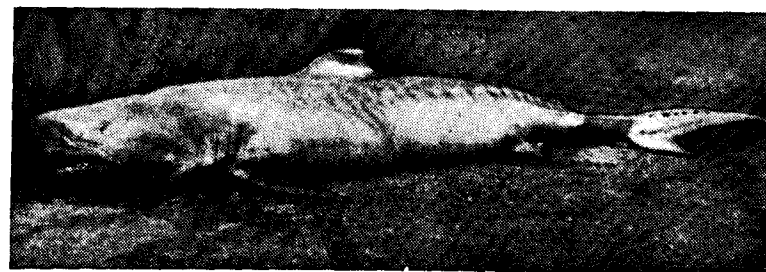
These sharks which are known as 'Kanj' or 'Boot' in Marathi, have heads which are flattened and drawn out laterally in the form of a hammer, with eyes situated at the extremities of the lobes. They are powerful swimmers and inhabit most of the warm seas. Some of them grow to a size of 15 feet. Their liver oil is usually rich in Vitamin A.

(2) SKATES AND RAYS (*Batoidei*)

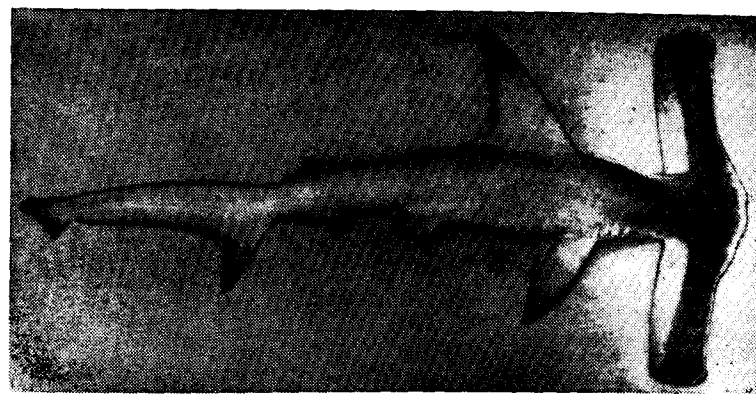
Unlike sharks, the skates and rays have a dorso-ventrally flattened body which may be guitar-shaped or quadrangular or roughly circular in shape. These fishes are admirably suited to live a life entirely at the



Son mushi—Dog fish (*Scoliodon sorrakowha*) (Guveir)



Waghbeer—Tiger Shark (*Gabocerdo arcticus*) (Faber) (a 12-foot Monster)



Kanj—Hammer-head Shark (*Sphyrna zygaena*) (Linnacus)

bottom of the sea with their mouth on the lower (ventral) side. Most of them have camouflage coloration, resembling the sea floor. As a rule, they are not active swimmers like sharks. Skates, lying mostly half buried in the sand or mud, are considered as less active than rays; the only active members of this group are saw-fishes. The food of all these fishes consists of almost all types of animals found on the sea-floor.

SKATES

GUITAR FISHES (FAM. Rhinobatidae)

This family is represented by three genera in the Maharashtra water : (1) *Rhina ancylostomus* the Mud-skate, with upper surface of the body marked with a number of round white spots, (2) *Rhynchobatus djiddensis* the Plough-head skate, and (3) the genus *Rhinobatus* the true Guitar fish. All these are widely distributed in the Indian Ocean and have acquired the name because of their somewhat guitar shaped bodies.

SAW FISHES (Genus *Pristis*)

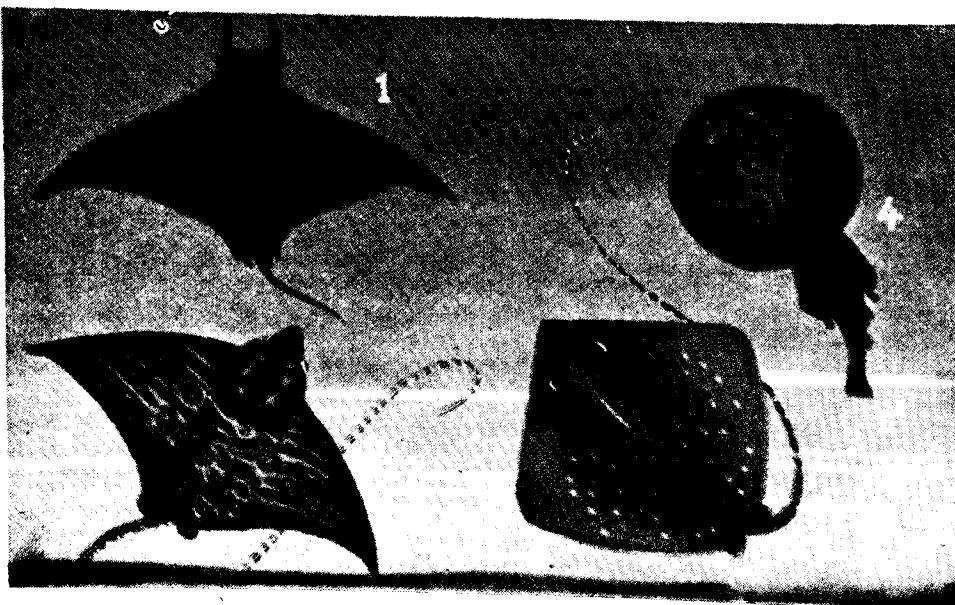
The basic anatomical peculiarity of these fishes is that the 'nose' is produced into a double-edged, saw-toothed sword. The saw fish is a ray, as is shown by the position of the gills on the underside of the pectoral fins. These fishes are represented in our waters by two species, *Pristis cuspidatus* and *P. microdon*, which are readily distinguishable by the number of teeth, the former having 23-25 pairs and the latter only 17-20 pairs. These fishes grow to a size of 18 to 20 feet in length. The saw of these fishes, specially of younger fish, is considered a popular article of curio with lovers of marine life. Liver of these fish yields oil rich in Vitamin A.

RAYs

The marine waters off the coast of Maharashtra abound in rays such as the sting rays, the eagle rays, the cow-nosed rays, the devil rays and the electric rays, all represented by 22 species belonging to five families. The principal feature of the sting rays is the presence of one or more spines with jagged saw-like edges, as formidable weapons on the tail, the length of which varies from 3 inches to 12 inches. These spines when worn out are usually replaced by others. A sting from these spines can inflict a nasty and painful wound. Along each edge of a spine is a narrow groove containing glandular tissue. The cells of this tissue secrete a virulent poison which enters the wound when inflicted. The poison is at times fatal to human beings. Eleven species of sting rays recorded from Maharashtra belong to the family *Trygonidae*. The eagle rays are represented by four species belonging to the family *Myliobatidae*, and the cow-nosed ray is represented by a single species *Rhinoptera javanica*. Two species of *Mobula*, of the family *Mobulidae* represent the devil rays, which are known to grow to a size of 18 feet across the disc. These fishes can be easily detected by the presence of two cephalic horns present on the head. All these rays feed on clams, oysters and other shell-fish, benthic animals etc.



1 Killis—speckled eel [*Muraena (Gymnothorax) undulata*] (lacepede)
2 Killis (*Muraena pseudothyrsioidea*) (Bleeker)
3 Waghya killis [*Muraena (Gymnothorax) favaginea*] Painted moray



1 Shing pakat—Devil ray (*Mobula dibolus*) (Shaw)
2 Kabra bolad—Mottled eagleray (*Aetomylae maculatas*) (Gray)
3 Gores or Goraspaket—Spotted ray [*Dasyatis (Himantura) gerrardii*] (Gray) (Electric ray)
4 Bijali or Zingina—Electric ray (*Torpedo marmorata*) (Risso)

CHAPTER 1

Fishes

The electric rays are represented by four species of the family *Torpedinidae*, of which *Torpedo marmorata* is the commonest. As the name suggests these fishes are capable of discharging electric current, produced by a special paired electric organs situated between the pectoral fins and the head. The electric discharge is either under control of the fish or may result on account of simple reflex action. The electrical discharge is used by the fish to kill the prey or in self-defence against potential enemy.

CLASS : TELEOSTOMI (Bony Fishes)

Bony fishes are marked by possession of true bone in place of cartilage of sharks and rays. Bony fishes are divided in different groups as under :

(1) SARDINES AND RELATED SPECIES

The order Clupeiformes which comprises the sardines, anchovies, Indian-shad, Tarpon etc., is commercially the most important group, contributing nearly one-fourth of the total marine fish landed in India. In maritime Maharashtra, it is represented by 6 families covering 18 genera and 31 species. Members of this group are generally small, rarely more than 12 inches except a few forms like tarpon, chanos and Shad. They feed mostly on plankton. Ehoaling and migration are the characteristic habits of these fishes. When the shoals are near the coastal regions mainly during the winter season, these are exploited by operating gill nets, cast nets and shore-seins called 'rampan'. Besides being an important source of food, Clupeiformes contributes largely to the industrial production of body fish oils and fish-meal, the latter well-known as an essential constituent in the diet of cattle, poultry and pigs.

(a) THE INDIAN TARPON (*Megalops cyprinoides*)

The Indian tarpon, also known as ox-eyed herring or silver king, belongs to the family *Megalopidae*. Its distribution is mainly in coastal waters and estuaries, and it may even enter fresh waters. Tarpon is a very active fish, pursuing shoals of smaller fish, especially mullets, its favourite food; occasionally it leaps out of water, like salmon, in sportive manifestation of its intense vitality. Unlike other Clupeiformes, it grows to about two feet. These qualities make Indian Tarpon a goodgame fish. It is bony but good eating when fresh.

It breeds in sea prior to monsoon and a large number of larvae are seen ascending estuaries. The larva of this fish, like the *Leptocephalus* larva of eels, is elongate, ribbon-like and transparent with tiny head and fins and air bladder visible as a prominent structure.

(b) SARDINES

Although sardines are represented in Maharashtra by 5 species, only 2 species *Sardinella longiceps* — the oil sardine, 'Tarli' or 'Haid', and *Sardinella fimbriata* — the white sardine or 'Pedwa' are of

CHAPTER 1

Fishes

considerable commercial importance along the Ratnagiri Coast. Vast fluctuations in sardine fisheries are known the world over, and maritime Maharashtra is no exception. They are mainly caught in shore seines or 'rampans.'

The average span of life of oil sardines is about 3 to 4 years; they grow to 10, 15 and 19 cm at the end of 1st, 2nd and 3rd year respectively. It is a plankton feeder, the favourite food being a diatom *Fragilaria oceanica*. The sardines are reported to spawn only once in their life span, as they attain maturity only in the third year. The normal catch (2,350 tonnes) mainly comprises immature specimens. Sardines are mostly cured, though a small portion is eaten in fresh condition. When landings are heavy they are used for extraction of oil (body oil).

(c) THE INDIAN SHAD AND GIANT HERRING

The Indian shad and the giant herring, locally known as 'Palla' and 'Bhing' respectively, are the two species of *Hilsa* viz. *H. ilisha* and *H. sinensis* belonging to the family Clupeidae. Though these fishes look similar and are similarly distributed from Persian Gulf to Burma, they prefer different habitats. *H. sinensis* inhabits the coastal waters, rarely coming into estuaries, while *H. ilisha* ascends into fresh waters. The former constitutes a sizable fishery (2,000 tonnes p. a.) in the coastal waters of northern Maharashtra extending up to Bankot creek (Savitri river). *H. ilisha* has now been of lesser significance to Maharashtra as it is available in small quantities only in Ulhas river near Kalyan and in a few smaller ones up to Savitri river near Bankot, the main abode on the west Indian coast being the Narbada.

Like Salmon, *H. ilisha* can be considered a truly anadromous fish, spending a part of its life in the sea and ascending rivers for the purpose of spawning. Because of this habit, any obstructions such as dams and weirs are detrimental to Hilsa fisheries, unless "fish passes" or ladders are provided for them to continue their spawning migration successfully. In Mahanadi, Godavari, Krishna and Cauvery rivers, the extent of migration of Hilsa has been greatly affected on account of the construction of anicuts or dams. Similar danger exist in the Narbada; the Hilsa fishery in Ulhas river near Kalyan is on the verge of extinction on account of pollution caused by factory effluents near Kalyan, in the vicinity of Bombay.

Both these species can be considered as large Clupeids, but *H. ilisha* is slightly smaller of the two, growing to about 24 inches in total length whereas *H. sinensis* grows to about 28 inches. There is, at present, a general belief that Hilsa fisheries are gradually depleting. It has been observed in the past that there is a five-year cycle in Hilsa fishery, but it is essential that concerted efforts to study the biology and fishery of Hilsa are made.

CHAPTER 1

Fishes

(d) ANCHOVIES

Anchovies are represented in the Maharashtra waters by 8 species, most important being, *Coilia dussumieri* — the Golden anchovy or 'Mandeli' which is commonly caught in the bag-nets along the coast of northern Maharashtra. They are popular as food among middle classes and are consumed in fresh condition in and around Bombay. At distant centres, they are dried for later use.

Incidentally, anchovies have assumed an important place in world fisheries, because of the unprecedented catches off Peru, making that country foremost amongst all in fish-production.

(e) RAINBOW SARDINES

Elongated body, rounded belly, desiduous scales and absence of lateral line characterize the family Dussumieridae to which these sardines belong. They are represented in our waters by two species *Dassumeria acuta* and *D. hasselti*. Coloration of bluish green on the dorsal side, silvery on the sides and a golden lateral band on the belly has earned the fish a popular name as rainbow sardine.

(2) SILVER BAR (*Chirocentrus dorab*)

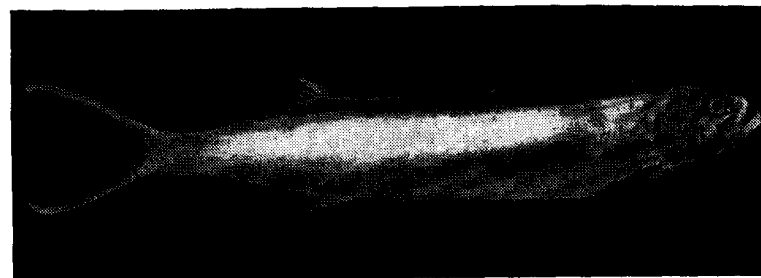
It is one of the commercially important fishes of Maharashtra with an average production of about 2,000 tonnes annually. Though the average size caught varies between 1 to 4 feet, it is known to attain larger size up to 12 feet, in length. The body is elongated, laterally compressed, of uniform height and silver in colour and hence the name — the silver bar. It is good for eating, but full of bones.

(3) CHANOS

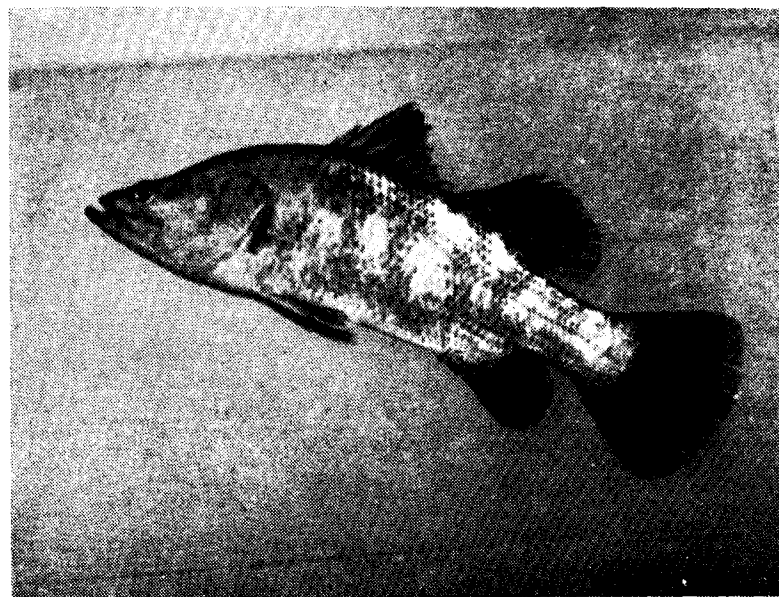
The Milk fish *Chanos chanos*, though not a very common fish in Maharashtra, is one that is occasionally found in estuaries or in the coastal waters. In the southern part of western India, it is found in large numbers. Young ones (fry) of the fish are collected and fattened in fresh or estuarine ponds for food purposes. The fish attains a maximum length of 4 to 6 feet. During April-June, millions of transparent larvae are caught in bays and estuaries in South India, particularly in the Gulf of Manaar. These larvae can be directly transferred to fresh water and are quite hardly for transport. In India, it is known to grow to 15 inches in sea-water, 19 inches in brackish water and 25 inches in fresh water, in the first year, under ideal conditions.

(4) BOMBAY DUCK

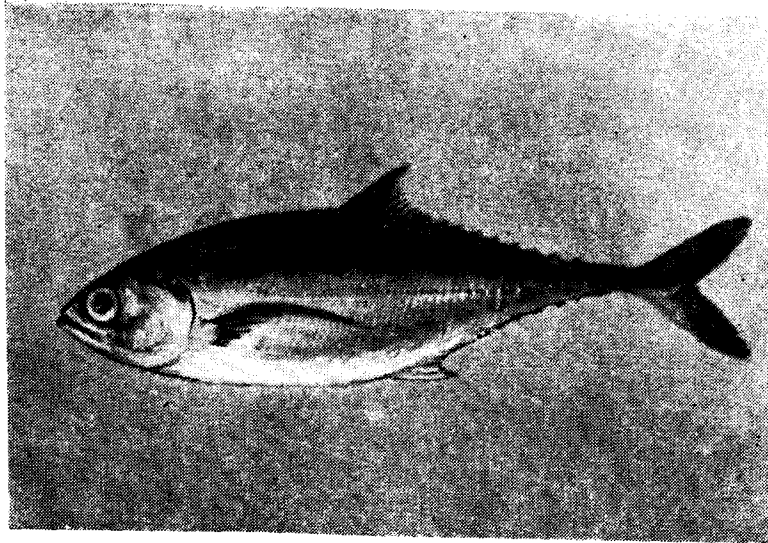
The Bombay duck, *Harpodon nehereus*, is one of the most important fishes of Maharashtra, with an average annual landing of about 40,000 tons, contributing 16 per cent. of the total marine catch in the State. The fish has a limited distribution in our waters, being restricted to northern Maharashtra, its southern limit being Paj — Harnai. It extends northwards up to Veraval in Gujarat State. The fish is mainly



Karali or Datal—Silver barfish (*Chirocentrus dorab*) (Forsk.)



Khajura, Jitoda or Bakti—Cock-up (*Lates calcarifer*) (Bloch)



Kat-bangada—Horse mackerel (*Megalispis cordyla*) (Linnaeus)



Bombay-duck (Bombil) being dried on scaffolds

caught in 'dol' nets, and is mostly sun-dried as food for the common man. It is also exported in dried condition to Mauritius, Burma, Singapore etc., and recently to European countries.

It is characteristically a deep water fish with soft cylindrical body and large mouth beset with numerous sharp teeth but peculiar in its habit of visiting in-shore waters and even creeks. Prawns and shrimp are its favourite food. Maturity is attained at the end of the second year or beginning of third year when the length is about 9 inches or 230 mm. It is a continuous breeder, having two peak spawning periods one during May to July and another during November to December.

(5) CAT FISHES (Techysuridae, Plotosidae)

Catfishes, comprising about 13 species out of which 11 are commercially important, have earned the name of catfishes on account of possession of the prominent barbels resembling the mustaches of cats. Scaleless body with adipose fin, serrated dorsal, pectoral spines and presence of barbels characterize the cat fishes. The serrated spines are known to inflict dangerous wounds. They mostly inhabit coastal waters and estuaries. The most interesting behaviour among some of the marine catfishes is that the male takes over the onerous responsibility of incubating eggs in the mouth until the young are hatched. It is, therefore, not uncommon during breeding season to get males with developing eggs in their mouth.

They are mainly caught by long lines and gill nets. Catfishes constitute an important supplementary food of the poor. They are cured and transported to the hinterland. The average annual catch in Maharashtra is about 5,000 tonnes.

(6) EELS AND MORAYS

Eels have a snake-like elongated body; dorsal, caudal, and anal fins are united to form a frill. In Maharashtra, eels are represented by 6 species belonging to 4 families. From commercial point of view, *Muraenesox talabonoides* is the only important species; it is a bottom dweller, off shore in habitat and contributes about 4200 tonnes p.a. Other eels, popularly called Morays, are found in the coastal regions, specially in crevices of rocks and stones and are displayed in the public aquaria all the world over. Only one member, *Pisodonophis boro* — the mud eel of the family Ophichthyidae inhabits estuaries and is mostly found in sand.

(7) GAR FISHES

The gar fishes are represented in Maharashtra waters by two families, *Belonidae* and *Hemirhamphidae*, and constitute a group of good food fishes. They are known in Marathi as "Toli" or "Toki" and are always in demand.

CHAPTER 1

Fishes

Family : Belonidae.—It comprises full beak gar-fishes, also known as needle-fishes or long-toms. They have both the jaws drawn out to form a long beak armed with sharp teeth. They have slender long body with characteristic coloration iridescent sea-green or bluish-green on the back, and silvery-white beneath. They are active and gregarious in habit, often thrusting themselves out of water to skim the surface with great speed, with only the tail remaining submerged. They generally grow up to about 18" in length but some of the larger species are known to grow to a length of 5 to 6 feet.

Four species that are mainly caught off Maharashtra coast are residents of open sea, migrating usually into coastal waters and sometimes into estuaries for breeding, as evidenced by the availability of their characteristic spawn in these areas, as a mass of globular jellies, light-pink in colour, with eggs, each measuring 3 mm. in diameter, huddled together by means of sticky threads, generally adhered to seaweeds.

Family : Hemirhamphidae.—The family includes half-beak fishes in which only the lower jaw is drawn out, the upper remaining short. They are represented in our waters by seven species belonging to two genera. Habits of these fishes are very similar to those of full-beak gar fishes. They are usually caught in in-shore water with the help of gill nets and are always in demand for the table.

(8) FLYING FISHES

Flying fish, near relative of gar-fishes and represented in our waters by four species of the family *Exocoetidae*, are characterised by slender sub-cylindrical body, longer lower lobe of the forked caudal fin, greatly enlarged pectoral fins helping the fish to glide, and a large air bladder. These fishes have a metallic blue or bluish green colour on the back, shading to silvery white beneath, with pectorals and pelvic fins often barred or blotched. They are found in all warm seas and are mainly inhabitants of open oceans. They are called Pakharu masa in Marathi near Ratnagiri where they occur occasionally.

Flight of these fishes represents an improvement upon the spasmodic leap of the gar fishes. It involves a four stage operation, breaking the surface, taxiing, flying and landing, in a manner very similar to that of an aeroplane. During the first part, the fish swims rapidly near the surface of the sea with fins folded, then spreads the pectorals to support the body, the propulsive power being supplied by vigorous movement of the tail, especially the strong lower caudal lobe. It then takes off at the crest of a wave and glides through the air, landing with a splash or a graceful dive into the water. It is estimated that flying fishes are capable of a sustained flight of about 200 to 300 yards at a speed of some 40 miles per hour. Sometimes, to the joy of sailors, these fishes land on the decks of ships.

The breeding habits of these fishes are similar to those of gar fishes, the eggs being deposited in the mass of drifting weeds. The young of

some flying fishes have a single or double barbel hanging from chin, sometimes quite long and elaborately fringed.

The flying fish fishery in Ratnagiri is seasonal; only during winter a small quantity is landed; it, however, forms a major fishery on the Coromandal coast. The flesh of these fishes is firm and palatable and is considered a delicacy. These fishes, besides being of commercial importance, play an important part in the life history of many giant fishes such as dolphins, bill fishes, tunnies and bonitos, whose principal food happens to be the flying fishes.

(9) SEA-HORSE AND ITS RELATIVES

The order *Syngnathiformes*, as the name implies ('syn' meaning 'together' and 'gnaths' meaning 'jaw'), includes fishes such as sea-horses, pipe-fishes, flute-mouths and ghost pipe-fishes, in which the jaws are fused or held together. In waters of Maharashtra, it is represented by three families, four genera and five species.

Every one has seen a horse with four legs, but believe it or not, the sea-horse has none. While creating a sea-horse, the King Neptune appears to have combined all sorts of oddities. Sea horses, in our waters, belong to the genus *Hippocampus*, meaning in Greek horse and monster, and are represented by two species, *H. trimaculatus* and *H. kuda*. The members of this group are the quaintest creatures having a head like a horse, body encased in an armour, and a prehensile tail. With these oddities, they have become the delight of souvenir-hunters and the idol of fish-fanciers.

The breeding habits of these fish are unique. They display a sexual diamorphism, the males have a pouch wherein the female deposits the eggs. The eggs undergo development in the pouch until the male after suffering the labour pains, brings forth the young 'pony' fishes.

No wonder such a fish should appear in ancient and medieval literature with many legends associated with it. For centuries, sea-horse was credited with having strong magical and medical qualities, considered as a sovereign remedy for the bite of a mad dog. In Java, people place sea-horse in the water, intended for real horses to drink and consider it an excellent tonic for them.

Pipe fishes, as the name suggests, are more slender and unlike sea-horses they do not have a prehensile tail. Their breeding habits are similar to those of sea-horses; the eggs are carried by the male enveloped in folds of skin which form a sort of brood-pouch under the belly. Majority of pipe fishes like sea-horses are marine, inhabiting coastal waters and reefs, but a few are fresh-water forms.

The pipe fishes on an average grow to a length of 6 to 8 inches; the smallest species recorded is less than an inch and the biggest about 22 inches.



1 Ghodamasa—Seahorse (*Hippocampus trimaculatus*) (Leach)

2 Wata—Pipefish (*Syngnathus intermedius*) (Kanp)

CHAPTER 1

Fishes

FLUTE MOUTHS

Flute-mouths or the Tobacco-pipe fish are represented in our waters by a single species, *Fistularia villiosa*. It has a flute like snout, an elongated scaleless body and weak and pointed fins. The tail fin is unique in having a long filament extending back from the caudal fork (middle portion of the fin), like a whiplash. It is formed of two fused caudal rays.

Compared to sea-horse and pipe-fishes, the flute-fish is considered a giant, as it grows to a length of 6 ft. and a weight of 8 pounds.

Last in the series are the ghost pipe-fishes or false pipe-fishes, represented in our waters by a single species *Solenostomus cynopterus*, belonging to the family *Solenostomidae*. So far, only one female specimen has been captured in Maharashtra waters near Ratnagiri. It was found among floating weeds. This weird little fish has two dorsal fins and large ventral fins; in females ventrals are united to form a brood pouch in which the eggs are fastened by stalks on filaments of the abdominal skin.

This is the only fish in the order *Syngnathiformes* which defies the general rule of 'father turn mother', since the incubation of eggs takes place in the so called brood pouch of the female described above.

(10) BARRACUDAS

Barracudas, also called Sea-pikes, are represented in waters of Maharashtra by three species viz. *Sphyraena acutipinnis*, *S. jello* and *S. obtusata*, belonging to the family *Sphyraenidae*. Of these, *S. obtusata*, the striped barracuda, is known to grow to a length of 6 feet and weight of 100 pounds.

In some parts of the world, particularly in Florida and West Indies, the barracudas are more dreaded than sharks, because they are not only ferocious but are liable to attack human beings without any provocation. The barracudas have powerful jaws, armed with strong dagger like teeth.

Barracudas, in general, are voracious eaters, their food consisting mainly of smaller fishes of all types.

They are readily taken on rod and line and are considered good food-fishes, except that there is a certain prejudice against eating them in certain seasons, when the flesh has an ill reputation of being poisonous.

(11) DOLPHIN FISH

Dolphin fish or the 'dorado', *Coryphaena hippurus*, an oceanic fish with world wide distribution, is the only species known of the family *Coryphaenidae*. The body is elongated and laterally compressed, with a curiously shaped head provided with a vertically cutting edge in front. The dorsal fin is long extending from the nape to the tail. The fish has brilliant colour when fresh, the back being emerald green dotted with brilliant blue spots, dorsal fin purple with light-coloured stripes, the belly golden and the tail yellow.

The dorado, a rapid swimmer, is a good game and spectacular fighter when hooked. It grows to a length of 6½ feet. Its most favourite food is the flying fishes.

(12) BLACK KINGFISH OR BUTTERFISH

As the popular names suggests, *Rachycentron canadus*, family Rachycentridae is black in colour and very delicate in taste. It is not common on our coast. It is reported to grow to a weight of 150 lbs. and is a good sporting fish, giving a spectacular fight. It is known as 'Modosa' in Ratnagiri.

(13) MULLET

Mulletts, family Mugilidae, have a world wide distribution, inhabiting both temperate and tropical waters. In general these fishes are small sided but a few of them are known to grow to a size of three feet. Blunt head, toothless mouth, large scales, absence of lateral line and first dorsal of 4 rays only, are the chief characteristics of these fish.

In waters of Maharashtra, 8 species have been recorded. These are mainly estuarine and can ascend freshwaters. They are known as 'Bôl' or 'Bhadvi' when small and Mangan' or Pilsa when large. Impoundment of fry of mullets in brackish water for fattening is not uncommon, especially in 'khar' lands and salt-pan areas in the monsoon. Fry coming with tidal waters in the month of June and July are impounded and allowed to grow for four or five months. Mulletts are common all along the coast and are excellent food when fresh and are highly valued.

Out of the 8 species recorded *Mugil cephalus* is the largest and most widely distributed. Mulletts mainly feed on filamentous and planktonic algae and vegetable debris on the bottom. Mulletts mostly breed during the early part of monsoon.

(14) THREADFINS

Threadfins are characterised by the pectoral fin, the lower portion of which consists of distinct elongated rays that gave them the name thread fins. These rays are known to serve as organs of touch. Of the six species recorded from Maharashtra, *Polydactylus indicus* and *Eleutheronema tetradactylus*, popularly called 'Dara' and 'Rawas' respectively are some of the most important species of our prime food fishes, growing to a size of 4 to 6 feet in length. Air-bladders of Dara are dried and exported for manufacture of isinglass and for refinement of brewery products. Average annual production of 'Rawas' and 'Dara' together is about 2,000 tons per annum in Maharashtra. Rawas prefers inshore waters and frequents creeks and estuaries during breeding season; whereas Dara prefers deeper portions of the sea. Rawas is caught in gill nets and is also popular with anglers. Dara being a bottom dweller is caught in bottom-set nets. It is a valuable fish for the trawl fisheries of Maharashtra.



Dara—Monk fish or giant threadfin
(*Polydactylus indicus*) (Shaw)

CHAPTER 1

Fishes

(15) COCK-UP

Lates calcarifer, the giant perch, popularly called 'Jitada', 'Khajura' or 'Bhekti', is a great delicacy and a popular game fish, growing to a length of about 5 feet. It breeds during monsoon, and fingerlings are collected for fattening in inundated salt-pans. It is carnivorous, feeding mainly on fishes, shrimps and snails. Being estuarine in habitat, it is tolerant to dilution in salinity. Young ones frequent flooded rice fields in search of their favourite food and when they grow up are captured by farmers in temporary ponds in their fields for their occasional feasts. This is observed near Pen and Panvel in Kolaba District.

(16) GROUPERS

These wide mouthed fishes of the family Serranidae are mainly inhabitant of rocky shores. They are known as Hekru or Gobra and are represented in waters of Maharashtra by 8 species, of which *Epinephelus lanceolatus* is the largest, growing to a length, sometimes above 6 feet. These are voracious in habit; at the Taraporevala Aquarium, these fish are sometimes seen to devour even a spiny lobster. They are very tenacious and remain alive for a long time after they are caught. They are, therefore, highly prized where "halal" is necessary.

(17) TARGET PERCHES

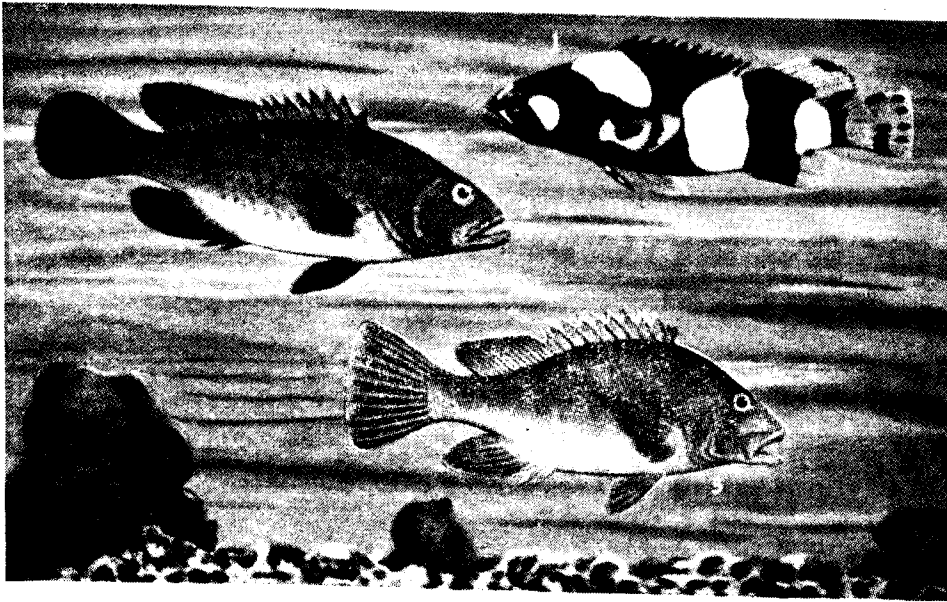
These are small fishes belonging to the family Theraponidae and are so called (target perch) because of concentric dark rings on the body and a dark spot on the dorsal fin, giving an appearance of bull's eye of a shooting target. Of the four species, *Therapon jarbua* and *Therapon theraps* are common, the former in the inshore waters and the latter in the off-shore waters. *T. jarbua* is known as "navera" it breeds freely in estuarine waters, young ones frequenting shallow fresh-water streams in large numbers.

(18) LADY FISH

Sillago sihama, lady fish or sand whiting, is one of the very popular food fishes of Maharashtra. It has an elongated, sleek and slender body, with olive green colour along the back becoming light on the abdomen. It prefers regions of coastal waters and estuaries. Polychaete worms form major item of its food. Spawning season extends from August to February. A study of sex ratio has revealed that males outnumber the female in the commercial catches in the proportion of 56.0 : 44.0. It attains a length of 15, 20, 25 cms. and 28 cms. (about 6, 8, 10 and 11 inches) in the 1st, 2nd, 3rd and 4th year of its life respectively. It is known as "Murdi," "nagli" or "Renavi".

(19) HORSE MACKERELS

The family Carangidae, which contains horse mackerels, has a large number of genera and species, and has a world wide distribution, playing an important role in the commercial fisheries. In Maharashtra, as many



- 1 Pivla Hekru—Yellow grouper (*Epinephelus lanceolatus*) (Bleeker)
- 2 Khavdya Hekru—Speckled grouper (*Epinephelus malabaricus*) (Bloch & Schor)
- 3 Ganeshor Tambusa—Rosy snapper (*Lutianus roseus*) (Day)



- 1 Wada—Scat (*Scatophagusargus*)
- 2 Dhagir—Blue ring (*Holocanthus annularis*)
- 3 Chand—Spotted dory (*Drepane punctata*) (Juvenile)
- 4 Nayada or Navhera—Target perch (*Therapon jairhna*)

as 27 species, belonging to 11 genera have been recorded. Most of these fishes are fast swimmers, inhabiting surface waters. They have a tendency to form schools, hunting smaller fishes for food.

Though most of the members do not grow to more than a foot in length, some like *Megalaspis cordyala* and *Scombroides tala* are large varieties. Most of the lesser varieties are commonly known as horse mackerels (species of the genus *Selar*, *Citule* and *Caranx*). The three species of *Trachynotus* are commonly known as the pseudo-pomfrets. *Scombraides tala*, also called port hole fish because of the circular marks on the body resembling port holes, is one of the very few carangids growing to about 4 to 5 feet in length. As a group, horse mackerel are not very popular as food fish, but when cured with salt, they are acceptable to many. Their catch averages 1,300 tonnes per annum.

(20) SNAPPERS

The snappers, belonging to the family *Lutianidae*, are so called because of their habit of snapping at baits, rendering them easy to be caught on lines. They are mostly inhabitants of rocky regions and coral reefs in tropical waters. This family is represented in our waters by nine species and most of them, being colourful, are good aquarium fishes. As food fish also, they are appreciated by all classes.

(21) LEOGNATHIDS AND GERRIDS

The families of *Leognathidae* and *Gerridae* are represented by 9 species and 5 species respectively. Leognathidae are small fishes, rarely exceeding 3 inches in size, and are caught in large numbers in trawl and shore-seine. Gerrids grow larger to about 6" in size. Though not very much prized as food fish, they are welcome to the fisherman because of their quantity.

(22) CROAKERS OR DRUM FISHES

The croakers belonging to family *Sciaenidae*, are known to make a peculiar grunting noise by means of their large air bladder. This has earned them a popular name of croakers or drum fishes. They are widely distributed in warm waters of the world; in maritime Maharashtra 17 species have so far been recorded. Out of these, the 'Ghol' *Pseudosciaena diacanthus* and the 'Koth' *Otolithoides brunneus* growing to a large size are commercially more important than the remaining small species of Sciaenids, popularly called 'Dhoma', which are very common in trawl catches, comprising nearly 30 per cent. of the total catch. The average annual production of 'Dhoma' in Maharashtra is about 9000 tons. In Bombay, they are eaten fresh, but in distant place like Ratnagiri, they are sundried and cured. It is mainly a poor man's fish. The 'Ghol' and 'Koth' fishery is of considerable importance to Maharashtra. Average landings of 'Ghol' and 'Koth' together are about 1700 tons per annum; their large air-bladders are dried and exported for use in preparation of isinglass and in refinement of brewery products.

CHAPTER 1

Fishes

(23) EMPEROR BREAMS

Emperor Breams belong to the family *Lethrinidae* of which only one species *Lethrinus miniata* is recorded from our waters though more species are likely to exist. Some of them change their colour pattern on capture or when disturbed. These fish inhabit tropical and sub-tropical waters and are gaily coloured and are given popular names as emperor, warrior, lancer, admirals etc.

(24) BUTTERFLY FISHES

These fish mostly belong to the families *Pomacanthidae*, *Chaetodontidae*, *Pomacentridae* and *Zanclidae*; common amongst them are the blue-ring butterfly fish, *Heniochus*, chaetodonts, the sergeant majors and the Moorish idols known for their exquisite beauty in having variegated colours. As such, they are attractive fishes for display in aquarium tanks. They abound in rocks and reefs of our coastal waters but do not form a fishery as such.

(25) CICHLIDS

The family Cichlidae is represented by two species, *Eetroplus suratensis* — the pearl-spot and *E. maculatus* — the orange-chromide. The Pearl spot is so called because of the whitish pearly spots on the entire body and is cultured in some places. It is known as 'Kalundar' because it turns black after death. It is essentially algivorous and breeds almost throughout the year. It is always considered good food fish. Both these fish live equally well in marine and fresh water, and are known for their parental care.

(26) RIBBON FISHES

Of the 3 species of ribbon fishes, family *Trichiuridae*, found in Maharashtra, *Trichiurus lepturus* and *Lepturacanthus savala* are common. They are respectively known as Wagti and Baga or Bale, and form a sizable fishery contributing about 6,500 tonnes per annum. Baga is much larger, nearly four feet in length, but the body in both is extremely elongated and laterally compressed so as to look like a silvery ribbon. They are voraciously carnivores, feeding when young on prawns, and mainly, when in adult condition, on fishes. These fishes breed around June when they migrate to off-shore waters.

Ribbon fishes are mainly caught in 'dol' nets, trawl nets and 'rampans'. The fish are mostly sun-dried or salted. Though not very much in demand in coastal areas, they serve as poor man's food in the interior tracts.

(27) MACKERELS

The family Scombridae, to which mackerels belong, includes most important food fishes, contributing large quantities to the total catch all the world over. In Indian waters, it is represented by a single species, *Rastrelliger kanagurta*, constituting sometimes as much as 25 to 30 per cent. in the total production of marine fishes in the country.

CHAPTER 1

Fishes

Although it has a distribution on the west and east coasts of India, the major part of the fishery, more than 90 per cent, is confined to the west coast, extending from Ratnagiri to Cape Comorin.

Rastrelliger kanagurta is a streamlined and speedy fish, gregarious in habit. Its food consists of microscopic zooplanktonic and phytoplanktonic organisms. Intensity of feeding is observed to be high when the mackerel are maturing, and low when they are in an advanced stage of sexual maturity. The sexes are indistinguishable up to a size of about 5 inches or 12 cms. and minimum size attained at first maturity is about 8-9 in. or 22-23 cms. The spawning season is considered to be from April to September. Majority of the catch comprises individuals in the range of 18 to 22 cm., indicating that the main catch is composed of second year class and immature mackerel. Specimens as large as 31 cm. have, however, been recorded.

On maritime Maharashtra, the fish occurs in the southern zone, the northernmost limit being Ratnagiri. On an average 4,000 tonnes of mackerel are landed annually.

The fishing season on Ratnagiri coast commences from October-November and lasts till February-March. Mackerel is mainly caught by shore-seine or 'Rampan'. It is a good food-fish and finds ready market in fresh condition. As such, large quantities of mackerel are brought in ice to Bombay from Ratnagiri by fish-carrier launches. The remaining quantity is either salt-cured by dry or wet process or canned. Cured mackerel has good export demand, particularly in Ceylon. Being a shoaling fish i.e. visiting our shores from distant oceanic regions, its occurrence is uncertain; in some years the shoals visit in large quantities while in others landings being very poor.

(28) SEER FISHES

Seer fishes, family *Scomberomoridae*, are represented in Maharashtra by three species viz. *Scomberomorus commersoni*, *S. guttatus* and *S. lineolatus*, contributing nearly 2000 tons per annum forming approximately 20 per cent of the total catch of seer fishes in the country. They are known as "Surmai", "Iswan" or "Towar" and being highly prized as food, are always in demand. They are essentially off-shore pelagic fishes; during winter i.e. November to January, particularly along Ratnagiri coast, they seem to move inshore when they are caught by surface gill-nets. Food of these fish consists of such items as squids, small fish and prawns. On Ratnagiri coast, when large catches are landed, they are carefully cured and despatched to flourishing markets for internal consumption.

(29) TUNAS

Tunas have lately come into importance in world fisheries because of the vast potential resources which till very recently remained untapped. Canned tuna, considered as a luxury fish in many western countries and especially in U.S.A., commands highest price. Treated in the manner

CHAPTER 1

Fishes

of the canning process, the tuna develops a consistency and flavour not unlike chicken, and is frequently referred to as "chicken of the sea".

As sharks are rovers of open ocean, the tunas are masters of all the three oceans the Atlantic, the Indian and the Pacific. They are widely distributed in tropical as well as temperate regions of the immense marine expanses. They are powerful swimmers, every line of their body or contour suggestive of rapid motion through water, like that of a torpedo. The streamlined body, bullet-shaped head, close-set jaws, spinous dorsal, pectoral and pelvic fins fitting into grooves and depressions, minimise the resistance in water to a great extent. The soft dorsal, and anal finlets set as stabilizers, and the powerful caudal fin actuated by muscular movements of the body, are all adapted to provide speedy motion cutting through water like a torpedo; they are known to have a speed of about 20 knots (or 23 miles per hour). Another unique feature of tunas is that their body temperature is higher, sometimes by 8° C than that of the surroundings. As such, they are essentially stenothermal living in a temperature range between 14°C to 20°C.

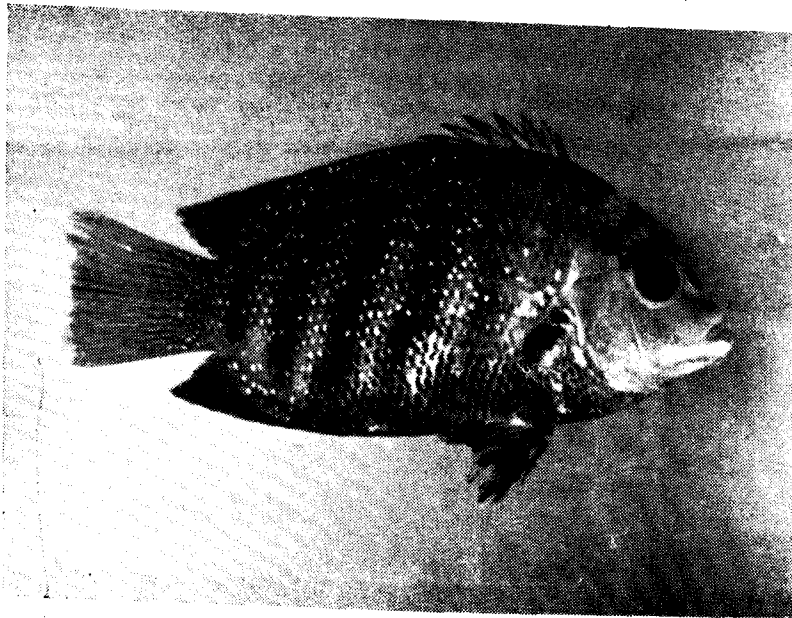
Tuna were well-known from ancient times as great migratory fishes. The migrations of common tuna was a subject of interest and speculation since Aristotle's time. "Whence they come and where they go" was a mystery and many theories were advanced to account for their seasonal occurrence. It is now known, fairly well, that the tuna undertake a migration for spawning and after spawning a migration for feeding.

In the waters off Maharashtra, tuna are represented by five species, of which the skipjack *Katsuwonus pelamis*, and the yellow-fin tuna *Neothunnus macropus*, are not as common as the other three species, *Euthynnus alletteratus affinis* — the little tuna, *Kishinoella tonggol* — the blue fin tuna, and *Auxis thazard* — the frigate — mackerel. Their fishery is mainly confined to the Southern Maharashtra, with Ratnagiri as the main landing centre, where it is estimated that, on an average, about 500 tons of tuna are landed annually. Though the chief methods for capture of tuna are pole and line, long line and purse seines in other parts of the world, on the coast of Maharashtra they are mainly caught by surface gill nets within a region of 10 to 20 fathoms during winter months of November and December.

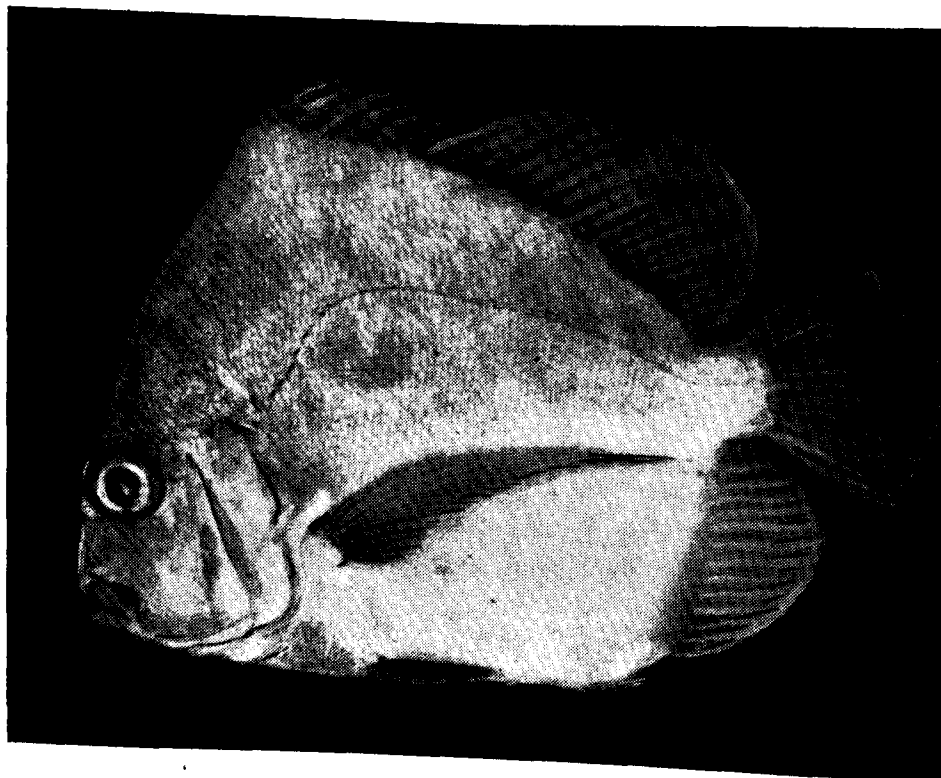
Most of the tuna available on the Ratnagiri coast have red flesh in contrast with the white flesh of all other fish. So the red flesh (meat) tuna is not very popular in fresh condition. The fish is, therefore, usually cured and sold in the interior villages.

(30) MARLINS AND SAILFIN FISHES

The family, Istiophoridae is represented in waters of Maharashtra by two species viz. *Tetrapturus brevirostris* the marlin or spear fish, and *Istiophorus gladius* — the sailfin fish. These two fishes can be easily



Kalundar—Pearl spot (*Etroplus suratensis*) (Bloch)



Chand—Spotted dory (*Drepane punctata*) (Linnaeus) (a full grown form)

distinguished from each other by their first dorsal fin; in the former the dorsal fin, though long, is very low except at the beginning, whereas in the latter, as the name suggests, it is very high all throughout like a sail of a boat. Both have an elongated compressed body with a long pointed rostrum, made of snout and upperjaw which are prolonged together, forming a sword-like structure from which they derive the name 'sword fish'.

(31) POMFRETS

Pomfrets are represented by three species viz. the silver pomfret "Saranga" or "poplet", *Pampus argenteus*, the black pomfret or Halwa, *Parastromateus niger* and the grey pomfret, *Pampus chinensis*. Of the three species, the silver pomfret is considered as the prime fish in the State. In quantity, this fishery contributing 7,000 tonnes p.a. yields only 4 per cent. of the total production, but it is so highly priced that its value is estimated at about Rs. fourteen million i.e. 20 per cent of the total catch value per annum.

The pomfrets are caught in 'dol' nets as well as in surface and bottom-set gill-nets. Recent change that has now taken place in this fishery is the utilisation of synthetic fibre, such as nylon in the fabrication of gill nets, which has brought about considerable improvement in the catch of this fish.

Though pomfrets are found all over maritime regions of the State, their occurrence is in greater abundance in northern Maharashtra mainly in Bombay and Thana districts. Distribution of the fish extends beyond Saurashtra coast but a major concentration appears to be in the neighbourhood of Veraval from where large quantities are sent to Bombay and Delhi.

(32) SCORPION FISHES

The family Scorpaenidae comprises the scorpion-fishes which have a world wide distribution in all tropical and temperate seas. As the name suggests, many of the species of the family Scorpaenidae are venomous, the deadliest being the stonefish, *Synanceia horrida* which inhabits Indian Ocean. Three species occur in the coastal waters of Maharashtra, viz. *Pterois russelli*—the Turkey fish or Lion fish, *Scorpaenopsis roseus* and *S. cirrhosus*. The Turkey fish has found favour with marine aquarists on account of its brilliant colours. It has acquired the name Turkey fish on account of its habit of slow and majestic swimming, with pectoral fins only, comparable to a turkey gobbler displaying its plumes. The venom apparatus of Turkey fishes consists of the 13 dorsal, 3 anal and 2 pelvic spines, channeled on the front and lined by venom glands. The other two species of scorpion fishes have also a similar venom apparatus but the number of spines is variable and their colours are not so bright and outstanding as those of Turkey fish.

(33) FLATFISHES

The flat fishes, also known as sole-fishes, belonging to order *Pleuronectiformes* are represented in Maharashtra waters by 4 families.

CHAPTER 1

Fishes

Family *Psettodidae* is represented by a single species, *Psettodes erumei*, popularly known as Indian turbot; family *Bothidae* is represented by three species of which *Pseudorhombus arsius* is the largest, growing to about 15 inches in length. Family *Soleidae* comprises the oval Sole, *Solea ovata* and 4 species of *Brachirus* of which *B. zebra* is the banded sole. Family *Cynoglossidae* is represented by *Paraplagusia bilineata* and 7 species of *Cynoglossus* of which *C. semifasciatus* is, commercially the most important species and ranks first in order of quantity landed.

Flatfishes do not form a composite fishery on our coast as the catches are mostly scattered and in small quantities. Secondly they are not popular as good food-fish. *Psettodes erumei*, which is known in Bombay as "Bhakas", grows to about 20" and is good in taste and without many small bones, but it does not command popularity, may be on account of its look and colour. One more factor for aversion is the bottom dwelling habit, the gentry not looking with favour on such forms for edible purposes.

Flat fishes, in newly hatched larval stage, are symmetrical and bilateral with eyes on both sides of the head. At this stage the fish swims vertically. When it is about an inch and a half in length, the larva undergoes metamorphosis during which one eye crosses over to the other side, thus having both eyes on one side which is pigmented, and the other side becomes white. From this stage onwards, the metamorphosed larva continues to live at the bottom of the sea, with both eyes on the upper side.

These fishes include in their diet almost all types of animals which frequent the benthic zone such as small fishes, crustaceans and polychaete worms.

Our flatfishes are small in size, varying from 6 inches to about 20 inches in length, though the European halibut, *Hippoglossus vulgaris*, not found in our waters, is known to grow to a length of 10 feet and a weight of 600 lbs.

(34) REMORAS OR SUCKER FISHES

Sucker-fishes, which are known as 'Luchak' in Bombay, belong to the family *Echeneidae* which is represented in waters of Maharashtra by two species, *Echeneis naucrates* and *Remora remora*. These fishes, growing to a length of 16 to 20 inches, have a structural peculiarity in having on upper side of the head a suction-disc, a modification of the dorsal fin, with the help of which they get themselves attached to sharks and other larger oceanic fishes and some times even to the bottom of ships; the power of adhesion is so great as to require a weight of 24 lbs. to separate them.

Although sharks are ferocious creatures, oddly enough, the Remoras make a sucker out of a shark. Sharks evidently do not derive any benefit from these fish; why the shark tolerates the sucker-fish is a marine mystery. The sucker-fish, on the other hand, derives certain benefits

CHAPTER 1

Fishes

from the sharks by getting protected against its enemies, by sharing the meal of the host and by enjoying free rides.

This habit of remoras, of getting attached to sharks and other floating objects has been profitably utilized by native fishermen of East Africa to catch turtles. Live fish are kept on board in buckets of water each with a ring round the tail to which a cord is attached. When a turtle is sighted, these fishes, either one, two or three, depending on the size of the turtle, are released into the sea, where they fasten themselves to the breast plate of the turtles. Some skill is required to haul the line and bring the turtle along side the boat.

No wonder, such an interesting fish, should find its way in the ancient classical and medieval literature. Several myths, attributed to this fish, are in vogue. According to Roman author Pliny, the death of the Emperor Caligula was on account of remoras stopping his great galley. Mark Antony's defeat at Actium was attributed to these fishes, which immobilized his ship at a critical point in the battle. The witch doctors of Africa have also found favour with sucker fishes, who in Madagascan magic prescribe a sucking disc as a sure remedy to hold back or bring back an unfaithful wife.

The scientific names *Echeneis* and *Remora* are Greek and Latin words meaning holding-back-ship and holding-back respectively. Norman and Fraser have aptly said, "both (names) refer to this alleged power of impeding vessels, a power which is, of course, purely mythical."

(35) PUFFERS, PORCUPINES AND BOX FISHES

These fishes are really the queer creatures of the king Neptune's world, unique in many ways. The puffers and porcupine fishes are globular, whereas the box fishes, as the name suggests, are box like, made of hexagonal plates fused rigidly together.

The puffer fishes, represented in Maharashtra waters by 4 species of the family *Logocephalidae*, have the uncanny power of swallowing air in case of emergency and inflating their body like a balloon. In this condition they float or drift passively with the water currents. Their puffy and grotesque appearance with wide set eyes, though giving them a startled and surprised look, is enough for protection. In addition to the name of Puffer fish, they are also known as coffer fish, globe fish or swallow fish.

The porcupine fish, *Diodon hystrix* of family *Diodontidae*, has spine-like projections all over the body, like a porcupine and when inflated it gives a repulsive appearance. The box fish is represented by one species *Lactoria cornuta* belonging to the family *Ostraciontidae*; it is also known as sea-cow, because of two horn like spines in front of the head.

The puffers and porcupine fishes are poisonous, and may cause Ciguatera a deadly disease, when these fish are eaten without prior treatment. A powerful nerve poison, known to cause rapid and violent

CHAPTER 1

Fishes

death, is said to be present in their liver, gonads and skin. Oddly enough, inspite of high toxicity, a puffer fish called "fugu" commands the highest price in Japan as a food fish, where specially trained "fugu cooks" are employed by exclusive restaurants. As Halstead puts it, "Unless you feel that you are a professional 'fugu' connoisseur, leave puffers alone — you will probably live longer."

(36) TOAD FISHES

Toadfishes, which belong to the family *Batrachoididae*, are small bottom dwelling fishes, inhabiting tropical marine waters; their appearance is repulsive owing to a broad depressed head and large mouth. They have an ability to change their colour at will to camouflage with the environment. The only representative of toad fish found in Maharashtra is *Batrachus grunniens*. It is poisonous, the venom apparatus consisting of two spines of dorsal fin and two opercular spines and their associated glands.

(37) DRAGONETS

The dragonets belonging to the family *Callionymidae* are represented in waters of Maharashtra by a single species *Callionymus sagitta*. It is mostly inhabitant of shallow bays and is brightly variegated in colour. Its head is flat and body is scaleless. There is sexual dimorphism in this fish, the males having first dorsal ray more elongated than in the females. The preopercle is armed with 5 strong spines which are said to be venomous.

(38) SURGEON FISHES

The surgeon fishes are represented in our waters by a single species *Acanthurus gahm* belonging to the family *Acanthuridae*. It is characterised by the presence of a lance-like, sharp movable spine on each side of the caudal peduncle.

When the fish is excited, the spine or the surgeon's knife, which is pointing forward, is extended out at right angles to the body and with lashing movements of the tail, it inflicts a deep and painful wound.

(39) MARINE NEONS, STAR GAZERS AND DOCTOR FISHES

The fishes belonging to the family *Labridae*, represented in the waters of Maharashtra are *PlatyGLOSSUS dussumieri* — the parrot fish, *Callyodon fasciatus* — the giant parrot fish, *Fissilabrus dimidiatus* — the delicate marine neon fish also known as Doctor Fish which has brilliant colours, and the star-gazer *Ichthyoscopus lebeck*. The star-gazer acquired this popular name on account of its habit of remaining buried in the sand with only the eyes and mouth protruding above, lying all the time at the bottom of the sea as if to gaze at the stars above. This habit has resulted in certain structural modifications such as the mouth becoming almost dorsal in position and the eyes, instead of being on the sides, have shifted to the top of the head. The star-gazer is also endowed with venom apparatus, which consists of two shoulder spines with venom glands attached to them. Besides, it has electric

CHAPTER 1

Fishes

organs, in the form of two oval areas behind the eyes, complicated in structure, being made up of many layers of electric plates and capable of giving a shock of painful intensity.

Doctor fishes are tiny fishes about 3 to 6 inches in size, brilliantly coloured in blue and black with horizontal strips and are found on the coast of Maharashtra in the littoral areas. Of the several varieties, the little cleaner — *Fissilabrus dimidiatus* is the most curious of sea dwellers, cleaning the teeth and infected tissues of other fishes and removing their parasites. It does all this in order to have its meal from other fishes. They doctor such fishes as squirrel fishes, groupers, vicious moray-eels and even poisonous scorpion fish. At one cleaning station, or as we may say a clinical centre, an ichthyologist observed that as many as 300 fishes were attended to, in a period of about six hours — pretty good going.

(40) RABBIT FISHES

The rabbit fishes, known as 'Thavus' in Bombay, are represented in Maharashtra waters by 5 species of the genus *Siganus* belonging to the family *Siganidae*. The fish are of moderate size and inhabit rocks and reefs. Some of them are intricately designed, so much so that one of the species, *Siganus vermiculatus* is popularly known as the jigsaw-puzzle fish. The dorsal, pelvic anal spines are very sharp and are said to be associated with venom glands and these need to be handled with care.

(41) LITTLE COD

Little cod, *Brigmaceros atripinnis*, known as 'Tenali' or 'Khada' in Marathi, is the only representative in India of the well-known cod family Gadidae, now placed under Brigmacerotidae. It is a slender fish hardly growing to about 3 inches or 7 cm. in length. Its tiny size is compensated by very large numbers in which it is caught in 'dol' nets in the coastal sea off Kolaba and Greater Bombay districts. Annual catch of this fish averages 3,000 tonnes. Being small and slender, it can be easily dried in sun and sent to the hinterland for sale in non-fishing season (monsoon). Being comparatively cheap, it is favoured by people of slender means.

(42) OCEAN SUN FISH

The two species recorded from the Maharashtra coast are the common round-tailed ocean sun fish, *Mola mola* and *Ranzania*. Sun fish has an oval body with thick leathery skin; the mouth is small with teeth fused together forming a single, sharp edged bony plate or beak in each jaw. The pelvic fins and the air-bladder are absent. It has a uniformly gray to olive-brown colouration with silvery reflections on the sides. The fish is reputed to grow to a size of 8 to 10 feet and a weight of more than a ton. Because of the dorsal and the anal fins being situated far back on the body, the fish appears to have an enormous head and, therefore, many times they are also referred to as "Head-Fishes".

CHAPTER 1

Fishes

Sun fish is an inhabitant of open oceans, often seen basking in the sun lying on its side at the surface of the sea during calm weather. It drifts more or less passively with the ocean currents, feeding upon small fish, jelly fishes and crustaceans.

Because of the curious shape, huge size, especially of the head region and its habit of basking in the sun, many myths are in existence about this fish. People in the past had attributed intelligence to this fish on account of the enormous head region and because of its habit of basking in the sun people thought it offered prayers to sun. But, this so-called scholarly fish is now known for its stupidity; it will allow a boat to come right up to it without making any efforts to escape. Though it is known to dive deep with great agility, it rarely does so, even when in danger.

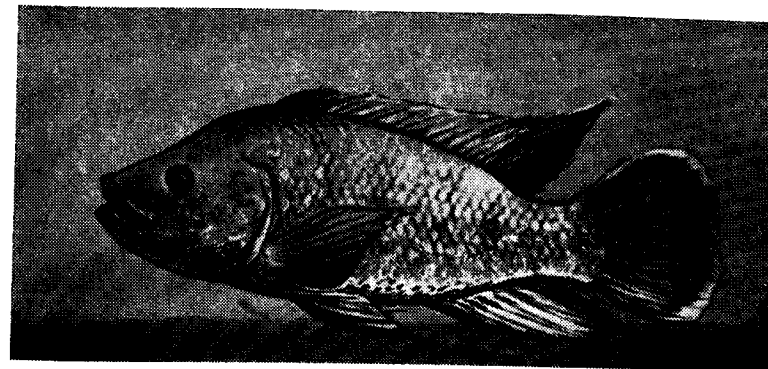
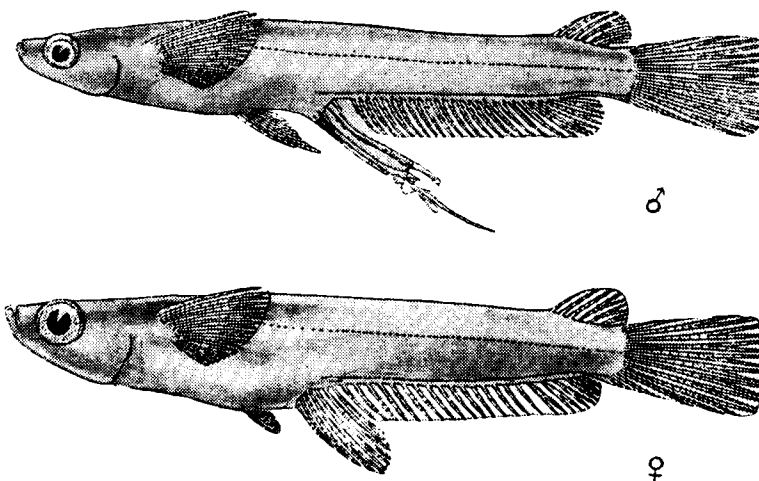
The sunfish is discredited for its lack of intelligence from the anatomical point of view also; although it may weigh about a ton, it has a brain weighing about 6 ozs. only. The fish has, under its skin, two to three inch layer of hard gristly material, making harpooning difficult. It is said to be impervious even to a bullet fired from Winchester rifles. The fish, when captured, is said to make grunting noise.

Very little information is available on the breeding habits of this fish but the ovary is reported to contain over 300 million eggs. The newly hatched larva is extremely tiny compared to the size of the fish.

(43) HORAICHTHYS OR ANU

This is one of the most remarkable fishes of Maharashtra ichthyologically i.e. in the science of fishes. Though the smallest known fish in India, it is outstanding in manifesting distinct sexual dimorphism unlike all other fishes of our country, the male having a specialised organ, called gonopodium. In addition, it possesses several other specialised structures not found in other fishes of the old world. The fish is one of the Cyprinodonts belonging to the order Cyprinodontiformes (Top-minnows). Most of the Indian members of this order are fresh water forms but this (Horaichthys) is an estuarine form capable of living temporarily in fresh water. It is so distinct from other fishes of the order that it has been placed in a separate family known as Horaichthyidae. Structurally it is akin to Gambusia of Poeciliidae of American waters but genealogically it is wide apart.

In Marathi, it is known as "Anu" indicating small size. Anu is hardly 2 cm in length and very slender, inhabiting quiet nooks and corners of creeks and backwaters. Being always on the surface of water, like the 'Piku' (Aplocheilus), it destroys the early instars of mosquitos and other insects, its favourite food being copepods. The fish has no English name as it was discovered in 1938, but can be called "Thready Top-minnow" because of its slender, thread like body on the surface of water.

Tilapia (*Tilapia mossambica*) (Petebrs)Anu or Motak—Thread top minnow (*Horaichthys setnai*) Kulkarni
(Upper figure—male fish Lower figure—female fish)

TAXANOMIC LIST OF FRESH WATER FISHES OF MAHARASHTRA

CHAPTER 1

Fishes

Series : Pisces
 Class : Teleostomi
 Sub-class : Actinopterygii

Serial No.	Scientific name	Popular English name	Marathi name
Order : CLUPEIFORMES			
Sub-order : Clupeoidi			
Family : Clupeidae			
1	Gudusia chapra (Hamilton) = Day : Clupea chapra	..	..
Sub-order : Notopteroidei			
Family : Notopteridae			
2	Notopterus chitala (Hamilton) = Day : Notopterus chitala.	.. Feather back	.. Patre, Chalat.
3	Notopterus notopterus (Pallas) = Day : Notopterus kaporat.	.. Feather back	.. Patre, Chahal.
Order : CYPRINIFORMES			
Sub-order : Cyprinoidei			
Family : Cyprinidae			
Sub-family : Abramidinae			
4	Oxygaster bacaila = Day : Chela bacaila.	.. Chilwa	.. Alkut.
5	Oxygaster boopis (Day) = Day : Chela boopis.	.. Chilwa	.. Alkut, Amli.
6	Oxygaster untrahi (Day) = Day : Chela untrahi Day	.. Chilwa	.. Alkut.
7	Oxygaster phulo (Hamilton) = Day : Chela phulo.	.. Chilwa	.. Alkut.
8	Oxygaster clupeoides (Bloch) = Day : Chela clupeoides.	.. Chilwa	.. Balshi, Alkut.
9	Laubuca laubuca (Hamilton) = Day : Perilampus laubuca.		
10	Laubuca dadyburjori Menon		
11	Esomus danrica (Hamilton-Buchanan) = Day : Nuria danrica (Hamilton-Buchanan).	Flying barb	.. Kurria, Dahwi.

CHAPTER 1

Fishes

Serial No.	Scientific name	Popular English name	Marathi name
Sub-family : Rasborinae			
12	<i>Barilius barna</i> (Hamilton) = Day : <i>Barilius barna</i> .		Jhorya.
13	<i>Barilius bendelisis</i> (Hamilton) = Day : <i>Barilius bendelisis</i> .		Jhorya.
14	<i>Barilius evazardi</i> (Day) = Day : <i>Barilius evazardi</i> .		Jhorya.
15	<i>Barilius gatensis</i> (Cuvier and Valenciennes) = Day : <i>Barilius gatensis</i> .		Jhorya.
16	<i>Rasbora daniconius</i> (Hamilton-Buchanan) = Day : <i>Rasbora daniconius</i> .	Rasbora	Dandai, Gana or Dawvan.
17	<i>Rasbora labiosa</i> Mukerji	Rasbora	Dandai.
18	<i>Rasbora rasbora</i> (Hamilton) = Day : <i>Rasbora buechanani</i> .	Rasbora	Dandai.
19	<i>Danio fraseri</i> (Hora)	Danio	Pidtui.
20	<i>Danio aequipinnatus</i> (McClelland) = Day : <i>Danio aequipinnatus</i> .	Giant danio	Balooki.
21	<i>Danio devario</i> (Hamilton) = Day : <i>Danio devario</i> .	Danio	
22	<i>Perilampus atpar</i> (Hamilton) = Day : <i>Perilampus atpar</i> .		Sonukli.
23	<i>Brachydanio rerio</i> (Hamilton) = Day : <i>Danio rerio</i> .	Zebra fish	Pidtui.
Sub-family : Cyprininae			
24	<i>Amblypharyngodon melettinus</i> (Cuvier and Valenciennes) = Day : <i>Amblypharyngodon melettinus</i> .	Attentive Carplet	
25	<i>Amblypharyngodon mola</i> (Hamilton) = Day : <i>Amblypharyngodon mola</i> .	Carplet.	
26	<i>Aspidoparia morar</i> (Hamilton) = Day : <i>Aspidoparia morar</i> .		Amlee.
27	<i>Balitora shimogensis</i> Silas and Kalawar		Phattar chatu.
28	<i>Tor khudree</i> (Sykes) = Day : <i>Barbus tor</i> .	Mahseer	Mhasheer, Khadra, Khadashi.
29	<i>Tor mussulah</i> (Sykes) = Day : <i>Barbus tor</i> .	Mahseer	Mhasheer, Mhaslya.
30	<i>Puntius amphibius</i> (Valenciennes) = Day : <i>Barbus amphibius</i> .	Scarlet banded barb.	Khavli.
31	<i>Puntius arenatus</i> Day = Day : <i>Barbus arenatus</i> .	Barb	Khavli.
32	<i>Puntius arulius</i> (Jerdon) = Day : <i>Barbus arulius</i> .	Aruli Barb	Khavli.
33	<i>Puntius conchoni</i> (Hamilton) = Day : <i>Barbus conchoni</i> .	Barb	Khavli.

CHAPTER 1

Fishes

Serial No.	Scientific name	Popular English name	Marathi name
34	<i>Puntius hexastichus</i> McClelland		
35	<i>Puntius chrysopterus</i> (McClelland) = Day : <i>Barbus chrysopterus</i> .	Barb	Khavli.
36	<i>Puntius chola</i> (Hamilton Buchanan) = Day : <i>Barbus chola</i> .	Green barb	Khavli.
37	<i>Puntius cosuatis</i> (Hamilton) = Day : <i>Barbus cosuatis</i> .	Barb	Khavli.
38	<i>Puntius chrysopoma</i> (Jerdon) = Day : <i>Barbus chrysopoma</i> .	Barb	Khavli.
39	<i>Puntius dobsoni</i> (Day) = Day : <i>Barbus dobsoni</i> .	Barb	Parag.
40	<i>Puntius fraseri</i> (Hora & Misra)	Barb	Kadwi.
41	<i>Puntius filamentosus</i> (Valenciennes) = Day : <i>Barbus mahicola</i> .	Cola Barb	
42	<i>Puntius gelius</i> (Hamilton) = Day : <i>Barbus gelius</i> .	Gelius Barb	Khavli.
43	<i>Puntius jerdoni</i> (Day) = Day : <i>Barbus jerdoni</i> .	Jerdon's carp	Potil.
44	<i>Puntius kolus</i> (Sykes) = Day : <i>Barbus kolus</i> .	Kolshi	Kolshi.
45	<i>Puntius melanostigma</i> (Day) = Day : <i>Barbus melanostigma</i> .	Barb	Khavli.
46	<i>Puntius neilli</i> Day = Day : <i>Barbus neilli</i> .	Barb	Khavli.
47	<i>Puntius punctatus</i> (Day)	Barb	Khavli.
48	<i>Puntius parrah</i> Day = Day : <i>Barbus parrah</i> .	Barb	Khavli.
49	<i>Puntius pinnauratus</i> Day = Day : <i>Barbus pinnauratus</i> .	Barb	Khavli.
50	<i>Puntius sophore</i> (Hamilton) = Day : <i>Barbus sophore</i> .	Barb	Khavli.
51	<i>Puntius sarana</i> (Hamilton-Buchanan). = Day : <i>Barbus sarana</i> .	Olive carp	Darai.
52	<i>Puntius stigma</i> (Cuvier and Valenciennes). = Day : <i>Barbus stigma</i> .	Two spot barb	
53	<i>Puntius sahyadriensis</i> (Silas)	Barb	Khavli.
54	<i>Puntius ticto</i> (Hamilton-Buchanan) = Day : <i>Barbus ticto</i> .	Firefin barb	Khavli.
55	<i>Puntius ambassis</i> (Day) = Day : <i>Barbus ambassis</i> Day.		
56	<i>Puntius malabaricus</i> Day = Day : <i>Barbus malabaricus</i> .		
57	<i>Puntius tetrapogon</i> (McClelland) = Day : <i>Barbus tetrapogon</i> .	Barb	Khavli.
58	<i>Puntius vittatus</i> (Day) = Day : <i>Barbus vittatus</i> .	Striped barb	Khavli.
59	<i>Puntius Wynaadenis</i> (Day)	Barb	Khavli.
60	<i>Catla catla</i> (Hamilton-Buchanan) = Day : <i>Catla buechanani</i> .	Catla	Catla.

CHAPTER 1

Fishes	Serial No.	Scientific name	Popular English name	Marathi name
	61	<i>Cirrhina cirrhosa</i> (Bloch) = Day : <i>Cirrhina cirrhosa</i> .	.. Carp.	
	62	<i>Cirrhina fulungee</i> (Sykes) = Day : <i>Cirrhina fulungee</i> .	.. Carp	.. Mulich, ganna.
	63	<i>Cirrhina mrigala</i> (Hamilton) = Day : <i>Cirrhina mrigala</i> .	.. Mrigal	.. Mrigal.
	64	<i>Cirrhina reba</i> (Hamilton) = Day : <i>Cirrhina reba</i> .	.. Carp.	
	65	<i>Labeo boggut</i> (Sykes) = Day : <i>Labeo boggut</i> .	.. Carp	.. Sandshi.
	66	<i>Labeo bata</i> (Hamilton) = Day : <i>Labeo bata</i> .	.. Carp	.. Tambti.
	67	<i>Labeo dussumieri</i> (Valenciennes) = Day : <i>Labeo dussumieri</i> .	.. Carp.	
	68	<i>Labeo ariza</i> (Hamilton) = Day : <i>Labeo ariza</i> .	.. Carp.	
	69	<i>Labeo fimbriatus</i> (Bloch) = Day : <i>Labeo fimbriatus</i> .	.. Col/er carp	.. Tambir.
	70	<i>Labeo calbasu</i> (Hamilton) = Day : <i>Labeo calbasu</i> .	.. Calbasu	.. Kanas.
	71	<i>Labeo kawrus</i> (Sykes) = Day : <i>Labeo kawrus</i> .	.. Carp.	
	72	<i>Labeo potail</i> (Sykes) = Day : <i>Labeo potail</i> .	.. Carp.	
	73	<i>Labeo pangusia</i> (Hamilton) = Day : <i>Labeo pangusia</i> .	.. Carp.	
	74	<i>Labeo porcellus</i> (Heckel) = Day : <i>Labeo porcellus</i> .	.. Carp	.. Tambudki.
	75	<i>Labeo rohita</i> (Hamilton) = Day : <i>Labeo rohita</i> .	.. Rohu	.. Rohu.
	76	<i>Labeo sindensis</i> (Day) = Day : <i>Labeo sindensis</i> .	.. Carp.	
	77	<i>Cyprinus carpio</i> . <i>Carassius carassius</i> (Linnaeus). = Day : <i>Carassius auratus</i> Day.	Gold fish	.. Soneri masa.
	78	<i>Garra mullia</i> (Hamilton) = Day : <i>Discognathus lamta</i> .	.. Stone sucker	.. Mallya.
	79	<i>Garra bicornuata</i> Rao	.. Stone sucker	.. Shingacha Mallya.
	80	<i>Garra gotyla</i> (Gray) = Day : <i>Discognathus lamta</i> .	.. Stone sucker	.. Shingacha Mallya.
	81	<i>Schismatorhynchus</i> (Nukta) nukta (Syker) = Day : <i>Labeo nukta</i> .	Nakta	.. Nakta.
	82	<i>Osteobrama cotio</i> (Hamilton) = Day : <i>Rohtee cotio</i> .	..	Bhongi.
	83	<i>Osteobrama cotio</i> var. <i>cunma</i> Day = Day : <i>Rohtee cotia</i> var. <i>cunma</i> .	..	Bhongi.
	84	<i>Osteobrama cotio</i> var. <i>peninsularis</i> Silas. = Day : <i>Rohtee cotia</i> var. <i>cunma</i> .	..	Bhongi.

CHAPTER 1

Fishes	Serial No.	Scientific name	Popular English name	Marathi name
	85	<i>Osteobrama vigorsii</i> (Sykes) = Day : <i>Rohtee vigorsii</i> .	..	Phankut.
	86	<i>Osteobrama neilli</i> (Day) = Day : <i>Rohtee neilli</i> .	..	
	87	<i>Rohtee alfrediana</i> (Cuvier and Valenciennes). = Day : <i>Rohtee Alfrediana</i> .	..	
	88	<i>Rohtee ogilbii</i> (Sykes) = Day : <i>Rohtee ogilbii</i> .	..	Vatani.
	89	<i>Osteochilus</i> (<i>Osteochilichthys</i>) <i>nashii</i> (Day). = Day : <i>Scaphiodon nashii</i> .	..	
	90	<i>Osteochilus</i> (<i>Osteochilichthys</i>) <i>thomassi</i> (Day). = Day : <i>Scaphiodon thomassi</i> .	..	
	91	<i>Crossocheilus</i> (<i>latius</i>) <i>latius</i> (Hamilton-Buchanan). = Day : <i>Cirrhina latia</i> .	..	
	92	<i>Thynnichthys sandkhol</i> (Sykes) = Day : <i>Thynnichthys sandkhol</i> .	.. Sandkol	.. Sandkol.
Family : Cobitidae				
	93	<i>Lepidocephalus guntea</i> (Hamilton) = Day : <i>Lepidocephalus guntea</i> .	Lesser loach	.. Mori.
	94	<i>Lepidocephalus thermalis</i> (Cuvier and Valenciennes) = Day : <i>Lepidocephalus thermalis</i> .	Lesser loach	.. Mori.
	95	<i>Psilorhynchus prateri</i> Hora.		
	96	<i>Parapsilorhynchus tentacultus</i> (Annandale).		
	97	<i>Nemacheilus botia</i> (Hamilton) = Day : <i>Nemacheilus botia</i> .	.. Striped loach	.. Chikli.
	98	<i>Nemacheilus beavani</i> Gunther.		
	99	<i>Nemacheilus botia</i> var. <i>aureus</i> (Day). = Day : <i>Nemacheilus botia</i> var. <i>aureus</i> .	.. Striped loach	.. Chikli.
	100	<i>Nemacheilus anguilla</i> (Annandale)	.. Loach	.. Chikli.
	101	<i>Nemacheilus denisonii</i> Day	.. Loach	.. Murunga.
	102	<i>Nemacheilus dayi</i> (Hora)	.. Loach	.. Chikli.
	103	<i>Nemacheilus evezardi</i> (Day)	.. Loach	.. Chikli.
	104	<i>Nemacheilus poonaensis</i> Menon	.. Loach	.. Chikli.
	105	<i>Nemacheilus sinuatus</i> Day	.. Loach	.. Chikli.
	106	<i>Nemacheilus striatus</i> Day	.. Loach	.. Chikli.
	107	<i>Nemacheilus savona</i> (Hamilton-Buchanan).	.. Loach	.. Chikli.
	108	<i>Nemacheilichthys ruppelli</i> (Sykes) = Day : <i>Nemacheilichthys ruppelli</i> .	.. Loach	.. Chikli.
	109	<i>Botia striata</i> var. <i>kolhapurensis</i> Kalawar and Kelkar.	Tiger loach	.. Wagha masa.

CHAPTER 1

Fishes	Serial No.	Scientific name	Popular English name	Marathi name
Sub-order : Siluriidei				
Family : Siluridae				
	110	<i>Ompok bimaculatus</i> (Bloch) = Day : <i>Callichrous bimaculatus</i> .	Butter cat fish	Wanz, Valanj.
	111	<i>Ompok pabo</i> (Hamilton) = Day : <i>Callichrous pabo</i> .	Butter cat fish	Kaliwanz.
	112	<i>Wallago attu</i> (Bloch and Schneider) = Day : <i>Wallago attu</i> .	Fresh water shark, Wolly.	V a l a s hivda, Padin Shivda.
Family : Schilbeidae				
	113	<i>Ailia coila</i> (Hamilton) = Day : <i>Ailia coila</i> .	Cat fish.	
	114	<i>Clupisoma garua</i> (Hamilton) = Day : <i>Pseudeutropius garua</i> .	Cat fish.	
	115	<i>Silonia childrenii</i> (Sykes) = Day : <i>Silundia sykesii</i> .	White cat fish	Silan.
	116	<i>Pseudotropius atherinoides</i> (Bloch)	Cat fish	Sura.
	117	<i>Pseudotropichthys taakree</i> (Sykes)	Cat fish	Munvi.
	118	<i>Neotropius khavalchor</i> Kulkarni	Cat fish	Khavalchor.
Family : Saccobranchidae				
	119	<i>Heteropneustes fossilis</i> (Bloch) = Day : <i>Saccobranchus fossilis</i> .	Stinging cat fish	Shingi.
Family : Claridae				
	120	<i>Clarias batrachus</i> (Linnaeus) = Day : <i>Clarias magur</i> .	Cat fish	Magur.
Family : Bagridae				
	121	<i>Rita rita</i> (Hamilton) = Day : <i>Rita buechanani</i> .	Cat fish.	
	122	<i>Rita kuturnee</i> (Sykes) = Day : <i>Rita hastata</i> .	Cat fish	Katarnee.
	123	<i>Rita pavimentata</i> (Valenciennes) = Day : <i>Rita pavimentata</i> .	Cat fish	Ghoghrya.
	124	<i>Mystus aor</i> (Hamilton) = Day : <i>Macrones aor</i> .	Cat fish	Shingala.
	125	<i>Mystus bleekeri</i> (Day) = Day : <i>Macrones Bleekeri</i> .	Cat fish	Shingala.

CHAPTER 1

Serial No.	Scientific name	Popular English name	Marathi name
126	<i>Mystus cavasius</i> (Hamilton) = Day : <i>Macrones cavasius</i> .	Cat fish	Katirna.
127	<i>Mystus gulio</i> (Hamilton) = Day : <i>Macrones gulio</i> .	Cat fish	Shingati.
128	<i>Mystus montanus</i> (Jerdon) = Day : <i>Macrones montanus</i> .	Cat fish	Shingati.
129	<i>Mystus malabaricus</i> (Jerdon) = Day : <i>Macrones malabaricus</i> .	Cat fish	Shingti.
130	<i>Mystus seenghala</i> (Sykes) = Day : <i>Macrones seenghala</i> .	Long nose cat fish.	Shingala.
Family : Sisordae			
131	<i>Bagarius bagarius</i> (Hamilton) = Day : <i>Bagarius yarrellii</i> .	Giant banded cat fish.	Khirit.
132	<i>Glyptothorax lonah</i> (Sykes) = Day : <i>Glyptosternum lonah</i>	Rock sucker	P h a t t a r chattu.
133	<i>Glyptothorax madraspatanum</i> Day	Rock sucker	P h a t t a r chattu.
134	<i>Glyptothorax annandeli</i> (Hora)	....	P h a t t a r chattu.
135	<i>Glyptothorax trewavasae</i> Hora	....	P h a t t a r chattu.
136	<i>Glyptothorax conirostre</i> var. <i>poonaensis</i> (Hora).	Rock sucker	P h a t t a r chattu.
137	<i>Gagata itchkeea</i> (Sykes) = Day : <i>Gagata itchkeea</i> .	Itchaka	Itchka.
138	<i>Nengra viridescens</i> (Hamilton) = Day : <i>Nengra viridescens</i> .		
139	<i>Euglyptosternum saisii</i> (Jenkins)		
Family : Anguillidae			
140	<i>Anguilla anguilla</i> (Hamilton) = Day : <i>Anguilla bengalensis</i> .	Fresh water eel	Aheer.
141	<i>Anguilla australis</i> Rich		
Order : BELONIFORMES			
Sub-order : Scombersocoldei			
Family : Belonidae			
142	<i>Xenentodon cancila</i> (Hamilton- Buchanan).	Fresh water gar fish.	Tokali, Kutra masa.
	= Day : <i>Belone cancila</i> .		

CHAPTER 1

Serial No.	Scientific name	Popular English name	Marathi name
Order : CYPRINODONTIFORMES			
Sub-order : Cyprinodontoidei			
Family : Cyprinodontidae			
143	<i>Aplocheilus lineatus</i> (Cuvier and Valenciennes) = Day : <i>Haplocheilus lineatus</i> .	Top minnow	.. Pikoo.
144	<i>Aplocheilus blochii</i> (Arnold)	.. Top minnow	.. Pikoo.
145	<i>Aplocheilus panchax</i> (Hamilton) = Day : <i>Haplocheilus panchax</i> .	.. Top minnow	.. Pikoo.
Family : Poeciliidae			
146	<i>Gambusia affinis paltruelis</i> (Baird and Girard).	<i>Gambusia</i>	.. <i>Gambusia</i> .
Order : OPHIOCEPHALIFORMES			
Family : Ophiocephalidae (Channidae)			
147	<i>Channa gachua</i> (Hamilton) = Day : <i>Ophiocephalus gachua</i> .	.. Dwarf murrel or dwarf snake head fish.	Dokrya, Daku, Dhok.
148	<i>Channa leucopunctatus</i> (Sykes) = Day : <i>Ophiocephalus leucopunctatus</i> .	.. Murrel or snake head fish,	Maral.
149	<i>Channa marulius</i> (Hamilton) = Day : <i>Ophiocephalus marulius</i> .	.. Murrel or snake head fish.	Kala masa Maral.
150	<i>Channa punctatus</i> (Bloch) = Day : <i>Ophiocephalus punctatus</i> .	.. Murrel or snake head fish.	Maral.
151	<i>Channa striatus</i> (Bloch) = Day : <i>Ophiocephalus striatus</i> .	.. Murrel or snake head fish.	Mangsha.
Family : Amphipnoidae			
152	<i>Amphipnous cuchia</i> (Hamilton) = Day : <i>Amphipnous cuchia</i> .	..	
153	<i>Amphipnous indicus</i> Silas and Dawson		
Order : PERCIFORMES			
Sub-order : Percoidae			
Family : Ambassidae			
154	<i>Ambassis baculis</i> (Hamilton-Buchanan) = Day : <i>Ambassis baculis</i> .	Glass fish	.. K a c h k i, Chembardi.

CHAPTER 1

Serial No.	Scientific name	Popular English name	Marathi name
155	<i>Ambassis nama</i> (Hamilton-Buchanan) = Day : <i>Ambassis nama</i> .	Glass fish	.. K a c h k i, Chembardi.
156	<i>Ambassis ranga</i> (Hamilton-Buchanan) = Day : <i>Ambassis ranga</i> .	Glass fish	.. K a c h k i, Chembardi.
Family : Nandidae			
157	<i>Nandus nandus</i> (Hamilton-Buchanan).		
158	<i>Badis badis</i> (Hamilton-Buchanan)		
Sub-order : Anabantoidae			
Family : Anabantidae			
159	<i>Anabas testudineus</i> (Bloch) = Day : <i>Anabas scandens</i>	.. Climbing perch	..
Family : Osphronemidae			
160	<i>Osphromenus gouramy</i> Lacépède = Day : <i>Osphromenus olfax</i>	.. Gorami	.. Gorami.
161	<i>Trichogaster lalia</i> = Day : <i>Colisa lalia</i> .	..	
Family : Polycanthidae			
162	<i>Macropodus cupanus</i> (Cuvier) = Day : <i>Polacanthus cupanus</i>	.. Indian Paradise Fish.	Chhoti Khajuri.
Sub-order : Gobioidae			
Family : Gobiidae			
163	<i>Glossogobius giuris</i> (Hamilton) = Day : <i>Gobius giuris</i> .	.. Goby	.. Kharpya Kharbi.
164	<i>Glossogobius bombayensis</i> (Annandale)	Goby	.. Kharpya Kharbi.
Order : MASTACEMBELIFORMES			
Family : Mastacembelidae			
165	<i>Mastacembelus armatus</i> (Lacépède) = Day : <i>Mastacembelus armatus</i> .	.. Sping ell	.. Vam.
166	<i>Mastacembelus pancalus</i> (Hamilton) = Day : <i>Mastacembelus pancalus</i> .	Fresh water ell	.. Vam, Vambat.
167	<i>Macrognathus aculeatus</i> (Bloch) = Day : <i>Rhynchobdella aculeata</i> .	Fresh water ell	.. Vam.

FRESHWATER FISHES

Freshwater fish fauna of Maharashtra belongs largely to three water shades namely the Godavari river basin, the Krishna basin and the coastal streams like Vaitarna, Ulhas, Savitri, etc. As the coastal streams are usually short and shallow and only the upper reaches of Godavari and Krishna rivers are located within the State boundry, indigenous fish fauna does not include many large forms. Secondly, commercially important varieties of fish like Catla, Rohu, Mrigal, which are suitable for cultivation in ponds do not also occur indigenously. These (latter) useful forms from Northern India along with many other exotic fish like Gourami, Tilapia, Cyprinus and grass and silver carp have been introduced for piscicultural purposes and they, now, do occur in several sheets of water in the State. Despite these introductions, the indigenous fish fauna can be considered as fairly varied and numerous. Scientific names of these fishes along with English and local Marathi names have already been given in section IV of this part. However, group-wise notes giving further details of these forms are given below :—

(1) PALLA OR INDIAN SHAD (*Hilsa ilisha*)

Palla or Pala is one of the popular seasonal fishes of Bombay. It is an anadromous fish spending part of its life in the sea and ascending rivers for breeding. It is, therefore, claimed both as marine as well as fresh-water fish. It ascends rivers for breeding in the months of July and August and is caught during that period only. The adults return to the sea after breeding and the young ones go to sea after four or five months' growth in freshwater.

Palla is one of the large clupeids growing to about 24 inches or 60 cm. in length and weighing 2 kg. when full grown. Though it has a number of small bones, it is highly esteemed as food-fish. It is quite popular even on the eastern coast of India where it occurs in the tributaries of the Ganges, Godavari and Krishna. On the west coast it is found in the Narbada. In Maharashtra, it was only in the Ulhas river that the fish used to ascend, but because of recent pollution on account of effluents discharged from Industrial concerns near Kalyan, the fishery is now almost extinct. The fish is seen in small numbers in other streams such as the Vaitarna, Savitri, Amba etc., but does not form a sizeable fishery. Fishes ascending these small rivers are also small in size.

(2) FEATHERBACK OR RAZOR FISH

A small tuft-like dorsal fin and also a thin razor sharp anal fin have earned the common popular names of these fishes. Only two species of the family Notopteridae occur in Maharashtra, the most common being *Notopterus notopterus*, known as 'Chalat' or 'Patre'. This is a small bony fish not very much prized as food fish, but is common in most of the rivers. It does not grow beyond a foot in length. Its

another cousin, *N. chitala* grows to a large size but is found only in a few eastern streams in the Vidarbha region. It is a carnivorous fish and is usually excluded from culturable waters.

(3) CHILWAS (*Chela* or *Oxygaster* spp.)

Chilwas, known locally as 'Amli' or 'Alkut', are small, laterally flattened, silvery bony fishes, commonly found in most of the rivers and reservoirs in large numbers. Being surface swimmers they are usually seen jumping and breaking the surface of water especially when a large fish is approaching them from below. The group is represented by three or four species in Maharashtra. Though the fish are small, not exceeding 4 inches or 10 cm., they are caught in abundance and thus serve as poor man's food in the interior. They are usually made into a curry but are tasty when fried crisp with spices.

(4) RASBORA GROUP OF FISHES

This group consists of three or four genera of small size. Genus *Barilius* has four species. These are also small fish commonly found in shallow streams but are quite active in their movements. *Rasbora*, known as 'Dandai' in Maharashtra has three species. *R. daniconius* is by far the most commonly found form in streams and ponds. It is a small, slender, active fish growing to about 4 inches or 10 cm. and thriving even in difficult environment. *Danio* which is known at some places as 'Pidtuli' has three genera. They live in the same habitat as the *Barilius* and *Rasbora*. All these three genera being quite active and inhabiting shallow waters are insectivorous and serve as useful agents for destroying mosquito larvae as well as cyclops and other copepods from our waters. Natural restriction on the population of mosquitos and guinea worm (through destruction of cyclops) is largely due to these apparently insignificant forms. Among these fishes, one known as *Brachydanio rerio* is a good aquarium fish commonly known as Zebra because of yellow and blue stripes on its body. It is found mostly in the Vidarbha region in small shallow streams and ponds. It is also bred extensively by aquarium keepers and sent abroad as aquarium pet.

(5) MAHASEERS

Mahaseer which belongs to the family Cyprinidae and genus *Tor* (formerly *Barbus tor*) is very popular as game fish. Three species of this genera occur in Maharashtra where they are known as 'Khadri', 'Mhaslya', 'Baras' or 'Khadas'. They have elegant streamlined body and large attractive scales. They inhabit running streams and are also found in reservoirs into which small streams debouch in the monsoon. They are known to take live bait and give a wonderful fight after they are hooked. Some anglers with worldwide experience consider Mahaseer as better fish for angling than even the trout. Several books have been written on the methods of hooking a Mahaseer and the thrills enjoyed while landing it. Mahaseer grow to a large size, say

CHAPTER 1
Fishes

even up to 50 kg. in weight. They are also good eating when they are up to about 5 kg; in larger fish the flesh is known to be rather coarse. Mahaseers normally breed in clear, running waters and take small fish as their food.

(6) BENGAL CARP (Catla, Rohu and Mrigal)

As mentioned earlier, these three carps have been introduced in Maharashtra on account of their usefulness in pisciculture in ponds and lakes. As young ones of these fish (fry) are being stocked every year in different sheets of water and as they are also being bred indigenously by hormone injections, these fishes are common everywhere in the State.

(i) Catla, also known as 'Catla' in Marathi, is the most favourite, with fish farmers, because of its rapid growth. It is known to grow to a size of 15 to 18 inches and a weight of two to three kg. in the first year in well manured ponds. With upturned mouth and large gill rakers, catla is a surface and column feeder mainly feeding on plankton. It attains maturity at the end of second year of its life and breeds in the third season. The breeding period is restricted mainly to June and July, when the rivers are in spate immediately after the first rains. The adult fish reach their spawning grounds which are mostly the shallow inundated fields by the side of the river and lay their eggs. They do not breed in confined waters such as ponds, reservoirs etc. However, in recent years the Maharashtra State Fisheries have succeeded in inducing these fishes to spawn in captivity in small enclosures of cloth nets called 'hapas' by administering pituitary hormone injections to well-grown parents, both male and female.

Catla is not only popular with fish farmers but also with anglers. It is taken on rod and line and is known to give a good fight. The Maharashtra State Angling Association procures Catla seed (baby fish) for stocking in their lake at Powai near Bombay. The record size of Catla taken on line so far, is a specimen of 55 lbs. The highest recorded weight of Catla is, however, 90 lbs.

(ii) Rohu.—This is another quick-growing carp, mostly sought by customers because of its popular taste. It is herbivorous, feeding on vegetable debris. Its mouth with fringed lips is well suited to browsing on the pond bottom. However, in young stage, it feeds on planktonic creatures such as water-fleas and animalcules.

Rohu grows a little slower than Catla and is known to grow to a size of 14 to 16 inches in the first year, attaining sexual maturity at the end of second year. It is known to grow over 3 feet and weigh over 20 kg. The breeding habits of Rohu are similar to those of Catla. It is elegant in form and being very active fish is not easily caught like the Catla. It is the most favourite fish of Bengal and is extensively used for pond culture throughout India.

CHAPTER 1
Fishes

(iii) Mrigal.—It is the third major carp having economic importance next to Catla and Rohu. Like the other two varieties, the young are plankton feeders, but soon they start feeding on vegetable debris, decaying leaves of aquatic plants together with some sand and mud. It grows at the rate of 8 to 10 inches in the first year. Its sexual maturity, breeding habits and season are similar to those of Catla and Rohu. It grows to over three feet.

(7) OTHER SMALLER CARPS AND BARBS

There are other varieties of carps which are of lesser importance from culturable point of view, though they are important for food value. The Kalbasu (*Labeo calbasu*) grows to about 8 to 10 inches in a year, feeding on algae, snails and worms in the ponds. The fringed-lipped carp (*Labeo fimbriatus*) is the commonest carp in Maharashtra waters and is locally called 'Tambir'. This fish is also a bottom feeder. It is almost as good as Rohu in taste and flavour but comparatively slow in growth.

The white carp (*Cirrhina cirrhosa*), which is a bottom and column feeder like Mrigal, grows to about 20 inches in size. It is not very common in Maharashtra, but is found occasionally in some streams. The pig-mouth carp (*Labeo kontius*) is a vegetable feeder mainly feeding on filamentous algae. It is known to grow to a length of about 2 feet. The Reba (*Cirrhina reba*) is widely distributed in Vidarbha region. It is a slender form, mainly feeding on planktonic algae and growing to about 11 inches in one year. The Bata (*Labeo bata*) though slow growing attains a length of about two feet. All these carps breed in monsoon.

There are about 28 species of the genus *Puntius* commonly called barbs, recorded from Maharashtra. Of these, *P. kolus* (Kolshi), *P. dobsonii* (Potil or Parag) and *P. sarana* (Posti or Darai) are medium sized fish. Although not very much prized as food fish, they do constitute a fishery of a minor nature on account of their comparatively frequent occurrence in the Deccan waters. *P. dobsonii* and *P. jerdoni* are considered as synonyms. According to market demand, the 'Potil' is considered to be the best of the three and is known to grow to about 6 kg. in deep pools and reservoirs. The Sarana barb (*Puntius sarana*) or the olive carp which is distributed throughout India, grows to a length of about a foot. It is a voracious feeder, feeding mainly on decaying plants, gastropods, worms, insects etc. They attain sexual maturity when they are about ten months old and about ten inches in length.

(8) STONE CARP

Garra mullia, which is known locally as 'Mallya', is one of the stone carps. Though there are two more species only *G. mallya* is most common. Growing only up to about 4 in. or 10 cm., it is very widely spread in shallow streams of Maharashtra. It has acquired the name stone carp because of its habit of moving about among stones and

CHAPTER 1

Fishes

submerged rocks and browsing on the green matter (algae) grown on the substratum in the streams. It has a stone gray camouflaging colour. It is good eating and breeds freely in the early part of monsoon.

(9) ROHTEES

Rohteas are represented by two genera, namely *Rohtea* and *Osteobrama*. Like the *Notopterus* and other small barbs Rohteas are common in the streams of Deccan, though they are not very popular as food fish. They are bony but being available in all the seasons are common in the catches of fishermen.

(10) LOACHES

Loaches form a group of small fish commonly available in the gravelly part of the river beds and streams. They are represented by four or five genera in this State as indicated in the taxonomic list. In the Konkan region they are known as 'Muri'. Though small, they are quite abundant. During monsoon they spread themselves into different shallow areas and especially into rice fields of the Konkan tract and when the fields and the streams are drying, they are caught in baskets or traps by cultivators and other field workers. They are always prized as good food for the poor and even for the rich who have a taste for this soft morsel of flesh. The bones being very small the fish are easily eaten as a whole in curry or when fried.

(11) CATFISHES

Catfishes, like the barbs, form a very large group of fish in the State, some remaining very small, say about three inches, and others growing as large as 60 in. or 150 cm. The catfish have derived the name because of the catlike whiskers or barbels around their mouth. These barbels (whiskers) serve as tactile organs. Some of the catfishes have powerful trenchant spines, which are capable of inflicting painful wounds. Some of the important catfishes are detailed as under :

Wolly or Wallago: This fish, which is known in Maharashtra as 'Shivda', 'Walshivda' or 'Padin', is common in all waters. It has a large mouth studded with sharp teeth and a laterally compressed elongated slim body. It is so voracious and destructive in habit that it has acquired the name 'freshwater shark' and because of this predatory habit the fish is usually excluded from culturable waters. It is, however, prized as a good food fish. It inhabits rivers, streams as well as big reservoirs. It breeds in the beginning of monsoon and the young ones spread into different sheets of water. The adult fish is usually caught in gill nets as well as on hooks and lines. It feeds on live fish, prawns or even frogs. The latter are sometimes used as bait on hook and line. The fish grows up to a length of about 72 in. or 180 cm. and weighs about 50 kg. Though destructive, it is an important commercial fish in our waters.

CHAPTER 1

Fishes

Shingala : Two species of Shingala, namely *Mystus aor* and *Mystus seenghala*, occur in Maharashtra. Like Wallago they are also carnivorous, grow to large size and are popular as food fish. They have fewer bones and are always prized high in the market.

In the Schilbeid group of fishes, *Silonia*, known in Poona as 'Shilan', forms an important food fish. It is usually available in monsoon. Other Schilbeid fishes known as 'Valanj' (Ompak) are also common along with *Clupisoma* and *Pseudotropius*. One more fish in this group is *Neotropius khavalchor*. It has special short pointed teeth on the protruded part of the snout forming a rasp-like structure. With this rasp-like teeth, they remove the scales of other larger fish and feed on the scales. Hence the name Khavalchor. It is a small fish growing to about 6 in. or 15 cm. and occurs in river Krishna in its upper reaches.

Magur and Shingi : This group comprising two genera, *Heteropneustus* (Shingi) and *Clarius* (Magur), represents the air-breathing catfishes of Maharashtra. As they live out of water for a long time and are tenacious, they are usually sold in live condition. Because of this, they are very popular especially with certain classes and are called 'Jeol' fish. They inhabit muddy waters and feed on small insects and bottom debris. They are usually dark grey in colour but in Magur, an albino form is sometimes met with. It is yellowish white with red eyes. They have a habit of remaining huddled up in one place. Magur occurs only in Vidarbha.

Gunj or Khiret : *Bagarius bagarius*, which is known as 'Gunj' or 'Khiret' is the largest growing catfish. It is known to grow to about 200 kg. Young ones are banded yellowish brown and grey and are liked by some people but after the fish attains 20 kg. in weight, the flesh is considered rather coarse. With its thick rostral barbel pointing backwards, depressed head and greyish brown (banded) colour, the fish looks rather repulsive.

Smaller catfishes : Other catfishes such as *Rita*, *Mystus* (other than Shingala), *Glyptothorax*, *Nengra*, *Gagata* etc. are all small in size. As some of these occur in abundance they are considered commercially useful. Their specific names are already mentioned in the taxonomic list.

(12) GLASS FISH

Three freshwater species of Ambassidae, *Ambassis baculis*, *A. lala* and *A. ranga* constitute the freshwater glass fishes of Maharashtra. They are very small, hardly 4 cm. in length and are of indifferent value as food fish. They are, however, prized as attractive aquarium fish. In another less known way they are useful to human race. They are very fond of cyclops, a water flea commonly found in freshwater. Cyclops being a carrier of guinea worm pest, its destruction adds to the possibility of reducing the incidence of this dreaded disease. In this respect the glass fish do play an important role, like Rasbora group at (4) above.

CHAPTER 1

Fishes

(13) FRESH WATER EELS

In this group, two different families are involved, namely the Anguillidae and Mastacembelidae. *Anguilla anguilla* of the family Anguillidae is known as 'Ahir' whereas members of Mastacembelidae are known as 'Wam'. Both are prized as food and are very much sought for. 'Ahir' is supposed to have special nutritional value. In some places the mucus from this fish along with gram flour is converted into pillets and given to people suffering from nervous debility. The scientific value of this is, of course, not known. The wam is known for its firm flesh and commands best price in the market. The fish lives in small crevices in the embankment of ponds and reservoirs or river banks. It is also known as Sawback because of saw-like spines on its dorsal side.

(14) CLIMBING PERCH

Anabas testudineus is remarkable because of the climbing habits attributed to it. Though its capacity to climb is doubted and never endorsed by anybody in recent years, it is, no doubt, a migrating form and is known to travel on soft grassy land particularly in the beginning of monsoon. This migration from pond to pond by travelling on grassy or soft wet land is possible because of the air breathing ability of the fish. It has developed a chambered or labyrinthic structure in a cavity near its head. Blood capillaries are distributed over this structure. The fish comes to surface of water and takes bubbles of air which then enter the aforesaid cavity or chamber. Haemoglobin of the blood corpuscles having come in contact with the air, oxygenation of the blood is achieved. This labyrinthic structure is an accessory respiratory organ, the normal one being the gills. But these gills in this climbing perch are reduced in size and the fish depends largely on aerial respiration. On account of this specialisation, the fish can remain out of water for hours together in moist condition and can travel on land.

The fish occurs in ponds in the coastal area. Though it forms an important fishery in Bengal where it is known as 'Koi', the fish is available only in small numbers in Maharashtra.

(15) GOBIES

Freshwater Gobies in Maharashtra are represented only by a single genus *Glossogobius* with two species, *G. guiris* and *G. bombayensis*. Both are known as 'Kharbi'. *G. guiris* is important because of its wide-spread distribution and common occurrence. It has a comparatively large mouth and sharp teeth. Having fewer bones it is popular as food fish. It is a slender elongated fish and grows to about 30 cm. in length and 300 gm. in weight. It is carnivorous in habits and breeds in small ponds and reservoirs.

CHAPTER 1

Fishes

(16) MURRELS

Murrels, by far, form the most important and a very valuable group of fishes occurring in fresh waters of Maharashtra especially from point of view of general popularity as food fish in inland tracts. The popularity can largely be ascribed to the flavour of their flesh and presence of fewer bones. They are known in English as Snakeheaded fish because of their snake-like head and elongated body. They have accessory respiratory organs and can take bubbles of air from surface of water to supplement their oxygen requirements. They thus frequent the surface of water and thereby make themselves available to hunters who many times kill them with the help of guns and pistols. The hunter waits near the bank of a river and as Murrel approaches the surface for taking bubbles of air, it is hit by bullet.

There are different species of the Murrel. They are included in the family Ophiocephalidae and under genus *Chana* (old name Ophiocephalus). Of the five species, *C. marulius* and *C. leucopunctatus* grow to large size, may be upto about 5 ft. in length and about 30 kg. in weight. They are carnivorous forms, feeding on other live fish. Because of this destructive habit they are avoided in culturable waters for the fear of their feeding on baby fish stocked in those waters.

Murrels have a sort of parental care. They build a nest of small weeds and lay eggs. They guard the nest, the eggs and thereafter the young ones also. The young ones move on the surface of water in thick groups, the parents remaining below and guiding the baby fish. In this way they guide the growing babies to places where they can get minute organisms for feeding. After the babies grow to about 3", parents compulsorily make them disperse; if they (babies) do not, the parents do not even hesitate to devour a few of them to compel the rest to go and follow an independent life. Murrels breed in the months of April and May.

(17) CYPRINODONTS (Top-Minnows)

This group of small minnows is represented in Maharashtra by two families, Cyprinodontidae and Horaichthyidae. Of the former, the genus *Aplocheilichthys* has three species *A. lineatus*, *A. blochii* and *A. panchax*. *A. lineatus* is known as 'Piku' in Bombay. They are usually found on the surface of water, keeping a constant vigil and actively looking for insect larvae or other living organisms. Because of their habit of remaining on the surface, they are also known as 'Tarangya', meaning a floating fish. They are very useful as destroyers of insect larvae and because of their capacity to swim on the surface they can approach even shallow sheets of water and destroy the mosquito larvae commonly found on the margins. They are capable of standing a wide range of salinity and temperatures and thus are a great help in ridding the coastal waters of mosquito larvae. The other two species

CHAPTER 1
Fishes

are usually found in the inland tracts like Vidarbha and Marathwada. They are also reared as attractive aquarium fishes.

(18) GAMBUSIA

Gambusia, which is also known as mosquito fish, is another small fish which is a great friend of men. Like the 'Piku', Gambusia is also a surface fish and specialises in destroying mosquito larvae. It is not an Indian fish but has been imported into our country from Central America specially as a biological control of mosquito larvae for eradication of malaria. For this purpose, the fish has been grown and nurtured by many municipalities. As, in this way, the fish is abundantly available at different places, it looks like an indigenous form to the layman. The fish is very outstanding in one more respect. Unlike all other known freshwater fishes of Maharashtra, nay India, it gives birth to young ones and does not lay eggs. It is, therefore, known as viviparous fish and belongs to a separate family Poeciliidae.

(19) COMMON CARP

Of the exotic fishes introduced in Maharashtra waters, the common carp, *Cyprinus carpio*, and its three varieties, the mirror carp, the scale carp and the leather carp, are important from point of view of pisciculture. Though these are essentially cold water varieties, because of their hardy nature, they have well adapted themselves to tropical conditions. It is reported that these fishes were first brought to India in the year 1939 and stocked in Nilgiri hills. Later on a stock acclimatised to lower altitudes was imported from Thailand and bred at Cuttack for distribution to States. It is known to grow to a length of 3 feet and a weight of 32 lbs. Originally from China, the fish was introduced in European countries centuries ago. From there, it was taken to the American continent. It is found in Japan and many other countries also.

The fish has an omnivorous feeding habit which includes decaying plants, worms, crustaceans etc., though young are plankton feeders. It grows to a size of 15 to 18 inches in a year, also attaining maturity at this age and size. The fish breeds throughout the year, the peak breeding period, however, being from January to February. The speciality of this carp is that unlike other major carps, it breeds in ponds and tanks. Having been domesticated for centuries, the fish is sluggish in habit. The eggs which are adhesive are found sticking to leaves of submerged plants.

The three varieties of *Cyprinus carpio* can be distinguished as follows: The mirror carp, *C. carpio* var *specularis*, has a yellowish golden colour with large and shiny scales, the scale carp, *C. carpio* var *communis*, has small scales whereas the leather carp, *C. carpio* var *nudus*, has a leathery appearance on account of scales being almost absent.

(20) GOURAMI

Giant Gourami: The Gourami (*Osphronemus goramy*) is a native of Java and Mauritius. It was first introduced into India in 1865 by Sir William Denison at Madras, where it established fairly well. The fish was successfully transplanted to Bombay in 1937. As the name suggests, it is a giant form in the group of gouramies, growing to about 24 in. or 60 cm. in total length and weighing 9 kg.

The fish is a vegetable feeder mainly feeding on aquatic plants such as water-lilies, lotus, submerged weeds and marginal grass. It is a very hardy fish and, therefore, easy for transport. Gourami breeds in captivity almost throughout the year and is a good table fish with few bones. For breeding, the fish builds an under-water nest on the margins of tanks in which the eggs are laid. The nest and the eggs are zealously guarded by both parents. The larvae hatch out in ten days. At a time as many as 3,000 eggs are laid. The larvae or fry grow to fingerlings size in three months. At the end of first year the fish attains a growth of about nine inches.

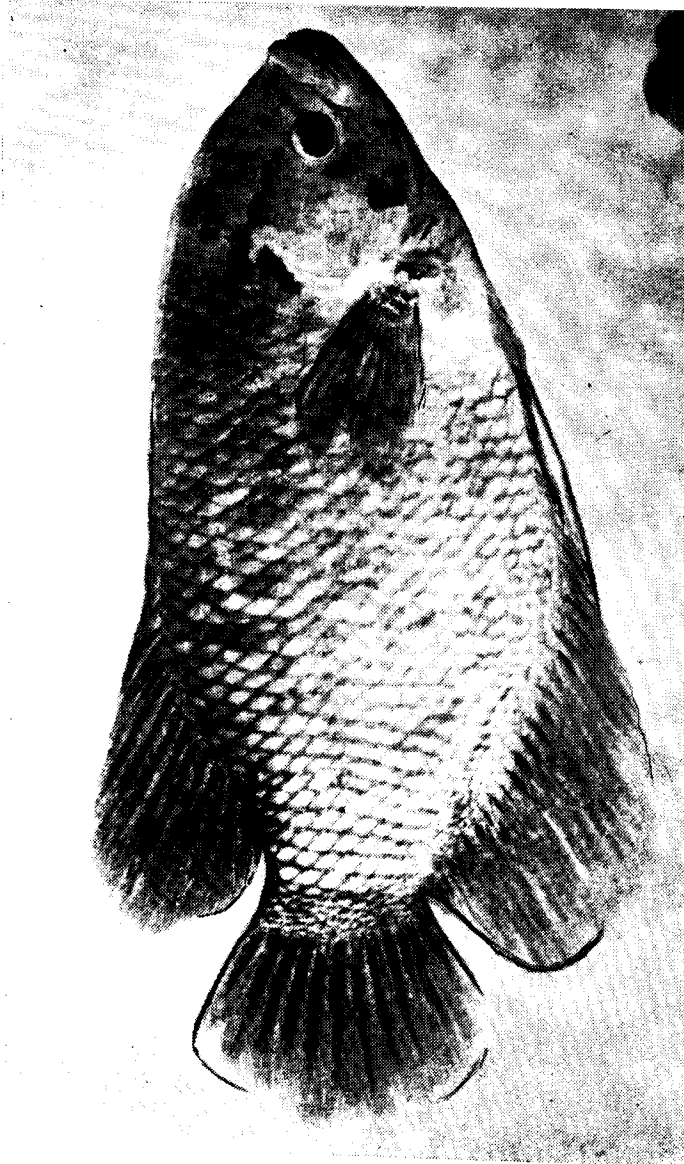
Dwarf Gourami : As the name indicates, the dwarf gourami (*Trichogaster lalia*), growing to about 3 in. or 7 to 8 cm., is one of the small gouramies as compared to the giant gourami (*Osphronemus goramy*) mentioned above; still smaller forms occur in Singapore and Malaysian waters. Though an insignificant fish in size, *T. lalia* is widely travelled and well-known in the aquarium world. The male is delicately coloured having fine alternating red and blue-green oblique bars on its body. The female is larger than the male but plain and dull in colouration. Like other small gouramies, they build simple bubble nests and breed in aquarium tanks. Being a labyrinthini form (having chambered accessory respiratory organs) they come to surface of water for taking a bubble of air. In nature, they inhabit stagnant puddles and feed on mosquito larvae, thus serving mankind. The fish occurs largely in Bhandara and Chanda district of Vidarbha region.

(21) BADIS AND NANDUS

Badis badis is known more as an aquarium fish than anything else. It is a small 5 to 7 cm. form remarkable for its ability to change its colour to suit the surroundings as a camouflage. It is normally brownish in colour with three or four black and green edged bands in double series. It inhabits shallow puddles and stagnant pools. In the aquarium it has a habit of remaining at the bottom and nibbling at vegetable detritus.

Nandus nandus (H.B.), though not popular as an aquarium form because of its size and carnivorous habit, is noted for its three black oblique bands on olive body colouration. These bands along with a few blotches on the head and yellowish-brown eyes make the fish resemble the juvenile or fry stage colouration of *Lates calcarifer*

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Gourami (*Osphronemus goramy*)

CHAPTER 1
Fishes

('Jitada' or 'Bekti'). Even the snout in both forms is very similar. The fish (Nandus) usually grows to 15 to 20 cm. in length but may reach 30 cm. in rare cases. It is considered good eating.

Both these forms occur in Vidarbha region and especially in Chanda and Bhandara districts.

(22) TILAPIA

The Tilapia (*Tilapia mossambica*), which is a member of the family Chichlidae enumerated in the taxonomic list of marine fishes because of their estuarine habits, is a native of South Africa, which has been successfully transplanted in some of the South-East Asian countries. Into Maharashtra, it was introduced from Ceylon. It is one of the hardiest fish known to live in any adverse conditions. It thrives in fresh water as well as estuarine or saline waters and feeds on aquatic vegetation as well as small animalcules. In ideal conditions, it grows to about 30 cm. and weighs a kg. It is a prolific breeder breeding almost throughout the year. It is called a mouth breeder because of the female hatching the eggs in her mouth. In case of danger, the young ones also are sucked into the mouth and protected. When the danger is over, they are thrown out. Being a very prolific breeder and adaptable in different ways, it pervades different waters especially in coastal areas and is likely to be a pest when stunted in growth.

(23) ORANGE CHROMIDE

Another Chichlid found in Maharashtra is *Etroplus maculatus*. It has been introduced from Andhra waters (Sunkesula). It is a small 8 cm. fish not very useful as food fish, but is popular as an aquarium fish under the name 'Orange chromide'. Local fishermen call it 'Thikree.' It is commonly met with in the fresh and estuarine waters around Bombay.

(24) GOLD FISH

Many are familiar with Gold fish, *Carassius carassius*, occurring in garden ponds and aquarium tanks. It is not a native of India but has been introduced from China and Japan several decades ago. Being of an attractive scarlet red colour and capable of thriving on variety of foods and climatic conditions, the fish has spread the world over and is considerably domesticated. In Maharashtra also, it is often seen in garden ponds and tanks in the compounds of mosques where they are fondly fed on bread and other articles of food. Its original colour was simple olive green but being easily bred, several colour varieties have been obtained by selective breeding over centuries. It is always popular as an ornamental fish.

CHAPTER 2—MARINE INVERTEBRATES

GENERAL INTRODUCTION

CHAPTER 2

Marine
Invertebrates

THE MARITIME REGION OF MAHARASHTRA COMPRISES AN EXTENSIVE COASTLINE OF 720 KILOMETRES and the sea waters around it, with the sea bottom mainly consisting of fairly hard clayey mud, interspersed with sandy patches. The bottom slopes gradually in northern Maharashtra, but is steeper in the southern half. Because of a number of streams and rivulets flowing into the sea, marshes are common. At intervals, hilly coastal tracts abutting into the sea give rise to rocky foreshores; rock however, does not extend far out into the sea. Coral is almost completely absent.

This maritime region is inhabited by a rich variety of invertebrate communities, living at different depths of water and sea bottom, mainly concealed from view and requiring special devices for their collection and study. A maritime region where collection can be easily made and which, consequently, has been studied the most, is the region influenced by tides, commonly called the inter-tidal zone.

A majority of the marine invertebrates are minute creatures, either throughout their life cycle or at some stage of their life history, rendering the compilation of such groups a difficult task in marine invertebrate taxonomy. As such the list of marine invertebrates presented in this chapter pertains mostly to the intertidal zones, particularly off Bombay and Ratnagiri, where such taxonomic studies have been more comprehensively undertaken.

Much of the work, especially at Bombay, was done as part of theses submitted for postgraduate degrees, and some of this has still remained unpublished. The present part of the Fauna volume cannot, therefore, be anything more than a compilation of the faunal lists extracted from these theses, as well as from some published papers. It may here be mentioned that, in some cases, workers have not realized the significance of usage of authors' names in parentheses. Thus, Subrahmanyam, Karandikar, and Murti, in the first part of their paper dealing with bivalve Mollusca, have inserted all the authors' names within parenthesis, whereas in the second part dealing with Gastropoda the authors' names are not in parenthesis. Similarly, Joshi, in his list of Isopoda,

CHAPTER 2
Marine
Invertebrates

has used authors' names without parenthesis, while Deshpande, in her list of Amphipoda, has inserted them within parenthesis. An attempt has been made here to correct these; otherwise the names of the animals and their authorship have not been altered, but have been retained as they were treated by the workers.

The list of marine invertebrates has been compiled from the following sources:—

- General intertidal fauna — Ph.D. thesis of late Dr. Y. M. Bhatt, entitled "a study of the intertidal organisms of Bombay" — Institute of Science, Bombay, 1959.
- Hydromedusae — Lele, S. H. & Gae, P. B.; "some common Hydro-medusae of the Bombay harbour." *Journ. Univ. Bombay* 3 (5), pp. 90-101, pls. i-iii, text fig. 1, 1935.
- Actinozoa — M.Sc. thesis of Kum. M. J. Dave, entitled "study of Anthozoa" — Institute of Science, Bombay, 1957.
- Bryozoa — Chhapgar, B. F. & Sane, S. R.; intertidal Entoprocta and Ectoprocta (Bryozoa) of Bombay." *J. Bombay nat. Hist. Soc.* 63 (2), pp. 449-454, pl. i, 1967.
- Chaetognatha — Lele, S. H. & Gae, P. B.; "common Sagittae of the Bombay harbour." *Journ. Univ. Bombay* 4 (5), pp. 105-113, pl. i, text figs. 1-3, 1936.
- Cestoda — Ph.D. thesis of late Dr. F. S. Khambata, entitled "Cestodes of marine fishes of Bombay", Institute of Science, Bombay, 1952.
- Polychaeta — Bhatt, Y. M. & Bal, D. V.; "an account of the Polychaetous annelids of Bombay." *Journ. Univ. Bombay* 32 (3-5), pp. 24-51, text figs. 1-12, 1963-64.
- Echinodermata — Sane, S. R. & Chhapgar, B. F.; "intertidal Echinodermata of Bombay." *J. Bombay nat. Hist. Soc.* 59 (2), pp. 672-676, pls. i, ii, 1962.
- Copepoda (parasitic) — Bassett-Smith, P. W.; "some new parasitic copepods found on fish at Bombay." *Ann. Mag. nat. Hist.* (7) 1, pp. 1-17, 7 pls., 18.
- A series of papers by Redkar, M., Rangnekar, P. G., & Murti, N. N., published in *J. Zool. Soc. India* 5 (2), 1953, *Rec. Ind. Mus.* 53 (3, 4), 1955, and *Journ. Univ. Bombay* 18-24, 1950-1956.
- Cirripedia — Karande, A. A.; "on Cirriped crustaceans (barnacles), an important fouling group in Bombay waters." *Proceedings of the Symposium on Crustacea*, 1965. *Mar. Biol. Assoc. India*, part iv, pp. 1245-1253, pls. i, ii, figs. 15, 16, 1967.
- Isopoda — M.Sc. thesis of U. N. Joshi.
- Amphipoda — M.Sc. thesis of Kum. K. B. Deshpande, entitled "a study of Amphipods of Bombay" — Institute of Science, Bombay, 1959.

CHAPTER 2
Marine
Invertebrates

Macrura (prawns) — Kunju, M.M.; "observations on the prawn fishery of Maharashtra coast." *Proceedings of the Symposium on Crustacea*, VTFF, *Mar. Biol. Assoc. India*, part iv, pp. 1382-1397, fig. 1, 1967.

(lobsters) — Chhapgar, B. F. & Deshmukh, S. K.; "on the occurrence of the spiny lobster, *Parulirus dasypus* (H. Milne-Edwards) in Bombay waters, with a note on the systematics of Bombay lobsters." *J. Bombay nat. Hist. Soc.* 58 (3), pp. 632-638, fig. 1, 1961.

Chhapgar, B. F. & Deshmukh, S. K.; "further records of lobsters from Bombay." *J. Bombay nat. Hist. Soc.* 61 (1), pp. 203-207, pl. i, 1964.

Anomura — M.Sc. thesis of K. N. Sankolli, entitled "intertidal Paguridae of Bombay" — Taraporevala Marine Biological Research Station, Bombay, 1959.

Ph.D. thesis of Dr. K. N. Sankolli, entitled "studies on Anomura (Decapoda, Crustacea), except Paguroidea, of Ratnagiri" — Taraporevala Marine Biological Research Station, Bombay, 1965.

Brachyura — Chhapgar, B. F.; on the marine crabs (Decapoda Brachyura) of Bombay State." Parts I & II. *J. Bombay nat. Hist. Soc.* 54 (2), pp. 399-439, 503, 549, pls. A, B, 1-10, text figs. 1-3, 1957.

Chhapgar, B. F.; "additions to the crab fauna of Bombay State." *J. Bombay nat. Hist. Soc.* 55 (3), pp. 582-585, i, ii, 1958.

Chhapgar, B. F.; "more additions to the crab fauna of Bombay." *J. Bombay nat. Hist. Soc.* 65 (3); pp. 608-617, pls. i, ii, 1969.

Stomatopoda — Chhapgar, B. F. & Sane, S. R.; "the Stomatopoda of Bombay". *Journ. Biol. Sci.* 9 (1 & 2), pp. 43-46, 1966.

Mollusca — Subrahmanyam, T. V., Karandikar, K. R., & Murti, N. N.; "Marine Gastropoda of Bombay". *Journ. Univ. Bombay* 21 (3), pp. 26-73, figs. 1-181, 1952.

Subrahmanyam, T. V., Karandikar, K. R., & Murti, N. N.; "the marine Pelecypoda of Bombay". *Journ. Univ. Bombay* 17 (5), pp. 50-81, 1949.

Faunal list of Ratnagiri was supplied by Dr. M. R. Ranade, Research Officer, Marine Biological Research Station, Ratnagiri.

SHORT NOTES ON PHYLA AND LISTS OF SPECIES

(1) PROTOZOA

Although no study has been made of this phylum in Maharashtra, a brief note is given here.

Animals belonging to this phylum are unicellular, mostly microscopic, and may be amoeboid, with cilia or flagella. They are common in the sea, ranging from the seashore to below 3000 fathoms. The best known

CHAPTER 2

Marine
Invertebrates

marine forms are the Foraminifera and Radiolaria, which have chambered shells of calcium carbonate or silica, and which form the Globigerina ooze on the sea bottom, or rock formations such as chalk and limestone. The Dinoflagellata sometimes reproduce in such enormous numbers as to cause a brown or red discoloration of sea water, resulting in mass mortality of fishes. *Noctiluca*, a Cystoflagellate is a pelagic form, presence of which produces luminescence in the sea.

The Sporozoa are a group of parasitic forms occurring both in fishes as well as invertebrates. A very common form infecting the skin and fins of fishes is *Oodinium*.

(2) PORIFERA

This phylum constitutes the most primitive multicellular animals called sponges. Most of the forms are marine, and all are sessile. The sponges may either form encrustations or assume various shapes, such as stalks, cups, vases or irregular shapes. There is an internal skeleton of spicules made of spongin, silica or lime. They occur from the intertidal zone to the deepest waters. A few are of commercial importance, such as the common bath sponge, this being the cleaned spongin skeleton of the animal.

Class Demospongiae
Subclass Tetractinellida
Order Choristida
Suborder Astrophora
Family Tetillidae
Genus *Tetilla* Schmidt

Tetilla dactyloidea (Carter)

Order Hadromarina (or Astromonaxonellida)
Suborder Monaxonida
Family Tethyidae
Genus *Tethya* Lamarck

Tethya lyncurium Linnaeus.

(3) COELENTERATA

This phylum consists of a wide range of numerous and diversified species. The body wall of these animals is made up of two layers of cells — the ectoderm and endoderm, with a jelly-like substance mesogloea in between. The body wall encloses a single cavity which serves as a digestive tract, called coelenteron, with only a single opening through which undigested material is also discharged. Another important feature which characterizes the members of this phylum is their radial symmetry. The animals in this phylum may have one of two types of body form, or they may go through both the forms at different stages of their life cycle. One form is the jelly-fish or umbrella shape — called medusa, and the other is a tubular form called polype. There are three classes.

CHAPTER 2

Marine
Invertebrates

The Hydrozoa include animals with the polype as the predominant form, although there might be an alternation of generations involving a medusa stage. Most of them are marine, and most are colonial. Most of the Hydrozoa are small in size and form branched colonies encrusted on stones, etc.; there are, however, some pelagic forms which swim by means of a float. The characteristic means of defence is by nematocysts which, in some animals, like the Portuguese Man-of-war, may be deadly. In the pelagic forms, the different polypes assume different roles, such as flotation, defence, digestion, and reproduction.

In the Scyphozoa, or jelly-fishes, the predominant stage is the swimming medusa, but there may be an alternation of generations with a temporary polype-like planula stage.

The Actinozoa include the sea anemones and corals. While the former are single and lack a skeleton, the latter form colonies and have a hard limy skeleton. Some, like the sea pens and sea fans, may lack a calcareous skeleton.

Phylum COELENTERATA
Class Hydrozoa
Order Hydroida
Family Pennariidae
Genus *Pennaria* Oken

Pennaria disticha Goldfuss

Family Tubulariidae
Genus *Tubularia* van Beneden

Tubularia crocea (Agassiz)

Tubularia larynx Ell. & Sol.

Tubularia (Ectopleura) pacifica (Thornely)

Genus *Corymorpha* Hartlanb

Corymorpha nutans Sars

Family Clavidae
Genus *Hydractinia*

Hydractinia gallensis (Thornely)

Family Bougainvillidae
Genus *Bougainvillia* Lesson

Bougainvillia ramosum (van Beneden)

Order Anthomedusae
Family Tubulariidae
Genus *Steenstrupia* Forbes

Steenstrupia bigelowi (Maas)

Order Leptomedusae
Family Phialuciidae
Genus *Phialucium* Maas

CHAPTER 2

Marine
Invertebrates

- Phialucium virens* (Bigelow)
 Family Eirinidae
 Genus *Eirene* Eschscholtz
- Eirene ceylonensis* (Browne)
 Family Aequoreidae
 Genus *Aequorea* Peron & Lesueur
- Aequorea pensilis* (Eschscholtz)
Aequorea conica Browne
 Order Trachymedusae
 Family Geryoniidae
 Genus *Liriope* Lesson
- Liriope tetraphylla* (Chamisso & Eysenhardt)
 Family Rhopalonematidae
 Genus *Aglaura* Peron and Lesueur
- Aglaura hemistoma* Peron and Lesueur
 Order Narcomedusae
 Family Aeginidae
 Genus *Solmundella* Haeckel
- Solmundella bitentaculata* (Quoy and Gaimard)
 Order Semaestomeae
 Family Pelagiidae
 Genus *Dactylometra*.
- Dactylometra quinquecirrha* (Desor)
 Genus *Pelagia* Person and Lesueur
- Pelagia noctiluca* (Forsk.)
 Class Actinozoa
 Subclass Alcyonaria
 Order Pennatulacea
 Family Veretillidae
 Genus *Cavernularia* Valenciennes
- Cavernularia orientalis* Thomson and Simpson
 Family Virgulariidae
 Genus *Virgularia* Lamarck
- Virgularia rumphii* Kolliker
 Subclass Zoantharia
 Order Actiniaria
 Suborder Nynantheae
 Tribe Athenaria
 Family Edwardsiidae
 Genus *Edwardsia* Quatrefages
- Edwardsia tinctoria* Annandale
 Family Haloclavidae
 Genus *Metapeachia* Carlgren

CHAPTER 2

Marine
Invertebrates

- Metapeachia tropica* (Panikkar)
 Family Haliactiidae
 Genus *Pelocoetes* Annandale
- Pelocoetes exul* Annandale
 Genus *Phytocoetes* Annandale
- Phytocoetes gangeticus* (Annandale)
 Tribe Thenaria
 Subtribe Endomyaria
 Family Actiniidae
 Genus *Anemonia* Risso
- Anemonia indicus* Parulekar
 Genus *Paracondylactis* Carlgren
- Paracondylactis indicus* Dave
 Family Acontiphoridae
 Genus *Acontiphorum*
- Acontiphorum bombayensis* Parulekar
 Family Diadumenidae
 Genus *Diadumene* Stephenson
- Diadumene schilleriana* (Stoliczka).

(4) Platyhelminthes

Commonly known as flatworms, these are soft-bodied, bilaterally symmetrical animals devoid of true segmentation. A mesoderm is present. They may be either free-living, like the planaria, or parasitic such as flukes and tapeworms. The parasites may occur on the body or gills or inside the body. Only the cestodes have been studied at Bombay.

- Class Cestoda
 Order Eucestoda
 Superfamily Tetrarhynchoidea
 Family Pterobothriidae
 Genus *Pterobothrium* Diesing
- Pterobothrium heteracanthum* Diesing [on *Carcharhnus bleekeri* (Dumeril)]*
- Family Otophthriidae
 Subfamily Otophthriinae
 Genus *Otophthrium* Linton
- Otophthrium balli* Southwell [on *Sphyrna blochii* (Cuv.)]
 Superfamily Phyllobothriodea
 Family Phyllobothriidae
 Genus *Anthobothrium* van Beneden

*Names of hosts are those given by the original worker (late Dr. Khambata).

CHAPTER 2

Marine
Invertebrates

Anthobothrium laciniatum Linton [on *Sphyrna zygaena* (Linn.) and *Carcharhinus bleekeri* (Dumeril)]

Anthobothrium floraformis (Southwell) [on *Galeocерdo tigrinus* (Muller and Henle)]

Genus *Echeneibothrium* van Beneden

Echeneibothrium cancellatum (Linton) [on *Rhinoptera javanica* (Muller and Henle) and *Aetobatis narinari* (Euphrasen)]

Echeneibothrium flexile (Linton) [on *Trygon sephen* (Forsk.) and *Trygon walga* (Muller and Henle)]

Family Onchobothriidae

Genus *Acanthobothrium* van Beneden

Acanthobothrium coronatum (Rud.) [on *Chiloscyllium griseum* Muller and Henle]

Acanthobothrium capsulorchisum Khambata [on *Rhynchobatus djeddensis* (Forsk.), *Trygon walga* (Muller and Henle), and *Trygon uarnak* (Forsk.)]

Acanthobothrium benedenii Loennberg [on *Trygon uarnak* (Forsk.)]

Genus *Platybothrium* Linton

Platybothrium spinulifera (Southwell) [on *Galeocерdo tigrinus* (Muller and Henle)]

Genus *Pedibothrium* Linton

Pedibothrium longispine Linton [on *Stegostoma tigrinum* (Forster)]

Genus *Phoreibothrium* Linton

Phoreibothrium exceptum Linton [on *Sphyrna blochii* (Cuv.)]

Genus *Spiniloculus* Southwell

Spiniloculus mavensis Southwell [on *Chiloscyllium griseum* Muller and Henle].

(5) *Aschelminthes*

This is a heterogenous phylum, of unsegmented or superficially segmented, free-living or parasitic animals. The main group, Nematoda, comprises the round worms which, as the name suggests, are cylindrical. The Kinorhyncha are minute, spiny 13-14 segmented forms found at the bottom of shallow seas. The Priapulida are also represented in the seas. Here the body has a distinct trunk with a proboscis which can be everted. In the Nematomorpha the body is long, thread-like and irregularly coiled when at rest. The Rotifera are mainly freshwater animals, but a few marine forms occur. Some are parasitic.

(6) *Entoprocta and Ectoprocta*

These two minor phyla, previously grouped together under Bryozoa or Polyzoa, are mostly marine and colonial forms, commonly known as sea-mats or sea-mosses, and resemble Hydroid zoophytes. While in the Entoprocta both the mouth and the anus are within the lophophore, in the Ectoprocta the latter lies outside. Majority of the forms are found in the seashore region, as extensive growths on stones, inside seashells, or as encrustations on boat hulls; their occurrence has been recorded as deep as 3000 fathoms.

Phylum ENTOPROCTA

Family Pedicellinidae

Genus *Pedicellina* Sars

Pedicellina cernua (Pallas)

Genus *Barentsia* Hincks

Barentsia gracilis (Sars)

Phylum ECTOPROCTA

Class Gymnolaemata

Order Ctenostomata

Suborder Stolonifera

Family Vesiculariidae

Genus *Amathia* Lamouroux

Amathia convoluta Lamouroux

Genus *Bowerbankia* Farre

Bowerbankia imbricata Adams

Order Cheilostomata

Suborder Anasca

Division Malacostega

Family Electridae

Genus *Electra* Lamouroux

Electra pilosa (Linnaeus)

Family Membraniporidae

Genus *Acanthodesia* Canu and Bassler

Acanthodesia savartii (Audouin)

Genus *Nellia* Busk

Nellia oculata quadrilatera D'Orbigny

Division Coelostega

Family Poricellariidae

Genus *Poricellaria* D'Orbigny

Poricellaria ratoniensis (Waters)

Division Cellularina

Family Bugulidae

Genus *Caulibugula* Verrill

CHAPTER 2

Marine
Invertebrates

CHAPTER 2

Marine
Invertebrates*Caulibugula zanzibariensis* (Waters)

Suborder Ascophora

Family Celleporidae

Genus *Celleporaria**Celleporaria pilaefera*(7) *Brachiopoda*

Superficially resembling the Mollusca because of their bivalved shell, members of this phylum are considered "living fossils" as they have flourished from Cambrian times to the present. The body is usually attached by a stalk. A lophophore is present.

Lingula, a representative of this phylum, occurs commonly at Ratnagiri.

(8) *Sipunculida*

The animals belonging to this minor phylum are all marine, found from the seashore down to 5000 fathoms. They are unsegmented worm-like creatures with a slender, eversible introvert and a thicker muscular body. The tip of the introvert bears tentacles. The intestine is spirally coiled. One or two metanephridia are present. Only one representative has been recorded from Maharashtra State.

Sipunculida

Genus *Dendrostomum* Grube*Dendrostomum signifer* Selenka and de Man(9) *Chaetognatha*

This is a minor phylum comprising pelagic arrow-shaped worms without a vascular system or excretory canals. A coelomic cavity is present. In their musculature they resemble the Nematodes.

Chaetognatha

Genus *Sagitta**Sagitta bedoti* Beraneck*Sagitta enflata* Grassi*Sagitta pulchra* Doncaster*Sagitta regularis* AidaGenus *Krohnitta**Krohnitta pacifica* Aida(10) *Annelida*

This is a heterogenous group comprising not only the familiar 'worms' but also other more primitive forms. Typically, the body is divided into a number of similar segments. The organs of excretion are nephridia. A trochophore larva is present.

CHAPTER 2

Marine
Invertebrates

The sub-class Polychaeta is the one most represented in the sea. Having a distinct head with eyes and tentacles, the motile forms have parapodia for swimming. Some forms live within tubes constructed by them, which may be parchment-like, hardened by sandgrains and bits of shells, or calcareous.

The class Hirudinaria is almost exclusively parasitic, at least in the marine forms. Marine leeches infest turtles and fishes, mostly Elasmobranchs.

The class Myzostomida is a very primitive one, comprising parasites of Echinodermata. They are disc-shaped, without any external segmentation. These forms have been collected from feather stars at Bombay, but have not been identified.

The class Archiannelida has not been recorded from Maharashtra, while the Echiurida has only one representative, recorded from Bombay. It is unsegmented, without parapodia, but has a pair of setae near the anterior end, and a large proboscis.

Phylum ANNELIDA

Polychaeta

Phanerocephala

Suborder Nereidiformia

Family Syllidae

Genus *Syllis* Savigny*Syllis (Syllis) gracilis* Grube*Syllis (Typosyllis) variegata* Grube*Syllis (Typosyllis) closterobranchia* Schmarda

Family Hesionidae

Genus *Leocrates* Kinberg*Leocrates claparedii* (Costa)*Leocrates diplognathus* MonroGenus *Leocratides* Ehlers*Leocratides ehlersi* (Horst)

Family Aphroditidae

Subfamily Polynoinae

Genus *Lepidonotus* Leach*Lepidonotus tenuisetosus* (Gravier)Genus *Gattyana* McIntosh*Gattyana deludens* FauvelGenus *Harmothoe* Kinberg*Harmothoe ampullifera* (Grube)

Subfamily Sigalioninae

Genus *Sthenelais* Kinberg

CHAPTER 2

Marine
Invertebrates

- Sthenelais boa* (Johnston)
 Genus *Leanira* Kinberg
Leanira japonica McIntosh
 Subfamily Acoetinae
 Genus *Panthalis* Kinberg
Panthalis oerstedii Kinberg
 Family Phyllodocidae
 Subfamily Phyllodocinae
 Genus *Phyllodoce* Savigny
Phyllodoce (*Anaitides*) *madeirensis* Langerhans
 Family Nereidae
 Genus *Dendronereides* Southern
Dendronereides heteropoda Southern
 Genus *Nereis* Cuvier
Nereis (*Nereis*) *talehsapensis* Fauvel
Nereis (*Nereis*) *capensis* Willey
Nereis (*Ceratonereis*) *costae* Grube
Nereis (*Ceratonereis*) *burmensis* Monro
 Genus *Perinereis* Kinberg
Perinereis vancaurica typica (Ehlers)
Perinereis cultrifera typica Grube
Perinereis vancaurica indica Bhatt
Perinereis cultrifera helleri Grube
Perinereis nuntia typica (Savigny)
Perinereis nuntia brevicirris (Grube)
Perinereis nuntia vallata Grube
Perinereis nuntia bombayensis Bhatt
Perinereis aibuhitensis Grube
Perinereis nigropunctata Horst
 Genus *Eurythoe* Kinberg
Eurythoe complanata (Pallas)
 Family Eunicidae
 Subfamily Eunicinae
 Genus *Eunice* Cuvier
Eunice savignyi Grube
Eunice siciliensis Grube
 Genus *Marphysa* Quatrefages
Marphysa mossambica Peters
 Genus *Lysidice* Savigny

CHAPTER 2

Marine
Invertebrates

- Lysidice collaris* Grube
 Subfamily Onuphidiinae
 Genus *Diopatra* Aud. and M.Edw.
Diopatra neapolitana Delle Chiaje
 Sub-family Lumbriconereinae
 Genus *Lumbriconereis* Blainville
Lumbriconereis heteropoda Marenzeller
 Genus *Arabella* Grube
Arabella iricolor (Montagu)
 Suborder Spioniformia
 Family Spionidae
 Genus *Polydora* Bose
Polydora (*Polydora*) *coeca* Oersted
 Family Cirratulidae
 Genus *Cirratulus* Lamarck
Cirratulus cirratus (Muller)
 Family Chaetopteridae
 Genus *Phyllochaetopterus* Grube
Phyllochaetopterus socialis Claparede
 Family Chloraemidae
 Genus *Flabelligera* Sars
Flabelligera diplochaitos Otto
 Suborder Terebelliformia
 Family Terebellidae
 Subfamily Amphitritinae
 Genus *Loimia* Malmgren
Loimia medusa (Savigny)
 Suborder Scoleciformia
 Family Arenicolidae
 Genus *Arenicola*
Arenicola bombayensis Kewalramani, Wagh and Ranade
 Cryptocephala
 Suborder Sabelliformia
 Family Sabellidae
 Genus *Spirographis* Viviani
Spirographis spallanzanii Viviani
 Genus *Dasychone* Sars
Dasychone serratibranchis Grube
 Genus *Potamilla* Malmgren
Potamilla leptochaeta Southern
 Family Serpulidae
 Genus *Vermiliopsis* Saint-Joseph

CHAPTER 2

Marine
Invertebrates*Vermiliopsis glandigerus* GravierGenus *Spirorbis* Daudin*Spirorbis foraminosus* Moore

Class Echiurida

Order Echiuroinea

Family Echiuridae

Genus *Ochetosoma* Leuckart and Ruppell*Ochetosoma bombayensis* (Prashad and Awati)

(11) Crustacea

This class of aquatic Arthropoda is akin to the insects on land in complexity of organisation, profusion in number, and economic importance to man. Crustaceans range from microscopic forms, on the richness of which depends fish life, to animals of the size of nearly 30 cms. Most of the Crustacea, as the name implies, are covered with a chitinous cuticle, which may be impregnated with lime salts. The body is typically divided into a head, thorax and abdomen, but the former two may be fused.

Sub-class Branchiopoda

A large number of body segments with leaf-like appendages on the anterior region characterize this subclass. The carapace may be absent, shield-shaped, or divided into two shell-like valves. It includes one of the most adaptive animals of the marine habitat — *Artemia salina*, commonly found in the evaporating works of salt pans. This animal can accustom itself from fresh water to saturated brine. Their eggs are impervious to outside influences, and therefore can remain viable for several years. They are gathered and used for hatching into the nauplius for feeding young of fishes. Other examples are *Apus* and *Branchipus*.

Sub-class Ostracoda

In this group, the unsegmented and laterally compressed body is enclosed in a bivalved carapace, which gives them a superficial resemblance to tiny transparent clams. Example *Cypris*.

Sub-class Copepoda

It includes a vast number of small Crustacea, playing an important role in the economy of the sea, because they constitute the main link in the food chain between diatoms and the larger animals.

They have an elongated segmented body, bearing usually five pairs of limbs, and a posterior abdomen without appendages. The free-living forms are found in both fresh and sea waters and form one of the most numerous items of plankton. Others are parasitic forms which have undergone a fantastic degeneration. The Branchiura are external parasites on fishes and have a flat, shield-like body with large compound eyes (e.g. *Argulus*).

CHAPTER 2

Marine
Invertebrates

Sub-class Cirripedia

These are shrimp-like animals, enclosed in a calcareous shell. The young are free-swimming, but as they grow they become permanently attached. They are popularly known as goose barnacles (*Lepas*) and acorn barnacles (*Balanus*). The Rhizocephala are extremely degenerate forms, mostly parasites of crabs and hermit crabs. A tumour-like part attached to the abdomen of the host extends as a network of filaments within the host.

Sub-class Malacostraca

These are highly developed animals. The thoracic and abdominal appendages are different. Paired compound eyes are present. The mandibles are provided with a palp. Except in the Leptostraca (e.g. *Nebalia*) the thoracic limbs are leg-like.

This subclass, of which the lobsters, prawns and crabs are the most popularly known and are of considerable commercial importance, also comprises the following groups :

The Mysidacea are small, transparent shrimp-like forms, but with biramous legs.

The Cumacea are also shrimp-like, but with sessile eyes and a short carapace.

The Isopoda have a depressed body, without a carapace, with sessile eyes. They may be either free-living or parasitic on the skin or gills of fishes or higher Crustacea.

The Amphipoda are similar to Isopoda, but the body is laterally compressed.

The Decapoda — it is the members of this group which, together with Mollusca, constitute the important "shell" fisheries. Most important of the group are the prawns. More than 75% of the total important of the group are the prawns. More than 75% of the total prawn production of India is from Maharashtra. From the prawns listed below only 10 species are so abundant as to be of commercial importance. However, of these, the smaller varieties (shrimps) such as *Acetes indicus* and *Palaemon tenuipes* form more than half of the catch. The larger prawns, *Metapenaeus affinis*, *Parapenaeopsis* spp. etc. are more abundant near Ratnagiri and are exported, deep frozen, to Japan and western countries.

Lobsters are also in great demand both in the State and outside, and "lobster tails" are an important item of export.

Crabs are also a favourite item of sea food. They differ from the prawns and lobsters in that their abdomen is hidden under the carapace.

The Stomatopoda (e.g. *Squilla*) have a large abdomen, a carapace leaving the last three cephalothoracic segments uncovered, subchelate second maxillipeds, and pleopods serving as branchiae.

Class Copepoda

Sub-Order Calanoida

CHAPTER 2

Marine
Invertebrates

- Family Calanidae
Genus *Undinula* Sewell
Undinula vulgaris (Dana)
Family Eucalanidae
Genus *Eucalanus* Dana
Eucalanus orassus Giesbrecht
Eucalanus suborassus (Giesbrecht)
Family Paracalanidae
Genus *Acrocalanus* Giesbrecht
Acrocalanus longicornis Giesbrecht
Acrocalanus monachus (Giesbrecht)
Genus *Paracalanus*
Paracalanus parvus (Giesbrecht)
Family Euchaetidae
Genus *Euchaeta* Philippi
Euchaeta marina (Prestandrea)
Family Centropagidae
Genus *Centropages* Kroyer
Centropages furcatus (Dana)
Centropages typicus (Kroyer)
Centropages dorsispinatus (Thompson and Scott)
Family Diaptomidae
Genus *Pseudodiaptomus* Herrick
Pseudodiaptomus ardjuna Brehm
Family Temoridae
Genus *Temora* Baird
Temora turbinata (Dana)
Family Pontellidae
Genus *Labidocera* Lubbock
Labidocera acuta (Dana)
Family Acartiidae
Genus *Acartia*
Acartia spinicauda (Giesbrecht)
Sub-Order Cyclopoida
Family Sapphirinidae
Genus *Sapphirina* Thompson
Sapphirina scarlata Giesbrecht
Family Oithonidae
Genus *Oithona* Baird
Oithona similis Claus
Family Clausidiidae
Genus *Conchylurus*
Conchylurus gracilis

CHAPTER 2

Marine
Invertebrates

- Conchylurus bombasticus*
Suborder Monstrilloida
Family Monstrillidae
Genus *Monstrilla* Dana
Monstrilla lata Desai and Bal
Genus *Cymbasoma* Thompson
Cymbasoma bali Desai and Krishnaswamy
Genus *Thaumaleus* Kroyer
Thaumaleus thompsoni
Suborder Harpacticoida
Family Tachidiidae
Genus *Euterpina* Norman
Euterpina acutifrons (Dana)
Suborder Caligoida
Family Pennellidae
Genus *Pennella* Oken
Pennella instructa Wilson
Pennella orthagorisci Wright
Family Bomolochidae
Genus *Bomolochus* Nordmann
Bomolochus tricerus Bassett-Smith (on *Stromateus cinereus**)
Bomolochus tetradonis Bassett-Smith (on *Tetrodon oblongus*)
Bomolochus megacerus Bassett-Smith (on *Stromateus niger*)
Family Ergasilidae
Genus *Ergasilus* Nordmann
Ergasilus polynemi Redkar, Rangnekar and Murti (on *Polynemus tetradactylus*)
Family Caligidae
Subfamily Anuretinae
Genus *Anuretes* Heller
Anuretes branchialis Rangnekar (on *Thynnus pelamys*)
Subfamily Caliginae
Genus *Caligus* Muller
Caligus parvus Bassett-Smith (on *Tetrodon oblongus*)
Caligus cybii Bassett-Smith (on *Cybbium lineolatum*)
Caligus hirsutus Bassett-Smith (on *Polynemus tetradactylus*)
Caligus phipsoni Bassett-Smith (on *Cybbium guttatum*)
Caligus longicaudus Bassett-Smith (on *Trichiurus haumela* and *Chirocentrus dorab*)

*Names of hosts are those given by the original workers (Bassett-Smith, and Redkar, Rangnekar, Murti, etc.).

CHAPTER 2

Marine
Invertebrates

- Caligus furcisetifer* Redkar, Rangnekar and Murti (on *Sphyrna blochii*)
Caligus nengai Rangnekar, Rangnekar and Murti (on *Arius nenga*)
Caligus bombayensis Rangnekar (on *Mugil cephalus*)
Caligus djedabae Rangnekar (on *Atule djedaba*)
Caligus unguidentatus Rangnekar and Murti (on *Clupea toli*)
 Genus *Sciaenophilus* van Beneden
Sciaenophilus benedeni Bassett-Smith (on *Sciaena diacanthus*)
 Genus *Pseudocaligus* Scott
Pseudocaligus laminatus Rangnekar (on *Spheroides lunaris*)
 Genus *Parapetalus* Steenstrup and Lutken
Parapetalus hirsutus Bassett-Smith (on *Polynemus tetradactylus*)
Parapetalus longipennatus Rangnekar (on *Caranx nigrescens*)
Parapetalus formicoides Redkar, Rangnekar and Murti (on *Dussumieria acuta*)
 Sub-family Lepeophtheirinae
 Genus *Diphyllogaster* Brian
Diphyllogaster aliuncus Rangnekar (on *Pampus argenteus*)
 Subfamily Mappatinae
 Genus *Mappates* Rangnekar
Mappates plataxus Rangnekar (on *Platax teira*)
 Family Euryphoridae
 Subfamily Tuxophorinae
 Genus *Midias* Wilson
Midias carangis Rangnekar (on *Caranx nigrescens*)
 Genus *Tuxophorus* Wilson
Tuxophorus tylosuri Rangnekar (on *Tylosurus strongylurus*)
 Superfamily Dichelesthioidea
 Family Anthosomatidae
 Genus *Lernanthropus* Blainville
Lernanthropus trifolius Bassett-Smith (on *Polynemus tetradactylus*)
Lernanthropus forficatus Redkar, Rangnekar and Murti (on *Trichiurus haumela*)
Lernanthropus rubiginosus Redkar, Rangnekar and Murti (on *Chatoessus nasus*)
 Family Dichelesthidae
 Genus *Cybicola* Bassett-Smith
Cybicola armata Bassett-Smith (on *Cybbium guttatum*)
 Genus *Pseudocongericola* Yu

CHAPTER 2

Marine
Invertebrates

- Pseudocongericola chefoonensis* Yu (on *Muraenesox talabonoides*)
 Family Eudactylinidae
 Genus *Kroyeria* van Beneden
Kroyeria echinatus Rangnekar (on *Sphyrna zygaena*)
 Superfamily Lernaeoidea
 Family Lernaeidae
 Subfamily Lernaeenicinae
 Genus *Lernaeenicus* Le Sueur
Lernaeenicus polynemi Bassett-Smith (on *Polynemus tetradactylus*)
 Genus *Terneonema* Milne-Edwards
Terneonema polynemi Bassett-Smith (on *Polynemus tetradactylus*)
 Family Perodermatidae
 Genus *Peroderma* Heller
Peroderma cylindricum Heller (on *Coilia dussumieri*)
 Order Lerneopodidea
 Family Chondracanthidae
 Subfamily Chondracanthinae
 Genus *Chondracanthus* De la Roche
Chondracanthus elongatus Bassett-Smith (on sole)
 Family Lerneopodidae
 Subfamily Clavellinae
 Genus *Brachiella* Cuvier
Brachiella appendiculosa Bassett-Smith (on *Stromateus niger* and *Polynemus tetradactylus*)
 Genus *Charopinus* Kroyer
Charopinus albidus Rangnekar (on *Pseudosciaena albida*)
 Family Naobranchiidae
 Genus *Naobranchia* Hesse
Naobranchia vermiformis Rangnekar (on *Chatoessus nasus*)
 Cirripedia
 Suborder Balanomorpha
 Family Balanidae
 Subfamily Balaninae
 Genus *Balanus* Da Costa
 Subgenus *Megabalanus* Hoek
Balanus tintinnabulum tintinnabulum Linnaeus
Balanus tintinnabulum zebra Darwin
 Subgenus *Balanus* Da Costa
Balanus amphitrite variegatus Darwin
Balanus amphitrite communis Darwin
Balanus amphitrite hawaiiensis Broch
Balanus amphitrite denticulata Broch
Balanus amphitrite cochinchensis Nilsson-Cantell

CHAPTER 2

Marine
Invertebrates

- Balanus amphitrite insignis* Nilsson-Cantell
Balanus amphitrite venustus Darwin
Balanus amphitrite niveus Darwin
Balanus amphitrite stutsburi Darwin
Balanus amphitrite cirratus Darwin
Balanus poecilotheca Kruger
Balanus patellaris Spengler
Balanus calidus Pilsbry
 Subgenus *Chirona* Gray
Balanus amaryllis Darwin forma *euamaryllis* Broch
Balanus amaryllis Darwin forma *nivea* Gruvel
Balanus ciliatus Hoek
Balanus socialis Hoek
 Subfamily Tetracitinae
 Genus *Tetracita* Schumacher
Tetracita squamosa viridis Darwin
Tetracita squamosa rufotincta Pilsbry
Tetracita purpurascens Wood
 Subfamily Chelonibiinae
 Genus *Chelonobia*
Chelonobia testudinaris Linnaeus
Chelonobia patula Ranzani
 Subfamily Coronulinae
 Genus *Platylepas*
Platylepas ophiophilus Lanchester
 Family Chthamalidae
 Genus *Chthamalus* Ranzani
Chthamalus malayensis Pilsbry
Chthamalus withersi Pilsbry
 Isopoda
 Flabellifera
 Family Eurydicidae
 Genus *Cirolana*
Cirolana bombayensis Joshi
 Family Corallanidae
 Genus *Lanocira*
Lanocira zeylanica Stebbing
 Genus *Alcirona*
Alcirona indica Niertsz
 Genus *Argathona*

CHAPTER 3

Marine
Invertebrates

- Argathona muraeni* Joshi (on *Muraena tessellata*)*
 Family Cymothoidae
 Genus *Nerocila*
Nerocila serra Sch. and Mein (on *Arius dussumieri*)
Nerocila orbignyi Guer. Mein (on *Arius dussumieri*)
Nerocila phaeopleura Bleeker (on *Histiophorus gladius*)
Nerocila pigmenta Joshi (on *Opisthopterus turtoor*)
 Genus *Anilocra*
Anilocra leptosoma Bleeker (on *Chaetossus nasus*)
 Genus *Cymothoa*
Cymothoa stromatei Sch. and Mein (on *Parastromateus niger*)
Cymothoa cinerius Joshi (on *Stromateus cinerium*)
 Family Sphaeromidae
 Genus *Sphaeroma*
Sphaeroma walkeri Stebbing
Sphaeroma annandalei Stebbing
 Valvifera
 Family Idoteidae
 Genus *Synidotea*
Synidotea variegata Collinge
Synidotea worliensis Joshi
 Epicaridea
 Family Bopyridae
 Genus *Epipenaeon*
Epipenaeon ovalis Pillai (on *Parapenaeopsis stylifera*)
Epipenaeon obovalis Joshi (on *Penaeus semisulcatus*)
 Genus *Parapenaeon*
Parapenaeon rotunda Joshi (on *Metapenaeus dobsoni*)
 Amphipoda
 Family Lyssianassidae
 Genus *Lyssianassa* Milne-Edwards
Lyssianassa ceratina (Walker)
 Family Leucothoidae
 Genus *Leucothoe* Leach
Leucothoe richiardi (Less.)
 Family Tironidae
 Genus *Tiron* Lilljeborg
Tiron bombayensis Deshpande
 Family Gammaridae
 Genus *Melita* Leach
Melita fresnelli (Audouin)

*Names of hosts are those given by the original worker (Shri Joshi).

CHAPTER 2

Marine
Invertebrates

Melita subchelata (Schellenburg)
 Genus *Elasmopus* Costa
Elasmopus subpectenicrus Deshpande
Elasmopus palpifera Deshpande
Elasmopus pecteniscus (Bate)
 Genus *Maera* Leach
Maera grossimana (Montagu)
Maera mastersii (Haswell)
Maera spinosa Deshpande
 Family Dexaminidae
 Genus *Guernea* Chevreux
Guernea dentata Deshpande
 Family Talitridae
 Genus *Parhyale* Stebbing
Parhyale fasciger (Stebbing)
 Genus *Parhyalella*
Parhyalella indica (Barnard)
 Family Podoceridae
 Genus *Podocerus* Leach
Podocerus brasiliensis (Dana)
 Family Aoridae
 Genus *Grandidierella*
Grandidierella gravipes (Barnard)
 Family Ampithoidae
 Genus *Ampithoe* Leach
Ampithoe ramondi (Audouin)
Ampithoe africana (Barnard)
 Family Corophiidae
 Genus *Erichthonius* Milne-Edwards
Erichthonius colabaensis Deshpande
Erichthonius plumosa Deshpande
 Penaeidea
 Family Penaeidae
 Subfamily Penaeinae
 Genus *Penaeus* Fabricius
Penaeus canaliculatus Olivier
Penaeus semisulcatus De Haan
Penaeus monodon Fabricius
Penaeus indicus Milne-Edwards
Penaeus merguensis Alcock
Penaeus penicillatus Alcock
 Genus *Miyadiella*

CHAPTER 2

Marine
Invertebrates

Miyadiella pedunculata Kubo
 Genus *Metapenaeus* Wood Mason
Metapenaeus monoceros (Fabricius)
Metapenaeus affinis (Milne-Edwards)
Metapenaeus dobsoni (Miers)
Metapenaeus brevicornis (Milne-Edwards)
Metapenaeus ensis (De Haan)
 Genus *Parapenaeopsis* Wood Mason
Parapenaeopsis stylifera (Milne-Edwards)
Parapenaeopsis sculptilis (Heller)
Parapenaeopsis uncta (Alcock)
Parapenaeopsis cornutus (Kishinouye)
Parapenaeopsis maxillipedo (Alcock)
Parapenaeopsis hardwickii (Miers)
 Genus *Trachypenaeus*
Trachypenaeus curvirostris (Stimpson)
 Genus *Metapenaeopsis*
Metapenaeopsis novae-guineae (Haswell)
Metapenaeopsis mogiensis (Rathbun)
 Genus *Atypopenaeus*
Atypopenaeus compressipes (Henderson)
 Subfamily Solenocerinae
 Genus *Solenocera* Lucas
Solenocera indicus Nataraj
 Family Sergestidae
 Genus *Acetes* H. Milne-Edwards
Acetes indicus Milne-Edwards
 Section Caridea
 Family Caridae
 Genus *Caridina*
Caridina weberi sumatrensis de Man
Caridina gracilirostris de Man
 Family Hippolytidae
 Genus *Saron* Thallwitz
Saron marmoratus (Olivier)
 Genus *Latreutes* Stimpson
Latreutes mucronatus Stimpson
 Genus *Hippolysmata* Stimpson
Hippolysmata dentata Kemp
Hippolysmata ensirostris Kemp

CHAPTER 2

Marine
Invertebrates*Hippolysmata ensirostris punctata* Kemp

Family Crangonidae

Genus *Pontocaris**Pontocaris lacazei* (Gourret)

Family Palaemonidae

Genus *Palaemon* StimpsonSubgenus *Nematopalaemon**Palaemon tenuipes* HendersonSubgenus *Exopalaemon**Palaemon styliferus* Milne-EdwardsGenus *Macrobrachium**Macrobrachium rosenbergii* (de Man)*Macrobrachium idae* (Heller)*Macrobrachium malcolmsonii* (Milne-Edwards)*Macrobrachium scabriculum* (Heller)*Macrobrachium equidens*Genus *Leander**Leander carinatus* Ortmann*Leander styliferus* Milne-Edwards*Leander mani* Sollaud*Leander serrifer* Stimpson*Leander potamiscus* Kemp

Family Palinuridae

Genus *Panulirus* White*Panulirus polyphagus* (Herbst)*Panulirus homarus* (Linnaeus)*Panulirus versicolor* (Latreille)*Panulirus ornatus* (Fabricius)

Family Scyllaridae

Genus *Scyllarus* Fabricius*Scyllarus sordidus* (Stimpson)Genus *Thenus* Leach*Thenus orientalis* (Lund)

ANOMURA

Family Paguridae

Subfamily Pagurinae

Genus *Paguristes* Dana*Paguristes incomitatus* AlcockGenus *Clibanarius* Dana*Clibanarius infraspinus* Hilgendorf*Clibanarius padavensis* de Man

CHAPTER 2

Marine
Invertebrates*Clibanarius arethusa* de Man*Clibanarius aequabilis merguensis* de ManGenus *Diogenes* Dana*Diogenes diogenes* (Herbst)*Diogenes custos* (Fabricius)*Diogenes custos affinis* Henderson*Diogenes custos planimanus* Henderson*Diogenes miles* (Herbst)*Diogenes avarus* Heller*Diogenes gardineri* AlcockGenus *Troglopagurus* Henderson*Troglopagurus jubatus* Nobili

Subfamily Eupagurinae

Genus *Pagurus**Pagurus kulkarnii* Sankolli

Superfamily Galattheoidea

Family Porcellanidae

Genus *Petrolisthes* Stimpson*Petrolisthes boscii* (Audouin)*Petrolisthes lamarckii* (Leach)Genus *Pachycheles* Stimpson*Pachycheles natalensis* (Krauss)Genus *Porcellana* Lamarck*Porcellana ornata* Stimpson*Porcellana gravelei* SankolliGenus *Pisidia* Leach*Pisidia spinulifrons* (Miers)*Pisidia dehaani* (Krauss)Genus *Polyonyx* Stimpson*Polyonyx hendersoni* Southwell*Polyonyx splendidus* Sankolli*Polyonyx loimicola* Sankolli

Superfamily Thalassinoidea

Family Laomediidae

Genus *Laomedia* De Haan*Laomedia astacina* De Haan

Family Callianassidae

Subfamily Callianassinae

Genus *Callianassa* Leach*Callianassa (Callichirus) kewalramanii* Sankolli

Subfamily Upogebiinae

Genus *Upogebia* Leach

CHAPTER 2

Marine
Invertebrates

- Upogebia (Upogebia) kemp* Sankolli
 Family Thalassinidae
Thalassina anomala (Herbst)
 Superfamily Hippoidea
 Family Hippidae
 Genus *Emerita* Scopoli
Emerita holthuisi Sankolli
Emerita emeritus (L.)
Brachyura
 Tribe Dromiacea
 Subtribe Dromiidea
 Family Dromiidae
 Genus *Dromia* Fabricius
Dromia dormia (Linnaeus)
 Genus *Conchoecetes* Stimpson
Conchoecetes artificiosus (Fabricius)
 Tribe Oxystomata
 Family Calappidae
 Subfamily Calappinae
 Genus *Calappa* Fabricius
Calappa lophos (Herbst)
 Subfamily Matutinae
 Genus *Matuta* Milne-Edwards
Matuta lunaris (Forsk.)
Matuta planipes Fabricius
 Family Leucosiidae
 Subfamily Leucosiinae
 Genus *Leucosia* Fabricius
Leucosia pubescens Miers
Leucosia perlata De Haan
Leucosia vittata Stimpson
Leucosia longifrons neocaledonica De Haan
 Genus *Philyra* Leach
Philyra globosa (Fabricius)
Philyra corallicola Alcock
 Genus *Nursia* Leach
Nursia abbreviata Bell
 Subfamily Iliinae
 Genus *Arcania* Leach
Arcania septemspinosa (Fabricius)
 Genus *Myra* Leach

CHAPTER 2

Marine
Invertebrates

- Myra fugax* (Fabricius)
 Family Dorippidae
 Subfamily Dorippinae
 Genus *Dorippe* Fabricius
Dorippe astuta Fabricius
 Tribe Brachygnatha
 Subtribe Oxyrhyncha
 Family Hymenosomidae
 Genus *Elamena* Milne-Edwards
Elamena cristatipes Gravely
Elamena sindensis Alcock
 Genus *Rhynchoplax* Stimpson
Rhynchoplax prox. octagonalis Kemp
 Family Maiidae
 Subfamily Acanthonychinae
 Genus *Menaethius* Milne-Edwards
Menaethius monoceros Latreille
 Genus *Acanthonyx*
Acanthonyx limbatus Milne-Edwards
 Subfamily Inachinae
 Genus *Achaeus*
Achaeus lacertosus Stimpson
 Subfamily Pisinae
 Genus *Hyastenus* White
Hyastenus planasi (Adams and White)
 Genus *Doclea* Leach
Doclea gracilipes Stimpson
 Subfamily Maiinae
 Genus *Paramithrax* Milne-Edwards
Paramithrax (Chlorinoides) aculeatus (Milne-Edwards)
 Genus *Schizophrys* White
Schizophrys aspera (Milne-Edwards)
 Family Parthenopidae
 Subfamily Parthenopinae
 Genus *Lambrus* Leach
Lambrus (Platylambrus) prensor Herbst
 Genus *Cryptopodia* Milne-Edwards
Cryptopodia angulata Milne-Edwards and Lucas
 Subtribe Brachyrhyncha
 Family Portunidae
 Subfamily Lupinae
 Genus *Scylla* De Haan
Scylla serrata (Forsk.)
 Genus *Portunus*

CHAPTER 2

Marine
Invertebrates

Portunus sanguinolentus (Herbst)
Portunus pelagicus (Linnaeus)
Portunus hastatoides Fabricius
 Genus *Charybdis* De Haan
Charybdis (*Goniosoma*) *cruciata* (Herbst)
Charybdis (*Goniosoma*) *lucifera* (Fabricius)
Charybdis (*Goniosoma*) *annulata* (Fabricius)
Charybdis (*Goniosoma*) *callianassa* (Herbst)
Charybdis (*Goniosoma*) *orientalis* (Dana)
Charybdis (*Goniohellenus*) *hoplites* (Wood-Mason)
 Genus *Thalamita* Milne-Edwards
Thalamita crenata Milne-Edwards
 Family Xanthidae
 Subfamily Xanthinae
 Genus *Atergatis* De Haan
Atergatis integerrimus (Lamarck)
Atergatis floridus (Rumph.)
 Genus *Xantho* Leach
Xantho (*Lophoxanthus*) *scaberrimus baccalipes* Alcock
 Genus *Leptodius* Milne-Edwards
Leptodius exaratus (Milne-Edwards)
Leptodius crassimanus Milne-Edwards
Leptodius euglyptus quadrispinosus Chhapgar
 Genus *Medaeus* Dana
Medaeus granulosus (Haswell)
 Genus *Etisus* Milne-Edwards
Etisus laevimanus Randall
 Genus *Galene* De Haan
Galene bispinosa (Herbst)
 Subfamily Actaeinae
 Genus *Actaea* De Haan
Actaea obesa Milne-Edwards
 Subfamily Menippinae
 Genus *Myomenippe* Hilgendorf
Myomenippe hardwickii (Gray)
 Genus *Sphaerozius*
Sphaerozius nudus (Milne-Edwards)
 Subfamily Oziinae
 Genus *Ozius* Milne-Edwards
Ozius rugulosus Stimpson
 Genus *Epixanthus* Heller

CHAPTER 2

Marine
Invertebrates

Epixanthus frontalis (Milne-Edwards)
 Subfamily Pilumninae
 Genus *Pilumnus* Leach
Pilumnus vespertilio (Fabricius)
 Genus *Heteropanope* Stimpson
Heteropanope laevis (Dana)
 Genus *Eurycarcinus* Milne-Edwards
Eurycarcinus orientalis (Milne-Edwards)
 Family Goneplacidae
 Subfamily Pseudorhombilinae
 Genus *Eucrate* De Haan
Eucrate crenata dentata (Stimpson)
 Genus *Litocheira* Kinahan
Litocheira angustifrons Alcock
 Family Pinnotheridae
 Subfamily Pinnotherinae
 Genus *Pinnotheres* Latreille
Pinnotheres placunae Hornell and Southwell
Pinnotheres vicajii Chhapgar
 Subfamily Xenophthalminae
 Genus *Xenophthalmus* White
Xenophthalmus pinnotheroides White
 Family Ocypodidae
 Subfamily Ocypodinae
 Genus *Ocypoda* Fabricius
Ocypoda ceratophthalma (Pallas)
 Genus *Gelasimus* Latreille
Gelasimus annulipes Latreille
Gelasimus marionis (Desmarest)
Gelasimus marionis nitidus Dana
 Subfamily Scopimerinae
 Genus *Dotilla* De Haan
Dotilla myctiroides (Milne-Edwards)
 Subfamily Macrophthalminae
 Genus *Macrophthalmus* Latreille
Macrophthalmus sulcatus Milne-Edwards
Macrophthalmus latreillei Desmarest
Macrophthalmus depressus Ruppell
 Family Grapsidae
 Subfamily Grapsinae
 Genus *Grapsus* Lamarck
Grapsus strigosus (Herbst)
 Genus *Metopograpsus* Milne-Edwards

CHAPTER 2

Marine
Invertebrates

- Metopograpsus messor* (Forsk.)
 Subfamily Varuninae
 Genus *Varuna* Milne-Edwards
Varuna litterata (Fabricius)
 Genus *Pseudograpsus* Milne-Edwards
Pseudograpsus intermedius Chhapgar
 Subfamily Sesarminae
 Genus *Sesarma* Say
Sesarma (*Sesarma*) *taeniolata* White
Sesarma (*Sesarma*) *minuta* de Man
 Order Stomatopoda
 Genus *Squilla* Fabricius
Cloridopsis scorio (Latreille)
Clorida latreillei Eydoux and Souleyet
Clorida denticauda (Chhapgar and Sane)
Clorida bombayensis (Chhapgar and Sane)
Clorida microphthalma (Milne-Edwards)
Alima supplex (Wood-Mason)
Oratosquilla quinquedentata (Brooks)
Oratosquilla nepa (Latreille)
Oratosquilla interrupta (Kemp)
 Genus *Harpiosquilla* Holthuis
Harpiosquilla raphidea (Fabricius)
Harpiosquilla harpax (De Haan)
 Genus *Manningia* Serene
Manningia pilaensis (de Man)
 Genus *Acanthosquilla* Manning
Acanthosquilla acanthocarpus (Claus)
Acanthosquilla multifasciata (Wood-Mason)
 Genus *Gonodactylus* Latreille
Gonodactylus falcatus (Forsk.)
Gonodactylus chiragra (Fabricius)
Gonodactylus demanii Henderson

(12) Mollusca

Animals belonging to this phylum are characterized by the absence of segmentation and have usually a shell which may, however, be internal and thus hidden.

Amphineura

These are bilaterally symmetrical forms with terminal mouth and anus, either without a shell or with eight, separate shell-plates, e.g. *Chiton*.

CHAPTER 2

Marine
Invertebrates*Pelecypoda*

This class includes the Mollusca having a shell consisting of two valves. Movement may be by means of a plough-like muscular foot. Plume = or plate = like gills are present, and there may also be tubular siphons, for taking in and throwing out water for respiration. Most of the economically important Molluscs are from this class, such as the oysters, clams, and mussels, all of which comprise the shell fishery. The pearl oyster, although not normally used for food, is equally important commercially because of the pearls it yields. In this class are also the marine wood-borers which cause considerable damage to wooden boats, piers, etc.

Gastropoda

The body is asymmetrical, with a well-developed muscular foot. A head with eyes and tentacles is present. Majority have a spirally twisted shell. In some, this may be concealed (e.g. *Aplysia*) within the body. In this class are the snails, shells of which are popular with collectors. Larger and small varieties of snails are eaten.

Scaphopoda

Popularly called elephant's tusk shells, they have an elongated body with bilateral symmetry, inside a tubular shell with open ends.

Cephalopoda

Highest developed of all Mollusca, there is a distinct head, with well developed eyes, surrounded by 8 to 10 tentacles. The body is bilaterally symmetrical. A shell may be present. They are active animals, e.g. squid, cuttlefish, octopus.

*Mollusca**Gastropoda*

Family Haliotidae

Genus *Haliotis* Linnaeus*Haliotis semistriata* (Reeve)

Genus Fissurellidae

Genus *Diodora* Gray*Diodora bombayana* (Sowerby)Genus *Emarginula* Lamarck*Emarginula elongata* (Phil)*Emarginula radiata* (Gould)Genus *Scutus* Montfort*Scutus unguis* (Linnaeus)Genus *Clypidina**Clypidina notata* (Linnaeus)

Family Patellidae

Genus *Cellana* Adams

CHAPTER 2

Marine
Invertebrates

Cellana radiata (Born)
 Family Trochidae
 Genus *Euchelus* Philippi
Euchelus asper (Gmelin)
Euchelus horrida (Phil)
Euchelus tricarinata (Lam.)
Euchelus indicus (Ad.)
 Genus *Trochus* Linn.
Trochus radiatus Gml.
Trochus stellatus Gmelin
 Genus *Monilea* Swainson
Monilea solariformis Sowerby
 Genus *Clanculus* Montfort
Clanculus depictus (Ad.)
Clanculus ceylanicus (Nevill)
 Genus *Isanda*
Isanda crenulifera (Ad.)
 Genus *Gibbula* Risso
Gibbula swainsonii (Ad.)
 Genus *Calliostoma* Swainson
Calliostoma scobinatum (Ad.)
 Genus *Umbonium* Link
Umbonium vestiarum (Linn.)
 Family Cyclostrematidae
 Genus *Cyclostrema* Marryatt
Cyclostrema vingulatum (Dkr.)
Cyclostrema solariellum (Mel.)
 Family Turbinidae
 Genus *Liotia* Gray
Liotia pulchella (Dkr.)
 Genus *Turbo* Linnaeus
Turbo brunneus (Roding)
 Genus *Astraea* Roding
Astraea stellata (Gml.)
 Genus *Tricolia* Risso
Tricolia minima (Mel.)
 Family Neritidae
 Genus *Nerita* Linnaeus
Nerita oryzae (Recl.)
Nerita polita Linn.
Nerita albicilla Linn.
 Genus *Neritina* Lamarck

CHAPTER 2

Marine
Invertebrates

Neritina crepidularia Lam.
Neritina pulchella (Reeve)
 Family Littorinidae
 Genus *Littorina* Ferussac
Littorina intermedia (Phil.)
Littorina ventricosa (Phil.)
 Genus *Tectarius*
Tectarius malaccanus (Phil.)
 Family Hydrobiidae
 Genus *Stenothyra*
Stenothyra woodmasonia (Nevill)
 Genus *Iravadia*
Iravadia trochlearis (Gould)
 Genus *Fairbankia*
Fairbankia bombayana (Blan.)
 Family Rissoidae
 Genus *Alvania* Risso
Alvania mahimensis (Mel.)
Alvania versoverana (Mel.)
 Genus *Pyramidelloides*
Pyramidelloides insolita (Desh.)
 Genus *Rissoina* Orbigny
Rissoina seguenzina (Issel)
Rissoina pachystoma (Mel.)
Rissoina canaliculata (Sch.)
Rissoina applanata (Mel.)
 Family Turritellidae
 Genus *Turritella* Lamarck
Turritella duplicata (Linn.)
Turritella columnaris Kiener
Turritella cerea (Reeve)
Turritella maculata Reeve
 Family Architectonicidae
 Genus *Heliacus*
Heliacus delectabilis (Mel.)
Heliacus homalaxis (Mel.)
 Genus *Architectonica* Roding
Architectonica laevigata (Lam.)
 Family Tiaridae
 Genus *Tiara*

CHAPTER 2

Marine
Invertebrates

- Tiara (Melanoides) tuberculata* (Muller)
Family Planaxidae
Genus *Planaxis* Lamarck
- Planaxis sulcatus* (Born)
Planaxis similis Smith
Planaxis acutus (Krauss)
Family Potamididae
Genus *Potamides*
- Potamides cingulatus* (Gmelin)
Genus *Telescopium*
- Telescopium telescopium* (Linn.)
Family Finellidae
Genus *Finella*
- Finella cerithina* (Phil.)
Family Cerithiidae
Genus *Diala* A. Adams
- Diala leithii* (Smith)
Genus *Alaba* H. and A. Adams
- Allaba rectangulata* (Craven)
Genus *Cerithium*
- Cerithium morus* (Lam.)
Cerithium rubus (Desh.)
Family Cerithiopsidae
Genus *Seila* Adams
- Seila bandorensis* (Mel.)
Family Triphoridae
Genus *Triphora* Blainville
- Triphora acuta* (Kiener)
Family Epitonidae
Genus *Epitonium* Roding
- Epitonium pretiosum* (Lam.)
Epitonium aculeatum (Sowerby)
Epitonium consors (C. and F.)
Genus *Acrilla*
- Acrilla acuminata* (Sowerby)
Family Janthinidae
Genus *Recluzia*
- Recluzia rollandina* (Petit)
Genus *Janthina* Roding
- Janthina roseola* Reeve
Janthina globosa Swainson
Family Fossaridae
Genus *Fossarus*

CHAPTER 2

Marine
Invertebrates

- Fossarus tornatillis* (Gould)
Fossarus fenestratus (Adams)
Fossarus trochlearis (Adams)
Family Capulidae
Genus *Capulus* Montfort
- Capulus violaceus* (Carp)
Family Calyptraeidae
Genus *Calyptraea* Lamarck
- Calyptraea pellucida* (Reeve)
Genus *Ergaea*
- Ergaea walshi* (Herrmannsen)
Family Xenophoridae
Genus *Xenophora* Fischer von Weldheim
- Xenophora solaris* (Linnaeus)
Family Strombidae
Genus *Lambis*
- Lambis lambis* (Linn.)
Genus *Tibia*
- Tibia curta* (Lam.)
Genus *Strombus* Linnaeus
- Strombus gibberulus* Linnaeus
Family Naticidae
Genus *Natica* Scopoli
- Natica lineata* Lamarck
Natica maculosa (Lam.)
Natica picta Recluz
Natica rufa (Born)
Natica ala papilionis (Roding)
Genus *Neverita* Risso
- Neverita didyma* (Bolten)
Genus *Mamilla*
- Mamilla zanzibarica* (Recl.)
Mamilla melanostomoides (Q. and G.)
Genus *Eunaticina* Fischer
- Eunaticina pomatiella* (Mel.)
Eunaticina papilla (Gmelin)
Eunaticina fibula (Reeve)
Genus *Sigaretus*
- Sigaretus planulatum* Recl.
Family Cypraeidae
Genus *Erato*



CHAPTER 2

Marine
Invertebrates

Erato pellucida (Reeve)
 Genus *Cypraea* Linnaeus
Cypraea arabica Linnaeus
Cypraea arabica histrio Gmelin
Cypraea ocellata Linnaeus
Cypraea lamarckii Gray
Cypraea pallida Gray
Cypraea lentiginosa Gray
Cypraea moneta Linnaeus
Cypraea annulus Linnaeus
Cypraea onyx Linnaeus
Cypraea vitellus Linnaeus
Cypraea tigris Linnaeus
 Genus *Volva*
Volva sowerbyana (Weinkauff)
 Family Amphiperatidae
 Genus *Primovula*
Primovula trailii (Adams)
Primovula pudica (Adams)
 Genus *Neosimnia* Fischer
Neosimnia spelta (Linnaeus)
Neosimnia indica (Reeve)
 Family Cymatidae
 Genus *Cymatium* Roding
Cymatium pileare (Linnaeus)
Cymatium aquatile (Reeve)
Cymatium cingulatum (Lamarck)
 Family Bursidae
 Genus *Bursa* Roding
Bursa tuberculata (Brod.)
Bursa granularis (Roding)
Bursa spinosa (Lamarck)
 Family Tonnidae
 Genus *Tonna* Brunnich
Tonna dolium (Linnaeus)
 Family Pyrulidae
 Genus *Pyrula*
Pyrula ficus (Linnaeus)
 Family Muricidae
 Genus *Murex* Linnaeus

CHAPTER 2

Marine
Invertebrates

Murex tribulus Linnaeus
Murex adustus Lamarck
Murex maurus (Brod.)
Murex virgineus (Roding)
 Genus *Drupa* Roding
Drupa contracta (Reeve)
Drupa tuberculata (Blainville)
Drupa konkanensis (Mel.)
Drupa subnodulosa (Mel.)
Drupa xuthedra (Mel.)
 Genus *Thais* Roding
Thais carinifera (Lam.)
Thais echinulata (Lam.)
Thais rudolphi (Lam.)
Thais bufo (Lam.)
Thais tissoti (Petit)
Thais hippocastamum (Lam.)
Thais blanfordi (Mel.)
Thais sacellum (Lam.)
 Genus *Ocenebra* Gray
Ocenebra bombayana (Mel.)
 Family Pyrenidae
 Genus *Pyrene* Roding
Pyrene scripta (Lam.)
Pyrene marquessa (Gaskoin)
Pyrene terpsichora (Sowerby)
Pyrene euterpe (Mel.)
Pyrene atrata (Gould)
Pyrene atomella (Duclos)
 Family Buccinidae
 Genus *Nassaria*
Nassaria suturalis (Adams)
 Genus *Engina* Gray
Engina zea (Mel.)
 Genus *Canthurus* Roding
Canthurus spiralis (Gray)
 Genus *Polia*
Polia rubiginosa (Reeve)
 Genus *Babylonia* Schluter
Babylonia spirata (Linn.)
 Family Magilidae
 Genus *Coralliophila* H. and A. Adams

CHAPTER 2

Marine
Invertebrates

- Coralliophila jereysi* (Smith)
 Family Xancidae
 Genus *Xancus* Roding
Xancus pyrum (Linnaeus)
 Family Volemidae
 Genus *Hemifusus* Swainson
Hemifusus pugilins (Born)
 Family Nassariidae
 Genus *Bullia* Griffith
Bullia mauritiana (Gray)
Bullia lineolata (Wood)
Bullia malabarica (Hanley)
Bullia vittata (Linnaeus)
 Genus *Nassarius* Forriep
Nassarius olivacea (Brug)
Nassarius jacksoniana (Quoy and Gaimard)
Nassarius nodifera (Powis)
Nassarius ornatus (Kiener)
Nassarius puha (Linnaeus)
Nassarius thersites (Bruguiere)
Nassarius canaliculata (Schepman)
Nassarius pictus (Dkr.)
Nassarius mucronatus (Adams)
Nassarius lentiginosus (Adams)
Nassarius eranea (Mel. and St.)
Nassarius nevilleana (Preston)
Nassarius varicifera (Adams)
 Genus *Cyllene*
Cyllene fuscata Adams
 Family Fasciolaridae
 Genus *Fasciolaria* Lamarck
Fasciolaria trapezium Lamarck
 Genus *Fusinus* Refinesque
Fusinus townsendi (Mel.)
 Genus *Persisternia*
Persisternia syracusanus
Persisternia pulchella (Reeve)
 Family Olividae
 Genus *Oliva* Bruguiere
Oliva nebulosa intricata (Marrat)
Oliva oliva (Linnaeus)

CHAPTER 2

Marine
Invertebrates

- Oliva gibbosa* (Born)
Oliva lepida Duclos
Oliva ispidula (Linnaeus)
 Genus *Olivella* Swainson
Olivella nympa (Adams)
 Family Mitridae
 Genus *Mitra* Lamarck
Mitra proscissa Reeve
Mitra (Costellaria) obeliscus (Reeve)
Mitra chinensis (Gray)
Mitra amphorella
 Family Harpidae
 Genus *Harpa* Walch
Harpa conoidalis Lamarck
 Family Cancellariidae
 Genus *Cancellaria* Lamarck
Cancellaria costifera Lamarck
Cancellaria scalarina Lamarck
Cancellaria bifasciata (Desh.)
 Family Marginellidae
 Genus *Marginella* Lamarck
Marginella mazagonica Mel.
 Family Conidae
 Genus *Conus* Linnaeus
Conus monachus Linnaeus
Conus monachus achatinus (Brug.)
Conus textile Linnaeus
Conus piperatus Dillwyn
Conus mutabilis (Reeve)
Conus lentiginosus (Reeve)
Conus insculptus (Kiener)
Conus figulinus Linnaeus
Conus monile Brug.
 Family Turridae
 Genus *Clavatula*
Clavatula virginia (Reeve)
 Genus *Surcula*
Surcula javana (Linnaeus)
Surcula amicta (Smith)
Surcula fulminata (Kiener)
 Genus *Drilla*

CHAPTER 2

Marine
Invertebrates

Drilla atkinsonii (Smith)
 Genus *Clavus*
Clavus crassa (Smith)
Clavus sacra (Reeve)
Clavus praeclara (Mel.)
 Genus *Mangelia* Risso
Mangelia fulvocincta (Nevill)
Mangelia lemniscata (Nevill)
Mangelia fortistriata (Smith)
 Family Terebridae
 Genus *Terebra* Bruguiere
Terebra cinctella
Terebra tenera Hinds
Terebra persica Smith
Terebra duplicata (Linnaeus)
Terebra capensis (Smith)
Terebra muscaria (Lam.)
Terebra affinis (Gray)
Terebra spectabilis (Hinds)
 Family Hydatinidae
 Genus *Hydatina* Schumacher
Hydatina velum (Gmelin)
 Family Acteonidae
 Genus *Bullina*
Bullina zic-zac (Megerle)
 Family Ringiculidae
 Genus *Ringicula*
Ringicula propinquans Hinds
 Family Bullidae
 Genus *Bulla* Linnaeus
Bulla ampula Linnaeus
 Family Atyidae
 Genus *Haminoea* Turton
Haminoea galba (Pease)
 Genus *Smaragdinella*
Smaragdinella andersonii (Mel.)
 Family Retusidae
 Genus *Retusa* Brown
Retusa involuta (Nevill)
 Genus *Pyrunculus*
Pyrunculus pellyi (Smith)
 Family Scaphandridae
 Genus *Cylichna* Loven

CHAPTER 2

Marine
Invertebrates

Cylichna cylindracea (Pennant)
 Genus *Acteocina* Gray
Acteocina townsendi (Mel.)
 Family Cavolinidae
 Genus *Cavolina* Abilgaard
Cavolina longirostris (Lesuer)
 Family Ellobiidae
 Genus *Ellobium*
Ellobium auris judae (Linnaeus)
 Genus *Cassidula*
Cassidula nucleus (Gmelin)
 Genus *Melampus* Montfort
Melampus fasciatus (Desh.)
Melampus coffea
Melampus sincaporensis Pfeiffer
 Family Siphonariidae
 Genus *Siphonaria* Sowerby
Siphonaria basseinensis (Mel.)
Siphonaria kurracheensis (Reeve)
 Family Lymnaeidae
 Genus *Lymnaea*
Lymnaea pinguis (Dohrn)
 Pelecypoda
 Family Nuculidae
 Genus *Nucula* Lamarck
Nucula layardi Adams
 Genus *Yoldia* Moller
Yoldia nicobarica Brug.
 Family Nuculanidae
 Genus *Nuculana* Link
Nuculana mauritiana Sowerby
 Family Arcidae
 Genus *Arca*
Arca bistrigata Dkr.
Arca requiescens Mel.
Arca inaequalis Brug.
Arca japonica Reeve
Arca rhombea Born
Arca granosa Lam.
Arca obliquata Wood
Arca lactea Linnaeus
Arca tenebrica Reeve
Arca symmetrica Reeve

CHAPTER 2

Marine
Invertebrates

Arca paulucciana T. Conefri
Arca tortuosa Linnaeus
 Family Mytilidae
 Genus *Mytilus* Linnaeus
Mytilus viridis Linnaeus
 Genus *Modiolus* Lamarck
Modiolus emarginatus Benson
 Genus *Brachyodontes*
Brachyodontes karachiensis Mel.
 Family Pinnidae
 Genus *Pinna*
Pinna nigra Dil.
 Family Pectinidae
 Genus *Chlamys* Roding
Chlamys senatoria Gml.
Chlamys singaporina Sowerby
Chlamys tranquebarius Gml.
 Genus *Spondylus*
Spondylus rubicundus Reeve
Spondylus hystrix Roding
 Family Limidae
 Genus *Lima* Bruguiere
Lima lima (Linnaeus)
 Family Anomiidae
 Genus *Anomia* Linnaeus
Anomia achaeus Gray
Anomia aenigmatica Ant.
 Genus *Placenta*
Placenta placenta (Linnaeus)
 Family Ostreidae
 Genus *Ostrea* Linnaeus
Ostrea crenulifera Sowerby
Ostrea bicolor Ham.
Ostrea lacerta Ham.
 Family Carditidae
 Genus *Cardita* Bruguiere
Cardita antiquata Lam.
Cardita calyculata Lam.
 Family Trapeziidae
 Genus *Trapezium*
Trapezium vellicatum Reeve
 Family Ungulinidae
 Genus *Diplodonta* Bronn

CHAPTER 2

Marine
Invertebrates

Diplodonta indica Desh.
Diplodonta rotundata Turton
 Family Lucinidae
 Genus *Lucina*
Lucina fibula Reeve
 Family Chamidae
 Genus *Chama* Linnaeus
Chama macrophylla Chem.
 Family Cardiidae
 Genus *Cardium*
Cardium asiaticum Bruguiere
Cardium latum Born
Cardium oxgonum Sowerby
 Family Veneridae
 Genus *Gafrarium*
Gafrarium divaritacum (Chemnitz)
 Genus *Sunetta*
Sunetta effossa Ham.
Sunetta solandri Gray
Sunetta donacina (Gml.)
Sunetta scripta (Linnaeus)
Sunetta meroe (Linnaeus)
 Genus *Meretrix*
Meretrix meretrix Linnaeus
 Genus *Dosinia*
Dosinia pubescens Phil.
Dosinia gibba Adams
Dosinia rustica Romer
Dosinia prostrata (Linnaeus)
Dosinia excisa Gml.
 Genus *Chione* Megerle von Muhlfield
Chione imbricata Sowerby
Chione layardi Reeve
Chione isabellina Phil.
Chione calophylla Ham.
 Genus *Katelsia*
Katelsia opima (Gml.)
Katelsia marmorata Lam.
 Genus *Venerupis*
Venerupis macrophylla Desh.
 Genus *Paphia*
Paphia malabarica (Dil)
Paphia textile Gml.
Paphia indica Sowerby

CHAPTER 2

Marine
Invertebrates

Paphia cor Sowerby
Genus *Clementia*
Clementia papyracea (Gray)
Family Petricolidae
Genus *Petricola* Lamarck
Petricola bipartita Desh.
Genus *Macra* Linnaeus
Macra cornea Desh.
Macra luzonica Desh.
Macra mera Reeve
Macra plicataria (Linnaeus)
Genus *Standella*
Standella capillacea Desh.
Standella pellucida (Gml.)
Genus *Raeta* Gray
Raeta abercrombiei Mel.
Genus *Lutraria*
Lutraria planata Dil.
Genus *Coecella*
Coecella transversalis Desh.
Family Donacidae
Genus *Donax* Linnaeus
Donax scortum Linnaeus
Donax incarnatus Gml.
Donax abbreviatus Lam.
Donax cuneatus Linnaeus
Family Garidae
Genus *Asaphis*
Asaphis deflorata Linnaeus
Genus *Soletellina*
Soletellina atrata Desh.
Soletellina diphos Linnaeus
Genus *Gari* Schumacher
Gari malaccana Reeve
Gari amethystus Prashad
Genus *Solecurtus*
Solecurtus exaratus Phil.
Genus *Sanguinolaria*
Sanguinolaria hendersoni Mel.
Family Semelidae
Genus *Semele* Schumacher
Semele cordiformis Sowerby
Semele regularis Smith
Genus *Abra*

CHAPTER 2

Marine
Invertebrates

Abra opalina Hinds
Family Tellinidae
Genus *Arcopagia*
Arcopagia capsoides Lam.
Genus *Tellinella*
Tellinella kolabana Mel.
Genus *Apolymetis*
Apolymetis edentulus Speng.
Genus *Gastrana*
Gastrana polygona Gml.
Genus *Macoma* Leach
Macoma truncata Jonas
Macoma ala Ham.
Genus *Angulus*
Angulus rubra Desh.
Angulus rubella Desh.
Angulus lechriogramma Mel.
Angulus thymares Mel.
Angulus emarginata Sowerby
Angulus sinuata Speng.
Family Glaucomyidae
Genus *Glaucomya*
Glaucomya cerea Reeve
Family Solenidae
Genus *Siliqua* Megerle von Muhlfield
Siliqua albida (Dkr.)
Siliqua radiata (Linnaeus)
Genus *Cultellus*
Cultellus cultellus Linnaeus
Cultellus maximus (Gml.)
Genus *Solen* Linnaeus
Solen truncatus Sowerby
Solen brevis Ham.
Solen lamarckii Desh.
Solen linearis Spg.
Family Aloididae
Genus *Aloidis* Megerle von Muhlfield
Aloidis modesta (Hinds)
Family Myidae
Genus *Cryptomya* Conrad
Cryptomya philippinarum (Adams)
Family Pholadidae
Genus *Pholas*

CHAPTER 2

Marine
Invertebrates*Pholas bakeri* Desh.*Pholas orientalis* Gml.Genus *Martesia**Martesia striata* (Linnaeus)

Family Teredinidae

Genus *Bankia* Gray*Bankia setacea* TryonGenus *Teredo* Linnaeus*Teredo (Kuphus) manni* Wright

Family Pandoridae

Genus *Pandora* Chemnitz*Pandora flexuosa* Sowerby

Family Thraciidae

Genus *Thracia* Sowerby*Thracia salsettensis* Mel.

Family Laternulidae

Genus *Laternula**Laternula labiata* Reeve(13) *Echinodermata*

This phylum consists of exclusively marine animals, with a radial symmetry. There is an exoskeleton of calcareous plates. A system of vessels, called the ambulacral system, is present; locomotion, if any, is by tube-feet.

Class Asteroidea

These are popularly called starfish, having a central disc with usually five arms. The anus is on the aboral surface. The larva is a bipinnaria or brachiolaria.

Class Ophiuroidea

The brittle stars have a central disc from which arms are sharply marked off. There is no anus. The larva is a pluteus.

Class Echinoidea

These have a globular, or heart or disc-shaped body enclosed in a shell. The anus is aboral. The larva is a pluteus. Popularly called sea urchins, heart urchins, and sand dollars.

Class Holothuroidea

These have an elongated cylindrical soft body with mouth and anus at opposite ends. There is a circlet of tentacles surrounding the mouth. The larva is an auricularia. Popularly called sea cucumbers, they are of edible value.

Class Crinoidea

Usually stalked, they have a theca of five radial and five basal plates, giving off five jointed arms. The anus is on the oral surface. E.g. feather stars.

CHAPTER 2

Marine
Invertebrates*Echinodermata*

Sub-phylum Pelmatozoa

Class Crinoidea

Order Articulata

Suborder Comatulida

Family Mariametridae

Lamprometra palmata palmata (Muller)

Sub-phylum Eleutherozoa

Class Holothuroidea

Order Aspidochirota

Holothuria pardalis Selenka*Holothuria scabra* Jagar

Order Dendrochirota

Family Cucumariidae

Actinocucumis typica Ludwig*Thyone conjugens* (Semper)

Order Apoda

Family Synaptidae

Anapta gracilis

Class Echinoidea

Subclass Regularia

Order Diadematoida

Suborder Camarodonta

Family Temnopleuridae

Temnopleurus toreumaticus (Leske)

Subclass Irregularia

Order Clypeastroida

Family Clypeastridae

Clypeaster rarispinus Meijere

Class Asteroidea

Order Spinulosa

Family Asterinidae

Asterina lorioli Koehler

Class Ophiuroidea

Order Ophiurae

Family Amphiuridae

Amphipholis squamata (Della Chiaje)

Family Ophiactidae

Ophiactis savignyi (Muller and Troschel)

Family Ophiothrichidae

Ophiothela danae Verrill*Macrophiothrix aspidota* (Muller and Troschel)

Family Ophiochitonidae

Ophionereis dubia (Muller and Troschel)

Plate I

- (a) A Foraminiferan Protozoon, showing shell filled with protoplasm, and pseudopodia ;
 (b) a "sun-animalcule" (Heliozoa), with stiff filamentous pseudopodia ;
 (c) *Noctiluca*, a phosphorescent flagellate ;
 (d) a "slipper-animalcule", or Ciliate ;
 (e) a calcareous sponge ;
 (f) part of a Hydroid colony with polyps enclosed in cup-like hydrothecae ;
 (g) a "Portugese man-of-war" (*Physalia*), showing float and different types of polyps ;
 (h) a typical jelly-fish (Scyphozoa) ;
 (i) a sea-anemone (Actinozoa) ;
 (j) *Gorgonium* or sea-fan, colony with polyps ;
 (k) brain coral.

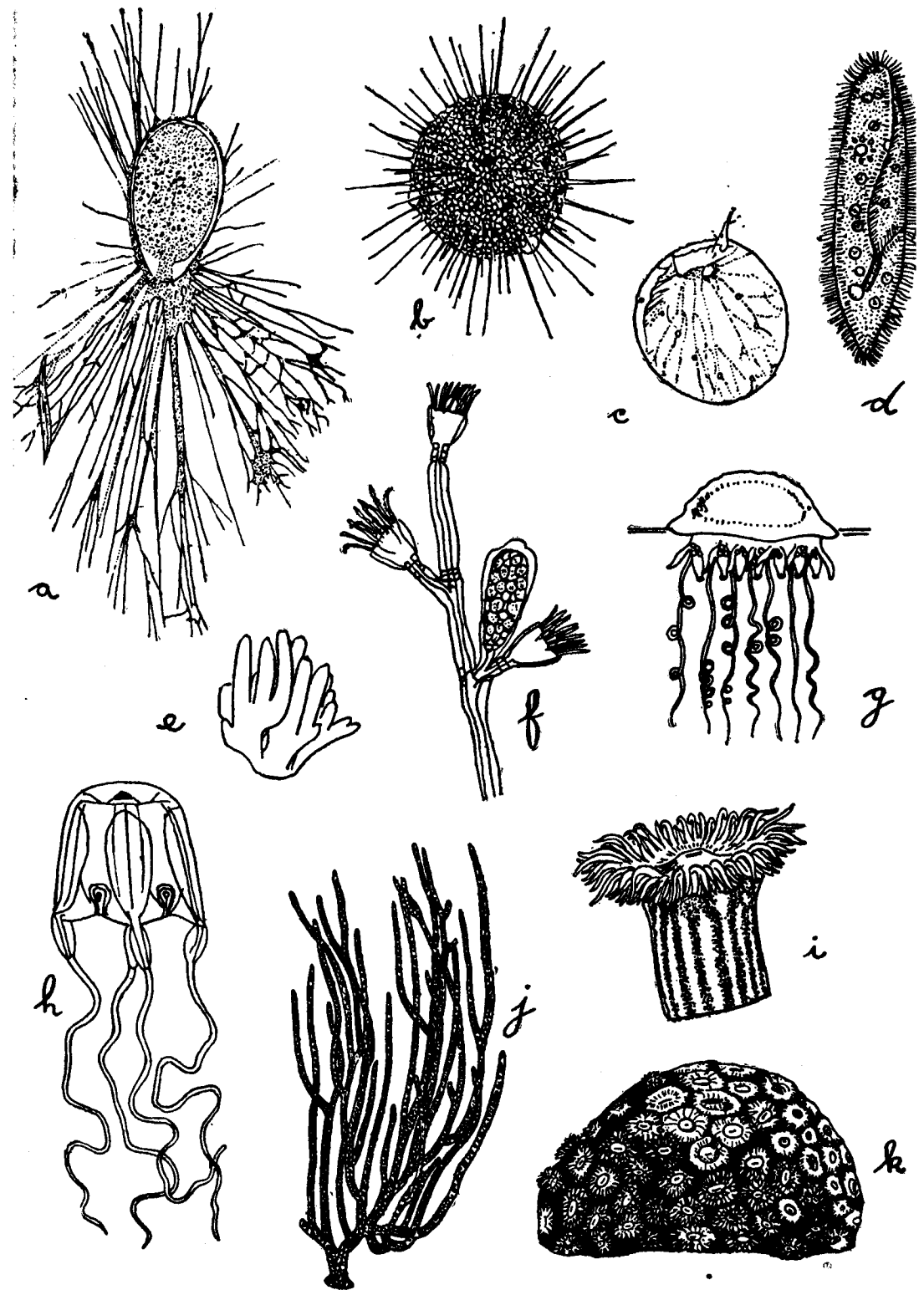
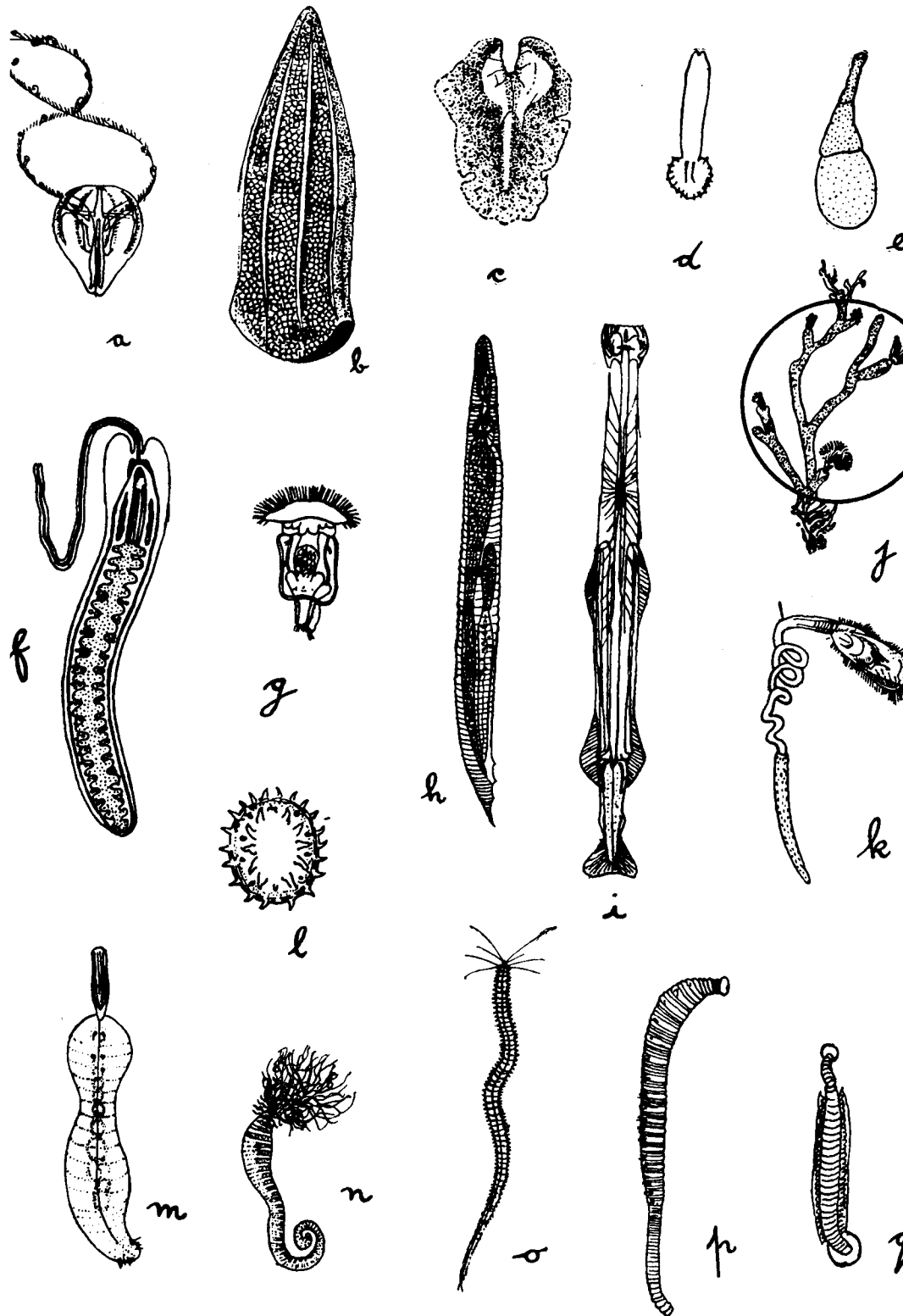


Plate II



- (a) *Pleurobrachia*, a Ctenophore ;
- (b) *Beroë*, another Ctenophore ;
- (c) a Planarian or "flat-worm" ;
- (d) *Gyrodactylus*, a fluke parasitic on fish ;
- (e) a Cestode parasite of fish ;
- (f) a Nemertine "worm" ;
- (g) a Rotifer or "wheel-animalcule" ;
- (h) a Nematode parasite ;
- (i) *Sagitta* (arrow-worm), a Chaetognath ;
- (j) part of a Bryozoan colony (further magnified within circle) ;
- (k) *Lingula*, a Molluscoid ;
- (l) *Myzostomum*, a parasite on Echinoderms ;
- (m) an Echiurid worm ;
- (n) a Terebellid worm ;
- (o) *Nereis*, a typical Polychaete worm ;
- (p) *Arenicola*, another Polychaete worm ;
- (q) *Branchellion*, a leech parasitic on fish.

Plate III

- (a) *Branchipus*, an Anostracan fairy shrimp ;
 (b) *Apus*, a Notostracan, showing shield-shaped carapace ;
 (c) *Daphnia*, a Cladoceran ;
 (d) *Cypris*, an Ostracod with bivalved carapace ;
 (e) a free-living Copepod ;
 (f) *Lernaea*, a parasitic Copepod ;
 (g) *Lepas*, or goose barnacle ;
 (h) *Balanus*, or acorn barnacle ;
 (i) a free-living Isopod or " sand-bug " ;
 (j) *Nebalia* (Leptostraca) ;
 (k) a Bopyrid (parasitic) Isopod.

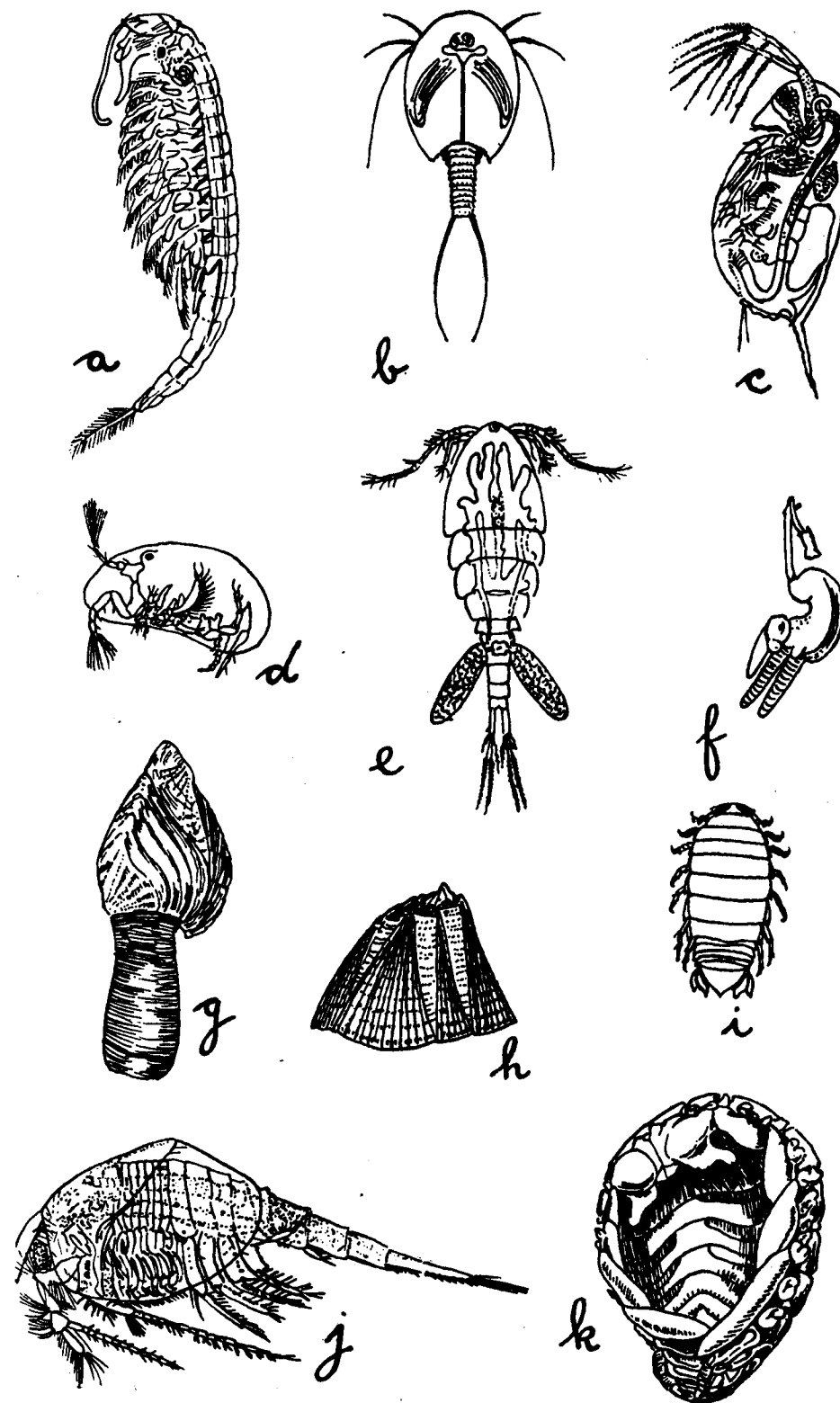
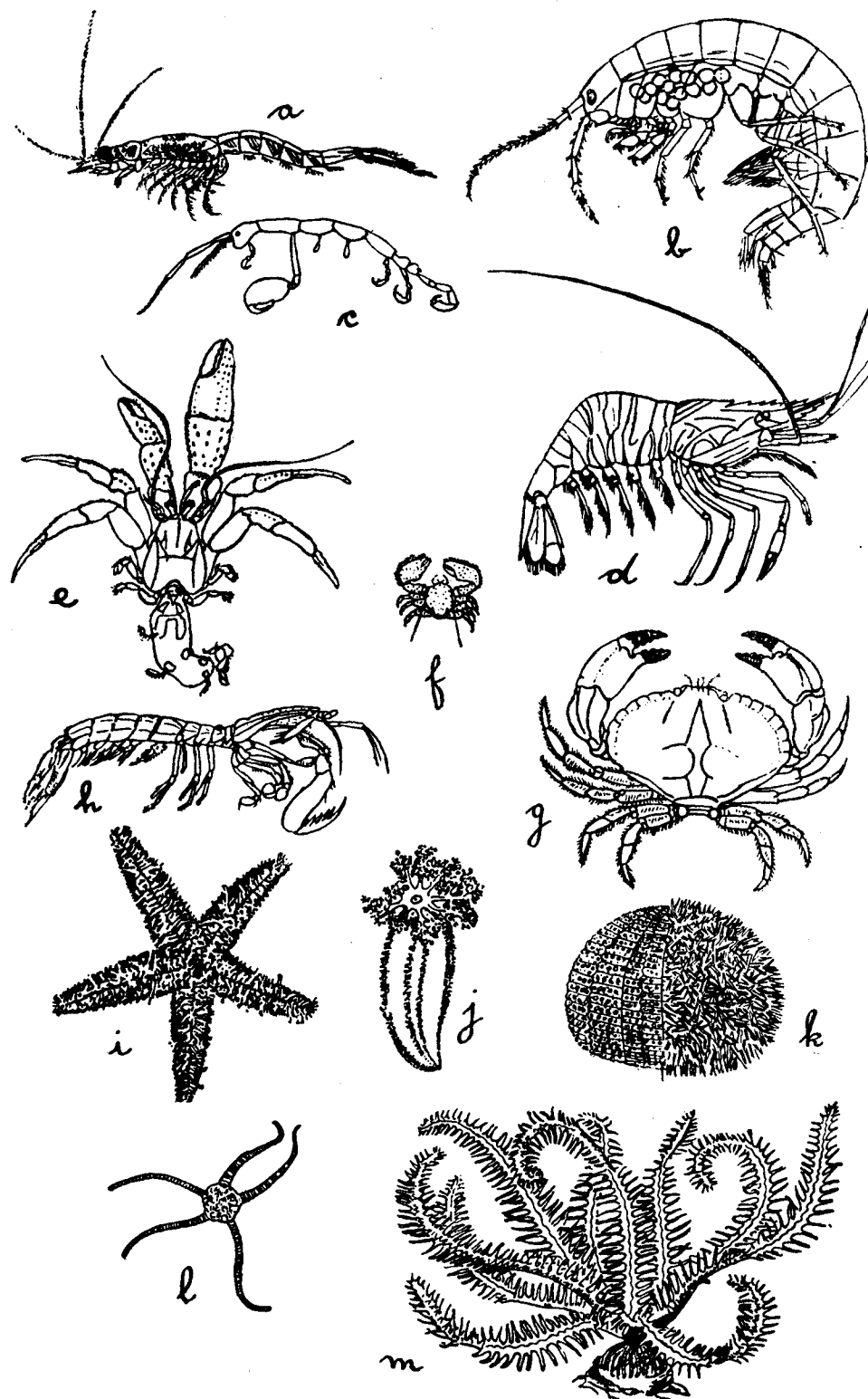


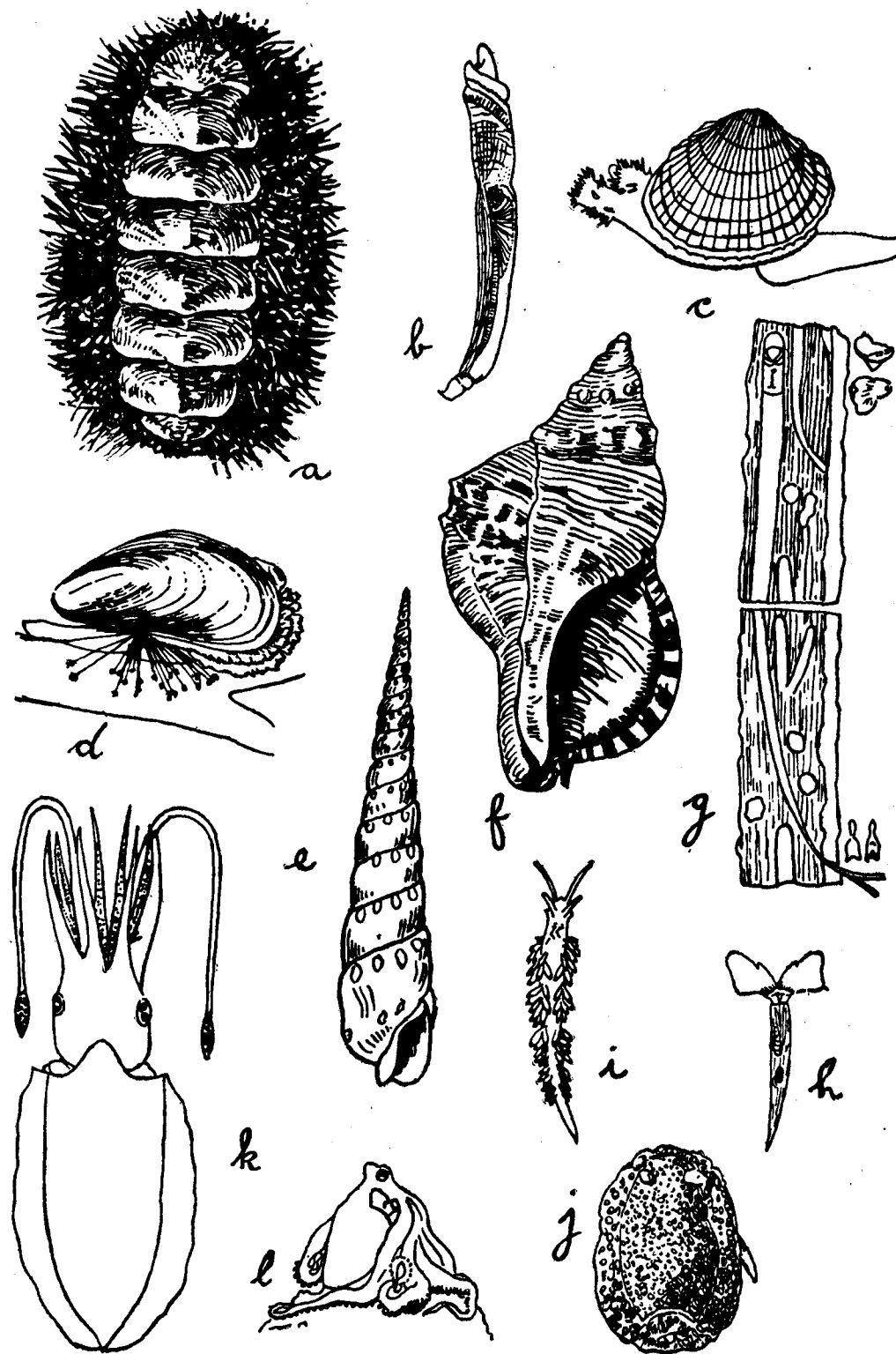
Plate IV



- (a) *Mysis* ;
- (b) *Gammarus*, a typical Amphipod ;
- (c) *Caprella*, a prehensile Amphipod ;
- (d) a typical prawn (Decapoda Natantia) ;
- (e) a hermit crab (Anomura) ;
- (f) *Petrolisthes*, a "porcelain crab" (Anomura) ;
- (g) a typical crab (Brachyura) ;
- (h) *Squilla* (Stomatopoda) ;
- (i) a starfish (Asteroidea) ;
- (j) a sea cucumber (Holothurian) ;
- (k) a sea urchin (spines on half removed to show test) ;
- (l) a brittle star (Ophiuroidea) ;
- (m) a feather star (Crinoid).

Plate V

- (a) *Chiton* (coat-of-mail shell) ;
 (b) *Dentalium* or elephant's tusk shell ;
 (c) *Cardium* or cockle, showing muscular foot and siphons ;
 (d) *Mytilus* or mussel, showing byssus threads for attachment ;
 (e) *Turritella* ;
 (f) *Triton* ;
 (g) *Teredo*, a wood boring Mollusc ;
 (h) a pteropod Mollusc ;
 (i) *Eolis*, a nudibranch ;
 (j) *Doris*, another nudibranch ;
 (k) *Sepia*, a squid (Cephalopod) ;
 (l) octopus.



CHAPTER 3—INSECTS

INTRODUCTION

INSECTS ARE ARTHROPODS — INVERTEBRATES, MADE OF CHITINOUS MATERIAL with three distinct divisions of body and possessing three pairs of legs and one or two pairs of wings in the adult stage. Possession of six legs in the adult stage which gives them the name 'Hexapoda' is sufficient to distinguish this class from all others. The body of an insect is made up of a series of segments, connected together one behind the other to give it an easy movement.

Divisions of the body (Fig. 1 see p. 288).—The body is divided into 3 parts: head, thorax and abdomen. (1) Head consists of mouth parts which may be biting or sucking, antennae made up of a number of joints, true eyes or ocelli and compound eyes, bigger and composed of innumerable lenses. (2) Thorax is composed of 3 compact segments, pro, meta and meso thorax. These segments may be separate or fused together and mixed up. The prothorax connects head with body and has a pair of legs underneath. The other two segments have a pair of legs and a pair of wings each. Legs are typical jointed organs, possessing 5 parts each—coxa, trochanter, femur, tibia and tarsus. Tarsus is segmented again, the last section being the claws. Wings are thin expansions of body integument, unlike those of birds, which are separate organs of the body. Wings, however, are not an essential attribute of the insect body. Some orders of insects do not possess them at all, while in some the families, or genera or species or even individual sexes have lost them due to degeneration. In a few cases like the flies, there is only one pair of wings and the hind pair is completely missing or reduced to a small rod—halteres. The back of the thorax is known as notum. (3) Abdomen is the last part of the body, consisting of about 11 segments of which only some are distinctly visible. The last segments carry the genitalia (sexual organs), styles, stings, ovipositor, cerci, etc. Generally this is the longest and softest part of the body.

There are two types of development in insects. Complete metamorphosis i.e. a complete change of form from egg to larva, larva to pupa and pupa to adult, each stage distinctly different from the other. The

CHAPTER :

Insects

CHAPTER 3

Insects

other type of growth is the incomplete or gradual metamorphosis in which the egg gives rise to a nymph or larva which is almost like the parent, in most cases, except for its small size, winglessness and sexual immaturity. It grows into an adult by moulting. There are some intermediate forms and a few do not go through any of these processes at all.

Classification.—The total number of world insect species, so far described is variously estimated at 7,00,000 to 15,00,000 by various authorities. These have been classified by authors variously, each giving importance to particular characters and so there is much confusion created in working at it. H. M. Lefroy, the noted Indian Entomologist says in "Indian Insect Life": "Entomologists have arrived at no definite conclusions which are generally accepted. The most diverse views prevail and there is no standard classification that is or can be universally employed, even if it be admittedly not academically accurate but sufficiently so for practical purposes." That position still remains. But as this chapter is faunistic and not taxonomical in its aim, it was considered enough, if we follow the Fauna of India volumes as far as possible, without entering into taxonomical controversies in the arrangement of families, genera and species and make changes where found quite necessary. Generally the sub-families, tribes, super-families etc. are ignored except when they help to reduce the generic or specific descriptions. In the arrangement of orders A.D. Imms is followed. (Text book of Entomology 1957).

The total number of species dealt with here is nearly 3000, with 1500 genera in about 200 families, belonging to 24 orders, which are found in Maharashtra. Attempts have been made to cite available literature on each group or even individual insect species, according to its importance and availability of such literature, which can be referred to, for details. A list of the recorded species is given first and the descriptions follow in the notes.

Generally the following books have been consulted and the same would be useful for detailed information desired by any reader (1) Fauna of British India volumes, (2) Indian Insect Life by H. M. Lefroy 1909, (3) Ecology and Control of Forest Insects by C. F. C. Beeson 1941, (4) General Text Book of Entomology by A.D. Imms 1957, (5) Reports of the Proceedings of the Entomological Meetings Pusa Nos. 2 to 5, (6) Bulletins by T.V.R. Ayyar and T. B. Fletcher, (7) Records of the Indian Museum, (8) Indian Forest Records, (9) Journal of the Bombay Natural History Society, (10) The Indian Journal of Entomology. Besides these a number of useful publications have been referred to but no claim is made that the list of insects of Maharashtra is complete. The descriptions given are naturally brief and the life history and habits have been given only for groups—family, genus etc. Localities of cosmopolitan species are not mentioned.

CHAPTER 3

Insects

Some species which are fairly common in India but which have not yet been recorded in Maharashtra are mentioned briefly for general information. Figures of some important families of insects are included to facilitate identification. Most of them have been copied from both 'Instructions for collectors No. 4A' of the British Museum (Natural History). They do not represent the natural size.

INSECT FAUNA OF MAHARASHTRA

Class : INSECTA

Sub-class : APTERYGOTA

Order Thysanura (Bristletails)

Serial No.	Scientific name
------------	-----------------

Family Machilidae

- | | |
|----|------------------------------|
| 1. | Assmuthia spinosissima Esch. |
| 2. | Assmuthia inermis Esch. |
| 3. | Platystelea barbifer Esch. |
| 4. | Machilis palipoda. |

Fam. Lepismatidae (Silverfish)

- | | |
|----|-----------------------------------|
| 1. | Lepisma (Acrotelsa) collaris Fab. |
|----|-----------------------------------|

Order Diplura

Fam. Campodeidae

- | | |
|----|------------------------------|
| 1. | Campodea staphylinus Westwd. |
|----|------------------------------|

Fam. Projapygidae

- | | |
|----|---------------------------|
| 1. | Indjapyx annandalei Silv. |
| 2. | Indjapyx seymourii Silv. |

Fam. Japygidae

- | | |
|----|--------------------|
| 1. | Japyx indicus Oud. |
|----|--------------------|

Order Collembola (Spring tails)

- | | |
|----|------------------|
| 1. | Isotoma minos D. |
|----|------------------|

Sub-class : PTERYGOTA

Order Ephemeroptera (Mayflies)

Fam. Palingeniidae

- | | |
|----|---------------------------|
| 1. | Anagenesia minor (Eaton). |
|----|---------------------------|

Fam. Polymitarcidae

- | | |
|----|----------------------------|
| 1. | Povilla corporaali (Lest). |
| 2. | Polymitarsys indicus Pict. |

Fam. Ephemeridae

- | | |
|----|-----------------------|
| 1. | Ephemera fulvata Nav. |
|----|-----------------------|

CHAPTER 3

Insects

Fam. *Potamanthidae*

1. *Potamauthus subcostalis* Nav.

Order : ODONATA (Dragonflies)

Sub-order : ZYGOTERA

Fam. *Coenagruidae*

1. *Lestes praemorsa* selys.
2. *Lestes viridula* Ramb.
3. *Protosticta mortoni* Fras.
4. *Copera marginipes* (Ramb.).
5. *Copera vittata* (Sel.).
6. *C. vittata deccanensis* (Sel.).
7. *Caconeura verticalis annandalei* Fr.
8. *Disparoneura nigerimma* Laid.
9. *Disparoneura tetrica* Laid.
10. *Chloroneura quadrimaculata* (Ramb.).
11. *Pseudagrion microcephalum* (Ramb.).
12. *Pseudagrion decorum* (Ramb.).
13. *P. hypermelas* Sel.
14. *Ceriagrion coromandelianum* (Fab.).
15. *Ceriagrion rubiae* Laid.
16. *C. olivaceum auranticum* Fr.
17. *Aciagrion hisopa* (Sel.)
18. *Aciagrion pallidum* Sel.
19. *Ischneura senegalensis* (Ramb.).
20. *Rhodischneura nursei* (Mort.)
21. *Enallagma parvum* Selys.
22. *Agriocnemis pieris* Laid.
23. *Agriocnemis splendidissima* Laid.
24. *Mortanagrion varralli* Fr.
25. *Coenagrion dyeri* Fr.
26. *Rhinocypha bisignata* Sel.
27. *Libellago lineata indica* (Fr.).
28. *Neurobasis chinensis* Linn.
29. *Vestalis gracilis* (Ramb.).

Sub-order : ANISOPTERA

Fam. *Gomphidae*.

1. *Cyclogomphus ypsilon* Sel.
2. *Cyclogomphus heterostylus* Sel.
3. *Burmagomphus pyramidalis* Laid.
4. *Mesogomphus lineatus* (Sel.)
5. *Macrogomphus annulatus* (Sel.).
6. *Microgomphus torquatus* (Sel.).
7. *Ictimus rapax* (Ramb.).
8. *Gomphidia T-nigrum* Sel.

CHAPTER 3

Insects

Fam. *Aeshnidae*

1. *Gynacantha millardi* Fr.
2. *Hemianax ephippiger* (Burm.).

Fam. *Libellulidae*

1. *Macromia flavicincta* Sel.
2. *Macromia cingulata* (Ramb.).
3. *Epopthemia vittata* Burm.
4. *Potamarcha obscura* (Ramb.).
5. *Orthetrum chrysostigma luzonicum* (Brau.)
6. *Orthetrum sabina* (Dr.).
7. *O. Glaucum* (Brau.)
8. *Brachydiplax sobrina* (Ramb.)
9. *Diplocodes trivialis* (Ramb.)
10. *Indothemis caesia* (Ramb.)
11. *Neurothemis fulvia* (Dr.)
12. *Neurothemis intermedia* (Ramb.)
13. *N. tullia* (Dr.)
14. *Rhodothemis rufa* (Ramb.)
15. *Trithemis aurora* (Burm.)
16. *Trithemis festiva* (Ramb.)
17. *T. pallidinervis* (Kirb.)
18. *Zyxomma petiolatum* Ramb.
19. *Tholymis tillarga* (Fab.)
20. *Pantala flavescens* (Feb.)
21. *Hydrobasileus croceus* (Brau.)
22. *Urothemis signata* (Ramb.)

ORDER ORTHOPTERA

Fam. *Acridiidae* (Short horned grass-hoppers)Sub-family *Acridinae*

1. *Scelimena herpago* serv.
2. *Scelimena uncinata* Serv.
3. *Tettix* (*Paratettix*) *dorsifer* Wlk.
4. *Hedotettix gracilis* De haan.
5. *Hedotettix lineifera* Wlk.
6. *Acantholobus curticornis* Hane.

Sub-family *Tryxalinae*

7. *Gymnbothrus* (*Stenobothrus*) *simplex*.
8. *Dociostaurus apicalis* Wlk.
9. *Dociostaurus turbatus* Wlk.
10. *D. mundus* Wlk.
11. *D. epacromoides* Wlk.
12. *D. decius* Wlk.
13. *Stenobothrus luteipes* Wlk.
14. *Aelopus tamulus* Fab=*Epacromia dorsalis* Th.
15. *Aelopus affinis* Bol.
16. *Stauroderus bicolor* Charp.

CHAPTER 3

Insects

17. *Chloebora crassa* Wlk.
 18. *Quirogesia blanchardiana* Saus.
 19. *Pternoscirta cinctifemur* Wlk.
 20. *Gastrimargus marmoratus* Thumb.
 21. *Heteroptarnis respondens* Wlk.
 22. *Sphingonotus baltiatu* Serv.

Sub-family *Betracotetriginæ*

23. *Eremopeza granulosa* Wlk.

Sub-family *Pyrgomorphinæ*

24. *Chrotogonus pallidus* Bl.
 25. *Chrotogonus trachypterus* Bl.
 26. *C. liaspis* Bl. (= *lugubris* Bl.)
 27. *C. sordidus* Kirb.
 28. *Aularches scabiose* Fab.
 29. *Aularches miliaris* Linn.
 30. *Poecilocerus punctiventris* Serv.
 31. *Poecilocerus pictus* Fab.
 32. *Attractomorpha crenulata* Fab.
 33. *Colemania sphenarioides* Bol.

Sub-family *Catantopinæ*

34. *Oxya valox* Fab.
 35. *Oxya furcifera*.
 36. *Hieroglyphus concolor* W.
 37. *Hieroglyphus banian* Fab.
 38. *H. bilineatus* Saund.
 39. *H. battoni* Kirb.
 40. *H. nigrorepletus* Bol.
 41. *Spathosternum prasiniferum* Wlk.
 42. *Gelastorrhinus laticornis* Serv.
 43. *Leptacris filiformis* Wlk.
 44. *Cyrtacanthacris* (*Patanga*) *succincta* L.
 45. *Cyrtacanthacris ranacea* Std.
 46. *Catantops humilis* Serv.
 47. *Teratodes monticollis* Gra.
 48. *Gerenia pastulipennis* Wlk.
 49. *Eucoplacra praemorsa* Stal.
 50. *Acridium* (*Schistocerca*) *peregrinum* Ol.
 51. *Euprepocnemis alacris* Serv.
 52. *Caloptenus erubescens*.
 53. *C. caliginosus*.
 Fam. *Tettigoniidae* (Long horned grass-hoppers)
 1. *Gryllacris signigera* Wlk.
 2. *Euremus basalis* Wlk.

CHAPTER 3

Insects

3. *Conocephalus indicus* Redt.
 4. *Xiphiodopsis straminula* Wlk.
 5. *Morsimus carinatus* Wlk.
 6. *Sathrophyllia rugosa* Linn.
 7. *Callimenellus opacus* Brun.
 8. *Mecopoda elongata* Linn.
 9. *Elimaea rufonotata* Thunb.
 10. *Elimaea securigera* Brun.
 11. *Ducetia japonica* Thunb.
 12. *Ducetia thymifolia* Fab.
 13. *Letana nigrosparsa* Wlk.
 14. *Trigonocorypha unicolor* Stol.
 15. *Himerta kinneari* Uv.

Fam. *Gryllidae* (Crickets)

1. *Gryllotalpa africana* Pal.
 2. *Brachytrypes portentosus* Licht.
 3. *Gymnogryllus humeralis* Wlk.
 4. *Liogryllus bimaculatus* De Geer.
 5. *Gryllus domesticus* Steph.
 6. *Gryllodes sigillatus* Wlk.
 7. *Gryllodes parviceps* Wlk.
 8. *Oecanthus indicus* Saus.
 9. *Nemobius vagus* Wlk.
 10. *Gymnogryllus fascialis* Wlk.
 11. *Gryllus configuratus* Wlk.
 12. *Gryllus guttiventris* Wlk.
 13. *G. signipes* Wlk.
 14. *G. lineiceps* Wlk.
 15. *G. ferricollis* Wlk.
 16. *Cyrtoxipha concolor* Wlk.
 17. *Cyrtoxipha alboatra* Wlk.

Order Phasmida (Leaf and stick insects)

1. *Phyllium scythe* Gr.

ORDER DERMAPTERA (EARWIGS)

Fam. *Pygidicranidae*

1. *Diplatys lefroyi* Bur.

Fam. *Labiduridae*

1. *Psalis dohrni* Kirb.
 2. *Psalis lefroyi* Bur.
 3. *Anosolabis annulipes* Luc.
 4. *Borellia stali* Dohr.
 5. *Labidura* (*Forcipula*) *trispinosa* Dohr.
 6. *Labidura lividipes* Duf.
 7. *L. riparia* Pall.

CHAPTER 3

Insects

Fam. *Labiidae*

1. *Labia arachidis* Yer.

Fam. *Forficulidae*

1. *Proreus simulans* Stal.
2. *Proreus melanocephalus* Dohr.
3. *Adiathetus nigrocastaneus* Bur.
4. *Eudohrnia metallica* Dohrn.

ORDER EMBIOPTERA

Fam. *Oligotomidae*

1. *Oligotoma saundersii* Westw.
2. *Oligotoma ceylonica indica* Dav.
3. *O. asymetrica* Men. Geo.

Fam. *Embiidae*.

1. *Embia bramina* Saus.
2. *Embia latreillei* Ramb.

ORDER DICTYOPTERA

Fam. *Blattaria* (Cockroaches)

1. *Ischnoptera continua* Wlk.
2. *Phyllodromia* (*Blatella*) *germanica* Linn.
3. *Phyllodromia figurata* Wlk.
4. *P. subcolorata* Wlk.
5. *P. annulifera* Wlk.
6. *P. fasciceps* Wlk.
7. *P. beviceps* Wlk.
8. *P. lycoides* Wlk.
9. *P. inexacta* Wlk.
10. *Allacta transversalis* Wlk.
11. *Allacta subrotundata* Wlk.
12. *A. telephoroides* Wlk.
13. *Blatta curta* Wlk.
14. *Blatta sexpunctata* Wlk.
15. *Blatta* (*Stylopyga*) *rhombifolia* Stde.
16. *Periplaneta americana* Linn.
17. *Periplaneta australasiae*.
18. *P. monochroma* Wlk.
19. *Leucophaea surinamensis*.
20. *Theganopteryx indica* Sauss.
21. *Cosmozosterix ruficornis* Wlk.
22. *Cutilla coxalis* Wlk.
23. *Rhyparobia maderiae* Fab.
24. *Corydia ornata* Sauss.
25. *Trichoblatta guerini* Sauss.

Fam. *Mantidae*

1. *Humbertiella indica* Sauss.
2. *Hierodula unimaculata* Oliv.
3. *Hierodula coarctata* Sauss.
4. *Eremoplana microptera* Westw.
5. *E. laticeps* W. M.
6. *Creoboter urbana* Fab.
7. *Aethalochroa ashmoliana* Westw.
8. *Gongylus gongylodes* Linn.
9. *Toxoderopsis curtipes* Westw.
10. *Toxoderopsis spinigera* W.M.

ORDER ISOPTERA (TERMITES)

Fam. *Kalotermitidae* (Drywood termites)

1. *Kalotermes* (*Neotermes*) *assmuthi* Hdm.

Fam. *Hodotermitidae*

1. *Hodotermes macrocephalus* Desn.

Fam. *Rhinotermitidae*

1. *Heterotermes* (*Leucotermes*) *indicola* Wasm.
2. *Captotermes heimi* Wasm.
3. *Coptotermes parvulus* Holm.

Fam. *Termitidae*

1. *Termes* (*Odontotermes*) *faea* Wasm.
2. *Odontotermes* (*Oyclotermes*) *obesus* Ramb.
3. *Odontotermes wallonensis* Wasm.
4. *O. brunneus* Hag.
5. *O. horni* Wasm.
6. *Microtermes incertus* Hag.
7. *Microtermes annandalei forma curvignathus* Holm.
8. *M. mycophagus* Desn.
9. *M. heimi* Wasm.
10. *M. obesi* Holm.
11. *Hamitermes quadriceps* Wasm.
12. *Trinervitermes* (*Eutermes*) *biformis* Wasm.
13. *Trinervitermes heimi* Wasm.
14. *T. rubidus* Hag.
15. *Capritermes unicolor* Wasm.
16. *Capritermes graveyi* Silv.
17. *C. longirostris* var. *cornutella* Silv.

Order Psocoptera (Booklice)

1. *Atropos* species.

CHAPTER 3

Insects

CHAPTER 3

Insects

Order Mallophaga (Bird lice—Biting lice)

Fam. *Phloptoridae*

1. *Nirmus* sp. on pheasants, crows.
2. *Goniocotes* sp. on pheasants.
3. *Lipeurus* sp. on pheasants, vultures and pigeons.
4. *Docophorus* sp. on crows.
5. *Nitzschia* sp. on swifts.

Fam. *Menoponidae*

1. *Colpocephalum* sp. on pheasants and crows.
2. *Menopon* sp. on pheasants and crows.

Order Siphunculata—Anoplura (Sucking lice)

Fam. *Pediculidae*

1. *Pediculus capitis* De G.
2. *Pediculus corporis* De G.
3. *P. vestimenti* De G.
4. *Pthirus pubis* Lea.

Fam. *Haematopinidae*

1. *Haematopinus suis*.
2. *Haematopinus tuberculatus*.
3. *H. eurystermus*.
4. *H. vituli* End.
5. *R. spinulosus* Burm.

Order Rhynchota (Hemiptera) Bugs

Sub-order Homoptera

Fam. *Cicadidae*

1. *Platypleura polita* Wlk.
2. *Platypleura coelebs* Stal.
3. *P. basiviridis* Wlk.
4. *P. octoguttata* Fab.
5. *Cryptotympana vesta* Dist.
6. *Dundubia emanatura* Dist.
7. *Platylomia latus* Wlk.
8. *Eamathia segrota* Stal.
9. *Eamathia diminuta* Wlk.
10. *Lethona locusta* Wlk.
11. *Scieroptera crocea* Guer.
12. *Lemuriana apicalis* Germ.

Fam. *Fulgoridae* (Lanternflies)

1. *Kalidasa albiflos* Wlk.
2. *Eurybrachys tomentosa* Fab.
3. *Dichoptera hyalinita* Fab.

CHAPTER 3

Insects

4. *Dictyophara pallida* Don.
5. *Dictyophara lineata* Dist.
6. *D. dixonii* Dist.
7. *Putala maculata* Dist.
8. *Udugama splendens* Germ.
9. *Dictyopharina viridissima* Mel.
10. *Brixia abomaculata* Dist.
11. *Kinnara fumata* Mel.
12. *Assamia moesta* Westw.
13. *Diotrombus carnosus* Westw.
14. *Pyrilla aberrans* Kirb.
15. *Pyrilla perpusilla* Wlk.
16. *Kusuma carinata* Dist.
17. *Tatwa bufo* Dist.
18. *Ricania marginalis* Dist.
19. *Phromnia viridula* Atk.
20. *Summanus indicus* Dist.
21. *Satapa granulosa* Dist.
22. *Flata ferrugata* Fab.
23. *Melicharia lutescens* Wlk.
24. *Hilavrita discolorata* Dist.
25. *Seliza ferruginea* Wlk.
26. *Pundaluoya simplicia* Dist.
27. *Sardia rostrata* Mel.

Fam. *Membracidae*

1. *Oxyrhachis rufescens* Wlk.
2. *Dograna duffulta* Dist.
3. *Leptocentrus substitutus* Wlk.
4. *Centrotypus securis* Buckt.
5. *Otinotus oneratus* Wlk.
6. *Otinotus pallescens* Dist.
7. *Anchon pilosum* Wlk.
8. *Tricentrus bicolor* Dist.
9. *Tricentrus albomaculatus* Dist.
10. *Gargara affinis* Dist.
11. *Gargara mixta*.

Fam. *Cercopidae* (Frog hoppers—Cuckoo spits)

1. *Machearota planitiae* Dist.
2. *Poophilus costalis* Wlk.
3. *Phyctus nebulosus* Fab.
4. *Phyctus affinis* Dist.
5. *P. inconspicuus* Dist.
6. *P. sexvittatus* Wlk.
7. *P. jayakari* Dist.
8. *Clovia puncta* Wlk.
9. *Aphrophora sigellifera* Wlk.

CHAPTER 3

Insects

10. *Callitettix versicolor* Fab.
11. *Caloscarta capitata* Stal.
12. *Caloscarta relata* Dist.
13. *C. trimaculata* Dist.

Fam. *Jassidae*

1. *Petaloccephala umbrosa* Dist.
2. *P. uniformis* Dist.
3. *P. latifrons* Wlk.
4. *P. bombayensis* Dist.
5. *P. nigrilinea* Wlk.
6. *Ledra mutica* Fab.
7. *Idiocerus niveosparus* Leth.
8. *Idiocerus atkinsoni* Leth.
9. *Tettigoniella ferruginea* Fab.
10. *Tettigoniella spectra* Dist.
11. *Penthimia compacta* Wlk.
12. *Penthimia maculosa* Dist.
13. *Tambila gravelyi* Dist.
14. *Conedaeus horvathi* Dist.
15. *Krisna strigicollis* Spin.
16. *Jassus indicus* Dist.
17. *Jassus elegans* Dist.
18. *Nepotettix bipunctatus* Fab.
19. *Deltocephalus brunnescens* Dist.
20. *Paralimnus lateralis* Wlk.
21. *Empoasca devastans* Dist.
22. *Typhlocyba dubia* District.

Fam. *Psyllidae* (Jumping bugs)

1. *Phacopteron lentiginosum* Buckt.
2. *Arytaina punctipennis* S.
3. *Diaphorina citri* K.
4. *Trioza jambulanae* Cr.
5. *Trioza obsoleta* Buckt.
6. *Pauropsylla depressa* Cr.
7. *Psylla obsoleta* Buckt.
8. *Megatrioza hirsuta* Cr.

Fam. *Aleurodidae* (Aleyrodidae) White flies—Mealy wings.

1. *Aleurolobus barodensis* W.
2. *Aleurocanthus spiniferus* Q.
3. *Dialeurodes vulgaris* K.
4. *Dialeurodes eugeniae* M.
5. *D. citri* A.
6. *Neomaskellia bergi* S.
7. *Trialeurodes ricini* M.
8. *Siphonimus finitimus* S.

CHAPTER 3

Insects

Fam. *Aphidiidae* (Plant lice—Green flies)

1. *Aphis maidis* F.
2. *Aphis gossypii* G.
3. *A. medicagenis* K.
4. *A. taveresi* D.
5. *A. odinae* V. D.
6. *A. malvae* K.
7. *A. nerii* B.
8. *A. rumicis* L.
9. *Macrosiphum solidagenis* F.
10. *Macrosiphum rosaeformis* D.
11. *Toxoptera graminum* R.
12. *Tetraneura hirsuta* B.
13. *Tetraneura ulmi* K.
14. *Myzus persicae* S.
15. *Greenidae artocarpi* W.
16. *Oregama bamboosae* B.
17. *Pentatonia nigronevosa* Coq.
18. *Setaphis bougainvillae* Thumb.
19. *Brevicoryne pseudobrassicae* Dav.

Fam. *Coccidae* (Scale insects—Mealy bugs)

1. *Aspidiotus destructor* Sign.
2. *Aspidiotus ficus* Ashm.
3. *A. hartii* Ckll.
4. *A. lantaniae* Sign.
5. *A. rosei* Mask.
6. *A. orientalis* News.
7. *A. curcuma* Gr.
8. *A. (Chrysomphalus) triglandulosus* Gr.
9. *A. aonidium* Ril.
10. *A. ceydoniae* C.
11. *A. (Chrysomphalus) aurantii* Mask.
12. *Vinsonia stellifera* Westw.
13. *Parlatoria proteus* Curt.
14. *Parlatoria proteus nyctilaspiformis*.
15. *Chionaspis dilatata* Gr.
16. *C. decurvata* Gr.
17. *C. vitis* Gr.
18. *Hemichionaspis (Pinnaspis) aspidistrae* Sign.
19. *Hemichionaspis buxi* Bouc.
20. *Fiorinia frontecontracta* Gr.
21. *Fiorinia sapindi* Gr.
22. *Diaspis echinocaeti* Bouc.
23. *Diaspis barberi* Gr.
24. *Lucaspis indica* Marl.
25. *Lepidosaphes piperis* Gr.

CHAPTER 3

Insects

26. *Lecanium hemisphaericum* Sign.
27. *L. nigrum* Niet.
28. *Ceroplastis actinoformis* Gr.
29. *Ceroplastis rubeus* Mask.
30. *C. ceriferus* And.
31. *Pulvinaria psidii* Mask.
32. *Dactylopius virgatus* Ckll.
33. *Dactylopius nipae* Mask.
34. *Ripersia* (*Pseudococcus*) *sachari* Gr.
35. *Ripersia oryzae* Gr.
36. *Phenococcus hirsutus* Gr.
37. *Antonina anceps* Gr.
38. *Saissetia hemisphaericum* T.
39. *Saissetia niger* N.
40. *Asterolecanum miliaris* Bors.
41. *Cerococcus hibisci* Gr.
42. *Icerya seychellarum* Westw.
43. *Icerya aegptiaca* Doug.

Sub-order : HETEROPTERA

Fam. *Pentatomidae*

1. *Brachyplatys vahllei* Fab.
2. *Coptosoma cribrarium* Fab.
3. *Cantao ocellatus* Thumb.
4. *Scutellaria fasciata* Pauz.
5. *Scutellaria nobilis* Fab.
6. *Chrysocoris stockerus* Linn.
7. *Chrysocoris purpureus* Westw.
8. *C. marginellus* Westw.
9. *Alphocoris lixoides* Germ.
10. *Melanodema apicifera* Dist.
11. *Podops bispinosa* Fab.
12. *Burrus spicatus* Dist.
13. *Laetistes vicinus* Sign.
14. *Cydnus indicus* Westw.
15. *Cydnus variance* Fab.
16. *C. perpunctatus* Sign.
17. *C. tanna* Dist.
18. *Macroscytus subaeneus* Dall.
19. *Macroscytus expansus* Sign.
20. *Geotomus pygmaeus* Dall.
21. *Brachypelta aterrima* Forst.
22. *Chilocor is assmuthi* Bred.
23. *Chilocoris solenopsides* Br.
24. *Dalpada clavata* Fab.
25. *Halys dentatus* Fab.
26. *Menedemus hieroglyphicus* Dist.

CHAPTER 4

Insects

27. *Laprius varicornis* Dall.
28. *Hippota dorsalis* Stal.
29. *Bonacialus dixonii* Dist.
30. *Gulielmus marmoratus* Dist.
31. *Gulielmus laterarius* Dist.
32. *Aeliomorpha lineaticollis* West.
33. *Adria parvula* Dall.
34. *Mecidia indica* Dall.
35. *Ochrophara montana* Dist.
36. *Nipha subferruginea* Westw.
37. *Nipha vittativentris* Stal.
38. *Halyomorpha picus* Fab.
39. *Halyomorpha scutellata* Dist.
40. *Codophila maculicollis* Dall.
41. *Dolycoris indicus* Stal.
42. *Eusarcocoris guttiger* Th.
43. *Eusarcocoris ventralis* Westw.
44. *Carbula scutellata* Dist.
45. *Carbula socia* Wlk.
46. *C. biguttata* Fab.
47. *C. insocia* Wlk.
48. *Plantia fimbriata* Fab.
49. *Antestia cruciata* Fab.
50. *Apines concinna* Dall.
51. *Gynenica affinis* Dist.
52. *Agonoscelis nubila* Fab.
53. *Stenozygum speciosum* Dall.
54. *Bagrada picta* Fab.
55. *Degonatus serratus* Dist.
56. *Placosternum alces* Stal.
57. *Catacanthus incarnatus* Dr.
58. *Nezara viridula* Linn.
59. *Zangis albomaculata* Dist.
60. *Piezodorus rubrofasciatus* Fab.
61. *Menida formosa* Westw.
62. *Menida flavovaria* Dall.
63. *Cresphontes monsone* Westw.
64. *Canthecona furcellata* Wolf.
65. *Amyotea malabaricus* Fab.
66. *Tassaratoma javanica* Thumb.
67. *Aurangabada singularis* Dist.
68. *Euthenis polyphemus* Stal.
69. *Cyclopelta siccifolia* Westw.
70. *Aspongopus janus* Fab.
71. *Aspongopus brunneus* Thumb.
72. *A. obscurus* Jab.
73. *A. nigriventris* Westw.

CHAPTER 3

Insects

74. *A. fuscus* Westw.
75. *Gonopsis diversa* Wlk.
76. *Gellia nigripennis* Dall.
77. *Microdeuterus megacephalus* Herr Seb.

Fam. *Coreidae*

1. *Anoplocnemis phasiana* Fab.
2. *Petillia lobipes* Westw.
3. *Petillia calear* Dall.
4. *Dalader planiventris* Westw.
5. *Brachytes bicolor* Westw.
6. *Homoescerus signatus* Wlk.
7. *Homoescerus prominulus* Dall.
8. *H. striicornis* Scot.
9. *H. albiventris* Dall.
10. *H. laevilineus* Stal.
11. *Notobitus mileagris* Fab.
12. *Notobitus dorsalis* Westw.
13. *Physomerus grossipes* Fab.
14. *Acanthocoris scabrator* Fab.
15. *Petalocnemis obscura* Dall.
16. *Pendulinus rostratus* Dist.
17. *Plinactus acicularis* Fab.
18. *Plinactus basalis* Westw.
19. *Cletus bipunctatus* Westw.
20. *Cletus rubidiventris* Westw.
21. *Cletomorpha hastata* Fab.
22. *Haidara producta* Dist.
23. *Haidara admota* Dist.
24. *Clavigralla gibbosa* Spin.
25. *Clavigralla horrens* Dist.
26. *Stenocephalus lateralis* Sign.
27. *Dulichius inflatus* Kirb.
28. *Leptocorisa varicornis* Fab.
29. *Riptortus pedestris* Fab.
30. *Akbaretus fisheri* Dist.
31. *Corizus bengalensis* Dall.
32. *Corizus rubicundus* Sign.
33. *Serinetha abdominalis* Fab.
34. *Serinetha augur* Feb.

Fam. *Lygaeidae*

1. *Oncopeltus nigriceps* Dall.
2. *Lygaeus militaris* Fab.
3. *Lygaeus hospes* Fab.
4. *Graptosteltus servus* Fab.
5. *Graptosteltus argentatus* Fab.

CHAPTER 3

Insects

6. *G. dixonii* Dist.
7. *Aspilocryptus modestus* Dist.
8. *Melanotelus bipunctatus* Dall.
9. *Lygaeosoma pusillum* Dall.
10. *Caenocoris nerii* Germ.
11. *Nysius inconspicuus* Dist.
12. *Blissus gibbus* Fab.
13. *Ischnodemus crebus* Dist.
14. *Ischnodemus atromaculatus* Dist.
15. *Geocoris tricolor* Fab.
16. *Dactylopius nipae* Mask.
17. *Chauliops fallax* Scot.
18. *Esmus typicus* Dist.
19. *Pachygrontha dixonii* Dist.
20. *Oxycarenus laetus* Kirb.
21. *Paromius seychellesus* Wlk.
22. *Palmera pallicornis* Dall.
23. *Palmera vineta* Say.
24. *P. nietneri* Dohrn.
25. *Caridops gibba* Berg.
26. *Fontejanus wasmanni* Bred.
27. *Prostemmidia mimica* Reut.
28. *Lachnophorus singalensis* Dohrn.
29. *Diniella trabeata* Dist.
30. *Aphanus sordidus* Fab.
31. *Aphanus lineosus* Dist.
32. *A. orientalis* Dist.
33. *A. sparsus* Dist.
34. *A. latus* Dist.
35. *Dieuches uniguttatus* Thumb.
36. *Dieuches leucoceras* Wlk.
37. *Poeantius festivus* Dist.
38. *Poeantius lineatus* Stal.

Fam. *Pyrrhocoridae*

1. *Physopelta apicalis* Wlk.
2. *Antilochus coqueberti* Fab.
3. *Euscopus albus* Dist.
4. *Odontopus nigricornis* Stal.
5. *Odontopus scutellaria* Wlk.
6. *Dermatinus lugubris* Dist.
7. *Scantius volucris* Gerst.
8. *Scantius pallens* Dist.
9. *Dysdercus cingulatus* Fab.
10. *Dysdercus evanescens* Dist.

CHAPTER 3

Insects

Fam. *Tingidae* (Lace bugs)

1. *Stephanitis typicus* Dist.
2. *Urentius echinus* Dist.
3. *Monanthia globulifera* Wlk.
4. *Haedus lectus* (Dr.)

Fam. *Hydrometridae*

1. *Hydrometra vittata* Stal.
2. *Gerris fluviatorum* Fab.
3. *Gerris fossarum* Fab.
4. *G. armata* Spin.
5. *Cylindrostethus productus* Spin.
6. *Halobates germanus* Buch.

Fam. *Henicocephalidae* (Enicocephalidae)

1. *Henicocephalus basalis* Westw.

Fam. *Reduviidae* (Assassin bugs)

1. *Eugubinus araneus* Dist.
2. *Bagauda avidus* Berg.
3. *Tribelocephala indica* Wlk.
4. *Tribelocephala orientalis* Dist.
5. *Sastrapada baerensprungi* Stal.
6. *Oncocephalus notatus* Klug.
7. *Oncocephalus annulipes* Stal.
8. *Thodelmus falleni* Stal.
9. *Allaeocranum biannulipes* Mont & Sign.
10. *Reduvius angiportus* Dist.
11. *Garbelius ornatus* Dist.
12. *Pasira perpusilla* Wlk.
13. *Pasiropsis nigerrima* Berg.
14. *Acanthaspis quinquespinosa* Fab.
15. *Acanthaspis luteipes* Wlk.
16. *Acanthaspis flavipes* Stal.
17. *A. angularis* Stal.
18. *A. regulosa* Stal.
19. *A. megapila* Wlk.
20. *A. apicata* Dist.
21. *A. concinnata* Stal.
22. *A. fusconigra* Doh.
23. *A. trimaculata* Reut.
24. *A. bombayensis* Dist.
25. *Conorhinus rubrofasciatus* de Geer.
26. *Androclus granulatus* Stal.
27. *Androclus pictus* Her. Seh.
28. *Ectomocoris quadriguttatus* Fab.

CHAPTER 3

Insects

29. *Ectomocoris tibialis* Dist.
30. *E. cordiger* Stal.
31. *E. vishnu* Dist.
32. *Piralis affinis* Serv.
33. *Piralis mundulus* Stal.
34. *P. arcuatus* Stal.
35. *P. lepturoides* Wolf.
36. *Quercetanus atromaculatus* Dist.
37. *Ectrychotes dispar* Reut.
38. *Lophocephala guerini* Lap.
39. *Harpacter fuscipes* Fab.
40. *Harpacter costalis* Stal.
41. *H. marginalis* Fab.
42. *Sphedanolestes stigmatillus* Dist.
43. *Sphedanolestes signatus* Dist.
44. *Syncanus indagator* Stal.
45. *Agriosphodrus dohrni* Sign.
46. *Cydnocoris crocatus* Stal.
47. *Euagoras plagiatus* Burm.
48. *Endochus umbrinus* Dist.
49. *Endochus enornatus* Stal.
50. *Isyndus heros* Fab.
51. *Coranus spiniscutis* Reut.
52. *Coranus fuscipennis*.
53. *Nagusta macroloba* Berg.
54. *Polididus armatissimus* Stal.
55. *Pachynomus biguttatus* Std.
56. *Prostemma flavomaculatum* Leth.
57. *Allacorhynchus vinulus* Stal.
58. *Nabis capsiformis* Germ.
59. *Nabis nigrescens* Dist.

Fam. *Saldidae*

1. *Salda dixonii* Dist.
2. *Leptopus greeni* (Dist.)

Fam. *Cimicidae*

1. *Cimex rotundatus* S. (hemipterus)

Fam. *Capsidae*

1. *Tancredus sandaracatus* Dist.
2. *Helopeltis antonii* Sign.
3. *Disphinctus politus* Wlk.
4. *Eurycyrtus lanarius* (Dist.)
5. *Calocoris angustatus* Linn.
6. *Poecilascytus consanguineus* Dist.

CHAPTER 3

Insects

7. *Poecilascytus pigmaeus* Dist.
 8. *Tyraquellus albofasciatus* Mots.
 9. *Gallobelicus crassicornis* Dist.
- Fam. *Anthocoridae*
1. *Triphleps tantilus* Mots.
- Fam. *Nepidae* (Water scorpions)
1. *Laccotrephes ruber* Linn.
 2. *Laccotrephes elongatus* Mount.
 3. *Ranatra filiformis* Fab.
- Fam. *Naucoridae*
1. *Heliocoris breviceps* Mont.
 2. *Heliocoris obliquatus* Spin.
 3. *H. acuta* Spin.
- Fam. *Belostomatidae* (Giant water bugs)
1. *Sphaerodema rusticum* Fam.
 2. *Belostoma indicum* Lep. & serv.
- Fam. *Notonectidae* (Backswimmers)
1. *Enithares indica* Fab.
 2. *Enithares templetoni* Kirb.
 3. *Anisops sardia* Herr. V. Sehif.
 4. *Anisops niveus* Fab.
- Fam. *Corixidae* (Water Boatmen)
1. *Corixa hieroglyphica* Duf.
 2. *Corixa lima* Dist.
- Order *Thysanoptera* (Thrips)
- Sub-order Terebrantia
- Fam. *Aeolothripidae*
1. *Aeolothrips fasciatus* Linn.
- Fam. *Heliothripidae*
1. *Hercothrips* (*Heliothrips*) *indicus* Bagn.
 2. *Rhipiphorothrips cruentatus* Hood.
 3. *Tryphactothrips rutherfordi* Bagn.
 4. *Taeneothrips brunneicornis* Bgn.
 5. *Taeneothrips distalis* Kar.
 6. *T. longistylus* Kar (= *nigricornis* Sehm).
- Fam. *Thripidae*
1. *Chirothrips manicatus* Hal.
 2. *Neocorynothrips* (*Ramakrishnothrips*) *jonnaphila* Ram.
 3. *Anaphothrips flavicinctus* Kar.
 4. *Anaphothrips* (*Dantabahuthrips*) *sacchari* Shun.

CHAPTER 3

Insects

5. *A. (Scirtothrips) dorsalis* Hood.
 6. *Ayyaria chaetophora* Kar.
 7. *Frankliniella sulphurea* Sch.
 8. *Microphalothrips brevipalpis* Kar.
 9. *Scolothrips asura* Ram. Marg.
 10. *Scolothrips sexmaculatus* Perz.
 11. *Thrips* (*Isothrips*) *orientalis* Bagn.
 12. *Thrips tabaci* Lind.
 13. *T. florum* Sch.
- SUB-ORDER TUBULIFERA
- Fam. *Phloeothripidae*
1. *Haplothrips ceylonicus* Schm.
 2. *Haplotarips ganglbaueri* Schm.
 3. *H. schultzei* Pries.
- Order *Neuroptera* (Lacewings and Ant lions)
- Fam. *Myrmelionidae* (Ant lions)
1. *Myrmelion singulare* Westw.
 2. *Myrmelion formicarius* Hag.
 3. *Palpares contrarius* Wlk.
 4. *Palpares pardus* Rbr.
- Fam. *Ascalphidae*
1. *Helicomitus dicax* Wlk.
- Fam. *Chrysopidae*
1. *Chrysopa Khandalina* Nav.
- Fam. *Hemerobiidae*
1. *Micromus australis* Hag.
- Order *Mecoptera* (Scorpionflies)
- Fam. *Panorpidae*
1. *Panorpa apendiculata* Westw.
- Order *Lepidoptera* (Moths and Butterflies)
- Sub-order Rhopalocera (Butterflies)
- Fam. *Danaiidae*
1. *Hestia lynceus* Mo & de N. (The Tree Nymph).
 2. *Danaus aglea aglea* Cr. (The Glassy Tiger).
 3. *Danaus limniace* Cr. V. *mutina* (The Blue Tiger).
 4. *D. genutia* (Cr.) (The Common Tiger).
 5. *D. chrysippus* (Linn) (The Plain Tiger).
 6. *D. melissa septentrionis* But. (Dark Blue Tiger).
 7. *Euploea core* (Cr.) (The Common Indian Crow).
 8. *E. crassa* But (kollari Fd.) (The Brown King Crow).

CHAPTER 3

Insects

Fam. *Satyridae* (Browns)

1. *Mycalesis mineus* (L.) (The Dark brand Bush Brown).
2. *Mycalesis visala* M. (The Long brand Bush Brown).
3. *M. lepcha* M. (The Bush Brown).
4. *M. perseus* (Fab.) (The common Bush Brown).
5. *Lethe rohria nilgiriensis* Guer. (The common Tree Brown).
6. *Ypthima baldus* F. (The common Five ring).
7. *Ypthima hubneri* Kirb. (The common Four ring).
8. *Zipoetis saitis* Hew. (The Tamil Cats eye).
9. *Ostrioena medus* (Fab) (The Nigger).
10. *Melanitis leda* (Dr.) (The common Evening Brown).
11. *Melanitis ismene* Cr. (Common Evening Brown).
12. *M. phedina* Cr. (The Dark Evening Brown).
13. *Elymnias hypermnestra* L. (The common Palm fly).
14. *Elymnias hyp.* Var. *caudata* But.

Fam. *Amathusiidae*

1. *Discophora lepida* (M.) (Southern Duffer).

Fam. *Nymphalidae* (Nymphs)

1. *Charaxes polyxena* (Cr.) (The Tawny Raja).
2. *Ch. pol. imna* But.
3. *C. fabius* (Fab.) (The Black Raja).
4. *Eriboea schreiberi* (God) (The Blue Nawab).
5. *Eriboea athamas* Dr. (The common Nawab).
6. *Apatura parisatis* Westw & var. *camiba* M. (The Black Prince).
7. *Euthelia lubentina* (Cr.) (The Gaudy Baron).
8. *Euthalia evalina* (St.) (The Red spot Duke).
9. *E. nais* (Fors.) (The Baronet).
10. *E. garuda anagama* Fruh. (The Baron).
11. *Parthenos sylvia virens* (M) (The Clipper).
12. *Limenitis procris* (Cr.) (The Commander).
13. *Neptis jumbah* M. (The Chestnut streaked Sailer).
14. *Neptis hylas* M. and var. *varuna* (The common Sailer).
15. *N. viraja* M. (The Yellow jack Sailer).
16. *N. columella nilgirica* M. (The Short banded Sailer).
17. *Hypolimnas bolina* (Linn) (The Great Egg fly).
18. *H. misippus* (Linn) (The Danaid Egg fly).
19. *Kallima philarchus* (Westw) and *K. p. horsfieldii* Koll. (The Blue Oak leaf).
20. *Precis hierta* (Fab.) (The Yellow Pansy).
21. *Precis orithyia* Linn. (The Blue Pansy).
22. *P. lemonias vaisya* Fruh. (The Lemon Pansy).
23. *P. almana* Linn. (The Peacock Pansy).

CHAPTER 3

Insects

24. *P. iphita* Cr. and *P. i. pluviatilis* Fruh. (The Chocolate Pansy).
25. *Vanessa cardui* Linn. (The Painted Lady).
26. *Argynnis hyperbius* (Joh.) (The Indian Fritillary).
27. *Atella phalantha* (Dr.) (The common Leopard).
28. *Atella alcippe* Cr. (The small Leopard).
29. *Cynthia erota* (Fab.) (The Cruiser).
30. *Cirrochroa thais* (Fab.) (The Tamil Yeoman).
31. *Cethosia nietneri mahratta* Feld. (The Tamil Lace wing).
32. *Byblia ilithyia* (Dr.) (The Joker).
33. *Ergolis ariadne* (Joh.) (The Angled Castor).
34. *Ergolis merione taprobana* Wd. (The common Castor-Castor butterfly).

Fam. *Acraeidae*

1. *Telchinia violae* Fab. (The Tawny Coster).

Fam. *Erycinidae*

1. *Libythea myrrha* (God.) (The Club Beak).
2. *Abisara echerius prunosa* M. (The Plum Judy).

Fam. *Lycaenidae* (The Blues)

1. *Spalgis epius* Westw. (The Ape fly).
2. *Talicauda nyceus* (Guerin) (The Red Pierrot).
3. *Castalius rosimon* Fab. (The common Pierrot).
4. *Castalius caleta* (Hew.) (The Angled Pierrot).
5. *C. c. decidia* Hew.
6. *C. ethion* (Doubl. Hew.) (The Banded Blue Pierrot).
7. *Taracus ananda* de Nec. (The Dark Pierrot).
8. *Taracus alteratus* M. (The Rusty Pierrot).
9. *T. theophrastus* Ev. (The Pointed Pierrot).
10. *T. extricatus* But. (The Rounded Pierrot).
11. *T. nara* Koll. (The Striped Pierrot).
12. *Syntarucus plinius* (Fab.) (The Zebra Blue).
13. *Azanus ubaldus* Cr. (The Bright Babul Blue).
14. *Azanus uranus* Butl. (The Dull Babul Blue).
15. *Azanus jesous* Guer. (The African Babul Blue).
16. *Neopithecops zalmora* But. (The Quaker).
17. *Megisba malaya thwaitesi* M. (The Malayan).
18. *Lycaenopsis puspa* Fruh. (The common Hedge Blue).
19. *Chilades laius* Cr. (The Lime Blue).
20. *Zizeeria putli* Koll. (The Grass Jewel).
21. *Zizeeria maha* Koll. (The Grass Blue).
22. *Z. lysimon* Hubn. (The Dark Grass Blue).
23. *Z. gaika* Tri. (The Tiny Grass Blue).
24. *Z. otis* F. (The Lesser Grass Blue).
25. *Euchrysops cnejus* Fab. (The Gram Blue) = (Pod butterfly).
26. *Euchrysops pandava* Hors. (The Plains Cupid).

CHAPTER 3

Insects

27. *Catochrysops strabo* Fab. (The Forget-me-not).
28. *Lampides boeticus* Linn. (The Pea Blue).
29. *Loxura atymnus* Cr. (The yam fly).
30. *Lycanesthes lycanina* Feld. (The Pointed Ciliate Blue).
31. *Jamides celeno* Cr. (The common Cerulean).
32. *Jamides bochus* Cr. (The Dark Cerulean).
33. *Nacaduba nora* Feld. (The common Line blue).
34. *Nacaduba Viola* M. (The Pointed Line blue).
35. *Curetis thetis* Dr. (The Indian Sunbeam).
36. *Horsfieldia anita* Hew (The Leaf Blue).
37. *Apharitis lilacinus* M. (Lilac Silverline).
38. *Spindasis vulcanus* F. (The common Silverline).
39. *Spindasis ictis* Hew (The common shot Silverline).
40. *S. lohita* M. and *S. l. lazularia* M. (The Long banded Silver line).
41. *Zesius chrysomallus* Hubn. (The Red Spot).
42. *Pratapa cleobis* God. (The Broad tail Royal).
43. *Pratapa deva* M. (The White Royal).
44. *Tajuria cippus* Fab. (The Peacock Royal).
45. *Tajuria jehana* M. (The Plains blue Royal).
46. *Cheritra freja* Fab. (The common Imperial).
47. *Rathinda amor* Fab. (The Monkey Puzzle).
48. *Catapocilma elegans* Dr. (The common Tinsel).
49. *Chliaria othona* Hew (The Orchid Tit).
50. *Deudoryx epijarbus* M. (The Cornelian).
51. *Virachola isocrates* F. (The Common Guava Blue).
52. *Virachola perse ghela* Fruh. (The Large Guava blue).
53. *Rapala varuna* M. (The Indigo Flash).
54. *R. melampus* Cr. (The Indian Red Flash).
55. *Rapala schistacea* M. (The Slate Flash).
56. *Amblypodia alemon* De N. (The Silky Oak blue).
57. *A. centaurus* F. (The Centaur Oak blue).
58. *Amblypodia amantes* Hew. (The Large Oak blue).
59. *Bindahara phocides* Fab. (The Plane).
60. *Surendra biplagiata* But. (The common Acacia Blue).
61. *Iraota timoleon* Stoll. (The Silverstreak Blue).

Fam. *Papilionidae* (Swallow tails)

1. *Troides helena* (Linn.) (The Bird wings).
2. *Polydorus hector* Linn. (The Crimson Rose).
3. *Polydorus aristolochiae* Fab. (The common Rose).
4. *Chilasa clytia clytia* Linn and var. *dissimilis* L. (The common Mime).
5. *Papilio polymnestor* Cr. (The Blue Mormon).
6. *Papilio helenus* L. var *daksha* M. (The Red Helen).

CHAPTER 4

Insects

7. *Papilio polytes* Linn. var.
 - (a) *cyrus* F.
 - (b) *romulus* Cr.
 - (c) *stichius* Hub.
 (The common Mormon).
8. *Papilio demoleus* Linn. (Lime Butterfly).
9. *Graphium agamemnon menides* Fruh. (The Tailed Jay).
10. *Graphium nomius* (Esp.) (The Spot Swordtail).
11. *Graphium sarpedon teredon* Fd. (The common Blue bottle).

Fam. *Pieridae* (The Whites and Yellows)

1. *Leptosia nina* Fab. (The Psyche).
2. *Delias eucharis* Dr. (The common Jezebel).
3. *Cepora nerissa* (Fab.) var. *phryne* F. (The common Gull).
4. *Cepora nadina* (Luc.) (The Lesser Gull).
5. *Anaphaeis aurota* Fab. (The Pioneer).
6. *Appias libythea* Fab. (The Striped Albatross).
7. *Appias albina* (Boisd.) (The common Albatross).
8. *Ixias marianne* (Cr.) (The White Orange tip).
9. *Ixias pyrene* Linn. (The Yellow Orange tip).
10. *Colotis calais* Cr. (The Small Salmon Arab).
11. *Colotis fausta fulvia* Wall. (The Large Salmon Arab).
12. *Colotis etrida* (Boisd.) (The Little Orange tip).
13. *Colotis eucharis* Fab. (The Plain Orange tip).
14. *C. amata* F. (The Small Salmon Arab).
15. *C. danae* F. (The Crimson tip).
16. *Hebomoia glaucippe* Lin. *australis* But. (The Great Orange tip).
17. *Valeria valeria* (Cr.) *hippia* F. (The Common Wanderer).
18. *Catopsilia crocale* Cr. (The Common Emigrant).
19. *Catopsilia pomona* Fab. var *catilla* Cr. (The Lemon Emigrant).
20. *C. pyranthe* Linn. (The Mottled Emigrant).
21. *C. florella* Fab. (The African Emigrant).
22. *Eurema brigitta* Cr. (= *libythia* Fab.). (The Small Grass Yellow).
23. *Eurema laeta* Boisd. (The Spotless Grass yellow).
24. *E. hecabe* Linn. var *simulata* M. (The Common Grass yellow).
25. *E. blanda* Boisd. (The Three Spot Grass yellow).
26. *E. venata, venata* M. (The Spotless Grass yellow).

Fam. *Hesperiidae* (The Skippers)

1. *Celaenorhinus leucocera* (Koll) (The Common Spotted Flat).
2. *Celaenorhinus ruficornis* (Mab.) (The Tamil Spotted Flat).
3. *C. ambareesa* M. (The Malabar Flat).
4. *Tagiades litigiosa* Mos. (The Water snow Flat).
5. *Sarangesa purendra* M. (The Spotted Small Flat).

CHAPTER 3

Insects

6. Sarangesa dasahara M. (The Common small Flat).
7. Odontoptilum angulata Feld. (The Chestnut Angle).
8. Caprona ranssonetti Feld (The Golden Angle).
9. Spialia (Syriacus) galba Fab. (The Indian Skipper).
10. Gomalia elma albofasciata M. (The African Marbled Skipper).
11. Chromus (Hasora) alexis (Fab.) (The Common banded Awl).
12. Chromus (Hasora) taminatus (Hubn.). (The white banded Awl).
13. C. badra M. (The Common Awl).
14. Bibasis (Ismene) jaina M. (The Orange Awlet).
15. Badamia exclamations Fab. (The Brown Awl).
16. Suastus gremius Fab. (The Indian Palm Bob).
17. Arnetta vindhiana M. (The Vindhyan Bob).
18. Matapa aria M. (The Common Red eye).
19. Gangara thyrasis Fab. (The Giant Red eye).
20. Taratrocera maevis Fab. (The Common Grass dart).
21. Taratrocera ceramus (Hew) (The Tamil Grass dart).
22. Ampittia diascorides Fab. (The Bush Hopper).
23. Telicota (Astychus) ancilla (The Palm dart).
24. Telicota pythias M. (The Dark Palm dart).
25. Thoressa (Halpe) honorei de N. (The Madras Ace).
26. Pelopidas (Baoris) conjuncta M. (The Conjoined Swift).
27. Pelopidas mathias Fab. (Paddy skipper) (The Small branded Swift).
28. Padraona (Potanthus) dara Koll. (The Common Dart).
29. Borbo cinnara Wall (=Baoris zelleri Led) (The Rice Swift).
30. Parnara (Baoris) guttatus Br. (The Straight Swift).
31. Baoris kumara M. (Caltoris kumara). (The Blank Swift).
32. Baoris (Borbo) bevani M. (The Bevans Swift).
33. Hyarotis adrastus Cr. (The Tree Flitter).
34. Udaspes folus Cr. (The Grass Demon).
35. Coladenia indrani indra Ev. (The Tricolour Pied Flat).
36. Iambrix salsala M. (The Chestnut Bob).

Sub-order : HETEROCERA (Moths)

Fam. Syntomidae (= Amatidae)

1. Ceryx imaon Stoll.
2. Amata cyssia Stoll.
3. Amata extensa Wlk.
4. A. hubneri Boisd.
5. A. passalis Fab.
6. Eressa musa Swin.
7. Euchromia polymena Linn.

CHAPTER 3

Insects

Fam. Arctiidae (Lithosiidae)

1. Spilosoma (Diacrisia) mona Sw.
2. Spilosoma brunneus M.
3. Spilosoma casignatum Koll.
4. Diacrisia indica Guen.
5. Pericallia (Arctia) ricini Fab.
6. Pericallia matherana M.
7. Estigmene (Alphaea) lactinea Cr.
8. Estigmene nigricans M.
9. E. dentata Wlk.
10. E. sipahi M.
11. Creatonotus (Amsacta) albistriga Wlk.
12. Amsacta moorei But.
13. Amsacta gongis Linn.
14. A. lineola Fab. (emittens Wlk).
15. A. simplex Wlk.
16. Phissama (Creatonotus) transiens Wlk.
17. Rhodogastria astra Dr.
18. Eligma narcissus Cr.
19. Deiopeia pulchella Linn.
20. Cyana (Chionaema) peregrina Wlk.
21. Cyana puella Dr.
22. C. subornata Wlk.
23. C. guttifera Wlk.
24. Paraona splendens But.
25. Philagria (Oeonistis) entella Cr.
26. Lithosia (Eilema) chota Swin.
27. L. basigera Wlk.
28. Aemene (Stictane) tenebrosa M.
29. Gurna (Miltchrista) indica M.
30. Asura (Nepita) conferta Wlk.
31. Asura rubricosta M.
32. Diacrisia obliqua Wlk.
33. Celama (Nola) crelacea Hamp.
34. Celama internella Wlk.
35. C. pascua Swin.

Fam. Agaristidae

1. Exsula (Eusamia) adulatrix Koll.
2. Aegocera venulia Cr.
3. Aegocera bimaculata Wlk.

Fam. Noctuidae

1. Glottula dominica Cr. = (Brithys crini F.)
2. Polytelea gloriosae Fab.
3. Adisura straminea Hamp.
4. Adisura atkinsoni M.

CHAPTER 3

Insects

5. *A. (Chariclea) marginalis* Wlk.
6. *Heliothis obsoleta* F.
7. *Heliothis assulta* Guen.
8. *Timora (Chariclea) flavia* Hamp.
9. *Timora bivittata* Wlk.
10. *T. sanguinolenta* M.
11. *Chariclea sinuata* M.
12. *Chariclea auriola* Wlk.
13. *C. uneta* Sw.
14. *C. artaxoides* M.
15. *C. dora* Swin.
16. *Agrotis ypsilon* Rott.
17. *Agrotis c—nigrum* L.
18. *A. triangularis* M.
19. *Euxoa segetis* Sch.
20. *Euxoa bicornica* Koll.
21. *Hadena consanguis* Guen. (= *Crateresta subterminata* H.)
22. *Trachea (Euplexia) indistans* Gr.
23. *Trachea consumata* Wlk.
24. *T. melanospila* Koll.
25. *Perigea (Euplexia) conducta* Wlk.
26. *Euplexia semifascia* Wlk.
27. *Euplexia metallica* Wlk.
28. *E. gemmifera* Wlk.
29. *Magusa tenebrosa* M.
30. *Aucha necteus* Wlk.
31. *Aucha minor* Hamp.
32. *Prodenia litura* Fab. (= *littoralis* Boisd).
33. *Spodoptera mauritia* Boisd.
34. *Amyna selenampha* Guen.
35. *Amyna octo* Guen.
36. *Eriopus recurvata* M.
37. *Laphygma exigua* Hubn.
38. *Athetis cognata* M.
39. *Athetis bremsa* Swin.
40. *A. fasciata* (M.).
41. *Catamecia furtiva* (Swin).
42. *Cirphis albistigma* M.
43. *Cirphis unipuncta* (Haw).
44. *C. vana* Swin.
45. *C. subsignata* M.
46. *C. moorei* Swin.
47. *C. loreyi* Dup.
48. *C. fragilis* But.
49. *C. micacea* Hamp.
50. *C. polemusa* Sw.
51. *Delta (Achmis) intermedia* (Brem).

CHAPTER 3

Insects

52. *Sesamia inferens* Wlk.
53. *Sesamia uniformis* Dudg.
54. *Chasmina cygnus* Wlk.
55. *Lithacodia (Hycloopsis) signifera* Wlk.
56. *Cytocanis denticulosa* Wlk.
57. *Megalodes insocia* Wlk.
58. *Tarache nitidula* Fab.
59. *Tarache upsilon* Wlk.
60. *Tarache opalinoides* Guer.
61. *Tarache catena* Sw.
62. *T. binominata* But.
63. *T. tropica* Guen.
64. *T. basifera* Wlk.
65. *T. embuta* Wlk.
66. *T. crocata* Guen.
67. *T. flavonigra* Sw.
68. *T. (Calloecia) swinhoei* But.
69. *Xanthoptera rubrifusa* Hmp.
70. *Earias fabia* Stoll.
71. *Earias insulana* Boisd.
72. *E. chromataria* Wlk.
73. *Gabala polyspilalis* Wlk.
74. *Neomilichia veprecola* Sw.
75. *Perigea specea* Guen.
76. *Perigea dolerosa* Wlk.
77. *Acontia graellsii* Feis.
78. *Acontia malvae* Esp.
79. *A. transversa* Guen.
80. *A. intersepta* Guen.
81. *Swinhoea vegeta* Swin.
82. *Metachrostis punctigera* Wlk.
83. *Metachrostis itwarra* Swin.
84. *M. badia* Swin.
85. *M. mallarba* Sw.
86. *M. uberosa* Sw.
87. *Periambia pulla* Sw.
88. *Naranga difusa* Wlk.
89. *Eublema rosita* Guen.
90. *Eublema divisa* M.
91. *Eublema abrupta* Wlk.
92. *E. trifasciata* M.
93. *E. parva* Hab.
94. *E. olivacea* M.
95. *E. albida* M.
96. *E. silicula* Sw.
97. *Zagira irrecta* Wlk.
98. *Zagira divisa* Wlk.

} Now transferred to Arctiidae.

CHAPTER 3

Insects

99. *Callyna siderea* Guen.
100. *Callyna jugaria* Wlk.
101. *C. costiplaga* M.
102. *Westermannia superba* Hubn.
103. *Plotheia celtis* M.
104. *Hyblaea puera* Cr.
105. *Hyblaea constellata* Guen.
106. *Homodes vivida* Guen.
107. *Barasa alopha* Hamp.
108. *Labanda semipars* Wlk.
109. *Blemina accipiens* Wlk.
110. *Argyrothripa occulta* Sw.
111. *Lophothripa vitea* Sw.
112. *Cletharra sceptica* Sw.
113. *Eutelia delabrix* Guen.
114. *Eutelia jacosatrix* Guen.
115. *E. nugatrix* Guen.
116. *E. apicifascia* Habn.
117. *E. flavillatrix* Wlk.
118. *Risoba obstructa* M.
119. *Odontodes aleuca* Guen.
120. *Stictoptera cuculioides* Guen.
121. *Churia arcuata* Wlk.
122. *Cosmophila (Anomis) flava* Fb.
123. *Cosmophila mesogona* Wlk.
124. *C. trilineata* M.
125. *C. fulvida* Guen.
126. *Carea subtilis* Wlk.
127. *Carea obsolescens* M.
128. *Beara dichromella* Wlk.
129. *Trisula variegata* M.
130. *Erygia apicalis* Guen.
131. *Ercheia cyttaria* Cr.
132. *Anisoneura selesbrosa* Guen.
133. *Spiredonia anops* Guen.
134. *Spiredonia feducia* Stoll.
135. *Catocala trisa* Sw.
136. *Nyctipao macrops* L.
137. *Nyctypao hieroglyphica* Dr.
138. *N. caprimulgus* Fab.
139. *N. crepuscularis* L.
140. *Polydesma quenevadi* Guen.
141. *Polydesma umbricola* Boisd.
142. *P. spessa* Guen.
143. *P. metaspila* Wlk.
144. *P. inangulata* Guen.
145. *P. ornata* M.

CHAPTER 3

Insects

146. *P. terminigera* Wlk.
147. *P. fraterna* M.
148. *Hylodes caramaea* Cr.
149. *Homoptera umbrina* Guen.
150. *Homoptera glaucinans* Guen.
151. *Panilla dispila* Wlk.
152. *Lyncestis amphix* Cr.
153. *Lyncestis unilinea* Sw.
154. *Catephia linteola* Guen.
155. *Catephia acronyctoides* Guen.
156. *C. inquieta* Wlk.
157. *Arcte cearulea* Guen.
158. *Sphingomorpha chlorea* Cr.
159. *Lacera alope* Cr.
160. *Achaea janata* L.
161. *Ophiusa illibata* Fab.
162. *Ophiusa palumba* Guen.
163. *O. dotata* F.
164. *O. mejanesi* Guen.
165. *O. arcuata* M.
166. *O. maturata* Wlk.
167. *O. renalis* Hamp.
168. *O. joviana* Cr.
169. *O. (Parallelia) algira* L.
170. *O. arctolaenia* Guen.
171. *O. conficiens* Wlk.
172. *O. (Parallelia) analis* Guen.
173. *O. crameri* M.
174. *O. onelia* Guen.
175. *O. (Anua) coronata* Jab.
176. *O. turrhaca* Cr.
177. *O. honesta* Hub.
178. *O. fulvotaenia* Guen.
179. *Serrodus inara* Cr.
180. *Sympis rufibasis* Guen.
181. *Buniana divulsa* Wlk.
182. *Buniana intorta* Swin.
183. *Bocula (Borsippa) pallens* M.
184. *Plecoptera reflexa* Cr.
185. *Plecoptera resistens* Wlk.
186. *P. erica* Sw.
187. *Acantholepis circumdatus* Wlk.
188. *Acantholepis trajectus* Wlk.
189. *A. inscitius* Sw.
190. *A. obeditalis* Walk.
191. *A. gemma* Swin.
192. *A. pansalis* Wlk.

CHAPTER 3
Insects

193. *Remigia archesia* Cr.
194. *Remigia frugalis* F.
195. *Trigonodes hyppasia* Cr.
196. *Trigonodes geometrica* F.
197. *T. stolidia* F.
198. *Entomogramma faultrix* Guen.
199. *E. tortum* Guen.
200. *Thermesia rubricans* Boisd.
201. *Thermesia bolinoides* Guen.
202. *Ischyja manlia* Cr.
203. *Platyja umminea* Cr.
204. *Episparis varialis* Wlk.
205. *Amphigonia hepatizans* Guen.
206. *Oxyodes scrobiculata* F.
207. *Hamodes orientica* Guen.
208. *Pleurona perhamata* Hamp.
209. *Spirama retorta* Cr.
210. *Spirama vespertilio* F.
211. *Ophideres salamina* F.
212. *Ophideres ancilla* F.
213. *O. fullonica* Linn.
214. *O. materna* Linn.
215. *O. hypermnestra* Cr.
216. *Calpe emarginata* Guen.
217. *Calpe minuticornis* Guen.
218. *Pseudocalpe angulifera* M.
219. *Arsacia saturalis* Wlk.
220. *Plusia furcifera* Wlk.
221. *Plusia eriosoma* Doub.
222. *P. obtusisigna* Wlk.
223. *P. orichalcea* F.
224. *P. agramma* Guen.
225. *Plusiodonta coelonota* Koll.
226. *Basilodes chryosticta* Hamp.
227. *Tinolus eburnigutta* Wlk.
228. *Calesia satellitia* M.
229. *Calesia dasypetra* Koll.
230. *Egnasia accingalis* Wlk.
231. *Capnodes ceylonica* Wlk.
232. *Raparna diagramma* Wlk.
233. *Raparna ochreipennis* M.
234. *R. imparata* Wlk.
235. *R. nigriceps* Hamp.
236. *R. tantilla* Sw.
237. *R. aenigmatica* Sw.
238. *Avitta surrigens* Wlk. (= *subsignans* Wlk.)
239. *Dierna strigata* M.

CHAPTER 3
Insects

240. *Simplicia marginata* M.
241. *Simplicia robustalis* Guen.
242. *Hydrillodes lentalis* Guen.
243. *Hydrillodes abavalis* Wlk.
244. *Nodaria extensalis* Guen.
245. *Nodaria fractalis* Guen.
246. *Catada suffuscalis* Sw.
247. *Dichromia erosia* Cr.
248. *Dichromia pullata* M.
249. *Rhynchina abductalis* Wlk.
250. *Rhynchina ferreipars* Hamp.
251. *R. parvularis* Sw.
252. *Hypena masuralis* Guen.
253. *Hypena lividalis* Hubn.
254. *H. mimicalis* Sw.
255. *H. iconicalis* Wlk.
256. *H. rectivittalis* M.
257. *H. abyssinialis* Guen.
258. *H. molpusalis* Wlk.
259. *H. obstupidalis* Sw.
260. *H. mandatalis* Wlk.
261. *H. nigrescens* M.
262. *H. indicatalis* Wlk.
263. *H. thermesialis* Wlk.
264. *H. ineffectalis* Wlk.
265. *H. thermophaea* Ham.

Fam. *Lymantriidae* (*Liparidae*) Tussock moths

1. *Laelia exclamationis* Koll.
2. *Laelia divestita* Wlk.
3. *L. testaceae* Wlk.
4. *Thiacidas postica* Wlk.
5. *Dasychira horsfieldi* Saund.
6. *Dasychira olearia* Sw.
7. *D. mendosa* Hab.
8. *D. inclusa* Wlk.
9. *D. securis* Hab.
10. *Lymantria incerta* Wlk.
11. *Lymantria ampla* Wlk.
12. *L. obsoleta* Wlk.
13. *L. beatrix* Stoll.
14. *L. viola* Sw.
15. *Euproctis lunata* Wlk.
16. *Euproctis guttata* Wlk. (= *flava* F.)
17. *E. fraterna* M.
18. *E. scintillans* Wlk.
19. *E. semisignata* Wlk.

CHAPTER 3

Insects

20. *E. flavinata* Wlk.
21. *E. varians* Wlk.
22. *E. digrama* Guer.
23. *Porthesia xanthorrhoea* Koll.
24. *Perina nuda* F
25. *Leucoma submarginata* Wlk.

Fam. *Hypsidae*

1. *Hypsa (Asota) alciphron* Cr.
2. *Hypsa sericea* M.
3. *H. (Aganais) ficus* F.
4. *Diagama hearsayana* M.
5. *Diagama marchali* Guer.
6. *Argina cribraria* Cl.
7. *Argina syringa* Cr.
8. *A. argus* Koll.
9. *Nyctemera lacticina* Cr.
10. *Nyctemera latistriga* Wlk.
11. *N. plagifera* Wlk.

Fam. *Sphingidae* (Hawk moths)

1. *Acherontia lachesis* F.
2. *Acherontia styx* Westw.
3. *Herse convolvuli* (Linn).
4. *Psilogramma menephron* Cr.
5. *Campsogene panopus* (Cr.)
6. *Leucophlebia emittens* Wlk.
7. *Polyptychus dentatus* (Cr.)
8. *Marumba dyras* Wlk.
9. *Cephonodes hylas* (Linn).
10. *Deilephila nerii* (Linn).
11. *Deilephila minima* (But).
12. *Nephele didyma* (F.).
13. *Gurelca hyas* (Wlk.).
14. *Celerio lineata livornica* (Esp.).
15. *Hippotion celerio* (Linn).

Fam. *Eupterotidae*

1. *Eupterote undata* Bl.
2. *Eupterote fabia* Cr.
3. *E. mollifera* Wlk.
4. *E. geminata* Wlk.
5. *E. undans* Wlk.
6. *E. translata* Sw.
7. *E. flavida* M.
8. *E. citrina* Wlk.
9. *Nisaga simplex* Wlk.
10. *Sangatessa subcurvifera* Wlk.

CHAPTER 3

Insects

Fam. *Notodontidae*

1. *Dudusa nobilis* Wlk.
2. *Phalera procera* Feld.
3. *Phalera raya* M.
4. *Turnaca acuta* Wlk.
5. *Anticyra combusta* Wlk.
6. *Antheua servula* Dr.
7. *Stauropus alternus* Wlk.
8. *Cerura liturata* Wlk.
9. *Ichthyura anachoreta* F.

Fam. *Geometridae*

1. *Thinopteryx crocoptera* Koll.
2. *Aplochloa vivilaca* Wlk.
3. *Plutodes transmutata* Wlk.
4. *Scardenia metallaria* Guen.
5. *Stegania urbica* Sw.
6. *Prionia rondelaria* F.
7. *P. incitata* Wlk.
8. *Luxiaria contigaria* Wlk.
9. *Macaria frugaliata* Guen.
10. *Macaria fasciata* F.
11. *M. inchota* Wlk.
12. *M. nora* Wlk.
13. *M. elvirata* Guen.
14. *M. sufflata* Guen.
15. *M. pervolgata* Wlk.
16. *M. emersaria* Wlk.
17. *Tephрина disputaria* Guen.
18. *Tephрина catalaunaria* Guen.
19. *Orsonoba clelia* Cr.
20. *Hyposidra talaca* Wlk.
21. *Hyposidra successaria* Wlk.
22. *Dilinia medardaria* Her & Seh.
23. *Dilinia capitata* Wlk.
24. *Hyperythra lutea* Cr. (*rufifimbria* Warr.)
25. *Biston varianaria* Sw.
26. *Boarmia bhurmitra* Wlk.
27. *Boarmia cornaria* Guen.
28. *B. contactaria* Wlk.
29. *B. acaciaria* B.
30. *B. sublavararia* Guen.
31. *B. infexaria* Wlk.
32. *B. hybernaria* Sw.
33. *Medasina objectaria* Wlk.
34. *Eumelea rosalia* Cr.
35. *Rambara infelix* Sw.

CHAPTER 3
Insects

36. *Sauris postalba* Hamp.
37. *Cambogia grataria* Wlk.
38. *Craspedia (Scopula) fluidaria* Sw.
39. *Craspedia nictata* Guen.
40. *C. addictaria* Wlk (=pulchellata F.)
41. *C. idearia* Sw.
42. *C. adeptaria* Wlk.
43. *C. fibulata* Guen.
44. *C. actuaria* Wlk.
45. *C. remotata* Guen.
46. *C. conscensa* Sw.
47. *Acidalia (Sterrha) chotaria* Sw.
48. *Acidalia testacea* Sw.
49. *A. bilinea* Sw.
50. *A. volutaria* Sw.
51. *Anysephyra albannularia* Wlk.=(*Ephyra invexata* Wlk.)
52. *Anisodes obrinaria* Guen.
53. *Anisodes obstataria* Wlk.
54. *Gnamptolonia aventiaria* Guen.
55. *Trygodes divisaria* Wlk.
56. *Problepsis deliaria* Guen.
57. *Problepsis delphiaria* Guen.
58. *Somatina anthophilata* Guen.
59. *Euschema (Dysphania) Palmyra* Stoll.
60. *Euschema percota* Sw.
61. *Pseudoterpna ruginaria* Guen.
62. *Pseudoterpna chlora* Cr.
63. *P. (Terpna) similis* M.
64. *Agathia lycaenaria* Koll.
65. *Agathia lactata* F.
66. *Euchloris (Cocochloris) uvidula* Sw.
67. *Euchloris quantula* Sw.
68. *Nemoria (Chlorissa) solidaria* Guen.
69. *Nemoria (Cornibaena) detenta* W.
70. *N. directa* Wlk.
71. *Euchrostes disparata* Wlk. (*Hemithea punctifimbria* War.)
72. *Euchrostes (Pyrrhachis) pyrrhogona* Wlk.
73. *Mexates coelataria* Wlk.
74. *Thalassodes quadraria* Guen.
75. *Thalassodes (Lophomachia) semialba* Wlk.
76. *T. (Gelasma) acutissima* Wlk.
77. *T. (Diplodesma) obnupta* Sw.

Fam. *Saturnidae* (Wild silk moths)

1. *Actias selene* Hubn.
2. *Attacus atlas* Linn.
3. *Attacus ricini* Boisd.

CHAPTER 3
Insects

4. *Antheraea paphia* Linn.
5. *Cricula trifenestrata* Helf.
Fam. *Bombycidae* (Silk worms)
1. *Bombyx mori* Linn.
2. *Ocinara varians* Wlk.
Fam. *Uranidae*
1. *Micronia aculeata* Guen.
Fam. *Epiplemidæ*
1. *Orudiza protheclaria* Wlk.
2. *Epiplema instabilata* Wlk.
3. *Dirades theclata* Guen.
4. *Gathynia miraria* Wlk.
Fam. *Psychidae* (Bag or Case worm moths)
1. *Clania crameri* Westw.
2. *Acanthopsyche (Oeceticoides) bipars* Wlk.
Fam. *Arbelidae*—*Inderbelidae* (Bark caterpillars)
1. *Arbela (Inderbela) tetraonis* M.
Fam. *Cossidae* (Goat or Carpenter moths)
1. *Cossus acronyctoides* M.
2. *Duomitus leuconotus* Wlk.
3. *Azygophleps pusilla* Wlk.
Fam. *Lasiocampidae*
1. *Taragama dorsalis* Wlk.
2. *Taragama siva* Lef.
3. *Suana concolor* Wlk.
4. *Metanastria hyrtaca* Cr.
5. *Trabala vishnu* Lef.
6. *Lenodora signata* M.
7. *Estigena pardalis* Wlk.
Fam. *Limacodidae (Cochliidiidae)*
1. *Thosia cana* Wlk.
2. *Natada velutina* Koll.
3. *Contheyla propexa* Sw.
4. *Miresa albipuncta* Her. Sch.
5. *Miresa metathermistis* Hamp.
6. *Parasa lepida* Cr.
7. *Parasa hilaris* Westw.
8. *P. bicolor* Wlk.
9. *Altha nivea* Wlk.
10. *Altha peralba* Swin.

CHAPTER 3

Insects

Fam. *Zygaenidae*

1. *Heterusia virescens* But.
2. *Chalcusia affinis* Guen.

Fam. *Drepanidae*

1. *Phalacra vidhisara* Wlk.
2. *Orecta extensa* Wlk.

Fam. *Thyrididae*

1. *Strigina scitaria* Wlk.
2. *Dixoa albatalis* Sw.
3. *Rhodoneura myrsusalis* Wlk.
4. *Rhodoneura myrtaca* Dr.
5. *R. ferrofusa* Hamp.
6. *Hypolamprus striatalis* Sw.
7. *Dysodia ignata* Wlk.

Fam. *Pyalidae*

1. *Lamoria planalis* Wlk. (= *Pempelia adeptilla* Wlk.)
2. *Galleria melonella* L. (= *Vindana obliquella* Wlk.)
3. *Crambus nigriciliellus* Zell.
4. *Platytes trichialis* Hamp.
5. *Platytes ictericalis* Sw.
6. *Eromene ocella* Haw.
7. *Chilo simplex* But. (*zonellus* Sw.)
8. *Surattha invectalis* Wlk.
9. *Ancylolomia chrysographella* Koll.
10. *Ancylolomia saundersiella* Zell.
11. *Charltona Kala* Sw.
12. *Charltona cervinella* M.
13. *C. bivitella* M.
14. *C. inconspicua* M.
15. *Niphopyralis albida* Hamp.
16. *Scirpophaga auriflua* Zell.
17. *Scirpophaga monostigma* Zell.
18. *Schoenobius bipunctifer* Wlk.
19. *Cirrhochrista brizalis* Wlk.
20. *Anerastia brunneovitella* Rag.
21. *Ponjadia* (*Saluria*) *paucigraphella* Rag.
22. *Polyocha* (*Monoctenocera*) *aurifusella* Wlk.
23. *Polyocha depressella* Sw. (= *saccharella* Dud.)
24. *Ephestia cautella* Wlk.
25. *Homoesoma fuscilla* Rag.
26. *Ancylosis* (*Eurozopherodes*) *niveicostella* Ham.
27. *Nephoteryx praetextalla* Chr.
28. *Nephoteryx akbarella* Reg.

CHAPTER 3

Insects

29. *Epicrosis aegnusalis* Wlk.
30. *Epicrosis lateritialis* Wlk.
31. *Phycita infusella* Meyr.
32. *Phycita clientella* Zell.
33. *Rhodophaea actiocella* Wlk.
34. *Tephros inanitilla* Rag.
35. *Etiella zinckenella* Treit.
36. *Orthaga roseiplaga* Hamp.
37. *Endotricha mesenterialis* Wlk.
38. *Diplopseustis perieresalis* Wlk.
39. *Hypsopygia mauritialis* Boisd.
40. *Hypsopygia olivalis* Sev.
41. *Pyrallis recisalis* Sw.
42. *Stemotophora bicoloralis* Leech.
43. *Tamraca torridalis* Led.
44. *Herculia tenuis* But.
45. *Herculia suffusalis* Wlk.
46. *Euryzona latifascia* Hamp.
47. *Triphassa xylinalis* Sw.
48. *Omphalocera accerseta* Sw.
49. *Sacada rufina* Hamp.
50. *Paractenia rubicundalis* Sw.
51. *Paractenia quisqualis* Sw.
52. *Bostra vibicalis* Led.
53. *Loryma recusata* Wlk.
54. *Tydis hypotialis* Sw.
55. *Discordia evulsa* Sw.
56. *Nymphula affinalis* Guen.
57. *Nymphula dimunitalis* Sn.
58. *N. depunctalis* Guen.
59. *Cataclysta blandialis* Wlk.
60. *Olacodes colonialis* Guen.
61. *Talanga sexpunctalis* M.
62. *Bradina admixtalis* Wlk.
63. *Scoparia phacalis* Hamp.
64. *Zinckenia fascialis* Hamp.
65. *Eurrhyarodes bracteolalis* Zell.
66. *Agrotera basinotata* Hamp.
67. *Aetholix flavibasalis* Guen.
68. *Pagyda salvalis* Wlk.
69. *Cnaphalocrosis medinalis* Guen.
70. *Marasmia venilialis* Wlk.
71. *Marasmia trapizalis* Guen.
72. *Syngamia abruptalis* Wlk.
73. *Syngamia latimarginalis* Wlk.
74. *S. floralis* Zell.
75. *Bocchoris incisalis* Snell.

CHAPTER 3

Insects

76. *Bocchoris onychinalis* Guen.
77. *B. acamasalis* Wlk.
78. *Ulopeza idyalis* Wlk.
79. *Caprinia conchylalis* Guen.
80. *Filodes fulvidorsalis* Hubn.
81. *Nevrina procopia* Cr. (= *Euglyphis falsalis* Sw.)
82. *Dichocrosis punctiferalis* Guen.
83. *Dichocrosis festivalis* Sw.
84. *D. nigrilinealis* Wlk.
85. *Nacoleia barcalis* Wlk.
86. *Nacoleia niphealis* Wlk.
87. *N. scilalis* Sw.
88. *Botyodes asialis* Guen.
89. *Sylepta sabinusalis* Wlk.
90. *Sylepta* (*Pyrallis*) *derogata* Fab.
91. *S. aurantiacalis* Fisc.
92. *S. lunalis* Wlk.
93. *S. tentalis* Led.
94. *S. arclalis* Guen.
95. *Lygropia quaternalis* Zell.
96. *Lygropia amyntusalis* Wlk.
97. *Agathodes ostentalis* Hub.
98. *Glyphodes* (*Margaronia*) *laticostalis* Guen.
99. *Glyphodes caprinodes* Hamp.
100. *G. negatalis* Wlk.
101. *G. psittacalis* Hub.
102. *G. vertumnalis* Guen.
103. *G. glauculalis* Guen.
104. *G. glaucus* Guen.
105. *G. pomonalis* Guen.
106. *G. celsalis* Wlk.
107. *G. bivitalis* Guen.
108. *G. canthusalis* Wlk.
109. *G. pyloalis* Wlk.
110. *G. bicolor* Swain.
111. *G. indica* Saund.
112. *Pygospila tyres* Cr.
113. *Pygospila costiflexalis* Guen.
114. *Euclasta defamatalis* Wlk.
115. *Lepyrodes neptis* Cr. (*perspicata*) Fab.
116. *Lepyrodes geometralis* Guen.
117. *Analyta melanopalis* Guen.
118. *Leucenodes orbonalis* Guen.
119. *Crocidolonia binotalis* Zell.
120. *Helula undalis* F.
121. *Sameodes cancellalis* Zell.
122. *Thliptocera cascata* Sw.

FAUNA

CHAPTER 3

Insects

123. *Archernis tropicalis* Wlk.
124. *Isocentris filalis* Guen.
125. *Maruca testulalis* Gey.
126. *Pachynoa spilosomoides* M.
127. *Pachynoa pectinicornalis* Guen.
128. *Pachyzancla phoeopteralis* Guen.
129. *Pachyzancla stultalis* Wlk.
130. *Phlyclaenodes massalis* Wlk.
131. *Antigastra catalaunalis* Dup.
132. *Protrigonia zizanalalis* Sw.
133. *Noorda blilealis* Wlk.
134. *Melasia Sabulosalis* War.
135. *Pionia* (*Hapalia*) *ablactalis* Wlk.
136. *Pyrausta* (*Hapalia*) *coclesalis* Wlk.
137. *Pionia* (*Hapalia*) *phoenicealis* Hub.
138. *Pyrausta* (*Hapalia*) *machoeralis* Wlk.
139. *Pyrausta fuscalis* Warr.
140. *P. incoloralis* Guen.
141. *Tegostoma comparale* Hub.
142. *Noctuelia floralis* Hub.

Fam. *Sesiidae* (*Aegeriidae*) Clearwings

1. *Ceretocorema postcristatum* Hamp.
2. *Melithia eurytion* Westw.
3. *Melithia chalciformis* F.

Fam. *Tineidae* (*Microlepidoptera*)Sub-family *Pterophoridae*

1. *Buckleria xerodes* Meyr.
2. *Buckleria wahlbergi* Zell.
3. *Sphenarches caffer* Zell.
4. *Platyptilia pusillidactyla* Wlk.
5. *Stenoptilia zophodactyla* Dup.
6. *Exelastis liophanes* Meyr.
7. *Exelastis atomosa* Wlsm.
8. *Steganodactyla concursa* Wlm.

Sub-fam. *Carposinidae*

9. *Meridarchis reprobata* Meyr.

Sub-fam. *Gelechiidae*

10. *Sitotroga cerealella* Oliv.
11. *Stomopteryx nerteria* M.
12. *Gnorimoschema heliopa* L.
13. *Phthorimaea blapsigona* M.
14. *Phthorimaea operculella* Zell.

CHAPTER 3

Insects

15. *Platyedra gossypiella* Saund.
16. *Lecithocera crypsilychna* Meyr.
17. *Trichotaphe geochrota* Meyr.
18. *Anarsia ephippias* Meyr.
19. *Melasina isopoda* Meyr.

Sub-fam. *Oecophoridae*

20. *Tonica zizyphi* S.
21. *Hypatima doleropa* Meyr.

Sub-fam. *Zyloryctidae*

22. *Nephantis serinopa* Meyr. (Black headed caterpillar).
23. *Amorbaea hepatica* Meyr.
24. *Odites centrias* Meyr.
25. *Odites spoliatrix* Meyr.

Sub-fam. *Hyponomeutidae*

26. *Hyponomeuta malinellus* Zell.
27. *Atteva fabriciella* Sw.

Sub-fam. *Graciliariidae*

28. *Acrocercops syngamma* Meyr.
29. *Acrocercops bifrenis* Meyr.
30. *Cyphosticha coerulea* Meyr.
31. *Gracillaria soyella* van Des.

Sub-fam. *Plutellidae*

32. *Plutella maculipennis* Curt.
33. *Phycodes radiata* Och.

Sub-fam. *Lyonetiadae*

34. *Opogona lachanitis* Meyr.
35. *Pylaetis mimosae* Stain.
36. *Phyllocnistis citrella* St.
37. *Phyllocnistis toparcha* Meyr.

Sub-fam. *Tineidae*

38. *Setomorpha insectella* Fb.
39. *Tinea pellionella* L.
40. *Trichophaga abruptella* Woll.
41. *Monopis monachella* Hubn.

Fam. *Hepialidae* (Swift moths)

1. *Phassus aboe* M. (=salsettensis M.)

Order : Trichoptera (Caddis flies)

Fam. *Calamoceratidae*

1. *Asotocerus flexuosus* Mart.
2. *Anisocentropus kempii* Mart.

Fam. *Molannidae*

1. *Montanna* sp.

Fam. *Leptoceridae*

1. *Cetodes postica* Banks.
2. *S. furcata* Nav.
3. *S. viridella* Nav.
4. *Oecetis insignis* Bank.
5. *O. punctulata* Nav.
6. *O. rufescens* Nav.

Fam. *Sericostomatidae*

1. *Goera nigricornis* Nav.
2. *Ignasata fuscata* Nav.
3. *Maniconeura indica* Mart.

Order : Diptera (Flies)

Sub-order *Nematocera*Fam. *Tipulidae*

1. *Pselliophora laeta* F.
2. *Pachyrhina bombayensis* Mae.

Fam. *Psychodidae* (Moth flies, Sand flies)

1. *Phlebotomus minutus* Rond.
2. *P. argentipes* An. Br.
3. *P. papatasii* Scop.

Fam. *Culicidae* (Mosquitoes)

1. *Anopheles aiteni* Jam.
2. *Anopheles culiciformis* Cog.
3. *A. hyrcanus* var. *nigerrimus* Giles.
4. *A. barbirostris* van. W.
5. *A. tassellatus* Thao.
6. *A. culicifacies* Giles.
7. *A. fluviatilis* Jam.
8. *A. minutus* Theo.
9. *A. aconitus* Don.
10. *A. jeyporiensis* Jam.
11. *A. subpictus* Gras.
12. *A. vagus* Don.
13. *A. turkhudi* List.
14. *A. moghulensis* Chr.
15. *A. stephensi* List.
16. *A. maculatus* Theo.
17. *A. theobaldi* G.
18. *A. Karwari* Ja.
19. *A. jamesi* Theo.

CHAPTER 3
Insects

20. *A. splendidus* Koid.
 21. *A. annularis* Van. W.
 22. *A. pullidus* Theo.
 23. *Aedes aegypti* Dya.
 24. *Culex concolor* R. V. D.
 25. *Culex fasciata* F. (= *rossii* Gel.)
 26. *C. tritaeniorhynchus* Gil.
 27. *C. tigripes* Gr. & Ch.
 28. *C. fatigans* Weid.
 29. *C. trimaculatus* Theo.
- Fam. *Cecidomyiidae*—*Itomididae* (Gall midges)
1. *Dasyneura gossypii* Felt.
 2. *Asphondylia sesami* Felt.
 3. *Contarinia andropogonis* F.
 4. *Pachytiplosis oryzae* (Wood M.) Mani.
- Fam. *Bibionidae*
1. *Plecia fulvicollis* F.
- Fam. *Simuliidae*
1. *Simulium rufithorax* Br.
 2. *Simulium auriohirtum* Brun.
- Fam. *Ceratopogonidae* (Biting midges)
1. *Bezzia vaga* Kief.
 2. *Bezzia hamifera* Kief.
 3. *Culicoides oxystoma* Kief (= *schultzei* End.)
- Sub-order Brachycera
- Fam. *Stratiomyidae*
1. *Wallacea argentia* Dol.
 2. *Evaza indica* Kert.
 3. *Sargus metallinus* F.
 4. *Microchrysa flaviventris* Wied.
- Fam. *Tabanidae* (Horse & Cattle flies, Gad flies, Clegs)
1. *Tabanus rubidus* Wied.
 2. *Tabanus speciosus* Ric.
 3. *T. indianus* Ric.
 4. *T. abconicus* Wlk.
 5. *T. subhirtus* Ric.
 6. *T. striatus* Fab. (= *hilaris* W. *partitus* W.)
 7. *Haematopota rosalis* Fab.
 8. *Haematopota montana* Ric.
 9. *H. cana* Wlk.
 10. *H. bilineata* Ric.
 11. *H. inconspicua* Ric.

CHAPTER 3
Insects

12. *H. immaculata* Ric.
 13. *Corizoneura taprobanes* Wlk.
 14. *Chrysops dispar* F.
- Fam. *Nemestrinidae* (Hirmoneuridae)
1. *Hieroneura annandalei* Lich.
- Fam. *Cyrtidae* (= *Acroceridae*)
1. *Oncodes octomaculatus* Brun.
- Fam. *Therevidae*
1. *Phycus brunneus* Wied.
- Fam. *Bombyliidae* (Bee flies)
1. *Hyperalonia sphinx* F.
 2. *Hyperalonia semifuscata* Br.
 3. *Exoprosopa lar* F.
 4. *Exoprosopa lateralis* Br.
 5. *E. insulata* Wlk.
 6. *E. vitripennis* Brun.
 7. *E. vitrea* Big.
 8. *Argyramoeba distigma* Wied.
 9. *Argyramoeba gastroa* Br.
 10. *A. argentiapicalis* Brun.
 11. *A. nigrofemorata* Brun.
 12. *Anthrax afra* F.
 13. *Bombylius wulpi* Brun.
 14. *Bombylius comastes* Brun.
 15. *B. fulvipes* Big.
 16. *Geron argentifrons* Brun.
 17. *Geron albescens* Brun.
- Fam. *Empidae*
1. *Syneches fuscipennis* Brun.
 2. *Acarterus pallipes* Bez.
 3. *Hybos bisetosus* Bez.
 4. *Drapetis discoidalis* Bez.
 5. *Elaphropeza variegata* Brun.
- Fam. *Dolichopodidae*
1. *Dolichopus saphirus* Beck.
 2. *Paraclius pilosellus* Beck.
 3. *Paraclius nudus* Beck.
 4. *Hereostomus compositus* Beck.
 5. *Tachytrochus salinarius* Beck.
 6. *Medetera grisescens* Meij.
 7. *Diaphorus mandarinus* Wied.
 8. *Sympienus bisuleus* Beck.
 9. *Chrysosoma leucopogon* Wied.

CHAPTER 3

Insects

Fam. *Pipunculidae*

1. *Pipunculus limpidipennis* Br.

Fam. *Syrphidae* (Hoverflies)

1. *Paragus serratus* F.
2. *Syrphus balteatus* De Geer.
3. *Sphaerophora indiana* Big.
4. *Baccha pulchrefrons* Aust.
5. *Eristalis taphicus* Wied.
6. *Eristalis obscuritarsis* de. M.
7. *Megaspis crassus* F.
8. *Xylota bistriata* Brun.
9. *Syretta rufifacies* Big.
10. *Eumerus aurifrons* Wied.
11. *Ceria trinotata* de Meij.
12. *Ceria eumenioides* Saund.

Fam. *Conopidae*

1. *Oecemyia flavipes* Brun.

Fam. *Trypetidae* (Fruit flies)

1. *Dacus longistylus* Wied.
2. *Dacus brevistylus* Bez.
3. *D* (= *Chaetodacus*) *cucurbitae* Coq.
4. *D. diversus* Coq.
5. *D. ferrugineus* F.
6. *D. zonatus* Saund.
7. *Carpomyia vesuviana* Bez.
8. *Carpodoxantha octopunctata* Bez.

Fam. *Agromyzidae*

1. *Agromyza obtusa* M.
2. *Agromyza phaseoli* C.
3. *Ophiomyia lantanae* F.

Fam. *Micropezidae*

1. *Calobata* sp.

Fam. *Chloropidae* (Eye flies)

1. *Siphunculina funicola* M.
2. *Formosina flavipes* M.
3. *Chalcidomyia atricornis* M.

Fam. *Oestridae* (Bot flies and Warble flies)

1. *Oestrus ovis* L.
2. *Gastrophilus equi* Cl.

Fam. *Calliphoridae*

1. *Lucilia papuensis* Macq.
2. *Lucilia sericata* (Meig.)
3. *L. cuprina* (Wied.)
4. *Bengalia jejuna* (Fab.)
5. *Bengalia lateralis* Macq.
6. *B. bezzi* Sr. Wh.
7. *Polenia asiatica* (Sr. Wh.)
8. *Strongyloneura pseudonebulosa* Sr. Wh.
9. *Metallia pollinosa* (Toa.)
10. *Rhina testacea* Rob.
11. *Sarcophaga albiceps* Meig.
12. *Sarcophaga hirtipes* Wied.
13. *S. orientoides* Sr. Wh.
14. *S. futilis* Sr. Wh.
15. *S. martellata* Sr. Wh.
16. *S. dux* Thom.
17. *S. fuscicauda* Boll.

Fam. *Tachinidae*

1. *Actia aegyptia* Vill.
2. *Actia hyalinata*.
3. *Carcelia baitenzorgiensis*.
4. *Carcelia kockiana*.
5. *C. sumatrensis*.
6. *C. concinnata*.
7. *Erycia nymphalidophaga*.
8. *Eutachina civiloides*.
9. *Exorista quadrimaculata*.
10. *Gonia cinerascens*.
11. *Masicera oculata*.
12. *Ptychomyia remota*.
13. *Thrycolyga sorbilans*.
14. *Winthemia albiceps*.

Fam. *Muscidae*

1. *Musca vicina* Macq.
2. *Musca domestica* L.
3. *M. nebulo* F.
4. *M. sorbens* Wied.
5. *M. vetustissima* Wlk.
6. *M. ventrosa* Wied.
7. *M. planiceps* Wied (= *formosana* Mall.)
8. *M. bezzi* Pat & Cr.
9. *M. crassirostris* Stein.
10. *Pyrellia proferens* Wlk.
11. *Bolellolarynx sanguinentus* Aust.
12. *Stomoxys calcitrans* L.

CHAPTER 3

Insects

CHAPTER 3

Insects

13. *Lyperosia exigua* Meij.
14. *Haematobia sanguinolenta* Aust.
15. *Dichaetomyia simulans* (Stern).
16. *Dichaetomyia nubiana* (Bigot).
17. *Dichaetomyia pallens* (Stun).
18. *Xenosia steini* V. E.
19. *Xenosia sordida* (St.)
20. *Graphomyia stipata rufitibia* St.
21. *Atherigona indica* M. (Anthomyiad fly).
22. *Passeromyia heterochaeta* (Vill).

Fam. *Hippoboscidae*

1. *Hippobosca maculata* Lch.
2. *Hippobosca capensis* Olf.
3. *Lynchia* (*Pseudolynchia*) *exornata* Sp.

Fam. *Nycteribiidae*

1. *Penicellidia jenynsi* (Westw) *indica*.
2. *Penicellidia bothyra*—*fletcheri* var. *pumela* (Scot).
3. *Nycteribia* (*Listropodia*) *allotopa* (Scot).
4. *Nycteribia parvula* Sp.
5. *N* (*Stylidia*) *annandalei* Scot.
6. *N* (*Acrocholidia*) *euxesta* (Sp.).
7. *Cyclopodia* (*Paracyclopodia*) *roylei* Westw.
8. *Paracyclopodia sykensis* Westw.

Order Siphonaptera (Aphaniptera) Fleas

Fam. *Pulicidae*

1. *Xynopsylla cheopis* (Roth).
2. *Xynopsylla astia* Roth.
3. *Xynopsylla brasiliensis* (Bak.)
4. *Ctenocephalus felis* (Bon.)
5. *Ctenocephalus felis orientis* Jord.

Order Hymenoptera

Sub-order Symphita

Fam. *Tenthredinidae*

1. *Athalia proxima* Klug.

Sub-order Apocrita

Fam. *Ichneumonidae*

1. *Echthromorpha notulatoria* F.
2. *Xanthopimpla pedator* F.
3. *Xanthopimpla nursei* Cam.
4. *X. candiensis* Cam.
5. *X. punctata* F.
6. *Orientotheronea maculipes* M.

CHAPTER 3

Insects

7. *Syzeuctus zanthorius* Cam.
8. *Metopius pulchripes* Cam.
9. *Metopius rufus* Cam.
10. *Bassus multicolor* Grav.
11. *Bassus clotho* Morl.
12. *Colpotrochia pilosa* Cam.
13. *Paniscus testaceus* Grav.
14. *Paniscus orientalis* Cam.
15. *Ophion asiaticus* Kok.
16. *Stauropodoctonus orientalis* Mor.
17. *Henicospilus* (*Enicospilus*) *flavicaput* Marl.
18. *Henicospilus merdarius* Gr.
19. *H. melanocampus* Cam.
20. *H. atricornis* Morl.
21. *H. orientalis* Cam.
22. *H. horsfieldi* Cam.
23. *Nototrachys foliator* F.
24. *Charops obtusus* Morl.
25. *Campoplex perditor* Forst.
26. *Diocles debilis* Morl.
27. *Diocles argenteopilosa* Cam.
28. *Pristomerus testaceus* Morl.
29. *Cratocryptus rufepes* Cam.
30. *Melcha nursei* Cam.
31. *Friona octobalteata* Cam.

Fam. *Braconidae*

1. *Iphiaulax spilocephalus* Cam.
2. *Microdus fumipennis* Cam.
3. *Microdus tuberculatus* Cam.
4. *Apanteles glomeratus* L.
5. *Apanteles chiloceda* R.
6. *A. (Urogaster) indicus* Cam.
7. *A. depressariae*.
8. *Rhogas lefroyi* D. & G. (*testaceus*) D. G.
9. *Microbracon lefroyi* D. G. (*greeni* Ash).

Fam. *Stephanidae*

1. *Wroughtonis cornuta* Cam.

Fam. *Evanidae*

1. *Evania antennalis* Westw.
2. *Evania apendigaster* (L.) Fab.
3. *Trichofoenus corynetes* Kief.

Fam. *Chalcididae*

1. *Leucospis bombayensis* Mani.
2. *Oncochalcis nursei* Cam.
3. *Brachymeria eccentricis* Cam.

CHAPTER 3

Insects

Fam. *Elasmidae*

1. *Elasmus anticles* Wlk.

Fam. *Chrysididae* (*Chrysididae*)

1. *Hedychridium wroughtoni* du Buy.
2. *Hedychridium rugosum* Sm.
3. *Chrysogona pumila* Klug.
4. *Stilbum cyanurum splendidum* F.
5. *Chrysis wroughtoni* du Buy.
6. *Chrysis bayadera* du Buy.
7. *C. dissimilanda* du Buy.
8. *C. oblitterata* Moc.
9. *C. speculata* du Buy.
10. *C. fuscipennis* Brul.
11. *C. cotesi* du Buy.
12. *C. saraksensis* Rad.
13. *C. libita* du Buy.
14. *C. bengalensis* Mocs.
15. *C. lusea* F.
16. *C. orientalis* Guer.
17. *C. schioedtei* Dadl.
18. *C. principalis* Sm.

Fam. *Scoliidae*

1. *Tiphia rufofemorata* Sm.
2. *Tiphia fulvohirta* Cam.
3. *Iswara luteus* Westw.
4. *Myzine dimidiata* Guer.
5. *Myzine madraspatana* Sm.
6. *M. bengalensis* Cam.
7. *M. petiolata* Sm.
8. *Scolia auriopennis* Lep.
9. *Scolia bilunata* Sauss.
10. *S. quadripustulata* F. var. *binotata* F.
11. *S. vivida* Sm.
12. *Elis eregone* Bing.
13. *Elis rubromaculata* Sm.
14. *E. ceylonica* Kirb.
15. *E. fumbriata* Klug.
16. *E. reticulata* Cam.
17. *E. thoracica* F.
18. *E. asiatica* Sauss.
19. *Liacos analis* F.

Fam. *Mutillidae*

1. *Mutilla lilliputiana* Andr.
2. *Mutilla pulchriceps* Cam.
3. *M. niveosignata* Andr.

CHAPTER 3

Insects

4. *M. dimidiata* Lep.
5. *M. colabensis* Andr.
6. *M. wroughtoni* Cam.
7. *M. pulla* Andr.
8. *M. constancae* Cam.
9. *M. budha* Cam.
10. *M. trimaculata* Cam.
11. *M. argenteomaculata* Sm.
12. *M. sexmaculata* Swed.
13. *M. serratula* Cam.
14. *M. maculiceps* Andr.
15. *M. arenaria* Fab.
16. *M. nudiceps* Andr.
17. *M. erythroceras* Cam.
18. *M. aurifex* Sm.
19. *M. placida* Sm.
20. *M. veda* Red.
21. *M. lunarifasciata* Andr.
22. *M. poonaensis* Cam.
23. *M. auropalliata* Andr.
24. *M. pulchriventris* Cam.
25. *M. argentipes* Sm.
26. *M. provida* Cam.
27. *M. pedunculata* Klug.
28. *M. valida* Cam.
29. *M. nobilis* Sm.
30. *M. emeryi* Magr.
31. *M. regia* Sm.
32. *M. indefensa* Cam.
33. *M. spinulosa* And.
34. *M. phaola* Cam.
35. *M. foveiscutis* Cam.

Fam. *Formicidae* (Ants)

1. *Dorylus labiatus* Shuck.
2. *Dorylus orientalis* Westw.
3. *Aenictus ambiguus* Sp.
4. *Aenictus westwoodi* For.
5. *A. shuckardi* For.
6. *A. latiscapus* For.
7. *A. wroughtoni* For.
8. *A. fergusonii* For.
9. *A. aitkeni* For.
10. *A. punensis* For.
11. *A. clavatus* For.
12. *Lioponera longitarsus* Mag.
13. *Lioponera parva* For.

CHAPTER 3

Insects

14. *Cerapachys aitkeni* For.
15. *Stigmatomma belli* For.
16. *Anochetus sedilloti* Em.
17. *Anochetus laytori* For.
18. *A. kanariensis* For.
19. *Drepanognathus saltator* Jer.
20. *Lobopelta dentilobis* For.
21. *Lobopelta diminuta* Sm.
22. *L. hysterica* For.
23. *L. dalyi* For.
24. *L. chinensis* Mayr.
25. *Diacamma vagans* Sm.
26. *Ponera confines* Rog.
27. *Ponera gleadowi* For.
28. *Bothroponera sulcata* Fr.
29. *Bothroponera rubiginosa* Em.
30. *B. rufipes* Jer.
31. *Mesoponera melanaria* Em.
32. *Sima rufonigra* Jer.
33. *Sima nigra* Jer.
34. *S. allaborans* Wlk.
35. *S. binghami* For.
36. *Myrmecaria brunnea* Saund.
37. *Crematogaster wroughtoni* For.
38. *Crematogaster contemplata* May.
39. *C. ebenina* For.
40. *C. soror* For.
41. *C. eberrans* For.
42. *C. dalyi* For.
43. *C. rothneyi* May.
44. *C. rogenhoferi* May.
45. *C. perelegans* For.
46. *Solenopsis geminata* F.
47. *Phidologiton diversus* Jer.
48. *Phidologiton affinis* Jer.
49. *P. lamellifrons* For.
50. *Meranophus bicolor* Guer.
51. *Meranophus belli* For.
52. *Triglyphothrix walshi* For.
53. *Triglyphothrix obesa* Er. And.
54. *Tetramorium wroughtoni* For.
55. *Tetramorium guineense* F.
56. *T. smithi* May.
57. *T. belgaense* For.
58. *Monomorium wroughtoni* For.
59. *Monomorium indicum* For.
60. *M. atomus* For.

CHAPTER 3

Insects

61. *M. destructor* Jer.
62. *M. floricola* Jer.
63. *M. latinode* May.
64. *Phidole naorojii* For.
65. *Phidole hoogwerfi* For.
66. *P. latinoda* Rog.
67. *P. sykesi* For.
68. *P. woodmasoni* For.
69. *P. rhombinoda* May.
70. *P. striativentris* May.
71. *P. multicens* For.
72. *P. indica* May.
73. *Aphaenogaster beccasii* Em.
74. *Holcomyrme creniceps* May.
75. *Holcomyrme scabriceps* May.
76. *Holcomyrme glabber* Andr.
77. *Trigonogaster recurvispinosa* For.
78. *Cardiocondyla wroughtoni* For.
79. *Cardiocondyla parvinoda* For.
80. *Dolicoderus taprobanae* Sm.
81. *Iridomyrmex inceptus* Rog.
82. *Iridomyrmex globus* May.
83. *Technomyrmex albipes* Sm.
84. *Technomyrmex brunneus* For.
85. *Tapinoma melanocephalum* F.
86. *Tapinoma indicum* For.
87. *Bothriomyrmex myops* For.
88. *Bothriomyrmex dalyi* For.
89. *B. wroughtoni* For.
90. *Oecophylla smaragdina* F.
91. *Acantholepis capensis* May.
92. *Acantholepis opacae* For.
93. *A. pulchella* For.
94. *Plagiolepis longipes* Jerd.
95. *Plagiolepis rothneyi* For.
96. *P. exigua* For.
97. *P. jerdoni* For.
98. *P. rogeri* For.
99. *Prenolepis longicornis* Lat.
100. *Prenolepis indica* For.
101. *Acropyga acutiventris* Rog.
102. *Lasius fuliginosus* Lat.
103. *Camponotus compressus* F.
104. *Camponotus taylori* For.
105. *C. mitis* Sm.
106. *C. rufoglaucus* Jerd.
107. *C. paria* Em.

CHAPTER 3
Insects

108. *C. angusticollis* Jerd.
109. *C. sericeus* F.
110. *Polyrhachis simplex* May.
111. *Polyrhachis clypeata* May.
112. *P. rastellata* Lat.

Fam. *Pompilidae*

1. *Macromeris violacea* Lep.
2. *Pseudagenia blanda* Guer.
3. *Pseudagenia tinctoria* Sm.
4. *P. veda* Cam.
5. *Salix aureocericeus* (Sm.).
6. *Salix fulvipennis* F.
7. *S. consanguineus* Saus.
8. *S. madraspatanus* Sm.
9. *S. flavus* F.
10. *Pompilus wroughtoni* Cam.
11. *Pompilus fenestratus* Sm.
12. *P. decoratus* Sm.
13. *P. mitis* Sm.
14. *P. ephippiatus* Sm.
15. *Ceropales annulitarsis* Cam.
16. *Ceropales claripennis* Cam.

Fam. *Eumenidae*

1. *Eumenes affinis* Saus.
2. *Eumenes peliolata* F.
3. *E. dimidiatipennis* Saus.
4. *E. essuriens* F.
5. *E. conica* F.
6. *E. edwardsii* Saus.
7. *E. flavopicta* Bl.
8. *E. arcuata* F.
9. *Rhynchium brunneum* F.
10. *Rhynchium abdominalis* Saus.
11. *R. nitidulum* F.
12. *R. leviscutis* Cam.
13. *R. metallicum* Saus.
14. *Odynerus sechellii* Saus.
15. *Odynerus ornatus* Sm.
16. *O. punctum* F.
17. *O. punctatipennis* Saus.
18. *O. miniatus* Saus.
19. *O. diffinis* Saus.
20. *O. ovalis* Saus.
21. *O. guttatus* Saus.
22. *O. erebodes* Cam.

CHAPTER 3
Insects

23. *O. wroughtoni* Cam.
24. *O. henricus* Cam.
25. *O. ornaticaudis* Cam.
26. *Katamenes interstitialis* Cam.
27. *Petrochilus fulvipennis* Cam.

Fam. *Vespidae*

1. *Belonogaster indica* Saus.
2. *Icaria ferruginea* F.
3. *Icaria wroughtoni* Cam.
4. *Icaria marginata* Lep.
5. *Icaria variegata* Sm.
6. *I. artifex* Saus.
7. *Polistes stigma* F.
8. *Polistes hebraeus* F.
9. *Vespa cincta* F.
10. *Vespa orientalis* F.
11. *V. ducalis* sorror D'Bug.

Fam. *Sphegidae* (*Sphecidae*)

1. *Astata nigricans* Cam.
2. *Astata agilis* Sm.
3. *Tachytes monataria* Sm.
4. *Tachytes nitidula* F.
5. *Tachysphex auriceps* Cam.
6. *Tachysphex erythrogaster* Cam.
7. *T. selectus* Nurs.
8. *Larra nigriventris* Cam.
9. *Notogonia (Motes) subtessellata* Sm.
10. *N. (Motes) jaculatrix* Sm.
11. *Liris aurata* F.
12. *Liris nigripennis* Cam.
13. *L. haemorrhoidalis* F.
14. *Piagetia ruficornis* Cam.
15. *Pison rugosus* Sm.
16. *Pison argentatum* Shuck.
17. *Trypoxylon intrudens* Sm.
18. *Trypoxylon bicolor* Sm.
19. *Ammophila laevigata* Sm.
20. *Ammophila elegans* Sm.
21. *A. brevipennis* Bing.
22. *A. apicata* Bing.
23. *A. erythrocephala* F.
24. *Sceliphron spinola* Lep.
25. *Sceliphron madraspatanam* F.
26. *S. coromandelicum* Lep.
27. *S. bilineatum* Sm.

CHAPTER 3
Insects

108. *C. angusticollis* Jerd.
109. *C. sericeus* F.
110. *Polyrhachis simplex* May.
111. *Polyrhachis clypeata* May.
112. *P. rastellata* Lat.

Fam. *Pompilidae*

1. *Macromeris violacea* Lep.
2. *Pseudagenia blanda* Guer.
3. *Pseudagenia tinctoria* Sm.
4. *P. veda* Cam.
5. *Salius aureocericeus* (Sm.).
6. *Salius fulvipennis* F.
7. *S. consanguineus* Saus.
8. *S. madraspatanus* Sm.
9. *S. flavus* F.
10. *Pompilus wroughtoni* Cam.
11. *Pompilus fenestratus* Sm.
12. *P. decoratus* Sm.
13. *P. mitis* Sm.
14. *P. ephippiatus* Sm.
15. *Ceropales annulitarsis* Cam.
16. *Ceropales claripennis* Cam.

Fam. *Eumenidae*

1. *Eumenes affinis* Saus.
2. *Eumenes peliolata* F.
3. *E. dimidiatipennis* Saus.
4. *E. essuriens* F.
5. *E. conica* F.
6. *E. edwardsii* Saus.
7. *E. flavopicta* Bl.
8. *E. arcuata* F.
9. *Rhynchium brunneum* F.
10. *Rhynchium abdominalis* Saus.
11. *R. nitidulum* F.
12. *R. leviscutis* Cam.
13. *R. metallicum* Saus.
14. *Odynerus sechellii* Saus.
15. *Odynerus ornatus* Sm.
16. *O. punctum* F.
17. *O. punctatipennis* Saus.
18. *O. miniatus* Saus.
19. *O. diffinis* Saus.
20. *O. ovalis* Saus.
21. *O. guttatus* Saus.
22. *O. erebodes* Cam.

CHAPTER 3
Insects

23. *O. wroughtoni* Cam.
24. *O. henricus* Cam.
25. *O. ornaticaudis* Cam.
26. *Katamenes interstitialis* Cam.
27. *Petrochilus fulvipennis* Cam.

Fam. *Vespidae*

1. *Belonogaster indica* Saus.
2. *Icaria ferruginea* F.
3. *Icaria wroughtoni* Cam.
4. *Icaria marginata* Lep.
5. *Icaria variegata* Sm.
6. *I. artifex* Saus.
7. *Polistes stigma* F.
8. *Polistes hebraeus* F.
9. *Vespa cincta* F.
10. *Vespa orientalis* F.
11. *V. ducalis* sorror D'Bug.

Fam. *Sphegidae* (*Sphecidae*)

1. *Astata nigricans* Cam.
2. *Astata agilis* Sm.
3. *Tachytes monataria* Sm.
4. *Tachytes nitidula* F.
5. *Tachysphex auriceps* Cam.
6. *Tachysphex erythrogaster* Cam.
7. *T. selectus* Nurs.
8. *Larra nigriventris* Cam.
9. *Notogonia (Motes) subtessellata* Sm.
10. *N. (Motes) jaculatrix* Sm.
11. *Liris aurata* F.
12. *Liris nigripennis* Cam.
13. *L. haemorrhoidalis* F.
14. *Piagetia ruficornis* Cam.
15. *Pison rugosus* Sm.
16. *Pison argentatum* Shuck.
17. *Trypoxylon intrudens* Sm.
18. *Trypoxylon bicolor* Sm.
19. *Ammophila laevigata* Sm.
20. *Ammophila elegans* Sm.
21. *A. brevipennis* Bing.
22. *A. apicata* Bing.
23. *A. erythrocephala* F.
24. *Sceliphron spinola* Lep.
25. *Sceliphron madraspatanam* F.
26. *S. coromandelicum* Lep.
27. *S. bilineatum* Sm.

CHAPTER 3

Insects

28. *S. violaceum* F.
29. *Sphex lobatus* F.
30. *Sphex splendidus* F.
31. *S. vicinus* Lep.
32. *S. luteipennis* Mocs.
33. *S. umbrosus* Chr. F.
34. *S. aurulentus* F.
35. *Ampulex compressa* F.
36. *Ampulex constanceae* Cam.
37. *Trirhogma cearulea* Westw.
38. *Psen clavatus* Cam.
39. *Stigmus niger* Mots.
40. *Gorytes* (Mellinus) *alipes* Bing.
41. *Gorytes* (Mel.) *amatorius* Sm.
42. *G. (M) politus* Bing.
43. *Stizus cornutus* Sm.
44. *Stizus rufescens* Sm.
45. *S. reversus* Sm.
46. *Bembex lunata* F.
47. *Bembex trepanda* Dahlb.
48. *B. indica* Hand.
49. *Philanthus basalis* Sm.
50. *Philanthus pulcherrimus* Sm.
51. *Cerceris albopicta* Sm.
52. *Cerceris humbertiana* Sa.
53. *C. dentata* Cam.
54. *C. tetradonta* Cam.
55. *C. sulphuria* Cam.
56. *C. pectiventris* Dahlb.
57. *C. wroughtoni* Cam.
58. *C. instabilis* Sm.
59. *C. pulchra* Cam.
60. *C. vishnu* Cam.
61. *C. vigilans* Sm.
62. *C. flavopicta* Sm.
63. *C. novarae* Saus.
64. *C. belli* Turn.
65. *C. melaina* Turn.
66. *C. dolosa*.
67. *Oxybelus robustus* Cam.
68. *Oxybelus agilis* Sm.
69. *O. forticarniatus* Cam.
70. *Crabro buddha* Cam.
71. *Crabro orientalis* Cam.
72. *C. ardens* Cam.
73. *C. bellus* Cam.
74. *C. aswad* Nur.

CHAPTER 3

Insects

Fam. *Haliotidae*

1. *Halictus sonescens* Sm.
2. *H. torridus* Cam.
3. *H. matheranensis* Cam.
4. *H. latisignatus* Cam.
5. *H. emergendus* Cam.
6. *H. salsettensis* Ckll.
7. *H. nasicensis* Ckll.
8. *Sphecodes albifrons* Sm.
9. *Sphecodes rubripes* Sm.
10. *Nomia westwoodi* Gri.
11. *Nomia curvipes* F.
12. *N. antennata* Sm.
13. *N. combusta* Sm.
14. *N. fervida* Sm.
15. *N. oxybeloides* Sm.
16. *N. maculitarsis* Cam.
17. *N. aliena* Cam.
18. *N. aurohirta* Cam.
19. *N. erythrogaster* Cam.
20. *N. mahratta* Cam.
21. *N. comperta* Ckll.
22. *N. parsiformis* Ckll.

Fam. *Andrenidae*

1. *Andrena torrida* Sm.
2. *Andrena mollis* Sm.

Fam. *Megachilidae* (Leaf cutter bees)

1. *Megachile anthracina* Sm.
2. *Megachile fulvovestita* Sm.
3. *M. bicolor* F.
4. *M. disjuncta* F.
5. *M. lanata* F.
6. *M. cephalotes* Sm.
7. *M. albifrons* Sm.
8. *M. femorata* Sm.
9. *M. Katinka* Nur.
10. *M. ubrica* Nur.
11. *M. lefroma* Cam.
12. *M. saphira* Cam.
13. *M. bombayensis* Cam.
14. *M. lissopoda* Cam.
15. *M. cathena* Cam.
16. *M. subfuscus* Cam.
17. *M. lerna* Cam.
18. *Aglaopis brevipennis* Cam.

CHAPTER 3

Insects

19. *Anthidium lachrymosum* Sm.
20. *Anthidium flavomaculatum* Cam.
21. *A. flaviventre* Cam.
22. *A. viaticum* Nur.
23. *A. pulchellum* Klug.
24. *A. ardens* Sm.
25. *A. ordinatum* Sm.
26. *A. rasorium* Sm.
27. *Ceratina eburneopicta* Ckll.
28. *C. virideseema* Dall.
29. *Coelioxys decipiens* Spin.
30. *Coelioxys minutus* Sm.
31. *Coelioxys latus* Cam.
32. *Tetralonia punctata* Cam.
33. *Tetralonia leucopoda* Ckll.
34. *Tetralioniella aliena* Ckll.
35. *Tetralioniella calidula* Ckll.
36. *A. cellularis* Cam.
37. *A. comberi* Ckll.
38. *Epeolus peregrinus* Ckll.

Fam. *Colletidae*

1. *Colletis dentata* Cam.

Fam. *Apidae* (Bees)

1. *Anthophora zonata* Linn.
2. *Anthophora confusa* Sm.
3. *A. fallax* Sm.
4. *A. violacea* Lep.
5. *Allodape parvula* Sm.
6. *Crocissa emarginata* Lep.
7. *Crocissa ramosa* Lep.
8. *Xylocopa latipes* Dr.
9. *Xylocopa dissimilis* Lep.
10. *X. auripennis* Lep.
11. *X. fenestrata* F.
12. *X. amethystina* F.
13. *X. leucothorax* (de Guer).
14. *X. tranquebarica* (F.)
15. *Apis* (= *Megapis*) *dorsata* F.
16. *Apis indica* F.
17. *Apis* (*Micrapis*) *mellifica* L.
18. *A. florea* F.
19. *Melipona laeviceps* Sm.
20. *Melipona iridipennis* Sm.
21. *Steganomus fulvipennis* Cam.
22. *Thaumantosoma testaceicorne* Cam.

CHAPTER 3

Insects

Order Coleoptera (Beetles and Weevils)

Fam. *Cicindelidae* (Tiger-beetles)

1. *Collyris brevipennis* Horn.
2. *Prothyma proxima* Chaud.
3. *Cicindela indica* Flent.
4. *Cicindela melancholica* F.
5. *C. imperfecta* Ch.
6. *C. sumatrensis* Hlst.
7. *C. funerea* Mc. L.
8. *C. sexpunctata* F.
9. *C. bicolor* F.
10. *C. gyllenhali* Dej.

Fam. *Carabidae* (Predaceous ground beetles)Sub-family *Carabinae*

1. *Colosoma orientale* Hope.
2. *Omophron lunatus* Ban.
3. *Siagona fabricii* Andr.
4. *Siagona flesus* F.
5. *S. rubescens* Andr.
6. *S. pumila* Andr.
7. *S. pygmaea* Andr.
8. *S. Kulla* Andr.
9. *S. dilutipes* Chaud.
10. *S. depressa* Mot.
11. *S. pubescens* Chaud.
12. *Luperca laevigata* F.
13. *Scarites semirugosus* Chaud.
14. *Scarites ceylonicus* Chaud.
15. *S. inconspicuus* Chaud.
16. *S. guineensis* Dej.
17. *S. mahratta* Andr.
18. *Oxylobus mahratta* Andr.
19. *Oxylobus dispar* Andr.
20. *O. punctatosulcatus* Chaud.
21. *O. bipunctatus* Andr.
22. *O. lateralis* Dej.
23. *Thlibops filiformis* Andr.
24. *Coryza maculata* Nietn.
25. *Clivina westwoodi* Putz.
26. *Clivina lobata* Bon.
27. *C. attenuata* Herb.
28. *Trilophus interpunctatus hispidulus* Putz.
29. *Dyschirius mahratta paucipunctus* Andr.
30. *Dyschirius perfectus* Andr.
31. *Sparostes striatulus* Putz.

CHAPTER 3

Insects

19. *Anthidium lachrymosum* Sm.
20. *Anthidium flavomaculatum* Cam.
21. *A. flaviventre* Cam.
22. *A. viaticum* Nur.
23. *A. pulchellum* Klug.
24. *A. ardens* Sm.
25. *A. ordinatum* Sm.
26. *A. rasorium* Sm.
27. *Ceratina eburneopicta* Ckll.
28. *C. viridessima* Dall.
29. *Coelioxys decipiens* Spin.
30. *Coelioxys minutus* Sm.
31. *Coelioxys latus* Cam.
32. *Tetralonia punctata* Cam.
33. *Tetralonia leucopoda* Ckll.
34. *Tetralioniella aliena* Ckll.
35. *Tetralioniella calidula* Ckll.
36. *A. cellularis* Cam.
37. *A. comberi* Ckll.
38. *Epeolus peregrinus* Ckll.

Fam. Colletidae

1. *Colletis dentata* Cam.

Fam. Apidae (Bees)

1. *Anthophora zonata* Linn.
2. *Anthophora confusa* Sm.
3. *A. fallax* Sm.
4. *A. violacea* Lep.
5. *Allodape parvula* Sm.
6. *Crocissa emarginata* Lep.
7. *Crocissa ramosa* Lep.
8. *Xylocopa latipes* Dr.
9. *Xylocopa dissimilis* Lep.
10. *X. auripennis* Lep.
11. *X. fenestrata* F.
12. *X. amethystina* F.
13. *X. leucothorax* (de Guer).
14. *X. tranquebarica* (F.)
15. *Apis* (= *Megapis*) *dorsata* F.
16. *Apis indica* F.
17. *Apis* (*Micrapis*) *mellifica* L.
18. *A. florea* F.
19. *Melipona laeviceps* Sm.
20. *Melipona iridipennis* Sm.
21. *Steganomus fulvipennis* Cam.
22. *Thaumantosoma testaceicorne* Cam.

CHAPTER 3

Insects

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6. *C. sumatrensis* Hlsl.
7. *C. funerea* Mc. L.
8. *C. sexpunctata* F.
9. *C. bicolor* F.
10. *C. gyllenhali* Dej.

Fam. Carabidae (Predaceous ground beetles)

Sub-family Carabinae

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2. *Omophron lunatus* Ban.
3. *Siagona fabricii* Andr.
4. *Siagona flesus* F.
5. *S. rubescens* Andr.
6. *S. pumila* Andr.
7. *S. pygmaea* Andr.
8. *S. Kulla* Andr.
9. *S. dilutipes* Chaud.
10. *S. depressa* Mot.
11. *S. pubescens* Chaud.
12. *Luperca laevigata* F.
13. *Scarites semirugosus* Chaud.
14. *Scarites ceylonicus* Chaud.
15. *S. inconspicuus* Chaud.
16. *S. guineensis* Dej.
17. *S. mahratta* Andr.
18. *Oxylobus mahratta* Andr.
19. *Oxylobus dispar* Andr.
20. *O. punctatosulcatus* Chaud.
21. *O. bipunctatus* Andr.
22. *O. lateralis* Dej.
23. *Thlibops filiformis* Andr.
24. *Coryza maculata* Nietn.
25. *Clivina westwoodi* Putz.
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28. *Trilophus interpunctatus hispidulus* Putz.
29. *Dyschirius mahratta paucipunctus* Andr.
30. *Dyschirius perfectus* Andr.
31. *Sparostes striatulus* Putz.

CHAPTER 3

Insects

32. *Apotomus atripennis* Mots.
33. *Apotomus hirsutulus* Bates.
34. *Tachys impressipennis* Mots.
35. *Tachys Klugi* Neitn.
36. *T. ornatus* Apet.
37. *T. pallidicornis* Andr.
38. *T. babaulti* Andr.
39. *T. charis* Andr.
40. *T. blandus* Andr.
41. *T. comptus* Andr.
42. *T. haliploides* Bates.
43. *T. latissimus* var *gracilis* Mots.
44. *Pogonus biroii* Csiki.
45. *Perileptus ceylonicus* Nietn.

Sub-fam. *Harpalinae*Fam. *Dytiscidae*

1. *Cybister tripunctatus asiaticus* Shp.
2. *Cybister confusus* Shp.
3. *C. lineatus* F.
4. *C. sugillatus* E.
5. *C. limbatus* F.
6. *C. rugulosus* Red.
7. *Hydraticus dejeani* Aub.
8. *H. vittatus* F.
9. *H. luczonicus* Aub.
10. *H. fabricii* M. & L.
11. *Sandracottus festivus* Ill.
12. *Eunectes sticticus* Lin.
13. *Laccophilus elegans* Shp.
14. *Laccophilus chinensis inefficiens* Boh.
15. *L. parvulus* Andr.
16. *L. anticatus* Sh.
17. *Bidessus antinialis* Reg.
18. *Bidessus inconstans* Reg.
19. *Hyphoporus aper* Shp.
20. *Rhantaticus congestus* Klug.
21. *Eretes sticticus* L.
22. *Hyphydrus indicus* Shp.
23. *Peschetius quadricostatus* Aub.
24. *Yola consanguinea* Reg.

Fam. *Gyrinidae* (Whirling beetles)

1. *Dineutus indicus* Aub.
2. *Orectochilus limbatus* Rig.
3. *Orectochilus discifer* Wlk.

CHAPTER 3

Insects

Fam. *Hydrophilidae*

1. *Hydrophilus piceus* L.
2. *Hydrophilus olivaceus* (F.)
3. *H. indicus* Bed.
4. *Stethoxus olivaceus* F.
5. *Stethoxus cashmeriensis* Rest. (*japonicus* Shp.)
6. *S. senegalensis* Perch.
7. *Sternolophus unicolor* Cast.
8. *Sternolophus brachyacanthus* Reg.
9. *S. rufipes* (F.)
10. *Paracymus evanescens* Shp.
11. *Paracymus crenatus* Reg.
12. *Cyclonotum orbiculare* P.
13. *Sphaeridium rectus* Shp.
14. *Philhydrus luteus* Reg.
15. *Deronectus belli* F.
16. *Regimbartia attenuata* Fab.
17. *Hydraena quadricollis* Woll.

Fam. *Paussidae*

1. *Ceratoderios andrewesi* Desn.
2. *Platyrhopalus denticornis* Don.
3. *Platyrhopalus mellyi* Westw.
4. *Paussus hearsayanus* Westw.
5. *Paussus wroughtoni* Wasm.
6. *P. soleatus* Wasm.
7. *P. suavis* Wasm.
8. *P. denticulatus* Westw.
9. *P. assmuthi* Wasm.

Fam. *Staphylinidae* (Rove beetles)

1. *Trogophloeus* (*Teoginus*) *exiguus* Er.
2. *Oxytelus* (*Tanycracrus*) *micans* Kr.
3. *Oxytelus* (*Anotylus*) *pygmaeus* Kr.
4. *O. (Anotylus) latiusculus* Kr.
5. *Platystethus cornutus* Gr.
6. *Stenus annamita* Faun.
7. *Stenus* (*Hypostenus*) *ventricosus* Fauv.
8. *Stenus tricarinatus* Kr.
9. *Pinophilus bomfordi* Epp.
10. *Pinophilus piceus* Fauv.
11. *Oedichirus dimidiatus* Epp.
12. *Paederus sondaicus* Fauv.
13. *Paederus fuscipes* Curt (= *peregrinus* Cam.)
14. *P. cornicollis* Mots.
15. *P. graciosus* Fauv.

CHAPTER 3

Insects

16. *Astenus gratellus* Fauv.
17. *Astenus melanurus* Kust.
18. *Charichirus Chinensis* Boh.
19. *Scopaeus testaceus* Mots.
20. *Scopaeus velutinus* Mots.
21. *Seimbaliium indicum* Epp.
22. *Cryptobium nigrobadium* Epp.
23. *Cryptobium abdominale* Mots.
24. *Leptacinus parumpunctatus* Gyll.
25. *Philonthus notabilis* Kr.
26. *Philonthus cinctus* Gr.
27. *P. aencipennis* Boh.
28. *P. cinctipennis* Faur.
29. *P. longicornis* Step.
30. *P. thermarum* Aub.
31. *Staphylinus (Platydracus) semipurpureus* Kr.
32. *Discoxenus lepisma* Wasm.
33. *Discoxenus assmuthi* Wasm.
34. *Doryloxenus termitophilus* Wasm.
35. *D. eutermis* Wasm.
36. *Coproporus minimus* Mots.
37. *Coproporus atomus* Kr.
38. *Schistogenia crenicollis* Kr.
39. *Astilbus impressicollis* Kr.
40. *Zyras (Glossacantha) armifrons* Epp.
41. *Zyras (Glossacantha) heimi* Wasm.
42. *Z. (G.) obscurus* F.
43. *Z. (G.) hastatus* Fauv.
44. *Dinusa heimi* Wasm.

Fam. *Histeridae*

1. *Platysoma dufali* Mars.
2. *Paromalus ceylonicus* Mots.
3. *Hister chinensis* Quen.
4. *Hister coelestis* May.
5. *H. bimaculatus* L.
6. *Cypturus aenescens* Er.
7. *Abroeus pareia* Mrs.

Fam. *Lycidae*

1. *Lycostomus nigripes* F.
2. *Lycostomus praestus* F.
3. *L. reitutatus* Bou.

Fam. *Lampyridae* (Fireflies and Glow worms)

1. *Lamprophorus tenebrosus* Wlk.
2. *Lampyris marginella* Boh.
3. *Lucida* species.

CHAPTER 3

Insects

Fam. *Melyridae*

1. *Hapalochrus fasciatus* F.
2. *Idiga belli* Gorh.
3. *Idiga cardoni* Bourg.

Fam. *Cleridae*

1. *Mecrobia rufipes* F.
2. *Mecrobia vidacea* L.
3. *Tillus notatus* Klug.

Fam. *Meloidae* (Blister beetles)

1. *Zonabris pustulata* Thumb.
2. *Mylabris balteata* Pall (indica F.)
3. *Gnathospastoides rouxi* Cast.
4. *Lyttia rufficollis* O.
5. *Lyttia tenuicollis* P.
6. *Epicauta* sp.
7. *Cantharis setacea* F.

Fam. *Elateridae*

1. *Agrypnus fuscipes* F.
2. *Lacon sinensis* Col.
3. *Heteroderus macroderus* Caud.
4. *Melanozanthus melanocephalus* F.
5. *Cardiophorus embraculatus* Caud.
6. *Cardiophorus eximius* Caud.
7. *Cardiophorus anaticus* Caud.

Fam. *Buprestidae*

1. *Sphenoptera gossypii* K.
2. *Sphenoptera parotteti* G.
3. *Aemaecodera kerremansi*.
4. *Aemaecodera fasciatipennis*.
5. *Belinota prasina* Th.
6. *Psiloptera fastuosa* F.
7. *Trachys bicolor* K.
8. *Trachys ipomoea* Th.

Fam. *Dermestidae* (Wooly bears)

1. *Anthrenus vorax* Wat.
2. *Anthrenus pimpinella* F.
3. *A. fasciatus*.
4. *Dermestes vulpinus* F.
5. *Trogoderma versicolor*.

Fam. *Trogositidae* (Ostomidae)

1. *Tenebroides (Trogosita) mauritanica* L. = 'Cadelle'.

CHAPTER 3

Insects

- Fam. *Nitidulidae*
1. *Meligethes cribrus* Gro.
 2. *Carpophilus hebetatus* Grov.
 3. *Carpophilus hemipterus* L.
 4. *C. plagiaticornis* Mots.
 5. *Epuraea indica* Gro.
 6. *Macroura orientalis* Nietn.
 7. *Macroura subrugosa* Gro.
 8. *Cybocephalus major* Mots.

- Fam. *Cucujidae*
1. *Cathartus advena*.
 2. *Hectarthrum depressum*.
 3. *Hectarthrum heros*.
 4. *H. trigeminum*.
 5. *Oryzaephilus* (Silvanus) *surinamensis* L.

- Fam. *Erotylidae* including (*Languridae*)
1. *Microsternus cribricollis* Gorh.
 2. *Megalodaene singhalensis* Csik.
 3. *Megalodaene hislopi* Cro.
 4. *Amblyopus triplacoides* Gorh.
 5. *Cycloxeus hispidus* Arr.
 6. *Andastus bombayensis* Arr. (*Languridae*).

- Fam. *Endomychidae*
1. *Eugonius vicinus* Arr.
 2. *Stenotarsus bicolor* Girst.
 3. *Saula ferruginea* Girst.

- Fam. *Coccinellidae* (Lady bird beetles)
1. *Coccinella septempunctata* F.
 2. *Coccinella repanda* Th. (= *transversalis* F.)
 3. *Thea* (*Halysia*) *cincta* F.
 4. *Alesia univittata* Hope.
 5. *Chilomenes sexmaculata* F.
 6. *Chilocorus nigritus* F.
 7. *Brunus suturalis* F.
 8. *Epilachna dodecastigma* Muls.
 9. *E. Vigintioctopunctata* F.
 10. *Symnus xerampelinus* Muls.

- Fam. *Tenebrionidae*
1. *Melarachna parvipennis* Frm.
 2. *Rhytinota insidiosa* Frm.
 3. *Rhytinota impolita* Frm.
 4. *Pachycera* (*Oedonocera*) *longula* Kr.
 5. *Penthioides seriatoporus* Frm.

CHAPTER 3

Insects

6. *Derosphoerus* sp.
7. *Encyalesthus aspiratus* Bat.
8. *Platydemus scriptipennis* Frm.
9. *Ceropria induta* Wied.
10. *Ceropria violacea* Bl.
11. *Tribolium castanum* Hb.
12. *Tribolium ferruginum* F.
13. *Amarygmus purpureofossus* Frm.
14. *Gonocephalum oblongum* F.
15. *Gonocephalum depressum* F.
16. *G. dorsograsosum* F.
17. *G. hoffmaineseggi* Slev.
18. *G. bengalensis* Berh.
19. *Mesomorpha villiger* Bl.
20. *Sleron reitheri* Geb.
21. *Sleron latipes* Guer.
22. *Heterotarsus indicus* Mars.
23. *Lypros indicus* Wied.
24. *Cossyphus depressus* F.
25. *Dastarcus indicus* (Fai)
26. *Sitophagus* sp.
27. *Opetiopalpus* sp.

- Fam. *Ptinidae* and *Anobiidae*
1. *Ptinus* fur L.
 2. *Anobium* (*Sitodrepa*) *panicea* L. (Death Watch).
 3. *Lasioderma testacea* Duff.

- Fam. *Bostrychidae* (Powder post beetles)
1. *Bostrychopsis bengalensis*.
 2. *Bostrychopsis parallela*.
 3. *Heterobostrychus equalis*.
 4. *Heterobostrychus hamatipennis* Les.
 5. *Sinoxylon anale* Lesn.
 6. *S. atratum* Les.
 7. *S. capillatum*.
 8. *S. crassum* Les.
 9. *S. pygmaeum*.
 10. *Schistoceros anobioides* Watt.
 11. *Xylodectes ornatus*.
 12. *Xylothrips flavipes* Ill.
 13. *Dinoderus minutus* F.
 14. *Rhizopertha dominica* F.

- Fam. *Scarabaeidae* (*Lamellicornia*)
- Group I—*Cetoniinae*
1. *Diceros cuvera* Newn.
 2. *Heterorrhina micans* Guer.

CHAPTER 3

Insects

3. Heterorrhina sinuatocollis Sch.
4. Anatona stillata Newm.
5. Anatona castanoptera Burm.
6. Pogonopus argentifer Westw.
7. Protactia peregrina Herb.
8. Protactia regalis Bl.
9. P. terrosa G. & P.
10. P. alboguttata Vig.
11. Chiloloba acuta Wied.
12. Clinteria klugi Hope.
13. Agestrata orichalcea Linn.
14. Spilophorus cretosus Hope.
15. Coenochilus brunneus Saund.
16. Coenochilus acutipes Arr.
17. C. pygidialis Jan.
18. C. trabecula Sch.
19. Xenoreoderus occidentalis Arr.

Group 2—Dynastinae

20. Oryctes rhinoceros Linn.
21. Eophileurus platyperus Wied.
22. Eophileurus perforatus Arr.
23. Phyllognathus dionysius F.

Group 3—Melolonthinae

24. Apogonia ferruginea F.
25. Apogonia nigricans.
26. Holotrichia pulvinosa Shp.
27. Tdionycha excisa.
28. Lachnosterna serrata.
29. Microtricha cotesi.
30. Serica lugubris Brsk.
31. Serica iridescens Bl.
32. S. globosa (Hbst.)
33. S. prunosa Brun.
34. Leucophorus lepidophora.
35. Antoserica marginella Hope.

Group 4—Rutelinae

36. Tropiorrhynchus orientalis (Newm).
37. Tropiorrhynchus podagricus Burn.
38. Popilia nasuta Newm.
39. Popilia adamas Newm.
40. Mimela macleana Vig.
41. Anomala dorsalis F.
42. Anomala varians Ol.
43. A. polita Bl.
44. A. ruficapilla Burm.

FAUNA

CHAPTER 3

Insects

45. A. communis Burm.
46. A. pomona Arr.
47. Rhinyptia indica Burm.
48. Adorhinyptia dorsalis Burm.
49. Adorhinyptia fusca Arr.
50. Prodoretus bombayanus.
51. Adoretus lobiceps Arr.
52. Adoretus excisus Oh.
53. A. incurvatus Oh.
54. A. stoliczkae Oh.
55. A. sorex Arr.
56. A. andrewesi Oh.
57. A. decanus Oh.
58. A. latirostis Oh.
59. A. pusillus Arr.
60. A. caliginosus Burm.
61. A. ovalis B.

Group 5—Coprinae

62. Scarabaeus sanctus F.
63. Gymnopleurus cyaneus F.
64. Gymnopleurus meliaris F.
65. G. gemmatus Har.
66. G. maculosus Macl.
67. G. dejeani Cast.
68. G. bombayensis Arr.
69. Sisyphus longipes Oliv.
70. Sisyphus hirtus Wied.
71. Heliocopris bucephalus F.
72. Catharsius hirtus Wied.
73. Catharsius sagax Quens.
74. C. pithecius F.
75. Copris repertus Wlk.
76. Copris imitans F.
77. Copris andrewesi W.
78. C. signatus W.
79. Phalops candezei Laus.
80. Caecobius aterrimus F.
81. Caecobius diminutivus Wlk.
82. C. inermis Arr.
83. C. ultor Sh.
84. C. vulcanus Syst.
85. Onthophagus hystrix Bou.
86. Onthophagus gulo Arr.
87. O. cavia Bou.
88. O. imperator Cast.
89. O. tardus F.
90. O. coeruleicollis Arr.

CHAPTER 3

Insects

91. *O. obacus* Bon.
 92. *O. vultur* Arr.
 93. *O. spinifex* F.
 94. *O. pactolus* F.
 95. *O. parvulus* F.
 96. *O. ramosellus* Bat.
 97. *O. catta* F.
 98. *O. bonasus* F.
 99. *O. ramosus* Wied.
 100. *O. laborans* Arr.
 101. *O. quaestus* Sh.
 102. *O. liliputanus* Laus.
 103. *O. tritinctus* Bon.
 104. *O. circulifer* Arr.
 105. *O. dama* F.
 106. *O. quadridentatus* F.
 107. *O. pardalis* F.
 108. *O. hindu* Arr.
 109. *O. ephippioderus* Arr.
 110. *O. semicinctus* d'Orb.
 111. *O. tragus* F.
 112. *O. fasciatus* Bon.
 113. *O. favrie* Bon.
 114. *O. truncaticornis* Sch.
 115. *O. turbatus* Wlk.
 116. *O. unifasciatus* Sch.
 117. *O. centricornis* F.
 118. *O. malabarensis* Bom.
 119. *O. ludio* Bom.
 120. *O. ceros* F.
 121. *Liatongus rhadamistus* F.
 122. *Oniticellus pallipes* F.
 123. *Oniticellus spinipes* Roth.
 124. *O. cinctus* F.
 125. *Drepanocerus setosus* Wied.
 126. *Onitis falcatus* Wulf.
 127. *Onitis virens* Lous.
 128. *Chironitis indicus* Laus.
 129. *Haroldius heimi* Wasm.
- Fam. *Lucanidae* (Lamellicornia) Stag beetles.
1. *Dorcus* (*Cladognathus*) *curvipes* Hope.
 2. *Figulus caviceps* Boil.
- Fam. *Cerambycidae* (Long horned beetles or Longicornia)
1. *Dissosternus pertii* Hope.
 2. *Priotyrannus mordax* Wh.
 3. *Cantherocnemis downesi* Pasc.
 4. *Macrotoma crenata* F.

CHAPTER 3

Insects

5. *Melegena flavipes* Gah.
 6. *Hypoescrus indicus* Gah.
 7. *Xystrocera globosa* Oliv.
 8. *Ploederus humeralis* Wh.
 9. *Aeolesthes holosericea* F.
 10. *Rhytidodera robusta* Gah.
 11. *Nyphasia fuscipennis* Gah.
 12. *Purpuricenus sanguinolentus* Oliv.
 13. *Pachyteria fasciata* F.
 14. *Pachylocerus corallinus* Hope.
 15. *Xylotrichus subcutalatus* Che.
 16. *Caloclatus patricius* Gah.
 17. *Epipedocera affinis* Chev.
 18. *Batocera rubus* L.
 19. *Coelesterna scabrata* F.
 20. *Olenocamptus bilobus* F.
 21. *Apomecyna pertigera* Th.
 22. *Glana spilota* Th.
 23. *Monohammus nivosus* Wh.
- Fam. *Chrysomelidae* (Leaf beetles)
1. *Sagra femorata* Dr.
 2. *Lema flavimana* Jac.
 3. *Lema subiridea* Jac.
 4. *L. downesi* Bal.
 5. *L. lycaon* Jac.
 6. *L. belgaumensis* Jac.
 7. *Crioceris impressa* F.
 8. *Pseudoclytra andrewesi* Jac.
 9. *Gynandrophthalma orientalis* Jac.
 10. *Gynandrophthalma cornuta* Jac.
 11. *G. minuta* Jac.
 12. *G. divisa* Jac.
 13. *Aetheomorpha nigropicta* Lef.
 14. *Pantocometis downesi* Bal.
 15. *Clytrasoma palliata* Fr.
 16. *Ceretobasis natr* La.
 17. *Ceretobasis ceylonensis* Jac.
 18. *Cryptocephalus angustomarginatus* Jac.
 19. *Cryptocephalus inconstans* Jac.
 20. *C. bombayensis* Jac.
 21. *C. belgaumensis* Jac.
 22. *C. sandrocottus* Suff.
 23. *C. andrewesi* Jac.
 24. *C. lefevrei* Jac.
 25. *C. indicus* Suff.
 26. *C. leopardus* Jac.
 27. *C. vahli* F.

CHAPTER 3

Insects

28. *C. raja* Jac.
29. *C. guttifer* Suff.
30. *C. senarius* Suff.
31. *Nodina indica* Jac.
32. *N. belgaumensis* Jac.
33. *Nodostoma thoracicum* Jac.
34. *Pagria flavopustulata* Bal.
35. *Pagria costatipennis* Jac.
36. *Pagria kanaraensis* Jac.
37. *Callisina promenula* Jac.
38. *Callisina balyi* Jac.
39. *Neculla pollinaria* Bal.
40. *Hyperascis fulvohirsuta* Jac.
41. *Eubraxis orientalis* Jac.
42. *Colasposoma metallicum* Cl.
43. *Colasposoma coeruleatum* Bal.
44. *C. bicoloratum* Jac.
45. *C. ornatum* Jac.
46. *Tricliona puncticeps* Duv.
47. *Tricliona variabilis* Jac.
48. *T. apicata* Jac.
49. *T. bifasciata* Jac.
50. *T. bicolor* Jac.
51. *T. marginata* Jac.
52. *Cleoporus maculicollis* Jac.
53. *Heminodes unicolor* Duv.
54. *Chrysolina fulvoaenea* Jac.
55. *Oides bipunctata* (F.)
56. *Hoplosoma unicolor* Ill.
57. *Aulacophora foveicollis* (Luc.)=(abdominalis Ger.)
58. *Aulacophora intermedia* Jac.
59. *A. impressa* (F.)
60. *Galerucella birmanica* (Jac.)
61. *Anastena nigromaculata* (Jac.)
62. *Monolepta longitarsis* Jac.
63. *Monolepta nigrobilineata* Mots.
64. *M. scripta* (Mots.)
65. *M. orientalis* Jac.
66. *M. trifasciata* Jac.
67. *M. puncticollis* (Jac.)
68. *M. pilosa* (Jac.)
69. *M. severini* (Jac.)
70. *M. andrewesi* Jac.
71. *M. fascipennis* (Jac.)
72. *M. multipunctata* (Jac.)
73. *M. indica* Jac.
74. *M. irratica* (Jac.)

CHAPTER 3

Insects

75. *M. maculosa* All.
76. *Hyphaenia obscuripennis* Jac.
77. *Mimastra scutellata* Jac.
78. *Palpoxena truncatipennis* (Jac.)
79. *Palpoxena dilaticornis* (Jac.)
80. *P. peliennis* Jac.
81. *P. pallida* (Jac.)
82. *P. modesta* Jac.
83. *Philopoma signata* Duv.
84. *Hyphosoma thoracica* Jac.
85. *Hyphosoma discoidalis* Jac.
86. *Bimala indica* Jac.
87. *Chaetocnema basalis* But.
88. *Chaetocnema minuta* Jac.
89. *C. belli* Jac.
90. *Ophrida hirsuta* Steb.
91. *Clitia indica* Jac.
92. *Podagricra striatipennis* Jac.
93. *Argopistes lamprotes* Maul.
94. *Longitarsus belgaumensis* Jac.
95. *Longitarsus sari* Maul.
96. *Luperomorpha nigripennis* Duv.
97. *Luperomorpha bombayensis* Jac.
98. *Aphthona hugeli* Jac.
99. *Phyllotreta downesi* Bal.
100. *Sebaethe nigricornis* Bal.
101. *Haltica cyanea* Web.
102. *Estigmena chinensis* Hope.
103. *Callispa duodecimmaculata* Chap.
104. *Amblispa laevigata* Guer.
105. *Leptispa pygmaea* Bal.
106. *Oncocephala tuberculata* Olive.
107. *Oncocephala dorsalis* Wied.
108. *Scellodonta strigicollis* Mots.
109. *Hispella brachycera* Gest.
110. *Hispella stygia* Chap.
111. *Dactylispa filiola* Weis.
112. *Dactylispa severini* Ges.
113. *D. praefica* Weis.
114. *D. nalika* Maul.
115. *D. soror* Weis.
116. *Hispa armigera* Oliv.
117. *Hispa aerea* Gest.
118. *H. palliscens* Guer.
119. *Platypriya erinaceus* F.
120. *Platypriya andrewesi* Weis.
121. *P. echidna* Guer.
122. *Hoplionota tenuicula* Spa.

CHAPTER 3

Insects

123. *Calopepla leayana* Latr.
124. *Calopepla andrewesi* W.
125. *Aspidomorpha furcata* Thun.
126. *Conchyloctenia nigrovittata* Boh.
127. *Sindia cathrata* F.
128. *Lacoptera quadrimaculata* Th.
129. *Oocassida pudibunda* Boh.
130. *Cassida enervis* Boh.
131. *Cassida subtilis* Weis.
132. *C. avia*.
133. *C. belli* Weis.
134. *C. dorsata* Duv.
135. *C. ruralis* Boh.
136. *C. flavoscutata*, spaeth.
137. *C. informis* Boh.
138. *Chirida hina* Maul.
139. *Chirida promiscua* Boh.
140. *Chirida bipunctata* L.

Fam. *Bruchidae* (Lariidae)

1. *Bruchus chinensis* L.
2. *Bruchus affinis* Fr.
3. *Bruchus quadrimaculatus* F.
4. *B. pesorum*.
5. *B. analis* F.
6. *B. theobromae* (L.) F.
7. *Caryoborus gonagra* F.

Fam. *Brenthidae*

1. *Cyphagogus silvanus* Sen.
2. *Cyphagogus westwoodi* Par.
3. *Callipariens faea* Sen.
4. *Allacometrus breviceps* Sen.
5. *Cerobates fossulatus* Mots.
6. *Cerobates tristatus* F.
7. *Trachalitzus bisulcatus* F.
8. *Symmorphocerus cardoni* Sen.
9. *Caenorychodes planicollis* Wlk.
10. *Euphenges delibratus* Kln.
11. *Opisthinoplus cavus* F. Wlk.

Fam. *Curculionidae* (Weevils)

1. *Blosyrus inequalis* Boh.
2. *Blosyrus unisulcatus* Mars.
3. *Tanymecus andrewesi* Fst.
4. *Tanymecus lentus* Fst.
5. *T. pinceps* Fst.
6. *T. tetricus* Fst.
7. *Dereodus sparsus* Boh.

CHAPTER 3

Insects

8. *Lepidospyris angustula* Mars.
9. *Parapionus varicolor* Mars.
10. *Episomus lacerta* F.
11. *Episomus arrogans* Boh.
12. *Ptochus horridulus* Fst.
13. *Ptochus nodulosus* Fst.
14. *Drepanoderus veridifasciatus* Wtsh.
15. *Myllocerus paetus* Mars.
16. *Myllocerus catechu* Mshl.
17. *M. pretiosus* Fst.
18. *M. simplex* Fst.
19. *M. disquatus* Mshl.
20. *M. dorsatus* F.
21. *M. tenuicornis* Fst.
22. *M. pauper* Fst.
23. *M. procerus* Fst.
24. *M. minutus* Fst.
25. *M. transmarinus* Hbst.
26. *M. subfasciatus* Guer.
27. *M. spurcatus* Wlk.
28. *M. discolor* Var. *variegatus* Boh.
29. *M. 11 pustulatus* Var. *marmoratus* Fst.
30. *Xanthotrachelus faunus* Oliv.
31. *Xanthotrachelus supersilius* Gyll.
32. *Lixus brachyrrhinus* Boh.
33. *Paramecops farinosus* Wied.
34. *Cylas formicarius* F.
35. *Balaninus C.-album* Fst.
36. *Alcides bubo* F.
37. *Alcides fabrici* F.
38. *Metialma balsaminae* Mots.
39. *Ceuthorrhynchus asperulus* Fst.
40. *Cryptorrhynchus mangiferae* F.
41. *Pachyonyx quadridens* Chev.
42. *Acythopeus citrulli* Mshl.
43. *Rhynchophorus ferrugineus* F.
44. *Cosmopolitus sordidus* Gern.
45. *Calandra oryzae* L. (Rice weevil).
46. *Calandra stigmaticollis* Gyll.

Fam. *Platypodidae* and *Scolytidae* (Pinhole borers)

1. *Xyleborus andrewesi*.
2. *Xyleborus laticollis*.
3. *Xyleborus parvulus*.
4. *Xyleborus perforans* (All *Scolytidae*).
5. *Platypus solidus* (*Platypodidae*).

CHAPTER 3

Insects

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CHAPTER 3

Insects

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4. *Xyleborus perforans* (All *Scolytidae*).
5. *Platypus solidus* (*Platypodidae*).

CHAPTER 3

Insects

SHORT NOTES ON ORDERS, FAMILIES AND SOME SPECIES OF
INSECTS WITH MARATHI NAMES

(Note—Marathi names of some have been included.)

APTERYGOTA—PRIMITIVE WINGLESS INSECTS

ORDER THYSANURA (BRISTLE TAILS)

A small order. About 350 described species in the world. Insects wingless with strong, biting mouth parts, long antennae, triangular longish abdomen of 11 segments, long appendages and cerci. The adult generally flat, scaly, greasy, shining. No metamorphosis, moult, grow in size upto 15-30 mm., silverygrey or white or brownish. Live concealed. Not well studied. Some household pests. Divided into 2 families.

Fam. *Machilidae*. Large compound eyes, no scales or appendages to the young, which develop as the insect grows. Moults 6 times to attain adulthood. 3 species recorded in termites nests. One—*M. palipoda* dark grey, elongate, tapering on both sides, 6-8 mm. long, 3 anal cerci, the middle one the longest with some more appendages, lives in cracks in soil, feeds on lichens. Nocturnal in habit.

Fam. *Lepismatidae* (Silverfish) कसर (Plate 1 Fig. 1) Compound eyes conspicuous, three long anal appendages. Active, hide in debris, crevices etc. Eggs laid in crevices. Reach adult stage after more than a year casting 45-60 moults, but begins laying eggs after 12-15 moults, rather uncommon among insects, mates often. *L. (Acrotelsa) collaris*, F., silverygrey to black, haunts dark places destroys books, clothes, photoes etc., sometimes eating surfaces only. See Paiva C. A. (1906) J. Asi. Soc. Bengal 2:346 Notes on rare insects.

ORDER DIPLURA

Similar to Thysanura but no eyes, anal appendages only 2. Generally found in decaying vegetable matter, damp soil, under stones. Not studied well. Described world species about 400, a few in India. Divided into 3 families.

Fam. *Campodidae*. Abdomenal segments with lobe like appendages, anal cerci long, 2 jointed. Common species *C. staphylinus* Westw. White, cylindrical; feeds in moss and decaying vegetation.

Fam. *Projapygidae*. Cerci short, stout, few segments. One species recorded in Koyna valley and another in Nagpur.

Fam. *Japygidae*. Anal appendages modified into forceps as in earwigs. *J. indicus* recorded in Nagpur; small larva like in decaying vegetable matter.

Refer, Sylvestry F. (1930) Rec. Ind. Mus 32:439. Contributions to.....Japygidae.

CHAPTER 3

Insects

ORDER COLLEMBOLA (SPRING TAILS) (PLATE 1 FIG. 2)

Very small, with 6 abdominal segments, a tube attached to the first vertically. Mostly jumping with special apparatus. Unnoticed in the plains, more common in temperate zones like the Himalayas. Generally live in soil, sometimes on surface of water, in swarms, feed on decomposing material or on epidermis of plants or rootlets. Make irregular holes in leaves. Feed in wounds made by beetles. Commonly found in groups. About 1,500 species described less than 100 in the Indian region, none in Maharashtra except *I. minos* common in damp situations.

PTERYGOTA—WINGED OR SECONDARILY
APTEROUS INSECTS

ORDER EPHEMEROPTERA (MAY FLIES) (PLATE 1 FIG. 3)

Delicate insects. Large forewings, small hind wings, short antennae, two or three long anal processes conspicuous when wings held over the body. Eyes large in males, smaller in females, sometimes raised above head. Mouth parts absent. Thorax well developed, abdomen tapering, hairy. Colour pearly or grey. Wings transparent with markings or darker tinge.

Eggs laid in masses in gelatinous strings or under stones in water. Nymphal life long, adult short lived. Males die soon after mating, females after laying eggs. Dance in air. Of no economic value. About 1000 species known; less than 100 in the Indian region, mostly from hill stations. Some found damaging wood work. Nymphs of *Anagania* damage wood of boats on lakes, some like *Povilla* bore into trunks of partially submerged trees.

Read. Chopra B. N. (1927) Rec. Ind. Mus. 29:91 Indian Ephemeroptera.

Eaton A. E. (1892) J. Asi. Soc. Bengal 60:406. Notes on Ephemeridae of Ind. Mus.

Hafiz A. A. (1937) Rec. Ind. Mus. 39:351 Indian Ephemeroptera.

ORDER ODONATA (DRAGON-FLIES) (PLATE 1 FIG. 4)

Adult with large mobile head, big eyes, compact thorax, a long thin abdomen ending in a pair of claspers. Body brightly coloured, wings long transparent, full of veins, coarse, plain or coloured, iridescent, a deep nodus (= a cross vein) and a Pterostigma (= thick dark short vein) on the upper margin.

Eggs laid in or near water. Larva aquatic flattish, active, with 3 pairs of legs abdominal segments clearly seen, carnivorous, occasionally eating their own kith and kin. Breathe with gills. Eject water from anal end. Full fed larva comes out of water, breaks the skin dorsally and the adult emerges. The young adult may differ from the old and the male from the female. Economically useful, destroying

CHAPTER 3

Insects

obnoxious insects like mosquitoes. More common in heavy rainfall tracts like the Konkan and W. Ghats. Some species migrate. About 4,500 species described, about 200 in the Indian region and about 60 in Maharashtra. Divided into 2 sub-orders—Zygoptera, Anisoptera.

(In the descriptions below in the measurements, Ab = abdomen and H.W. = hind wing).

SUB-ORDER ZYGOPTERA (राचणी)

Both wings similar, held vertically above in repose. Nodus before the middle of the wing. Eyes separated considerably.

Fam. *Coenagridae*. *L. praemorsa* Ab. 32-35 mm. H.W. 21-22 mm. Upper side black, green stripe on thorax, sides green, blue or black or spotted. Wings hyaline, pterostigma (nodus) deep brown. Abdomen black at end. *L. viridula* similar but brown above, white below with 2 green and one brown stripes on back. *P. mortoni* Fras. Abd. 42-43 mm. H.W. 20 mm. Blackish, sides blue with black stripes. Abdomen black marked blue and white.

C. marginipes. Ab. 28-31 mm. H.W. 16-18 mm. Yellowish black, greenish stripes below. Varies in colour. Female differs in colour. *C. vittata* similar only thorax brown with yellow spots, abdomen black, sides bluish. *C. verticalis annandalei* Fr. Ab. 29 mm. H.W. 19 mm. Velvety black, brown below, reddish stripes on thorax. Wings shaded at top. Markings white in females with yellow.

D. nigerimma. Ab. 23-35 mm. H.W. 15-17 mm. Black above, brown and yellowish below, paired white spots in mid abdomen. Female more blue in head. *D. tetrica* similar but bigger. *C. quadrimaculata*. Ab. 32 mm. H.W. 22 mm. Red with blue lines, black spot below, blackish bands on wings, abdomen red with white, brown and black. *P. microcephalum* Ab. 27 mm. H.W. 17 mm. Blue. Blue spots on head, female greenish head. Migrates *P. decorum*. Slightly bigger, blue or greenish, blue spots and blackish lines on head, white below. A plains species. Migrates. *P. hypermelas* Ab. 23-24 mm. H.W. 14-15 mm. Black, thorax with purplish brown stripes, white below. Abdomen brown, marked black. Female with restricted markings, paler.

C. coromandelianum. Ab. 28-30 mm. H.W. 18-20 mm. Yellow, white below, female duller. *C. rubiae* Ab. 26-29 mm. H.W. 17 mm. Yellow with brown tinges, abdomen vermilion tint. *C. olivaceum auranticum* Ab. 34-38 mm. H.W. 22-33 mm. Red or brownish, legs blackish. *A. hisopa* Ab. 24-26 mm. H.W. 15-16 mm. Black and blue, violet stripes on sides of thorax, pinkish beneath. *A. pallidum*. Ab. 31 mm. H.W. 18 mm. Brown, blue stripes, abdomen long, broadening at end, white with black markings.

I. senegalensis. Ab. 21-23 mm. H.W. 13-15 mm. Black, sides blue. Thorax with yellow stripes. Scarce, scattered. *T. nursei*. Ab. 14 mm. H.W. 9-10 mm. Black, greenish stripes. Abdomen crimson at thorax

CHAPTER 3

Insects

with black spots, yellow and black lower down. *E. parvum*. Ab. 17 mm. H.W. 11 mm. Black, thorax with blue stripes, sides paler, white below. Abdomen blue marked black.

A. pieris Ab. 16-18 mm. H.W. 9-10 mm. Black with pink marks and stripes, sides bluish, white below. Abdomen pale blue marked black. *A. splendidissima* Ab. 18 mm. H.W. 10 mm. Black, blue spots and stripes, white below. *M. varalli* Ab. 23-25 mm. H.W. 14-15 mm. Reddish, bluish spot near eye, stripes on sides. *C. dyeri* Ab. 22-23 mm. H.W. 16 mm. Black with blue spots and stripes, thorax grey with black lines. Abdomen greenish with black. Female: Thorax black, pale green stripes above, sides bluish and white, abdomen greenish with white.

R. bisignata Sel. Ab. 20 mm. H.W. 24-26 mm. Velvety black, yellow and pink spots. Forewing long, narrow, hyaline, yellow and black. *L. lineata indica* Ab. 14-16 mm. H.W. 15-18 mm. Black, yellow spots. Brownish tinge. Wing base amber, tips black. No nodus in forewing. *N. chinensis* Ab. 45-50 mm. H.W. 32-38 mm. Green. Blue, yellow below. Brownish stripes on sides, white below. Wings pigmented. *V. gracilis* Ab. 45-56 mm. H.W. 34-38 mm. Green marked yellow and black, yellow underneath. Wings hyaline with the lustre of mother of pearls.

SUB-ORDER ANISOPTERA (चतुर)

Wings dissimilar, hind wings broader at base, held depressed in repose. Eyes large, touching or almost touching each other. Nodus in the middle or nearer the tip of the wing.

Fam. *Gomphidae*. Rather large insects, abdomen varying between 30 and 45 mm. and hind wing 23-35 mm. in various species. Colour generally black marked with yellow stripes or spots. Wings generally slightly coloured at base or tip.

Fam. *Aeshnidae*. *G. mellardi*. Ab. 46 mm. H.W. 44 mm. Head yellow, black lines. Body brown marked blue and reddish, wing base yellowish, yellow at upper border. Migrant.

Fam. *Libellulidae*. *Macromia* spp. large Ab. 40-50 mm. H.W. 32-42 mm. Brown with black thin lines. Thorax with metallic reflex marked with yellow. Wings tinted yellowish brown. Abdomen black ringed yellow. Female brighter. *E. vittata*. Ab. 50-57, H.W. 48-52 mm. Body bluish green, marked yellow. Abdomen spotted. Hindwing tip amber. *P. obscura*. Ab. 29-32 mm. H.W. 35 mm. Thorax black or bluish, yellow marks occasionally, black stripes on sides bordered yellow.

O. C. luzonicum. Ab. 28-30 mm. H.W. 30-32. Head black and yellow, thorax greenish, stripes on sides, abdomen blue tapering. *O. glaucum*. Ab. 29-35 mm. H.W. 33-40 mm. Thorax dull blue or black. Females and young yellowish, bordered by a brown stripe. Sides reddish, 2 yellow stripes. Wing base yellow or brown. Abdomen bluish, tip black.

CHAPTER 3
Insects

B. sobrina. Ab. 20-24 mm. H.W. 25-28 mm. Head blue and brown, yellow spots at top. Thorax brownish with black markings. Abdomen black or blue, marked yellow in females and young. *D. trivialis*. Ab. 19-22 mm. H.W. 22-23 mm. Thorax bluish, light yellow in females and young, minutely spotted, black lines on sides. Yellow dot in hind wing centre.

I. caesia. Ab. 25-26 mm. H.W. 28-31 mm. Thorax blackish to violet, greenish in females and young, yellow patch on hind wing. Abdomen brown, pale yellow markings. *N. fulvia*. Ab. 21-26 mm. H.W. 27-32 mm. Brown, fine black borders to thorax and abdomen. Wings opaque, reddish, a clear patch at top. *N. intermedia*. Ab. 22-24 mm. H.W. 24-27 mm. Thorax greenish, reddish stripes. Wing base amber. Abdomen reddish, brownish stripe. *N. tullia*. Ab. 16-20 mm. H.W. 19-23 mm. Black, yellow narrow line on thorax white stripe on abdomen. Wing basal half blue black. Female yellow, thorax greenish with yellow stripe, wings amber at base, paler in centre, blackish brown above. Black band on abdomen.

R. rufa. Ab. 25-29 mm. H.W. 32-37 mm. Head and thorax reddish brown. Abdomen scarlet, yellow patch in wings at base. Female yellow with a white stripe on thorax and yellow on abdomen. *T. aurora*. Ab. 21-29 mm. H.W. 24-34 mm. Thorax purplish, brown and black stripes. Wings hyaline, crimson nerves, reddish stripe at base. Abdomen yellow, constricted in the middle. Female thorax yellowish with stripes. Abdomen brown and black. *T. festiva*. Ab. 22-28 mm. H.W. 26-32 mm. Thorax black with shades of purple. Wings opaque, hind wing base brown, dark rays above. Abdomen black. Female yellow marked with black. *T. pallidinervis*. Ab. 28-32 mm. H.W. 30-36 mm. Head and thorax yellow and purple, Wing nerves, front wing base yellow. Abdomen black marked yellow.

Z. petiolatum. Ab. 37-42 mm. H.W. 32-35 mm. Reddish brown, wings hyaline or brownish, deep at top. Abdomen tip black. *T. tillarga*. Ab. 28-33 mm. H.W. 33-37 mm. Brown and reddish. Irregular brown mark and a white spot in hind wing. *P. flavescens*. Ab. 29-35 mm. H.W. 38-40 mm. Yellowish brown sides bluish and reddish, thorax bluish or greenish. Hind wing base yellowish, brown spot at apex. Black spots at abdominal end. *H. croceus*. Ab. 29-33 mm. H.W. 40-42 mm. Yellow with tinges. Wings pale brown at top, hind wing reddish at base and on one side. Abdomen marked black. *U. signata*. Ab. 27-28 mm. H.W. 34-37 mm. Red, lower side yellowish, black marks on abdomen and thorax. Wing veins crimson, base of front amber in the hind extended.

Refer. Fraser F. C. (1933-36) Fauna Br. India. Odonata Vol. 1 to 3.

ORDER PLECOPTERN—PERLIDAE (STONE FLIES) (PLATE 1 FIG. 5)

Soft bodied, biggish, odonata type. Antennae long, weak mouth parts. Wings membranous, flat on back at repose. Processes at the end of abdomen. Weak fliers. Breed in water, rarely leave the surroundings. Adults rest on stones, tree trunks etc.

CHAPTER 3
Insects

Eggs laid in clear water, stony beds preferred. Nymphs similar to Odonata but with long antennae and cerci, long hairy legs with claws. Feed on algae, mosses etc. Moults 12-36 times to attain adulthood. About 1300 species described, a few known from India, none noted in Maharashtra.

See Lefroy H.M. (1909) Indian Insect Life P. 124 Perlidae. Imms A.D. (1959) General Text Book of Entomology, P. 311.

ORDER ORTHOPTERA

Vary in size, 8-100 mm. Undergo gradual development. Possess two pairs of wings, upper pair (tegmina) thick, parchment like, lower pair thin, net of nerves, kept folded under tegmina when not in use. Hind legs strongly developed for leaping. 3 families.

Fam. Acrididae. Short-horned grass hoppers टोळ (Plate 1 Fig. 6).—Eggs laid underground in masses in capsule. Generally hatch in June-July. Young feed on surrounding vegetation. Some grow and die at the same place, a few pests of specific crops, some migrate in huge groups in adult stage and are known as locusts. About 5,000 species described, about 500 in the Indian region, about 50 in Maharashtra. The whole family herbivorous. Divided into sub families, 6 important.

Sub-family Acridinae. Subaquatic, small, mostly recorded from Bombay or round about. Most of them dull brown, full of protuberances, spines on thorax, tegmina ending in a thin process. *L.* 24-26 mm. *S. uncinata* *L.* 11 mm. In some species like *T. dorsifer* thorax ridged, fawn coloured eyes raised, in some front legs compressed. Length 10-26 mm.

Sub-family Tryxalinae. Legs generally spiny. Recorded generally in Bombay and round about. *G. simplex*. Darkish brown, black band on head, thorax with 3 ridges. Tegmina long. *L.* 18 mm. *Dociostaurus* spp. are with slight differences brown above, yellow below, yellow stripes on thorax, black spots at the end. Tegmina hyaline with spots and stripes. Length 13-23 mm. *A. tamulus*. Green, brown or reddish, tegmina with brown or whitish spaces. Hind femur slender, banded brown, tarsi yellow, blue and red. Length 18 mm. Pest on cultivated grasses, legumes, cotton etc. *A. affinis*, Reddish brown, abdomen yellowish with dark spots. Tegmina spotted. *L.* 19-24 mm. Pest on sugarcane, jawar etc. *S. bicolor* small, green, brown, etc. universally feeding on grasses.

Sub-family Oedipodinae. Very common in Western Ghats. Fairly big 20-40 mm. brown or greenish with markings on tegmina. Wings transparent, big, partly coloured. *G. marmoratus*. Green and brown, whitish marks at base of tegmina, a curved black central band in the wings. Feeds on paddy, lucern etc. *L.* 35-40 mm. *H. respondens*. Reddish yellow spotted with black, thorax velvety, wings tinged red and yellow, black markings above, *L.* 19-22 mm. Feeds on low grasses.

CHAPTER 3
Insects

Sub-family Batracotetriginæ. *E. granulosa* noted in Bombay. Female with traces of black spots and bands on thorax, tegmina reddish, dark spotted, wings hyaline, yellowish at base, interrupted brown band beyond. L. 38-50 mm.

Sub-family Pyrgomorphinæ. Surface grass-hoppers, with short tegmina. *Chrotogonus* spp. (खरपुडी, नाकतोडे). Universal. Feed on low grasses and crops in swarms, biting holes. Almost all yellow or yellowish brown, short, stoutish. Length 15-22 mm. *A. scabiosa*. Shining black, yellow band across head and sides of thorax, abdomen banded red, tegmina greenish or brown with yellow spots. L. 44-60 mm. Attacks palms, *Erythrina* etc. Often a serious pest on forest trees. *A. miliaris*. Similar; the yellow band missing.

Poecilocerus spp. (Painted grass hoppers) Green or blue, yellow lines and spots. Tegmina blotched yellow, wings vermillion at base. L. 38-40 mm. Feed on calotropis, bamboos and occasionally on cultivated crops. Nymphs yellow painted black, red spots. *A. crenulata*. Green pubescent abdomen, wings rosy. L. 16-26 mm. Pest on brinjal, tobacco, *Amaranthus* etc. *C. sphenoroides* (Deccan Wingless grass hopper). (बिनपंखी टोळ.) Straw or green, abdomen striped. Red and blue bands behind eyes. Tegmina short, reddish, wings absent. L. 25-35 mm. Attacks cereals and pulses all over the State.

Sub-family Catantopinae. *O. valox*. Green, black band on head, thorax and knees. Hind legs red, tarsi blue. L. 16-32 mm. Pest on paddy, sugarcane, pulses etc. *Hieroglyphus banian*, (भातावरील टोळ). Green or straw coloured, incised black lines on thorax, hind tarsi blue with black spines. Legs red. L. 30-45 mm. Major pest on paddy. Also attacks maize, wild grasses, sugarcane etc. Young hoppers brownish yellow, a yellow stripe on thorax. Others similar and minor pests. *S. prasiniferum*. Brownish or green, dark stripe on head and thorax, yellow and dusky lines all over. Variable. L. 13-20 mm. Pest on Tectona.

G. laticornis. Delicate green, stripe under antennae, tegmina narrow, wings hyaline, L. 20-22 mm. Forest insect. *C. ranacea*—Cotton grass hopper, (कापसावरील टोळ) Reddish brown, brown lines below eyes, broad, pale band on sides of thorax, hind femur white, tegmina yellowish, dark spots on upper margin, brown ringed patches all over. L. 45-55 mm. Feeds on cotton, castor, groundnut plants in plains. *C. succincta* (Bombay locust) Pale brownish, slender, streaks of black and yellow, thorax laterally compressed, stripe in the middle. Tegmina long, pale with white stripes, black spots and lines. L. 48-56 mm. male, 57-63 mm. female. Some times forms swarms and flies over Andhra and Madras States. Breeds in Kanara and Goa forests. Nymphs green, antennae yellow, change to brown, then black with white rings. Cosmopolitan pest.

T. monticollis (Hooded grass-hopper). Green or brownish, antennae, top margin of hood, knees, spines, lines on hind legs, Yellow.

CHAPTER 3
Insects

Tegmina opaque. Front part of thorax raised enormously into a hood with coarse structure. L. 35-65 mm. Common voracious eater. *C. humilis*. Greenish brown, tegmina long, abdomen and legs yellowish, red below. L. 22-30 mm. Feeds on grasses, cotton etc.

Fam. *Tettigoniidae*. Long-horned grass-hoppers (लांब भिशांचे टोळ) (Plate 1. Fig. 7).—Generally of large size. Antennae long thin, tegmina thin, leaf like. Most of the species produce sound by movement of tegmina. Some wingless, some carnivorous, a few phytophagous. Eggs laid under leaves or stems, under tree bark or in soil. Females with long sword like ovipositors. About 4,000 species known, about 200 in the Indian region. Less than 20 mentioned near about Bombay. Habits of only a few known.

C. indicus. Narrow, elongate, green and brown. Breeds continuously in tall grass and waste lands. Male produces shrill notes, difficult to locate. *S. rugosa*. Large, 60-70 mm. Feeds on *Butea* (फळस). Peculiar appearance. Large, flattened, bark coloured i.e. brown or grey motionless on barks of trees by day, actively feeding by night. Noted for cryptic form and colour. Difficult to see. *M. elongata*. Large 50-70 mm. crepuscular, attracted to light. Varies in colour considerably from greenish to dark brown with large blotches on tegmina. Tibiae spiny. Males chirp loudly at night. Love big trees. *L. nigroparsa*. Feeds on sandal foliage (*Santalum*). Eggs laid in succulent shoots or stems of young seedlings, December-February.

Fam. *Gryllidae*—Crickets. (नाकतोडे) (Plate 1. Fig. 8 and 9 Leaping insects with long, filiform antennae, auditory organ on foretibia. Wings turned over at right angles from dorsal to lateral surface of the body. Tarsi 3 jointed. Female with long ovipositor. True crickets i.e. *Gryllinae* produce loud sound by rapid vibrations of wings. Described species about 900, about 150 in the Indian region, a few found in Maharashtra.

G. africana (Mole cricket). Plate 1, Fig. 9. Light brown, powerful digging forelegs, head and thorax hard, antennae short, hind wing extending beyond short tegmina and into thin processes. Cerci prominent. Body soft. L. 30-40 mm. Breeds in burrows under trees. Feed on young plants and roots. Mother takes care of the eggs and young. Attracted to light. *B. portentosus* (Brown cricket). Blackish brown, short tegmina. Nymphs burrow deep in soil, throwing earth above ground, live there. Life cycle 8-12 months. Feed on young seedlings and low shoots of vegetation at night, hide by day. Extremely noisy. L. 50-55 mm. Destructive to *Casuarina* plantations. Used as food by some tribes in N. India (Beeson 1941). *G. humeralis*. Smallish grey cricket, attacking *Casuarina*, *Eucalyptus*, *Sissoo* etc. L. *bimaculatus*. Greyish black, hiding under stones, logs etc. Adult about 20-30 mm. Two yellowish spots below thorax, tarsi spiny. Feeds on decaying vegetation, insects. Cuts leguminous crops at ground level.

CHAPTER 3

Insects

G. domesticus (Black headed cricket). Greyish, head black, long antennae. Breeds in dry, barren soil. Hide by day, feed in clusters at night. Do not fly though winged. L. 25-30 mm. Omnivorous. *Grylloides* spp. Common house crickets. Blackish, feed on greasy and fatty matter or paper, cloth, leather etc. Also attacks nursery seedling. L. 20 mm. *O. indicus*. Delicate, greenish white, flat, wings almost transparent, antennae thin, long hind legs spiny. Often found on tobacco but not doing harm. Probably predaceous on some other small insects. Also noted on paddy and other dense vegetation.

See Fletcher T. B. (1920) Rep. Pro. Ento Meet. Pusa.

Annotated list of Crop pests.

Uvarov B. P. (1928) Locusts and grass hoppers. Imp. Bur. Ent. Lond.

ORDER PHASMIDA (LEAF AND STICK INSECTS)

Assume the shape of leaf or stick. More common in thick moist forests. Entirely herbivorous. Life history, habits not known fully. About 2,000 species known, 65 from the Indian region, mostly in the north. General life :—Hard coated eggs laid broadcast or cemented to a sheltered surface in rows. Nymphal life a few weeks to some months. Feed on plant leaves. Found in a variety of forms and colours, some looking like fallen sticks some like blades of grasses and some like leaves. Resemble the habitat completely and escape enemy notice.

Leaf insects : (Plate 1, Fig. 10a). All parts flat, leaf like. Prothorax small, meso and meta longer, forewings small, hind pair bigger resembling leaf. A few species wingless. May be green, yellowish, brownish like dry leaf. Stick insects : (Plate 1, Fig. 10b). Round, long with long legs. All of greyish colour and of uniform width from head downwards. Forewings short if present, hind wings longer closely covering the body at rest. Many wingless.

ORDER DERMAPTERA (EARWIGS) (विचवाची मावशी)

(Plate I, Fig. II)

Known by various synonyms. e.g. *Labidura*, *Forficulidae*, *Dermaptera*, *Euplexoptera*, *Harmoptera*, *Forficularia* etc. Household or outside scavenging insects. Eggs laid under stones, barks of trees, decaying vegetation, in flowers or near roots of plants like sugarcane. Commonly, mother incubates the eggs. Larvae resemble adult, active, get protection from mother for sometime. Feed almost on any food but insects like Dipterous larvae preferred. Adult slender with short horny forewings (Elytra) covering the larger radially folded hind wings, lower portions of which are exposed. Abdomen extends below wings, ending in a pair of thick processes, known as forceps. L. 5-25 mm. Rarely fly. Can run about quickly. Possess strong mandibles. Some species wingless. Forceps of males greatly differ from the female forceps. Most active in damp and rainy season. Breed all through the

CHAPTER 3

Insects

year in irrigated fields. Considered beneficial, being insect feeders. About 900 species known, 100 in Indian region, less than 20 in Maharashtra, representing 4 families.

Fam. *Pygidicranidae*. *D. lefroyi*. Large, black, abdomen blackish red, widening downwards. Forceps, stout, trigonal, gently tapered, pale yellow, tip black. Common in eastern side of Western Ghats.

Fam. *Labiduridae*. *P. dohrni*. Black, brilliant oily lustre. Forceps short, stout, hooked at end. *P. lefroyi*. Shining blackish red, elytra cut slantingly at apex. Forceps red, stout, conical, straight. Feed on plantain roots. Medium size. *A. annulipes*. Med. size. Head black. Wingless. Abdomen parallel sided, last segment largest. Forceps stout, strongly curving inside, right crossing above left at apex. *B. stali*. Small, black, shining, ovate flaps on sides of neck. Forceps trigonal in first half, tapering, cylindrical next. Right curved more than left.

L. trispinosa (Forcipula). Medium size. Dark, dense yellowish hair. Wings black, tips yellowish. 2 fine spines at the end of abdomen. Forceps long straight for about two-thirds of length. A spine on inner side in the middle of the straight part, 2nd tooth at bend, then straight ending in a hook inwards. Cosmopolitan. *L. lividipes*. Small, blackish, wings pointed. Abdomen last segment broad, big, ball like structure at base of forceps. Forceps bowed inward at an angle, overlapping at end, a tooth a little above apex. Breeds in grass, attracted to light. *L. riparia*. Big, white alive, brownish when dead. Red band at suture of elytra, smoky band in the middle. Forceps taper gradually, often a spine at end. Breeds in grasses.

Fam. *Labidae*. *L. arachides*. Medium size. Dark brown. Wings abortive, abdomen slightly hairy. Forceps short, gently curve in, small tooth in inner margin at base, another below. Cosmopolitan.

Fam. *Forficulidae*. *P. simulans*. Medium sized, slender, brick red, wings orange, dark band at the edge. Abdomen broad, flat. Forceps arched inwards, tooth in inner margin one-third from base, often one more at apex. *P. melanocephalus*. Small, brown to black, elytra and wings long, yellowish brown. Forceps reddish, simple, straight in female, short, broad, gently curved in and blunt at end with a tooth in male. Common in sugarcane roots and in tunnels made by borers. *A. nigrocastaneus*. Medium sized, smooth, black. Wings orange, black margins. Forceps short, stout, three teeth in curved. *E. metallica*. Large, reddish, parts metallic, greenish. Wings smoky. Forceps nearly straight, fine teeth in inner margin, distinct tooth in the middle.

Read. Burr M. (1910) Fauna Br. India—Dermaptera.

Hebard M. (1923) Mem. Dept. Agr. 7 : 195-242 Studies in Ind. Derm.

ORDER EMBIOPTERA (PLATE 1, FIG. 12)

Of no economic importance. Mouth parts like those of Orthoptera, wings like termites. Delicate brownish. Prothorax small, meso and

CHAPTER 3
Insects

meta longer, abdomen generally of ten segments. Wings smoky. Few veins, Front pair of legs stout, middle reduced, hind pair with swollen parts. Generally males winged, females wingless. Usually found under stones or some sheltered place. Some live as commensal in spiders nests. Readily come to light, enter houses. Live in webs, thread prepared by themselves by fore feet. Eggs laid in groups in silken tunnels. Mother takes care of the young. Carnivorous but can live on vegetarian food. More than one and often many live in the same tunnel. Move backwards and forwards if disturbed. Life cycle 55-70 days. About 140 species are described so far, only a few in India and about 3 in Maharashtra. *O. saundersii* (*E. bramina* = *E. latreillei*). Pale chocolate brown, wing veins and bands also brown. L. 7 mm. *O. ceylonica* lives as a commensal in spiders nest, has dark smoky wings. L. 5-7 mm. *O. asymetrica*, dark brown, head and thorax blackish, wings greyish, black veined. L. 9-10 mm.

ORDER DICTYOPTERA

Consists of 2 families—*Blattaria* and *Mantidae*. Fam. *Blattaria* (Cockroaches) (झुरळ) (Plate 1, Fig. 13) Flattened. Large forewings covering the hindwings flatly over abdomen. Legs large, spiny, cover lower side of thorax. Head generally turned below thorax. Usually brown or mahogany, a few green, yellow or spotted. Some species wingless, in a few only females apterous. Live on ground, houses, caves, plants etc. Omnivorous. Serious household pests.

Methods of reproduction three. (1) Oviparous, eggs covered by a capsule (Oothica) carried by mother for short time protruding from the body and then laid in a crevice. (2) Ovoviviparous, egg capsule carried by the female for most of the egg period and (3) Viviparous, egg capsule not seen outside but young emerge directly. The insect has strong biting mouth parts, slippery to touch, hides in dark corners or crevices. Long lived both as nymphs and adults. Nocturnal except tree cockroaches. Some are disease carriers. About 3500 species known, 200 in India, about 25 in Maharashtra.

P. germanica. Small, brown, wings longer than body, dark brown streaks on thorax. L. 10-12 mm. *Allacta* spp. 6-10 mm. similar to above but wings shorter than body, legs weakly spined. *Blatta* spp. Long antennae, trapezoidal thorax, wings in males shorter than abdomen, females wingless. Legs with 3 rows of weak spines. *B. rhombifolia* 40-50 mm. with varied yellow markings, common in homes. *P. americana*. Large, 30-35 mm. reddish brown, infests houses and stores. Thorax trapezoid, sides whitish, antennae long, slender, legs long spines in 3 rows. Oviparous. Nymphs feed on organic matter for 8-15 months, adults also live long. Emanate obnoxious smell. Fly in houses just before rains. *P. australasiae* similar but 20-25 mm. lighter in colour, thorax with complete light coloured ring, a yellowish narrow patch in the corner of the forewing. *C. ornata*, a tree cockroach almost circular, wingless.

CHAPTER 3
Insects

Fam. *Mantidae* (Praying or Preying mantids) (खंडोबाचा घोडा) (Plate 1, Fig. 14) Posture of sitting as for prayers. Raptorial forelegs thick set and folded under head and thorax, sitting motionless for long periods, with head and thorax raised. Wholly carnivorous. Spiny forelegs, seize any insect including other mantids and even its own male approaching for mating. Vary in form. Get completely assimilated in the surroundings and so can prey better unnoticed. Eggs laid on a twig in masses in a viscid liquid froth exuded by the mother, which assumes a solid mass of layers and is known as oothica. Nymphs emerge in masses, prey like parents, moult, develop, attain adult stage in about a year. About 1800 species known, less than 100 in the Indian region, about 10 in Maharashtra.

H. indica. Dull grey, L. 25-30 mm. found on barks of trees. *Hieradula* spp. robust, green, 65-70 mm. familiar in gardens and field crops. *Euremoplana* spp. long, slender, dull brown, common in plains. Attracted to light. *C. urbana*, Common, green, a black ringed eye spot on tigmia, 35-40 mm. *A. zshmoliana*. Elongate dark brown, 100-110 mm. *G. gongylodes* Queer, inhabits forests. 80-120 mm. long, thorax long, stick like, triangular leaf like expansions on sides of head. Two hind pairs of legs long, thin with thin circular expansions at joints. Abdomen leaf like, short, almost circular. Male winged, female with attenuated wings. Indistinguishable from surroundings.

Read : B. M. Giglio Tos, E., Rehn J. et al. *Genera Insectorum* pts. 119, 144, 177, 196-203.

Fletcher T. B. (1914) *Some South Indian Insects*. P. 195.

Williams C. E. (1904) *Tr. Ent. Soc. Lond.* P. 125. Notes on the life history of *Gongylus*.

ORDER ISOPTERA (TERMITES) (वाळवी, उदयी)

(Plate II, Fig. 15 a queen, b king, c worker, d soldier a, b, c, d.)

Termites are wrongly called white ants. In no way connected with ant group except for social habits. Live in highly developed colonies. Divided into a number of forms, mainly (1) Kings and queens, Deeply coloured, large compound eyes, wing pads showing the dropping of wings after the nuptial flight. (2) Large and small workers, wingless, white, eyes practically absent, broad reddish head. Both sexes present but non-functional. (3) Soldiers of all sizes. Wingless with large red head, big mandibles and both sexes non-functional.

Breeding habits of all species similar with slight variations. Sexual forms mature at a certain time of the year, produce wings, swarm in air, shed wings and mate. A large number perish. Mated pair digs a hole in earth and lays eggs. The first progeny cared for by parents. Later this brood takes charge of the nest, feed the later borns, keep nest clean, forage, look after the royal pair etc. These are workers. Parents mate often. Soldiers, also born with workers, protect the

CHAPTER 3

Insects

colony and act as scavengers. Eggs are produced by thousands a day. The queen becomes a white, big mass of 8-10 cms. length, the king grows slightly.

Termites live on cellulose or other organic matter in soil e.g. humus, fungi, lichen etc., Some species cultivate in the nests gardens of fungi, which look like honey combs, for feeding purposes. Some useful as ground scavengers but most are harmful. Nests of various types. About 1700 species known, nearly 200 in India, a few in Maharashtra divided into 5 families, 4 represented in India and Maharashtra

Fam. Kalotermitidae (Dry wood termites). From colonies inside sound dry wood, rarely go to ground or moisture. Common in houses and heart wood of living trees. *K. assmuthi* found in fields, not in buildings. No worker class. Nymphs develop into reproductives. Soldiers have quadrangular head, flattened in front, mandibles toothed. Nests of excavations and tunnels without coating.

Fam. Hodotermitidae. Similar to *Kalotermitidae* but has worker class. *H. macrocephalus* found in sandy soils. Feed on irrigated transplants or on grasses.

Fam. Rhinotermitidae. Nests underground but attacks buildings overground. Protozoa in intestines digest wood. *H. indicola* General wood destroyer. Nests independently or with *O. obesus*, close to royal cell. Attacks soft wood, glass surfaces etc., fills cavities with excrements. Swarm in the morning with first monsoon showers. *C. heimi*. Important dry wood species, making irregular galleries in wood in houses and in open. Outer surface of constructional timber left in tact. Destroys electric installations. Workers white with deep brown head. Swarm at sun set from January to March. *C. parvulus* attacks logs on ground and tree trunks through galleries covered with earth.

Fam. Termitidae. Big family. Different habits. No protozoa in intestines. Do not feed on hard timber, confine to decayed wood, grass, humus, fungi etc.

T. faea a serious household pest; covers of mud conspicuous, crumble easily. Very common. Worker blackish, head brownish. No mounds formed. Swarm at night-fall at the close of the rainy season. *O. obesus* very conspicuous in black soils. Individuals vary considerably in size. Builds huge mounds cultivates fungus gardens extensively. Destroys anything including sugarcane setts, palms etc. Royal cell at ground level by the side of the fungus garden. Swarms at break of monsoons at dusk. *M. incertus* etc. found in nests of *O. obesus* or independently. Their tunnels smooth, soldiers few. *M. annandalei* attacks wood on floor. No big nests. Swarm at the beginning of monsoons. *M. heimi* has small nests of hard organic material, with minute holes and has many queens. Attack dead wood in fields. *M. obesi* found in nests of *obesus*. Pest on wheat, crucifers etc.

CHAPTER 3

Insects

T. biformis form small galleries on ground or under stones, workers yellow, legs long. Soldiers with pear shaped head ending in a tube. Cut grass tops and carry to nests by thousands at sunset. *T. heimi* and *T. rubidus* similar, the former with aromatic odour, latter attacks wood on ground. *Captotermes* spp. tunnel in pillars of *obesus*, destroying wood. Mandibles twisted, cannot bite.

Read : J. Bomb. nat. Hist. Soc. Vol. 22, 23 and 30 by Assmuth and Annandale respectively and Vol. 52, 53 and 56 by Roonwall M.L.

ORDER PSOCOPTERA (BOOK LICE) (पुस्तकांतील ऊ)

(Plate II, Fig. 16)

Small insects, 3-8 mm. 2 pairs of banded wings, a few wingless, soft body, small prothorax, tarsi 2-3 jointed, resemble termites but body brighter and colours dull. Species noticed 1000, only 10-11 in India, none recorded in Maharashtra.

Life history simple. Eggs laid under silken webs. Young cluster with mother, run about, in old books, photoes, collections of insects etc. Live in damp or sheltered places. A species of *Atropos* destroys dry insect specimens.

Read Notes on Neuroptera of Ind. Museum in Rec. Ind. Mus. Vol. 3 and 8.

ORDER MALLOPHAGA (BIRD LICE, BITING LICE) (पशु पक्षांवरील उवा)

Flat bodies, small, wingless, biting mouth parts. Head large, broad. Mainly parasites on birds, a few on mammals. Life passed on host body stuck up in one place. Eggs firmly attached to bird feather or animal hair. Nymphs exactly like mother, stick to feather. About 3 moults cast to attain adulthood. Feed externally. A few suck blood if opportunity occurs. Usually long lived but die immediately on hosts death. Never migrate from one to another. Lice infecting birds have two claws and infecting mammals have one only. Total world species 2,600, about 100 in India, mostly recorded near the Himalayas and Calcutta. Divided into 5 families. Full details not known.

ORDER SIPHUNCULATA, ANOPLURA, SUCKING LICE (उवा)

(Plate II, Fig 17)

Small wingless flat, blood sucking. Head protruded with pointed beak, retracted when not in use. Fused thorax distinct. Legs stout, conspicuous claws. Parasitic on mammals including man. Not sufficiently studied. Described species about 225, a few recorded in India. Divided into five families but only one, *Pediculidae* is important.

P. capitis is the human head louse. *P. corporis* slightly smaller, found on human body under clothes. Both disease carriers, e.g. typhus,

CHAPTER 3

Insects

relapsing fever, trench fever etc. *P. pubis* (Crab louse) breeds in the pubic region and looks like a crab. Not a disease carrier. Goa records *H. tuberculatus* on buffalo, *H. eurystermus* on domestic cattle.

See Hopkins G. H. E. (1949) Proc. Zool. Soc. Lond. 119:387 Host association of the lice of mammals.

ORDER HEMIPTERA—RHYNCHOTA (BUGS) (Plate II).

Many species affecting human life Suck food by beak which remains folded under body when not in use. Four wings in adult stage with a few exceptions. Divided into 2 sub orders, Homoptera and Heteroptera, each distinct from the other.

SUB-ORDER HOMOPTERA

Small insects of different types. Front of the head bent, wings held over the body as a roof, sloping on sides, consistency uniform. Many apterous in adult stage. Pronotum small, tarsi 1 to 3 jointed, metamorphosis complete or incomplete or may differ in sexes. Mostly plant feeders, appear singly or in groups. Multiply rapidly. Nine families.

Fam. Cicadidae. (Plate II, Fig. 18) Ocelli on vertex of head in triangle. Tarsi 3 jointed, male with a musical apparatus (opercula) attached to base of abdomen as flaps. Fairly big, head well developed, antennae ending in bristles. Wings large, often coloured veins conspicuous. Thorax well developed, abdomen broadly connected. Female with ovipositor. Mostly found in thick moist forests. Eggs laid under tree barks in slits. Nymphs drop to ground, feed on tender roots for a long time, sometimes for years, attached to a branch when full grown cast the final skin, split open outer cover for the adult to come out. Adults feed on plant sap for a year or so. Feed often in one position ejecting a fluid excreta which bursts into a fine spray. If in numbers a mild rain is caused. Males produce shrill notes. About 1,500 species described, about 200 in India. About 12 from Maharashtra known.

Platyleura species. Brownish yellow, black spots and stripes on head. Tegmina with brown markings. L. 20-25 mm. *C. vesta*. Head truncate black, prothorax reddish, yellowish line. L. 58, f 22 mm. Pest on sandal. *P. latus* (Knife grinder). Thorax greenish, abdomen reddish, black markings. Wing veins prominent. L. 32-38 mm. Produces shrill noise reechoing in forests. *Khimbya* spp. Brownish yellow with spots. L. 24 mm. *S. crocea*. Black and yellow, mimics honey bee. L. 15-20 mm.

Fam. Fulgoridae (Lantern flies) गवतांतील माशा (Plate II, Fig. 19) Large family, variety of forms. Large coloured, moth like, some small. Mostly infest grasses. Head elongated, produced below with a beak. 2 ocelli in cavities. Body well developed, short, tegmina much longer, roof like. Legs expanded, tufted or spined. Mostly hill species, some from the plains.

Eggs laid in masses, covered with a fluffy material. Nymphs gregarious, waxy, generally with a pair of anal filaments. Active, some

CHAPTER 3

Insects

leaping. Common in rains. Hibernate in cold season in any stage. Described species about 4,500, about 400 in India. About 30 fairly common in Maharashtra.

E. tomentosa, short, oblong, greenish and red. Tegmina spotted. L. 6-9 mm. Cosmopolitan pest e.g. on *Cajanus*, *Cassia*, *Calotropis* etc. *Dichoptera* spp. L. 19-20 mm. Brown and black. *D. pallida*. Brown, legs striped, tegmina, stigma brown. L. 7-8 mm. Pest on sugarcane leaves. Springs at touch. *A. moesta*. Body short, 2-3 mm., red and black, tegmina very long 13-14 mm., black with white spotted border, patches in the middle. Pest on sugarcane, Palm leaves etc. *D. carnosus* similar but patches brown, on maize at Nagpur.

P. aberrans (उसाच्या पानावरील माशा) Straw coloured, tegmina paler, spots and two lines at apex. Head produced, ridged. L. 8 mm. Serious pest on sugarcane. Secretes honey dew, develops black mould. Young nymphs pale brown with waxy spiny tail like processes, actively hopping. *P. perpusilla* similar with no lines. *K. carinata*, yellowish, brown band at apex of tegmina L. 4-5 mm. found in sugarcane. *R. marginalis*. Small, stout, blackish, broad wings. Tegmina black with 3 white patches and spots. Pest on *Zizyphus*, sandal etc. *P. viridula*. Greenish yellow, leaf like tegmina, 2 elongate spots. L. 11-12 mm. Pest on forest trees. *F. ferrugata*. Yellowish and greenish, reddish spots. L. 7-8 mm. Pest on *Tectona*, sandal etc. in the Deccan. *P. simplicia*, Small, active greyish brown, wings rounded, blackish marks at apex. Abdomen spotted. Serious pest on shoots of jowar (*Sorghum*) and maize. Appear in clusters. (See south Indian Insects p. 494 by Fletcher T. B.)

Fam. Membracidae. (Plate II, Fig. 20) Prothorax develops into a single process, often with 2 thorns on sides pointing backwards. Generally small, dull brown, resembling thorns. Tarsi 3 jointed. Antennae attached in front between eyes. Legs well developed, can walk, leap or fly. Eggs laid in slits in barks of trees. Young gregarious, brown, shiny, moist with a tube like anal end which exudes sweet liquid. Ants attracted. Development slow. Rarely in large numbers. About 2000 species described, 150 Indian. A few recorded in Maharashtra.

O. rufescens. Reddish brown, the back process broad based, long, goes over wings. Tegmina yellowish, a brown patch. L. 7-8 mm. Process 3-4 mm. Found on *Cassia*, *Tur* (*Cajanus cajan*) *Phyllanthus* etc. *L. substitutus*. Process produced forwards, back process almost straight. Black, legs reddish. L. 6-7 mm. Process 4-5 mm. Breeds in thorny *Capparis* and other bushes. Mimics thorns. *C. securis* also found in bushes. Black, tegmina yellowish, body 10 mm. Process 10 mm. *Otinotus* spp. Reddish brown, lateral process upturned, back process long. L. 6-7 mm. Process 3-4 mm. On sandal. *A. pilosum*. Brownish grey. Lateral process direct, obliquely upwards. Tegmina with 2 spots. L. 5 mm. Process 4 mm. On legumes. *Gargara* spp.

CHAPTER 3

Insects

Purplish brown, legs reddish, back process short, robust. No lateral processes. L. 4 mm. Process 2 mm. Widespread, breeds in Sissoo, Dalbergia etc.

Refer Ind. For. Rec. Vol. 19, 26 and 17 Ent. (10) Membracidae of India.

Fam. *Cercopidae* (Frog hoppers, Cuckoo spit insects) थुक किडा (Plate II, Fig. 21) Small, prothorax simple. Adults generally straw coloured, wedge shaped, can leap. Nymphs live in cuckoo spits—the watery liquid produced by them in a froth. This may solidify into tubes to form a nest. About 150 species recorded in India, about 15 in Maharashtra.

M. planitia. Brown, black spot on head and in 3 rows on thorax, curved spine on scutellum going over the back. Nymph in self made tubes. Found in Zizyphus, Bel (Aeagle sp.) cotton etc. *P. nebulosus*. Yellowish grey, 9-10 mm. spots and bands on tegmina. Nymphs discharge a mist. Feed on sandal, grasses etc. *P. affinis*. Larger, brown, on jack fruit tree. *C. lineaticollis* about 10 mm. Brown, yellow stripes on body, on jack fruit tree. *C. relata*. Reddish yellow, forewing bluish black, red markings. Nymphs purple and yellow. Pest on jack fruit stalk.

See Chatterjee and Bose (1933) Ind. For. Rec. 18 (1) : 1 and 19(2) : 8 Cercopidae of Sandal.

Fam. *Jassidae* (Jassids) (तुडतुडे) (Plate II, Fig. 22) Small. Various colours. Wings lightly folded over body, parallel side borders. Head generally broad, curved, attached behind broadly to prothorax. Legs spiny. Eggs laid in slits in plants made by female. Nymphs active, whitish, feed on cell sap. Exude honey dew causing mould on plants. Nymphal life fairly long. Adults live long and may diapause in that stage. About 300 species recorded in India, about 25 in Maharashtra.

Petaloccephala spp. Light yellow to brown. 12-13 mm. *P. nigrilinea* a serious pest on Dodonia, Lantana etc. L. *mutica*. Brownish yellow, dark spots on tegmina, spear shaped head. L. 16-19 mm. Minor pest on mango, sandal etc. *I. niveo-sparsus* (Mango hopper) (आंब्यावरील तुडतुडे) Straw coloured 2 spots on face, 3 patches and 4 spots on scutellum, 2 on tegmina. Suck juice from young mango flower shoots. *I. atkinsoni*, also on mango, two triangular two round spots and a band on scutellum. L. 4-5 mm.

T. ferruginea. Straw coloured, spotted. *T. spectra* almost white, 4 spots on head. Both 7-9 mm. pests on paddy. *K. strigicollis*. Robust 10-15 mm. dry grass colour, 2 spots on head, one on tegmina. Varies in markings and size. Widely distributed. *Jassus* spp. Yellowish white, thorax brown with yellow granules, stout, L. 7-8 mm. Vector of Spike disease in sandal. *N. bipunctatus* (Spotted jassid, *Divali Makhi* = (दिवाली मक्खी Hindi) Green, a black spot on tegmina,

CHAPTER 3

Insects

tips black in male. 2-3 mm. Bad pest on paddy and other crops. Swarms at light. *D. brunnescens*. Brownish, first 2 pairs of legs annulated. L. 4 mm. minor pest on paddy. *E. devastans*. (कापसावरील तुडतुडे). Pale straw coloured, 2 black spots on head, one on greenish tegmina, whitish spots on thorax etc. L. 3 mm. Bad pest on cotton, more on exotics. *T. dubia*. Bright yellowish, 2 spots on head. L. 3 mm. on wheat at Nagpur.

Refer Beeson, Dover et-al. (1933, 34 and 40) Ind. For. Rec. 17; 19 and 20.

Pruthi H. S. (1930-36 and 40) Ind. For. Rec. 6 (4) and Mem. Ind. Mus. 11:1.

Fam. *Psyllidae* (Jumping bugs). Small, one or two pairs of sparsely veined transparent wings. Thick, well developed body. Live in tender shoots, free or in galls of various shapes and sizes. Stalked eggs laid scattered on young foliage. Flat nymphs moult 5-6 times to reach adulthood. Often very injurious to young seedlings. About 8 species noted in the State of Maharashtra.

P. lentiginosum. Brown, wings black spotted. L. 2-5 mm. Pest on mosquito tree (*Goruga pinnata*) and pepper. Forms big galls. *A. punctipennis*. Light brown. L. 2 mm. Active, wings spotted, swarm on indigo and twist the plant. Nymphs yellowish. *D. citri* Greenish brown, active, 2 mm. Attacks citrus plants. *Trioza* spp. on tender shoots of *Eugenia* and *Diospyros*. *P. depressa*. Larva yellow, adult red. Makes galls on ficus leaves and cinnamon.

Read : Crawford D. L. (1912-1924) Rec. Ind. Mus. 7 and 26 Indian Psyllids.

Laing F. 1930. Ind. For. Rec. 14:166. Some records of Indo-Malayan Psyllids.

Fam. *Aleurodidae* (White flies, Mealy wings) (पांढरी माशी) Small. Resemble scale insects except in adult stage. Nymphs scale like with an orifice. Adults white winged with few veins, of equal size, sometimes with markings and bristles. Can walk and fly. Eggs with short stalk, laid on leaves in a circular band. Larva active, legs flat, fixes itself in a convenient and favourable spot, drops legs in second instar, gets covered with wax except for a small orifice from which honey dew exudes, attracting ants and causing mould. Life cycle 22-30 days. These are pests on sugarcane, citrus, jasmine, castor, Pomogranate, 'jambul' etc.

See : Misra C. S. (1921) Bull. 103 Agr. Res. Inst. Pusa. Some Ind. Economic Aleurodidae.

Peal H. W. (1903) J. Asi. Soc. Bengal 72:61 contribution. Aleurodidae.

Singh K. (1931) Mem. Dept. Agr. India 12:1-98 contribution Aleurodidae.

CHAPTER 3

Insects

Fam. *Aphidiidae* (Plant lice—Green flies) (मावा) Very small, 1-2 mm., yellowish green or black, roundish. Generally a pair of tubes at the sides of the anal end. Winged or wingless. Head prominent, antennae long, beak underneath. Wings when present hyaline, front pair long with few veins. Always found in colonies including both winged and wingless. Breeding and multiplication peculiar. Generally parthogenetic and viviparous. New borns generally female, reproduce in 3-4 days, multiply rapidly. Produce wings at will to establish new colonies. Winged forms, both male and female, mate and produce eggs. Found almost on every type of plant, sucking juice from leaves and tender parts, contorting or crumbling them, arresting growth. A few form galls. Exude a waxy fluid from anal tubes for protection; honey dew from anus which attracts ants and produces sooty mould. Number of described species not available. Literature on aphids vast; only some important points mentioned here.

Das B. (1918) Mem. Ind. Mus. 6:132 Aphididae of Lahore.

David S. K. (1955 & 1958) J. Bomb. nat. Hist. Soc. 53:479 and 55:110.

Additions to aphids of India.

Deshpande V. G. (1937) Ibid 39:470 Preliminary account of Aphids in Poona.

George C. (1927) J. Asi. Soc. Bengal (n.s.) 23:1 Some Indian Aphididae.

Fam. *Coccidae* (Mealy bugs, Scale insects) (चिकट्या). Small, but very conspicuous colonies, covered with fluffy mass, scales produced by themselves. Generally 1-2 mm. Each group with specific coverings, mostly greyish white in colour.

Females wingless inactive, males winged active. Reproduction sexual or asexual. Females lay large number of eggs in the cell cover and produce females. Multiply more rapidly when parthenogenetic. Nymphs oval, flattened with legs antennae and eyes which shed in later moults. First instar sexes similar. Males develop wings after 3rd instar going through a pupal stage. Females flat, immobile, get fixed to host plants by mouth parts or excretions or moulted skins. Males with single pair of long, narrow, transparent wings, mouth parts absent, eyes taking their place. Penis conspicuous. Feed on cell sap causing death, knots, swellings or galls. Lac insect belongs to this family. Most species very destructive. *T. lacca* produces lac. Many species found in Maharashtra. Literature :—

Ayyar T.V.R. (1921, 26, 36) J. Bomb. Nat. Hist. Soc. 26, 31, 39. Some South Indian Coccids.

Green E. E. (1919) Rec. Ind. Mus. 16:433 Notes on Indian Coccidae.

Hingston R.W.G. (1929) J. Bomb. Nat. Hist. Soc. 33 : 880 Life of a mealy bug.

CHAPTER 4

Insects

Ramachandra Rao. S. & Ayyar T.V.R. (1934) Bull. 4 Ind. Coun. Agr. Res.

SUB-ORDER HETEROPTERA (ढेकूण, ढेकण्या)

More uniform in character than Homoptera. Four wings in adult stage, the first pair covering the hind pair and body flatly. Forewing horny at base (Hemelytra) and membranous at tip (membrane). Little difference between young and adult except for size and wings. Both live and feed together, mostly on plants. Some species predators. Produce noxious odour. Life history simple. Eggs laid on food or near it, nymphs moult produce slight wings in third or fourth instar attain adulthood after 5th to 7th. Many change colour during this period. Numerous families.

Fam. *Pentatomidae* (Plate II, Fig. 23 a and b). Striking colours. Almost all similar in structure—a small shielded head, antennae at the lower side of the head, beak four segmented, folded underneath. Most of them vegetable feeders, a few predators. About 3400 species known, 600 in the Indian region, about 85 in Maharashtra.

B. vahlii. Black, shining, yellow lines and spots. L. 7-8 mm.
C. cribrarium. Brownish or yellowish, black beneath. L. 4-5 mm.
 Gregarious in rains. Both pests on *Val* (D. lab lab.) *C. ocellatus* brown or reddish, bluish black underneath, spots with brownish rings. L. 16-28 mm. Gregarious on moon tree—*Macaranga roxburghii*. Helps fertilization. *Scutellaria* spp. bluish green to purple brown, spotted. L. 17-22 mm. Feed on grape vines and forest trees—*Phyllanthus*, *Casearia* etc. *Chrysocoris* spp. Bluish or brassy green, black spots. L. 14-17 mm. Common on Lantana, *Phyllanthus*, garden bushes etc. Bombay southwards. *P. bispinosa*. Brownish 2 spines to sides of thorax. L. 7-8 mm. on paddy in Deccan.

Cydnius spp. Widely distributed, known as 'geranium bugs' or 'gundis', create great nuisance. Live under stones, soil or fallen leaves. Attracted to light in rainy season, in swarms. Brownish black, antennae thickened at top, 4-7 mm. *Macroscytus* spp. *Cydnius* habits, widely distributed. Black. L. 3-10 mm. *B. aterrima* oval, elongate, black, front pairs of legs with 2 spines. L. 12-13 mm. Wide spread in early parts of the year. *Chilocoris* spp. Small, 3-4 mm. Black or brown, head with erect spinules, eyes prominent. *Cydnius* habits. Breed at roots of grasses.

H. dentatus. Brownish yellow, partly black, patches of spots and bands. L. 17-23 mm. on *Babul* (*A. arabica*) and *Casuarina*. Probably predaceous. *Gulielmus* spp. Brownish, black spots on back. L. 9-10 mm. Attracted to light. *A. parvula*. Brown, scutellum with 2 spots, a band, often a spot at apex. L. 7-8 mm. Comes to light. *O. montana*. Elongate, brownish yellow, antennae partly red, L. 12-13 mm. Recorded in Chanda. Damages bamboo seed crop, in swarms. (See Fletcher T.B.—1919 Bull. 89 Agr. Res. Inst. Pusa)

CHAPTER 3

Insects

D. indicus. Brownish, narrow, black spots near legs and abdomen. L. 10 mm. Minor pest on *jowar* (*Sorghum*) maize, lucern etc. in the Deccan. *E. guttiger*. Yellow, punctured black, often 2 spots on scutellum. Apex yellow, abdomen black. L. 5 mm. Minor pest on *bajri* (*P. typhoideum*). *E. ventralis*. Brownish, head black, antennae brownish. L. 5-7 mm. Pest on *Til* (*Sesamum*). *Carbula* spp. Golden yellow or brown, black spines to thorax, spotted. L. 8 mm. *P. fimbriata*. Green and red, 2 spots on membrane. Common pest, chiefly on Lantana. *A. cruciata*. Yellowish, black markings, two lines to head and 2 spots. Spots on back. Pest on coffee berries, citrus, jasmine, mango, *Zizyphus* etc. *A. concinna*. Black, shining, spotted, legs white and black. L. 6-7 mm. Pest on rabi crops. *A. nubila*. Brownish or orange yellow, membrane sooty, black spots beneath. L. 10-11 mm. Pest on *Dolichos*. Mistaken for *Dolycoris* but here wings cover the body.

B. picta. Painted bug. (रंगी ठिपक्याचा डेकूण) Black, brownish yellow bands all over and 2 spots on scutellum. L. 5-7 mm. Pest on Crucifers. *N. viridula*. Green or yellowish, often with lines or spots. L. 12-16 mm. Widely distributed. Cosmopolitan pest. Vector of fungus diseases. *P. rubrofasciatus*. Greenish or yellowish, margin reddish, purplish band on thorax, elytra reddish. L. 8-10 mm. Widely distributed in irrigated crops like lucern, senji etc. in hot weather. *C. furcellata*. Brownish yellow, bronzy punctures, a band on head, prothorax with double spine. Designs of brown and black. Beneath yellowish with black spots or annulations. L. 15-16 mm. Predaceous on caterpillars of *Hyblaea*, *Antheraea* etc.

A. malabaricus. Reddish with black spots. Yellow beneath. L. 12-14 mm. Minor pest on cotton in Vidarbha. *T. javanica*—Soap nut bug. Yellowish, white powdered beneath. Legs reddish. L. 25-31 mm. Pest on *Sapindus trifoliatus*. Produces shrill noise if caught. *C. siccifolia*. Black, membrane brownish or yellowish. L. 11-16 mm. Attacks leguminous plants. *Aspongopus* spp. found in low crops, amongst roots, stones etc. *A. janus* brownish yellow or red. Head, bands on body and membrane black, abdominal margin red. L. 16-20 mm. *A. brunneus*. Brownish-yellow, cloudy beneath, abdomen red.

Fam. *Coreidae* (Plate II, Fig. 24) Larger varieties mostly brownish, smaller green, a few red. Head small, 4 jointed beak folded below. Prothorax large, spines at angles. Leaf like expansions of legs or antennae not uncommon. About 2,000 species described, 150 in India and about 35 in Maharashtra.

A. phasiana. Variable, brown. Abdomen above red. Hind leg curved at base expanded inwardly below, broadly dentate at apex. L. 22-28 mm. Destroys shoots of plants. Throws a jet of fluid backwards upto about 18 inches (350-450 mm). See Chatterjee N. (1936) Ind. For. Rec. Ent. Ser. 2 : 159 and Hingston (1929) J. Bomb. Nat Hist. Soc. 33:341 Study in insect protection. *D. planiventris*. Brownish

CHAPTER 3

Insects

yellow, prothorax produced, dentate, membrane with spots. L. 23-28 mm. on shrubs and grasses in hilly tracts. *B. bicolor*. Brownish yellow or reddish, parts black, spots on thorax. L. 22-25 mm. on *Asparagus*.

H. signatus. Brownish yellow, a band on thorax, elytra reddish, margin yellowish, a spot at top. L. 19-21 mm. on trees and weeds. Attracted to light. *N. mileagris*. Blackish greenish, clytra brownish at apex. Abdomen above black with 2 spots. L. 18-23 mm. *P. grossipes*. Brownish yellow, a line on head and prothorax, hind legs irregular, prominent spine. L. 20-24 mm. Common pest. *A. scabrator*. Brown with reddish points, margins of prothorax and elytra spiny, speckled beneath, hind legs slightly thickened, spiny. Abdomen expanded. L. 13-15 mm. Agricultural pest.

C. bipunctatus. Brownish yellow and roseate, yellow spots on elytra, abdomen with black markings. L. 9-10 mm. *C. rubdiventris*. Slender elongate, reddish brown, spots beneath. Cosmopolitan pest. *C. gibbosa* (तुरीच्या शेगावरील डेकूणा) Tur pod bug. Brownish yellow, spiny, parts of thorax, elytra, spots on body red. Black spines on prothorax. L. 8-10 mm. *C. horrens*. Brownish, apex of clytra red, abdominal margin spotted. L. 7 mm. Both common on *Tur* (*C. cajan*) and *Val* (*Dolychos*.)

D. inflatus mimics ant *Polyrrhachis spiniger*, associated with it in trees. Dull black, pubescent, prothorax thin, spiny, elytra short thin, tips white. (Proc. Ent. Soc. Lond. 1891:17). *L. varicornis* (Rice bug) लोंबोवरील डेकूणा Brownish yellow, antennae yellow ringed, body thin, long. L. 15-17 mm. Serious pest on paddy in West coast. Also on *jowar* (*Sorghum*), *nachni* (*Eleusine*). See Fletcher T. B. (1914) Ent. Mem. Dept. Agh. R. pedestris. Brownish yellow, margin red, abdominal margin spotted, hind legs thickened, marked reddish. L. 15-18 mm. On young leguminous pods and wheat. *C. bengalensis*. Brownish yellow, black lines on prothorax, 4 spots on elytra, margins yellow. L. 6 mm. Pest on *bhendi* (*H. esculentus*). *S. abdominalis*. Red, legs long hairy. L. 16-20 mm. *S. augur*. Similar, slightly smaller. Both found in association with red cotton bug (*Dysdercus*) which they resemble. Probably parasitic on them.

Fam. *Lygaeidae* (Plate II, Fig. 25) Small, dark or bright colours. Antennae inserted under head. Membrane with 4-5 veins. Beak 4 segmented. About 2000 species described, 150 in the Indian region, nearly 40 in Maharashtra.

O. nigriceps. Red. Parts of body, a band on elytra, membrane black with 2 spots, may vary. L. 9-10 mm. Pest on *Nidung* (*E. nereifolia*). *Lygaeus* spp. Pale red. Parts of body, spots and joints black. Variable. L. 10-16 mm. Nymphs red, feed in small clusters on cotton, *Calotropis* etc. *Graptosteltus* spp. Pale reddish and black, feed on low herbage. L. 6 mm. Cosmopolitan. *M. bipunctatus*. Red, greyish hairs, 2 spots on prothorax. May vary slightly. L. 6-7 mm.

CHAPTER 3
Insects

On sand dunes near sea in Bombay. *C. nerii*. Deep brown and red, black spots beneath, membrane black. L. 7-9 mm. on *Kanher* (Oleander). *N. inconspicuus*. Reddish brown, a band on thorax elytra whitish, spotted. L. 3 mm. On green plants. *B. gilbbus*. Black, elytra pale brown with a spot, membrane dirty white. L. 4-5 mm. Nymphs at roots of sugarcane and grasses.

D. nipae in twisted cotton shoots. *O. laetus*. Dusky cotton bug. कापसावरील पांढुरका डेकण्या Dark brown, corium reddish with a spot, membrane greyish. L. 4 mm. Serious pest on cotton seeds and malvaceous plants. *Palmera* spp. Black, 4 yellow spots on prothorax (may be absent), membrane sooty with spots. L. 6 mm. Commonly found in grass. Probably predaceous. *F. wasmanni*. Shining brown black. Corium whitish with black spots and band. L. 5 mm. (See Fauna. Rhynchota 2 : 58 for brachypterous male).

A. sordidus (Groundnut pod bug) शेगावरील डेकण्या and other species. Dark brown or reddish, membrane sooty black with a red spot. Yellow spots underneath. L. 9-10 mm. on cotton, groundnut, sesame etc. in debris under trees like ficus. Carry wheat grains from threshing yards, like harvester ants.

Fam. *Pyrrhocoridae*. Fairly large insects with bright colours, mostly red. Ocelli absent. Membrane full, incomplete or missing. About 100 species recorded in India, about 10 in Maharashtra.

P. apicalis. Brown, partly red, band on corium and membrane black. L. 19-20 mm. *A. coqueberti*. Red, partly black, corium thickly punctured, femur spined. L. 14-16 mm. Both in dense vegetation. *O. nigricornis*. Red or brownish, parts black, front legs serrate, one or two spines prominent. L. 16-22 mm. On flowers of *Wedelia*. *O. scutellaria*, similar but abdomen exposed, tarsi bristled. *D. cingulatus*. Red cotton bug. कापसावरील तांबडा डेकण्या Yellowish brown, head, margins of thorax red. Red beneath with white bands. Scutellum, spot on corium, membrane and legs black. L. 9-10 mm. Attacks cotton bolls, all malvaceous plants, gourds, cabbage, etc. *D. evanescens*. Bigger, paler, black bands on abdomen below. Not common.

[See Mem. Dept. Agr. Ind. Ent. Ser. 2(3)]

Fam. *Tingidae* (Lace bugs) Small, beautifully sculptured, upper surface with lace like markings. Dull colours, gregarious, feed on plant sap. Eggs thrust into plant tissue, nymphs feed with mother. About 700 species known, only a few in India and less in Maharashtra.

S. typicus. Pale, hyaline, margins of areolets (feathery part of elytra) and abdomen dark brown. L. 4 mm. to apex of elytra. Pest on turmeric and plantain. *U. echinus*. Pale brownish yellow, areolets hyaline, below reddish and black. L. 3 mm. On brinjal. *M. globulifera*. Brownish yellow, corium margins brown, centre hyaline. L. 3 mm. On *Tulsi* (*Ocinum* sp.) and safflower. *H. lectus* on *Elephantia* in Bombay.

CHAPTER 3
Insects

Fam. *Hydrometridae* (पाण्यातले डेकूण) (Plate II, Fig. 26). All aquatic or subaquatic as indicated by name. Very thin, long, with long head, 3 segmented beak, abdomen below with silvery pubescence. Legs long. Inhabit still water and sea. All predaceous. Detailed life not known. About 70 species known, a few Indian. The following round about Bombay.

H. vittata. Ferruginous, linear, elongate head, eyes prominent in the centre. Antennae long. L. 12 mm. *Gerris* spp. Dark, elongate, black lines and spots on body. L. 11-13 mm. Active on still water surface, sucking out insects there. *G. armata*. Apterous, abdomen black with yellow spots. *Halobates* spp. marine insects. Lefroy records (Ind. Ins. Life P. 695) *H. germanus* a grey insect as abundant on west coast, during may, blown by strong winds on the shore sands.

Fam. *Henicocephalidae*. Small family, about 50 species known. Very small, at times appear in swarms like gnats. Only one species recorded in Bombay. *H. basalis*. Peculiar looking. Tarsi single jointed, two spurs on forelegs, dark brown, grey and yellowish hair. Prothorax thick, sculptured. L. 8 mm. Common in damp soil and decaying vegetation. Probably predaceous on other insects.

Fam. *Reduviidae*. (Assassin bugs) (शिकारी डेकूण) (Plate II, Fig. 27). Strong curved beak. Generally red and black. Mimic other insects. Head long, eyes away from prothorax which is distinct, well developed, often constricted in the middle. Mostly predaceous. About 3,000 species recorded, 250 in India, 60 in Maharashtra.

E. araneus. Pale brownish yellow, head black, slender, brown spots. L. 8-9 mm. In spiders nests. *O. notatus*. Abdomen projecting on sides, dry grass colour, spotted, a spot on head, lines on prothorax. L. 10-11 mm. Common in plains. Attracted to light. Attacks different kinds of plants. *O. annulipes*. Similar habits, lighter in colour, spines on prothorax. L. 14-24 mm. Widely distributed. *Acanthaspis* spp. On tree trunks, manure heaps etc. Nocturnal, bite severely. *A. quinquespinosa*. Black, yellow spines and spots. Legs and antennae reddish. L. 16-19 mm. *A. luteipes*. Purple brown. *C. rubrofasciatus*. Brown, spots on abdomen and a line and spot on corium. L. 19-23 mm. Nocturnal. Found in houses. Probably a disease carrier. Preys on other insects. A similar American bug is known as 'Kissing bug'.

Ectomocoris spp. Brownish black and yellowish, corium spotted. L. 14-17 mm. Hide by day. Bite painful. *Piralis* spp. Scutellum constricted, prothorax greenish. L. 17-21 mm., one sp. 9-10 mm. Nocturnal. Bite severely. *Harpacter* spp. Coral red, partly black and brownish violet. L. 12-16 mm. Predaceous on *Dysdercus* species. *Sphedanolestes* spp. Black, partly red, yellow spots beneath. L. 8 mm. *C. crocatus*. Golden yellow, black band on head. Membrane black. L. 14-15 mm. Common in rice fields. Resemble braconid wasp.

Endochus spp. Brown, speckled or yellowish. L. 20-21 mm. Look like ants, predaceous on aphids on *Tur* (*Cajanus*) cotton etc. *I. heros*.

CHAPTER 3
Insects

Dull brown and black, prothorax with 2 tubercles and 2 spines. L. 12-31 mm. Mimics and preys on Coreid bugs. *P. biguttatus*. Black, yellow spot on corium, front legs swollen, abdomen exposed on sides. L. 9-13 mm. *P. flavomaculatum*. Black and greenish, elytra spotted. L. 6 mm. In grass and fallen leaves. *Nabis* spp. Elongate, greyish yellow or green, a spot near eyes, brown bands and spots. L. 8-9 mm. Live in grasses. Suck up caterpillars.

Fam. *Saldidae*. Aquatic or semiaquatic, a few away from water. Short broad head, large eyes, 3 segmented beak, not folded below. About 150 species recorded, very few in India, only 2 in Maharashtra.

S. dixonii. Greenish black with brownish hair, margins of corium yellow, membrane blackish. L. 3 mm. In wet vegetation. *L. greeni*. Black with yellow spots and streaks, leg joints brown. L. 5-6 mm. Active. Flies easily.

Fam. *Cimicidae* (Bed bugs) (घरातले डेकूण) Oval, flattened, short hemelytra, rostrum in a ventral groove, ocellae absent. Parasitic on mammals and birds. Common species *Cimex rotundatus*, the common bed bug. Dull reddish brown, 5-6 mm. nocturnal. Lays eggs in crevices of beds, walls etc. Life cycle 2-6 months. Sucks human blood. Carrier of "Kala azar".

Fam. *Capsidae*. (Plate II, Fig. 28) Small, body soft, a triangular semidetached piece of wing, known as cuneus at apex of corium. Perfectly mimic other insects like ants. Almost all plant feeders. Lay eggs in plant tissues by ovipositor. More common on hills. About 5,000 species described, 150 in the Indian region, about 10 in the State.

H. antonii. Black, yellow line on thorax, elytra greenish brown, scutellum purplish red. L. 6-8 mm. Serious pest on Cacao, cucurbits, cashew, tea, guava, etc. *D. politus*. Dark, shining, straw coloured, spot on corium, abdomen red beneath. L. 8-11 mm. Pest on tea, Cinchona etc. and in the young leaves of Solanum, Peperonia etc. *Eurycyrtus* and *Lygus* species. Dull, straw coloured. L. 4-5 mm. *C. angustatus* (Earhead bug). Elongate thin spiny legs. Greenish yellow. L. 6-7 mm. Pest on ripening earheads of jowar and maize. *Poecilascytus* spp. Black, legs with rings. L. 3-4 mm. feed on low vegetation. *G. crassicornis*. Red, black spots on elytra. L. 3 mm. Pest on tobacco and tomato.

Fam. *Anthocoridae*. Similar to *Capsidae*. Dark coloured, flattened. Legs and antennae long. Small in size. Found in flowers, feeding on pollen or thrips. About 10 species recorded in India, one in this State. *T. tantilus*. Black, L. 2 mm. Looks like *Oxycaraenus laetus*. Widespread in plains in sunflowers and other green plants.

Fam. *Nepidae* (Water scorpions) (पाण बिचु) (Plate II, Fig. 29) Aquatic, flat with dingy colours, body elongate, sides parallel. Front legs attached almost to top of prothorax for preying as in mantids and scorpions. Beak short strong, antennae concealed. Two tubes at apex

CHAPTER 3
Insects

of abdomen for air. Can fly to other watery places. Predaceous. Eggs spined at one end laid on weeds. Nymphs similar to adults. About 150 species described, 20 mentioned in India, only 3-4 in Maharashtra.

L. ruber. Brown, abdomen reddish, with a band, apex dark, tubes longer than body. L. 30-35 mm. *L. elongatus*. Smaller, 17-20 mm. Sides slanting, abdomen brownish, sides reddish. *R. filiformis*. Brownish yellow, thorax reddish, a band on abdomen. Elongate, membrane short. L. 27 mm.

Fam. *Naucoridae*. Aquatic, small, dull coloured. Hind legs spiny, forelegs at top of thorax. Head deep in thorax, forelegs for preying, hind for swimming. Compact, oval, flat. About 150 species described, 24 Indian, 3 mentioned in Bombay.

H. breviceps. Symetrically oval, yellow, brown impressions, spotted. L. 9-10 mm. 2 more species. Head and prothorax spotted black, elytra black.

Fam. *Belostomatidae*. (Giant water bugs) (राक्षसी पाण डेकूण) (Plate II, Fig. 30) Aquatic, hind legs flattened, hairy, front legs away from eyes. Predaceous. A pubescent band under abdomen. Short powerful beak. Life not studied fully. In one species eggs carried by male on back. Nymphs like adults. About 100 species known, 6 in India, 2 in Maharashtra. *S. rusticum*. Brownish yellow, head broad, eyes oblique, membrane short. L. 15-16 mm. *B. indicum*. Dark brownish yellow, membrane small. L. 62-82 mm. Sluggish, breathing tubes visible outside. Feed on large insects and small animals e.g. *Oryctes*, Grasshoppers, toads and tadpoles.

Fam. *Notonectidae* (Back swimmers) (पाठीवर पोहणारे डेकूण) (Plate II, Fig. 31) Oblong, convex, eyes large, antennae robust, short. Forelegs attached at the bottom of prothorax. Aquatic. Swim upside down. Forelegs grasping, hind for swimming. Predaceous. Common in fresh water tanks. Punctures painful. Eggs thrust into stems of water plants. About 23 species mentioned in India, 4 in Maharashtra, Bombay.

A. indica. Thorax brownish yellow, scutellum black, corium black with a spot. L. 8-10 mm. Frequents stagnant water, paddy fields etc. *A. templetoni*. Pale yellowish, deep brown patches, membrane black. L. 10-12 mm. *A. sardia*. Reddish, eyes black, corium dirty, grey eyes almost meeting at bottom. L. 6-8 mm.

Fam. *Corixidae* (Water boatmen) (नावाडी) (Plate II, Fig. 32) Small, aquatic, body depressed, head broader than prothorax, beak short, concealed, antennae short, held under margins of head, hemelytra complete, hind legs hairy. About 200 species described, 25 in Indian region, 2 recorded in Bombay.

C. hieroglyphica. Greenish or yellowish grey, prothorax with 7-8 lines. L. 5-7 mm. *C. lima*. Head yellowish, prothorax paler with reddish lines. Generally remain at bottom clutching at roots, stones etc. but come to surface for air.

ORDER THYSANOPTERA (THRIPS) (मुरड्या, बोकड्या)

(Plate IV, Fig. 33)

Minute, 1-2 mm. Thin, elongate. Piercing mouth parts. Thorax well developed, distinct. Winged or wingless. Wings long, narrow, with fringes of long hairs. Abdomen, thin, tapering, long. Colour generally black, often yellow, metallic bluish or greenish. The largest species may be about 5 mm.

Divided into 2 sub-orders (1) Terebrantia, (2) Tubulifera. The former lays eggs in slits made by ovipositor, in plants. The latter lays openly on leaves, stems or under bark. Nymphs resemble mother in character, feed the same way. Terebrantia becomes inactive after 2 moults, enters a sort of pupal stage and emerges as adult, shortly after. Tubulifera, after two moults enters a pupal stage, develops wing pads and then full wings. Life cycles of species vary from 1 to 7 a year. Hibernate in any stage. Generally lay eggs after mating but parthenogenesis not uncommon. In some species males are rare. Majority feed on tissues of plants by piercing their beaks inside. Sometimes serious pests, specially for young, tender crops. May feed on leaves, flowers, under bark, form galls or transmit virus. Migrate in large numbers, but rarely. Some found in debris. About 1,500 species known, 300 in India and about 50 in Maharashtra.

SUB-ORDER TEREBRANTIA

Fam. *Aelothripidae*. *A. fasciatus* attacks flowers of mango, Brassica etc. and leaves of Medicago. *A. collaris* Pest on wheat.

Fam. *Heliothripidae*. *H. indicus*. A serious pest on Solanaceous plants—potato, tomato, brinjal etc. Also attacks crucifers, palms and legumes. *R. cruentatus*. A cosmopolitan pest. *T. rutherfordi* on Calotropis, Acalypha, Santalum etc. *T. brunneicornis* on rose. *T. distalis* on *Val* and pulses. *T. longistylus* on legumes, Crotalaria etc.

Fam. *Thripidae*. *C. manicatus* on tobacco and grasses. *N. jonna-phila* on grasses and crucifers. *A. mundus* on sweet potato. *A. flavicinctus* on grasses mainly, on tobacco, arrowroot etc. *A. sachari* on grasses. *A. dorsalis*. Serious pest on chillies, causes 'leaf curl' disease (रुई). Also recorded on castor, cotton, brinjal, Poinciana. *A. chaetophora* on crotons and legumes. *F. sulphurea*. Common pest on almost all crops. *M. brevipalpis* on flowers of chrysanthemum, cosmos, zinnia etc. *S. asura* on banana and santalam leaves. *S. sexmaculatus*, predator on mites of jowar leaves, chillies, calocasia and cotton. *S. orientalis* on flowers of jasmine, morinda etc. *T. tabaci*. Serious cosmopolitan pest, more on onion. *T. florum* on a variety of plants, noted in Vidarbha.

SUB-ORDER TUBULIFERA

Fam. *Phloeothripidae*. *H. ceylonicus* in crotalaria flowers. *H. ganglbaueri* on Petreaea and Solanum species. *H. schultzei* a rare pest on mango. Vast literature on the subject. Some important pieces are :

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Order Neuroptera (Lace wings and Ant lions)

Small to fairly big, soft bodied, longish antennae, biting mouth parts, 2 pairs of membranous wings with numerous veins, held roof like over body when at rest. Larvae carnivorous, some aquatic. Adults weak fliers, feed on soft bodied insects, honeydew etc. A large number of families but only 5 of fair importance in the State.

Fam. *Myrmelionidae*. (Ant lions)(भोवरा रेतीतला) (Plate IV, Fig. 34) Short, knobbed antennae, 2 pairs of large equal sized wings, patches of brown or black, hyaline in smaller species. Head and eyes large, mouth parts biting. Thorax hairy, legs strong, short, spiny. Eggs laid in sand or earth. Larva with large flat head, moveable all round, thorax stout, mandibles long, sawlike forming a sucking tube. Some species live in debris, some form pits in soil to capture insects. All carnivorous. Larval period long. Pupate in soil in cocoons. Adults generally nocturnal but may fly by day. Attracted to light. 4 species noted. See Gravely F. H. (1911) Rec. Ind. Mus. 6 : 101 Development of some Indian Ascalaphid.

Fam. *Ascalaphidae*. Adults similar to Myrmelions, but with straight longer antennae, smaller wings, less marked, eyes divided into 2 parts. Attracted to light. Eggs laid on plants, larvae flat, square headed with long sawlike mandibles, spiny body. Feed on small insects. Head not moveable independently. Only 1 species noted in the State.

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CHAPTER 3
Insects

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CHAPTER 3
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CHAPTER 3
Insects*

clusters of 15-20. Larvae with long mandibles, suck up the body fluid of aphids and throw their skins over own body. Very active, voracious. Pupate on plant in white silken cocoons. One species common.

See Chatterjee N. C. (1934) Ind. For. Rec. 19:5 Neuroptera of sandal.

Fam. *Hemerobiidae*. Two types of insects. One aquatic, not recorded in Maharashtra. Second similar to *Chrysopa* feeding on aphids on plants but skins not cast on body in larval stage. Adult larger in size. 1 species noted.

See Chatterjee N. C. (1934) Ind. For. Rec. 19:(5):2 spike disease of sandal.

ORDER MECOPTERA (SCORPION FLIES)

Delicate, carnivorous. Peculiar long head, antennae long, hairlike, legs long and thin, all wings of equal size, slightly bigger than body, membranous, held flat open at an angle over the body at repose. Some wingless. Abdomen longish with cerci, male with apical joint swollen and turned up, imitating a scorpion. Tarsi five jointed. Eggs laid in ground in a mass. Larvae like caterpillars, possess legs, spines, spots on body segments, mandibular mouth parts. Feed on decaying vegetable matter, underground. Pupate in soil. Adults active predaceous.

See Lefroy H. M. (1909) Ind. Ins. Life P. 145.

Needham J. G. (1909) Rec. Ind. Mus. 3:195 Neuroptera at the Ind. Museum.

ORDER LEPIDOPTERA (BUTTERFLIES AND MOTHS)

Distinct in character in all stages of growth. Adults with 2 pairs of scaly wings of different colours. Generally proboscis coiled under head, stretched when feeding. Body full of scales. Size 5 to 300 mm. Eggs of 3 types, flat, scalelike of small moths, round and sculptured of bigger moths, dome shaped and sculptured of butterflies. Larva—Caterpillar. Head distinct, a plate behind, 3 pairs of jointed thoracic legs, 2-5 pairs of simple abdominal legs and biting mouth parts. Pupa, generally brown elongate, compact, usually enclosed in a cocoon made of chitin, often enclosed in sand or soil particles, silk or other material. Life history and habits uniform but vary in detail. Adults copulate soon after emergence. Female lays eggs singly or in masses nearest the food. Caterpillars longish, cylindrical, with soft chitinous skin, coloured differently in different species, with sparse hair or thick tufts, emerges and feeds on its food, moults a number of times, often changing colour at every moult. Pupates in a safe place, till which time it feeds and defecates continuously unless it is in a resting condition. Pupa immobile but moves the abdominal tip if disturbed. Pupa also may rest.

CHAPTER 3
Insects

Classification of Lepidoptera is a complex matter as authors differ in opinion vastly. It is difficult to be very precise on this point. Similarly the generic, specific and even family names have been changed often, leaving the readers and students of the subject confused at the end. It is convenient, however, both for the authors and students, to follow Hampson (Catalogue of Lepidoptera Phalaenae in the British Museum—1895—1920) in this regard and his classification for moths has been generally adopted here. For the sake of easy reference, the names given in the Fauna of Br. India by Hampson have been given and wherever changes have taken place, attempts have been made to give the new names in brackets. The Forest Entomologist Dr. P. N. Chatterjee was consulted in this matter. Butterflies have been dealt with separately and the latest publication on this subject, viz. Butterflies of the Indian Region by Wynter Blyth 1957 is followed in this case, with slight modifications wherever necessary. The order is thus divided into two sub-orders, butterflies (*Rhopalocera*), moths (*Heterocera*).

SUB-ORDER RHOPALOCERA (BUTTERFLIES) कलपाक्षरे

(Plate III, Fig. 36)

Fam. *Danaiidae*. Large, tough, forelegs undeveloped. Flight slow, possess unpleasant smell and evil tasting juices for protection from natural enemies, like birds, lizards etc. Larva cylindrical, smooth, coloured, marked with spots and bands. Pupa green with spots. Small family, less than 50 recorded in India, a few in Maharashtra.

H. lynceus. Large, semitransparent, greyish white wings with black spots. Exp. 110-160 mm. In Western Ghats above 1,000 ft. *D. aglea*. Deep brown, front wings extensively marked bluish white. Exp. 70-80 mm. *D. limniace*. (and race *mutina*). Black, large irregular, white or pale blue markings on forewing. Exp. 90-100 mm. *D. genutia* (so far known as *D. plexippus*). Wings reddish brown, white spotted black apex to forewing, veins broadly black. Exp. 75-95 mm. A great migrant. Universal. *D. chrysippus*. Very common throughout the year. Reddish brown, light veins, 4 black spots, in irregular line in forewing. Exp. 70-80 mm. A migrant. (variety *septemtrionis* also noted). *E. core*. Large, blackish brown, wings with marginal white spots in 2 lines. Exp. 85-95 mm. Migrant. Enters houses. The other two species are similar.

Fam. *Satyridae* (The Browns). Inconspicuous, dull brown or blackish, wings short, broad, with eye spots, often bands. Forelegs small. Larva brown, green, pink or yellow, rough, slightly hairy, spindleshaped. Two tail and two head points. Pupa generally green with golden or dark spots. About 200 species in India, mostly breeding in grasses or bamboos.

Mycalesis spp. Brown above, yellow ringed spots between lines on border of front wing. Variable. Exp. 40-55 mm. At low elevations. *M. lepcha* only at higher altitudes, is darker, spots white ringed with

the 3rd missing. *L. rohria*. Ocelli in under hind wing distorted, apical one larger, apical costal white spots in forewing upper side. *Y. baldus*. Very common. Brown, a white band on hindwing, a coarse striation on underside. Exp. 32-48 mm.

Z. saitis. Velvety black, broad white band on each wing, prominent rings under hindwing. Exp. 60-65 mm. Live in thick forests, W. Ghats, 1,000-3,000 ft. Hide, shy. *O. medus*. Small brown, 2 pale lines on border of wings. Below white band across both wings. 2 eye spots in front wing and 3 in hind. Exp. 45-55 mm. *M. leda*. Brownish, corner of wing produced, one big, one small white centred black spots. Border of hindwing uneven, one point produced. Under-side striated. Exp. 60-80 mm. Crepuscular, mimics dry leaves, fond of toddy palms, over ripe fruits etc. *M. ismene* very similar. Caterpillars light green, tapering on both sides, roughened skin, horned head, processes at anal end. Pest on paddy leaves. *M. phedina* has no black spot in forewing, faint if present. Darker in colour. Exp. 60-85 mm. Inhabits higher elevations. *E. hypermnestra*. Four races. One in Maharashtra. *E. h. caudata*. Breeds on palms. Blackish purple gloss, blue bands and spots in forewing margin. Hindwing produced, broad chestnut border above. Female differs slightly. Exp. 65-80 mm. Palm plantations or thick forests preferred. Female rare.

Fam. *Amathusiidae*. Large, sombre, some brilliantly coloured, antennae long, slender, gradually thickening. Forelegs, undeveloped. Wings broad, forewings strongly arched. Larva brown or blackish, a band on the back red, yellow or black marks, two tail points. Sparse long hairs on body. About 30 species recorded in India, one in Maharashtra. *D. lepida*. Dark brown, bluish white spots or a band on pointed forewing, hindwing plain brown, often with spot. Exp. 85-110 mm. Rare. Shy. In W. Ghats in bamboos.

Fam. *Nymphalidae* (Nymphs). Brightly coloured, tawny with black markings, banded, spotted, blotched, striped or variegated with different patterns. Hind wing plain, tailed, toothed or angled. Thorax robust, abdomen short. Antennae long, knobbed at top. Larva green or brown with branched spines, varying in structure. Some with head and tail points. A very big family. India records about 250 species. A few in Maharashtra.

C. polyxena. Reddish brown, thick dark border in forewing (female with a white band), white centred dots in hind. Tailed. Exp. 90-100 mm. Confined to thick jungles. *C. p. imna* similar. *C. fabius*. Dark brown, band across wings broken to spots in forewing. Two tails to hind wing. Exp. 70-80 mm. Fond of overripe fruits, toddy palms. *E. athamus*. Discal band pale yellow of varying width. Exp. 60-75 mm. *E. schreiberi*. Dark brown, white discal band, broadly blue edged small white spots at outer border. Exp. 90-100 mm.

P. sylvia virens. Big, green, large, semi transparent white spots on forewing, black veins, 2 black lines and black markings in hindwing. Exp. 115-130 mm. Likes thick forests, heavy rainfall tracts. *L. procris*. Reddish brown, white bands on both wings, 2 rows of marginal black spots on hindwing, two wavy lines on fore. Exp. 60-75 mm.

P. nephte inara. Dark brown with bluish band, a white spot in forewing, orange band in hind. Exp. 55-70 mm. Inhabits wet regions of W. Ghats. *P. perius*. Brown, 4 patches of broad white lines in forewing, a white band across both wings, a line of white spots below it. Exp. 60-70 mm. In open country. *N. jumbah* resembles *P. perius* but white row of spots faint or absent, under forewing with chestnut streaks and hindwing with spots. Exp. 60-70 mm. *N. hylas* and *varuna*. Upper forewing with 3 spots not in line, the white band in hindwing conjoined, markings yellow, not streaked below, violet bands under side. Exp. 55-75 mm. *N. colomella* similar but white spots on under forewing separated, prominent.

H. bolina. Male black, white centred iridescent blue oval patch in each wing. 60-70 mm. Female dark brown, wings bordered with white elongate spots. Small bluish spots on forewing. Exp. 80-110 mm. Enter houses. Common in rains. *H. misippus*. Male black, blue ringed white spots in each wing. Female reddish brown, mimics. *D. chrysippus*. Black wing margins more waved, one or two black spots on hindwing. Universal. Exp. 70-85 mm. *K. philarchus* (and race *horsfieldii*). Blue to dark green above, wings pointed at apex. Pale blue band, black tip in forewing. Under side dry leaflike. Exp. 85-110 mm. Found in thick forests, Nasik southwards. Likes overripe jack, mango and toddy.

Precis found throughout the year, first two in dry and others in wet areas. *P. hierta*. Bright yellow, forewing borders black, yellow spots at top, hindwing blue with black border. Exp. 45-60 mm. *P. orithya*. Bluish, forewing black, apex pale brown, white bands and coloured spots. Hind wing blue, coloured spots. Variable. Exp. 40-60 mm. *P. lemonias* (var. *vaisya*). Dark brown, yellow spots in notched forewing. Two ringed spots, one big one small in each wing. Exp. 45-60 mm. *P. almana*. Yellowish red. Forewings with black bars in the upper corner, a ringed spot below. Hindwing tip produced, a big ringed spot. Margins dark. Under side leaflike. Exp. 60-65 mm. *P. iphita*. Dark brown, obscure bands in wings, row of spots of same colour in hindwing. Exp. 55-80 mm.

V. cardui. Pinkish red, black markings. Forewing slightly concave 2 rows of 4 and 3 white spots, hindwing with whitish patches, a border of spots. Exp. 55-70 mm. Common migrant. *A. hyperbius*. Bright tawny, lines of black spots on wings. Under hindwing greenish with silver markings. Exp. 65-85 mm. Hill dweller, migrates to plains in winter. *A. phalantha*. Similar to *Argynnis* but no silver markings.

CHAPTER 3
Insects

Black spots under forewing, 4-5 black lines upper side. Exp. 50-60 mm. Common in dry weather. *A. alcippe* similar, smaller Exp. 35-50 mm.

C. erota. Male yellowish brown, female greenish brown, forewing with 2 lines of white spots. Hindwing toothed with 2 ringed spots. Borders of black wavy lines. Exp. 70-110 mm. In thick forests of W. Ghats. *C. thais*. Tawny, black margin to forewing, a line of black spots in hindwing. Exp. 60-70 mm. Evergreen shady places haunted. *C. nietneri mahratta*. Orange red, hindwing deeply toothed, borders of wings black with white designs. Possess obnoxious odour. Common in W. Ghats. *B. ilityia*. Bright tawny, veins black, a broad black band cut into 2 in forewing. Black bars and spots. Variable. Exp. 45-55 mm. Common in plains.

E. ariadne. Bronzish black, slender wavy lines on wings, forewing concave. Varies seasonally. Exp. 45-60 mm. Prefers plains. *E. merione* (and var. *taprobana*). Similar but forewing not concave, lines on wings double and wavy. Exp. 45-60 mm. Prefers hills and forested country. Larva green, spiny, whitish band on back, feeds voraciously on castor leaves, leaving only ribs. Pupates on twig. (Known as Castor butterfly).

Fam. *Acraeidae*. About 200 known species, only 2 or 3 Indian, one recorded in Maharashtra. *T. violae*. Wings sparsely scaled, brick red, spotted, black margin on one side. Hindwing border black with white spots. Exp. 50-65 mm.

Fam. *Erycinidae*. Small family. India records 21 species, 2 in Maharashtra. Forelegs in males brush like, in females fully developed. *L. myrrha*. Dark brown, palpi beaklike, forewing produced and cut, a clublike band in the middle, another at top. Broad band in hindwing. Exp. 45-55 mm. *A. echerius* (var. *prunosa*). Dark brown, hindwing toothed, male purple spot, faint white bands on forewing. Exp. 40-50 mm. Likes shade.

Fam. *Lycaenidae* (Blues). Medium to small, blue colour predominating. Many possess tails. Designs generally on under side. Forelegs well developed. Larvae woodlouse shaped, head hidden below, smooth, hairy or tuberculate. Often with 2 anal tubes to exude honey dew and attract ants. Pupa variable. Species of Indian region about 450, about 70 in Maharashtra. *S. epius*. Small, brown, centre forewing white. Grey below with fine brown wavy lines. Exp. 20-30 mm. Eggs laid amongst scale insects. Larva covers body with sucked up scale skins, attracts ants. Pupa resembles monkey head. *T. nyceus*. Blackish brown, hindwing end red. Below white, forewing end black with white spots. Hindwing spotted, margin red and black. Exp. 30-36 mm. *C. rosimon*. White. Wings spotted, dark bordered, bases bluish. Below white with black spots and streaks. Tailed. Exp. 24-32 mm. *C. caleta*, Blackish forewing, white underside, a triangular band at base, 3 elongated spots one each side. Exp. 26-32 mm.

CHAPTER 3
Insects

C. ethion. Violet. Broad white band on each wing. Under side white with 2 black oblique lines. Forewing with 2 elongated rows of small black spots. Exp. 26-32 mm. Larvae in *Zizyphus*, attract ants.

T. ananda. Male purplish blue, dark border. Female brown, spot in centre of wings underneath. Exp. 22-28 mm. Reared by *Crema-togaster* ants. *T. alteratus*. Bright blue, a spot in forewing, border black. Below cream, reddish streaks. Exp. 20-30 mm. *S. plinius*. Violet blue, female with blue and brown wings, dark spotted white areas. Below white with brown bands, spotted borders. Tailed. Exp. 22-30 mm. *Azanas* spp. All similar. Male bright blue, brown border. Female brown. Under side light marginal spots, dark spots on hindwing. No tail. Exp. 20-25 mm. Haunt deserts. *N. zalmora*. Brown, white patch on forewing, hindwing generally white. Below white with black spots. Exp. 20-30 mm. Breeds in thick forests on Rutaceae.

M. malaya thwaitesi. Dark brown, white patch on forewing. Below white, a black spot at one end, four at base of hindwing. Variable. Tailless. 20-30 mm. *L. puspa*. Violet blue, black margins, broader in female. White patches on wings generally. Exp. 25-35 mm. *C. laius*. Male purple blue, dark border. Female brown, wing base blue. Below pale brown or grey, wavy borders and dark spots. Exp. 26-30 mm. Breeds in lime and pomelo gardens. *Z. putli*. Brown above, row of orange spots on hindwing margin underneath. Tailless. Smallest. 15-20 mm. *Z. maha*, male pale blue, broad dark borders, female brown, blue basal scaling. Under hindwing border of 2 wavy lines, one spot, 3 spots at base. Exp. 26-30 mm. *E. cnejus* (Pod butterfly). Pale violet blue, borders darker. Under hindwing a band of black spots. 2 black spots in corner in males. Exp. 25-30 mm. Minor pest on gram. Larva light green, spiny. Pupates in soil. *E. pandava*. Darker, brownish grey below. Borders of wings with wavy lines. Dark spots, 4 at base, 2-3 at corner, one away. *C. strabo*. Similar to *E. cnejus* but spots below one or two only. 25-35 mm. *L. boeticus*. Male blue, female brown, hindwing bordered with crescents. Below pale brown, brown lines. Two crowned spots in corner of hindwing. Exp. 24-36 mm. Tailed.

L. lycaenina. Forewing pointed, hindwing angled at corner. Under hindwing base a spot. Male blue, female brown, blue bases, dark marginal spots on hindwing. Exp. 24-29 mm. *J. celeno*. Pale blue, female wings broad dark bordered. White lines under forewing. Tailed. Exp. 27-40 mm. *J. bochus*. Male bright blue, black border. Female dull. No shining. Below dark brown with whitish disconnected lines. Tailed, a black spot above it. Exp. 25-34 mm. *N. nora*. Blue, tailed. Variable underside. Dark brown with white lines to yellow or grey with dark bands. Exp. 18-25 mm. *C. thetis*. Male red, female white. Both with black borders. Forewing apex pointed. White below with parallel lines. Tail-less. Exp. 40-48 mm.

CHAPTER 3

Insects

H. anita. Male deep purple or blue with black borders, narrow on hindwing. Female brown, bright purple patches. Below leaflike. Tailed. Exp. 45-52 mm. *A. lilacinus*. Male iridescent blue, top end dusky. Female bluish brown. Exp. 32-36 mm. *S. vulcanus*. Male faintly blue shot. Both sexes above, forewing black spotted, orange areas. Underside pale yellow, black edged red bands. 2 tails to a spot. Exp. 26-32 mm. Larvae reared by *Crematogaster* ants. *S. ictis*. Below pale yellow or khaki with deeper bands. Exp. 27-35 mm. *S. lohita*. Male above blue, female brown. Creamy or reddish below with black or reddish bands. Exp. 30-42 mm.

Z. chrysomallus. Male copper red, dark border. Female pale blue, brown border. Hindwing with 2 spots and 2 tails in male 3 in female. Below greyish with lined loose spots. Exp. 30-42 mm. Tended by *Oecophylla* ants. *P. cleobis*. Blue, wings produced, forewing apex black, less extensive in female. Inner tail broad. Below brownish. Exp. 27-38 mm. *T. cippus*. Shining greenish blue, forewing top black, female like *jehana*, wing fringe brownish or whitish. Below pale. Exp. 31-45 mm. *J. jehana*. Blue, corner forewing pale in female, wavy lines on forewing, fringes white. Below grey to white. Exp. 30-37 mm. *C. freja*. Brown, male purplish. Hindwing border white, spotted black. Below faint whitish bars, black spots at corner of hindwing, metallic scales. Two tails, one long and broad. Exp. 38-42 mm.

R. amor. Dark brown. Band of white spots in forewing, hind with 2 black and a band of reddish spots. Below white to brown. Forewing with dark markings, white lines. Three tails, central longest. Exp. 26-28 mm. *C. elegans*. Violet blue, narrow border. Female paler, border broader. Below grey-brown, black and silver edged bands and spots. 3 tails, middle longest. Exp. 28-32 mm. *C. othona*. Male bluish, forewing apex, and hindwing border black. Female brown lower part whitish. Below white with black bars and markings, a black spot. Two thin tails with an orange spot at top of each. Exp. 24-27 mm. Rare.

D. epijarbus. Male red. forewing border brown, centre black. Hindwing dark, veins black. Female brown, forewing pale. Below brown with bars, a band in centre. Hindwing partly black, yellow ringed spot, slender tail. Exp. 34-44 mm. *V. isocrates*. (Pomegranate butterfly) (सुरा, सुरसा डाळिंबावरील फुलपाखरू) Bluish brown. Orange patch in forewing, orange and black spots in hindwing in female. Exp. 34-50 mm. Larva pest on pomegranate, guava, loquat, tamarind, orange etc. feeding inside fruit. Full grown caterpillar dirty brown, short, stout, a few hairs. 15-20 mm. long. Pupates in fruit. *R. varuna*. Dull, shining blue, forewing shading to dark border. Female paler. Below brown with gloss, broad bands on forewing, curved in hind. Exp. 28-32 mm. *R. schistacea*. Dark slaty blue, brilliant lower down. Female darker more purple than *varuna*. Below brown, a band in

CHAPTER 3

Insects

forewing. Exp. 30-33 mm. *R. melampus*. Red. Forewing border black. Female paler. Below slaty. Exp. 33-38 mm. *B. phocides*. Male black, hindwing end and tail yellowish, margin brilliant blue. Below brownish. Female brown. White tail and corner. Hindwing black, spot in the middle. Below white. Exp. 38-42 mm. Found in evergreen forests.

Fam. *Papilionidae* (Swallow tails) Large, generally black or dark brown with designs. Wings usually long and narrow. Most have tails to hindwing. Forelegs fully developed. Larva conspicuously coloured, spindle shaped large flexible head, 2 tube like attachments behind. Pupa variable. About 600 species known, about 100 in India, 11 in Maharashtra.

T. helena. Forewing black, hind golden, black veins in males, rows of spots in females. Largest in Indian butterflies. Exp. 140-190 mm. W. Ghats, south of Bombay. Strays out. *P. hector*. Black, abdomen red. Forewing with irregular white marks, hind with rows of crimson spots. Tailed. Exp. 90-110 mm. *P. aristolochiae*. Black, hindwing with elongate white spots, dirty red crescents on margin. Exp. 80-110 mm. Tailed.

C. clytia. Dark brown, cream markings above, margins of wings with elongated and round yellowish spots, yellow spot in the corner. No tail. Exp. 90-100 mm. *P. polymnestor*. Black, pale blue band to forewing, hind-wing black at base, bluish above, black spots. Tailless. Exp. 120-150 mm. *P. helenus* Var. *daksha*. Black, tailed. Hindwing with white patch, usually a series of crescents on margins. Under side marginal red spot. Exp. 110-130 mm. Not common. *P. polytes*. Male black, tailed, forewing bordered white spots, a row inside the hindwing. Usually red marginal spots. Female 3 forms. (a) *cyrus*. Similar to male, red marginal spots strongly marked. (b) *romulus*. Similar to *P. hector* but body not red. (c) *stichius*. Similar to *P. aristolochiae*, but hindwing with an additional row of red spots, usually. No red markings on body. Exp. 90-100 mm.

P. demoleus (लिंबावरील फुलपाखरू) Pest on orange leaves and other Rutaceae. Wings black, big yellow spots and one red and blue ringed spot in lower wing. Tailless. Exp. 80-100 mm. Larva changing colours, grey at first, greenish white and then opaque green, irregular broad white mark on back, sparse blunt spines. Pupates on host plant. *G. agamemnon*. Black with a stumpy tail, bright green stripes and spots all over. Exp. 85-100 mm. *G. nomius*, Forewing with dark margin, white spots and dark bars. Hindwing with black band, white crescents and grey patch at a corner. Below red spots in centre. A sword like tail. Exp. 75-100 mm.

Fam. *Pieridae* (Whites and Yellows). Small to medium, white, yellow or orange with black markings generally. Foreleg fully developed. Generally inhabit open country. Larva cylindrical, smooth, slightly

CHAPTER 3

Insects

hairy tubercles. Green with pale stripes. Feed in Capparidaceae. About 100 species recorded in India, about 26 in Maharashtra.

L. nina. White, a spot and tip black in forewing. Delicate Exp. 35-50 mm. *D. eucharis*. White, veins black, wing borders black, white elongate spots in fore and reddish in hindwing. Below hindwing red spots. Exp. 66-83 mm. *C. nerissa* (var. *phryne*). White, wing veins black, black border to forewing, white spots in corner. Hindwing with black terminal border. Below yellow, veins green. Black markings more extensive in female. Variable. Exp. 40-65 mm. *C. nadina*. Dusky white, forewing black at top, hindwing border black. Female brownish black, central wing area white. Under hindwing greenish with darker areas. Varies seasonally. Exp. 55-65 mm.

A. aurota. White, forewing apex black with white streaks, black arrow in centre. Hindwing with white spotted black border. Female darker. Exp. 45-55 mm. *A. libythea*. White, forewing border black, arrow in centre. Male with white streaks. Hindwing white. Female with black spotted border. Exp. 50-60 mm. Migrant. *I. marianne*. White, forewing apex orange, black borders, 4 black spots in female. Hindwing terminal border black. Variable. Exp. 50-55 mm. *I. pyreme*. Similar to above but yellow, female white or yellow, band of the same colour with 2 black spots on apex. Exp. 50-70 mm. *C. calais*. Pink, wing borders broadly black, spotted pink. Some females white. Exp. 35-50 mm. *C. fausta fulvia*. Similar, hindwing margin black spotted. Exp. 40-50 mm. *C. etrida*. White, black edged orange apical patch to forewing. Hindwing border black spotted. Spots less in female. Exp. 25-45 mm. *C. eucharis*. Bigger but almost the same as *etrida*. Exp. 40-45 mm.

H. glaucippe. White, Forewing top orange with black edges and spots. Hindwing often with marginal spots and in female brownish spots. A row of discal spots below. Exp. 80-100 mm. *V. valeria* (var. *hippia*). Male bluish green, dark veins, fairly broad black margins to forewing with spots, increasing in size at apex. Female whiter, hindwing markings prominent. Exp. 65-80 mm. *C. crocale*. Sulphur yellow basally, female usually. Under side unmarked. Antennae black, wings bordered black, spotted with ground colour in males. Exp. 55-75 mm. *C. pomona* (var. *catilla*). Similar but with one or two black spots above and 1 or 2 black margined silver spots below. Antennae red. Exp. 55-80 mm. *C. pyranthe* and *C. florella*. Smaller, reddish or blackish markings to wings. Under hindwing with green or brown fine lines. Exp. 50-70 mm. All migrants.

Eurema spp. Common all over on legumes. Exp. 30-40 mm. Bright yellow with slight differences in markings. *E. brigitta*. Forewing border evenly rounded inside, 2 black spots underside, black edge to hindwing. *E. laeta*. Inner side of border uneven. One black spot underneath. *E. hecabe* (*simulata*). Forewing border broadly black with an excavation in the middle hindwing border black. Irregular

CHAPTER 3

Insects

ring spots on both wings below and 2 dark spots. Variable. *E. blanda*. Similar but with 3 spots below.

Fam. *Hesperiidae* (Skippers). Look like moths with hooked antennae, beyond the club. Larva smooth, slightly flattened with a distinct neck. Pupa in folds of leaf. General food grasses, Scitamin plants, palms, bamboos etc. Known species about 3,000, about 500 in the Indian region and 36 in Maharashtra.

C. leucocera. Brown, a band of white transparent spots in forewing, small spots at upper end. Hindwing bordered with yellow spots. Variable. Exp. 45-55 mm. *C. ruficornis*. Similar but hindwing spots not clear. In *C. ambareesa*, three rows of yellowish spots in hindwing. *T. litigiosa*. Black to brown, minute spots in upper half of forewing, hindwing apex white with black spots. Exp. 37-44 mm. *S. purendra*. Blackish brown, forewing with spots one large quadrate. Hindwing with large dark spots above white specks below. Exp. 30-35 mm. *S. dasahara*. Spots smaller, less, quadrate spot absent. Dark spots under hindwing. 30-35 mm. *O. angulata*. Pale brown and chestnut, angular wings, white transparent spots in fore and lines in hindwing. Exp. 40-45 mm. Breeds in Sapindaceae.

C. ransonnetti. Brown with yellowish areas and white spots in forewing. Hindwing dark, central area yellowish, dark veins. Wings angular. Exp. 35-45 mm. *S. galba*. Brown with white spots. Wing fringe chequered. Exp. 24-27 mm. *G. elma albofasciata*. Olive brown, a black band in forewing. White spots, a white band in hindwing. Exp. 25 mm. *C. alexis*. Male brown, unmarked. Two large, one small white spots in forewing apex. Both sexes. Hindwing below glossed blue, a whitish band and at apex a black patch. Exp. 45-50 mm. *B. jaina*. Brown, upper border forewing orange, hindwing fringe orange also veins. Exp. 60-70 mm.

B. exclamationis. Brown, wing base paler. Forewing elongated with whitish elongated spots. Exp. 50-55 mm. *S. gremius*. Brown, under hindwing greyish with black spots. Exp. 32-42 mm. Breeds in palms. *A. vindhiana*. Brown. 2 or 3 spots in centre, 3 small at apex of forewing. Under hindwing obscure spots. Exp. 25-32 mm. Breeds in bamboos in hills. *M. aria*. Brown, hindwing fringe grey or pale yellow. Exp. 40-55 mm. Breeds in bamboos. *G. thyrsis*. Brown, 3 quadrate spots in mid forewing. 2-3 smaller at apex. Exp. 70-76 mm. Large butterfly. Pest on palms.

T. maevius. Forewing with small spots in a line, central and end ones shifted a little. Under hindwing whitish or greenish with a spot. Exp. 22-28 mm. *T. ceramus*. Spots conjoined in 2 or 3 groups in outer half of wing. Exp. 23-30 mm. *A. diascorides*. Brown with yellow markings. In forewing a broad band at base 3 elongate spots and a white patch, veins black. Under hindwing yellow with irregular black spots. Exp. 22-28 mm. Breeds in paddy and grasses. *T. ancilla*. Two forms *T. augias*. Brown, yellowish band on both wings, yellow

veins in forewing. On sugarcane. *T. pythias*. Yellow veins absent. Exp. 32-36 mm. on bamboos. *T. honorei*. Three rectangular spots in line in forewing. Hindwing yellow in centre, black spots underneath. Exp. 30-38 mm. *P. conjuncta*. Forewing with 3 irregular spots in centre in line. 4 smaller in apex, one away, 2 at costa. Small spots under hindwing. Exp. 45-52 mm. In bamboos and grasses. *P. mathias* (Paddy skipper) (पाने गुंडाळणारी भातातील अळी). Similar to but smaller than *conjuncta*, 4th spot at apex absent, 7-8 spots under hindwing. Exp. 32-38 mm. Larva pest on paddy. Pale green, pale bars on back, a white line on sides. Feeds inside rolled leaf. *P. guttatus*. Forewing with 3 white spots in a line at apex, 3-5 in hindwing. *B. cinnara*. Spots white, smaller. Exp. 30-36 mm.

U. folus. Black, three bunches of white spots in forewing, large central white patch in hindwing. Exp. 40-48 mm. Occasional pest on ginger, turmeric. *H. adrastus*. Black. In forewing 2 spots in centre, smaller at base, another one in the middle, 3 joined at apex. Fringes chequered brown and white. Exp. 38-48 mm. *I. salsala*. Brown, orange scales. Female forwing, 6-7 white spots, may be absent in males. One to three black edged silver spots in hindwing. Exp. 26-30 mm.

SUB-ORDER : HETEROCERA (MOTHS) पतंग

(Plate III, Fig. 37)

Fam. *Syntomidae*. Semidiurnal. Spurs on legs short or wanting. Many brilliantly coloured. In many cases wings have transparent spots. Larvae short, hairy, resembling *Arctiidae*. Pupate in silken and hairy cocoons in soil. About 2,000 species described, 100 in the Indian region, about 10 in Maharashtra.

C. imaon. Black with yellow streaks and bands, head yellow, hyaline patches on wings. Exp. 34 mm. *Amata* spp. Collar yellow, wings with transparent spots, yellow or orange bands, 3 spots on hindwing. Exp. 22 mm. *A. passalis*. Orange bands on abdomen, wings black, reddish at base hyaline spots. Larva serious pest on beans, Capsicum, Daisy etc. round about Nagpur. *Eressa* spp. Black with yellow spots on wings, bands on abdomen. Exp. 24-28 mm. *E. polymena*. Orange spots on wings, crimson bands on abdomen. Exp. 44-52 mm.

Fam. *Arctiidae*. Small to moderate, white or brightly coloured. Proboscis present, body well scaled. Prolific breeders. Larvae hairy, often with tufts, feed under leaves in clusters when young, disperse later. Commonly known as hairy caterpillars. Appear early in rains, destroy young crops. Pupate in soil in cocoons. Moth nocturnal, attracted to light generally. About 3,500 species known, 500 in India, about 50 in Maharashtra.

Spilosoma spp. Buff or brown, black spots, red abdomen. Males with feathery antennae. Forewings long, narrow. Exp. 50 mm. *D. indica* white with black spots, yellow abdomen. Exp. 32-42 mm. *P. ricini*.

Brown abdomen, hindwing crimson, dark spots and bands all over. Exp. 40-65 mm. Larvae—Black hairy caterpillar, dark brown, speckled white, tufts of long black hairs. Move in hordes. Omnivorous. *E. lactinea*—Black hairy caterpillar. Crimson, forewing white, border crimson black blotches on hindwing. Exp. 45-50 mm. Serious sporadic pest on millets and legumes. *C. albistriga* (सुरवंट, कान्ना) Red hairy caterpillar. Abdomen yellow with black bands, dark spots on wings, yellowish border to forewing. Exp. 44 mm. Larvae blackish brown, long black hairs, orange stripe on back. Pest on cereals and legumes. *A. moorei*. Very similar.

P. transiens. Blackish with orange abdomen. Exp. 50-60 mm. *R. astra*. Blackish with black spots on body, hyaline wings, smoky borders. 50-70 mm. *E. narcissus*. Yellow, forewing olive above, grey brown below, a white band in centre. 70-80 mm. *D. pulchella*. White, thorax yellow with spots, scarlet bands and black spots to forewing. Exp. 40-45 mm. Larva grey, a white band on back, red spots on sides. A serious pest on *Sann* (crotalaria). *Cyana* spp. White, abdomen reddish, scarlet bands, three black spots on forewings, hindwing pale crimson. Exp. 25-30 mm.

P. entella. Orange, thorax green, green irregular band on forewing. 42-46 mm. *Lithosia* spp. Brownish black. *G. indica*. Brown, parts orange, 2 yellow spots on forewing. Exp. 28-30 mm. *A. conferta*. Orange, black bands on wings. Exp. 25-35 mm. Larva dark with orange spots and tufts of hair, abundant in rainy season on house walls, paths, verandahs etc. Feed on lichen. *D. obliqua*. Similar but paler, oblique line in forewing, abdomen blackish with yellowish tufts. Larva black and yellow with long black or black and white hairs. Omnivorous. Known as Bihar hairy caterpillar. *Celama* spp. Common. White and brown moths, not of any economic importance.

Fam. *Aqaristidae*. Small, economically unimportant. Diurnal, brightly coloured. Resemble Noctuids. Antennae dilated at tips. Clicking sound produced in flight. Larva with tufts of hair on sides. About 300 species in the world, 40 Indian, 3-4 in Maharashtra.

E. adulatrix. Black, forewing banded yellow, blue spots at base, hindwing with reddish spots. Exp. 80 mm. *Aegocera* spp. Mouth covered with hairs. Antennae dilated, forewing red brown, a streak in the middle. Exp. 33-45 mm.

Fam. *Noctuidae*. Short, robust, moderate to big. Antennae simple, hairy or feathery. Forewing narrow, hindwing larger. Colours sombre, cryptic. Proboscis present. Nocturnal. Most attracted to light. Larvae smooth or lightly haired, cylindrical, 3 pairs of thoracic and 2-5 pairs of prolegs. Generally vegetable feeders, some cut seedlings at ground level and known as cut worms. Total described species about 10,000 more than 2,000 in the Indian region, mostly in the hill areas. About 300 found in the plains. Only economically important species mentioned here.

G. dominica. Dull brown, forewing border spotted, hind white. Exp. 36-38 mm. *P. gloriosae*. Blue black, orange and yellow markings, hindwing blackish, border orange. Exp. 30-40 mm. Larvae of both thick, black, velvety, white spots, red marks. Pest on lilies. *Adisura* spp. Brownish, wings pinkish speckled yellow. Exp. 24-30 mm. *H. obsoleta*. (घाट्यांतील अळी, हरभऱ्यांतील अळी). Greenish grey or reddish brown, with a wavy line and a spot on forewing, conspicuous from below. Hindwing border blackish. Exp. 30-40 mm. Larva brownish, white band on sides, black specks on body. Varies. Omnivorous but prefers gram, cotton, maize. *Timora* spp. Reddish or orange, white band, on forewing, bordered black or indistinct specks. Hindwing white. Exp. 30-35 mm.

A. ypsilon (Greasy cut worm) (देठ कुरतडणाऱ्या अळ्या) Moth brownish or dark, waved double lines and black streaks to forewing, hindwing blackish brown. Exp. 46-52 mm. Larva grey, brown, stout, curls to touch, hides by day. Cuts young plants at ground and feeds underground. At times serious. *Euxoa* spp. Similar, but larvae feed on roots, tubers etc., below ground. *Trachea* spp. Pale reddish brown, indistinct double waved lines on forewing, spots on margin. Exp. 34 mm. Larvae feed under bark of *Ficus*. *T. melanospila*, green and brown with white and black markings, a cosmopolitan pest.

Perigea sp. Blackish brown, faint lines and white specks on forewing. Exp. 36-38 mm. Larva smooth, greenish, brown blotches and white spots, feeds on *Acanthod*, nigerseed, safflower, jute etc. *M. tenebrosa*. Dark and brown or grey with patches. Hindwing white, black border. Exp. 36-42 mm. *Aucha* spp. greenish grey. About 44 mm. *P. litura* (Tobacco caterpillar) (तंबाकूवरील कीड) Yellowish brown, yellow streaks at base of forewing, a curved band in the middle. Exp. 30-45 mm. Larva (cut worm) brownish, yellow and black dots, black band on 1st abdominal segment. Hides in soil. A serious pest on tobacco, potato, Lantana etc.

S. mauritia (Swarming caterpillar) (लष्करी अळ्या). Moth grey and black, dark patch in margin, pale double waved lines, big white spot in forewing. Exp. 35-40 mm. Larva green with lighter stripes, smooth, stout. Vary. Pest on paddy. *Amyna* spp. Brown, blackish and greyish tinge, black waved lines, marginal spots in forewing. Exp. 20-36 mm. Minor pests. *L. exigua*. (पानावरील अळी). Yellowish brown, pale double lines on forewing, irregular yellowish spots, hindwing white with dark border. Exp. 25-32 mm. Larva greenish or pinkish brown, dark and yellow lines, stout. Pest on lucern, onion, indigo.

Athetis spp. Brown, pale waved lines, white spots in forewing. Abdomen, hindwing white. Exp. 24-37 mm. *C. albistigma*. लष्करी अळ्या (Climbing cut worm.) Moth stout, dark brown, a faint band at apex of forewing, a curved series of specks. Exp. 40-45 mm. Larva smooth, stout, brownish bands on body, appear in swarms climb paddy plants,

destroy ear heads. *C. unipuncta*. Larva similar, destroys 'jowar' shoots. Moth brownish with dark specks and blotches, a white speck in forewing in the middle and a black one in one side. Black specks on border. Exp. 45-50 mm.

S. inferens (Wheat stem borer) (गव्हाऱ्या खोडातील कीड) Reddish, brown line on forewing, hindwing white. Exp. 25-30 mm. Larva delicate, pinkish, boring and feeding inside stem of wheat, sugarcane, *nachni* (ragi) or paddy and maize. *S. uniformis*. Similar, attacks sugarcane and maize. *T. nitidula*. Larva dark brown, smooth but irregular body, feeds on cotton leaves. Moth white, forewing border black and white with 2 black blotches on costa *X. rubrifusa*. Small reddish. Found in low vegetation in Vidarbha.

Earias spp. (Spotted boll worms) (कापसातील ठिपकेदार अळी) Two common species. *E. insulana*, moth green, pinkish tinge at times. Larva dirty white, yellowish spots on sides, spiny. *E. fabia*. Buff or white with green wedge in forewing. Larva blackish blue, yellow spots on sides, smooth. Both feed voraciously on cotton buds or bolls, bhendi and other malvaceous fruits. *E. chromataria*, a pink spot in forewing. All 18-20 mm. (For details see Deshpande and Nadkerny—1941 Mon. 10 Ind. Coun. Agr. Res., New Delhi. Spotted Boll worms in S. Gujarat).

G. polyspilalis. Yellowish, forewing reddish, red and white spots at base and margin. Exp. 25 mm. *A. graelsi*. Stout, orange, dark streak in forewing. Exp. 30 mm. Larva green semilooper with black horse shoe marks, feeds on cotton leaves or other malvaceous plants. *Metachrostis* spp. Purple brown, forewing with faint lines, spots in centre. Exp. 26-32 mm. *Eublemma* spp. Some plant pests a few predaceous. *E. abrupta*. Red brown. Pest on fig trees. *E. olivacea*. Olive green, shoe mark on forewing. Caterpillar red brown with yellow spots, hairs. Rolls leaves, feeds from inside or attacks shoots in brinjal. *E. silicula* in Bombay and Nagpur, also similar but attacks mango flower, jowar ear-heads, castor fruits etc.

W. superba. Yellowish white, forewing silvery, brown, white bands, two dark conjoined spots. Exp. 36 mm. *P. celtis*. Grey brown, forewing with a spiral dark line. Exp. 24 mm. *H. puera*, reddish brown and *H. constellata*, green, orange bands on abdomen, forewing with designs and dark specks, hindwing black, orange band in centre, small one below. Exp. 32-40 mm. Bad pests on teak leaves.

C. flava. Serious cotton leaf pest. Moth brownish yellow, base of forewing reddish, irregular red lines, a white speck in centre, toothed line at margin. Hindwing blackish. Female bigger, darker. Exp. 32-40 mm. Larva green semilooper, white specks, prolegs reddish. *Carea* spp. Red brown, forewing with an oblique and a curved line, irregular border. Hindwing white, pinkish at border. Exp. 36-40 mm. Larvae feed on *Ficus* and *Eugenia* leaves. *T. variegata*. Big, hairy moth, red brown with dark markings. Hindwing yellowish white, a black

CHAPTER 3

Insects

spot in centre, broad black border. Exp. 80-105 mm. Larva hairy, red brown, blue, warts, feeds on *F. religiosa*.

C. trisa. Yellowish, forewing deep brown with 2 waved lines, hindwing blackish. Exp. 42 mm. *N. macrops*. Exp. 134-160 mm. and other species 90-110 mm. are common moths, black with a large yellowish or brownish eye spot in the centre of the wing and faint black lines. Fly at night fall, make clicking sound at flying. *Polydesma* spp. Exp. 45-55 mm. Breed in grasses or barks of trees. All brown with different tints. Larva semilooper, green or brownish. *H. carenea*. Stout, brown, wing ends lighter. Exp. 80-90 mm. Larva looper, green with black specks, bands, whitish blotches and 2 anal tubercles. Feed on *Acanthaceae*.

Homoptera spp. Red brown, wings lined. Exp. 35-50 mm. *Catephia* sp. Black with dark irregular bands in forewing, a ringed spot. Larva grey, red stripes, yellow lines, a white spot at anal end, pest on sweet potato leaves. *A. cearulea*. Stout, hairy, black and brown, wings with bluish patches, a curved spot on forewing. Exp. 80-85 mm. *S. Chlorea* looks like a hawk moth. Brown, yellowish lines on tapering body. Wings striated with irregular patches and spots. Exp. 60-84 mm. Larva green, white marks, a bar of orange and blue, feeds on *Acacia*. *A. janata* (Castor semilooper) (एरंडीवरील उंट अळी) Stout, grey brown, clear markings on forewing, hindwing black, with 3 white blotches and a band. Exp. 60-70 mm. Larva thin semilooper, bluish grey with bands and specks, red dots, black line. Pest on castor, other *Euphorbiaceae*. *O. joviana* on *Phyllanthus* leaves. *O. algira* on castor. *O. arctolaenia* on pomegranate *O. analis* on *Phyllanthus* and *O. tirrhaca* on guava. *Ophiura* spp. Moderate size, up-turned palpi, tibiae with long hairs in males. Larva semilooper, a double process on hind end of body.

S. inara. Stout, brownish, a white line and blotches at base of forewing. Exp. 55-75 mm. *S. rufibasis*. Reddish, forewing pointed, wavy bluish line in middle, white in hindwing. Exp. 50 mm. Pest on Litchi. *B. divulsa*. Blackish brown, black spot at base of forewing, black patch and specks above. Exp. 40 mm. on *Dalbergia*. *P. reflexa*. Grey brown, 3 waved lines, black spots in forewing. Exp. 30 mm. Pest on *Dalbergia*. *A. circumdatus*, yellowish brown with oblique band, black patches and spots in forewing. Exp. 24-28 mm. *R. archesia*. Brown, angled and waved lines to forewing, red band on border. Hindwing blackish with bands. Exp. 42-54 mm. Larva yellowish green, black stripes, feeds on legumes. *R. frugalis*. Greyish moth, larva brown. Pest on gramineae—paddy, jowar etc. *T. hyppasia*. Brown, white band divides forewing, a black patch. Exp. 46 mm. Larva, semilooper, yellowish, feeds on legumes. *I. manlia*. Dark brown, blue band on hindwing. Males smaller, dark blotches on forewing. Exp. 80-100 mm. Larva brown with streaks, back points raised, feeds on *Terminalia*, cinnamon etc.

CHAPTER 3

Insects

E. varialis. Brownish, forewing angled, pointed, white lined, yellow and white patches at apex, red in centre. Exp. 50 mm. *Spirama* spp. Larva darkish brown, large 6 (inverted comma) mark on forewing. *Ophideres* spp. destructive to orange fruits in the adult stage, a rare instance. *O. fullonica* (फळाचा रस शोषणारा पतंग) (black shoe mark on hindwing) sucks up the juice by its long proboscis from the ripening oranges. Moths stout. Exp. 80-100 mm. Brown, orange or greenish brown, forewing with bands, hindwing orange with black spots or marks. Larva red, black and brown, humped, feeds on weeds. (See T.V.R. Ayyar—1941 Hand Book of Entomology pp. 298-301).

C. emarginata. Reddish, abdomen dark, forewing tip curved, golden border. Exp. 40-45 mm. *C. minuticornis*. Similar, wing border silvery. Larvae semiloopers, violet brown, scarlet and yellow spots, white dots in the former, grey with yellow black bordered dots in latter. Feed with *Ophideres*. *Plussia* spp. Serious pests of agricultural crops. *P. furcifera* and *eriosoma*. Grey and black, a faint silvery Y mark on front wing. Exp. 36 mm. Green larva feeds on mint, pulses and *sann* hemp. *P. obtusisigna*. V mark white, gilded above. Exp. 32-40 mm. Larva green, white lines and dots, black dots behind. Feed on legumes. *P. orichalcea*. Brassy patch on forewing. Pest on crucifers. *P. agramma*. Grey brown, no Y mark, bronzy reflections. Pest on cucurbits. *Hypena* spp. with conspicuous palpi. Larvae green semiloopers, speckled with dots. Defoliate Lantana, *Abrus*, *Desmodium* etc.

See Lefroy H. M. (1907) Mem. Dept. Agr. Ent. 1-11 and Ind. Ins. Life pp. 440-458.

Fam. *Lymantridae* (Tussock moths) कांबळ किडे Clothed with hairlike scales. Antennae feathery in males, tufts of hair at abdominal end of females. Proboscis absent. Larvae with erect tufts of hair, often poisonous or irritating. Pupate in cocoons of silk and hair under debris. About 200 species recorded in India, about 30 in Maharashtra.

L. exclamationis. Brown, a black line on forewing. Exp. 36-44 mm. *L. divestita*. Yellowish, yellow head, collar. *L. testaceae* with a black patch on forewing. All breed in grasses. *T. postica*. Greyish brown, forewing with double lines obliquely curved. Hindwing with a brown patch. Exp. 38-44 mm. Pest on *Zizyphus* leaves. *D. horsfieldi*. Grey, abdomen orange, waved lines to forewing, hind pale with a dark spot. Exp. 70-86 mm. Abundant in forests after rains. *D. mendosa*. Brownish, 4 curved lines on forewing. 34-54 mm. Larva blackish, red spots, white lines, tufts of hair, feeds on leaves of potato, country almond etc. *Lymantria* spp. Red brown to yellow brown, abdomen banded, wings crimson and/or greyish brown, forewings with lines and spots. Exp. 36-54 mm. *L. incerta* & *L. ampla*. Larvae feed on rose, *tur* (*Cajanus*) *Quisqualis* etc. *Euproctis lunata*. Yellowish brown, black spot in forewing in male, brownish anal tuft in female. Exp. 34-38 mm. Larva brown, tufts of long hair, quadrate white

CHAPTER 3

Insects

marks, feeds on *Acacia*, *Zizyhus*, rose etc. *E. fraterna*. Orange, and black spots on forewing. Exp. 20-25 mm. Larva feeds on rose and castor leaves. *E. scintillans*. Brown thorax, abdomen black or yellow, anal tuft orange, wing brown, 2 dark streaks. Exp. 32-38 mm. Larva with tufts of grey hair, omnivorous—linseed, hibiscus, *bajra* etc. *P. xanthorrhoea*. Blackish white, anal tuft orange, hindwing blackish in male. Exp. 28-37 mm. Larva black with black tufts of hair, crimson lines, yellow spots, on *Cassia*, grasses, cereals etc.

Fam. *Hypsidæ*. Moderate size, colours conspicuous. Legs smooth with spurs, proboscis present. Larva hairy, brightly coloured, feeds openly by day but rarely attacked by birds. Pupate in leaves in soil. About 50 species recorded in India, about 10 in Maharashtra.

H. alciphron. Forewing blackish brown, white streaks, orange at base with 5 spots, hindwing orange, black spotted. Exp. 62-76 mm. Larva with black and yellow lines feeds on *Ficus*, droppings making perceptible sound. *Diagama* spp. Dusky, black spots in forewing, hindwing orange. Exp. 36 mm. Larva pest on *Caressa*. *A. cribraria*. (सुरवंट) Deep brown, orange spots in forewing, black blotches in hind. *A. syringa*. Orange with pink spots on forewing, blotches in hindwing. Common pests on *Sann* (*Crotalaria*). *Nyctemera* spp. Whitish with black spots, forewing brown with white spots, a band on inner margin. Exp. 42-48 mm. Pest on weed seed head of *Vernonia*.

Fam. *Sphingidae* (Hawk moths). Medium to big, longish forewings, hindwings small, antennae gradually thickening pointed at tip and hooked. Legs with spurs or spines. Flying by day or night, feeding on wing. Most attracted to light. Larva stout, a horn on last but one segment. Generally beautifully coloured, feeding openly. Pupa in soil. More than 1000 species described, about 200 in the Indian region, about 50 occur in Maharashtra. (See Fauna Br. India T. R. Bell. of ac. 1937.)

A. lachesis. Skull mark on thorax, grey blue stripe on abdomen, yellow side patches. Forewing blackish, yellow and white scales. Squeaks if disturbed. Steals honey from bee-hives. Exp. 100-130 mm. *A. styx styx* (Deaths head moth) (तिळाच्या पानावरील अळी) Similar to above but skull mark not clear, yellow patches extensive, no black patch at base of hindwing. Exp. 90-130 mm. Larva green, yellow or grey with yellow dots, oblique yellow stripes. Pest on *sesamum* leaves. *H. convolvuli* (स्ताळीच्या पानावरील कीड) Grey brown, grey stripes on abdomen, white, black, pink patches on sides. Exp. 80-120 mm. Fast fliers. Larva smoky brown, short black lines on sides, yellow stripes, or green with yellow or pink black edged bars. Pest on *udid* (black gram) and sweet potato leaves.

P. menephron. Grey, brown bands on sides of thorax, black stripes on abdomen, brown patches on sides. Variable. Exp. 80-140 mm. Rapid flier. Makes clicking noise if disturbed. Larva bluish green,

CHAPTER 3

Insects

yellowish tubercles, oblique stripes. Feeds on *Jasminum*, *Olea* etc. *C. panopus*. Dark chocolate, pink bands on abdomen and wings. Larva green, back, white, yellow stripes and tubercles. Exp. 110 mm. Feeds on mango leaves. *Oxyambulyx* spp. Small, yellowish or reddish, greenish spots on forewing and stripes on abdomen and thorax. Larvae green with yellow and white markings. Feed on *Anacardiaceae*. *Clanis* spp. Reddish, black patch at hindwing base. Larva greenish, yellow tubercles. Exp. 100 mm. Pest on legumes rarely found.

M. dyras. Pale brown, a dark line. Forewing with wavy edge and curved lines, hind with 2 spots. Exp. 94-114 mm. Larva blue green, a white spot, streaks and spines. Feeds on *Bombax*, *Sapindas* etc. *C. hylas* (Humming bird hawk moth). गणारा पतंग, शीळ वाजवणारा पतंग Yellowish. Abdomen with transverse black and red band, transparent wings, black anal tuft. Exp. 60-70 mm. Flies at dusk, hard to see, makes humming noise. Larva green, yellow tubercles, purplish stripes. Feeds on *Rubiaceae*. Ejects green fluid when excited. *D. nerii*. Green, white patch, a black spot, white and rosy band on forewing. Exp. 70-120 mm. Feed on *Nerium*.

N. didyma. Olive brown or green, black bands on abdomen, 2 silvery spots on forewing. Exp. 70-80 mm. Larva on *Carissa*. *Macroglossum* spp. Grey with orange or yellow abdominal patches, a white stripe, dark grey spots on abdomen. A black spot, lines on forewing. Exp. 38-60 mm. Feed on *strychnos nux-vomica*. *C. lineata livornica*. Greenish, abdomen brownish, black and white side patches. Wings brown and crimson with white patches, bands, and black dots. Exp. 52-90 mm. Larvae feed on *Rubiaceae*, *Euphorbiaceae*. *Hippotion* spp. Brown. Forewing narrow, abruptly pointed, abdomen sharply pointed. Forewing lined. Hindwing red generally. Exp. 54-84 mm. Larvae feed on various plants.

Theretra spp. Brown or chestnut with at least one dark line from apex to inner margin of forewing. Hindwing red or dusky. Wings narrow, pointed. Abdomen sharply pointed. Larvae with small round head, body tapering towards head, hind part cylindrical, horn medium sized. Dull and smooth. Feed on variety of food plants. *R. acteus*. Purplish grey, a stripe on back. Forewing centre greenish, hindwing blackish. Exp. 64-80 mm. Larva green or brown with stripes and spots. Feeds on variety of plants e.g. *Vitis*, *Begonia*, *Colocasia*. etc.

Fam. *Eupterotidae*. Generally large, mouth parts hairy, no proboscis, antennae feathery on one side. Spurs on legs. Colours dull. Inhabit hilly areas. Larvae stout with tufts of hair. Feed gregariously. Hair poisonous, easily get detached when larva gets excited. Pupate in cocoons of silk and hair and rest in it from end of rain to beginning of next year. About 50 species recorded in the Indian region, a few in Maharashtra.

E. undata. Varies in colour. Pale brown, yellowish to deep brown, waved lines on wings. Exp. 74-110 mm. Pest on *Bombax*, *Careya*,

CHAPTER 3

Insects

Dalbergia etc. *E. fabia*. Yellow, Exp. 90-130 mm. Pest on *Erythrina*. *E. geminata*. Forewing with a curved line, another line crossing both wings. Exp. 60-80 mm. Larva pest on *Moringa*, *Cajanus*, tea, cotton, cacao etc. *N. simplex*. Forewing whitish, yellowish or reddish, generally with red brown streaks. Exp. 40-50 mm. In grasses in W. Ghats

Fam. *Notodontidae*. Resemble *Noctuidae*. Generally grey or brown, long tapering abdomen ending in long scales or tufts. Mostly hill forms. Larvae peculiar. Anal proleg absent, that part tapering up often bears paired processes. Thorax compact. About 200 species recorded in India, less than 15 in Maharashtra.

D. nobilis. Yellowish buff and brownish, wing margins spotted, brown band in forewing, tuft of hair at anal end. Exp. 75-100 mm. Found in thick jungles. (See T. R. Bell—1935 J. Bomb. nat. Hist. Soc. 38:124) *P. procera* and *P. raya*. Brown, black bands on abdomen. forewing silvery grey, base dark, patch at apex. Exp. 81-84 mm. *A. combusta*. Thorax brown, abdomen orange, spotted black. Forewing yellowish with streaks. Exp. 52-74 mm. Larva green, sparsely hairy, whitish bands, green stripes, feed on maize. *S. alternus*. Grey with dark tufts on abdomen forewing narrow with waved lines, red spots. Exp. 44-62 mm. Larva red brown, pale line and protuberances on back, both ends swollen, two processes at anal end. Feed on *Cajanus*, *Acacias* etc. *C. liturata*. White with black waved lines and spots. Abdomen black or banded with black. Exp. 46-90 mm.

Fam. *Geometridae*. Moths medium to big, slender, large papery wings, flight weak. Proboscis present. Females of some species wingless. Larvae elongate, slender, loop while moving. Mimic twigs. About 12,000 species known, nearly 1,500 in the Indian region and less than 100 in Maharashtra, mostly near Bombay and Poona.

P. transmutata. Yellow, reddish patches on wings, silvery border to lower patch. Exp. 28 mm. *L. contigaria*. Brown irrorated with black, a spot in centre and bands in each wing. Hindwing toothed. Exp. 40-45 mm. *Macaria* spp. feed on *Acacias*. *M. frugaliata*. Pale red, irrorated with black. 28 mm. *M. fasciata*. Slaty grey, white band on wings. Exp. 42 mm. *M. emersaria*. Grey, dark spots on abdomen, curved lines and a basal spot on forewing. Exp. 32-40 mm.

Tephрина spp. Whitish, wings with broad bands, end portion purplish grey. Exp. 28-30 mm. Larva in *Acacia* and grasses. *O. clelia*. Pale reddish brown, angled lines and specks on dentated wings. Exp. 40-60 mm. Larva greenish black, slightly hairy, 2 protuberances on back, feeds on *Convolvulaceae*. *H. talaca*. Blackish grey, forewing tip produced, hindwing pointed in the middle, both with wavy lines. Exp. 45-60 mm. Larva pinkish green feeds on *Ficus*, *Combretum*, *Jambrona* etc. and on rose. *H. successaria*. Similar but brick red. *D. capitata*. Red 4 lines on fore and 2 on hindwing. Exp. 34 mm. Larva feeds on *Zizyphus*.

CHAPTER 3

Insects

B. varianaria. Reddish, covered with purplish black spots. Exp. 50-80 mm. Larvae attack *Acacias*. (See J. Bomb. nat. Hist. Soc. 11:691) *Boarmia* spp. Some bad pests on forest trees. *B. acaciaria* larvae feed on *Cassia*, *Dalbergia*, *Shorea* etc. Moth with reddish band on abdomen, designs of red and white on wings. *M. objectaria*. Reddish brown with blackish scales, faint grey lines and spots on forewing border. Exp. 50 mm. *R. infelix*. White, yellow spots in traces. Exp. 20 mm. *Craspedia* spp. Pests on Kohl-rabi, spinach, hedge plants etc. *Acidalia* spp. Forewing generally acute, produced, hindwing rounded. Exp. 15-16 mm. Found in forests near Bombay and Poona. *Anisodes* spp. Pinkish, specks on wings. Exp. 25-32 mm.

Problepsis spp. White, wings with two ringed olive patches. Exp. 40-45 mm. *Euschema* spp. Beautiful moths, blue thorax, yellow tipped abdomen with purplish bands, pale blue wings with purple markings. About 90 mm. Larva yellow, spotted black, bluish bands. Feeds on *Carallia*. *Pseudoterpna* spp. White wings sculptured brown or olive. Exp. 45-55 mm. *Agathia* spp. Green, brownish specks and patches on wings, hindwing angled and pointed. Exp. 40-45 mm. Pests on forest trees. *Euchloris* spp. Brown or green, lines and specks on wings. Exp. 25-30 mm. *Nemoria* spp. Green, white lines on wings. Exp. 22 mm. *N. dentata*. Yellow green, forewing with oblique lines, specks on margin. Exp. 30-36 mm.

T. quadraria. Bluish green, delicate lines, wing border yellowish, under side white. Exp. 38 mm. Larva green, pair of orange processes on head, feeds on *litchi* (*Nephelium*) maize, Wagata etc. *T. semialba*. Wings green, base reddish in forewing, white lines. Exp. 28 mm.

See Prout L. B. (1926) J. Bomb. nat. Hist. Soc. 31:129, 308, 780 Ind. Geom.

Mem. Dept. Agr. India 9:247 Indian Geometridae.

Fam. *Saturnidae* (Wild Silk moths) रानटी रेशमाचे किडे Large, crepuscular. No proboscis. Legs short, hairy, simple. Antennae feathery, wings with eye spots. Almost all pupate in silk cocoon. Larvae feed on forest trees. About 40 species recorded in India, about 4-5 in Maharashtra.

A. selene. Light green, long curved tail to hindwing, transparent reddish eye spot in each wing. Exp. 130-180 mm. *A. atlas*. Red brown wings with pale and black lines, hyaline triangular spots, black border. Largest moth, exp. 250-300 mm. *A. ricini*. Domesticated and distributed all over India for sericulture on castor leaves. Moth greyish brown, white lines on thorax, eye spot at expanded tip of forewing, white bands and a semi circular white spot on each wing. Larva white, green, grey etc. changing colours. Spines on body. Spins fine white cocoons. (See Ayyar T.V.R.—1932. Mad. Agr. Jour. 20 : 395, 483. Silk-worm rearing as Cottage Industry). *A. paphia*. Reddish or yellowish, a band on border, eye spot on each wing. Exp. 140-190 mm. Larva green, pairs of yellow humps and white

CHAPTER 3
Insects

spots on each side. Silk cocoon hard, brownish grey, oval, attached by a silken peduncle, gives Tusser silk. Larva feeds on *Bassia*, *Dalbergia*, *Shorea* (See Beeson—1941 P. 695 Eco. Cont. For. Ins.) *C. trifenestrata*. Brown, yellowish or reddish, a dark continuous line from forewing tip to mid hindwing. White spot on each wing. Exp. 60-90 mm. Larva black brown, with 6 tubercles, reddish stripe on sides and poisonous spines. Cocoon of golden silk in a net work. Feeds on forest trees, mango leaves etc.

Fam. *Bombycidae* (Silk worms) (रेणुमाचे किडे) Medium. No proboscis. Antennae feathery. Legs hairy, front wing with a wavy border. About 15 species recorded in India, 2 in Maharashtra.

Bombyx mori fully domesticated. Many races differing in silk production and habits according to environment, some with one brood in a year (univoltine) others more (Multivoltine). Moths can hardly fly though fully winged. Larvae feed only on mulberry leaves. Reared on a large scale. Moth pale cream, wings half spread, 35-40 mm. Whitish hard eggs laid in bunches. Larva dirty white, clear segments, a horn on last segment. Length 50 mm. when full grown. Spin yellowish white cocoon of pure silk and pupate inside. Moth emerges after 10-12 days. Such cocoons give broken thread. For getting fully long one thread from single cocoons, moths are smothered by boiling cocoons. Moths allowed to emerge only for further breeding. (See Lefroy and Anson—1916—Report on an enquiry into the Silk Industry in India and report of proceedings of the All-India Sericultural Conference 1939 Government of India). *O. varians*. Brownish or grey, 4 curved wavy lines and a dark patch below apex. Exp. 26-32 mm. Larva feeds on *Ficus*, *Gular* etc. (See Trop Agr. 86:263, 1936. Some pests of fruit trees).

Fam. *Uranidae*. Resemble butterflies and Geometrid moths. Confined mostly to hills. Day flying, large. Larva stout, tuberculated. Indian species few, only one recorded in Maharashtra. *M. aculeata*. Blackish white, wings closely striated with black, hindwing pointed, a black spot at end. Exp. 45-50 mm.

Fam. *Epiplemidae*. Similar to *Uranidae*. Moths night fliers, rest during day with forewings rolled up, hindwings folded over body. Look like spiders. About 500 species known, less than 50 Indian, 4-5 in Maharashtra, near about Bombay.

E. instabilata. Blackish, thorax white, forewing thickly speckled with brown, yellow and black, white spot in centre. Exp. 24 mm. *D. theclata*. Greenish grey, abdomen yellowish, forewing with a triangular patch with brown border. Exp. 22 mm. Larva voraciously feeds on *Adina*, *Randia* etc.

Fam. *Psychidae* *T.* (bag or case worn moths). पिशवीतून फिरणारी अळी Males rather small, wings with a few scales and markings. Antennae feathery. Abdomen long. Crepuscular. Females worm like, enclosed

CHAPTER 3
Insects

in cases made by themselves, in larval stage, of vegetable matter and silk. Some species with no mouth parts, antennae and legs. Never come out of the case, the male fertilising her there only. Eggs also laid in the same case. Larvae when hatched come out, make their own case, tough and durable, composed of pieces of leaf, thorns, leaf stalks or powdered vegetable matter interwoven by silk, open at both ends. Larva half comes out for feeding. Full fed male closes one end and pupates inside. The female rests for sometime and attains adult hood. Life cycle may last more than a year. About 800 species recorded, 50-60 in India, mostly in hills, about 3 in or near Bombay.

C. crameri. Brown, forewing reddish, hindwing smoky, both short and broad. Exp. 30 mm. Larval case formed of twigs of *Acacias*, *Bombax*, *Cassuarina*. *Tamarindus* etc. Exp. 18-28 mm. Food, apple, tea, *Acacias*.

(See Fletcher T. B. (1919) Proc. 3rd Ent. Mect. Pusa pp. 137-139 and 322.

Fam. *Arbelidae* (Bark caterpillars) (झाडाच्या सालीतील अळी) Small family, less than ten species recorded in India, one in Maharashtra. No proboscis, antennae feathery. *A. tetraonis*. Brown, abdomen black, forewing pale, spots on border, hindwing whitish with brown spots and streaks. Exp. 36-50 mm. Larva brown with dark patches, sparse hair, forms galleries in bark of powdery matter and own excreta woven in silk. Feeds in bark galleries. Pest on *Citrus*, *Casuarina*, *Peltophorum*, *Eucalyptus*, etc.

Fam. *Cossidae* (Goat or Carpenter moths). Medium to large narrow wings, abdomen long, generally grey, brown or dull colour. Male smaller. Antennae feathery. No proboscis. Larva stout, strong, tunnelling in trees, smooth with dorsal plates. Pupate naked in tunnels. Nocturnal. Indian species less than 50, mostly in hills and forests, 2-3 in Maharashtra.

C. acronyctoides. Brown, forewing lined, hind with faint net work. Base of forewing black in females. Exp. 36-50 mm. Larva in *Tamarix*. *D. leuconotus*. Large, black with grey scales, irregular white patches. Thorax white. Exp. 100-180 mm. Huge, brown larva bores into *Acacias* and other trees. Life cycle more than a year.

Fam. *Lasiocampidae* (Lappet moths). Moderate sized, thick bodied, cryptic designs resembling leaves generally. Antennae short, feathery, legs hairy. No proboscis. Eggs in clusters covered with hair. Larva with long tufts pointing downwards. Feed on leaves. Pupate in soil in cocoons of silk and hair, rest in this stage after rains. Less than 100 species recorded in India, about 7 in Maharashtra.

T. dorsalis. White and red, 2 white spots on forewing. *T. siva*. White abdomen forewing grey with 2 brown spots, 2 whitish lines. Exp. 48-84 mm. Larva brownish, large dark hairy patches, black spots behind. Bad pests on *Acacias*, *Zizyphos*, rose, tamarind etc. (See Fletcher T. B.—1919 Bull. 89 Agr. Res. Inst. Posa.).

CHAPTER 3

Insects

S. concolor. Red brown, forewing spotted, border greyish, a few whitish lines. Exp. 52-146 mm. Larva brown black, humped, pest on a variety of plants. *M. hyrtaca*. Reddish brown, forewing with 4 pale lines, black patch with white spots in centre, border of spotted line. Both absent in female. Exp. 48-74 mm. Larva feeds on *jamboul* (*Eugenia*), *Bassia*, *Acacia*, *Eucalyptus* etc. *T. vishnu*. Male pale green, 2 pale lines and dark spots on forewing. Hindwings extended on sides in sitting posture. Head not seen. Looks like leaf. Female yellowish, bigger with big brown patches on forewings. Exp. 50-90 mm. Larva red spots on yellow head, long side tufts of brown and grey, black spots. Varies—Pest on *Eugenis*, *Terminalia*, *Shorea*, *Castor*. *E. pardalis*. Brown. Exp. 38-76 mm. At rest resembles a dried leaf with the projecting palpi forming a black twig.

Fam. *Limacodidae*. Thick set, wings short, broad, rounded, hindwings comparatively small. Flat scale like eggs laid in rows. Larvae with retractile head, glide with their legs. Smooth round swellings. Known as slug caterpillar. Irritant spiny or with thick smooth skin or with segments invisible. Rare in plains. Pupate in hard round cocoons with a lid and diapause generally on tree trunks. About 150 species recorded in India, about 10 in Maharashtra.

T. cana. Dull brown, forewing with 2 lines, a dark speck. Exp. 25-30 mm. Spiny, green larva with yellow stripe, feeds on castor, *Cassia* etc. *N. velutina*. Red brown with a seal skin line. Exp. 60-78 mm. Larva green, spiny protuberances and 4 white patches feeds on mango, *Bombax* leaves. *P. lepida*. Abdomen brown, forewing green with a reddish patch at base and top. Exp. 30-50 mm. Larva greenish, 3 bands on back, short spinous tubercles on sides. Polyphagous, on leaves of mango, palms, castor, *Eugenia*, *Butea* etc. *A. nivea*. White, 3 black spots in forewing and 2 in hindwing. Exp. 30 mm. Larva feeds on castor, *Bombax* etc.

Fam. *Zygaenidae*. Moths of divergent appearance, some like *Syntomidae*, some like butterflies etc. Diurnal. Generally in thick forests and cold regions. Larva short, cylindrical with protuberances shooting out short hairs. Feeds on leaves exposed. 2-3 species recorded in Maharashtra out of about 300 listed in India.

H. virescens mimics butterfly. Forewing dark green, yellow spots, Exp. 76 mm. Larva feeds on tea. *C. affinis*. Wings metallic green and blue marked black with a white band. Exp. 50 mm.

Fam. *Drepanidae* (Hook tips). Small, slender. Apex of front wing produced generally. Mostly hill dwellers. Larva smooth, last prolegs missing, humps on segments, long processes at anal end. Less than 100 species recorded in India, 2 in Maharashtra.

P. vidhisara. Reddish with waved lines and black specks in wings, 28-38 mm. *O. extensa*. Pinkish yellow, forewing produced, with dark spots and yellow line. Exp. 40-54 mm.

CHAPTER 3

Insects

Fam. *Thyrididae*. Moderate size. Antennae simple, hyaline patches and bands on wings, mid tibiae with one pair, hind with two pairs of spurs. Recorded species about 100; Indian about 60 and in Maharashtra about 7.

S. scitaria. Reddish, wings paler brown, a brown band across both wings. Exp. 24-48 mm. Larva green, black head and black dots. Pest on forest trees. *R. mirsalis*. Grey brown, forewing with 3 brown patches, border yellow, underside silvery. Exp. 22-26 mm. *R. myrtaca*, more red. Larva feeds on *Loranthus*, *Bassia*, *Achras* etc. *Dignata*. Brownish, wings full of small lines with irregular dark patches. Variable. Exp. 32-38 mm. Larva feeds on crotons. Bores in wood.

Fam. *Pyrilidae*. Large family. Moths medium to small, delicate, diverse colours but cryptic or warning type. Antennae usually simple, thorax and abdomen slender, densely scaled, legs long with conspicuous spurs. Wings slender. Eggs laid conspicuously on food singly or in clusters. Larva cylindrical, generally with dark tubercles and slight hairs. Live concealed boring in stems, fruits, barks or in decaying or rolled leaves. A few aquatic, a few household pests rests in larval stage. Pupa brown, sheltered. A few do not rest. Bad agricultural and store pests. Indian species about 1,500, nearly 200 in Maharashtra.

G. melonella (Wax caterpillar). Larva feeds on wax in beehives, in silken galleries. Dirty white, stout, very destructive. Moth yellowish brown with black scales. Exp. 20-40 mm. *C. simplex* (*C. zonellus*) (जवारीच्या खोडातील किडा) (Jowar stem borer). Yellowish with black scales upper border darker, Elliptical circle of minute black spots in forewing. Exp. 20-25 mm. Larva dirty white, brownish tubercles. Pest on *jowar*, maize, etc. *A. chrysographella*. Brownish, forewing with black scales, yellow and silvery bands. Exp. 20-40 mm. *A. saundersiella*. Similar. Larva in rolled paddy and grass leaves. *Scirpophaga* spp. (*S. cane stem borer*) (उसाचे शेंड्यातील किडा) Larvae bore into stem on top shoot. *S. auriflua*. White, anal tuft yellow, pink or orange. Exp. 24-50 mm. Larva creamy white, dark tubercles. *S. bipunctifer* (भाताचे खोडातील कीड). Similar but yellowish brown, a black spot on forewing. Caterpillar white, bores into paddy stem. *Polyocha* sp. Golden. tinges of crimson or pinkish with spots and bands. Exp. 22-36 mm. White larva bores in sugarcane below ground.

E. cautella. Flour moth. (चोटेर) Small, greyish brown. Exp. 14-16 mm. Common in store rooms. Eggs laid in bunches in store, larvae weave silken threads and feed, pupate in cocoons on sides of receptacles. Rapid multiplication. Destroy stored products, flours, tamarind and cotton seeds. *Nephoteryx* spp. Straw coloured, slightly blackish, black specks on forewing. Exp. 20-26 mm. Larvae feed on green leaves. *Phycita infusella*. Serious pest on cotton shoots (Cotton shoots roller) (कापसाच्या शेंड्यातील कीड) Dark grey, crossbar on forewing.

CHAPTER 3

Insects

Exp. 16-20 mm. Larva greenish or reddish. *P. clientella*. Pale red brown, reddish patch on forewing. Exp. 22 mm. Larvae roll up brinjal leaves. *E. zinckenella*. Grey, forewing border white, ridge of raised scales at base. Larva green or reddish, bores into pods of pulses, sannhemp etc.

H. mauritalis. Pink, orange spots, black lines and a patch on forewing. Exp. 20-24 mm. Larva parasitic on larvae of *Polistes* wasps and on roots of *Dalbergia*. *P. recisalis*. Slender, reddish. Waved black lines and specks on forewings. Exp. 22 mm. Breed in rotting material. *B. vibicalis*. Grey brown to reddish purplish with black. A spot and 2 lines on forewing. Exp. 34 mm. Larva black, hides by day, defoliates *Shorea* by night. *Nymphula* spp. Delicate moths. Larva aquatic with tubular gills, can live outside water also. Moths come to light. *N. depunctalis*. (सुरळ्यातील अळी) White, speckled black, bands of buff, long fringes to wings. Larva green, orange head, lives in cases of paddy leaves prepared by itself. *C. blandicalis*. Yellow, forewing base silvery, brown and silvery patches at top, hindwing border with black edged yellow spots. Exp. 12-20 mm. *T. sexpunctalis*. Brownish yellow, forewing with brown patches hindwing white and yellow, 2 black spots. Exp. 20-24 mm. Larva on wild fig. *S. phacalis*. Forewing with tufts of raised scales. Grey irrorated with black and brown. Larvae feed on lichen and moss.

E. fascialis. Deep brown, white irregular marks. Exp. 24 mm. Larva green with white lines and black crescents on sides of thorax. Pest on *Amaranthus*, garden plants. *A. basinotata*. Pale yellow, spotted orange, forewing with a mark and patch on costa. Exp. 16 mm. Larva defoliates *Eugenia*, *Lagerstroemia* etc. *P. salvalis*. Grey with orange stripes on thorax, black and white on abdomen, wings with orange lines. Exp. 22-26 mm. Larva pest on *Tectonia*. *C. medinalis*. Buff, dusky wing fringes. Exp. 20 mm. Larva folds paddy and grass leaves, feeds inside. *M. trapizalis*. Blackish brown, lines and 2 spots on forewing. Exp. 22 mm. Larva in folded leaves of jowar, maize.

S. abruptalis. Yellow, black and grey lines on wings. Exp. 18 mm. Green larva feeds in folded leaves of *Tulsi* (*Ocinum*). *C. conchylalis*. White, translucent, shining forewing with golden brown costal band. Exp. 40-45 mm. Larva feeds in folded leaves of forest trees. *F. fulvidorsalis*. Brightly coloured. Brown wings patched orange, abdomen long, tufts on sides. 30-44 mm. Larva green, whitish bands, black spots, feeds on *Thunbergia*. *D. punctiferalis*. Castor capsule borer (एरंडीच्या बोंडावरील कीड). Yellow, speckled black. Larva reddish with tubercles. Pest on Castor shoots, capsules, guava, tumeric, ginger, cardamon etc. *Nacoleia* spp. Spotted wings of different colours, Exp. 30-36 mm. Pests on legumes. *B. asialis*. Orange yellow, two brownish spots on wings with 3-4 lines. Exp. 50 mm. Larva short, thick, green with reddish bands, black spots, feeds on *Ficus* spp.

CHAPTER 3

Insects

S. derogata (Cotton leaf roller) (कापसावरील पानगुंडाळणारी अळी) Yellowish white with black rings and spots on abdomen, brownish double lines on wings. Exp. 28-40 mm. Larva transparent, green, rolls cotton leaves in a funnel shape. Attacks other malvaceous plants too. *S. aurantiacalis*. Yellow brownish, a patchy band, spots and lines on forewing. Exp. 34-36 mm. Pest on *Shorea*. *S. lunalis*. Blackish yellow, white bands on abdominal end. Exp. 30 mm. Pest on grape vine, *Lantana*, *Helecteres* etc. *Lygropia* spp. Brownish with lines and spots on forewings. Exp. 20-26 mm. Pests on *Grewia*. *A. ostentalis*. Faun, white marks on thorax and abdomen. Forewing costa white with white bordered patch and pink bands. Exp. 20-40 mm. Pest on *Erythrina*.

Glyphodes spp. Larvae generally translucent, green, roll leaves and feed on neighbouring leaves. *G. vertumnalis*. Yellowish green, wing fringe black. *G. bivitalis*. Forewing chestnut, 2 semi-hyaline patches, margins grey. Larva brown, white specks, black dots on thorax, feeds on *Ficus*. *G. bicolor*. Black brown marked with white patches on wings. Larva pest on *Apocyanaceae* spp. *G. indica*. Black brown, part of abdomen white, wings white bordered black. Exp. 24-28 mm. Larva feeds on cucurbits and cotton. *P. tyres*. Black, shot with purple, white spots and stripes. Exp. 42-46 mm. Larva creamy with black spots feeds on forest trees. *L. neptis*. Brown, white bands on abdomen, elongate spots on wings. Exp. 32 mm. *L. geometralis*. Yellow striated with black. Exp. 26 mm. Larvae of both feed on *mogra* (*Jasminum*).

L. orbonalis. (वांग्यातील अळी) White, black and brown. Forewing base blackish, yellowish patches. Exp. 24 mm. Larva pink, bores into brinjal fruit. *C. binotalis*. Reddish with rusty markings, a tuft of hair on forewing. Exp. 26 mm. Larva green or brownish, white stripes and black dots on sides. Feeds on Crucifers. *H. undalis* (Cabbage borer). Grey and brown, black marginal specks on forewing and lines. Exp. 20 mm. Larva 15-20 mm. Whitish brown, striped. Pest on Cabbage.

S. cancellalis. Yellowish, abdomen tinged with white, wings with black border, elongate markings on upper border. Exp. 22 mm. Occasional pest on *Tectona*. *M. testulalis*. Blackish brown, forewing with a white band, 2 spots, hindwing border blackish. Exp. 26-30 mm. Larva greenish, spotted. Pest on green pulse pods. *P. phoeopteralis*. Blackish, a speck, spots and lines on wings. Exp. 22-30 mm. Larva green, rolls leaves and feeds. *A. catalaunalis*. Brown, wing veins and margins reddish. Exp. 20 mm. Larva green with black spots and hairs bores into *Til* pods (*Sesame*) or rolls leaves. *N. blilealis*. Black, patches on abdomen, hindwing white, abdomen black. Exp. 24 mm. Larva white at first and then green, a pest on *Moringa* leaves. *Hapalia coealis*. Reddish, hindwing paler. Exp. 28-30 mm. Larva rolls

CHAPTER 3

Insects

leaves of bamboo, sugarcane, maize etc. *H. machaeralis* (Teak skeletoniser). Yellow with pink zigzag lines on forewing.

Fam. *Sesiidae* (Clear wings) Diurnal. Feed on wings. Rest on leaves in hot sunshine. Mid tibia with one and hind with 2 pairs of spurs. Wings almost hyaline. Many mimic Hymenoptera species. Larva fleshy, colourless, feeds on bark or pith. Only a few species known.

C. postcristatum. Reddish, anal tuft black, wings yellowish hyaline. Exp. 16 mm. M. eurytion. Black, thorax greenish, silvery bands on abdomen, forewing hyaline, banded. Exp. 24-30 mm. Larva forms galls in snake gourd stems.

Fam. *Tineidae*. A large family of small moths with narrow wings, broad fringes, dull colours. Generally nocturnal. Legs long and spurred. Eggs laid singly. Larva thin, smooth with various colours, and habits. Generally harmful to agriculture and stored products. About 2,400 species recorded. Indian species not properly listed yet. The large number of sub-families are now treated as families. The few species recorded in Maharashtra mentioned.

S. nerteria. Dark brown, white dot on costa of forewing. Exp. 6-10 mm. Larva green, black head, 5-6 mm. mines in groundnut leaves, soyabeans etc. joins the leaves and feeds inside. *P. gossypiella* (कापसावरील गुलाबी अळी) (Pink bollworm). A world cotton pest. Moth blackish brown, nocturnal. Eggs laid under bracts of bolls. Whitish larvae bore in, enter seed, feed, grow, become pink, drop down and pupate in soil or debris. Attack cotton buds also. Larva diapauses in seed, in store or in fields from November-December to June-July. Can rest in seed cotton or soil also. *P. operculella* (बटाटाचातील अळी) Potato borer. Worldwide pest. Attacks potato both in field and store. A grey brown moth. Eggs laid in eyes of potato, larva enters and feeds inside, pupates outside in silken cocoons. *P. blapsigona* attacks brinjal flower bud. Adult grey brown, larva, pink. *G. heliopa* (Tobacco caterpillar). (तंबाकूच्या खोडातील अळी) Similar to above. Bores in tobacco stem, causes swellings. *A. ephippias*. Reddish brown, a line, spots in front wing. Larva pinkish blue, yellowish head, attacks top shoots of groundnut and other leguminous plants.

T. zizyphi. Moth small, brown. Larva greenish, feeds in folded citrus leaves. *N. serinopa* (Black headed caterpillar). (काळ्या तोंडाची अळी). Often serious pest on palm leaves. Moth small, whitish. Larva slender, greyish, black head. Feeds in galleries formed by itself. *P. maculipennis*. (Diamond black moth) (चौकटी (हिरे) ठिपक्यांचा पतंग) Pest on all crucifers. Caterpillar slender, pale green, feeds in groups on leaves, biting holes. Pupates on leaves. Moth small, grey, a wavy white line on border of forewing forming diamond like line on back while sitting. *P. radiata*. Brown with white markings. Larva yellowish, flattish, dark stripes on sides, feeds on fig and other ficus plants.

CHAPTER 3

Insects

A. syngamma cause whitish blisters on leaves of mango. *C. coerulea* on Lab. lab. and *G. soyella* on pigeon pea—*Tur.* *P. citrella*. (लिंबाच्या पानावरील अळी) Moth small, grey. Larva whitish, mines in young citrus leaves and curls them. Pupates in glistening mine. *P. toparcha* similarly attacks grape vine leaves.

Literature Fletcher T. B. (1921) Mem. Dept. Agr. Ind. Ent. b 181 Tineidae.

(1926) Sci. Mono. No. 4 Imp. Coun. Agr. Res. P. 73 Tineidae.

Meyrick (1904-12) J. Bom. Nat. Hist. Soc. 16-23 Descriptions of Indian Microlepidoptera

Fam. *Hepialidae* (Swift moths). Large moths, rare except in hills. Short, simple antennae, short legs, no proboscis. Long body, narrow wings. Hang on tree twigs like bats in some cases. Larvae bore in stems. Less than 15 species recorded in India, one in Maharashtra.

P. aboe. Dull brown with 10 dark angular marks on forewing, two indistinct marks on hindwing. Exp. 70-88 mm. Larva bores in various forest trees.

ORDER TRICHOPTERA (CADDIS FLIES)

(Pl. III, Fig. 38)

Resemble Lepidoptera. Pass through similar stages but in water. Eggs laid in masses in a gelatinous secretion in water on plants over hanging. Larvae in water, weave tough cases of sand particles, shells, weed bits etc., at the bottom according to the habits of the species. Feed on algae or minute animals. Larvae of a few species live openly in water under stones. Pupa in water. Adults come out in a bubble, live just for reproduction. Cannot feed in adult stage. Total world species 3,000, Indian records not available, about 12 in Maharashtra.

Fam. *Calamoceratidae*. *A. flexuosus*. Yellowish-brownish, rufous haired, truncated wings. L. 7-5 mm. *A. kempi*, yellow, wings with yellowish hairs. L. 8 mm.

Fam. *Molannidae*. Montana species. Brown, yellow wings with rufous hairs.

Fam. *Sericostomatidae*. *M. indica*. Brown, two dark warts behind the head, wings greyish yellowish with yellowish hairs. L. 5 mm.

Read : Martinov A. Moscow (1935-36) Rec. Ind. Mus. 37:95 and 38:239

Collection of Trichoptera from the Indian Museum.

Mosely M.E. (1933-41) J. Bom. Nat. Hist. Soc. 36-42.

Indian Caddis flies.

CHAPTER 3

Insects

ORDER DIPTERA. FLIES (माइया) (Plate III)

Possess single pair of membranous wings, hind pair reduced to a knob-halteres. Mouth parts suctorial, forming a proboscis or a sponge pad. Large mesothorax, fused with small pro and metathorax. Metamorphosis complete. Larva usually shades of white, apodous, tapering to a small or retracted head. Mouth parts generally biting. Pupa free in hardened larval cuticle or in puparium. Almost all adults day fliers, feeding upon nectar of flowers, decaying organic matter, etc. a few blood suckers, some parasitic or predaceous on other insects. Some vectors of diseases like malaria, sleeping sickness elephantiasis, yellow fever etc. Undergo complete metamorphosis. Diverse larval habits affect man considerably. Described species about 64,000 (A.D. Imms 1957), 75,000 (C.F.C. Beeson 1941). About 6,000 found in India. Classification changed slightly from time to time.

The order divided into 3 suborders. In arrangement of suborders, families etc. A. D. Imms Text Book of Entomology is followed. Families, species of which are not met with in Maharashtra are not mentioned.

SUB-ORDER NEMATOCERA

Larvae with well developed head, biting horizontal mandibles, pupae generally free. Antennae of imago many segmented, long, with no hairlike tip. Most primitive. (See Brunetti E. 1912 and 1920. Rec. Ind. Mus. 7:446 and 17:276).

Fam. *Tipulidae* (Leather jackets, Daddy long legs, Crane flies). (लंबूस माइया) (Plate III, Fig. 39) Fly large, legs thin, long, fragile, V shaped mark on thorax. Female with long ovipositor, male with a pair of claspers. Eggs laid in damp surroundings, larvae brown or grey, transparent, live in wet earth, under bark, putrid water etc. Possess blunt tail, feed on decaying vegetable matter, pupate in same place. Two known in Maharashtra.

P. laeta. Bright orange, abdomen with black lines or almost black, legs partly black, 3 orange spots on wings. L. 10-15 mm. *P. bombayensis*. Reddish, 3 black stripes on thorax, 3 black spots on abdomen, wings yellowish. L. 13-21 mm.

Fam. *Psychodidae*. (Moth flies, Sand flies) Very small, covered with long, coarse hair and scales. No ocelli. Larvae in decaying vegetable matter, stagnant water etc. with a tube at anal end. Attracted to moist spots. Adult capable of sucking blood. Found in water sheds, windows, some attracted to light. Some vectors of diseases like 'Kala azar'. Run round in little circles. Only one genus known in Maharashtra.

P. minutus. Silver grey, golden hairs, wings narrow, blunt. L. 2-3 mm. *P. argentipes*. Females blood suckers. L. 2 mm. Brownish, bunches of black hair, side of thorax cream colour. Eyes large, black.

See: Sinton J. A. (1924-33) Ind. J. Med. Res. 11 and 21. Notes on Ind. Phlebotomus.

CHAPTER 3

Insects

Fam. *Culicidae* (Mosquitoes) (डास, मच्छर) (Plate III, Fig. 40) Slender flies with long proboscis, stiff palpi, legs thin, antennae long, feathery in males. Wings fringed with scales at posterior margin and veins. Larvae and pupae aquatic, very active, breathe air from surface. About 1,600 species known, about 300 in the Indian region. About 30 in Maharashtra. More abundant in tropics. Some vectors of wide-spread diseases.

Eggs laid in or near the surface of water. Larvae with well developed head and thorax, minute and large eyes, tufts of hair for gathering food. Abdomen ends with 4 gills. Breathing tube on 8th segment. Anophele larvae float near surface of water horizontally, culex hang head downwards, at an angle, breathing tube touching surface. Generally feed on minute algae, but a few carnivorous, preying mostly on their own kind. A number destroyed by fish. Pupae active, moving, float at surface. Adult Anophele sits at an angle but Culex parallel to wall.

Life cycle lasts 15-20 days generally. Adult can feed at 23°C or above (70°F.). Remains inactive at lower temperature. Females of most species suck animal blood, males take nectar from flowers or water. Carry diseases like malaria, filaria, yellow fever, dengue etc. Most of the mosquitoes look alike but differ greatly in detail. One species *A. aegypti*, Tiger mosquito, common in west coast near big rivers is banded black and white, man hunting, day biting, more common in cities and towns. Breeds in artificial collections of water eg. pots jars, bottles etc. Carrier of Dengue fever.

See: Puri I. M. (1935 & 1938) Rec. Mal. Surv. Ind. 5 Schematic table for identification of Anophele mosquitoes. Pts. 1 and 2 Health Bull. 10 and 16.

— (1936) Ibid.

6. Distribution

of Anop. mosquito H. B. 17.

Strickland C. and Chowdhari K. L. (1927) Illustrated Key to Identification of Ano. larva.

Fam. *Cecidomyiidae* (Gall midges). Very small. 1-8 mm. tender slender flies. Longish antennae with whorls of hair, broad wings with a few straight veins. Legs simple. Larvae with various habits (1) Live on plant tissue, make galls, pass pre-adult stages in them. (2) Live in galls made by other insects. eg. Coleoptera, Trypetidae etc. (3) Feed on plant tissues without forming galls. (4) Live in decaying material, and (5) Live as predators on other small insects, mainly Coccids, aphids, psyllids, mites etc. About 3,000 species described, about 150 in the Indian region, and 6 in Maharashtra.

D. gossypii. Attacks cotton buds. Larvae, yellow, white and red, crowd in buds. L. 1-2 mm. *A. sesami* attacks *Til* (Sesamum), produces wrinkles and twisted galls. Whitish maggots live inside. Fly small,

CHAPTER 3
Insects

thin, mosquito like. *C. andropogonis* (Jowar gall midge.) Small, pinkish. Larvae bore into tender ears of *jowar*. Adults look like mealy wings. *A. oryzae* (Paddy gall fly) (फिली, काने) Adult, mosquito like, yellowish brown, hairy, antennae reddish brown. L. 3 mm. Larvae cause galls on paddy shoots, prevent earhead formation, cause 'silver shoots'.

See: Mani M. S. (1936-39) Rec. Ind. Mus. 36:371, 37:425, 38:193 and 39: 281 Indian Itomidiac.

Fam. *Bibionidae*. Medium size, antennae thick jointed close segmented, front femora thick, front wing vein thick. Wings dark or dark spotted, large. Black or orange red, sluggish. Larvae with horny head and jaws, generally feed on decaying matter. Occasionally found attacking fresh vegetables. Pupae free or in last larval skin, breathing tubes projecting. About 400 species known, one in Maharashtra. *P. fulvicollis*. Antennae reddish brown or black, thorax orange, abdomen black, wings pale brown or blackish. Length 6-7 mm.

Fam. *Simulidae*. Only one genus. Short thick body, broad wings, short legs, squat appearance. Front wing veins thick, rest faint. Wrongly called eye flies in India. Do not hover round eyes. Males harmless, live in woods, feed on honeydew or leaf juice. Females vicious, bite men, cattle, etc. Attack any orifice of body, like eye, ear, nose, etc. L. 2-3 mm. Larvae aquatic, attached by tail end to rocks in running water, feed on algae. Pupa fastened to water plants. Fly emerges in air bubbles. Eggs laid in gelatinous masses on stems of water plants.

S. rufithorax. Reddish, a row of white hairs on the back of head. Abdomen blackish. *S. auriohirtum*. Reddish, yellowish hairs, abdomen and often thorax black.

Fam. *Chironomidae* (Midges)—Resemble mosquitoes. Male antennae feathery, head small, concealed at times under robust humped thorax. Mouth parts weak, forelegs elongate, wings unscaled, veins in front marked, fainter down. Earlier life aquatic. Dance in swarms. Adults do not feed, die early. About 2,000 species described, 150 in Indian region, none noted in Maharashtra so far.

Read Kieffer J. J. (1911 & 13) Rec. Ind. Mus. 6 and 9. Description of Chironomidae.

Fam. *Ceratopogonidae* (Biting midges). Adults like Chironomids but thorax not humped, mouth parts piercing, forelegs not elongate. Larvae aquatic or terrestrial, no legs. Adults predatory. Some larvae aquatic, snakelike, transparent, live in surface water of stagnant pools or slow streams, wriggle rapidly, a tuft of long bristles at tail end. Terrestrial type live in decaying vegetable matter, under bark etc. caterpillar like, pair of processes at both ends. Bristly body. Fly hairy winged. About 400-500 species known, less than 100 in India, 3 in Maharashtra, Poona and Igatpuri.

SUB-ORDER BRACHYCERA

CHAPTER 3
Insects

Larval head retractile, pupa exposed with spines. Adult antennae short, 3 segmented, often a terminal style.

Fam. *Stratiomyidae*. Bristleless, 3rd antennal segment annulated, mid tibiae with no spurs. Small to rather large, flattened with white, yellow or green markings. Larvae (Rat tailed maggot) elongate, leathery, flattened. Live in earth, dung, decaying matter. Some aquatic. Adult sluggish, frequents grasses in marshes.

About 1,400 species described, Indian species not properly listed, a few noted round about Bombay. *W. argentia*. Antennae and legs yellow, thorax black with golden band, abdomen shining black. L. 3 mm. *E. indica*. Flat, black, sparse yellowish or whitish pubescence, abdomen metallic, yellowish, bronze or cupreous in male, violet or blue in female. L. 9-10 mm. *M. flaviventris*. Head black, body shining metallic green, yellowish pubescence in male, abdomen brownish yellow in female. L. 4 mm.

Fam. *Tabanidae* (Horse or Cattle flies, Clegs, Gad flies. Dan flies). (घोड मारो, गोमाशी) (Plate III, Fig. 41). Troublesome to cattle in India. Body broad, flat, head large, eyes large touching each other in males, often spotted or striped, antennae clear, proboscis strong, pointing downwards, often horizontal and long. Wings large, body not covered at rest. Females blood suckers, males live on flower nectar or juice. Females live on juices in the absence of blood. Make humming sound while approaching the victim. Wound painful but does not swell. Spread 'Sura' disease in cattle. Heamatopota feed on human blood in damp places and are known as Clegs.

Eggs laid in masses in marshy plants. Larvae with retractile head, strong mouth hooks. Taper at both ends. Carnivorous. About 2,000 species described, less than 200 in India, about 15 in Maharashtra.

Tabanus spp. Reddish brown, generally with stripes and spots. L. 8-22 mm. *T. speciosus*. Black, 3 series of white spots on abdomen, antennae red. L. 19 mm. Most common on cattle. *H. rosalis*. Wings with white spots, abdomen elongate, brown with 3 stripes and white spots. L. 9-11 mm. Bad cattle pest. Breeds in rice fields, resting in larval stage in soil for nearly 8 months. *C. dispar*. 2nd abdominal segment pale with a black half moon, wings white with a black band. Attack animals including man at night, live concealed during day in bushes, leaves etc.

Fam. *Nemestrinidae* (*Hirmonneuridae*). Large, bristleless flies, many veins running parallel to the hind margin of the wing. Antennae short, terminal style thin. Hover over flowers, suck nectar by long proboscis. Eggs laid in burrows of Coleoptera. Larvae with small retractile head, blown by wind get attached to female beetles, go to their burrow and feed on their grubs. About 200 species known. One recorded in

CHAPTER 3
Insects

Maharashtra. *H. annandalie*, grey with bands on abdomen, legs, antennae and proboscis bright yellow. Thorax blackish, with black and yellow pubescence. L. 11-13 mm.

Fam. *Cyrtidae*. Bristleless flies, head covered by eyes, thorax humped, abdomen inflated, globular. Larvae parasitic on spiders. Thick, short, head very small, large plates to hind spiracles. About 200 species known, one in Igatpuri. *O. octomaculatus*. Thorax brownish with 3 black stripes, abdomen blackish, light yellow pubescence. Wings enormous, yellowish grey, a black mark at base. L. 4 mm.

Fam. *Therevidae*. Elongate, pubescent, broad head, slender legs, antennae short. Adult and larvae predaceous. Larvae in rotten wood or earth. Pupae free. Adults sit on twigs waiting for prey, head up, abdomen depressed. Dance in groups early morning. About 500 species described, about a score in India, one in Maharashtra.

P. brunneus. Head covered with silver grey pubescence, proboscis, thick, protruding. Body shining black, with grey and yellowish bands. L. 6-7 mm.

Fam. *Asilidae* (Robber flies) (दरोडी माही) (Plate III, Fig. 42 a & b). Usually moderate to large, elongate, bristly, strong, piercing proboscis. Entirely predaceous. Attack insects larger and stronger than themselves. Larva elongate, cylindrical, dark head, hard skin. Lives in decaying material. Some predaceous on coleopterous larvae, some scavengers. Pupa crawls out for fly emergence. About 4,000 species known, 150 in India, mostly on slopes of the Himalayas, a few in South. None recorded in Maharashtra though species of *Promachus* and *Laxenecera* are commonly seen.

See Bromley S. W. (1935) Rec. Ind. Mus. 37:219 New Asilidae from India.

—(1938) Ind. J. Agr. Sci. 8:863 New Asilidae from India.

Fam. *Bombyliidae* (Bee flies) (Plate III, Fig. 43). Densely pubescent, large to moderate, long projecting proboscis, slender legs, wings generally darkly marbled, half open at sitting posture. Larvae change in structure considerably. Full grown larva cylindrical or slightly flattened, a small retractile head, predaceous. About 2,000 species described more than 100 recorded in India. Inhabit dry and unpromising areas. Adult flight rapid.

Hyperalonia spp. Black to reddish, bright yellow hair, bands on abdomen in one species. L. 9-12 mm. *Exoprosopa* spp. mostly black with red and yellow marking and hairs. L. 7-18 mm. *Argyramoeba* spp. Black with yellow or white hair and spots and bands. L. 5-11 mm. *A. afra*. Blackish, yellow and white scales, 2 white bands on abdomen, oblique band on wings. L. 5-7 mm. *B. wulpi*. Black, yellow and black hairs, 2 white spots on thorax. Abdomen with silvery white scales, (female small reddish yellow hairs, 2 white spots on each side)

CHAPTER 3
Insects

Wings smoky brown. L. 4-5 mm. *G. argentifrons*. Black, face whitish, white hair on sides of abdomen. L. 3-4 mm.

Fam. *Empididae*. Small, 2-5 mm, rather bristly, distinct neck, small round head, horny proboscis projecting. Legs spined or thickened. Grey, yellowish or dark, thin long abdomen. Suck flower or insect juices. Dance in air, inhabit moist situations. Larvae in earth or humus, predaceous, transverse swellings on ventral side. About 2,600 species known, less than 100 recorded in India, mostly in the Himalayan region and hills, about 5 in Maharashtra.

A. pallipes. Black, antennae and bristles yellow, wings yellowish at base. L. 5 mm. *E. variegata*. Thorax brick red, blackish at base of wings, abdomen yellowish with a black band. L. 2 mm.

Fam. *Dolichopodidae*. Small, thin with long legs, metallic green or blue, short thick proboscis, antennae with two visible joints. Wings generally clouded or with dark markings. Thorax flat, rows of bristles along the back, inhabit generally moist situations. A few on sea shores. Predaceous on soft bodied insects in adult stage. Some walk on water. Larvae in soil or decaying material or aquatic. Some predaceous on Coleopterous larvae or pupae. Elongate, cylindrical, swellings on abdominal segments, last one with 4 protuberances. Adults common in rains flitting from leaf to leaf. About 2,000 species described, about 100 found in India, 10 in Maharashtra. Clear descriptions not available.

See Ribetro S. (1923). Rec. Ind. Mus. 25:335 Corrections and amplifications. Dolichopodidae.

Fam. *Pipunculidae*. Hovering flies with big mobile head. Frequent flowers and moist herbage. Antennal tip sometimes beaklike. Larvae parasitic on Homoptera, narrow at head, pupate in soil. Very few species known, hardly 25 in India, one at Igatpuri. *P. limpipennis*. Grey, bare, head with silvery shimmer, abdomen greenish, a process at the end. L. 2 mm.

Fam. *Syrphidae* (Hoverflies). (Pl. III, Fig. 44). Brightly coloured, fairly big, generally bristleless. Hover over flowers on sunny days, almost stationery or with jerky movements, quivering wings. Feed on nectar or pollen. Larvae generally predaceous, feeding on aphids or other Homoptera on open plants, some in decaying material, some others in water. The first type flattish, triangular back, thin end, faint green or brown. Second cylindrical with short respiratory tubes and 3 pairs of fleshy protuberances on 11th segment. Water living ones rat tailed, body terminating in a long flexible respiratory process. More than 3,000 species known about 100 recorded in India, mostly in hills, about 10 in Maharashtra.

S. balteatus. Orange, 3 stripes on thorax, yellow pubescence. Abdomen with a black spot and line. L. 8-11 mm. Larvae feed on aphids, Coccids. *S. Indian*. Black, 2 greyish stripes on thorax, spots

on sides, yellow band on abdomen. L. 6-7 mm. Feeds voraciously on aphids. *E. taphicus*. Yellowish grey with brownish pubescence. Thorax with 4 stripes, abdomen shining, wings with brownish stigma. L. 9 mm. *M. crassus*. Black, abdomen bare with yellowish spots. L. 12 mm. *S. rufifacies*. Dull black, hind femora orange an elongated spot on abdomen. L. 8 mm. *C. trinotata*. Black, 2 stripes and spot on thorax. Abdomen with 2 spots, wings grey and brown. L. 18-21 mm.

See Bhatia H. L. (1931 and 1933) Ind. J. Agr. Sci. 4:503 and 6:543 Studies in life histories of Indian Syrphidae.

Fam. *Conopidae*. Resemble Hymenoptera, often with a waist, elongate, almost bare. Antennae 3 jointed with style. Wings often coloured. Slow fliers. Generally parasitic on Hymenoptera, chase the victim and lay eggs on its body. Life cycle passed inside the body, larva entering it as soon as born. Less than 50 species recorded in India almost all in hills. One recorded in Mahabaleshwar. *O. flavipes*. Black, covered with ashy grey dust, antennae orange brown, three stripes and three spots on thorax. L. 4-5 mm.

Fam. *Trypetidae* (Fruit flies) (फळ माशी) (Pl. III, Fig. 45) Bright yellow or orange patterns on wings. Size moderate. Head hemispherical, front broad. Includes serious pests on fruits and vegetables. Long white eggs laid on host plant by a strong ovipositor. Maggots feed for about a fortnight inside, generally fall and pupate in soil. Full grown larva round. Often forms galls. About 1,200 species recorded, 150 in India, about 10 in Maharashtra.

D. cucurbitae. Orange, wings with wide brown border, black bristles on body. Pest on all cucurbits. *D. ferrugineous*. Brown, yellow markings on thorax, hyaline wings, fore border and end cell brown. Variable. Universal pest on mango, guava, peach, brinjal etc. *D. zonatus* with brown spot on wing, on custard apple. *C. vesuviana*. Yellow, black spotted, banded wings. Serious pest on zizyphus fruits (*Bor*). Controlled considerably by a braconid-*Bracon fletcheri* Sil.

Refer : Bezzi M. (1913) Mem. Ind. Mus. 3:53 Indian Trypanecidae (Fruit flies).

Munro H. K. (1934) Rec. Ind. Mus. 37:15. Rec. Ind.

Trypetidae.....new species.

Fam. *Agromyzidae*. Small to minute, not well defined. Look like small house flies. Blackish grey or silvery. Front broad, antennae short. Larvae leaf miners. A few live in stems and galls made by other insects. One predaceous. Small white maggots, tapering towards head which consists of 2 hooks only, mine in leaves. Pupate in the mine or in soil. Very few species found in India, 3 from Maharashtra.

A. obtusa (Gram pod fly). Black, eggs thrust in the pod. Maggots burrow in seed of red gram (*Tur*) Cajanus. Pupate there. *A. phaseoli*

on cow pea (*Dolichos*). Fly blue black. *O. lantanae* destroys the weed *Lantana*.

See Ramachandra Rao Y. (1920) Mem. Dept. Agr. 5 and 6 *Lantana* Insects.

Fam. *Micropezidae*. Rather large, body and legs long, slender, face retracting in profile. Wings often marked or spotted. Found in decaying vegetable matter. Not much known about the family. A species of *Calobata* (larva) bores into the rhizomes of turmeric and ginger.

Fam. *Chloropidae* (Eye flies) (चिलट) Small, shining, dark coloured or yellowish. Head hemispherical. Front broad, often with bristles at vertex. Wings and legs short. No bristle at the tibial end. Larvae generally phytophagous, a few predaceous. Only a few species known in India and about 3 in Maharashtra.

S. funicola. Shining, bluish black, L. 1-2 mm. Common in hot season, trying to sit on eyes. Attracted to blood serum, perspiration etc. Clusters on hanging thread, string etc. Breeds in putrifying organic material. *F. flavipes* and *C. atricornis* attack ginger haulms.

Fam. *Oestridae* (Bot flies and Warble flies) (आंतड्यांतील माशी) Resemble bees. Mouth parts rudimentary, antennae short, wings generally clouded. Large ovipositor. Almost all internal parasites in larval stage. Eggs laid on host skin, generally mammals. Larva of Bot flies enter stomach and feed there, of Warble flies cause swelling under skin and live inside it. Full fed larvae, cylindrical or barrel shaped, not tapering, become spiny in last moult, come out by perforating skin, pupate in soil or surface litre. Those in stomach pass out with faeces and pupate in soil. Hosts generally specific. Hardly 10 species recorded in India ; less in Maharashtra.

O. ovis. Bare, silvery reflections, dark, pinple like spots. L. 11 mm. Eggs laid in nostrills of sheep, goat, antelope etc. Larvae develop in frontal sinuses. *G. equi*. Brownish yellow, pubescent, 3 rows of dark spots on abdomen. A band across the wing. A parasite on horses. 400-500 eggs laid in the knee or fet lock. Larvae transferred by animals tongue to mouth and stomach.

Fam. *Calliphoridae*. Metallic blue or green flies, ovi or viviparous. Larvae generally saprophytic, some carnivorous and produce myiasis or parasitic on arthropods or man causing myiasis of ear, nose, eyes etc. Important in medical and veterinary sciences. Very large number of world species known, about 250 recorded in the Indian region, Maharashtra records less than 20.

Lucilia spp. Common 'Green bottle'. Shining green or purple, bristles on sides of thorax. L. 6-8 mm. Pest on sheep. Some deposit eggs in fresh meat, offal etc. *Bengalia* spp. Brown or grey, bands on abdomen, borders whitish. L. 11-15 mm. Steals ant pupae on the march. *M. pollinosa*. Thorax greenish reddish, pubescence yellowish, abdomen yellowish with black stripes. L. 5-6 mm. *S. albiceps*. Grey,

CHAPTER 3
Insects

abdominal end black. L. 8-11 mm. Breeds in filth. Parasitic on moth *Nonagria*, causes myiasis in bulbs. *S. hirtipes* var. *orchidea* causes human intestinal myiasis. Other species breed in any dead or decaying matter. Most species attracted to *Aristolochae*.

See Patton W. S. (1917) Rec. Ind. Mus. 12:185 Indian flies of the sub-family *Rhininae*.

(1920-22) Ind. J. Med. Research 8 and 9.

(1929) Insects, ticks, mites and venomous animals. Medical.

Fam. *Tachinidae*. (Pl. III, Fig. 46). Resemble house flies. Almost all parasitic on lepidopterous larvae or other insects. Body bristly, arista (antennal end) bare, proboscis long. Larva parasitic, adults nectar feeders. Egg laying mostly indiscriminate but generally on host body. Larvae feed internally. Full grown larva segmented, thick, fat. Pupate in soil. Life cycle 15-20 days. About 100 Indian species recorded, a number occur in Maharashtra.

A. aegyptia. Small, grey. Parasitic on *Earias* spp. *Laphygma*, *Spodoptera* etc. *A. hyalinata*. Parasitic on Noctuids, *Pyalids*, *Gelichids*. *Carcelia* spp. Common on caterpillars of *Arctidae*, *Lymantriidae* etc. *E. civiloides* on Noctuids, *Pyalids*, *Hyblaeids* and *Sphingids*. *M. oculata* on *Baoris*, *Parnara*, *Plusia* etc. *Ptychomyia* spp. on any lepidopterous larvae. *Sturmia* spp. also similar. *Thrycolyga* spp. attack almost any caterpillar. *W. albiceps* on Noctuids, *Pierids*, *Sphingids*.

Refer : Beeson and Chatterjee S. N. (1935) Ind. For. Rec. Ent. 1(9) on the Biology of Tachinids.

Russel H. (1922) J. Bom. Nat. Hist. Soc. 28 : 703 Indian Parasitic flies.

Fam. *Muscidae* (House flies) (माडी, घरमाडी) (Pl. III, Fig. 47) Includes *Anthomyidae* and *Cordyluridae*. All look like house flies. Small to medium, a few blood sucking. Body compact, 4 visible abdominal segments, no bristles at base. Antennal arista (end) plumose, one or both sides. Majority of larvae scavengers in dung or decaying matter, taper at head, possess mouth hooks. Pupae in earth, rounded at both ends, brown. About 500 species recorded in the Indian region, about 20 in Maharashtra.

M. vicina. Common domestic fly of oriental region, similar to *M. domestica* L. of colder regions. Grey, 3 thoracic stripes, abdomen orange and yellow with black stripe. Breeds in moist corners and crevices, never in dung. Carrier of diseases. *M. nebulosa*. Four thoracic stripes, otherwise similar. *M. sorbens*. Two uninterrupted thoracic stripes. Abdomen with silvery stripes, spots and patches. Breeds in dung. Carries bacterial eye diseases. *M. planiceps*. Thorax with 4 narrow stripes, abdomen yellow, upper border black, silvery spots, a median stripe. Cattle blood sucker. *M. crassirostris*. Abdomen black at base, grey below, black stripes. Blood sucking. *Stomoxys*

CHAPTER 3
Insects

(Biting house flies) breed in horse dung, sewage, refuse etc. 3 species found in slaughter houses in Bombay. *B. sanguinentus*. Grey, two stripes on thorax. A brown stripe and triangular patches on abdomen. *S. calcitrans* "occurs wherever a civilised man is found and seen every where all the year round". Thorax whitish, 2 stripes and 2 patches, a small stripe just above the wing. Abdomen yellow grey.

A. indica (*Anthomyiad* fly) (ज्वारीची खोड माडी) Dark grey, 3 mm., active. A serious pest on *jowar* (*Sorghum*). Life stages passed in shoots, causing death. *P. heterochaeta*. Larvae live with wiretailed swallows, feed on debris, feather dust etc. and later bore into flesh of the bird and kill it.

Fam. *Hippoboscidae* (गोमाडी) (Pl. III, Fig. 48). Head sunk into thorax, with a proboscis, antennae one segmented, legs short and stout, claws strong, generally toothed. Wings present or absent. Flat, tough, leathery ecto-parasites. Known as 'Kuku machi', 'Cattle flies', 'Scaters', 'Dog flies', etc. Common on dogs in India.

Egg and larval period passed in the body of the mother. Larva pupates as soon as laid, on hard dry surfaces, floors, window sills etc. Only one laid at a time. 3 species common all over India. *H. maculata* on cattle, *H. capensis* on dogs and *L. exornata* on pigeons.

Fam. *Nycteribiidae* (वायुळ माडी) Small, wingless, almost like lice or spiders, sticking to the body of the host. Entirely parasitic on bats. Head bent back over thorax when at rest. Legs long with strong claws, clutch at the hair of the host, dorsal side to host body. As the head is bent back, can feed in that position. About 50 species in India, a number in Maharashtra.

See Scott H. (1914) Ann. Mag. Nat. Hist. (8) 14:209 Some oriental *Nycteribiidae*.

(1925) Rec. Ind. Mus. 27:351 *Nycteribiidae* of India, Ceylon, Burma.

Speicer (1907) Rec. Ind. Mus. 1:295 New *Nycteribiidae* of India.

ORDER SIPHONAPTERA (FLEAS) (पिसु)

Small, laterally compressed. No wings, no eyes. Antennae short and stout, mouth parts piercing and sucking, thoracic segments clear. Last 3 segments of abdomen modified for sexual purposes with prominent pair of claspers, aedigus projecting between them in males, slightly different in females. Larvae elongate, legless. Pupae enclosed in cocoons. Adults blood sucking ectoparasites on man, birds, rodents etc. Can never live in cold dead bodies. Can jump upto about 20 cms. and leap forward upto 35 cms. Breed in unclean premises in houses, in cracks, under floor mat or dirty corners. Rat fleas breed in store houses, barns etc. Larvae active, legless, grow upto 4 mm. feed on dirt and dust on floor or from the host body. Not parasites. Pupate in cocoons. The adult remains dormant till it finds a host and issue out in numbers to any stimulus such as a mass movement in the vicinity.

CHAPTER 3
Insects

The female requires host blood before laying fertile eggs. Adults bite the host, suck blood, infect the host with diseases like Bubonic plague. Contains about 100 species in 17 families. Comparatively few studied in India. Only one family is important.

Fam. *Pulicidae*. *E. gallinaceus* on bandicoot, poultry, cat, dog, porcupine etc. *P. irritans* on man, dogs, near rats, on fox etc. *X. cheopis*. Common all over India. Chief hosts rat and man. A carrier of Bubonic plague, supposed to have been introduced into India by this species in 1896 or so from the Nile valley. Comparatively rare in plains of Bengal, Madras etc.

Read: Sharif M. (1930) Rec. Ind. Mus. 32:20 Revision of Siphonaptera (1937) Parasitology 29:225 Life history and biology of Rat flea.

ORDER HYMENOPTERA (Pl. IV)

Contains 3-4 apparently different kinds of insects e.g. saw flies, wasps, ants, bees. Common important characters are (1) Abdomen joined to thorax by a flexible joint, not easily visible in saw flies and bees, (2) Four membranous wings, front pair much larger, few nerves and enclosed spaces, (3) Thorax compact, united, (4) Females furnished with a sting, ovipositor, a saw or a borer, (5) Three natural sections, head, thorax and abdomen distinct. Mandibles always present even when other parts of the mouth modified.

Larvae vermiform, footless except in a few, eg. saw flies. Pupa enclosed in membrane clearly seen. Generally highly organised, living in communities. Some produce useful products like honey, some parasitise destructive insects, a few harmful plant pests. Classification changed often. At present divided into 2 sub-orders (1) Symphyta (*Calastogaster*) including families having abdomen broadly attached to thorax, larvae with abdominal legs. (2) Apocrita (*Clistogaster*)—Abdomen deeply constricted between 1st and 2nd segments. Larvae without legs.

SUB-ORDER SYMPHYTA

Fam. *Tenthredinidae*. (Pl. IV, Fig. 49)—Saw-flies. More than 2,500 species described, about 100 known in India. One serious pest on cruciferous crops. *A. proxima* (Mustard Saw fly) (कोबीवरील काळीमाशी) Soft, dark, thorax red, smoky wings. L. 5-7 mm. Ovipositor converted into a saw. Eggs in plant tissue. Greenish grey larvae with 3 pairs of thoracic legs and 8 pairs of abdominal legs feed on leaves, grow to 25-30 mm. change to black velvety. Curl and fall down, feigning death, if disturbed. Pupate in soil, rest in this stage. (See Malaise R. 1932. Rec Ind. Mus. 36:435 Saw flies of the Ind. Mus.).

SUB-ORDER APOCRITA (गांधील माश्या)

Base of the abdomen turned into a petiole to thorax. Most of them social, live in colonies.

CHAPTER 3
Insects

Fam. *Ichneumonidae*. (Pl. IV, Fig. 50). Mostly parasitic on lepidopterous larvae but also attack Coleoptera, Diptera and aphids. Some apterous, some brachypterous (short winged), most winged fully. Generally eggs laid in the victims body by a long ovipositor. Larvae feed inside, come out to pupate. More than 1,000 species in Indian region, mostly in the Himalayas.

E. notulatoria. Black, head yellow, eyes prominent, yellow stripes on abdomen, legs stout brownish. L. 17-18 mm. Parasitises *Hyblaea*, *Hapalia* etc. *Xanthopimpla* spp. Yellow with black spots, L. 8-17 mm. parasitise Noctuids and Pyralids. *S. zanthorius*. Brownish yellow, black marks, antennae red. L. 9-10 mm. On *Dichocrosis* *Lygropia*. *B. multicolor*. Head yellowish, thorax black with yellow mark and a line, abdomen reddish in the middle. L. 5-7 mm. Frequents grasses, crucifers, lucern etc. *B. clotho*. Yellow, legs pale, hind tibiae white. L. 5 mm. Parasitic on *Syrphus*, *Athalia*. *P. testaceus*. Brownish yellow, abdomen reddish. L. 16-22 mm. Parasitic on *Prodenia*. *Ophion* spp. Yellowish red, shining, L. 15-18 mm. *Henicospilus* spp. Golden yellow to shades of yellow, plain or with a few black markings. Attack Noctuids, Pyralids and *Lymantriidae*. *C. obtusus*. Black, small, 8-9 mm. Legs partly, abdomen hardly red. Parasitic on Noctuids. *D. debilis*. Small 4 mm. Black. Dense pubescence. Legs, part of abdomen red. Parasitic on *Pterophoridae*. *D. argenteopilosa*. Similar with tarsi black, 9 mm. On Noctuids and Pyralids. *P. testaceus*. Brownish yellow, mandibular apices, abdominal base black. 7-8 mm. Parasitic on lac predator *Holcocera pulvereana*. *M. nursei*. Reddish yellow, white marks on body, white after petiole, antennae black, red and white. L. 8-10 mm. Variable. Parasitic on Noctuids eg. *Earias* sp.

Literature:

Beeson and Chatterjee S. N. (1935 & 39) Ind. For. Records Ent. 1 & 5 Biology of Ichneumon.

Cushman R. A. (1927) Rec. Ind. Mus. 29:241. New Ind. Ichneumonidae.

(1934 & 37) Ibid 20:141 New Ichneumonidae from India.

Fam. *Braconidae*. Similar to *Ichneumonidae*, some difference in wing venation. Head large, antennae straight, long, abdomen long, slender. Size and shape vary. Generally parasitic on lepidopterous larvae but also on Coleoptera, Diptera, Rhynchota. Life cycle 10-12 days. Eggs generally laid on the body of the host, larva may feed inside or out. About 300 species described in India, some known in Maharashtra.

I. spilocephalus. Reddish, antennae black, abdomen pale golden. L. 7-10 mm. *A. avenae* on wheat aphid. *A. chilocida* on Chilo in sugarcane. *A. depressariae* on *Platyedra* (Pink boll worm). *R. lefroyi*. On *Earias* spp. *M. lefroyi* (greeni) Parasitises almost any caterpillar. (See literature quoted under *Ichneumonidae*).

CHAPTER 3

Insects

Fam. *Stephanidae*. Small, antennae closely knitted, about 30 segments, longish abdomen and ovipositor. Hind femora usually swollen and spined, hindwing with no enclosed spaces. Few species known, one in Bombay.

Fam. *Evanidae*. (Pl. IV Fig. 51). Very distinct. Abdomen fixed to thorax on the dorsal side on the median segment by a thin petiole. Antennae thin straight, 13 segments. About 300 species known, about 50 in India, only 3-4 in Maharashtra. The original 3 genera take the status of families now but here they are treated as 3 genera.

Evania most common, parasitise eggs of cockroaches, enter houses, steamers etc. for the purpose. Trichofaenus parasitic on aphids or Sphecids.

Fam. *Chalcidoidae*. Antennae elbowed, 2 jointed trochanter, wings with one or two veins, no stigma or closed cells. Abdomen hard, no folds. Ovipositor attached a little above anal end. Generally black, often iridescent. Head large, thorax compact, femur often swollen.

Now divided into 14-18 families, only 2 or 3 represented in Maharashtra and only a few species. Almost all parasitic on eggs, larvae, pupae of other insects, including Hymenoptera. Some hyperparasites. Some found in galls as parasites, some live in galllike structures in figs etc. The following Chalcididae is part of this.

Fam. Chalcididae. (Pl. IV, Fig. 52) *L. bombayensis*. Black, spotted and striped white, legs brownish red. L. 5-6 mm. *O. nursei*. Black, shining, legs yellow and black, silvery pubescence. L. 5 mm.

Fam. Elasmidae. *E. anticles*. Elongate, 7-8 mm., abdomen flat, wings narrow, hyaline.

Fam. Trichogrammatidae. Attack eggs of Lepidoptera.

Fam. *Bethylidae* including Chrysididae (Cuckoo wasps). Only the latter represented in Maharashtra. Brilliantly metallic green, blue or ruby. Integument hard, coarsely sculptured, abdomen flexible, generally carved below thorax. When touched or attacked form a ball or thick ring, wings projecting on sides. Ovipositor concealed in a thick tube. Generally parasitise the parasitic solitary bees and wasps. More than 1,000 species described, nearly 100 in India about 18 in Maharashtra.

Hedychridium spp. Bright green, mesonotum bluish, abdomen margined black. L. 6-7 mm. *S. cyanurum splendidum*. Metallic green, 3rd abdominal segment purple, blue in certain lights. L. 9-12 mm. male 12-16 mm. female. Universal. *Chrysis* spp. Narrow, elongate, blue or greenish, scutellum golden, black spots on ventral side of abdomen. L. 6-7 mm. *C. oblitterata*. Metallic green, parts violet blue, legs green and brown. Variable. L. 6-9 mm. *C. fuscipennis*. Green and blue, blackish spot on mesonotum, antennae and tarsi blackish, 3 grooves at base of abdomen. L. 8-12 mm. Parasitic on *Eumenis* spp. Cosmopolitan.

CHAPTER 3

Insects

Fam. *Scoliidae* (Pl. IV, Fig. 53) including *Tiphidae* and *Sapygidae*. Generally inhabit warm countries. Fairly big, black with red and yellow markings, big iridescent wings, conspicuous mandibles. Males generally slender with spines at anal end. Females robust with ovipositor. Both hairy. Legs stout, short, spiny. Parasitic on Coleoptera. A big family, thousands described, about 100 in India, only a few in Maharashtra.

T. rufofemorata. Small, black, mandibles and parts of hind legs red, black base to wings. L. 12 mm. *M. dimidiata*. Jet black, abdomen with tints, wings violet at tip. L. 15 mm. *M. madraspatana*. Black, abdominal base red, wings blackish, hindwing hyaline at base. L. 19 mm. *Scolia* spp. Black, wings shining coppery. *S. bilunata*. Densely punctured, 2-4 yellow spots on abdomen. L. 15-25 mm. *Elis* spp. Black, with or without yellow bands and coloured pubescence. L. 10 mm. to 33 mm. *E. asiatica*. Entirely black. L. 24-32 mm. *L. analis*. Black, apical segments red, wings iridescent. L. 19-22 mm. male 26-33 mm. females.

Fam. *Mutillidae* (Solitary ants). (Pl. IV, Fig. 54) Male winged, female apterous. Pronotum produced in angles upto wings, apex of abdomen with teeth. Female legs stout for digging, tibiae with spines. Breeding habits peculiar. Male siezes the wingless female, carries her to a convenient place and mates with her. Preys on other beneficial wasps e.g. *Eumenes*, *Crabro* etc. Thousands of species recorded in the L. *analis*. Black, apical segments red, wings iridescent. L. 19-22 mm. male. 26-33 mm. female.

Mutilla spp. all black with spots and lines. *M. lilliputiana*. 2 spots each on head and abdomen, thorax red, a golden abdominal segment. L. 3 mm. *M. colabensis*. 2 pairs of white spots on abdomen. L. 6 mm. *M. budha*. Thorax brownish, a golden spot and band on abdomen. 11 mm. *M. serratula*. Thorax red, yellow band on abdomen. L. 5 mm. *M. aurifex*. Head and thorax red, a pointed spot, 3 bands on abdomen golden. L. 9 mm. *M. poonaensis*. Brownish, abdomen black purplish with a white spot and band at apex. L. 6 mm. *M. pedunculata*. Brownish, lower part of abdomen black, pubescence white, forewing apex brownish. L. 10-11 mm.

Fam. *Formicidae* (Ants) (पुंरा) (Pl. IV, Fig. 55) Head, thorax and abdomen distinct. The 1st one or two abdominal segments very thin, form pedicel to connect abdomen with thorax. Remaining abdomen (gaster) 6-7 segments visible. Legs thin, long, can run fast. Live in communities, divide work of the common nest amongst different castes. Colony consists, usually of one or more queens, laying eggs continuously, king to fertilize her often, workers of 2 or 3 class, major (big) minor (small), really undeveloped females which do all the nest work—foraging, cleaning, feeding, protecting eggs etc. and soldiers with large heads and mandibles for the protection of the workers and the nest, in fact a class of workers. Usually the adults produce wings at the beginning of the rainy season or at end, fly in

CHAPTER 3

Insects

air, shed wings, a few mate and with the help of workers start new colonies. King follows queen. Most ant species are scavengers, a few harvest grains, some tend cattle (aphids, lycaenid larvae etc.) for honey dew and some carnivorous. Eggs laid by queen carried by workers. Larva white, legless, seedlike, fed by workers. Pupae naked or in cocoons cared for by workers. More than 6,000 species described, 500 in the Indian region, more than 100 in Maharashtra. Generally the workers are described for identification.

Dorylus spp. Long, narrow bodied, workers blind, possess stings, one node to pedicel. Male winged, female apterous. Resemble termites, attracted to light, cut plants at ground level or roots. (See Huston T. C. 1936 Trop. Agr. 87:293. The Root eating ant). *Aenictus* spp. Akin to *Dorylus* but pedicel 2 jointed. Hunt in columns of 3 and 4 abreast. Very ferocious. Male attracted to light. Brown or yellow, head black. L. 2.3-7 mm. (See Wroughton 1892. J. Bomb. Nat. Hist. Soc. 7:177 Our ants.) *Lioponera* spp. Black, thorax red shining. Antennae close together. Pedicel one jointed, rectangular. L. 2-4 mm. *C. aitkeni*. Red, elongate, narrow, eyes small, lateral. Abdomen black. L. 5 mm. *Anochetus* spp. Reddish brown, abdomen darker. Head irregularly rectangular, eyes prominent, L. 3-7 mm. *Lobopelta* spp. Black with reddish tinge, metallic lustre, pedicel one jointed. Head longish, eyes higher up. Make sound audible to man. Move in columns of 2-4 in military formation, feed on termites, other animals. L. 5-6 mm.

D. vagans. Black, greenish tint, tips of appendages, legs red. Mandibles large, body lined. L. 8-13 mm. Nest under stone, brick work etc. Possess pungent sting. Probably feed on *Camponotus* spp. and caterpillars. *Ponera* spp. 2.5 to 3.5 mm. Yellowish, head broader behind, oval, no mandibles. Thorax narrow, node conspicuous. *Bothroponera* spp. Head quadrangular, no mandibles, pedicel one jointed, sting conspicuous, powerful. Dull black, antennae and legs reddish. Abdominal tip red. L. 5 mm. to 15 mm. *Sima* spp. Black, pedicel 2 jointed. Thorax elongate constricted in the middle, hind portion raised conspicuously. Abdomen long with sting. Thorax, antennae red. L. 10-12 mm. Virulent sting causes inflammation. Mimicked by many spiders and wasps. Nests in tree hollows, bamboos etc.

M. brunnea. Brown, shining. L. 5-8 mm. Head short rounded, thorax with spines at both ends, petiole long. Nests in ground, heaps earth in grains at entrance. Bites tips of buds, feeds on exuding juice in groups and on plant tissues. Pest in citrus groves. *Crematogaster* spp. (Tree ants) make globular nests of papery material in trees or nest in tree trunk hollows, attack mantid eggs and other insects. Bite freely. Keep ant cattle. Turn up abdomen as if for stinging and therefore 'Cock-tailed ants'. Head square, thorax narrow, constricted in the middle. Yellowish or blackish red, shining, 3-5 mm. long.

CHAPTER 3

Insects

S. geminata. Reddish yellow, abdomen oval, marked brown, thorax narrow, pedicel thin, L. 3-4.5 mm. May damage seedlings, sometimes very useful as a scavenger (See P. S. Negi, J. Bom. Nat. Hist. Soc. 36:1018 The small red ant...useful to man & Pro. 3rd Ent. Meeting Pusa P. 34:1919).

Phidologiton spp. Common in Maharashtra. Size small to very big, smaller more ferocious. Soldiers look fierce. Nest in sheltered places, enter houses, carry away things. Generally march through covered ways. Bite viciously. Head large, thorax raised with 2 spines at back. *Meranoplus* spp. Reddish, hairy, 3-5 mm. Head trapezoidal, broader behind, thorax compact, spines pointing backwards. *M. bicolor*. Red, abdomen black, long soft hair, 3-5 mm. A minor pest on pulse leaves. *Triglyphothrix* spp. Stout built. Brown, peculiar wooly appearance, thorax with spines behind. Nodes broad, flattish. L. 3-3.5 mm.

Tetramorium spp. Head rectangular, posterior margin distinct, pedicel nodes rounded, 1st petiolate anteriorly. Light to deep brown or yellowish. L. 2.5 to 3.5 mm. *Monomorium* spp. 1.5 to 3 mm. Reddish, abdomen black, head rectangular, thorax long, narrow, slightly broader in front, 1st node of pedicel higher than 2nd. Nests in floorings or walls, invades houses, attacks meat, sweets and even wire insulations. *Phidole* spp. Large heads, 2 lobes posteriorly. Front of thorax raised, convex, 2 tubercles on sides, metanotum sloping to a spine on each side. Pedicel 2 jointed, nodes above. Known as Harvester ants. Gather grains in nests. Supposed to be intelligent. (See Fauna Br. Ind. Hym. 2:220. Bingham C. T. 1903). Small, 2-3 mm. Brown and yellow, smooth.

Holcomyrmex (Harvester ants'). Collect grains and store in nests. Head large rectangular, sides straight, corners behind rounded, thorax massive, raised, convex in front, flattish behind. Brown, abdomen dark red to black, L. 3.5 to 7 mm. *T. recurvispinosa*. Tawny olive, head elongate, narrow, thorax convex, two recurved spines behind. Two nodes of pedicel close together. L. 2 mm. *Cardiocondyla* spp. Widespread. Thorax short, stout, 2 spines behind. Pedicel long, 2nd node broader. Abdomen oval, 1st segment large. Red, abdomen black, L. 2 mm. *Iridomyrmex* spp. Triangular head, thorax slender, 3 segments clear—1st broad convex, 2nd cylindrical, 3rd raised. Abdomen short, broad, oval. Nest in sandy soils near plants with aphids, coccids etc. Carry off dead bodies. Emit unpleasant odour.

Technomyrmex spp. Heartshaped head, thorax broad, cut at 2nd joint, convex, 3rd joint separated. (See David A. S. 1962. J. Bom. Nat. Hist. Soc. 58:289 Biology of tree ant.) *Tapinoma* sp. Body pubescent, few hairs, head elongate, oval, thorax constricted at 2nd joint, legs stout, pedicel short, abdomen elongate oval. L. 1.5-2 mm. Cut plants and eat inside. Fond of sweets, visits aphids, coccids etc.

CHAPTER 3
Insects

Nests deep underground, populous. *Bothriomyrmex*, similar to *Tapinoma*. *O. smaragdina* (Red tree ant) (ओबोल) Rusty or yellowish red, slightly pubescent. Mandibles long, dentate, eyes large. Thorax long very narrow in front, last section rounded above. Legs long, slender. Pedicel long, swollen in centre. Abdomen short, oval with anal point. L. 7-11 mm. Vicious, common in orchard trees, mostly on mango. Weaves leaves together for nests, holding larvae in mouth and using them as shuttles. Moves rapidly with raised abdomen. Stings severely. Distributes in orchards aphids, coccids etc. from which it derives honeydew. (See Aitken E. H. 1889. J. Bom. Nat. Hist. Soc. 4:151 and 5:422. (Green E. (1900) J. Bom. Nat. Hist. Soc. 13:181 and Wroughton (1893) J. Bom. Nat. Hist. Soc. 7:39).

Acantholepis spp. Head quadrangular, rounded above. Divisions of thorax clear, constricted in the middle, 2 spines behind. Pedicel one jointed, a spine on each side. Abdomen oval, pointed. L. 2-3 mm. Generally nest in soil or hollow in masonry. Visit aphids, coccids etc. attack caterpillars and collect dead insects. *Plagiolepis* spp. Similar to *Oecophylla* but abdomen massive. Some yellowish or some black very small to 5 mm. *Prenolepis* spp. Segments of thorax distinct, first 2 convex, third broad, flat at apex. Pedicel short. Abdomen high, convex, over hanging pedicel. L. 2-3 mm. Brownish. Nest under fallen leaves or decaying trees. Rears *Pausidae*. (Beetles) *Camponotus* spp. Segments of thorax clear, broad in front, compressed behind, pedicel one jointed surmounted by a node. Abdomen oval, 1st segment less than half of whole. *C. compressus*. Black, opaque, legs and parts of antennae brown or red. Head triangular. L. 6-16 mm. Keep 'ant cattle'. Large workers invade houses. Generally rest under trees, throw up heaps of soil. May rest in walls. Feed also on termites, caterpillars etc. Winged, attracted to light. (See Ayyar P. N. K.—1937 J. Bom. Nat. Hist. Soc. 39:750 and Wroughton—1892 J. Bom. Nat. Hist. Soc. 7:30). *Polyrhachis* spp. Resemble *Camponotus* but thorax and node of pedicel armed with spines or angular points, abdomen short, 1st segment more than half of total. L. 4-7 mm. Nest in low bushes, high trees, under bamboo sheaths and sugar-cane leaves, not easily visible. Tend cattle. (See Ind. Ins. Life P. 232).

Fam. *Pompilidae*. (Pl. IV, Fig. 56). Brilliantly coloured, conspicuous, large or small, legs long. Pronotum extending upto wing base. Parasitic on spiders, a few on cockroach, crickets etc. Live in mud nests, holes underground etc.

M. violacea. Black, purple and blue reflections, wings with purple effulgence. Thickly powdered. L. 22-30 mm. *Pseudagenia* spp. bear silvery hair. *P. blanda*. Smooth, shining, metallic blue, antennae and legs black. L. 12-14 mm. *P. tincta*. Black, abdomen yellowish brown partly, powdered. L. 7-9 mm. *Salix* spp. Very common

CHAPTER 3
Insects

in Lonavla, Matheran. Ample wings, long legs, claws with teeth under margins. Abdomen broadly attached. Generally red or black, golden hair, wings reddish or yellow or smoky. L. 17-38 mm. (*S. veda* only 9 mm.) *S. madraspatanus*, a cosmopolitan species, black, hairy, abdomen bluish, wings brown, purple effulgence. L. 24-28 mm. *Pompilus* spp. Front legs hairy, hind spiny. Nest in burrows in ground, hunt spiders, at times cockroaches. Black with brilliant colours, abdomen attached broadly, covered with grey powder, upper part of wings black generally. *Ceropales* spp. Rather rare in India. Long legs, plain, abdomen short. *C. claripennis*. Black, shining, yellow stripes, 2 yellow marks on thorax, abdomen rusty red. L. 8-9 mm.

Fam. *Eumenidae*. (Pl. IV, Fig. 57). Solitary wasps of temperate regions. Wings folded longitudinally, spine at apex of mid tibiae, claws with teeth, slender, 8-20 mm. Warning colours, petiole well marked, females with stings. Tunnel in the ground, some known as mason or potter wasps, construct oval or globular vaselike nests of mud, fastened to twigs, walls, furniture etc. Predaceous on lepidopterous larvae, sometimes others, about 5-10 larvae for each cell. Egg deposited on a filament attached to wall of nest and the nest sealed. Some enter houses. Less than 100 recorded in India, about 20 in Maharashtra.

E. essuriens. Yellow, parts of the thorax black, hind legs and petiole reddish. L. 16-20 mm. *E. conica*. Red with black bands, wings clouded. L. 18-25 mm. builds nests anywhere. *E. arcuata*. Black, two curved spots and 2 lines on thorax, 2 broad bands, lines and spots on abdomen yellow. L. 19-26 mm. Enters houses. *Eumenes* have a number of enemies. *Rhynchium* spp. Small, no petiole. First abdominal segment cupshaped, slightly constricted or narrowed. Solitary. Enter houses freely, build little round shells of clay, often use ready holes for nests closing them with clay lids, feed young on caterpillars. Brownish red with black spots and lines or black, red with bands, silvery hair. L. 12-20 mm. *Odynerus* spp. Very similar to *Rhynchium*. More slender. Use crevices or holes for nests generally, close with mud lids, larval food small caterpillars. Black, shining with spots and bands or red with yellow bands or markings. L. 6-11 mm.

See Cretin (1909) J. Bom. Nat. Hist. Soc. 14:820 *Eumenis dimidiatipennis* S.

Hingston R. W. G. (1926 & 27) *Ibid* 31:241, 754, 890 and 32:98, 246. Potter wasps.

Fam. *Vespidae* (True wasps) (गंधील मासी) (Pl. IV, Fig. 58) Wings longitudinally folded at rest. Mid tibiae with 2 spurs. Warning colours. Petiole long, slender fore tibiae with comb. Social. Nests for one season or more. Workers present in some species. Generally virulent, irritable, sting badly. Nests of papery

CHAPTER 3
Insects

material of chewed vegetable fibre, hexagonal. Generally open all-round with many cells. Feed on insect or fruit juices, sugar, sweets etc. Young feed on crushed material. Destroy considerable number of insects. Adult impregnated females hibernate in winter in houses, found colonies next season. Hornets belong to this family. About 100 species in India, 10 in Maharashtra.

B. indica. Dark brown, yellow and black bands on abdomen. L. 18-24 mm. *Icaria* form small nests of 5-40 cells haging to a twig, leaf or wall, generally in two rows. Adult generally reddish with yellow bands or spots. L. 8-15 mm. *Polistes* spp. Make nests on house verandahs, sheltered places, form horizontal combs, complex with a diameter of 125-150 mm. Hibernate in winter in cracks and clinks in houses. Brown and yellow with black marks. L. 11-14 mm. *P. hebraeus*. Yellow or brownish, fine black lines. L. 20-24 mm. A nuisance in houses. *Hypsopygia* larva (Pyralid) feeds on the wasp larvae and the nest. *Vespa* spp. Cosmopolitan. Build nests in trees, on ground, at roots of trees, under eaves of houses. Fierce, irritable. Stings dangerous. Found in sweetmeat shops. Combs completely enclosed, keeping free passage to each comb. *V. cincta*. Brownish, red or black, yellow band on abdomen. Vary. Stout, L. 20-35 mm. in forests. *V. orientalis*. Similar, common in sweetmeat market. Does no harm to man. (See Burton R. W.—1950 J. Bom. Nat. Hist. Soc. 49:796. Stings by the Indian Hornets.)

See also Bingham C. T. (1890) J. Bom. Nat. Hist. Soc. 5:233-252 Hymenoptera.

Dover C. (1922) J. Asi. Soc. Beng. 18 : 17 Resume Ind. Wasps and Bees.

Fam. *Sphegidae*. (Pl. IV, Fig. 59) Pronotum transverse, side angles not prolonged to base of wings. Generally bright coloured, metallic. Thorax massive, petiole long. Solitary digging wasps. Larvae legless, soft, white. Pupate in silken cocoons. Predaceous on insects, generally lepidoptera.

Astata spp. Resemble Diptera. Burrow in hard sandy banks, store bug nymphs to feed the young. *A. nigricans*. Black, pubescence white, abdominal tip and tarsi bronzy. L. 8-9 mm. *A. agilis*. Black, red band on abdomen. L. 7-8 mm. *Tachytes*. Beautiful sand wasps, small, inconspicuous, storing nymphs of Orthoptera for the young. Black, pubescence silvery, abdomen rusty golden. L. 12-20 mm. *Tachysphex*. Similar to *Tachytes* but longer and slenderer. Black, golden pubescence, legs partly or fully red, abdomen red or a red band, silvery hairy bands to segments. L. 9-13 mm. *L. nigriventris*. Black with glittering silver haired bands on abdomen. L. 10-12 mm. *Notogonia* spp. Predaceous on crickets. Some build mud nests fixed to stones. Black, silvery hair. *N. subtessellata*. Patches of gold, hind femora blood red. L. 8-13 mm. *N. jaculatrix*. Wings yellowish. L. 12-14 mm. (See F. L. Wain J. Bomb. Nat. Hist. Soc. 54:957)

CHAPTER 3
Insects

Liris spp. Similar habits, very active. Black with golden hair, silvery band on abdomen. *L. aurata*. Orange, legs and parts of antennae red. L. 15-20 mm. Nest under thick bushes. *P. ruficornis*. Black, petiole, legs and parts of body red, silvery hair in the middle. L. 9-10 mm.

Pison spp. Black, silvery pubescence or bands. Common in plains. L. 8-10 mm. Hunt spiders. *Trypoxylon* construct nests of clay in straw, hollow reeds, cane holes of furniture etc. partitioned off into cells, each containing small spiders. Black with red, yellowish legs. L. 9-10 mm. *Ammophila* spp. Store caterpillars or spiders for the young, burrow in soil. Body large, long, narrow abdomen. Black, glistening silvery hair, abdomen partly or fully rtd, wings clear or yellowish. L. 20-23 mm. *A. erythrocephala*. Red, abdomen blue black, wings with purple shine. L. 32-34 mm. *Sceliphron*, (कुमारीण) Robust mud wasps, build nests in houses, store spiders. Black, petiole long, abdomen small oval. *S. spinola*. Black pubescence, petiole and legs yellow. L. 27-30 mm. *S. madraspatanam*. Silvery hair, yellow petiole, yellow spots and lines. L. 18-22 mm. Build mud nests on walls, furniture, make 5-7 nests separately and daub them with mud from outside into one whole, like a lump of mud. (See Edwards S.B. 1921—J. Bom. Nat. Hist. Soc. 28:293). *S. bilineatum*. Yellow spot on abdomen, red apical joints of tarsi. Builds cylindrical single mud nests. L. 16-19 mm. *S. violaceum*. Cobalt blue, antennae and tarsi black. L. 16-19 mm. Makes no cells, lays in natural holes and closes them with lime or plaster.

Sphex. Large, petiole short, legs stout, spiny. Burrow in ground, store crickets, cockroaches etc. for larval food. *S. lobatus*. Brilliant blue, green. Legs, antennae black. Preys on *Brachytrypes achatinus* (Cricket) (See J. Bom. Nat. Hist. Soc. 15:531, 30:743 and 31:147). *S. splendidus*. Dull brick red, abdomen purplish blue, petiole reddish. L. 18-24 mm. Other species black, parts red and yellow. L. 18-36 mm. *Ampulex*. Prey generally on large cockroaches, robust with short petiole. *A. compressa*. Metallic blue or green, hind 2 pairs of legs red. L. 15-20 mm. *A. constanceae*. Black and reddish, whitish band on abdomen. L. 9 mm. *S. niger*. Black, shining, front legs yellowish partly. L. 6 mm. Collect aphids. Nests in ready made holes in wood or trees. (See J. Bom. Nat. Hist. Soc. 15:12) *Gorytes*. No petiole, abdomen oval, pointed at apex, 1st segments narrowing to thorax. Some prey on *Fulgoridae*, some on *Curculionidae*—larvae. Black, yellow or white lines on body. L. 6-13 mm.

Styzus, prey on Orthoptera. Abdomen elongate, massive, never petiolate, broadly touching thorax, spots and bands on body. *S. cornutus*. Black, silver hair, red band on abdomen, wings dark, purple effulgence. L. 19 mm. *Bembex* nest in sandy banks, dig their own tunnels, keep open door and feed the young often, unlike other wasps or insects. Prey on Dipterous larvae. Gregarious, broad head, large eyes, flattened

CHAPTER 3
Insects

thorax, legs stout, spiny, abdomen broad, massive, no petiole. Black or reddish, yellow marking. L. 18-25 mm. *Philanthus*. Head wider than thorax, thorax ovate, legs stout spiny. Abdomen with 1st segment narrow at base. Mimic bees, visit flowers with them and hunt them down. Nest in narrow tunnels in sandy banks. *P. basalis*. yellowish white lines and spots on body. L. 12 mm. *P. pulcherrimus*, carries hive bees and others to its nest. *Cerceris*. Head as wide as thorax, broad, triangular space below thorax with convergent furrows. Legs stout, spiny. Abdomen oblong joining thorax by narrow 1st segment. Black or brownish, spots and bands on abdomen, in some species parts of abdomen red. L. 7-10 mm. Only *C. vigilans* 12-15 mm. *Oxybelus* spp. Peculiar spines on post scutellum. Burrow in soil, prey on Diptera. Head and thorax of equal width, petiole thin, abdomen conical, short and broad, hind legs spiny. Black and whitish. L. 7-9 mm. *Crabro*. Big roundish head, a triangular enclosed space at thorax, legs short, stout, spiny. Abdomen oval, joined to thorax by a thinnish segment. Construct burrows in soil, in rotten wood or plant stems. Usually prey on Diptera but others are not spared. Black, silvery hair on face, yellow markings on body. L. 5-9 mm.

Fam. *Apidae* (Now super family *Apoidae*). Includes bees, social or solitary. Fam. *Colletidae* not represented in Maharashtra. *Apidae* of Bingham (Fauna Br. Ind.) split into 5 families, only 4 in India. Thousands described, about 400 in India, a good number in Maharashtra. Adults help pollination. Most carry a pollen basket, a few which do not, stay as guests in other colonies. Both adult and larvae feed on pollen, flower nectar, larvae fed by workers. Lead social life like ants and termites. New families shown in brackets.

(Fam. *Halictidae*) Live in tunnels in soil, fertilized females survive winter, produce brood next season which takes charge of the colony. *H. sonescens*. Black or brownish, white pubescent bands on abdomen, partly straw coloured. L. 8-9 mm. *Sphecodes* spp. Black, abdomen red, shining. L. 11-12 mm. Parasitise *Halictus* spp. *Nomia*. Extensive genus. Nests in hard earthen banks or under house plinths. Store pollen for young. Small 7-8 mm. rarely upto 15 mm. Black, glittering on legs, parts reddish yellow. Generally bands on abdomen.

(Fam. *Andrenidae*) Hill dwellers. Only 2-3 recorded in plains. Solitary bees, building nests separately in colonies in earth. Gather pollen from particular flowers. Play host to *Nomada* and *Strepsiptera*. *Andrena* spp. Black, abdomen red or yellow, wings hyaline. L. 8-13 mm.

(Fam. *Megachilidae*—Leaf cutter bees) (पाने कापणारे भुंजे) Cut out portions of leaves as lining for nests, enter houses, stuff available holes with mud and leaf pieces, some tunnel in ground.

CHAPTER 3
Insects

M. anthracina attacks 'Tur' (*Cajanus*) and rose leaves. Black, long hair on sides on thorax, pollen brush dense, black. Wings dark with purple effulgence. L. 16-21 mm. Other species mostly black, pubescence yellow or white or partly reddish, pollen brush generally white. L. 11-15 mm. *Anthidium* spp. Males larger than females. Black, pubescent spots and bands on abdomen. L. 5-9 mm. *Coelioxys* spp. Abdomen sharply tapering. Black, snowwhite pubescence, bands on abdomen. L. 7-11 mm. Some species rob *Megachile* in their nests, of their pollen.

(Fam. *Apidae*) (भुंजे व मधमाश्या) (PL IV, Fig. 60). Includes all kinds of bees, soil nesting, parasitic, plant nesting and honey producing. *Anthophora* spp. Stout, hairy, nest in soil in large colonies. Black, generally pubescent, black ring on hind tibiae, blue or white bands on abdomen. L. 8-15 mm. *Ceratina* nest in hollows of dead wood. Eggs grow in size after laying. Stout, no pollen basket, abdomen narrowed at base. *C. viridissima*. Bright green or blue, black lines on thorax and abdomen. L. 8-10 mm. *Allodape*. Cylindrical. Look like *Prosopis*. Swarm on wet sands on streams. L. 5-6 mm. *Crocissa* spp. parasitic on *Anthophora*. Thorax short, legs stout, wings broad, abdomen conical. *C. ramosa*. Black with spots on thorax, an inverted V, white broad lines on sides. L. 10-13 mm. *Xylocopa* (Carpenter Bees) (भुंजे). Robust, hairy on sides, short thorax. Enter houses with buzzing noise, cut neat round holes in beams to make nest. Some active at night. 7 species common. Four black; black pubescence on sides, wings dark, coppery green effulgence, tibiae twisted in males. L. 20-35 mm. *X. amethystina* with wings of purple lustre 12-17 mm. *X. tranquebarica*. Reddish black hair, wings yellowish. L. 28-30 mm.

Apis (Honey bees) (मधमाश्या) Social. Community consists of Queen—egg laying female, some males and a number of workers—immature females. Queen goes on laying eggs. Hatching, rearing the young etc. done by workers. Colony multiplies rapidly, population reaching 40-50 thousand at times in a short time. Special cells and special food prepared for future queens. The young queens may start new colonies in due course or replace the old one in the same comb, sometimes killing the old one.

Worker bees have pollen basket—a hairy structure on hindlegs to collect pollen, wax glands on abdomen to build combs with and a strong sting for defence. The male bee (drone) has none of these, is larger, fertilizes the queen as required. Queen, bigger in size, has no wax plate or pollen basket but has a sting and ovipositor combined, lives 2-3 years, lays thousand or more eggs daily.

Bees live in hives constructed by themselves. Hive consists of combs each made up of thousands of hexagonal cells. In each cell of the lower part, the queen lays an egg and the workers fill it with pollen and honey (bee bread). No special place is kept in the hive for

CHAPTER 3
Insects

workers. They cluster together. Upper cells of the comb contain honey only, no eggs. Wax is prepared by workers by consuming nectar, pollen etc. which is regurgitated in the comb cells. Bees have a number of enemies. Some wasps (hornets) attack them, *Philanthus ramakrishnae* T. carries them away bodily. *Acherontia styx* W. feeds on stored honey. Caterpillars of *Galleria melonella* L. feed on wax. Besides birds, bears, foxes cause damage.

Three species of bees are common. (1) *A. dorsata* (Rock bee) (आय्या माशी) Largest. Builds hives in open on trees, rocks, arches of buildings etc. Very ferocious. Attacks man and animals, sometimes stings them to death. A single comb may be 4-5 ft. long, produces plenty of honey. Deserts hives often with no apparent reason. Worker blackish, base of abdomen brownish yellow. Pubescent. Wings cloudy hyaline. Sting curved. L. 18-19 mm. (2) *A. indica* (सात पुडी) found in plains, in forests and hills. Builds nests in parallel combs in hollow trees, in cracks, inside well, etc. Easily domesticated. Workers smooth, shining, pubescent. Black, first 5 segments of abdomen yellowish. Wings hyaline, iridescent. L. 12 mm. The only domesticated Indian bee reared in artificial combs, kept in gardens in countryside. Yield of honey, however very poor. Therefore now replaced by *A. mellifica*—a European bee, similar in every respect but yielding higher quantity of honey. There are many races but the most popular one is the Italian bee. Another species *A. florea* F. is too small and is of no economic value. (3) *Melipona* or (Dammar bees) build nests in hollows of trees, holes in walls etc., store honey in globular cells, pendent from roofs. Honey dark, small in quantity. Bees 4-5 mm. wings long and big. About a dozen species in the Indian region, two in Maharashtra. *M. laeviceps*. Smooth, shining, black and brown with reddish hair. *M. iridipennis*. Similar, pubescence silvery.

Read Ghosh C. C. (1936) Bull. 6 Imp. Coun. Agr. Res. Bee keeping—Revised 3rd edition.

Sardar Singh (1962) Bee keeping in India. Ind. Coun. Agr. Res. New Delhi.

ORDER COLEOPTERA (BEETLES AND WEEVILS) (ढालपक्षी-ढालपंखी)
(Plate V)

Largest order of insects of small to large size. First pair of wings—elytra, hard thick, covers very much bigger, well folded lower wings and the body tightly. Some genera and families with abbreviated wings, some wingless. Mouth parts strong, biting. Legs strong, body fairly hard. Metamorphosis complete. Larva generally round, almost smooth, three pairs of thoracic legs, no prolegs. Some species aquatic, some semi-aquatic, a large number terrestrial. Generally herbivorous, some parasitic, some store pests, a few carnivorous. Mouth parts biting, strong.

CHAPTER 3
Insects

Classification rather confused as in most big insect orders. Here, however, Leng is followed (1920 Catalogue of Coleoptera of America north of Mexico.) in arrangement of families, as is common now. A number of families, not found in this tract are omitted from the list. Total number of described species 2,20,000. Indian species estimated at about 15-16 thousand, less than a thousand in Maharashtra.

Fam. *Cicindelidae* (Tiger beetles) (वाघे) (Pl. V, Fig. 61). Generally brightly coloured, green, brown or black with spots or bands of white. L. 10-25 mm. Head short, thick-set, constricted behind the prominent eyes in many genera. Mouth parts conspicuous. Prothorax large cylindrical. Legs long, slender, spined. Predaceous on other insects in larval and adult stage. Adults hunt for insects, larvae wait for the prey to come to their tunnels or hiding places. Eggs laid in moist soil or on twigs. Larva with broad flat head tunnels and enters it. Body strong with protuberances and curves, powerful jaws. Less than 300 species known in the Indian region. Most species of Maharashtra recorded in Bombay area.

C. brevipennis. Violet, elytra deeply punctured. L. 24 mm. *P. proxima*. Dark blue, front green or black, a line on pronotum, 2 whitish spots on elytra. L. 10-12 mm. *Cicindela* spp. Metallic black, green, blue etc. with spots and lines, generally legs longish and red. L. 7-8 mm. to 15-17 mm. with intermediate sizes.

See Gravely F. H. (1912) Rec. Ind. Mus. 7:207 Habits of some Tiger beetles of Orissa.

Fam. *Carabidae* (Predaceous ground beetles) (Pl. V, Fig. 62). Similar to *Cicindelidae*. Black or brown, some with large patches of yellow, oval, more flattened. In some species elytra soldered together, no wings. Legs long or short and stout. All hunting, carnivorous. Single eggs laid in soil or twig. Larva slender, active, large head, long mandibles, thorax and abdomen smooth, tapering, cerci at end. Black or dull. Predaceous in groups. A few nibble at plant roots. Pupate in soil. Generally rest in adult stage, open or buried in soil. Diurnal or nocturnal. Come to light. Known as 'Bombardier beetles' as most can produce a mild sound by squirting a liquid through their anus to frighten pursuers. (See New Scientist No. 233 of 4/5/1961 P. 261). About 20,000 species known, 500—600 in the Indian region 50-60 in Maharashtra.

C. orientale. Black, bronze upper side, punctures greenish, head flat. L. 22-28 mm. *O. lunatus*. Yellowish, partly brown, 3 patches on thorax, 3 on green elytra. L. 6-7 mm. *Siagona* spp. Generally brownish, some with one or two spots, legs red or reddish. One species *S. pigmaea*, apterous, dark red stripes on prothorax. L. 8-9 mm. found in rice fields. *Scarites* spp. Black, legs with reddish pubescence. L. 18-25 mm. *Oxylobus* spp. Apterous, shining, black, elytra oval, convex, hides under stones or dung. Vary in length 14-25 mm. *S. striatulus*. Black, base of antennae, stout legs, red. L. 16-20 mm.

CHAPTER 3
Insects

C. attenuata. Black, shining, antennae brownish, legs red. L. 6-9 mm.
C. westwoodi. Brown, antennae and legs yellowish. L. 6-7 mm.
D. m. paucipunctus. Brown, elytral border red. L. 3 mm. under stones.

A. atripennis. Black or brown, legs brick red. L. 3-4 mm. *P. ceylonicus*. Brick red, antennae brownish, elytral borders blackish. L. 3 mm.
B. xanthacrum. Bronze green and yellow, blackish beneath. L. 4-5 mm. *Tachys* spp. Brassy, shining, reddish, black, green etc. with spots. L. 2-3 mm.

Read Andrews H. E. (1936) Ind. For Rec. Ent. Ser. 11(8):177 New Carabidae of India.

Fam. *Dytiscidae*. (Pl. V, Fig. 63) Aquatic beetles. Hind legs enlarged for swimming, spiny, flattish, front tarsi of males swollen, colours sombre. Oval, no part projecting, head broad, tightly fixed to thorax. Biting, carnivorous. If caught excrete a white fluid at the joint of head and thorax and an unpleasant fluid at the anus. Eggs laid singly in water weeds. Larva aquatic, voracious, preys on molluscs, aquatic insects, small fish, tadpoles etc. Swims with oarlike legs fringed with hair. Takes air by 2 terminal lobes of abdomen with head down in water. Pupates in moist soil. Adult has air enclosed under elytra and in felted hair. Hind legs flat with long hairs, help swimming. Can live and fly on land freely. Habitat flowing or stagnant water, sweet, brackish or hot. About 4,000 species known, less than 200 in the Indian region. No detailed list of Indian species available. A few species, almost all collected by T. R. Bell in Khandesh, mentioned.

Cybister spp. Black, brick red border all round. L. 25-30 mm. One species, *C. sugillatus* fully black. *Hydraticus* spp. Seedlike, black, broad, irregular, brick red lines on body. L. 12-15 mm. *Laccophilus* spp. Brown, tapering at tail end. Small, 2-3 mm. *Bidessus* spp. Brown. 1-2 mm.

Fam. *Gyrinidae*. (Whirling beetles) (गोठण) Gregarious, small. Swim on surface of fresh water, move very fast. Ovoid or elliptical, flattened, steely black or bronze lustre. Antennae short, stout, eyes divided into 2 parts, forelegs long, hind broad flattened, developed for swimming. Eggs in rows on submerged water weeds. Larva elongate with clear segments and gills. Carnivorous. Adults attracted to light. About 700 species described less than 50 in the Indian region. A few collected in Khandesh.

D. indicus. Bluish black, sloping on sides slightly, oval, abdominal end exposed. *O. limbatus*. Elongate, brown, 3-4 mm. *O. discifer*. Elongate, elytra truncated, abdominal end exposed. L. 9-10 mm.

Fam. *Hydrophilidae*. Basal joints of antennae long, apical broadened, clubbed. Resemble *Dytiscidae* but less compact. Aquatic or terrestrial. The latter black, less than 15 mm., smooth, shining. The former with

CHAPTER 3
Insects

legs slightly flattened, hairy for paddling. Live in water or damp, marshy places. Mostly herbivorous, a few carnivorous. About 2,000 species known, about 100 in India, 12 in Maharashtra, mostly in Khandesh.

H. piceus. Large, black, head bent, a large spine running below thorax beyond hind coxae. *Stethoxus* spp. Black, elongate, about 30 mm. *Sternolophus* spp. Black. Elongate, 7-11 mm. *Paracynus* spp. Brownish, slightly longer than broad 1-6 mm. *P. luteus*. Brownish, elongate, 3-4 mm.

Fam. *Paussidae*. Small, rectangular, antennae peculiarly expanded, elytra generally truncated, last abdominal segment exposed. Legs often expanded, leaflike, usually slender, meant for walking. Found wandering in ant nests. Fly suddenly and settle down quickly as if dropped down. Discharge fluid from the anus which explodes. Secrete liquid to attract ants which tend them. Attracted to light. Life history not studied well. Larvae described as carnivorous adapted for myrmecophilus life. Broad, segments swollen, eyes rudimentary if present. Similar to Carabid larvae. About 400 species described, sixty found in India, about 10 in Maharashtra.

C. andrewesi. Reddish brown, black band from head. Antennae a broad flat club. L. 5 mm. *P. denticornis*. Reddish (variable), 2 longitudinal patches. Antennae broad, oval, convex, L. 7-10 mm. *P. mellyi* with round antennae. *Passus* spp. Red and black or brownish, antennae like inverted jug without handle or triangular. L. 6-7 mm.

Fam. *Staphylinidae*. (Rove beetles) (Pl. V, Fig. 64) Look like earwigs. Short elytra cover fully developed wings. Antennae long 10-11 jointed, abdomen long exposed. Small, brightly coloured. Breed in decaying organic matter e.g. dung, dead animals etc. Some predaceous. Life not known fully. Larvae of 3 types. Pupae like those of lepidoptera but exposed. About 20,000 species described, less than 600 in India, about 50 in Maharashtra.

T. exiguus. Cylindrical, black, lustrous, legs brown or yellowish. L. 1.5 mm. Found in vicinity of water. *Oxytelus* spp. Black, shining, elytra yellow, legs brownish. L. 1.5 to 3 mm. frequent dung, carrion, rotten fruit etc. *P. cornutus*. Black, elytra brownish, black at base and sides. Legs brownish yellow. L. 3-4 mm. *Stenus* spp. Shining, black, parts brownish or reddish. L. 3-6 mm. *Pinophilus* spp. Black, abdominal margins, antennae, legs reddish. L. 6-10 mm. *O. dimidiatus*. Shining red, elytra, apex of abdomen black. L. 8 mm. *Paederus* spp. Shining red and blue black. L. 9 mm. or less. *Astenus* spp. Elongate, narrow, red and black, 3-5 mm. *Scopaeus* spp. Yellow, red and black. L. 3-4 mm. *S. indicum*. Reddish yellow, elytra brownish. L. 4-5 mm. *Cryptobium* spp. Elongate, depressed, red and black, antennae yellow. L. *parumpunctatus*. Brown, antennae reddish, legs yellowish. L. 6-7 mm. *Philonthus* spp. Black, inner borders of elytra, legs,

CHAPTER 3

Insects

antennae reddish. L. varies from 4-5 mm. to 9-12 mm. *P. aenci-pennis*. Black, elytra green, legs reddish. L. 8 mm. *S. semipurpureus*. Black with violet reflex, golden pubescence on elytra, 2 stripes on abdomen. L. 23 mm. *Discoxenus* spp. Reddish, L. 2-3 mm. *T. heimi*. Brown, apex of abdomen yellow. L. 2 mm. and *Doryloxenus* spp. Reddish yellow, black anal end, L. 2.5 mm. all live in termites nests. *A. impressicollis*. Reddish, abdomen black with yellowish bands. L. 3 mm. in termite nests. *Zyras* spp. Black, thorax red, legs reddish yellow. L. 3-8 mm. *D. heimi*. Shining brown, blackish markings. L. 2.2 mm.

Fam. *Histeridae*. Compact, hard, shining. Antennae clubbed. Elytra truncated, abdominal end exposed. Black or brown, a few marked with red. Some metallic. Feign death when frightened. Live under bark, dung or carrion, some in burrows of wood boring insects, a few in the nests of termites or ants. Larvae short with short legs, wrinkled, carnivorous. About 2,500 species described, about 150 recorded in India. No regular list for Maharashtra.

P. dufali. Flat, black, predaceous on bark feeding insects. L. 3 mm. *P. ceylonicus*. Black, shining, 1 mm. *H. chinensis*. Black, oval. L. 8-11 mm. Generally in cow dung. *H. bimaculatus*. Black, broad, big. L. 17-20 mm. *A. pareia*. Black, roundish L. 1-2 mm.

See Gardner J.C.M. (1935) Genera Insectorum. *Histeridae*-*Niponina*.

Fam. *Lycidae*. Big family of minor importance. Not studied well. Diurnal, clustering on plants. Brightly coloured, conspicuous, distasteful to birds. About 2,800 species known, 400 in India (Klein 1931 Cat. Ind. Ins). Larvae flat, small head, elytra corrugated, often brightly coloured. Only 3 known from Maharashtra.

Lycostomus spp. Feed on sandal flowers.

See Gravely F. H. (1915) Rec. Ind. Mus. 11:358 *Lyropaeus* and *Trilobite* larvae.

Fam. *Lampyridae* (Fire flies and Glow worms) (काजवे)
(Pt. V, Fig. 65 a & b). Nocturnal. Possess photogenic organs or tissues. All or only one stage may be luminiscent. Winged adult male a 'fire fly', wingless female 'glow worm'. More common in the rainy season. Eggs laid in soil, protected by mother in some species. Larvae flat, feed on soil insects, worms, snails etc. Pupate in soil or rotting wood. Generally adults do not feed but the male takes droplets of water and some females are cannibalistic. Life cycle may last a year or two. In fire flies the ventral portion of the abdomen luminous at its will. Females flat, each segment separate. 3 pairs of legs spread out. Males flat with sawlike antennae and striated elytra. About 1,100 species known, Indian species not listed, a few known from Maharashtra.

CHAPTER 4

Insects

L. tenebrosus (Indian glow worm) Luminiscent in all stages. Male. Head black, pronotum brown, elytra soft, brown, shorter than abdomen. L. 20-30 mm. Female. Pale yellow, wingless, flat, thread like processes at tail end. Larva similar. Feeds on snails voraciously. *Lampyris* and *Luciola* spp. Males brownish yellow and black, large eyes, long elytra. L. 5-10 mm. Common in rains in shrubs. Good fireflies. Females feeble light producers, remain on ground. *Diaphenes* spp. rather similar.

(See Paiva C. A.—1919 Rec. Ind. Mus. 16:19-28 Notes on Ind. Glowworm).

Fam. *Melyridae*. Resemble *Cleridae*—brightly coloured cylindrical, parallel sided. Carnivorous or herbivorous. Larvae flattish, active, move fast on trees in search of insect larvae, molluscs etc. About 4,000 species known. Indian species not listed, a few in Maharashtra.

H. fasciatus. Blue, orange stripes. L. 6 mm. Run about on crops and small plants. *Idiga* spp. Elongate, brown or blue elytra folded rooflike on body. L. about 10 mm. Feed on flowers.

Fam. *Cleridae*. Brightly coloured, small, head and thorax smaller than elytra, sides parallel, body cylindrical, antennae slightly knobbed, head prominent, prothorax distinct. Active, found on trees, flowers, grasses etc. Some predaceous on boring insects. Larvae bright, slightly flattened, pronotum strongly protected, fleshy abdomen, often with swellings. About 3,000 species described, less than 200 in India, a few in Maharashtra.

Mecrobis spp. Elongate, cylindrical, blue. L. 4 mm. Household pests on animal products like horns. *T. notatus* found with *Bostrichid* beetles, parasitic on them in bamboo roofs. L. 6-7 mm.

Fam. *Meloidae* (Blister beetles) (Pl. V, Fig. 66) (हिगे, बाळे, सोसे)
Distinct neck joining head to thorax, elytra loose on abdomen, integument weak. Appendages to claws. L. 25 mm. or less. Colours blue, brown, green or dull. Antennae long, simple. Eyes large. Head bent down. An acrid oil cantharidin, irritant and of commercial value, exuded from apices of femora. Masses of eggs laid in soil or grasses. Active larvae feed on eggs of grass hoppers or larvae of *Aculeate Hymenoptera*. Adults diurnal, herbivorous, feed on flowers, occasionally on leaves. One brood in rainy season. About 2,000 species known, less than 100 in the Indian region, a few in Maharashtra.

Z. pustulata. Black, wavy orange bands. L. 25-28 mm. On groundnut. *M. balteata*. Orange, wavy black bands. L. 15-25 mm. on groundnut and grasses. *G. rouxi*. Yellow, elytral tips rounded. L. 20-25 mm. A serious pest on earheads of paddy-cereals. *Lytta* spp. Green otherwise like *G. rouxi*. *Epicauta* sp. Red head, inverted V shaped mark on elytra L. 10-11 mm. on paddy. *C. setacea* on cowpea flowers. (See Iyer and Guha—1931—J. Ind. Inst. Scie. 14:A. 3:31).

Fam. *Anthicidae*. Beetles of this family, resembling ants, living in large numbers on the ground in herbage, grasses etc. are common but no record of them seems to have been made so far.

Fam. *Elateridae* (Click beetles) (Pl. V, Fig. 67). Striking beetles of small to medium size, brown, yellow or brightly coloured. Antennae varied. Head embedded in strong thorax, prothorax large, strong, hind corners produced, fitting well in elytra. Produce clicking sound, falling upside down, by a process in ventral surface. Larvae elongate, cylindrical, long upto 50 mm., mouth parts biting, legs for active burrowing. Habits differ widely e.g. (a) Larvae living in soil—wire worms—feed on vegetable matter, (b) larvae in wood or bark feed on wood, and (c) some larvae in soil or wood predaceous on other beetle grubs. About 7,000 species known, Indian not listed. Some species commonly found in Maharashtra.

A. fuscipes. Black, 28-40 mm. Larva in soil and adult predaceous on cockchafer grubs. Long lived. Life cycle 1-2 years. *L. sinensis* in decaying wood. Black, 10-11 mm. *M. melanocephalus*. Thin, brown, elytral tips black. *Cardiophorus* spp. Brownish and black, elongate, 5-13 mm. (See Gardner J. C. M.—1930. Ind. For. Rec. 14(13):283. Immature stages of Ind. Coleoptera—Elat.).

Fam. *Buprestidae*. (Pl. V, Fig. 68) Similar to *Elateridae* but hind angles of prothorax not produced, size 5-50 mm., beautiful metallic colours, some with efflorescence. Integument hard, head partly sunk in thorax closely fixed to elytra, legs short, folded at rest. Larvae borers of plants or miners of leaves, legless, thoracic segments flat, swollen into bulb. Abdomen long, slender. Mandibles strong. Pupate in larval galleries. About 12,000 species described, Indian species commonly found in forest trees, a few as agricultural pests. Noted in Maharashtra are :

S. gossypii. Shining, coppery brown, longish, efflorescent. L. 8-10 mm. Larva yellowish white, flattish, bores into cotton plant *S. parotteti*, burrows in groundnut stem, near soil. *Aemaedera* spp. bore into various forest trees. Beetles black, irregular orange spots and bands. L. 6 mm. *B. prasina*. Bluish green, smooth, angles of pronotum red. L. 25 mm. in forest trees and mango. *P. fastuosa*. Metallic bluish green, 20-25 mm. on Acacias and teak. *T. bicolor*. Dark bluish, small. A leaf miner of *Butea*, causes brown blisters on leaves. *T. ipomoea* causes similar damage to sweet potato.

Fam. *Dermestidae*. (Wooly bears) (अस्वली) Small, clothed with fine hair or scales. Antennae short, clubbed. Whole life cycle passed in the same material. Free living larvae predaceous, under bark of trees. Household species feed on skins, hides, horns, wool, cheese, stored insects etc. Larvae hairy in tufts, oval, elongate, brown. Eggs do not hatch until favourable conditions occur. Larva and adult can live long even without food. Serious enemies of natural history specimens. Less than 100 species known, a few from India.

Anthrenus spp. attack woollens, carpets, hair stuffings etc. of animal origin. Adult oval with white, yellow, black and red markings. L. 3 mm. Larva brown with bristly hair, 6-7 mm. Life cycle 1-3 years. *D. vulpinus*. Skin beetle. Black above, white below. L. 10-12 mm. Breeds in stored skins, meat, cheese, dried fish, silk cocoons etc. *T. versicolor*. Small, brown. Serious pest on preserved entomological specimens and on stored grains.

Fam. *Trogositidae*. Small, dark, antennae short, terminal segments dilated on one side. Prothorax robust, legs short, elytra light. Generally under tree bark, decaying wood. Predaceous. *T. mauritanica* ('Cadelle') however, found in stored grains, flowers, almonds etc. Adult brown to black, flattish, 7-8 mm. Larva white, cylindrical, rather hairy. L. 18-20 mm.

Fam. *Nitidulidae*. Small, brown or black, slightly pubescent. Resemble *Staphylinidae*. Vary in shape, diet etc. Mostly feed on fermenting fruit juices, flowers, sugarcane or on fungi and moulds or on fresh pollen. Also found in carcasses, flesh and bones. Some predaceous on bark beetles. About 2,200 species described, 250 in the Indian region; about 8 in Maharashtra but no details available.

Fam. *Cucujidae*. Small to large, brown, flattened. Antennae long. Generally under tree bark, decaying wood and stored produce. No literature on Indian species. A few known in Maharashtra.

C. advena. L. 2 mm. in stored grains, lac and seeds. *Hectarthrum* spp. Black shining, L. 12-15 mm. robustly built, predaceous on Coleopterous larvae. *O. surinamensis* (Saw toothed grain beetle). A world wide pest on stored grain, flour, dry fruit etc. Edges of thorax serrated. L. 2 mm.

Fam. *Erotylidae* including *Languridae* (Pl. V, Fig. 69). Brilliant, small, antennae clubbed. Feed on mushrooms and in plant stems infested with moss and fungus. About 2,000 species known, less than 300 in the Indian region, a few in Maharashtra.

M. cribricollis. Shining black, 2 orange patches on elytra. L. 5-6 mm. *Megalodaene* spp. Black, plain or with orange bars. L. 6-9 mm. *C. hispidus*. Brownish, greyish bristles, antennae and underside reddish yellow. L. 3-4 mm. in termite nest. *A. bombayensis*. Bright red, elytra blue. L. 5 mm.

Fam. *Endomychidae*. Antennae strongly clubbed. Abdomen with 5-6 segments visible from underside. Feed on fungus on timber. Small, hemispherical to elongate, slightly bigger. Larvae broad, ovate. About 600 species described, 150 in Indian region.

B. vicinus. Black, red half circle and a narrow bar on elytra. L. 9-11 mm. *S. bicolor*. Bright brownish red, elytra partly black, antennae brown. L. 3-4 mm. Attracted to light. *S. ferruginea*. Straw coloured, antennae dark, partly brownish. L. 4 mm.

CHAPTER 3

Insects

Fam. *Coccinellidae* (ठिपकेदार भुंगेरे) (Pl. V, Fig. 70). Usually round, convex, head sunk in thorax, antennae clubbed, generally spotted. Some insectivorous—on aphids, coccids etc. a few phytophagous. Larvae spiny, active, brightly coloured, tapering, broad in front. Can subsist on soft parts of plant. Eggs laid in a rectangular mass under the host leaves. Beetles gregarious. Pass resting period in groups. Nearly 5,000 species known. Indian species not listed, a good number found in Maharashtra.

C. septempunctata. Larvae slate coloured with yellow patches. Adult yellowish or reddish with 7 black spots. *C. repanda*. Three black curved bands, a spot in centre. Both the species feed on aphids, psyllids, scales etc. *T. cincta*. Larva yellowish, 4 rows of black spots on back, adult round, yellowish, feed on fungus bodies and on aphids on jowar, cotton, brinjal etc. *C. sexmaculata*. Widely distributed. Yellow or orange, anchor shaped mark on thorax, two zig zag lines and a black dot on each elytra. Black markings may be absent or the insect may be fully black. *C. nigritus*. Round, black, shining. *E. dodecastigma* ठिपके भुंगेरे (वांग्यावरील). Pest on Solanaceous plants. Larvae stout, yellow with branching spines. 7-10 mm. Adults yellowish with 12 black spots. *E. vigintioctopunctata* with 28 spots. *S. xerampelinus*. Dull black, pubescent, 3-4 mm., round. Larva like a mealy bug in white waxy processes. Predaceous on cotton aphids.

See Annon (1919) Bull. 89 Agr. Res. Inst. Pusa.

Stebbing E. P. (1903) Ind. Mus. Notes 6:47 Notes on Known Indian Coccinellidae.

Subramanyam T. V. (1923) Rep. Pro. 5th Ent. Meet. Pusa. P. 108 Coccinellids of S. I.

Fam. *Tenebrionidae*. (Pl. V, Fig. 71) (Fam. *Cistelidae* also similar but no species recorded in Maharashtra). Generally black, common in deserts and drier places, herbivorous, body hard, flat, globular, elytra fitting over body or soldered in apterous forms. L. 2-15 mm. Larvae in ground, look like wire worms, tough, cylindrical. Feed on vegetable matter, a few damage flours and grains badly. About 10,000 species known, 400 in the Indian region, about 30 in Maharashtra.

Ethas sp. Keeled, long thin thorax and head, abdomen slightly broader. *Derosphoerus* sp. Long, cylindrical, black, thin ridges and furrows. L. 15-22 mm. Both in decaying wood. *P. scriptipennis*. Brownish orange, black band on elytra. L. 1-2 mm. in decaying wood. *Ceropria* spp. Shining black, 10 mm., in rotten wood or under bark. *T. castaneum* and *ferrugineum*. Small, 5 mm. brown, flattish. Cosmopolitan pests of stored products e.g. flours, grain, insect store, furniture etc. *Gonocephalum* spp. Black to brownish, elongate thorax as broad as abdomen, edges curved up, generally covered up with sand. L. 8-14 mm. Larva yellowish brown, feeds on rootlets of sugarcane, coffee, weeds etc. *M. villiger*. Black or brown, flat, 7-8 mm. Cosmopolitan.

CHAPTER 3

Insects

A nuisance in houses, fall from the roof and cover the whole ground. Breed in decaying leaves, old trees, decaying vegetable matter and thatched roofs. *C. depressus*. Resembles seed. Thorax, elytra produced into curved thin lamella, like a Cassid beetle. L. 13-15 mm.

See Gardner J. C. M. (1929-31) Ind. For. Rec. 14:16 Immature stages of Indian Coleoptera.

Fam. *Ptinidae* and *Anobiidae*. Small, integument hard, cylindrical, head merged in thorax, antennae fully clubbed. Larvae thick set, white, fine haired, hunch backed. Almost all borers in drugs, tobacco, dried fruit, flours, mealy powders and furniture. Larval head small, eyes distinct body finely wrinkled. Tunnel into the food, feed and pupate inside. About 500 species described, a few recorded from India. Some important ones found in Maharashtra.

P. fur. A museum pest. *A. panicea* in books, papers, dry wood, dry vegetable matter. Can produce a sound 'Death Watch' by knocking its head against wood in the tunnel. *L. testacea*. Broad, pubescent brown, 5 lines on elytra, bores into cigars, cigarettes, cured tobacco, turmeric etc.

Fam. *Bostrychidae*. Small, compact, cylindrical, hard thickened integument, legs short, tibiae broadened. In some species, the toothed prothorax conceals the head, in some hind portion truncated and toothed, antennae elbowed at top on one side. Generally eggs laid in tunnels bored by mother in dry wood. Larvae white soft, strong thorax, tapering and curled behind, eyes absent, feed inside. Pupae naked. Commonly known as 'Powder post beetles'. Less than 600 species known, nearly 100 in the Indian region. A few recorded in Maharashtra.

B. bengalensis bores in tent poles and pegs. *B. parallela*. A common borer in bamboos, mango wood etc. *H. equalis* attacks timbers, packing cases, boxes, plywood pannels, sapwood in furniture and buildings. Common in saw mills. *S. atratum* bores into living saplings or seedlings of sandalwood causing die back. *S. anale* the most common powder post beetle. *S. anobioides*, a cosmopolitan borer. *X. ornatus*. Wide spread, variable in size and markings, bores into climbers, logs of wood about to die, pest on *Acacia*, *Bauhinia*, *Bombax* etc. *X. flavipes*. Common in moist subtropical parts, not found in higher altitudes, attacks mango, *jambol*, *Terminalia* etc. *R. dominica* धान्यातील लाल कीड. Cosmopolitan store pest, on paddy and other grains and flours and starch foods. Whole life passed in the food material. Beetle dark brown with a globular head, serrated front margin. L. 3-4 mm.

Refer Beeson C. F. C. (1935) Indian Forester 61:250 Boxwood borers.

Beeson and Bhatia B. M. (1937) Ind. For. Rec. (Ent.) 11 (12):223 Biology of Bostrychidae.

Fam. *Scarabaeidae*. (Lamellicornea). A large family of about 19,000 species. Beetles convex, elytra not covering abdomen completely, antennal tips made up of leaf like folds. Authors differ vastly on the classification of this family. However, some biological groups have been accepted by many and are defined on the basis of larval and adult food.

Group 1. *Cetoninae* (Pl. V, Fig. 72) Brilliant colours, day flying, mouth parts soft. Larvae generally feed in decaying vegetable matter including roots. Some inhabit ants nests for this purpose. About 2,500 species known, 250 in India and about 20 in Maharashtra.

D. cuvera. Black, shining, red patch on pronotum, yellow on elytra, abdominal end red. L. 15-19 mm. *Heterorrhina* spp. Green to blue, oval, elongate. L. 18-26 mm. *Protaetia* spp. Shades of black, shining, irregular patches or spots, globose, compact. L. 13-28 mm. *P. alboguttata*. Metallic green or blue, white spots, elongate, oval. L. 13-22 mm. Larva feeds in decaying leaf mould and nurseries. *C. acuta* with golden pubescence, depressed. L. 14-18 mm. Swarm in leguminous flowers. *C. klugi*. Black or chocolate, orange bands and spots. L. 13-17 mm. Pest on *Tectonia* roots. *A. orichalcea*. Green, blue, purplish or black, parts orange red. Long, narrow, rather flat, L. 36-46 mm. tunnels in pandanus. *Coenochilus* spp. Black or reddish, silky hair, legs slender. L. 12-14 to 19-20 mm.

Group 2 *Dynastinae*. Striking, large. Nocturnal, not commonly met with. Males and females differ widely in appearance due to horn development of males. Some have stridulatory organs. Early life passed in compost or tree trunks, adults feed on palm leaves or fronds. A few attack roots of sugarcane, rice etc. in larval stage. More than 1,000 species described, about 50 in the Indian region and four in Maharashtra.

O. rhinoceros. (माडाच्या शेंड्यातला भुंगेरा) Smooth, black or deep brown, reddish pubescent below. Elongate, cylindrical, recurved horn on head. Thorax front part excavated. L. 40 mm. Known as 'Rhinoceros beetle', 'Red palm beetle', 'Coconut beetle'. Earlier life in manure pits generally or in decaying vegetable matter, for nearly a year. Larva stout, curved, dirty white with red legs. Adults remain in pupal case for some time before emerging. Adult may live 8-10 months. Attack palm tops. *P. dionysius*. Red, tawny hairs beneath, compact, thorax excavated, elytra punctured in lines. L. 16-24 mm. Pest on paddy roots.

Group 3 *Melolonthinae*. Now treated as a separate family. Antennae with a knob of closely folded leaflets. Elytra not covering abdomen fully. All claws of equal size. Includes cockchafers. Thick set, fairly large to small, prothorax large, rounded, head small, forelegs broadened, hind spiny. Larvae soft, stout, wrinkled, curved, last segment very big. Feed in decaying vegetable matter or on roots of plants. Very

harmful. Pupate deep in soil. Life cycle about a year. Nocturnal, attracted to light.

Apogonia spp. Small 6-9 mm. brown, globular, shining. Feed in swarms on leaves of *Ficus*, *Bombax*, *Tectona* etc. *Holotrichia* spp. defoliate *Shorea*, *Tectona*, *Cassia*. *H. pulvinosa*. Brown, stout, 20 mm. L. serrata. Pest in gardens and sugarcane fields. *M. cotesi* defoliates garden trees. *Serica* spp. Brown globose. L. 7-12 mm. Come to light.

Group 4 *Reutelinae*. (Pl. V, Fig. 73). Mostly brightly coloured. Similar to *Melolonthinae* but claws of unequal size. Eggs laid in soil, increase in size after laying. Larvae feed on roots of grasses or plants for 6 to 9 months, pupate in soil. Adults emerge in swarms and feed in groups. About 400 species recorded in India, about 30 in Maharashtra.

Tropiorrhynchus spp. Metallic green or yellow, thin, with or without patches or lines. L. 11-14 mm. *Popilia* spp. Oval, stout, convex, metallic green or golden. L. 10-11 mm. *A. dorsalis*. Reddish or yellowish, head, inner borders of elytra and hind legs black. L. 14-17 mm. Pest on *Crinum latifolium*. Cosmopolitan. *A. varians*. Brownish yellow. L. 20-25 mm. Larva in sugarcane roots. Attracted to light. Other *Anomala* species, Straw coloured, head and legs with different colours. Oval. Vary from 11 to 23 mm. Larvae feed on plant or grass roots. *R. indica*. Yellowish, head black, tarsi red. L. 13-16 mm. Attacks *Shorea*. *Adoretus* spp. Mostly nocturnal. Hide in soil by day. Feed on leaves of cultivated plants e.g. rose, cannabis, mango etc. by night. Attracted to light. Colours deep brown to yellowish, generally plain, a few with spots and stripes. L. 8-14 mm.

Group 5 *Coprinae*. Round or oval, convex. Mandibles weak. Live in dung. Real 'Dung rollers'. Dung rolled into a ball, rolled to suitable places for food. Useful and benevolent as scavengers of abnoxious material. Single egg laid in a hollow ball in underground chamber. Larva feeds inside, pupates there. A few breed in ant nests. Life cycle 6-8 weeks. Indian region records about 400 species, about 80 in Maharashtra.

Gymnopleurus spp. Broad, depressed, blackish blue, green or violet with or without designs of bristles, colour underneath different. L. 6-20 mm. *Sisyphus* spp. Spider like body, compressed laterally, long posterior legs, hairy above, smooth beneath. Black, reddish bristles unevenly distributed. L. 4-10 mm. *H. bucephalus*. Massive, front tibiae with 3 teeth, posterior swollen. No scutellum. Black, elytra and underside red, covered with hair. L. 39-55 mm. Cosmopolitan. *Catharsius* spp. Very similar, one or two more furrows in elytra and hind legs. Blackish, opaque, hairy. L. 15 to 37 mm. *Copris* spp. Body compact, smooth above, convex, head broad, semicircular. Black, shining, antennae and part of lower surface red. L. 11-22 mm.

C. aterrimus. Short thorax hollow, front tibiae short, broad with straight teeth. Black, legs and antennae reddish. L. 3-5 mm. *O. imperator*. Metallic green, elytra reddish, inner margins green. L. 14-20 mm. *O. tardus*. Coppery green or blue, elytra yellow. L. 6-9 mm. (A good pollen carrier story by M. Cleghorn 1914 J. Asi. Soc. Beng. 10:421). *O. vultur*. Black, antennae red. L. 8 mm. feeds on dead locusts. *O. catta*. Brownish yellow, partly green or coppery black. L. 8-13 mm. widely distributed. Males known as 'Gazella'—antelope and females 'Cotta'—metallicus. Other species spread all over Maharashtra of this genus, vary from 5-20 mm., black or blue-black, shining underneath, partly yellow or reddish. *L. rhadamistus*. Orange yellow, pronotum, margins, spots and bars on elytra, greenish or bluish black. L. 11-15 mm. *Oniticellus pallipes*. Orange yellow, speckled brown or black, elongate. L. 6-9 mm. *D. setosus*. Black, antennae and tarsi reddish. Elongate oval, pronotum with shallow large pits. L. 4-6 mm. *Onitis* spp. Black, reddish yellow hair, clypeus elyptical. L. 16-23 mm. *H. heimi*. Black or red or in parts, broadly oval, hemispherical. L. 2-3 mm. in the nest of *Phidole* ant.

See Fletcher T. B. (1919) Rep. Pro. 3rd Ento. Meet. Pusa pp. 165-183 Annotated list of crop pests.

Hingston R. W. G. (1923) A naturalist in Hindustan pp. 209-274.

Fam. *Lucanidae* (Stag beetles). (सांभर किडे) *Lemellicornia*. (P. V, Fig. 74) Smooth, shining, elytra covering the body. Mandibles in males greatly developed, often equal to the rest of the body, in females usually small and stout. Size varies greatly even in same species in all respects. Generally inhabit thick moist forests and high altitudes. Larvae fleshy, strongly curved, stridulating. Feed in decaying or soft logs of wood, never in hard or seasoned wood, in irregular tunnel for a year or two and pupate inside in debris. About 900 species known, about 150 in the Indian region, 2-3 small ones in Maharashtra.

D. curvipes. Black, female shining, male dull, convex, eyes prominent, a curved spine on thorax. Elytra punctured, pointed at shoulder. L. 12-20 mm. 11-14 mm. Female excluding mandibles. *F. caviceps*. Black, shining punctured above, a double hump in hind part of head, depression in front, a laminar projection. L. 9-10 mm.

Fam. *Passalidae* consists of black or dark brown beetles fairly big, flattened with elytra longitudinally striated, covering abdomen fully. Resemble *Tenebrionidae*. Soft wood borers. Can produce notes. Not common in Maharashtra.

Fam. *Cerambycidae*. (Pl. V, Fig. 75) (झाड पोखरणारे लांब मिशांचे किडे) Attractive colours, elongate. Very big to small, some cryptic, some mimetic. Head well developed, mandibles and eyes prominent. Antennae very long, simple, dentate or with tufts of hair. Legs long, pubescent. Squeak audibly. Eggs laid singly in cracks of barks.

Larvae, legless with powerful mandibles, stout thorax, tunnel, feed inside wood. Dorsal plate on each segment. Pupate in tunnel after 3 months to 3 years, according to seasons, localities and species. About 15,000 species known, more than 1,200 in the Indian region, about 25 recorded in Maharashtra.

M. crenata. Brown, antennae and legs reddish, a pair of depressed triangles on thorax, 2 spots in front and bands behind. L. 37-52 mm. Attacks Tamarind, Bombax, Eucalyptus etc. *P. sanguinolentus*. Black, two red or yellow bands on elytra, prothorax with a spine. L. 12-21 mm. *Pachyteria fasciata*. Metallic blue, part of antennae, a band on elytra yellow. L. 24-29 mm. *X. subcutalatus*. Dark brown, pubescent, prothorax with a black band and spots, irregular bands on elytra. L. 10-17 mm. *B. rubus*. Big, yellowish, elongate with orange spots, a spine on each side of thorax. L. 55-65 mm. Larva 70-80 mm. bores into mango, tamarind and such other trees. *C. scabrata*. Grey or yellow, wavy orange bands on elytra, black bands on antennae. L. 25-35 mm. Generally on Casuarina, mulberry etc. *O. bilobus*. Brown, white spots on elytra, pest on fig. *A. pertigera*. Small 10-12 mm. Brownish with white irregular patches, attacks cucurbits. *G. spilota*. Head and thorax black, elytra reddish, tip black. Black areas banded white. L. 10-12 mm. Pest on Bombax. *M. nivosus*. Blackish brown, velvety, big white patch on elytra. L. 23-28 mm. In *Akh—Rui* (*Calotropis*).

Fam. *Chrysomelidae*. (Pl. V, Fig. 76). Rather small, brightly coloured, smooth with simple legs. Almost all plant pests feeding mostly on leaves. Divided into a number of groups of similar habits. Life history differs in different groups. About 26,000 species known so far, less than 3,000 in the Indian region. Maharashtra records about 150.

S. femorata. Metallic blue or green, depressed at base of elytra, legs toothed. L. 16-20 mm. Feeds on *Dolichos*, *Fabia* etc. *Lema* spp. breed in grasses and plants. Yellow and black, L. 4-6 mm. *L. flavimana*, legs robust, elytra violet blue. *L. subiridea* purplish. *C. impressa* yellowish, black or deep brown beneath with silver patches. L. 7-10 mm. Feed on *Ficus* spp. and flowers of *Callicarpa*, *Dioscorea* etc. *C. palliata*. Yellowish, antennae, legs black, black spots on elytra. L. 12-15 mm. Cosmopolitan. *Cryptocephalus* spp. Yellow and black with spots and bands of various types, a few reddish. L. 2-5 mm.

Nodina spp. Greenish, antennae, legs yellowish, black beneath, elongate. L. 1-2 mm. *Pagria* spp. Black or brownish, antennae yellowish, yellowish spots on elytra. L. 2-4 mm. One species brown. *Callisina* spp. Shining black, 2 rectangular, 2 elongate spots. L. 4-5 mm. *Colasposoma* spp. Metallic blue or violet. L. 6-8 mm. *C. ornatum*. Coppery, bluish bands and borders to elytra. *Tricliona* spp. Various colours, mostly yellow and black or brown or red. L. 3-5 mm.

C. maculicollis. Yellowish, 2 black patches on thorax, elytra brown. L. 3 mm. *C. fulvoaenea*. Apterous, dirty yellow, brassy gloss. L. 8 mm. *H. unicolor*. Shining yellow brown, oblong, narrow, universal.

A. foveicollis (abdominalis) (भोपळ्याच्या पानावरील लाल काळे, भुंगेरे) (Pl. V, Fig. 76a) Universal pest on cucurbits. Orange red or brown, black underneath, oblong, broadened backwards. L. 6-7 mm. *A. impressa*. Brown, elytra, underneath black. *G. birmanica*. Brown, eyes black, antennae, legs blackish brown. L. 7 mm. *Monolepta* spp. (Flea beetles) Ovate, convex, narrowed on both sides, brown, often elytra black or striped, spotted and blotched. L. 3-5 mm. *M. scutellata*. Dark red brown, antennae, legs black. L. 7-8 mm. *P. truncatipennis*. Blue green, bronzy reflections, antennae brown. L. 7 mm. Other species of the genus brown with underside black. L. 5-6 mm.

Flea beetles (पिसू भुंगेरे) (Pl. V, Fig. 76b). Name acquired due to the habit of the adult jumping like fleas. Plant feeders both in larval and adult stage. Adult oblong ovate, femora of hindlegs much thickened, antennae between eyes. Very small. Larvae brownish or yellowish, convex, 3 pairs of thoracic legs, a pair of fleshy legs on 8th abdominal segment. Burrow in the middle of leaves, shoots, axils, often in fruits. Adults riddle leaves with holes.

P. signata. Yellowish, antennae, 2 stripes on elytra and borders black. L. 3-4 mm. *Hyphosoma* spp. Brown, 4 black spots on thorax or plain, antennae black. L. 4-6 mm. *Chaetocnema* spp. Black or brassy, blackish brown underneath. L. 1-2 mm. *O. hirsuta*. Oblong, narrowed behind, yellow, reddish spots on elytra, silvery pubescence. L. 7-8 mm. on *Boswellia*—'Gugul' used as frankincense. *P. striatipennis*. Oblong, pointed behind, yellow, elytra metallic blue, black underneath. L. 3-4 mm. *L. belgaumensis*. Oblong, brownish, border dark. L. 2-3 mm. Common on legumes like Sann hemp. *H. cyanea*. Blue, antennae black, scutellum black. L. 5 mm. Widely distributed on weeds often in swarms.

Hispa group. Agriculturally important. Adults generally covered with long, stout, upright spines or pitted in lines. Legs short, elytra often truncated, metallic black, brown or other colours. Often cryptic. Eggs laid in tissues of plants, flat larva mines in leaf or tender shoots, pupates inside. Adults small, generally feed on epidermis. Diapause in adult stage.

E. chinensis. Variable. Generally elongate, stout blunt antennae, elytra punctured in lines. Light brown black. L. 10-16 mm. Pest on bamboo. *L. pygmaea*. (वीट, निळे भुंगेरे) Narrow, cylindrical, constricted in the middle, metallic green or blue. L. 4-5 mm. Serious pest on paddy, sugarcane. *Oncoccephala* spp. Brick red, elytra blackish, wedge shaped, dilated posteriorly. L. 4-7 mm. On sweet potato. *S. strigicollis*. Small 5-7 mm. with 6 spots. Known as 'Udadya' (उदद्या) in Marathi as it resembles 'Udid'—black gram. Pest on

grape vines. *Hispella* spp. Oblong, black, black tipped brown spines, spines, bronzy reflections. L. 3-4 mm. on grasses, Lantana. *Dactylispa* spp. Oblong, straw coloured and black or reddish, anterior spines reddish tipped black. L. 3-4 mm. *D. severini* 7 mm. similar. *H. armigera* (करपा). Oblong, blue black, elytra constricted in the middle, antennae black, thickened at apex, 4 branched spine on side of thorax, a single spine behind. L. 4-5 mm. Serious pest on paddy. *P. erinaceus*. Red brown, 2 red bands on prothorax, each enclosing 2 black bands. L. 5 mm. On *Zizyphus* (*Bor*). *P. andrewesi*, similar, on sugarcane.

Tortoise beetles. *Cassidinae*. (Pl. V, Fig. 76c). Characterised by round form, edged with thin extended borders, dorsal side convex, central area drawn to a point. Imitate tortoise. Bright metallic colours, specially red, gold, green etc. antennae under margin of head pressed in. Often called living jewels. Shining disappears on death. Eggs laid singly or in clusters in an Ootheca. Larvae elongate oval, spiny, carry excrementitious matter at anal end. Live in groups, feed on epidermis of leaves by night generally, in the rainy season. Attack mostly *Convolvulaceae*—*Ipomeas* like sweet potato. A fairly large number recorded in Maharashtra.

H. tenuicula. Quadrate, narrow behind. Brownish black, yellowish patch in elytral expansion. L. 5 mm. *C. leayana*. Oblong varies in colour, prothorax yellowish edged black, elytra greenish bronze, violet margin. L. 14-16 mm. on *Gmelina arborea*—*Shevanti*. (शेवंति) *A. furcata*. Roundish, golden when alive, reddish dead. L. 6-8 mm. On *Ipomea* spp. *C. nigrovittata*. Red or yellowish with 4 black spots in corners, 3 rows of irregular spots in duplicate. L. 8-10 mm. *L. quadrimaculata*. Oval, narrow at anal end, brown with black spots, black patches on margin. L. 8-9 mm. *O. pudibunda*. Dirty greenish tinge, elytra green in life. L. 7 mm. On *Bor* (*Zizyphus*). *C. enervis*. Ovate, convex, brown, margins with honey comb structure. L. 4-5 mm. *C. avia* with series of black patches on elytra. L. 5-6 mm. *C. belli*. Brick red, elytra with black designs. *C. dorsata*. Brown with red spots and stripes. L. 6-7 mm. *C. hina*. Ovate, convex, brownish green, black patches underneath. L. 4-5 mm.

See Maulik S. (1921) Rec. Ind. Mus. 22:23, 24. Notes on *Cryptosoma* beetles.

Fam. *Bruchidae* (कडधान्यातील किडे, पोर किडे) (Pl. V, Fig. 77). Small, thickset, hind legs thickened, hairy below, antennae sawlike. Colour sombre, abdomen thick, seed like, about 5-6 mm. or less. Eggs generally glued to seed. Larva whitish or brownish, curved, robust, bores in seed, stored pulses more favoured. Feeds and defecates inside, completely covers the hollowed part. Pupates inside, comes out as beetle after cutting a circular hole in seed. Pairs and breeds in open air, on the surface on grain heaps. Serious pests on all grains and seeds. A few breed in pulses in field also. Locally known as Pulse beetle, bean

CHAPTER 3
Insects

beetle, pea beetle. About 900 species described, about 50 in India. A few in Maharashtra.

B. chinensis. Dark brown or speckled, body abruptly rounded behind, hind legs stout at base. L. 6 mm. Attacks all pulses. *B. affinis* attacks peas in field and in store. *B. theobromae*. Brownish with mixed black and white stripes attacks *Tur*—redgram and peas in field. *C. gona-gra*. Grey brown. L. 8 mm. Universal pest on tamarind seed and leaves.

See : Fletcher T. B. (1919) Rep. Proc. 3rd Ento. Meeting, Pusa. P. 239.

Kunhi Kannan K. (1919) Bull. 6 Mys. Dept. Agr. Ent. Ser pp. 31.

Fam. *Brenthidae*. Small to medium, elongate, long straight rostrum. Similar to weevils (*Curculionidae*). Males larger, differ in structure from females. Usually bare, shining, dull brown or ferrugineous. Almost all borers in wood, or under bark, a few in ant nests. Life cycle nearly a year. About 1,700 species described, less than 300 in the Indian region, 10-15 in Maharashtra specially on west coast. No details available.

Fam. *Anthribidae*. Economically not important. Borers of wood, seed or fruit. Vary in shape and size. Life cycle about a year. Adults long lived. More than 2,000 species described, a large number recorded in India but not listed; species in Maharashtra not known.

Fam. *Curculionidae* (Weevils) (टोके, सोंडे भुंगेरे) (Pl. V, Fig. 78). Long rostrum, antennae elbowed. Generally small, a few 40-50 mm. Any colour. Some pubescent, some scaly. Compact, thick set, eyes at base, antennae on sides of rostrum (beak), prothorax well developed, abdomen large, covered completely by elytra, ample wings folded in between. Eggs laid singly in tissue of plant. Larvae white, soft, wrinkled, legless, slightly curved, feed on leaves or tunnel and feed inside stem, root, seed etc. Pupate there. Cocoons of fibre or gummy material, its own excrement or naked. Adults active, sham death. Destructive to agricultural crops, stored products, both as larvae and adults. About 30,000 species known, about 4,000 in the Indian region, a complete list from Maharashtra not yet available.

B. inequalis. Black, dense brown or grey scaling, beak short, broad, prothorax broader. L. 4-7 mm. Pest on sesame, cluster beans. *Tanymecus* spp. Shining black, golden hair, green or grey scales, elytra pointed behind with deep lines. L. 13-14 mm. *T. pinceps*. 7 mm. Black with green scaling feeds on cotton leaves, beans in rice fields. *L. angustula*. Black, scanty scaling, coppery reflections, darker markings. L. 5-6 mm. *E. lacerta*. Grey to brown, generally 2 white stripes on thorax, dark lateral stripe, a large patch, about 6 spots. L. 8-13 mm. Pest on beans in rice fields, *Erythrina*, millets, pulses, cotton bark etc. (Fletcher. Some S. Indian Insects P. 327). *Ptochus* spp. Black or brown, red antennae. L. 2-6 mm.

CHAPTER 3
Insects

M. catechu. Black, metallic green scales, prothorax with stripes on each side. L. 2-3 mm. on leaves of *A. catechu*. *M. pretiosus*. Similar with 3 black stripes on thorax and a few black spots. L. 3-4 mm. on brinjal leaves. *M. dorsatus*. Blackish green or golden scales, 3 black stripes on thorax, elytra mottled with conjoined dark spots. L. 4-5 mm. on leaves of sword beans—*Canavalia*. *M. transmarinus*. Black, brown scales often mottled with grey. L. 3-6 mm. Cosmopolitan—on *Zizyphus*, cotton, *Dalbergia* etc. *M. subfasciatus*. Similar, with 3 faint stripes on prothorax, elytra with bands. L. 4-6 mm. on brinjal, potato leaves. *M. discolor variegatus*. Black, fawn scales, pale markings. L. 5-7 mm. Omnivorous. *M. 11 pustulatus*. Grey scales, 11 spots on elytra. L. 4-6 mm. Cosmopolitan on millets, cotton etc. *M. 11 p. marmoratus* with broken stripes instead of spots.

L. brachyrrhinus. Widely distributed, mostly on *Amaranthus* and *niger*. Larva produces galls in the stem. *C. formicarius*. (Sweet potato weevil) (स्ताळ्यांतील सोंडे भुंगेरे). Beautiful red and black weevil, shining elongate, attacks sweet potato tubers and leaves. At times serious. About 6 mm. *A. bubo*. Dark brown, coarsely sculptured, long beak and legs. Bad pest on *Sesbania*, causes swellings on stems. *M. balsaminae*. Larvae make galls in balsam. *C. asperulus* in flowers of *Tur* (*Cajanus*). *C. mangiferae*. Mango stone borer (अंब्याच्या बाट्यातील भोंगा) Roundish, oval, grey, rough coated, frog like, bores into mango stone, specially grafted varieties, more common in coastal tracts. *A. citrulli* on creepers of watermelon and fruits of 'Kakarulu' in Nagpur. *R. ferrugineus*. Elongate, compact, red, velvety, 6 spots on thorax. L. 25-30 mm. Bores in palms, specially coconut. *C. sordidus*. Elongate, black, big sloping thorax. L. 10-12 mm. Attacks plantain stems at roots. *C. oryzae* (Rice weevil). Small 3-4 mm. Brownish black, cylindrical, beak curved. Feed and breed in grain stores in both larval and adult stage. Cosmopolitan. *C. stigmaticollis*. Minute, dark. Bores in stems of coconut in Ratnagiri District.

See Ayyar T. V. R. (1922) Bull. 125 Agr. Res. Inst. Pusa Weevil fauna of S. I.

Fletcher T. B. (1919) Rep. Proc. 3rd Ento. Meet. Pusa Annotated list of crop pests.

Gardner J. C. M. (1934-38) Ind. For. Rec. 20 and N. S. 3 Immature stages.

Gardner J. C. M. (1931-38) Ind. For. Rec. 16. Ent. 1 and 3 New Indian *Curculionidae*.

Fam. *Platypodidae* (Pinhole and shot hole borers). Small weevils with rostrum short. Fitting tightly in the galleries they bore in logs or susceptible trees. Legless larvae also found in similar galleries. About 5,000 species known, a large number found in the Indian region,

CHAPTER 3
Insects

but not fully, systematically recorded or described. About 5 recorded in Maharashtra.

Refer Beeson C. F. C. (1914) Ind. For. Rec. 14:209 Biology of the genus *Xyleborus*.

Stebbing E. P. (1907) J. Bom. Nat. Hist. Soc. 18:18 Effect of moonlight on the attack of shoot borers.

ORDER STREPSIPTERA (STYLOPS)

A small order of about 300 species. Nothing much is known in India of these insects except that other insects like bees, crickets, some homopterous species are parasitised—stylopised by them. The male active, front wing twisted and degenerated, hindwing folded like a fan. Fertilises the female, almost a wingless sac, in the body of the host. The young shoot out and hop like fly maggots, attach to the body of the adult hosts and are thus carried to the nests where fresh infection takes place. Adult male about 2 mm. Larva (triangulin) 0.1 to 1.5 mm.

See Subramaniam T. V. (1922) Tr. Ent. Soc. Lond. p. 131 New genus of Strepsiptera.

Rec. Ind. Mus. 34:43 (1932) New genus of Strepsiptera.

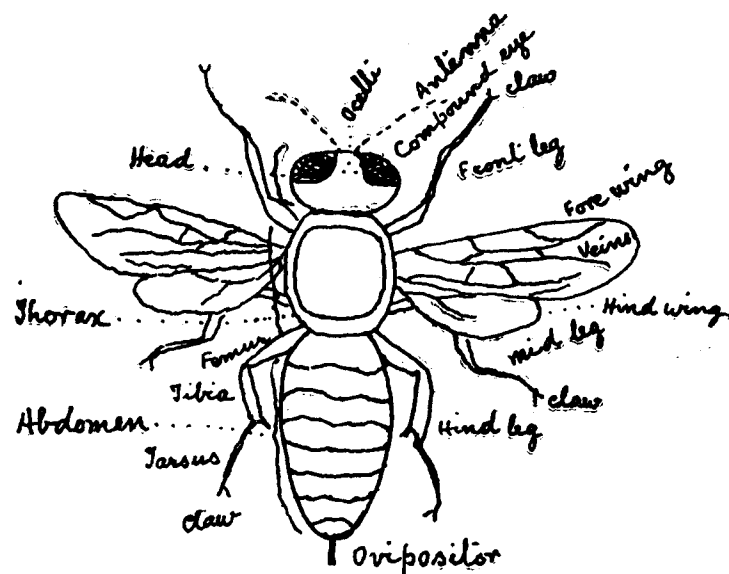


Fig. 1

PLATE I

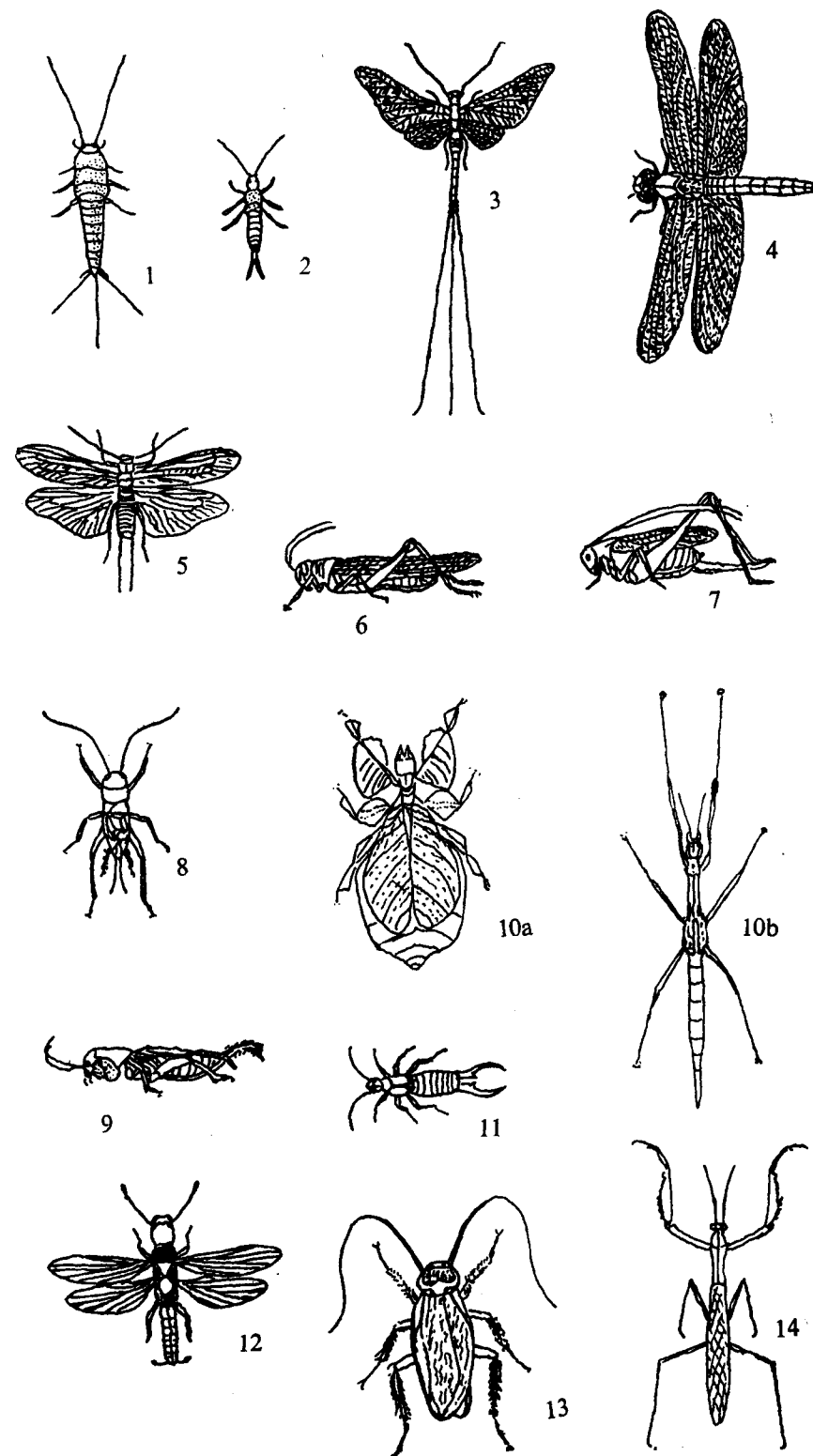


PLATE II

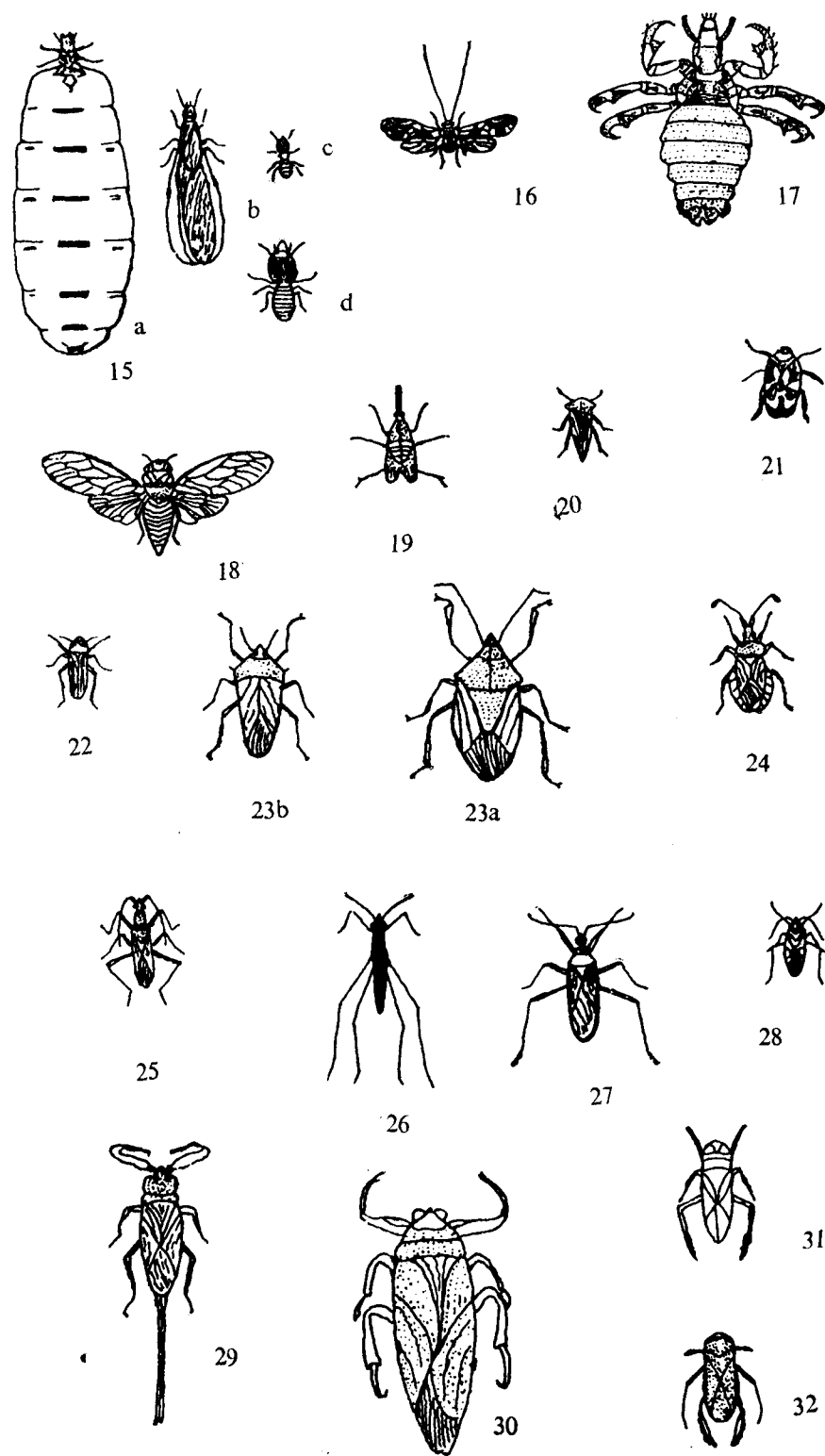


PLATE III

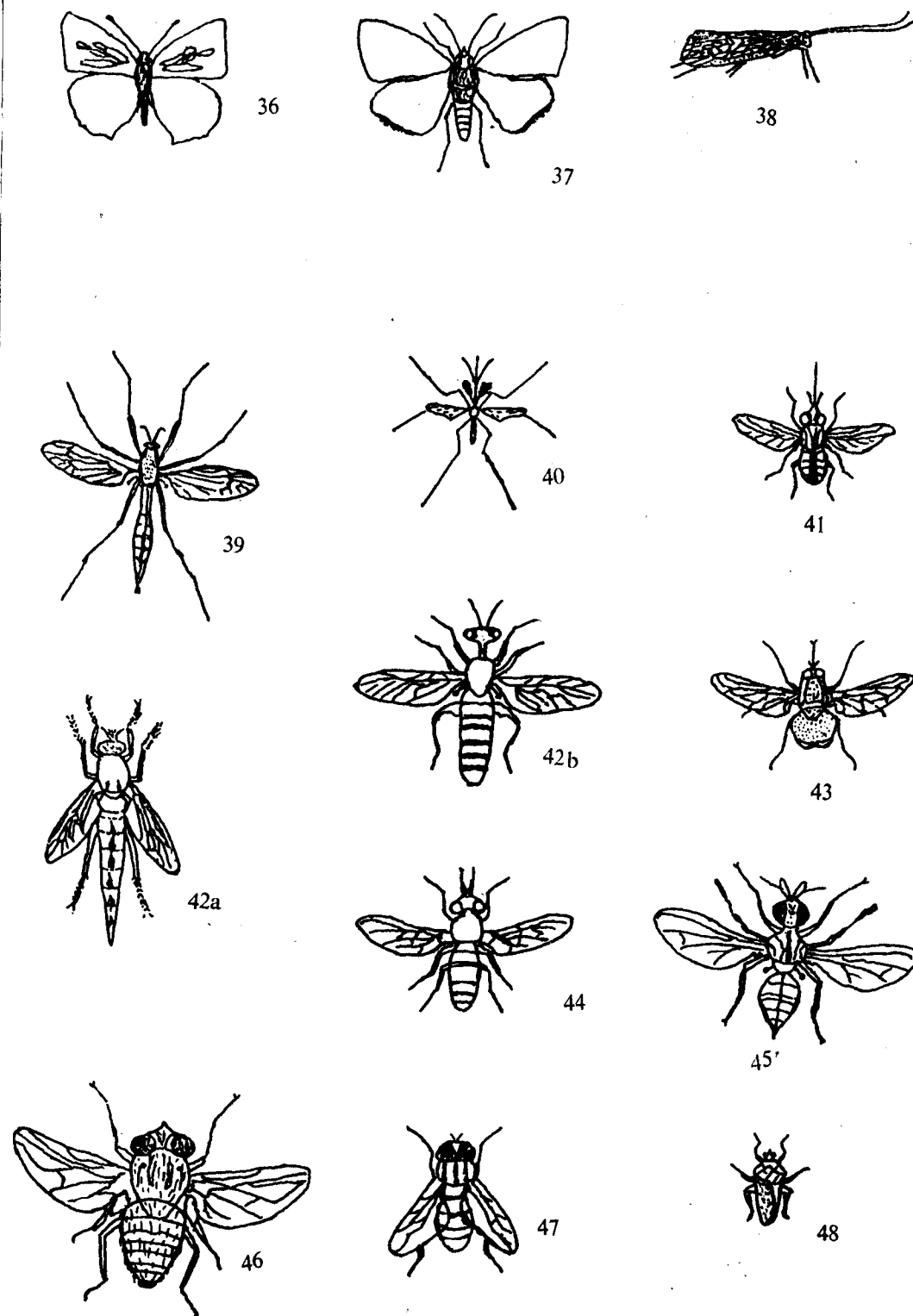


PLATE IV

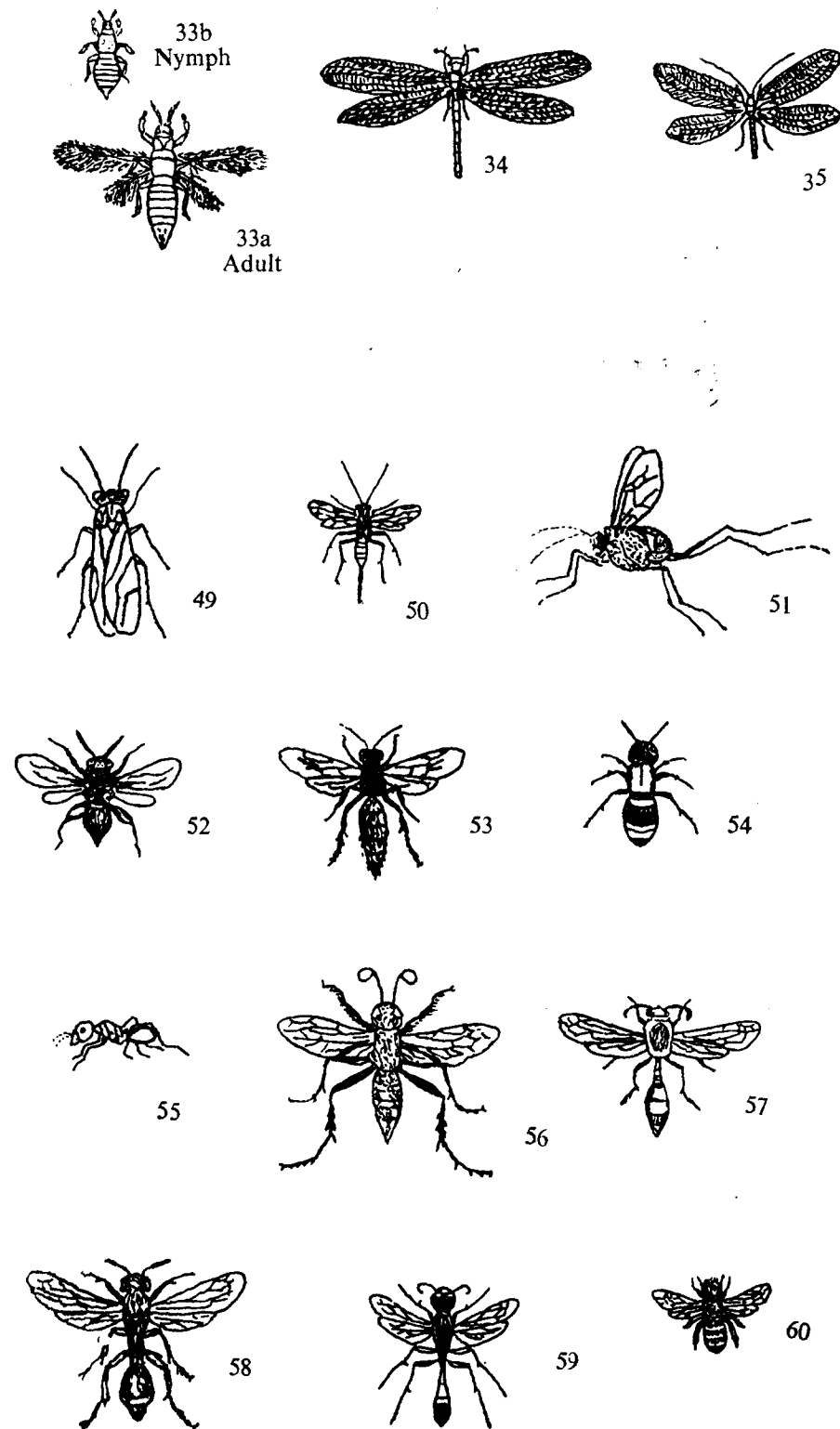
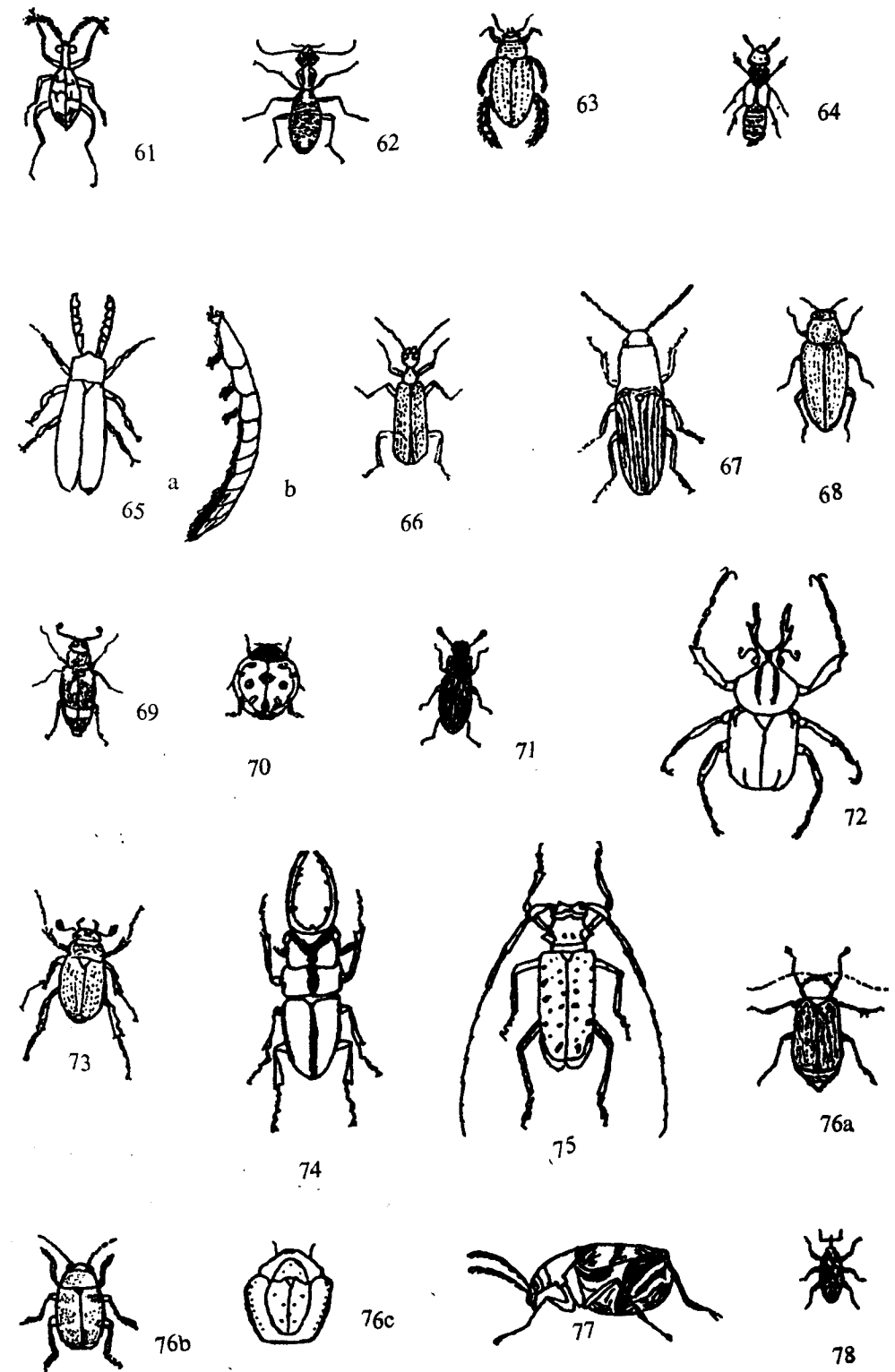


PLATE V



CHAPTER 4 — SPIDERS

CHAPTER 4

Spiders

THE ARACHNIDA MAY BE DISTINGUISHED FROM THE HEXAPODA (Insecta) Chilopoda (Centipedes), and Diplopoda (Millipedes) by the entire absence of the pair of feeler-like appendages, known as antennae, on the head and also by the fact that there is no differentiated head having two or three pairs of appendages modified to act as jaws. In the remaining great class of Arthropoda — the Crustacea — which possesses numerous terrestrial species, there are two pairs of antenniform appendages at the anterior end of the body and at least three pairs of appendages modified as jaws.

The Arachnida are viviparous or oviparous. The young are born or hatched from the egg in a form substantially resembling their parents, and except in the case of the Acari (Mites and Ticks), growth is not accompanied by metamorphosis, the characters of the adult being gradually assumed with each successive moult of the integument.

Classification — Including the marine form *Limulus*, and the two degenerate groups *Tardigrada* and *Pentastomida*, whose claims to be regarded as Arachnida are somewhat slender, the members of this class may be grouped into the following orders :

1. Scorpions,
2. Uropygi,
3. Amblypygi,
4. Araneae,
5. Solifugae,
6. Palpigradi,
7. Pseudoscorpiones,
8. Opiliones,
9. Acari.

This part only deals with the Araneae (spiders), recorded so far from Maharashtra State.

ORDER ARANEAE (SPIDERS)

The body of a spider consists of two regions, the *cephalothorax* and the *abdomen*, having four pairs of legs and modified organs of prehension, the *chelicerae*.

Spiders differ from other Arachnida in having the abdomen unsegmented and joined to the cephalothorax by a narrow stalk. There is a single small family of spiders, Liphisiidae, in which the abdomen is segmented ; representatives of this family occur only in Burma and from Malay Paninsula to Sumatra. In the genus *Tetrablemma*, found

CHAPTER 4
Spiders

in Ceylon, the abdomen bears a series of plates, which are evidently vestiges of a segmented condition. But in all Indian spiders the abdomen is sac-like.

In spiders the cephalothorax, like the abdomen, is unsegmented, although frequently the head and the thorax are slightly separated by a furrow, the *cervical* groove. In such cases, most writers refer to the head as the cephalic part, or the *pars thoracica*; but the simple terms *head* and *thorax* are sufficient for all purposes, and will be used when it is necessary to refer to the principal divisions of the cephalothorax. The hard integument forming the dorsal wall of the cephalothorax is termed the carapace.

The head is that portion of the cephalothorax which bears the eyes and so-called mouth-parts, the appendages that are used for seizing and chewing the prey. It is either slightly or not at all separated from the thorax; but it is almost always easily distinguished.

The abdomen is soft skinned and oval in form. Not infrequently it is horny. The *generative organs* and the anterior pair of breathing-organs open ventrally along a curved groove, the *genital fold*, which marks off the fore part of the abdomen as the *epigastric area*. These breathing organs or pulmonary sacs are covered by plates or *opercula*, and the integument in front of the genital aperture is in many females horny and variously modified to form an organ, the *vulva* or epigyne. The breathing organs of the posterior pair are either operculate pulmonary sacs or tracheal tubes with simple apertures, which rarely open separately behind the genital fold, but more commonly unite to form a single aperture situated just in front of the spinning mamillae.

There are usually three pairs of *spinning mamillae* attached to the hinder end of the lower surface of the abdomen an anterior and intermediate and posterior pair. Each of the latter consists of a single segment, the others of two or three segments.

Males are almost invariably smaller, sometimes very much smaller, than females, and may be always recognized by the modification of the tarsus of the palp to act as an intromittent organ. This organ appears only at maturity. Similarly in the females the genital aperture is opened and the vulva fully formed only at the last moult, when maturity is reached. All spiders are oviparous. The eggs are enveloped in a silky cocoon, and are disposed of in various ways by the mother.

Spiders are cosmopolitan in distribution and occur as far north as Greenland and Spitzbergen.

LIST OF SPECIES IN MAHARASHTRA

Family I—Eresidae

1. *Stegodyphus mirandus* Pocock
2. *S. sarasinorum* Karsch
3. *S. pacificus* Pocock
4. *S. socialis* Pocock

CHAPTER 4
Spiders

Family II—Scytodidae

5. *Scytodes propinqua* Stoliczka
6. *S. thoracica* (Latreille)
7. *Loxosceles indrabeles* Tikader

Family III—Ditynidae

8. *Dictyna rebai* Tikader
9. *D. shiprai* Tikader
10. *D. umai* Tikader
11. *D. bedeshai* Tikader
12. *D. tungabhadrai* Tikader
13. *D. chandrai* Tikader

Family IV—Oecobiidae

14. *Oecobius putus* Cambridge
15. *O. marathaus* Tikader

Family V—Filistatidae

16. *Filistata poonaensis* Tikader

Family VI—Pholcidae

17. *Artema atlanta* Walckenaer
18. *Crossopriza lyoni* (Blackwall)

Family VII—Theridiidae

19. *Latrodceus hasseltii* Simon
20. *Agyrodes cyrtophore* Tikader
21. *A. jamkhedes* Tikader
22. *A. gouri* Tikader
23. *A. dipali* Tikader

Family VIII—Tetragnathidae

24. *Tetragnatha geniculata* Karsch
25. *T. mandibulata* Walck
26. *Eucta javana* Thorell

Family IX—Argyropidae

27. *Argyope pulchella* Thorell
28. *A. arcuata* Simon
29. *Cyrtophora citricola* (Forsk.)
30. *C. cicatrosa* (Stoliczka)
31. *Gasteracantha geminata* (Fabri.)
32. *G. leucomelaena* Dolesc.
33. *G. brevispina* Dolesc.
34. *Cyrtarachne raniceps* Pocock
35. *C. sundari* Tikader
36. *C. promilai* Tikader
37. *Leucauge decorata* (Blackwall)
38. *L. celebesiana* (Walck.)
39. *Nephila maculata* (Fabri.)
40. *Herennia ornatissima* Dolesc.

CHAPTER 4

Spiders

41. *Araneus mitifica* (Thorell)
42. *A. rumpfi* Thorell
43. *Cyclosa insulana* (Costa)
44. *C. confragra* (Thorell)
45. *C. mulmeinensis* (Thorell)
46. *C. moonduensensis* Tikader
47. *Ordgarius hobsoni* (Cambridge)
48. *Chorizopes anjanas* Tikader
49. *C. khanjanas* Tikader
50. *Cladomelea mundhva* Tikader

Family X—Hersiliidae

51. *Hersilia savignyi* Lucas

Family XI—Thomisidae

52. *Thomisus pooneus* Tikader
53. *T. shivajiensis* Tikader
54. *T. lobosus* Tikader
55. *T. katrajghatus* Tikader
56. *Xysticus minutus* Tikader
57. *Oxyptila maratha* (Tikader)
58. *Philodromus betrabatai* Tikader
59. *P. bhagirathai* Tikader
60. *P. kendrabortai* Tikader
61. *P. maliniae* Tikader
62. *P. mohiniae* Tikader
63. *P. devhutai* Tikader
64. *Ebo bharatae* Tikader
65. *Misumena menoka* Tikader
66. *M. indra* Tikader
67. *M. greenae* Tikader
68. *M. silveryi* Tikader
69. *Tmarus kotigeharus* Tikader
70. *Runcinia roonwali* Tikader
71. *Misumenoides deccanes* Tikader
72. *Pasias marathas* Tikader
73. *Misumenops khandalaensis* Tikader
74. *Amyciaea forticeps* Cambridge
75. *Monaeses parvati* Tikader
76. *Thanatus dhakuricus* Tikader
77. *T. mandali* Tikader
78. *Tibellus elongatus* Tikader
79. *T. chaturshingi* Tikader
80. *T. poonaensis* Tikader
81. *T. katrajghatus* Tikader

Family XII—Lycosidae

82. *Hippasa pantherina* Pocock
83. *H. pisaurina* Pocock

CHAPTER 4

Spiders

84. *Lycosa sumatrana* Thorell
85. *L. fletcheri* Gravely
86. *L. birmanica* (Simon)

Family XIII—Oxyopidae

87. *Oxyopes chittarae* Tikader
88. *O. sushilae* Tikader
89. *Peucetia choprai* Tikader

Family XIV—Salticidae

90. *Marpissa tigrina* Tikader

NOTES ON SPECIES

The family Eresidae is distinguished by the following characters : Cephalothorax very wide in front (resembling at first sight that of Salticidae) ; cephalic region high ; clypeus low ; four median eyes forming a small quadrangle narrower in front than behind, the anterior lateral eyes on the side of the head, the posterior lateral far remote from the rest of the eyes and situated high up on the posterior portion of the head. Abdomen very heavy, over hanging cephalothorax ; cribellum thick transversely divided. A single genus *Stegodyphus* occurs in Maharashtra.

The commonest form is the social spider *Stegodyphus sarasinorum* Karsch. This spider is gregarious in its habits. It spins a labyrinthine tube, which ends blindly at one end and the other end expands into a broad sheet, which however, is smaller than that spun by the genus *Hippasa* (family Lycosidae).

This species does not sting the prey to death, but feeds on the captive alive, all members of the colony sharing the same victim. Spiderlings hatch in the month of October and November and feed on their parents, hibernating in webtubes in winter. Two other species *Stegodyphus pacificus* and *Stegodyphus mirandus* also occur in the State but are not so widely distributed as *sarasinorum*.

Species of the family Scytodidae have the cephalothorax usually very high behind. Eyes six in number. Labium fused with sternum. Legs very long and slender. Two genera occur. In the genus *Scytodes*, the cephalothorax is high and subglobose behind and slopes forward. Eyes six, small and light coloured, arranged in three widely separated pairs. Of the two species in Maharashtra, *Scytodes propinqua* and *Scytodes thoracica*, the latter has a wide distribution in the old and new worlds.

Spiders of the genus *Loxocles* are medium sized, yellowish or brownish in colour and without conspicuous markings. The cephalothorax is low and depressed. The anterior row of eyes is strongly recurved. The palpus of the male is rather simple. A single species *Loxocles indrabeles* newly described from Poona in 1963.

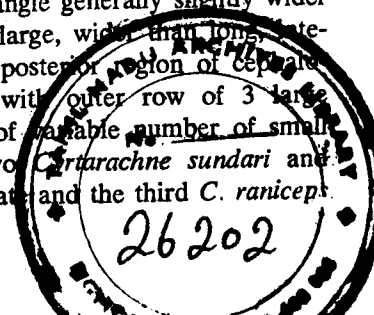
The hackled-band spiders of the family Dictynidae are small orbellate spiders of the suborder Araneomorphae with one pair of book lungs

Spiders

Spiders of the family Tetragnathidae have the cephalothorax long and eyes in two rows ; lateral eyes nearly contiguous, chelicerae long with strong teeth, specially developed in males for locking with those of the females in copulation. Legs greatly elongated. Palp in male simple.

Spiders

The genus *Cyrtarachne* has the carapace unarmed, convex, median eyes not very prominent, the ocular quadrangle generally slightly wider than long, laterals contiguous. Abdomen large, wider than long, integument leathery, strongly overlapping the posterior region of cephalothorax in front. Chelicerae subapically with outer row of 3 large teeth which differ in size and inner row of variable number of small teeth. Three species in Maharashtra, two *Cyrtarachne sundari* and *C. promilai* so far known only from the State and the third *C. raniceps* widespread.



CHAPTER 4
Spiders

The genus *Leucauge* has the cephalothorax truncate in front, legs long and slender, especially the first two pairs; the posterior femur with fringe of long hairs. Abdomen twice as long as wide, blunt at both ends and ornamented with bands or spots of silvery pigment. Two species, both widespread in the Indian region.

Spiders of the genus *Nephila* have the Cephalic region convex and moderately high, generally armed posteriorly with two tubercles; ocular quad nearly square. Legs very long, clothed with spines, metatarsi longer than tibiae and patella. Vulva not well developed. Male very small, with simple palpus. The single representative in Maharashtra is the Giant Woodspider, *Nephila maculata*, whose large webs are a feature of Konkan forests. It is widely distributed along the Western Ghats and in Eastern India.

The genus *Herennia* has the carapace flat; eyes not extending across the frontal area; quadrangle scarcely longer than wide; eyes of posterior line nearly straight. Abdomen coriaceous, flattish above, with sharply defined, often lobate lateral margins, impressed with radially arranged lines of spots. Male with simple palpus. A single species *Herennia ornatissima* occurs in the State. It is widely distributed in India, Ceylon and Burma.

The genus *Araneus* has the cephalothorax convex; eyes of posterior line slightly or strongly recurved; lateral eyes separated or in contact. Legs strong; protarsi shorter than tibiae and patellae. Two widely distributed species in the State.

In the genus *Cyclose*, the eyes are subequal, the posterior median almost in contact, the median ocular area wider in front than behind; both rows of eyes, the head and thorax separated by a deep cervical groove. Of the four species in the State, one *Cyclosa moonduensis* is described from Poona.

Spiders of the genus *Ordgarius*, have the carapace convex, armed above with a few symmetrically placed tooth-like tubercles. Abdomen very large, wider than long, widely rounded laterally, tuberculate above. A single species *O. hobsoni* in Maharashtra.

The genus *Chorizopes* has the cephalothorax longer than wide, cephalic region high. Clypeus short and curved forward, chelicerae robust. Abdomen mainly provided with tubercles posteriorly. Two species in the State, both described on the basis of specimens collected near Poona.

The *Cladomelea* spiders have the abdomen tuberculate, and clothed with fine hairs. Cephalothorax slightly longer than wide, narrowing in front; middle of the thorax provided with conspicuous spine like tubercles. A single species *Cladomelea mundhya* known from the State.

Spiders of the family *Hersillidae* have the cephalothorax as long as wide, with cephalic region elevated, narrow and defined by a deep

CHAPTER 4
Spiders

semicircular sulcus; both rows of eyes strongly recurved. Legs except III pair, very long and slender, armed with three claws. Abdomen short, subpentagonal, posterior spinners very long, usually longer than the abdomen. The common tree spider *Hersilia savignyi* is widely distributed in India, Ceylon and Burma.

The typical members of the family *Thomisidae*, have a peculiar crab-like appearance. Carapace and abdomen usually short and broad; but somewhat elongate in *Tibellus* and *Thanatus*. Eyes small, particularly the posterior, usually circled with black, both rows being recurved. First two pairs of legs long and stout and frequently move sideways as is done by a crab; the legs are less obviously laterigrade in the genera *Philodromus* and *Thanatus*, and not at all in *Tibellus*. The members of the genus *Oxyptila* have the integument furnished with some characteristic clavate setae, but in the other genera the hairs are normal.

The genus *Thomisus* has the cephalothorax truncated in front, with the upper fore-corners strongly and conically protuberant and divergent, bearing the lateral eyes. Eyes very small. Abdomen narrow and truncated in front, enlarging to a considerable width behind, where at either corner of the dorsal side is a short blunt conical protuberance. Legs long, I and II much longer than III and IV. Four species have been described from Maharashtra.

In the genus *Xysticus*, the carapace is rather square-fronted, clothed with simple, isolated hairs and spines, which are usually pointed, rarely blunt, but never clavate. Posterior eyes nearly equidistant, medians smaller than laterals; the anterior medians usually a little further from each other than from the anterior laterals. The lateral eyes situated in low subconfluent tubercles. The tibiae and metatarsi of the anterior legs usually furnished with more than three pairs of inferior spines. Tarsal claws furnished with five or six isolated teeth. Abdomen much wider behind than in front, usually bearing a dentated band on its dorsal surface. These spiders live under stones and leaves or under loose bark; a few live on low plants and bushes. This genus is widely distributed in Europe and America and was recently recorded from India.

The genus *Oxyptila* has the cephalothorax, abdomen and legs clothed with some clavate or spatulate hairs; clypeus with a row of clavate hairs. Eyes black, median ocular trapezium longer than broad; posterior medians closer to one another than to laterals. Legs stout and short; tibiae I and II armed ventrally with two pairs of spines. A single species *Oxyptila maratha* described from Poona.

In the genus *Philodromus*, the cephalothorax is broader than long and relatively narrower in front than in genera *Xysticus* and *Oxyptila*. Eyes smaller and more uniform in size than in genera *Xysticus* and *Oxyptila*, in a smaller crescent shaped group with the anterior row much the shortest; posterior slightly recurved, the medians further from each

CHAPTER 4
Spiders

other than from the laterals. Abdomen usually oval, not appreciably widened or truncated behind. Legs relatively long, II pair of legs slightly longer than I pair; III and IV pairs a little shorter than I and II pairs. Six species described from Maharashtra.

The genus *Ebo* is easily recognized by the great length of the second pair of legs and the almost straight posterior row of eyes. A single species, *Ebo bharatae* occurs in the State.

Spiders of the genus *Misumena* are distinguished by carapace armed with a few short fine spines. The eyes of the anterior row are equidistant and in a more or less recurved line. The median ocular area is a little narrower in front than behind. Lateral eyes situated in slightly elevated confluent tubercles. Legs I and II much longer than III and IV. Four species have been described from the State.

The members of the genus *Tmarus* are easily distinguished from other crab-spiders by having the abdomen high and pointed behind. The lateral eyes of each side are on two distinct tubercles, of which the posterior is larger. A single species *Tmarus kotigeharus* is known from Maharashtra.

In the genus *Runcinia*, the cephalothorax is longer than wide, with small ocular tubercle. Clypeus vertical. Cephalothorax dorsally provided with spines. Abdomen long, laterally provided with longitudinal muscular corrugation. A single species *Runcinia roonwali* in the State.

The genus *Misumenoides* is closely related to *Misumena*, but differs in having a distinct, wide carina on the clypeus and one between the eye rows. The carapace is relatively flatter. A single species *Misumenoides deccanes* occurs.

The genus *Pasias* has the cephalothorax slightly wider than long, clothed with fine hairs. Clypeus high, margin provided with spines. Abdomen long, cylindrical, narrowed behind and spined. Represented by a single species *Pasias marathas*.

The genus *Misumenops* is closely allied to *Misumena* but differs in having large and prominent spines on the femora of the first and second pairs of legs, and on the upper face of the tibiae of the same legs. The cephalothorax and abdomen are more spiny than in *Misumena*. The tubercles of the lateral eyes are joined by a rounded ridge, and posterior lateral eyes are not larger than the posterior median eyes. Represented by a single species *Misumenops khandalaensis*.

The genus *Amyciaea* has the cephalothorax high, and eyes situated on the high portion of cephalothorax. Both lateral eyes large and provided with prominent tubercles. Abdomen long. Ant like spiders, the single species *Amyciaea forticeps* in the State resembles the Red Ant.

CHAPTER 4
Spiders.

The genus *Monaeses* is related to *Tmarus* but differs in having abdomen produced well beyond the spinners. This spider is found on twigs of flowering plants. When at rest, the anterior pair of legs are stretched out longitudinally forward, and the spider clasps the twig closely with its two posterior pairs. The members of the genus differ greatly in form from the ordinary type of crab-spiders. Represented by a single species *Monaeses parvati*.

The genus *Thanatus* differs from *Philodromus* in the relative position of the eyes, and in the relative lengths of the legs. Carapace scarcely longer than wide. Anterior row of eyes close together and both rows recurved and form together a crescent-shaped area; posterior eyes equidistant. Abdomen oval, not appreciably enlarged or truncated behind and marked with a lance-shaped band. Tarsi and metatarsi armed with scopulae. These spiders live on ground or low plants and tall grass. The genus is widely distributed in Europe and America and recently two species were described from India. Both occur in Maharashtra.

The genus *Tibellus* has the cephalothorax appreciably longer than wide. The change in position of the eyes has gone further than in the genus *Thanatus*, and the eyes of the anterior row with the posterior median pair form a small compact hexagonal group from which the posterior laterals are conspicuously removed. Abdomen long and cylindrical or cigar-shaped. Legs relatively long, bearing scopulae on both tarsi and metatarsi. These spiders are found on grass and on bushes; when at rest the legs are stretched out longitudinally two pairs forward and two backward. Represented by four species in the State.

Spiders of the family Lycosidae have the cephalothorax high, narrowing in front; eyes of anterior row small, forming straight or slightly curved line, eyes of posterior row strongly recurved. Legs spiny, III legs shorter than the others, tarsi with three claws and claw-tufts absent. Abdomen oval or elongated, spinners forming a compact group, generally subequal in length. These spiders, commonly called the hunting or wolf spiders, are very fast runners. They catch their prey on foot. Only a few genera of this family, such as *Hippasa* spin a tabular retreat, which expands externally into a broad sheet. Other members of the family dig a tabular tunnel in the ground. The cocoon is carried by the female, attached to her spinners. The young on hatching, are carried by their mother on her back for some time.

The genus *Hippasa* has the anterior row of eyes wider than posteriors; posterior eyes more widely separated. Posterior spinners considerably longer than the anteriors. These spiders spin a silken thread, which expands into a sheet-like or funnel-like snare. Represented by two species, both widely distributed.

CHAPTER 4

Spiders

In the genus *Lycosa*, the cephalothorax is high mainly on the cephalic region, four posterior eyes very large and arranged in a quadrangle, which is a little wider behind than in front; eyes of anterior row small, straight. Legs with short spines, tibia II with three pairs of ventral spines. Represented by three widely distributed species.

In the family Oxyopidae, the cephalothorax is oval and high; cephalic region narrow, subacuminate; eyes forming a compact sub-circular group, those of the posterior line being typically strongly procurved and those of the anterior recurved, the anterior medians minute; clypeus very high. Mandibles long, fang short; fang-groove unarmed or weakly armed; maxillae and labium very long. Legs long, slender, armed with long black spines, three claws. Abdomen generally oval, narrowed behind; spinning-mamilla short, subequal; a small cololus present.

The genus *Oxyopes* has the posterior row of eyes strongly procurved and the eyes of which it is composed are equidistant from each other. Ocular quadrangle limited by the posterior median eyes and the anterior lateral eyes. Represented by two species.

The genus *Peucetia* has the anterior median eyes smallest; posterior median eyes and posterior lateral eyes forming only a slightly procurved row, not so procurved as in *Oxyopes*. Cephalothorax not so high or convex as that of *Oxyopes*. Male palp with characteristic paracymbial process in each species, sometimes partly broken off during mating. Represented by a single species *Peucetia choprai*.

The family Salticidae comprises those spiders commonly known as "jumping spiders". They are characterised above all by the massive square-fronted carapace, bearing on its front the four large forward-directed eyes; behind these, set well back, are two small eyes, and behind these again there are the two posterior eyes of the medium size, the whole forming a large quadrangle. Legs normally rather short, with two tarsal claws and usually a claw tuft, tarsal scopulae are sometimes present. Represented by the genus *Marpissa* distinguished by the carapace being rather oval. Ocular trapezium is about 1.5 times broader than long, parallelsided. Chelicerae with one tooth on inner margin and two on outer margin. The first pair of legs are slightly stouter than the second pair and are armed with three pairs of spines beneath the tibia. A single species *Marpissa tigrina* known so far from the State.

CHAPTER 5—BIRDS

CHAPTER 5

Birds

THE AVIFAUNA OF MAHARASHTRA CONSISTS OF 466 SPECIES OF BIRDS, and 497 forms belonging to 68 families. There are 1,200 species of birds listed from India and Pakistan in the Synopsis (Ripley 1961), and the total number of live bird species in the world is about 8,600. Out of 497 forms recorded from Maharashtra 290 are residents and 160 are migrants. 14 are listed as vagrants and stragglers, and about 30 are of uncertain status.

The Indian avifauna is greatly influenced by the Indo-Chinese elements. There are 176 species of birds confined only to the Indian Sub-region and Maharashtra has 68 of these. Out of these 68, 39 have Indo-Chinese affinities. In the dry portions of the Deccan plateau some species have Ethiopian influence and 4 or 5 have a palaearctic affinity. This list has been compiled from 3 main sources—"Birds of the Bombay Presidency by Barnes published in 1885; The Catalogue of Birds in the collections of the Bombay Natural History Society, and the published notes in the Journal of the Bombay Natural History Society. These have been supplemented by our own observations during the past decade. Statements on the abundance of species, however, are based entirely on Barnes. When we say that a bird species is reported from a particular district we do not mean thereby that the species does not occur in any other districts. It only indicates that the bird has been observed and identified in that particular district and is so recorded.

We do not claim that this is a complete list of the birds of Maharashtra; it is written with the hope that it will lead to a more thorough investigation into the interesting avifauna of Maharashtra.

LIST OF 19 ORDERS DESCRIBED

Order-1	.. Podicipediformes
Family	.. Podicipedidae
	Blacknecked Grebe (<i>Podiceps nigricollis</i>)
	Little Grebe (<i>Podiceps ruficollis</i>)

CHAPTER 5

Birds

- Order-2 .. Procellariiformes
 Family .. Procellariidae
 Audubon's Shearwater (*Procellaria lherminieri*)
 Black Petrel (*Bulweria aterrima*)
 Family .. Hydrobatidae
 Wilson's Storm Petrel (*Oceanites oceanicus*)
 Order-3 .. Pelecaniformes
 Family .. Phaethontidae
 Short-tailed Tropicbird (*Phaethon aethereus*)
 Family .. Pelecanidae
 Grey Pelican (*Pelecanus philippensis*)
 Family .. Sulidae
 Masked Booby (*Sula dactylatra*)
 Family .. Phalacrocoracidae
 Cormorant (*Phalacrocorax carbo*)
 Indian Shag (*Phalacrocorax fuscicollis*)
 Little Cormorant (*Phalacrocorax niger*)
 Darter (*Anhinga rufa*)
 Family .. Fregatidae
 Frigate Bird (*Fregata ariel*)
 Order-4 .. Ciconiiformes
 Family .. Ardeidae
 Little Green Heron (*Butorides striatus*)
 Pond Heron (*Ardeola grayii*)
 Cattle Egret (*Bubulcus ibis*)
 Large Egret (*Egretta alba*)
 Smaller Egret (*Egretta intermedia*)
 Little Egret (*Egretta garzetta*)
 Indian Reef Heron (*Egretta gularis*)
 Night Heron (*Nycticorax nycticorax*)
 Chestnut Bittern (*Ixobrychus cinnamomeus*)
 Family .. Ciconiidae
 Painted Stork (*Ibis leucocephalus*)
 Openbill stork (*Anastomus oscitans*)
 Whitenecked Stork (*Ciconia episcopus*)
 White Stork (*Ciconia ciconia*)
 Blacknecked Stork (*Xenorhynchus asiaticus*)
 Lesser Adjutant (*Leptoptilos javanicus*)
 Family .. Threskiornithidae
 White Ibis (*Threskiornis melanocephala*)
 Spoonbill (*Platalea leucorodia*)
 Family .. Phoenicopteridae
 Flamingo (*Phoenicopterus roseus*)
 Lesser Flamingo (*Phoeniconaias minor*)
 Order-5 .. Anseriformes
 Family .. Anatidae
 Greylag Goose (*Anser anser*)

CHAPTER 5

Birds

- Barheaded Goose (*Anser indicus*)
 Lesser Whistling Teal (*Dendrocygna javanica*)
 Brahminy Duck (*Tadorna ferruginea*)
 Marbled Duck (*Anas angustirostris*)
 Pintail (*Anas acuta*)
 Common Teal (*Anas crecca*)
 Spotbill Duck (*Anas poecilorhyncha*)
 Mallard (*Anas platyrhynchos*)
 Gadwall (*Anas strepera*)
 Wigeon (*Anas penelope*)
 Garganey (*Anas querquedula*)
 Shoveller (*Anas clypeata*)
 Common Pochard (*Aythya ferina*)
 White-eyed Pochard (*Aythya nyroca*)
 Tufted Duck (*Aythya fuligula*)
 Scaup Duck (*Aythya marila*)
 Cotton Teal (*Nettapus coromandelianus*)
 Nukhta or Comb Duck (*Sarkidiornis melanotos*)
 Order-6 .. Falconiformes
 Family .. Accipitridae
 Blackwinged Kite (*Elanus caeruleus*)
 Honey Buzzard (*Pernis ptilorhynchus*)
 Pariah Kite (*Milvus migrans*)
 Brahminy Kite (*Haliastur indus*)
 Shikra (*Accipiter badius*)
 Crested Goshawk (*Accipiter trivirgatus*)
 Sparrow-Hawk (*Accipiter nisus*)
 Besra Sparrow-Hawk (*Accipiter virgatus*)
 Longlegged Buzzard (*Buteo rufinus*)
 White-eyed Buzzard-Eagle (*Butastur teesa*)
 Changeable Hawk-Eagle (*Spizaetus limnaeetus*)
 Crested Hawk-Eagle (*Spizaetus cirrhatus*)
 Bonelli's Hawk-Eagle (*Hieraaetus fasciatus*)
 Booted Hawk-Eagle (*Hieraaetus pennatus*)
 Rufousbellied Hawk-Eagle (*Lophotriorchis kienerii*)
 Imperial Eagle (*Aquila heliaca*)
 Tawny Eagle (*Aquila rapax*)
 Steppe Eagle (*Aquila nipalensis*)
 Greater Spotted Eagle (*Aquila clanga*)
 Lesser Spotted Eagle (*Aquila pomarina*)
 Black Eagle (*Ictinaetus malayensis*)
 Whitebellied Sea Eagle (*Haliaeetus leucogaster*)
 Black Vulture (*Torgos calvus*)
 Griffon Vulture (*Gyps fulvus*)
 Indian Longbilled Vulture (*Gyps indicus*)
 Indian Whitebacked Vulture (*Gyps bengalensis*)
 Egyptian or Scavenger Vulture (*Neophron percnopterus*)

CHAPTER 5

Birds

- Pale Harrier (*Circus macrourus*)
 Montagu's Harrier (*Circus pygargus*)
 Pied Harrier (*Circus melanoleucos*)
 Marsh Harrier (*Circus aeruginosus*)
 Short-toed Eagle (*Circus gallicus*)
 Crested Serpent Eagle (*Spilornis cheela*)
 Osprey (*Pandion haliaetus*)
- Family .. Falconidae
 Lanner Falcon (*Falco biarmicus*)
 Peregrine Falcon (*Falco peregrinus*)
 Shahn Falcon (*Falco peregrinus peregrinator*)
 Hobby (*Falco subbuteo*)
 Redheaded Merlin (*Falco chicquera*)
 Redlegged Falcon (*Falco vespertinus*)
 Lesser Kestrel (*Falco naumanni*)
 Kestrel (*Falco tinnunculus*)
- Order-7 .. Galliformes
 Family .. Phasianidae
 Painted Partridge (*Francolinus pictus*)
 Grey Partridge (*Francolinus pondicerianus*)
 Common Quail (*Coturnix coturnix*)
 Blackbreasted Quail (*Coturnix coromandelica*)
 Bluebreasted Quail (*Coturnix chinensis*)
 Jungle Bush Quail (*Perdica asiatica*)
 Rock Bush Quail (*Perdica argoondah*)
 Painted Bush Quail (*Perdica erythrorhyncha*)
 Red Spurfowl (*Gallus spadicea*)
 Painted Spurfowl (*Gallus lunulata*)
 Red Junglefowl (*Gallus gallus*)
 Grey Junglefowl (*Gallus sonneratii*)
 Common Peafowl (*Pavo cristatus*)
- Order-8 .. Gruiformes
 Family .. Turnicidae
 Little Bustard Quail (*Turnix sylvatica*)
 Button Quail (*Turnix tanki*)
 Common Bustard-Quail (*Turnix suscitator*)
- Family .. Gruidae
 Common Crane (*Grus grus*)
 Sarus Crane (*Grus antigone*)
 Demoiselle Crane (*Anthropoides virgo*)
- Family .. Rallidae
 Bluebreasted Banded Rail (*Rallus striatus*)
 Banded Crake (*Rallina eurizonoides*)
 Baillon's Crake (*Porzana pusilla*)
 Spotted Crake (*Porzana porzana*)

CHAPTER 5

Birds

- Ruddy Crake (*Amaurornis fuscus*)
 Brown Crake (*Amaurornis akool*)
 Whitebreasted Waterhen (*Amaurornis phoenicurus*)
 Water Cock (*Gallicrex cinerea*)
 Moorhen (*Gallinula chloropus*)
 Purple Moorhen (*Porphyrio porphyrio*)
 Coot (*Fulica atra*)
- Family .. Otididae
 Great Indian Bustard (*Choriotis nigriceps*)
 Lesser Florican (*Sypheotides indica*)
- Order-9 .. Charadriiformes
 Family .. Jacanidae
 Pheasant-tailed Jacana (*Hydrophasianus chirurgus*)
 Bronzewinged Jacana (*Metopidius indicus*)
- Family .. Haematopodidae
 Oystercatcher (*Haematopus ostralegus*)
- Family .. Charadriidae
 Sub-family .. Charadriinae
 White-tailed Lapwing (*Vanellus leucurus*)
 Sociable Lapwing (*Vanellus gregarius*)
 Redwattled Lapwing (*Vanellus indicus*)
 Yellow-wattled Lapwing (*Vanellus malabaricus*)
 Grey Plover (*Pluvialis squatarola*)
 Eastern Golden Plover (*Pluvialis dominica*)
 Large Sand Plover (*Charadrius leschenaultii*)
 Sand Plover (*Charadrius asiaticus*)
 Little Ringed Plover (*Charadrius dubius*)
 Kentish Plover (*Charadrius alexandrinus*)
 Lesser Sand Plover (*Charadrius mongolus*)
- Sub-family .. Scolopacinae
 Whimbrel (*Numenius phaeopus*)
 Curlew (*Numenius arquata*)
 Blacktailed Godwit (*Limosa limosa*)
 Bartailed Godwit (*Limosa lapponica*)
 Common Redshank (*Tringa totanus*)
 Marsh Sandpiper (*Tringa stagnatilis*)
 Greenshank (*Tringa nebularia*)
 Green Sandpiper (*Tringa ochropus*)
 Wood Sandpiper (*Tringa glareola*)
 Terek Sandpiper (*Tringa terek*)
 Common Sandpiper (*Tringa hypoleucos*)
 Turnstone (*Arenaria interpres*)
 Wood Snipe (*Capella nemoricola*)
 Pintail Snipe (*Capella stenura*)
 Fantail Snipe (*Capella gallinago*)

CHAPTER 5

Birds

	Jack Snipe (<i>Capella minima</i>)
	Woodcock (<i>Scolopax rusticola</i>)
	Sanderling (<i>Calidris albus</i>)
	Little Stint (<i>Calidris minutus</i>)
	Temminck's Stint (<i>Calidris temminckii</i>)
	Dunlin (<i>Calidris alpinus</i>)
	Curlew-Sandpiper (<i>Calidris testaceus</i>)
	Broadbilled Sandpiper (<i>Limicola falcinellus</i>)
	Ruff & Reeve (<i>Philomachus pugnax</i>)
Family	.. Rostratulidae
	Painted Snipe (<i>Rostratula benghalensis</i>)
Family	.. Recurvirostridae
	Blackwinged Stilt (<i>Himantopus himantopus</i>)
	Avocet (<i>Recurvirostra avosetta</i>)
Family	.. Dromadidae
	Crab Plover (<i>Dromas ardeola</i>)
Family	.. Burhinidae
	Stone Curlew (<i>Burhinus oedicnemus</i>)
Family	.. Glareolidae
	Indian Courser (<i>Cursorius coromandelicus</i>)
	Collared Pratincole (<i>Glareola pratincola</i>)
	Small Indian Pratincole (<i>Glareola lactea</i>)
Family	.. Stercorariidae
	Antarctic Skua (<i>Catharacta skua</i>)
Family	.. Laridae
	Sooty Gull (<i>Larus hemprichii</i>)
	Great Blackheaded Gull (<i>Larus ichthyaetus</i>)
	Brownheaded Gull (<i>Larus brunnicephalus</i>)
	Blackheaded Gull (<i>Larus ridibundus</i>)
	Whiskered Tern (<i>Chlidonias hybrida</i>)
	Whitewinged Black Tern (<i>Chlidonias leucoptera</i>)
	Gullbilled Tern (<i>Gelochelidon nilotica</i>)
	Caspian Tern (<i>Hydroprogne caspia</i>)
	Indian River Tern (<i>Sterna aurantia</i>)
	Common Tern (<i>Sterna hirundo</i>)
	Rosy Tern (<i>Sterna dougallii</i>)
	Whitecheeked Tern (<i>Sterna repressa</i>)
	Blackbellied Tern (<i>Sterna acuticauda</i>)
	Brownwinged Tern (<i>Sterna anaethetus</i>)
	Sooty Tern (<i>Sterna fuscata</i>)
	Little Tern (<i>Sterna albifrons</i>)
	Large Crested Tern (<i>Sterna bergii</i>)
	Lesser Crested Tern (<i>Sterna bengalensis</i>)
	Indian Skimmer (<i>Rynchops albicollis</i>)

CHAPTER 5

Birds

Order-10	.. Columbiformes
Family	.. Pteroclididae
	Indian Sandgrouse (<i>Pterocles exustus</i>)
	Painted Sandgrouse (<i>Pterocles indicus</i>)
Family	.. Columbidae
	Greyfronted Green Pigeon (<i>Treron pompadora</i>)
	Orangebreasted Green Pigeon (<i>Treron bicincta</i>)
	Green Pigeon (<i>Treron phoenicoptera</i>)
	Green Imperial Pigeon (<i>Ducula aenea</i>)
	Imperial Pigeon (<i>Ducula badia</i>)
	Blue Rock pigeon (<i>Columba livia</i>)
	Nilgiri Wood Pigeon (<i>Columba elphinstonii</i>)
	Rufous Turtle Dove (<i>Streptopelia orientalis</i>)
	Indian Ring Dove (<i>Streptopelia decaocto</i>)
	Red Turtle Dove (<i>Streptopelia tranquebarica</i>)
	Spotted Dove (<i>Streptopelia chinensis</i>)
	Little Brown Dove (<i>Streptopelia senegalensis</i>)
	Emerald Dove (<i>Chalcophaps indica</i>)
Order-11	.. Psittaciformes
Family	.. Psittacidae
	Alexandrine Parakeet (<i>Psittacula eupatria</i>)
	Roseringed Parakeet (<i>Psittacula krameri</i>)
	Blossomheaded Parakeet (<i>Psittacula cyanocephala</i>)
	Bluewinged Parakeet (<i>Psittacula columboides</i>)
	Indian Lorikeet (<i>Loriculus vernalis</i>)
Order-12	.. Cuculiformes
Family	.. Cuculidae
	Redwinged Crested Cuckoo (<i>Clamator coromandus</i>)
	Pied Crested Cuckoo (<i>Clamator jacobinus</i>)
	Common Hawk-Cuckoo (<i>Cuculus varius</i>)
	Indian Cuckoo (<i>Cuculus micropterus</i>)
	The Cuckoo (<i>Cuculus canorus</i>)
	Small Cuckoo (<i>Cuculus poliocephalus</i>)
	Indian Banded Bay Cuckoo (<i>Cacomantis sonneratii</i>)
	Indian Plaintive Cuckoo (<i>Cacomantis merulinus</i>)
	Drongo Cuckoo (<i>Surniculus lugubris</i>)
	Koel (<i>Eudynamis scolopacea</i>)
	Small Greenbilled Malkoha (<i>Rhopodytes vridirostris</i>)
	Sirkeer Cuckoo (<i>Taccocua leschenaultii</i>)
	Crow-pheasant (<i>Centropus sinensis</i>)
	Lesser Coucal (<i>Centropus toulou</i>)
Order-13	.. Strigiformes
Family	.. Strigidae
Sub-family	.. Tytoninae
	Barn Owl (<i>Tyto alba</i>)

CHAPTER 5
Birds

- Sub-family .. Striginae
 Striated Scops Owl (*Otus brucei*)
 Scops Owl (*Otus scops*)
 Collared Scops Owl (*Otus bakkamoena*)
 Great Horned Owl (*Bubo bubo*)
 Forest Eagle-Owl (*Bubo nipalensis*)
 Dusky Horned Owl (*Bubo coromandus*)
 Brown Fish-Owl (*Bubo zeylonensis*)
 Jungle Owlet (*Glaucidium radiatum*)
 Brown Hawk Owl (*Ninox scutulata*)
 Spotted Owlet (*Athene brama*)
 Forest Spotted Owlet (*Athene blewitti*)
 Mottled Wood Owl (*Strix ocellata*)
 Brown Wood Owl (*Strix leptogrammica*)
 Shorteared Owl (*Asio flammeus*)
- Order-14
 Family .. Caprimulgiformes
 .. Caprimulgidae
 Indian Jungle Nightjar (*Caprimulgus indicus*)
 European Nightjar (*Caprimulgus europaeus*)
 Sykes's Nightjar (*Caprimulgus mahrattensis*)
 Longtailed Nightjar (*Caprimulgus macrurus*)
 Common Indian Nightjar (*Caprimulgus asiaticus*)
 Franklin's Nightjar (*Caprimulgus affinis*)
- Order-15
 Family .. Apodiformes
 .. Apodidae
 Sub-family .. Apodinae
 Malaysian Edible-nest Swiftlet (*Collocalia fuciphaga*)
 Large Brownthroated Spinetail Swift (*Chaetura gigantea*)
 Alpine Swift (*Apus melba*)
 Large Whiterumped Swift (*Apus pacificus*)
 House Swift (*Apus affinis*)
 Palm Swift (*Cypsiurus parvus*)
- Sub-family .. Hemiprocninae
 Crested Swift (*Hemiprocne longipennis*)
- Order-16
 Family .. Trogoniformes
 .. Trogonidae
 Malabar Trogon (*Harpactes fasciatus*)
- Order-17
 Family .. Coraciiformes
 .. Alcedinidae
 Lesser Pied Kingfisher (*Ceryle rudis*)
 Common Kingfisher (*Alcedo atthis*)
 Threetoed Kingfisher (*Ceyx erithacus*)
 Storkbilled Kingfisher (*Pelargopsis capensis*)
 Whitebreasted Kingfisher (*Halcyon smyrnensis*)
 Blackcapped Kingfisher (*Halcyon pileata*)
 Whitecollared Kingfisher (*Halcyon chloris*)

CHAPTER 5
Birds

- Family .. Meropidae
 European Bee-eater (*Merops apiaster*)
 Bluecheeked Bee-eater (*Merops superciliosus*)
 Bluetailed Bee-eater (*Merops philippinus*)
 Green Bee-eater (*Merops orientalis*)
 Bluebearded Bee-eater (*Nyctyornis athertoni*)
- Family .. Coraciidae
 European Roller (*Coracias garrulus*)
 Indian Roller (*Coracias benghalensis*)
- Family .. Upupidae
 Hoopoe (*Upupa epops*)
- Family .. Bucerotidae
 Common Grey Hornbill (*Tockus birostris*)
 Malabar Grey Hornbill (*Tockus griseus*)
 Malabar Pied Hornbill (*Anthracoceros coronatus*)
 Great Pied Hornbill (*Buceros bicornis*)
- Order-18
 Family .. Piciformes
 .. Capitonidae
 Green Barbet (*Megalaima zeylanica*)
 Small Green Barbet (*Megalaima viridis*)
 Crimsonthroated Barbet (*Megalaima rubricapilla*)
 Crimsonbreasted Barbet (*Megalaima haemacephala*)
- Family .. Picidae
 Wryneck (*Jynx torquilla*)
 Rufous Woodpecker (*Micropternus brachyurus*)
 Small Yellownaped Woodpecker (*Picus chlorolophus*)
 Lesser Goldenbacked Woodpecker (*Dinopium benghalense*)
 Indian Goldenbacked Threetoed Woodpecker (*Dinopium javanense*)
 Indian Great Black Woodpecker (*Dryocopus javensis*)
 Yellowfronted Pied Woodpecker (*Picoides mahrattensis*)
 Pigmy Woodpecker (*Picoides nanus*)
 Heartspotted Woodpecker (*Hemicircus canente*)
 Blackbacked Woodpecker (*Chrysocolaptes festivus*)
 Larger Goldenbacked Woodpecker (*Chrysocolaptes lucidus*)
- Order-19
 Family .. Passeriformes
 .. Pittidae
 Indian Pitta (*Pitta brachyura*)
- Family .. Alaudidae
 Redwinged Bush Lark (*Mirafra erythroptera*)
 Ashycrowned Finch-Lark (*Eremopterix grisea*)
 Rufoustailed Finch-Lark (*Ammomanes phoenicurus*)

CHAPTER 5

Birds

- Malabar Crested Lark (*Galerida malabarica*)
 Sykes's Crested Lark (*Galerida deva*)
 Eastern Skylark (*Alauda gulgula*)
- Family .. Hirundinidae
 Plain Sand Martin (*Riparia paludicola*)
 Dusky Crag Martin (*Hirundo concolor*)
 Swallow (*Hirundo rustica*)
 Wiretailed Swallow (*Hirundo smithii*)
 Indian Cliff Swallow (*Hirundo fluvicola*)
 Striated Swallow (*Hirundo daurica*)
 House Martin (*Delichon urbica*)
- Family .. Laniidae
 Grey Shrike (*Lanius excubitor*)
 Baybacked Shrike (*Lanius vittatus*)
 Redbacked Shrike (*Lanius collurio*)
 Rufousbacked Shrike (*Lanius schach*)
 Brown Shrike (*Lanius cristatus*)
- Family .. Oriolidae
 Oriole (*Oriolus oriolus*)
 Blacknaped Oriole (*Oriolus chinensis*)
 Blackheaded Oriole (*Oriolus xanthornus*)
- Family .. Dicruridae
 Black Drongo (*Dicrurus adsimilis*)
 Grey or Ashy Dronge (*Dicrurus leucophaeus*)
 Whitebellied Drongo (*Dicrurus caerulescens*)
 Bronzed Drongo (*Dicrurus aeneus*)
 Haircrested Drongo (*Dicrurus hottentottus*)
 Greater Racket-tailed Drongo (*Dicrurus paradiseus*)
- Family .. Artamidae
 Ashy Swallow Shrike (*Artamus fuscus*)
- Family .. Sturnidae
 Greyheaded Myna (*Sturnus malabaricus*)
 Blackheaded Myna (*Sturnus pagodarum*)
 Rosy Pastor (*Sturnus roseus*)
 Pied Myna (*Sturnus contra*)
 Common Myna (*Acridotheres tristis*)
 Bank Myna (*Acridotheres ginginianus*)
 Jungle Myna (*Acridotheres fuscus*)
 Grackle or Hill Myna (*Gracula religiosa*)
- Family .. Corvidae
 Indian Tree Pie (*Depdrocitta vagabunda*)
 House Crow (*Corvus splendens*)
 Jungle Crow (*Corvus macrorhynchos*)
- Family .. Bombycillidae

CHAPTER 5

Birds

- Sub-family .. Hypocoliinae
 Grey Hypocolius (*Hypocolius ampelinus*)
- Family .. Campephagidae
 Pied Flycatcher-Shrike (*Hemipus picatus*)
 Large Wood Shrike (*Tephrodornis virgatus*)
 Common Wood Shrike (*Tephrodornis pondicerianus*)
 Large Cuckoo-Shrike (*Coracina novaehollandiae*)
 Smaller Grey Cuckoo-Shrike (*Coracina melaschistos*)
 Blackheaded Cuckoo-Shrike (*Coracina melanoptera*)
 Scarlet Minivet (*Pericrocotus flammeus*)
 Small Minivet (*Pericrocotus cinnamomeus*)
 Whitebellied Minivet (*Pericrocotus erythropygius*)
 Ashy Minivet (*Pericrocotus divaricatus*)
- Family .. Irenidae
 Common Iora (*Aegithina tiphia*)
 Marshall's Iora (*Aegithina nigrolutea*)
 Goldfronted Chloropsis (*Chloropsis aurifrons*)
 Goldmantled Chloropsis (*Chloropsis cochinchinensis*)
 Fairy Bluebird (*Irena puella*)
- Family .. Pycnonotidae
 Redwhiskered Bulbul (*Pycnonotus jocosus*)
 Whitecheeked Bulbul (*Pycnonotus leucogenys*)
 Redvented Bulbul (*Pycnonotus cafer*)
 Whitebrowed Bulbul (*Pycnonotus luteolus*)
 Yellowbrowed Bulbul (*Hypsipetes indicus*)
 Black Bulbul (*Hypsipetes madagascariensis*)
- Family .. Muscicapidae
- Sub-family .. Timaliinae
 Spotted Babbler (*Pellorneum ruficeps*)
 Slatyheaded Scimitar Babbler (*Pomatorhinus schisticeps*)
 Rufousbellied Babbler (*Dumetia hyperythra*)
 Yelloweyed Babbler (*Chrysomma sinensis*)
 Common Babbler (*Turdoides caudatus*)
 Large Grey Babbler (*Turdoides malcolmi*)
 Rufous Babbler (*Turdoides subrufus*)
 Jungle Babbler (*Turdoides striatus*)
 Whiteheaded Babbler (*Turdoides affinis*)
 Quaker Babbler (*Alcippe poioicephala*)
- Sub-family .. Muscicapinae
 Rufoustailed Flycatcher (*Muscicapa ruficauda*)
 Redbreasted Flycatcher (*Muscicapa parva*)
 Whitebellied Blue Flycatcher (*Muscicapa pallipes*)
 Bluethroated Flycatcher (*Muscicapa rubeculoides*)
 Tickell's Blue Flycatcher (*Muscicapa tickelliae*)

CHAPTER 5

Birds

	Verditer Flycatcher (<i>Muscicapa thalassina</i>)
	Greyheaded Flycatcher (<i>Culicicapa ceylonensis</i>)
	Whitebrowed Fantail Flycatcher (<i>Rhipidura aureola</i>)
	Whitethroated Fantail Flycatcher (<i>Rhipidura albicollis</i>)
	Whitespotted Fantail Flycatcher (<i>Rhipidura albogularis</i>)
	Paradise Flycatcher (<i>Terpsiphone paradisi</i>)
	Blacknaped Flycatcher (<i>Monarcha azurea</i>)
Sub-family	.. Sylviinae
	Fantail Warbler (<i>Cisticola exilis</i>)
	Streaked Fantail Warbler (<i>Cisticola juncidis</i>)
	Franklin's Longtail Warbler (<i>Prinia hodgsonii</i>)
	Rufousfronted Longtail Warbler (<i>Prinia buchanani</i>)
	Plain Longtail Warbler (<i>Prinia subflava</i>)
	Ashy Longtail Warbler (<i>Prinia socialis</i>)
	Jungle Longtail Warbler (<i>Prinia sylvatica</i>)
	Tailor Bird (<i>Orthotomus sutorius</i>)
	Bristled Grass Warbler (<i>Chaetornis striatus</i>)
	Striated Marsh Warbler (<i>Megalurus palustris</i>)
	Thickbilled Warbler (<i>Phragamaticola aedon</i>)
	Indian Great Reed Warbler (<i>Acrocephalus stentoreus</i>)
	Blyth's Reed Warbler (<i>Acrocephalus dumetorum</i>)
	Paddyfield Warbler (<i>Acrocephalus agricola</i>)
	Booted Warbler (<i>Hippolais caligata</i>)
	Orphean Warbler (<i>Sylvia hortensis</i>)
	Whitethroat (<i>Sylvia communis</i>)
	Lesser Whitethroat (<i>Sylvia curruca</i>)
	Hume's Lesser Whitethroat (<i>Sylvia althaea</i>)
	Chiffchaff (<i>Phylloscopus collybita</i>)
	Tytler's Leaf Warbler (<i>Phylloscopus tytleri</i>)
	Tickell's Leaf Warbler (<i>Phylloscopus affinis</i>)
	Olivaceous Leaf Warbler (<i>Phylloscopus griseolus</i>)
	Yellowbrowed Leaf Warbler (<i>Phylloscopus inornatus</i>)
	Largebilled Leaf Warbler (<i>Phylloscopus magnirostris</i>)
	Dull Green Leaf Warbler (<i>Phylloscopus trochiloides</i>)
	Bright Green Leaf Warbler (<i>Phylloscopus nitidus</i>)
	Large Crowned Leaf Warbler (<i>Phylloscopus occipitalis</i>)
Sub-family	.. Turdinae
	Rubythroat (<i>Erithacus calliope</i>)
	Bluethroat (<i>Erithacus svecicus</i>)
	Blue Chat (<i>Erithacus brunneus</i>)
	Magpie-Robin (<i>Copsychus saularis</i>)
	Shama (<i>Copsychus malabaricus</i>)
	Black Redstart (<i>Phoenicurus ochruros</i>)
	Stone Chat (<i>Saxicola torquata</i>)
	Pied Bush Chat (<i>Saxicola caprata</i>)
	Desert Chat (<i>Oenanthe deserti</i>)

CHAPTER 5

Birds

	Pied Chat (<i>Oenanthe picata</i>)
	Indian Robin (<i>Saxicoloides fulcata</i>)
	Blueheaded Rock Thrush (<i>Monticola cinclorhynchus</i>)
	Blue Rock Thrush (<i>Monticola solitarius</i>)
	Malabar Whistling Thrush (<i>Myiophoneus horsfieldii</i>)
	Orangeheaded Ground Thrush (<i>Zoothera citrina</i>)
	Tickell's Thrush (<i>Turdus unicolor</i>)
	Blackbird (<i>Turdus merula</i>)
Family	.. Paridae
Sub-family	.. Parinae
	Grey Tit (<i>Parus major</i>)
	Blackspotted Yellow Tit (<i>Parus xanthogenys</i>)
Family	.. Sittidae
Sub-family	.. Sittinae
	Chestnutbellied Nuthatch (<i>Sitta castanea</i>)
	Velvetfronted Nuthatch (<i>Sitta frontalis</i>)
Sub-family	.. Salpornitinae
	Spotted Grey Creeper (<i>Salpornis spilonotus</i>)
Family	.. Motacillidae
	Hodgson's Tree Pipit (<i>Anthus hodgsoni</i>)
	Tree Pipit (<i>Anthus trivialis</i>)
	Paddyfield Pipit (<i>Anthus novaeseelandiae</i>)
	Tawny Pipit (<i>Anthus campestris</i>)
	Blyth's Pipit (<i>Anthus godlewskii</i>)
	Brown Rock Pipit (<i>Anthus similis</i>)
	Forest Wagtail (<i>Motacilla indica</i>)
	Yellow Wagtail (<i>Motacilla flava</i>)
	Yellowheaded Wagtail (<i>Motacilla citreola</i>)
	Grey Wagtail (<i>Motacilla caspica</i>)
	White Wagtail (<i>Motacilla alba</i>)
	Large Pied Wagtail (<i>Motacilla maderaspatensis</i>)
Family	.. Dicaeidae
	Thickbilled Flowerpecker (<i>Dicaeum agile</i>)
	Tickell's Flowerpecker (<i>Dicaeum erythrorhynchos</i>)
	Plaincoloured Flowerpecker (<i>Dicaeum concolor</i>)
Family	.. Nectariniidae
	Purplerumped Sunbird (<i>Nectarinia zeylonica</i>)
	Small Sunbird (<i>Nectarinia minima</i>)
	Loten's Sunbird (<i>Nectarinia lotenia</i>)
	Purple Sunbird (<i>Nectarinia asiatica</i>)
	Yellowbacked Sunbird (<i>Aethopyga siparaja</i>)
Family	.. Zosteropidae
	White-eye (<i>Zosterops palpebrosa</i>)

CHAPTER 5

Birds

Family	..	Ploceidae
Sub-family	..	Passerinae
		House Sparrow (<i>Passer domesticus</i>)
		Yellowthroated Sparrow (<i>Petronia xanthocollis</i>)
Sub-family	..	Ploceinae
		Baya (<i>Ploceus philippinus</i>)
		Blackthroated Weaver Bird (<i>Ploceus benghalensis</i>)
		Streaked Weaver Bird (<i>Ploceus manyar</i>)
Sub-family	..	Estrildinae
		Red Munia (<i>Estrilda amandava</i>)
		Green Munia (<i>Estrilda formosa</i>)
		Whitethroated Munia (<i>Lonchura malabarica</i>)
		Whitebacked Munia (<i>Lonchura striata</i>)
		Spotted Munia (<i>Lonchura punctulata</i>)
		Blackheaded Munia (<i>Lonchura malacca</i>)
Family	..	Fringillidae
Sub-family	..	Carduelinae
		Common Rosefinch (<i>Carpodacus erythrinus</i>)
Family	..	Emberizidae
		Blackheaded Bunting (<i>Emberiza melanocephala</i>)
		Redheaded Bunting (<i>Emberiza bruniceps</i>)
		Greynecked Bunting (<i>Emberiza buchanani</i>)
		Crested Bunting (<i>Melophus lathami</i>)

SHORT NOTES ON BIRDS UNDER 19 ORDERS

(1) *Order Podicipediformes*.—The Order Podicipediformes comprises several species of diving birds known as Grebes which have an almost world-wide distribution. In India we have only one genus comprising 3 species, of which 2 are found in Maharashtra. The rare migratory Blacknecked Grebe (*Podiceps nigricollis*) has been once observed near Poona, and the non-migratory species, the Little Grebe (*Podiceps ruficollis*) is common everywhere in the ponds and lakes of the State. The Little Grebe is a fresh-water bird, and is the only bird to be seen very often in a pond. It has a general duck-like appearance, but has a very short tail, and a short tapering bill. The feet are not webbed, but each toe is shaped like a leaf which helps the bird to propel itself through water. They breed during the monsoon, and build their nests on floating vegetation. Because it is an expert diver and disappears in the water for long periods it is locally named 'dubki'.

(2) *Order Procellariiformes*.—This order includes oceanic birds like Shearwaters, Petrels and Storm Petrels. All these are distinguished by their tubular nostrils and the three fully webbed front toes. They have long pointed wings, and are powerful fliers. Their colours are either black, grey or white. They feed mainly on fish.

CHAPTER 5

Birds

Two families occur in Maharashtra : (1) Procellariidae represented by Audubon's Shearwater *Procellaria lherminieri* and the Black Petrel *Bulweria aterrima*, and (2) Hydrobatidae represented by Wilson's Petrel *Oceanites oceanicus*, a specimen of which was obtained from Bombay harbour in 1947.

(3) *Order Pelecaniformes*.—This order comprises five families of fish-eating birds characterised by having four toes connected by a web. These birds have a world-wide distribution. Tropic birds and frigate birds are found only in tropical oceans while pelicans, cormorants and darters frequent inland waters.

Family Phaethontidae—Tropic birds : Three species have been recorded in India of which one is found in Maharashtra, namely the short-tailed tropic bird (*Phaethon aethereus*)—Tropic birds are seldom seen near the coast and are really wanderers of the high seas. They can hover motionless and then dive from great heights for fish and squid. Their nearest breeding ground in India is the Persian Gulf area. The long pointed wings and the two elongated tail feathers are diagnostic features. Their colours are mainly white and brown.

Family Pelecanidae—Pelicans : Pelicans are large swimming birds with an enormous pouch which is useful for catching fish in the water. In the wild state they are hardly ever seen in Maharashtra and have only once been recorded from Pandharpur, Sholapur District, in the cold weather.

Family Sulidae—Boobies : Boobies are large-sized birds with long bills, webbed feet and long wings. They are generally black and white in colour and their favourite haunts are rock cliffs along the sea coast. They are powerful fliers and can dive from a height of about 100 ft.

Only one straggler, the masked booby (*Sula dactylatra*) has been recorded in Maharashtra. This was at Nasik in 1958.

Family Phalacrocoracidae—Cormorants and Darter : This family is represented by four species in India and all these are resident in Maharashtra, namely the cormorants (*Phalacrocorax carbo*), the Indian Shag (*Phalacrocorax fuscicollis*), the little or pigmy cormorant (*Phalacrocorax niger*), and the darter (*Anhinga rufa*). These are aquatic birds living mainly on fish and are normally seen on lakes and rivers. They have long necks and bills and stiff rounded tails. They sometimes hunt in groups driving the fish before them and gulping them down when they are brought to bay. Surprisingly their loose plumage is not water repellant and often they come out of water to dry themselves. Their main colours are grey-black and white. Cormorants and the Indian shag have hooked beaks while the darter has a straight sharp beak. The darter is known as "the snake bird" because of its long neck which looks very much like a snake when the bird swims with its body submerged.

Family Fregatidae—Frigate Birds or “Man O’War Birds” : There is only one record of a frigate bird (*Fregata ariel*) from Maharashtra State in 1956. These birds inhabit tropical seas far away from land. They feed on flying fish and also parasitise on other sea-birds whom they chase and force to disgorge their food.

(4) Order Ciconiiformes.—Many species of birds of this Order are found all over Maharashtra State. These are mainly large birds with long necks and bills. Their legs are well adapted for wading and feeding in shallow water. The feet are webbed at the base of the three front toes; the hind toe is well developed and helps in perching on trees and among reed beds. The majority of these species breeds in colonies, except the bitterns and the little grey heron. They feed on molluscs, insects, frogs and fish. There are four families with 34 species of this Order occurring in India out of which 27 species are found in Maharashtra. All these are resident birds with the exception of the bittern (*Botaurus stellaris*), the white stork (*Ciconia ciconia*) and the black stork (*Ciconia nigra*).

Family Ardeidae—Herons, Bitterns and Egrets : These are gregarious birds, both during the breeding season as well as in winter. They frequent fresh water lakes, ponds and rivers, but the Indian reef heron (*Egretta gularis*) is found in tidal reefs and on rocks on the sea coast. Most of the bitterns are fond of marshes where they can conceal themselves well with the protective colouring of their plumage. Fourteen species of the Family Ardeidae are found in Maharashtra.

Family Ciconiidae—Storks : Out of the eight species of storks found in India, seven occur in Maharashtra. Storks have a very wide distribution in tropical as well as in temperate regions throughout the world. They are large birds with strong long legs and powerful bills. In Maharashtra the white stork and the black stork are migrants while the others are resident and breed in the State. Their nest is a massive structure of sticks and other material.

The openbill stork (*Anastomus oscitans*) is an interesting species found in Maharashtra. This bird has a prominent gap between its upper and lower mandibles which is visible from a distance. It is believed that the shape of the bill helps the bird in cracking the shells of snails which are its staple diet. These birds fly gracefully and effortlessly, ascending on thermal currents. Many of them have spectacular courtship dances.

Family Threskiornithidae—Ibises and Spoonbills : This family comprises four species divided into two groups, (1) Ibises with long downward curving bills, and (2) Spoonbills with spoon-shaped bills. The white ibis (*Threskiornis melanocephala*) is about the size of a domestic hen and has a naked black head and a slender black down-curved bill. The Spoonbill (*Platalea leucorodia*) is a large white heron—like bird with a flat bill.

Family Phoenicopteridae—Flamingos : Flamingos are large birds of spectacular beauty. When they fly in formation their snowwhite plumage suffused with pink, makes an unforgettable picture. The only breeding ground of the species in Asia is the Rann of Kutch. In the non-breeding season they have been observed in many areas of Maharashtra. Flamingos have a specially adapted bill which enables them to suck in tiny insects from the muddy water and the slush into which they delve their bills. Both species of flamingo (*Phoenicopterus roseus*) and the lesser flamingo (*Phoeniconaias minor*) have been recorded from Maharashtra State.

(5) Order Anseriformes—Family Anatidae—Ducks and Geese : Members of this family are found practically throughout the world. All have short legs and short broad and flat bills. The foot is four-toed, three in front being joined by a fully developed web. They all have efficient oil glands. The majority of these species breed on the ground, but some nest in hollow trees.

Ducks :—The sexes usually look different. The neck is short and the bill is broad and flat. After the breeding season the male assumes the colours of the female. Of the 43 species belonging to 17 genera listed from India, 17 species of 8 genera are found in Maharashtra. All are migratory except the lesser whistling teal (*Dendrocygna javanica*), the cotton teal (*Nettapus coromandelianus*), and the Nukhta or Comb Duck (*Sarkidiornis melanotos*).

Geese :—Both sexes look alike. They have comparatively long legs and the bill is high at the base.

These birds feed mainly on vegetable matter.

(6) Order Falconiformes.—The birds of prey have almost a world-wide distribution except in the Antarctic region and in some of the remote oceanic islands. Their principal features are the strong hooked bill, strong feet with three toes in front and one behind, all with powerful claws, and large wings for fast sustained flight. Being diurnal carnivorous birds, their eyes are very well adapted for acute vision. Their coloration consists of various shades of grey, brown and black. In the majority of the species, the female is considerably larger than the male. Their habitat is extremely varied from dry open country to dense, deep forest.

Falcons and hawks form two important groups of this order. In the falcon there is a well marked notch on the lower edge of the upper mandible and its tarsus is short and naked, and it has more sharply pointed wings than those of the hawk. Of the 63 species listed in India 42 are found in Maharashtra, 19 of these being migratory.

Family Accipitridae—Hawks and Vultures : 34 species found in the State, consist of a wide assortment of birds. The blackwinged kite (*Elanus caeruleus*), the common pariah kite (*Milvus migrans*), and the Brahminy Kite (*Haliastur indus*) are found around our villages, towns and cultivated lands.

CHAPTER 5

Birds

The shikra (*Accipiter badius*) is a well known resident species and is found in most parts of Maharashtra. The sparrow hawk (*Accipiter nisus*) is a winter migrant recorded occasionally from the Deccan and Thana.

Eagles generally capture their prey alive while vultures feed on dead bodies. A common resident species on the west coast of Maharashtra is the whitebellied sea-eagle (*Haliaeetus leucogaster*). When viewed from below it is snow-white except for a broad black border of the wings and tail. In flight, it holds the wings like a flat 'V' and its local name 'Kakan' is based on the fact that it calls 'kak-kak-kak', particularly during mating.

Five species of vultures have been recorded from the State and all except *Gyps fulvus* are resident. The whitebacked vulture (*Gyps bengalensis*) and the Egyptian or Scavenger Vulture (*Neophron percnopterus*) play a valuable part as scavengers.

The pale harrier (*Circus macrourus*), the Montagu's harrier (*Circus pygargus*), the pied harrier (*Circus melanoleucos*) and the marsh harrier (*Circus aeruginosus*) are common winter visitors recorded from many districts of Maharashtra. The marsh harrier, as its name suggests, mainly found near water.

The osprey (*Pandion haliaetus*) is a fish-eating species and the only member of its genus which is a winter migrant to Maharashtra.

Family Falconidae : Eight species of falcons are known to occur in Maharashtra State. These include the lanner falcon (*Falco biarmicus*), the shahin (*Falco peregrinus peregrinator*), the peregrine (*Falco peregrinus japonensis*), the redheaded merlin (*Falco chicquera*), the redlegged falcon (*Falco vespertinus*), the kestrel (*Falco tinnunculus*), and the lesser kestrel (*Falco naumanni*). All these are winter visitors.

(7) Order Galliformes.—Two families of this order, Family Phasianidae, are found all over the world, characterised by their compact plump form and terrestrial habits. They have short rounded wings, featherless sturdy tarsi adapted for scratching the soil for grains, seeds, roots and insects. Many of these species are polygamous and the male usually has highly developed secondary sexual characters such as gaudy combs and crests. The hen is soberly coloured and is very productive of eggs. The eggs are laid on the ground without any nest and the young are able to run about almost immediately after hatching. Many of these forms lend themselves to domestication and they are good as food.

Family Phasianidae—Pheasants, Junglefowl, Partridges, Quails : 13 species occur in the State and except the Common Quail (*Coturnix coturnix*) all are resident.

The painted partridge (*Francolinus pictus*) and the grey partridge (*Francolinus pondicerianus*), both good sporting birds, are common in Maharashtra. The former is found near well watered areas while

CHAPTER 5

Birds

the latter prefers dry open ground and thorny scrub country. Their calls can be heard from a long distance and are a delight of the countryside.

Quails are much smaller birds than partridges. They are brown and grey closely barred and vermiculated. They inhabit grasslands, standing crops and scrub jungle throughout the State. The painted bush quail (*Perdica erythrorhyncha*) is found only in Peninsular India and is rather rare.

The red junglefowl (*Gallus gallus*), the ancestor of the domestic poultry, has been reported from Khandala and areas around Bombay. The grey junglefowl (*Gallus sonneratii*) has been recorded from forests throughout the State.

The Peacock (*Pavo cristatus*) is the 'National Bird' of India. It is polygamous and two to five females often accompany a male. They were once quite common throughout the forests of the State but their numbers have now been considerably reduced, and they have disappeared from many forest areas.

(8) Order Gruiformes.—The Order Gruiformes includes a heterogeneous group of terrestrial and water birds.

Family Turnicidae.—Button—and Bustard—Quail : These birds are found in temperate as well as tropical regions of the whole world and are similar in habit and coloration to the true quails but lack the hind toe. The richly coloured female is polyandrous and is aggressive during courtship. When a clutch is completed the male incubates the eggs and rears the young while the female proceeds to pair with another male.

Three species occur in Maharashtra. The little bustard quail (*Turnix sylvatica*) occupies grassland and plains and can be differentiated from the common bustard-quail (*Turnix suscitator*) by the absence of a black breast band. The button quail (*Turnix tanki*) is found in grassland and scrub areas and is the largest member of this family.

Family Gruidae—Cranes : These are among the largest birds in India and inhabit marshes and plains, being particularly fond of rice fields. Of the six species found in India three are recorded from Maharashtra and two of these are winter visitors. The common crane (*Grus grus*) and the Demoiselle crane (*Anthropoides virgo*) are winter visitors and the Sarus crane (*Grus antigone*) is a straggler in Maharashtra, but breeds commonly in Gujarat.

Cranes are gregarious birds and after the breeding season migrate vast distances.

Family Rallidae—Rails, Crakes and Coots : In general the rails are of brownish colour and small in size, but a few are bright green or purple and fairly large. With the exception of coots (*Fulica atra*) and moorhen (*Gallinula chloropus*) the other species of this Family are

very secretive. Many rails are crepuscular and active at night. In spite of the fact that their flight is weak, they migrate long distances. The nest is usually built of marsh vegetation by both sexes and both parents share domestic duties.

Except the Baillon's crake (*Porzana pusilla*) and the spotted crake (*Porzana porzana*), the other species are resident and breed in during the monsoon.

The bluebreasted banded rail (*Rallus striatus*) has been recorded as nesting from the Bombay area. The Indian banded crake (*Rallina eurizonoides*), the ruddy crake (*Amaurornis fuscus*), the brown crake (*Amaurornis akool*) and the whitebreasted waterhen (*Amaurornis phoenicurus*) are commonly seen in reeds and marsh land, while the water cock (*Gallicrex cinerea*) the moorhen (*Gallinula chloropus*) and the purple moorhen (*Porphyrio porphyrio*), as well as the coot are commonly seen in village tanks.

Family Otididae—Bustards : Two species of this Family, the great Indian bustard (*Choriotis nigripes*) and the lesser florican (*Sypheotides indica*) are found in Maharashtra. The great Indian bustard, a large handsome bird, is unfortunately in danger of becoming extinct. It inhabits bare open plains and breeds from July to September. It was found throughout the State thirty years ago, but recently has been recorded from very few areas in Maharashtra. These birds are polygamous.

The lesser florican is also a resident and is found in drier parts of Maharashtra. In the male, the head, neck and underparts are glossy velvet black contrasting sharply with the white wing coverts. The female is streaked with brown and buff.

(9) Order Charadriiformes.—Charadriiformes is an Order consisting of ten Families, birds varying in size from small to fairly large. Of the 152 species of this Order recorded in India, 66 occur in Maharashtra. These birds mainly live on the ground near water, and though they often have webbed feet, the hind toe is absent.

Family Jacanidae—Jacanas : The jacanas or lily-trotters have a world wide distribution. In Maharashtra they are commonly found in tanks, ponds and jheels, either as residents or as local migrants.

The pheasant-tailed jacana (*Hydrophasianus chirurgus*) is a beautiful bird with a conspicuous long tail, and brown and white coloration, with golden yellow on the hind neck during the breeding season. The bronzewinged jacana (*Metopidius indicus*) is slightly smaller and less common than its cousin. It is not as handsome as the pheasant-tailed jacana, but can be easily identified by its greenish bronze coloration and the white eyebrows. Both the jacanas nest on floating vegetation on which they can walk with ease aided by their four long toes. Jacanas feed on aquatic insects, molluscs, etc. and the females are believed to be polyandrous.

Family Haematopodidae—Oystercatchers : Of the two species in India, *Haematopus ostralegus* is recorded from Maharashtra. This black-and-white shore bird has a prominent red bill and red legs. It feeds on sand worms, crabs, snails, bi-valves etc. and is a cold weather visitor to Maharashtra ; seen along the sea coast.

Family Charadriidae —

Subfamily Charadriinae—Plovers

Subfamily Scolopacinae—Curlew, Whimbrel, Godwit

Subfamily Phalaropinae—

Of the 67 species recorded in India 34 occur in Maharashtra and these have been subdivided into three subfamilies as above.

The redwattled lapwing (*Vanellus indicus*) is one of the commonest of the four lapwings seen in Maharashtra. This brown and white bird has long legs and a crimson wattle, the throat and crown are black. It is common in open country near water and lays its eggs in scrapes or natural depressions on ground. The nest is very difficult to locate because the eggs match the colour of the surroundings. Its loud call 'did he do it' often indicates the presence of the bird in the countryside.

Maharashtra has seven species of migratory plovers belonging to the genus *Pluvialis*. They frequent mudflats and saltpans, river banks and sea-shores, feeding on insect larvae and crustaceans of many kinds. A typical example of this subfamily is the eastern golden plover (*Pluvialis dominica*) with a thick head, large eyes and a stout bill. The plumage is mottled white brown and golden yellow above. It is found in Maharashtra between August and May. Its breeding grounds are in Siberia.

The lesser sand plover (*Charadrius mongolus*) is another wader found along beaches, mudflats and creeks, in many parts of the State. In its winter plumage the bird is ashy-brown and fulvous above and white tinged with rufous below. It has a black bill and greenish grey legs.

A slightly smaller bird of the same Subfamily is the little ringed plover (*Charadrius dubius*). Its white forehead, white neck with a prominent black colour are good identification marks. One of the large members of Charadriidae family are whimbrels and curlews which are of the size of a domestic hen, but with very large downcurved bills. The whimbrel (*Numenius phaeopus*) and the curlew (*Numenius arquata*) are found along the sea coast and tidal creeks. They are good sporting birds and have been greatly persecuted. The whimbrel is slightly smaller than the curlew with a pale coronal band which the curlew lacks.

The redshank (*Tringa totanus*) and greenshank (*Tringa nebularia*) are rather similar looking water birds found in the same kind of locality. The redshank has red legs and white rump while the greenshank which is slightly larger has olive grey legs and its bill is slightly up-curved.

CHAPTER 5
Birds

Perhaps the commonest among the Charadriidae is the sandpiper (*Tringa hypoleucos*). This olive-brown bird with white underparts constantly bobs its body up and down. It flies close to the water on stiffly held wings and has a prominent white wing-bar which can be seen in flight.

The green sandpiper (*Tringa ochropus*) and the wood or spotted sandpiper (*Tringa glareola*) are less common.

There are seven species of snipes in India and four of these (namely wood, common, pintail and jack snipe) occur in Maharashtra. Like the woodcock they have long bills and their eyes are placed far back on the head.

The common fantail snipe (*Capella gallinago*) is dark-brown with a fulvous edge to the feathers. It has a prominent pale rufous line on the head as well as prominent eyebrows of the same colour. It is a common cold weather visitor frequenting marshes and mud-flats. It breeds in northern and central Europe and is recorded from many districts in Maharashtra.

The pintail snipe (*Capella stenura*) differs from the foregoing species in having 26 or 28 attenuated pin feathers as against 14 in the fantail snipe. It frequents the same type of country as the other species.

The stints which are slightly bigger than sparrows are found in large groups along sea shores and tidal creeks. Their colours are rufous brown and white and it is not always easy to distinguish the little stint (*Calidris minutus*) from Temminck's stint (*Calidris temminckii*). The latter has white outer tail feathers as against the completely black tail of the former.

The ruff—the female being known as reeve—(*Philomachus pugnax*) is a common winter visitor to Maharashtra. It is slightly larger than the common sandpiper and its plumage is brown mottled with black and buff above and on the breast, the lower plumage is white. It has spectacular courtship displays, the courting males gather together in traditional arenas to jump, flap their wings and spar. They are not very common in the State.

Family Rostratulidae : This family is represented by a single species, the painted snipe (*Rostratula benghalensis*). This is fairly common in Maharashtra and its long bill and conspicuous white ring round the eye make it easy to identify. The upper plumage is metallic olive green with buff and blackish streaks; the lower plumage is brown and white. It feeds on small invertebrates, grains and shoots. It builds its nest on the ground.

Family Recurvirostridae : This family includes the Blackwinged Stilt (*Himantopus himantopus*) and Avocet (*Recurvirostra avosatta*). Both these species are seen in swamps, mud-flats and creeks in various parts of the State. The Stilt is a black and white bird with conspicuously long red legs and the Avocet is coloured black and white and can be

CHAPTER 5
Birds

recognised by its prominently up-curved bill. The Avocet skims the surface of water for small crustaceans, worms, etc.

Family Dromadidae : This family is represented by a single species the Crab Plover (*Dromas ardeola*). This bird is black and white with a white head, neck and underparts, and a black back and bill, and grey-white legs. It is found commonly in the islands on the northern part of the Indian Ocean and the coast of North-East Africa and the Persian Gulf. It has been recorded from Kolaba District in Maharashtra.

Family Burhinidae : This family comprises the odd-looking Stone Curlews. Two species occur in India of which one is resident in Maharashtra. The Indian Stone Curlew (*Burhinus oedicnemus*) is an ashy brown bird with eyes having bright yellow iris surrounded by a broad white ring of feathers. The legs are greenish yellow and the bird is only 3-toed. It is found in dry country and in sandy river beds. Its food consists of insects, worms, snails and frogs and it has been recorded from several areas of Maharashtra.

Family Glareolidae : This family consists of Coursers and Pratincoles. Of the six species in India, three occur in Maharashtra.

The Indian Courser (*Cursorius coromandelicus*) is about the size of our Common Myna. It is ashy-brown above with a rich rufous crown and a prominent white and black stripe through and over eyes. It has only three toes and its general appearance reminds one of a Lapwing in the field. This bird is fairly common in Maharashtra. Except for the fact that it has only one white stripe down the neck instead of two, it looks very similar to the Jerdon's or Doublebanded Courser (*Cursorius bitorquatus*), which has become extinct in India.

The Collared Pratincole (*Glareola pratincola*) is a swallow-like plover, olive-brown above, pale rufous and white below. A black line runs from behind the eyes across the breast forming a narrow gorget. It has a white rump and long pointed wings. The bill and the tail are short. It flies in the manner of a swallow and runs like a plover on land. It inhabits thin scrub grassland and cultivated fields. It breeds in Sind in West Pakistan and has been recorded as a straggler in Ratnagiri District. One was also shot at Bhayander in the Thana District.

Family Stercorariidae : Skuas and Jaegers. Four species are recorded in India. These oceanic birds obtain most of their food by chasing gulls and making them disgorge their catch which is then caught in the air. A specimen of the Antarctic Skua (*Catharacta skua lönnbergi*) was picked up on the Malvan Coast of Ratnagiri District.

Family Laridae : Gulls and Terns. This family consists of many species of Gulls and Terns and of the 36 species found in India 19 occur in Maharashtra. One of the commonest is the Blackheaded Gull (*Larus ridibundus*) which is seen along our sea-coast and in the harbours.

CHAPTER 5

Birds

in mixed flocks with other Gulls picking up wastes thrown into the water from ships. A black patch above the ear covers makes it easy to identify the bird. A similar looking, though somewhat smaller, bird is the Brownheaded Gull (*Larus brunnicephalus*) which is found in the same kind of habitat as the Blackheaded Gull. The Great Black-headed Gull (*Larus ichthyæetus*) is larger than the foregoing species.

The Indian Skimmer (*Rynchops albicollis*) is rather an odd-looking waterbird. It is black and white and brown in colour and can be recognised by its scissors-shaped orange-red bill. The knife-like lower mandible projects beyond the upper and this rare Tern-like bird feeds mainly at twilight flying over the water with an open bill so that the lower mandible ploughs through the water. In this way it catches insects and small fish from the surface, while entirely on the wings.

The Whiskered Tern (*Chlidonias hybrida*) is a fairly common winter visitor. Its main colours are ashy-grey and white with some black behind the top of the head. In summer it wears a black cap and frequents tanks, marshes and creeks. It feeds on fish, tadpoles, etc.

The Little Tern (*Sterna albifrons*) is the smallest member of the Tern family. It is grey above, white below and has orange yellow bill, legs and feet. The crown and the nape are black. Apart from migrants which come to Maharashtra in winter, the species was found nesting on the islet of Uttan Washi in the north-west of Greater Bombay.

The Indian River Tern (*Sterna aurantia*) has a black head, pale grey upper parts and white lower parts. It is fairly common throughout the State, except in the Deccan. A few birds apparently nest in the State.

The Gullbilled Tern (*Gelochelidon nilotica*) is a grey white bird distinguished by its black bill, legs and feet. It frequents creeks, mudflats and sea-shores. It is a common winter visitor to Maharashtra and breeds in colonies in Europe.

(10) *Order Columbiformes*.—This order consists of two families, Pteroclididae and Columbidae i.e. Sandgrouse and Pigeons and Doves.

Family Pteroclididae : Sandgrouse are game birds found chiefly in Asia and Africa. They are of the size of pigeons, but have short legs with three front toes partly united. They are gregarious and terrestrial, and are found in steppes and deserts and feed mainly on seeds.

The Common Sandgrouse *Pterocles exustus* is a brown and yellow bird and the male has a chocolate abdomen. These birds are found in open country and avoid hilly districts, swamps and forests.

The Painted Sandgrouse *Pterocles indicus* is a colourful bird. The breast is chocolate coloured with white bands and general plumage is barred with grey, buff, white and yellow. It is fond of scanty jungle and is a resident species.

CHAPTER 5

Birds

Family Columbidae : Pigeons and Doves form a very large family, having nearly 289 species throughout the world. Of these 36 are found in India and 15 have been recorded from Maharashtra.

Many varieties of Pigeons have been bred from the original parental stock of the Common Rock Pigeon *Columba livia*. Pigeons are reputedly monogamous, both sexes take part in nest building, incubation and feeding the young. The young are fed in the initial stages while they are in the nest by a regurgitated substance called "pigeon's milk" secreted by the parents. Adults live on fruits and seeds.

The grey-fronted green pigeon *Treron pompadora*, the Orange-breasted Green Pigeon *Treron bicincta* and the Green Pigeon *Treron phoenicoptera* are all classed as Green Pigeons. They have beautiful plumages of soft green colours and are very partial to banian and peepal trees. None of these green pigeons are very common.

Two species of Imperial Pigeons are found in the State, the Green Imperial Pigeon *Ducula aenea* and the Imperial Pigeon *D. badia*. Both these birds are entirely frugivorous and frequent evergreen forests. They are rather rare species.

The Blue Rock Pigeon *Columba livia* is common everywhere both in urban and rural areas. The Nilgiri Wood Pigeon *Columba elphinstonii* is found in forested areas and is common in Mahabaleshwar.

Doves mostly feed on the ground and their predominant colours are grey and buff. The Little Brown Dove *Streptopelia senegalensis* is a good representative of the whole group. The Emerald Dove *Chalcophaps indica* is a brightly coloured bird with metallic bronze green upper plumage. The head, neck and underparts are lilac and pinkish grey. This species is found in humid evergreen forest. It is very fond of termites and thus plays an important part in keeping this pest under control.

(11) *Order Psittaciformes*.—Parrots are a well defined Order of tropical birds containing over 300 species. India has no true parrots but has 14 species of parakeets and five of these are found in Maharashtra. They are popular cage birds.

The birds of this order have zygodactyle type of feet with the first and the fourth toes turned permanently backward. They live on nuts, and fruits and can do a great deal of damage to agriculture. A special type of hinge at the base of their skull enables them to move the upper mandible and to crush extremely hard objects easily. They nest in natural holes in trees, walls and other places. They are extremely noisy and outside the breeding season congregate in vast flocks which have their favourite roosting sites.

The largest parakeet in India is the Alexandrine Parakeet *Psittacula eupatria* named after Alexander the Great, who is supposed to have taken these birds from India. The male of this species has a prominent red patch on the wings and a pink and black collar. The female lacks

these adornments. This species is not uncommon along the Vindhya Range but it does not occur in the Deccan.

The Rose-ringed Parakeet *P. krameri* is our commonest parakeet and a lively little bird affecting both thin forest and cultivation. As in the former species the male has a rosy and black collar while the female is plain green. Both sexes have pale yellow beaks.

The Blue-winged Parakeet, *P. columboides* is fairly common in the evergreen forests of the Western Ghats. The Indian Lorikeet, *Loriculus vernalis* is the smallest member of this family being the size of a house sparrow. This bird has a brushlike tongue which enables it to feed on the nectar of flowers, and it plays an important part in cross pollination of flowers. It sleeps hanging head downwards like a bat and is a cold weather visitor to Maharashtra.

(12) Order Cuculiformes.—This Order includes 147 species of Cuckoos some of which are parasitic and some non-parasitic. The Ethiopian and Oriental Regions have the largest numbers. Most of them are coloured in shades of grey, brown and black.

The common Hawk Cuckoo *Cuculus varius* parasitises on babblers. Its loud piercing call sounds like 'brain fever' and the general coloration and appearance of the bird make it look like a hawk. Many small birds move away at the approach of the Common Hawk Cuckoo and the female thus gets an opportunity to deposit her eggs in the nests of the host.

The Drongo Cuckoo *Surniculus lugubris* is of the same size as the Black Drongo, for which it is liable to be mistaken, but it has a short tail and flies like a cuckoo. It is found in well wooded country.

The Plaintive Cuckoo *Cacomantis merulinus* which is a common bird of the Deccan lays its eggs in the nests of tailor birds and ashy wren warblers. Some plaintive Cuckoos also produce eggs that match very closely the eggs of the host birds.

The Pied Crested Cuckoo *Clamator jacobinus* is a regular visitor to western India just prior to the monsoon and lays its eggs in the nests of several species of babblers.

The Koel *Eudynamis scolopacea* is a familiar bird of our gardens. The male is jet black while the female is barred brown and white and lays her eggs in the nests of house crows and jungle crows. They call loudly in the hot weather.

The Green-billed Malkoha *Rhophodytes viridirostris*, the Sirkeer cuckoo *Taccocua leschenaulti* and the Crow Pheasant *Centropus sinensis* all belong to the non-parasitic group of cuckoos. The Malkoha is a forest loving bird coloured olive grey; the Sirkeer Cuckoo is an earthy brown and green bird found in scrub jungle and forests of the Deccan; the Crow Pheasant may be seen everywhere. The Crow Pheasant feeds on small vertebrates and is a great destroyer of young birds and eggs.

(13) Order Strigiformes—Family Strigidae : Of the 150 living species of owls 28 are found in India and 15 in Maharashtra. Owls have short parrot-like beaks, large eyes projecting forward and uncommonly well developed ears. They are carnivorous and mainly nocturnal and live on insects, fish, amphibians, small mammals and birds. Their soft plumage enables them to fly noiselessly and pounce upon their unsuspecting prey. Some owls like the Hawk Owl hunt by day. Most owls have round faces except the Barn Owl. Owls nest in the deserted nests of other birds or cavities in trees, cliffs and ruined buildings. Many species prefer to live near human habitations. The Barn Owl is rather different looking from other owls in that it has a heart-shaped face instead of the round face of the others. It lacks the tufted ear-like feathers and has relatively long legs and feathered toes. Since this bird feeds solely on rats and mice which do so much damage to agriculture it plays a very useful role in checking the numbers of rodents.

Subfamily Striginae : : The Scops Owls are small birds about the size of a myna. They have a world-wide distribution and three species are found in Maharashtra, including one migratory species, the Striated Scops owl *Otus brucei*. These birds feed on insects, small mammals and birds. The specific name *brucei* was given after the Rev. H. Bruce who obtained the first specimens recorded from Poona, Khandala and the Deccan.

The Great Horned Owl *Bubo bubo* is a forest species and breeds in caves near rivers and the banks of streams. The forest Eagle Owl *Bubo nipalensis* slightly smaller than the former is also primarily a forest bird. The Dusky Horned Owl *Bubo coromandus* is greyish brown and about the same size as *B. nipalensis*. The Brown Fish Owl *Bubo zeylonensis* can be recognised by its bare unfeathered legs. It has been recorded from several parts of Maharashtra State but is nowhere common.

The Spotted Owlet *Athene brama* is a very common species and lives around human habitations. The Jungle Owlet *Glaucidium radiatum* is heavily barred in front and the forest spotted owlet *Athene blewitti* is rather similar in appearance to the spotted owlet. It is a very rare bird. It has been recorded from Khandesh but there have been no recent reports about its occurrence.

The Mottled Wood Owl *Strix ocellata* and the slightly larger brown wood Owl *Strix leptogrammica* are found in forests in well wooded country. The Short-eared Owl *Asio flammeus* is a winter migrant to Maharashtra.

(14) Order Caprimulgiformes.—Nightjars are Crepuscular and nocturnal and are found singly or in pairs in scrub country. They inhabit the warmer regions of the world and produce a "cherring" call note from which they get their name 'nightjar'. During the day

CHAPTER 5

Birds

the birds sit quietly on the ground and their protective coloration matching the shades of dry fallen leaves makes them invisible. They fly silently and have an enormous gape which enables them to hawk insects. Of the seven species recorded in India six occur in Maharashtra.

The Common Nightjar *Caprimulgus asiaticus* is about the size of a myna. Its plumage is a rich mixture of yellow, grey, brown, black and fulvous; white patches on the wing show up well in flight. This bird is found in scrub country in light jungle and in compounds and is a resident species. The Indian Jungle Nightjar *C. indicus* is not very common except in the hilly area of the Deccan and the European Nightjar *C. europaeus* is a migrant. The Syke's Nightjar *C. mahrattensis* and Franklin's Nightjar *C. affinis* are frequently found in the wooded areas of the Deccan.

(15) *Order Apodiformes*.—Due to their superficial resemblance Swifts are often confused with Swallows, but they are quite unrelated. In Swifts all the four toes are turned forwards and the feet are so weak that unlike Swallows they cannot perch on telegraph wires. They are highly gregarious birds and they live mostly on the wing. Capturing insects, bathing, copulating and even collecting nesting material is done in the air. They are usually sooty or brown in colour with white or pale-green markings on the thorax, rump and tail. The mouth opens widely and helps the bird to capture many insects at a time. The tail takes many forms and can be either deeply forked, soft-tipped or with needle like spines. Unlike Swallows, Swifts do not close their wings at the side with every stroke. They only whip the air rapidly with the points of their wings which are always extended and curved evenly over the whole length like a bow. The nests are built of feathers, fibres, moss and even pure saliva and are attached to vertical surfaces of walls, cliffs, hollow trees and rock ledges. The young are hatched naked and remain in the nest for exceptionally long periods, sometimes up to six weeks. Of the 14 species recorded in India, six are found in Maharashtra.

Subfamily Apodinae : Birds of this family have very highly developed salivary glands which become particularly active during the breeding season. In one group of Swiftlets, (*Collocalia*) the saliva is used as material for nest construction and it is from this that bird-nest soup is made. In Maharashtra the Malayasian Edible Swift nest Swiftlet (*Collocalia fuciphaga*) breeds at Vengurla and Malvan in the Ratnagiri District.

The Alpine Swift (*Apus melba*) is one of the fastest birds and reaches a speed of about 150 miles per hour. It is a brown bird with white underparts and is occasionally seen in hilly areas.

The large White-rumped Swift (*Apus pacificus*) is a migratory species with a deeply forked tail. The House Swift (*Apus affinis*) is

CHAPTER 5

Birds

found near human habitations and is common everywhere in Maharashtra.

The Palm Swift (*Cypsiurus parvus*) builds its nest on the underside of a palm fronds usually Palmyra Palm. It is one of the smallest birds of the Swift family.

Subfamily Hemiprocninae : The Crested or Tree Swift *Hemiprocne longipennis* is the only member of the Apodidae which is able to perch on a tree as the toes are suitably formed for this purpose. The nest is made along a horizontal branch of a tree.

(16) *Order Trogoniformes*.—The family Trogonidae consists of 34 species of gorgeously coloured birds. Trogons are unique in that their inner toe is also turned backward. They are primarily forest dwelling birds. Their distribution is discontinuous for they are found on the west side of the Indian Subcontinent and then again in Nepal, Sikkim and Bhutan, but nowhere in between.

Of the three species occurring in India only one occurs in Maharashtra. The Malabar Trogon (*Harpactes fasciatus*) is about the size of a myna and in the male the head, neck and breast are blackish brown, and the underparts are a bright pink. They feed on insects.

(17) *Order Coraciiformes*.—This order consists of a variety of birds including hoopoes, bee-eaters, hornbills, kingfishers and rollers.

Of the thirty species found in India, 19 occur in Maharashtra. The characteristic of this Order is that the second, third and fourth toes are united together to some extent.

Family Alcedinidae : The Indian Pied Kingfisher (*Ceryle rudis*) is a black and white bird slightly bigger than a myna, commonly found along river banks and inland estuaries. It hovers over the water and plunges down when a fish is sighted. The common Kingfisher (*Alcedo atthis*) is found along our sea-coast, village ponds and on rivers. It perches on overhanging branches or on a stump or boulder in the water and dives after its prey.

The Three-toed Kingfisher (*Ceyx erithacus*) is the smallest Kingfisher and a forest species. It is generally found along the banks of mountain streams.

The Stork-billed Kingfisher (*Pelargopsis capensis*) has a prominently large bill and is the largest Kingfisher of Maharashtra State. It lives on crabs, frogs and small reptiles. It breeds in shady areas near streams and rivers. Barnes considered it to be a straggler in the Deccan.

The White-breasted Kingfisher (*Halcyon smyrnensis*) is easily the commonest member of this family, being seen in all localities from the sea coast to the interior.

The Blackcapped Kingfisher (*Halcyon pileata*) is one of the most beautiful of our birds and is occasionally seen near the sea coast and tidal rivers. The White-collared Kingfisher (*Halcyon chloris*) is a very rare bird having been recorded only once from Ratnagiri in 1878.

CHAPTER 5

Birds

Family Meropidae : Bee-eaters can be easily identified by their predominantly green colour and their projecting central tail feathers. They fly with rapid wing strokes and then glide gracefully and return again and again to the same perch from which they sally out after winged prey. Many are seasonal migrants and they nest in holes in mud-bank and on the sea-shore. One of the commonest of this family is the Common Bee-eater (*Merops orientalis*). The European Bee-eater (*Merops apiaster*) and the Blue-checked Bee-eater (*Merops superciliosus*) are winter migrants. The Bluetailed Bee-eater (*Merops philippinus*) though a resident, occurs sparingly in dry open country. Blue-bearded Bee-eater (*Nyctyornis athertoni*) is found in evergreen forests of western ghats and its breeding season is from February to August.

Family Coraciidae : Rollers are brilliantly coloured, blue and green Jay like birds. The sexes are similar and during the breeding season they roll and somersault in the air and it is from this that they get their name. During flight the bright varied colours of the wings attract attention. Of the three species in India two are recorded in Maharashtra. The European Roller (*Coracias garrulus*) is a winter visitor and it can be distinguished from the resident Indian Blue Jay or Roller (*Coracias benghalensis*) by the latter's blue underparts as distinguished from the brown underparts of the visitor. The blue-black wings of the Indian Roller are also more colourful. The Indian Roller nests in cavities in trees from March to July and has been recorded from Satara, Poona and Greater Bombay.

Family Upupidae : The Hoopoe (*Upupa epops*) is the only member of this family and is a beautiful fawn coloured bird with a prominent crest, black-and-white wings, and a long curved bill. It probes the earth for worms, spiders, crickets, etc. and breeds in cavities in trees and walls. The European Hoopoe is a common cold weather visitor, and has been recorded from Greater Bombay and the Kolaba District.

Family Bucerotidae : There are about 45 species of Hornbills in the Ethiopian and Oriental regions, and they have extraordinary nesting habits. Of the eight species found in India, four occur in Maharashtra. Hornbills are reputed to mate for life, and they make interesting and amusing pets. During the breeding season the female with the eggs she has laid is imprisoned inside the nest which is sealed up for a period of from one to four months except for a slit used by the male to feed the female. This ensures that the female and the young are protected from predators, but the male has to work very hard to keep the family supplied with food. Though Hornbills are frugivorous birds, some species have been observed eating lizards and snakes.

The Common Grey Hornbill (*Tockus birostris*) is a grey coloured bird found in dry deciduous forest. It breeds from March to June. Another Common species is the Malabar Grey Hornbill (*Tockus griseus*), it has no casque above its bill and occurs in areas where there is heavy rain fall in the Western Ghats.

CHAPTER 5

Birds

A larger bird is the Malabar Pied Hornbill (*Anthraceros coronatus*) which has black upper parts and white lower parts, the tail being all white. It is found in the Western Ghats right down to Ceylon. The largest of the Hornbills in Maharashtra is the Great Pied Hornbill (*Buceros bicornis*) which is as large as a vulture and like the former is predominantly black and white bird. It has a yellow bill and is found in the dense evergreen forests of the Western Ghats.

(18) Order Piciformes.—This Order comprises Barbets, Honeyguides and Woodpeckers divided into three families. Only one family (Indicatoridae) is not represented in Maharashtra. Maharashtra has fifteen representatives of the forty-four species occurring in India.

Family Capitonidae : Barbets are small to medium sized birds with green predominating in their plumage. They have heavy thick beak and zygodactyl feet. They are frugivorous birds and are entirely arboreal. Four species are found in Maharashtra, the Green Barbet (*Megalaima zeylanica*), the small green Barbet (*Megalaima viridis*), the Crimson-throated Barbet (*Megalaima rubricapilla*) and the Crimson-breasted Barbet or the Coppersmith (*Megalaima haemacephala*). The last named is an ubiquitous species found everywhere from the busiest city to forests in the interior. Its call *tok-tok-tok* reminiscent of Coppersmith at work is responsible for its common name.

Family Picidae : Woodpeckers have long tongues enabling them to probe deep into rotting wood for insects, a chisel-shaped bill and a stiff tail which is used for supporting them vertically on tree trunks.

The Wryneck (*Jynx torquilla*) is a winter migrant and it has a remarkable capacity of twisting its neck over 360°. Though it belongs to the Woodpecker family it often descends to the ground to pick up ants and insects. It is not common in Maharashtra, though recorded from Bombay and the Deccan.

The Rufous Woodpecker (*Micropternus brachyurus*) is remarkable for its habit of nesting in the nests of Crematogaster ants. How the young ones escape being killed by these ants remains a mystery. Though found in many areas in the State it is not common.

The Small Yellow-naped Woodpecker (*Picus chlorolophus*) and the Lesser Goldenbacked Woodpecker (*Dinopium benghalense*) occur in our deciduous forests. The Three-toed Woodpecker (*Dinopium javanense*) has been recorded from Savantwadi (south Ratnagiri District). The Indian Great Black Woodpecker (*Dryocopus javensis*), though not common, has been observed in Khandesh and the Western Ghats. The Pigmy Woodpecker (*Picoides nanus*) always makes its nest on the underside of a branch and has been recorded from many areas of the State. The little Heartspotted Woodpecker (*Hemicircus canente*) is found along the West Coast of India and also in the interior in Khandesh. The Black-backed Woodpecker (*Chrysocolaptes festivus*) and the larger Golden-backed Woodpecker (*Chrysocolaptes lucidus*)

CHAPTER 5

Birds

are found in forest areas of the Western Ghats. The Yellow-fronted Pied Woodpecker (*Picoides mahrattensis*) is fairly common in the State and breeds between January and May.

(19) *Order Passeriformes*.—This Order contains the largest number of species. Almost 5,100 out of the world total of 8,600 living birds belong to this order. All have four toes; the first pointing backwards and the other three in front. All the toes are unwebbed and the hind toe is the most powerfully developed and capable of independent movement. The young birds are born blind and almost naked.

Out of the 638 passerine species found in India, 170 occur in Maharashtra. A few typical species representing different families are described below.

Family Pittidae : Pittas are brightly coloured birds about the size of a myna, with long legs and very short tails. The Indian Pitta (*Pitta brachyura*) is found in scrub jungle as well as in deciduous and ever-green forests. Its colours are green, blue, fulvous, black and white with a crimson abdomen and under tail parts. It is a monsoon visitor and is found in many areas of Maharashtra.

Family Alaudidae : Larks are birds of open areas, grass-lands and deserts. They are mainly brown and grey with conical bills and their rear toe has a straight long claw. They sing loudly both on the wing and on the ground and their nest consists of just a slight scrape on the ground, usually near a tuft of grass. The Redwinged Bush Lark (*Mirafra erythroptera*) is common in the drier parts of the State. During the breeding season the male flies high up and descends to the ground on outstretched wings singing the while. The Ashy Crowned Finch Lark (*Eremopterix grisea*) has a spectacular courtship display and the bird descends at great speed on closed wings checking itself when almost touching the ground. The Rufous-tailed Finch Lark (*Ammomanes phoenicurus*) is a larger bird and quite common in fallow and cultivated fields.

The Malabar Crested Lark (*Galerida malabarica*) streaked brown above and grey below can be recognised by its crest which can be erected at will. This and Sykes's Crested Lark (*Galerida deva*) are representative of the Wood Lark group. The short-toed Lark (*Calandrella cinerea*) so named because of its short rear claw, is a common winter migrant. It is a gregarious species and associates with other larks. They are found in many areas of the State. The Eastern sky Lark (*Alauda gulgula*) is a familiar resident bird, and in the breeding season it sings vigorously for long periods on fluttering wings high up in the air.

Family Hirundinidae : There are 75 species of swallows and martins throughout the world. Out of the 13 species found in India, 8 are recorded from Maharashtra. These birds have long pointed primaries

CHAPTER 5

Birds

and are capable of sustained flight over long periods. The tails are deeply forked and in some species the Central tail feathers project beyond the tail. Though they have weak feet, they are capable of perching on telegraph wires and on the bare branches of trees. They obtain their food by hawking aerial insects and they breed in colonies making their nests of mud or excavating burrows in soft mud-banks.

The Plain Sand Martin (*Riparia paludicola*) is a brown and white bird found near river banks. It breeds in holes in banks from November to February. The Crag Martin (*Hirundo rupestris*) is a slightly larger sandy-brown bird which breeds in the Himalayas and visits Maharashtra in winter. The Dusky Crag Martin (*Hirundo concolor*), considerably smaller, is a resident species and common throughout the State. It is usually found near crags, old buildings and forts in the company of swallows and swifts. It is solitary in its nesting habits and the nest is neat saucer of mud affixed to a wall. The breeding season is between July and September.

The Common Swallow (*Hirundo rustica*) is a winter visitor from Europe seen here between September and April. They are glossy blue above and white below, and have been recorded from most areas of the State.

The Wiretailed Swallow (*Hirundo smithii*) is a resident bird easily recognised by its projecting tail feathers. The Indian Cliff Swallow (*Hirundo fluvicola*) is smaller than most other swallows and its underparts are streaked with black. It is a resident species and its mud-nest lined with feathers is attached to ceilings, bridge girders and other places.

The Redrumped or Striated Swallow (*Hirundo daurica*) is a resident species and, though common in most areas of the State, seem to prefer hilly districts.

The House Martin (*Delichon urbica*) is a rare winter visitor. The tarsus and toes are feathered. The upper parts are black glossed with deep blue, while the rump and lower parts are white.

Family Oriolidae : Orioles are brightly coloured myna size birds and of the four species occurring in India three are found in Maharashtra. They are arboreal birds found in gardens and forests and in most species the females are considerably duller in colour than the males. Young birds are heavily streaked below. They make a hammock type nest of vegetable fibres, rags etc. and both sexes participate in domestic duties. They feed on insects and berries.

The Golden Oriole (*Oriolus oriolus*) is a handsome gold-coloured bird with black wings and a red bill. It has a pleasant mellow whistling call.

CHAPTER 5

Birds

The Blacknaped Oriole (*Oriolus chinensis*) is larger than the previous species and has been recorded from Ratnagiri and Savantwadi.

The Black-headed Oriole (*Oriolus xanthornus*) has a jet black head, throat and upper breast, and is found in more wooded areas than the Golden Oriole.

Family Lanidae : There are 70 species of birds belonging to this family in the world ; nine are found in India and out of these five occur in Maharashtra. All of them belonging to one genus. Shrikes are carnivorous and their staple food consists of insects. They have powerful hooked beaks and strong claws.

The Grey Shrike (*Lanius excubitor*) is the largest of the family found in India and frequents dry open country.

The Bay-backed Shrike (*Lanius vittatus*) is found in thorny jungle, gardens and cultivated land in the drier portions of the State, and breeds from April to September.

The Rufous-backed Shrike (*Lanius schach*) frequents more humid areas than the bay-backed species, and is rather similar looking except for the fact that it has no white mirror on the wings.

The Red-backed Shrike (*Lanius collurio*) and the Brown Shrike (*Lanius cristatus*) are winter visitors.

Family Dicuridae : Of the 20 species of Drongos occurring in the world, six are found in Maharashtra. They are all birds with predominantly black plumages tinged with green, blue and purple. The sexes are alike. They live on insects which are caught on the wing.

The Black Drongo (*Dicrurus adsimilis*) is the commonest member of the family and is found in varying habitats. It has been called *Kotwal* because it protects other birds nesting on the same tree as itself from attacks by crows.

The White-bellied Drongo (*Dicrurus caeruleus*) only slightly larger, is much less common and occurs in well-wooded country. The Grey or Ashy Drongo (*Dicrurus leucophaeus*) is a winter visitor partial to deciduous forests. The Bronzed Drongo (*Dicrurus aeneus*) and the Hair-crested Drongo (*Dicrurus hottentottus*) are rather rare birds, while the Greater Rackettailed Drongo (*Dicrurus paradiseus*) with its prominent tail feathers is seen in many wooded areas of Maharashtra.

Family Artamidae : This family consists of 10 species which resemble swallows more than shrikes, and which have long wings and powerful bills. They are very gregarious birds and are closely associated with palmyra palm trees. They live on insects, moths and butterflies which are captured on the wing. Only one species is found in Maharashtra, the Ashy-Swallow Shrike (*Artamus fuscus*). This is a plump grey bird with a short tail and a heavy bill. It is slightly larger than a Bulbul and when perched its closed wings reach the end of the tail.

CHAPTER

Birds

Family Sturnidae : This is a very large family of 110 species originally belonging to the old world. 19 species are found in India of which 8 are recorded from Maharashtra. They are all gregarious birds with pointed wings and they are either insectivorous or frugivorous.

The Grey-headed Myna (*Sturnus malabaricus*) is a grey bird washed with rufous with a white forehead. The Black-headed Myna (*Sturnus pagodarum*) is again a grey and rufous bird with a long black crest. The Rosy Pastor (*Sturnus roseus*) is a common winter migrant. They breed in Central Europe and are largely responsible for keeping locust populations under control. The large flocks which are seen in Maharashtra do some damage to jowar and other crops.

The Pied Myna (*Sturnus contra*) is a bird mainly of central and eastern India, but is now slowly spreading westwards and has been recently recorded breeding in Greater Bombay. The Common Myna (*Acridotheres tristis*) is a bird which may be found in almost every type of habit. The Bank Myna (*Acridotheres ginginianus*) is somewhat smaller than the common Myna and has a bare patch of orange skin behind the eye. Like the Pied Myna it has been recently recorded breeding in the suburbs of Bombay.

The Jungle Myna (*Acridotheres fuscus*) as its name implies is not found in urban areas and can easily be recognised by a small tuft of feathers on the forehead. The Grackle or Hill Myna (*Gracula religiosa*) is a glossy purple black bird with yellow wattles and patches of naked skin on the head. It is found in evergreen forests in Western Ghats and is a favourite cage bird because of its ability to mimic human speech.

Family Corvidae : Crows, Magpies and Jays make up this family. They are omnivorous birds living on insects, seeds, fruits, the eggs of reptiles and birds, nestlings, etc. There are over 100 species in the world and of the 22 found in India 3 occur in Maharashtra.

The Indian Tree Pie (*Dendrocitta vagabunda*) frequents well-wooded country and open deciduous forests. The House Crow (*Corvus splendens*) is too wellknown to need a description. Its breeding season is from April to June. The Jungle Crow (*Corvus macrorhynchos*) is a larger bird entirely black and is now invading areas nearer human habitation. Its breeding season commences earlier than that of the House Crow, and is normally from December to April. The Jungle Crow is a great destroyer of young birds and their nests.

Family Bombycillidae : Representatives of two sub-families, Bombycillinae (Waxwings) and Hypocolinae (Silky Flycatchers) occur in India, and only the species belonging to the latter sub-family is found in Maharashtra. The Grey Hypocolius (*Hypocolius ampelinus*) has been recorded only once in Kolaba District by Dr. Salim Ali in 1930. It was apparently a straggler. The nearest breeding ground is in Afghanistan.

Family Campephagidae : This family consists of 80 species of Cuckoo Shrikes. Fourteen of these are found in India and nine have been recorded from Maharashtra. Most of them are drab-coloured birds except the minivets. As in the true shrikes, their beaks are hooked at the tip but they are exclusively arboreal and insectivorous birds and search their food among the leaves and barks of trees. In the non-breeding season they are gregarious and hunt in big parties.

The Pied Flycatcher Shrike (*Hemipus picatus*) resembles a flycatcher with its short flat bill, black and white upper plumage, black tail and white underparts. It is found in forest tracts and is well distributed in the State. The Common Wood Shrike (*Tephrodornis pondicerianus*) is found throughout the State. The Large Cuckoo Shrike (*Coracina novaehollandiae*) is fairly common in many districts of the State. The male is grey above and white below while the female is barred grey with white below. The bill is strong and crow-like. The smaller Grey Cuckoo Shrike (*Coracina melaschistos*) is smaller than the preceding species, is uniformly dark-grey above and barred with white on the underside. The Blackheaded Cuckoo Shrike (*Coracina melanoptera*) is a small bird which frequents orchards and groves.

The Scarlet Minivet (*Pericrocotus flammeus*) is a strikingly coloured bird. The male has a black head, neck and wings, while the rest of the plumage is scarlet. The female is grey above and orange below. The birds are found in evergreen forests as far north as Khandesh. The Rosy Minivet (*Pericrocotus roseus*) the Small Minivet (*Pericrocotus cinnamomeus*), the short-billed Minivet (*Pericrocotus brevirostris*) are fairly common, while the Whitebellied Minivet (*Pericrocotus erythropygius*), a smaller bird, is somewhat rare.

The Ashy Minivet (*Pericrocotus divaricatus*) has only recently been added to the Indian list, having been found at Karnala in the Kolaba District of Maharashtra. It is a bird which occurs in South-East Asia from Burma to Japan.

Family Irenidae : This small family comprises six species of brightly coloured birds, inhabiting well-wooded areas, dense forests and gardens. They are arboreal and live on fruits, insects, and nectar. The nest is a loosely constructed hammock placed in trees. Both sexes take part in domestic duties.

The Common Iora (*Aegithina tiphia*) is a richly coloured yellow and black bird, somewhat smaller than a bulbul, with a very melodious call. It is a fairly common species. Marshall's Iora (*A. nigrolutea*) is rather uncommon but has been recorded as a breeding bird in Khandesh. The Gold-fronted Chloropsis (*Chloropsis aurifrons*) is found throughout the State and is a good mimic. Jerdon's Chloropsis (*Chloropsis cochinchinensis*) looks similar to the former species except for the fact that it has no gold on the crown. The Fairy Bluebird (*Irena puella*) is a resident of evergreen dense forests and has been seen around Savantwadi (South Ratnagiri).

Family Pycnonotidae : Of the 19 species of Bulbuls found in India, six have been recorded from Maharashtra. The commonest are the Redwhiskered Bulbul (*Pycnonotus jocosus*) and the Redvented Bulbul (*Pycnonotus cafer*). They are found in gardens, villages, open scrub country and deciduous jungles, but avoid dense forests. The White-cheeked Bulbul (*Pycnonotus leucogenys*) and the White-browed Bulbul (*Pycnonotus luteolus*) are less common than the foregoing species, while the Yellow-browed Bulbul (*Hypsipetes indicus*) is found in the hilly areas like Mahabaleshwar and Matheran and is not uncommon in its restricted habitats. The Black Bulbul (*Hypsipetes madagascariensis*) likewise is found only in the hilly portions of the State.

Family Muscicapidae : This is a large family containing about 400 species. They have short flat bills with bristles of the base and in India there are the following five sub-families Timaliinae, Muscicapinae, Pachycephalinae, Sylviinae and Turdinae. Pachycephalinae is not represented in Maharashtra.

Sub-family Timaliinae : Babbler are dull coloured birds which move about in small parties of seven to ten birds. They have short rounded wings which is the cause of their feeble flight. They look for insects amongst the fallen leaves on the ground, and they are rather noisy birds. Of the 121 species of this subfamily found in India, 10 are found in Maharashtra State. The Common Babbler (*Turdoides caudatus*) is a typical member of this subfamily inhabiting scrub country. The spotted Babbler (*Pellorneum ruficeps*) frequents light jungle and has an extremely attractive long-drawn whistling song. The Slaty-headed Scimitar Babbler (*Pomatorhinus schisticeps*) is partial to bamboos and dry deciduous forests and its bubbling call can be heard from a long distance. The Rufous-bellied Babbler (*Dumetia hyperythra*) and the Yellow-eyed Babbler (*Chrysomma sinensis*), both found in light jungle and scrub country, are the smallest members of this subfamily. The large Grey Babbler (*Turdoides malcolmi*) and the Jungle Babbler (*Turdoides striatus*) are widely distributed. The other Babblers in the State are : the Rufous Babbler (*T. subrufus*) and the Quaker Babbler (*Alcippe poiocephala*).

Sub-family Muscicapinae : Flycatchers are small thrushlike birds which are confined to the old world. They feed on insects captured on the wing. The Brown Flycatcher (*Muscicapa latirostris*) is common around Ratnagiri and occurs sparingly at some places in the Deccan. The Rufoustailed Flycatcher (*M. ruficauda*) is a very rare cold weather visitor recorded from Ahmednagar and Sholapur. The Redbreasted Flycatcher (*M. parva*) is a common visitor and the Blue-throated Flycatcher (*M. rubeculoides*) is a rare winter visitor to the Deccan. The Verditer Flycatcher (*M. thalassina*) is a cold weather visitor to many parts of the State, but is nowhere very common. The Greyheaded Flycatcher (*Culicicapa ceylonensis*) is a migrant seen between October and May.

CHAPTER 5

Birds

The Whitebellied Blue Flycatcher (*Muscicapa pallipes*) is a rare bird recorded from Bhimashankar in Poona District. Tickell's Blue Flycatcher (*Muscicapa tickelliae*) is a resident bird commonly seen in wooded areas. It breeds between June and August. The Whitebrowed Fantail Flycatcher (*Rhipidura aureola*), the White-throated Fantail Flycatcher (*R. albicollis*) and the White-spotted Fantail Flycatcher (*R. albogularis*) are very lively and graceful birds almost incessantly on the move. They are found in gardens, and wooded areas. The Whitebrowed is commoner in open country.

The Paradise Flycatcher (*Terpsiphone paradisi*) is a strikingly handsome bird. The male is pure white with a glossy black crest and long tail ribbons. The total length of the bird may be as much as 22 inches. The female is chestnut above and white below and lacks the tail streamers of the male. This is a seasonal migrant and more information is necessary about the movement of this species.

Sub-family Sylviinae : Warblers are a large group of small birds comprising about 380 species, mainly in the old world. They are sober coloured birds with small straight bills. The migratory species have longer wings than the resident birds. They are purely insectivorous birds and are found on trees, bushes, grass reeds and other areas where they can find suitable food. Of the 92 species recorded in India, 28 are found in Maharashtra. The Tailor Bird (*Orthotomus sutorius*), a familiar bird equally at home in scrub jungle and town gardens is a typical member of this sub-family. The Ashy Longtail Warbler (*Prinia socialis*) is found in many habitats and frequents gardens while the Jungle Longtail Warbler (*Prinia sylvatica*) keeps away from human habitations.

Among the migrants the Indian Great Reed Warbler (*Acrocephalus stentoreus*) is well known for its loud warbling call and is fond of mangrove swamps. The Blyth's Reed Warbler (*Acrocephalus dumetorum*) is extremely common in winter in all localities. The Booted Warbler (*Hippolais caligata*) and the White-throat (*Sylvia curruca*) are also migrants but not too common anywhere. The Olivaceous Leaf Warbler (*Phylloscopus griseolus*) and the Yellowbrowed Leaf Warbler (*P. inornatus*) are among the smallest of the group of Leaf Warblers.

Sub-family Turdinae : This sub-family is distributed all over the world, there being some 134 species in India, and 17 in Maharashtra. In size, the birds range from about a sparrow to a Myna, and feed principally on insects, worms and berries.

The commonest species of Turdinae in India is the Magpie Robin (*Copsychus saularis*) approximately 7 inches. Both sexes are black and white, the black on the male, however, being glossy while on the female it tends to a slaty grey. It is a familiar bird of our gardens and villages. It sings loudly from the top of a chosen tree or building

CHAPTER 6

Birds

during the breeding season, thus establishing its territory, and nests in a variety of places ranging from holes in trees to the vents in a sanitary system or just under the tiles of a roof. While it is only the female which builds the nest, the male assists with the family duties later on. The diet consists mainly of insects and nectar.

The Shama (*Copsychus malabaricus*) about 10½ inches, is a cousin of the Magpie Robin, and has a bright chestnut lower plumage with a longer tail, the rump being white. It is a bird of the forest, and, like its cousin, is an exceptional singer. It feeds on insects and nests in the hollows of tree-stumps.

The black Redstart (*Phoenicurus ochruros*) about 5½ inches, is a common migrant to Maharashtra in the winter months. The male is black with orange-chestnut underparts, while the female is lighter with a red tail. The principal food, insects, is acquired by a characteristic strutting movement on the ground, the tail being quivered at the same time.

The Indian Robin (*Saxicoloides fulicata*) around 6 inches, is a sparrow-sized black bird with a red-brown patch under the tail; the female is brown. Three races of the species—*Saxicoloides fulicata cambaiensis*, *S. f. intermedia* and *S. f. fulicata* occur in Bombay. The bird is a common countryside resident, feeding, like the previous species, on insects picked up from the ground. Its nest-sites range from a hole in an earth-bank to the sheltered side of a signboard.

The Blue Rock Thrush (*Monticola solitarius pandoo*) is a fairly common winter visitor found in the rock hillsides and scrub jungle. The male is indigo blue, and the female, brown above and a barred white and brown below. The peculiar jerky movement of the tail is a characteristic. The diet consists of insects and berries.

The Orangeheaded Ground Thrush (*Zoothera citrina*) which is the size of a myna, keeps to the better wooded areas. It has an orange head, neck and underparts, with the rest of the upper parts blue. In the female the blue is tinged with olive-green. Nesting in trees, the bird feeds on insects and fallen berries.

The Malabar Whistling Thrush (*Myiophorus horsefieldii*) is black and cobalt blue, approximately the size of a myna, and a resident species in Maharashtra. It keeps to ravines and hill streams, and its clear, prolonged whistling song has earned for it the name of the 'Whistling Schoolboy'.

Family Paridae : This family contains over 60 small birds, all of them less than 'sparrow-size' and distributed throughout the world. India has 35 species, of which only 1 species is recorded in Maharashtra. This is the Southern Grey tit (*Parus major*). The bird is about 5 inches long, grey, black and white, with white cheeks, a black throat, and a black band running down the centre of the belly. It is seen in wooded localities feeding on insects, buds, fruits, nuts and seeds, a diet

CHAPTER 5

Birds

adapted to its short, thick bill. Mainly a resident of the Deccan, it has been recorded North of Bombay as well.

Family Sittidae : This family comprises the nuthatches, and consists altogether of about 30 small birds distributed in Europe, Asia, Australia and North and Central America. They have the ability to move almost vertically up and down tree-trunks with ease. The 18 species which occur in India fall under three subfamilies, viz. Sittinae, Salpornitinae and Tichodromadinae, of which the former two are represented in Maharashtra.

Of the subfamily Sittinae, a representative is the Velvetfronted Nuthatch (*Sitta frontalis*) purplish blue above and greyish lilac below. The bird gets its name from the black velvety forehead while the male has a black stripe above and below the eye. Not easily seen, they are usually in small flocks or mixed parties in the Western Ghats and in various wooded tracts. They nest in small hollows or woodpecker-like holes in trees.

The subfamily Salpornitinae is represented by the Spotted Grey Creeper (*Salpornis spilonotus*). It is about 6 inches long, a small active bird with a long decurved beak and wings which are long and pointed. The entire plumage is spotted and barred with white. It is found on large trees in the well-wooded country of the Western Ghats. According to the Fauna volume, this Creeper is common in Khandesh as well.

Family Motacillidae : This is divided again into two well-defined groups of birds ; the wagtails which are usually either black and white or blue and yellow, and which are distinctive in their long tail, and the pipits which resemble larks and are generally streaked and spotted with brown.

The Tree pipit, (*Anthus trivialis*) 6 inches, is about the size of a sparrow, but slimmer and with a longer tail. The sandy brown upper plumage is boldly streaked with black-brown. The birds are found along the ground in open spaces and wooded areas, flying into trees when disturbed. They are winter visitors to Maharashtra.

Out of some 18 kinds of wagtails found in our country, 17 are migrants from Russia and Siberia. In Maharashtra nine species and races are recorded. They feed on small invertebrates, especially insects.

The forest Wagtail (*Motacilla indica*), has short central tail feathers, olive-brown upper plumage, and completely white underparts. There is a black band across the breast. Judging from the number of examples of the species observed in Maharashtra, it is likely that the bird is a rare visitor in the State.

The two subspecies of Yellow Wagtails, (*Motacilla flava thunbergi* and *M. f. beema*) are both migratory visitors to Maharashtra, the former, Greyheaded yellow wagtail being fairly common. This bird has a darker grey head and deeper yellow underparts than Blueheaded

CHAPTER 5

Birds

yellow wagtail (*M. f. beema*), which has a blue grey head. Both are about 6½ inches long and are found on beaches, marshes, lawns etc. There are records from all over Maharashtra.

The two subspecies of the Yellowheaded Wagtail (*Motacilla citreola citreola* and *M. c. werae*) differ from the Yellow Wagtails in having a bright yellow head in breeding plumage. The birds are difficult to distinguish in non-breeding plumage, as they resemble the Yellow Wagtails in size (about 7 inches) and have all their habits.

The Grey Wagtail (*Motacilla caspica*) which is also 7 inches long, differs from the yellow wagtails in having a white eyebrow and a greenish yellow rump and uppertail coverts, along with a pair of white outer tail feathers.

Two subspecies of White Wagtails (length 7 inches) are the Pied or White Wagtail (*Motacilla alba dukhunensis*) and the Masked Wagtail (*M. a. personata*) both of which visit Maharashtra in winter. In the white wagtail the front and sides of the head are white in the summer plumage, whereas in the Masked Wagtail the sides of the head are mottled with black and white. There are records of the species from Bombay, Salsette, Thana, and Kolaba districts. While the masked wagtail is distributed throughout the State, the white wagtail is common in the Deccan during the cold season.

The only resident wagtail in India, the Large Pied Wagtail (*Motacilla maderaspatensis*) is the largest, with a total length of over 9 inches. The breast and upper plumage in this bird are black ; the under parts and the coverts are white, and there are also prominent white patches on the wings and above the eyes. For a nest, the bird usually selects the bank of a river or rock near an area of water, and the nest is a shallow cup of cobweb and plant fibres. The species is distributed throughout the State and is recorded from Salsette, Panvel, Kolaba, Poona, and Khandala.

Family Dicaeidae : This family comprises over fifty small birds found from India into the South-East through to New Guinea. Some fourteen species are found in India, of which 3 are recorded in Maharashtra.

The Tickell's Flowerpecker (*Dicaeum erythrorhynchos*) is an active, although diminutive, olive-brown bird, even smaller than a sunbird. It has a short tail and a slightly curved bill. It keeps to the trees, feeding on nectar and various berries, notably Loranthus. The nest is an oval pouch of vegetable fibre. It is a resident in the country, common in many areas in the Deccan and recorded from Poona, Bombay, Salsette, Thana, Ratnagiri and elsewhere in Maharashtra.

Family Nectariniidae : This family comprises over a hundred small birds found in Africa, Asia and Australia. There are 27 species in India, of which five are found in Maharashtra. The males in this family are known for their intense, metallic colouring, while the females are duller, greenish or brown. The narrow extensible tongue forms

CHAPTER 5
Birds

a tube which is divided into two at the tip and is, obviously, used for collecting nectar.

The Purple Sunbird (*Nectarinia asiatica*) is over 4 inches long with a brilliant purple colouring and an outstandingly longcurved bill. The females and young birds are greenish brown and yellow. A most useful agent in the process of cross-pollination, the sunbird feeds on nectar and insects. It is a common resident in Maharashtra, its long untidy nests being suspended on fences, vines, etc. A disconcertingly similar species is the Purplerumped Sunbird (*Nectarinia zeylonica*) with the upper parts and breast crimson, green and purple, the lower parts yellow, and rump purple. This is also a resident.

Loten's Sunbird (*Nectarina lotenia*) 5 inches in length, and larger than the previous species, has a longer bill and is metallic green and purple above; below, it is a sooty green with a maroon band across the breast. The female is olive-brown. This bird also is a nectar-feeding resident recorded from Salsette, Kolaba, Thana, although not very common in Maharashtra.

Family Zosteropidae: The White-eyes are small, greenish-brown warbler-like birds found mainly in the tropics. A diagnostic characteristic is the white ring of silky down around the eye. There are some 85 living species of the family, of which two only are found in India, and only one in Maharashtra.

The White-eye (*Zosterops palpebrosa*) about 4½ inches in length, is a resident bird, coloured a greenish-yellow above and a bright yellow to greyish white below. The bill is slender and slightly curved, and the tail short. Again, it has a natural function as an assistant in cross-pollination, feeding mainly on nectar and insects. The nest is built in gardens and on hedges about 3-6 feet from the ground and comprises a neat, well-lined cup of down, plant-fibres, and so on. It is common over the Deccan and has been recorded from Bombay, Salsette and Nasik.

Family Ploceidae: This contains about 273 species distributed in the Ethiopian, Indian and Australian regions. The tradition of calling these birds the 'Weavers' derives from the elaborately interwoven nests that many of the species in this family build. In India, the family is represented by two subfamilies, the Passerinae (House sparrow) and the Ploceinae (Weaver birds). The State of Maharashtra has representatives of all the genera of ploceid birds found in India.

The Baya, similar in appearance to the House sparrow, is far more attractive in the breeding season—i.e. the monsoon—than otherwise, with its bright yellow breast. The male is polygamous. During the breeding season, rather in the beginning, it starts building its own compactly woven home on a Babul or Ber tree. The retort-shaped nest, with its entrance from below, is usually constructed of coarse grass, rice stalks, jowar or bajri sticks. When the nests are half-constructed,

CHAPTER 5
Birds

the males 'hold up' their work and await the arrival, *en masse*, of females who come after the first fury of the monsoon is over. After an inspection of the various nests, the females choose their own homes (the corresponding male is accepted incidentally). The male then completes the nest—working more assiduously, and adds an elongated tube. The female lays two or three white eggs and starts incubation. The male then starts his second nest nearby, acquires a second female, and so the process continues. It has been authentically observed that in a single season a male may mate with as many as five females. On occasion a second, indeed sometimes a third, nest is suspended from the first, making a three-decker.

From the economic point of view, the weaver birds are harmful, often damaging standing crops of Jowar and Bajri in the Deccan. They themselves, however, are resilient, withstanding heavy damage to their colonies by infuriated farmers. The fact, however, that they feed the young almost exclusively on soft bodied insects, compensates the farmer for the toll they take of his crops.

Sub-family Passerinae: This family consists of the sparrows; the House sparrow (*Passer domesticus indicus*) and the Yellow throated Sparrow (*Petronia xanthocollis xanthocollis*) are the two representatives occurring in Maharashtra, out of a total of 7 species found in India. The Yellow throated sparrow is the same size (5½ inches) as the former, the main distinguished feature being, the lemon-yellow patch on the throat in the male, and two white bars on the closed wing. The Yellow-throated Sparrow appears in harvested fields and groves, obviously for the sake of the insects, but it also feeds on nectar. It is fairly common over the State, nesting in holes in trees, and has been recorded from Thana, Salsette, Elephanta Island and Kolaba.

Sub-family Estrildinae: This comprises a group of small, sparrow-like birds called the Munias, which are known for their popularity as cage birds. Some 16 forms are found in India, out of which 6 are recorded in Maharashtra.

The Spotted Munia (*Lonchura punctulata*) is about 4½ inches long, which means that it is slightly smaller than a sparrow. The breeding plumage, by far the more attractive, consists of chocolate-brown upper parts, as well as a dark brown lower plumage spotted with white and brown. The bill is thick and conical, the tail short. It feeds in large flocks, mainly on grass seeds, in open or cultivated country, and is distributed all over the State. The nests, which are in colonies on trees, are globular structures of plant fibres. The bird has been recorded from Salsette Island, Thana, Kolaba, and Ratnagiri.

The Indian Red Munia (*Amandava amandava*) 4 inches in length, also a popular cage bird, is slightly smaller than the previous species. In breeding plumage, the male is deep crimson with white spots and

CHAPTER 5

Birds

completely white breast and flanks. The female and the non-breeding male are brownish with a crimson rump. According to authoritative sources, the species is rare in the Deccan, but has been recorded from Salsette Island.

Family Fringillidae : This is divided into the subfamilies Fringillinae (Chaffinches) and Carduelinae (Goldfinches and allied species). In all there are some 61 fringillid birds in India, only one specimen, however, being recorded in Maharashtra. This is the Common Rosefinch (*Carpodacus erythrinus*) 5 inches in length, belonging as is evident from the name, to the latter of the two families. It resembles the sparrow in build ; its beak, however, is stouter and the tail forked. During the breeding season the male has a dull crimson head, breast and back. The female is brownish. The birds are seen in flocks, and are winter migrants which seem particularly attracted to the hilly forest tracks all over the State. The food comprises of berries, seeds, shoots and buds. There are records of this rosefinch from Salsette Island, Kolaba and Satara.

Family Emberizidae : This family, the buntings, is a large group of small birds distributed over a great area of the world. A characteristic feature is their conical and sharply pointed beaks, with the upper mandible nearly straight, and a small hard process on the palate. These birds are slightly larger than sparrows. There are some 20 species in India, and 4 in Maharashtra.

The Blackheaded Bunting (*Emberiza melanocephala*) 9½ inches, is larger than a sparrow and has a forked tail. In breeding plumage the male has a black head, rufous brown and fulvous upper parts and bright yellow underparts. The female is generally duller, being rufous brown with a vinous tinge on the breast and hints of yellow all over the body. The birds are fairly common visitors to the State, often seen around cultivated areas, and estimated to do some damage to crops.

CHAPTER 6—MAMMALS

CHAPTER 6

Mammals

INTRODUCTION

MAMMALS, WHICH INCLUDE MAN, ARE WITH THE BIRDS, the most highly evolved among present day animal life. Several characters in the organisation of mammals enable its species to live under conditions which are impossible for other groups. One among these is in its ability to maintain a constant temperature irrespective of the temperature of its environment permitting life in habitats impossible to groups like the reptiles. However this does not mean that all mammals are able to live under all environmental conditions. In India, for instance, with its varied climatic conditions, the 317 species of known mammals include animals adapted to all the major climatic types, but the mammals of Maharashtra totalling 85 species are mainly forms adapted to tropical conditions. Among 85 species in Maharashtra, 25 are exclusively Indian, 38 occur in countries to the east, 10 in countries to the west, 8 both in the west and east and four are cosmopolitan. The 25 Indian species include ten confined to the southern peninsula among which a bat *Myotis peshwa* (Thomas, 1915) is known only from Poona and Bombay.

Three major climatic types occur in Maharashtra. The heavy rainfall region along the west coast adjacent to the western ghats or mountain ranges is known as Konkan, where the forests when present are tropical wet evergreen, tropical semi-evergreen and tropical moist deciduous. To the east of the ghats, the Deccan plateau including the Marathwada area, is dry and open. Forests when present are of the tropical thorn type. The forested areas of districts in the north-east i.e. the Vidarbha area are largely tropical dry deciduous.

The list, given below, of mammals occurring in Maharashtra or likely to have existed is based on information available in literature, the collections in the Bombay Natural History Society and personal experience. The destruction of forests, cultivation of fallow lands and change in habitats through introduction of exotics make it unlikely that the larger mammals would occur in appreciable numbers in any part of the State. The Cheetah (*Acinonyx jubatus*), has already been extinct for many years and the Blackbuck (*Antelope cervicapra*) once

CHAPTER 6
Mammals

seen in thousands in the Deccan has now declined to the verge of extinction and unless immediately protected would cease to exist in the few remaining pockets in the State. Unless well thought out and effective protection is offered to the fauna, the list would be of only historic value within a few years.

LIST OF MAMMALS OF MAHARASHTRA

Order Insectivora

(Insect-eating Mammals)

- Family Tupaiidae Tree-shrew
 (1) *Anathana ellioti* (Waterhouse, 1850) .. Madras Tree-shrew
 Family Erinaceidae Hedgehog
 (2) *Paraechinus micropus* (Blyth, 1846) .. Indian Hedgehog
 Family Soricidae Shrew
 (3) *Suncus murinus* (Linnaeus, 1766) .. House Shrew, *Chichundri*
 (4) *Suncus stoliczkanus* (Anderson, 1877) .. Anderson's Shrew

Order Chiroptera

- Sub-Order Megachiroptera Fruit-eating Bats
 Family Pteropidae
 (5) *Rousettus leschenaulti leschenaulti* (Desmarest, 1820) .. Fulvous Fruit Bat
 (6) *Pteropus giganteus giganteus* (Brunnich, 1782) .. Indian Flying Fox, *Wagul*
 (7) *Cyanopterus sphinx* (Vahl, 1799) .. Short-nosed Fruit Bat
 Sub-Order Microchiroptera Insectivorous Bats
 Family Rhinopomatidae Rat-tailed Bats
 (8) *Rhinopoma microphyllum* (Brunnich, 1782) .. Larger Rat-tailed Bat
 (9) *Rhinopoma hardwickei* (Gray, 1831) .. Lesser Rat-tailed Bat
 Family Emballonuridae
 (10) *Taphozous melanopogon* (Temminck, 1841) .. Black-bearded Tomb Bat
 (11) *Taphozous longimanus* (Hardwicke, 1825) .. Long-armed Tomb Bat
 (12) *Taphozous saccolaimus* (Lesson, 1842) .. Pouch-bearing Bat
 (13) *Taphozous kachhensis* (Dobson, 1872) .. Tomb Bat
 Family Megadermatidae False Vampires
 (14) *Megaderma spasma* Linnaeus, 1758 .. Malay False Vampire.
 (15) *Megaderma lyra* Geoffroy 1810 .. Indian False Vampire
 Family Rhinolophidae Horseshoe Bats
 (16) *Rhinolophus rouxi* Temminck 1835 .. Roux's Horseshoe Bat
 (17) *Rhinolophus lepidus* Blyth 1844 ..
 (18) *Rhinolophus luctus beddomei* Anderson 1905 .. Great Eastern Horseshoe Bat

CHAPTER 6
Mammals

- (19) *Hipposideros speoris* (Schneider, 1800) .. Schneider's Leaf-nosed Bat
 (20) *Hipposideros bicolor* (Temminck, 1834) .. Bi-coloured Leaf-nosed Bat
 (21) *Hipposideros galeritus* (Cantor 1846) .. Cantor's Leaf-nosed Bat
 Family Molossidae Wrinkle-lipped Bats
 (22) *Tadarida aegyptiaca* (Geoffroy 1818) .. Wrinkle-Lipped Bat
 Family Vespertilionidae
 (23) *Myotis peshwa* (Thomas, 1915) .. Peshwa Bat
 (24) *Pipistrellus coromandra* (Gray, 1838) .. Indian Pipistrelle
 (25) *Pipistrellus mimus* Wroughton, 1899 .. Indian Pygmy Pipistrelle
 (26) *Pipistrellus ceylonicus* (Kelaart, 1852) .. Kelaart's Pipistrelle
 (27) *Pipistrellus dormeri* (Dobson, 1875) .. Dormer's Bat
 (28) *Hesperoptenus tickelli* (Blyth, 1851) .. Tickell's Bat
 (29) *Scotophilus temmincki* (Horsfield, 1824) .. Lesser Yellow Bat
 (30) *Scotophilus heathi* (Horsfield, 1831) .. Greater Yellow Bat
 (31) *Miniopterus schreibersi* (Kuhl, 1819) .. Long-winged Bat
 (32) *Kerivoula picta* (Pallas, 1767) .. Painted Bat

Order Primates

(Apes and Monkeys)

- Family Cercopithecidae Macaques and Langurs
 (33) *Macaca radiata* (Geoffroy, 1812) .. Bonnet Monkey *Makad*, *Sharduri Makar*
 (34) *Presbytis entellus* (Dufresne, 1797) .. Langur *Wanar*, *Sharduri Makar*

Order Pholidota

(Pangolin)

- Family Manidae
 (35) *Manis crassicaudata* Gray, 1827 .. Indian Pangolin-thriya, *Kassoli mangar*, *Khanli mah*, *Khawala mangar*

Order Carnivora

(Dogs, Cats, Bears, Civets, etc.)

- Family Canidae
 (36) *Canis lupus pallipes* Sykes, 1831 .. Wolf, *Landga*
 (37) *Canis aureus* Linnaeus, 1758 .. Jackal, *Kolha*
 (38) *Vulpes bengalensis* (Shaw, 1800) .. Bengal Fox, *Kokri*

CHAPTER 6
Mammals

- (39) *Cuon alpinus* (Pallas, 1871) .. Dhole or Indian Wild Dog *Kolsun, Kolsa, Kolsara*
- Family Ursidae .. Bears
- (40) *Melursus ursinus* (Shaw, 1791) .. Sloth Bear—*asval*
- Family Mustelidae .. Martens and Ratels, Otters
- (41) *Mellivora capensis indica* (Kerr, 1792) .. Ratel or Honey Badger
- (42) *Lutra perspicillata* Geoffroy, 1826 .. Smooth-coated Indian Otter *pana manjar, jal manjar*
- Family Viverridae .. Civets and Mongooses
- (43) *Viverricula indica* Desmarest, 1817 .. Small Indian Civet—*jowadi manjar*
- (44) *Paradoxurus hermaphroditus* (Pallas, 1777) Common Palm Civet—*ud manjar*
- (45) *Herpestes edwardsi* (Geoffroy, 1818) .. Indian Grey mongoose—*mungoos*
- (46) *Herpestes smithi* Gray, 1837 .. Ruddy mongoose
- Family Hyaenidae
- (47) *Hyaena hyaena* Linnaeus, 1758 .. Striped Hyena—*taras*
- Family Felidae .. Cats
- (48) *Felis libyca ornata* Gray 1830 .. Desert Cat
- (49) *Felis chaus* Guldenstaedt .. Jungle Cat—*baul, bagoda*
- (50) *Felis bengalensis* Kerr, 1792 .. Leopard Cat, *wagati*
- (51) *Felis rubiginosa* Geoffroy, 1831 .. Rusty-spotted Cat
- (52) *Panthera pardus* (Linnaeus, 1758) .. Leopard—*Karda asnea, singhal, bibalya*
- (53) *Panthera tigris* (Linnaeus, 1758) .. Tiger *Wagh*

Order Artiodactyla

(Pig, Deer, Antelopes)

- Family Suidae
- (54) *Sus scrofa cristatus* Wagner, 1839 .. Wild Boar—*ran dukkar*
- Family Tragulidae .. Mouse-Deer
- (55) *Tragulus meminna* (Erxleben, 1777) .. Indian Spotted Chevrotain : *pisori sheda*
- Family Cervidae .. Deer
- (56) *Muntiacus muntjak aureus* (H. Smith, 1826) .. Muntjac or Barking Deer—*bhekad*
- (57) *Axis axis axis* (Erxleben, 1777) .. Spotted Deer—*Chital*

CHAPTER 6
Mammals

- (58) *Cervus unicolor niger* (Blainville, 1816). Sambar—*sambar*
- Family Bovidae .. Antelope, Oxen
- (59) *Tetracerus quadricornis* (Blainville, 1816) Four-horned Antelope, *bhekari*
- (60) *Boselaphus tragocamelus* (Pallas, 1766). Nilgai—*rohu, nilgai, nil(ô)*
- (61) *Bos gaurus* H. Smith, 1827 .. Gaur: *gaviya, gawa*
- (62) *Bubalus bubalis* (Linnaeus, 1758) .. Indian Wild Buffalo—*jangli mhai*
- (63) *Antelope cervicapra* (Linnaeus, 1758) .. Blackbuck—*haran, kal-wit*
- (64) *Gazella gazella bennetti* (Sykes, 1831). Chinkara—*chinkara*

Order Lagomorpha

- Family Leporidae .. Hare
- (65) *Lepus nigricollis* Cuvier, 1823 .. Indian Hare—*sasa*

Order Rodentia

(Squirrels, Porcupines, Rats and Mice)

- Family Sciuridae .. Squirrels
- (66) *Petaurista petaurista philippensis* (Elliot, 1839) Common Giant Flying Squirrel—*kotikar*
- (67) *Funambulus palmarum* (Linnaeus, 1766). Three-striped Palm Squirrel—*khadi khar*
- (68) *Funambulus pennanti* Wroughton 1905.. Five striped Palm Squirrel—*khadi khar*
- (69) *Funambulus tristriatus* Waterhouse, 1837. Jungle striped Squirrel—*Zani*
- (70) *Ratufa indica* (Erxleben, 1777) .. Indian Giant Squirrel—*shekra*
- Family Hystricidae .. Porcupines
- (71) *Hystrix indica indica* Kerr, 1792 .. Indian Crested Porcupine—*sheval salendra, saloo*
- Family Muridae .. Rats and Mice
- (72) *Vandeleuria oleracea* (Bennet, 1832) .. Indian Long-tailed Tree Mouse
- (73) *Millardia meltada meltada* (Gray, 1837) Soft-furred Field Rat : *Metad*
- (74) *Rattus blanfordi* (Thomas 1881) .. Blandford's Rat
- (75) *Rattus rattus* (Linnaeus, 1758) .. House Rat—*undeer*
- (76) *Mus musculus* (Linnaeus, 1758) .. House Mouse

CHAPTER 6
Mammals

- (77) *Mus booduga* (Gray, 1837) .. Little Indian Field Mouse
 (78) *Mus cervicolor* Hodgson, 1845 .. Fawn-coloured Mouse
 (79) *Mus platythrix* Bennet, 1832 .. Indian Brown Spiny Mouse
 (80) *Golunda ellioti* Gray, 1837 .. Indian Bush Rat
 (81) *Bandicota bengalensis* (Gray & Hardwicke 1833) .. Lesser Bandicoot Rat
 (82) *Bandicota indica* Bechstein, 1800 .. Large Bandicoot Rat
 (83) *Tatera indica* (Hardwicke, 1807) .. Indian Gerbil

Order Cetacea

(Whales and Dolphins)

- (84) *Balaenoptera physalus* (Linnaeus, 1758) Common Rorqual ; Finback
 (85) *Balaenoptera musculus* (Linnaeus, 1758) Great Blue Whale
 (86) *Neomeris phocaenoides* (Cuvier, 1829) Black Finless Porpoise

Order Insectivores

SHORT NOTES ON
MAMMALS.

Small sized primitive mammals mainly nocturnal in habit, in this order, include the Tupaia or Tree Shrews, hedgehogs, shrews and moles.

The tree shrews (Family Tupaiidae) unlike other insectivora, are largely diurnal. Two races of the species *Anathara ellioti* of the monotypic genus *Anathana*, restricted to the peninsula occur in Maharashtra. *Anathana ellioti wroughtoni* Lyon 1913 in the heavy rainfall forests of the Konkan and *Anathana ellioti pallida* Lyon 1913 in the deciduous forests of the Vidarbha region. This species is squirrel-like in habit and size but is easily distinguished by its long snout, and uniform grizzled brown colour. Singly or in pairs in undergrowth in forests. Feeds mainly on insects and perhaps fruits. The Vidarbha race is said to associate with babblers. Tree shrews have several characters in common with primates and are now usually grouped with them.

The occurrence of hedgehogs (Family Erinaceidae) in Maharashtra rests on the evidence of two skins from Poona of the Indian Hedgehog (*Paraechinus micropus*). Hedgehogs probably occur in Marathwada districts as well as in north-western Vidarbha. The largest of Indian insectivores, they are distinguished by the spiny back and sides. In defence the animal rolls itself into a ball, the retracted head and limbs being completely covered by the spiny mantle of the back. An inhabitant of dry, plains country, the hedgehog is a solitary animal and spends the day in burrows varying in length from 12 to 24 inches under bushes. The food is predominantly insects.

CHAPTER 6
Mammals

The shrews (Family soricidae) are represented by the Common or Grey Musk shrew (*Suncus murinus*), a commensal of man often mistaken for a rat. The soft grey fur and long snout are distinctive. A musky odour is produced by glands on the sides of the body. The shrew is very beneficial as it feeds largely on noxious insects and is also intolerant of rats in its territory. The young trail behind the mother in her nocturnal rambles forming a train by each holding to the tail of the one in front. Several races of the musk shrew based on size and body colour have been described from various parts of the country. Another species occurring in Maharashtra is Anderson's shrew (*Suncus stoliczkanus*) recorded from Bombay, Poona, and Vidarbha.

Order Chiroptera

Flying mammals with the forelimbs modified for flight. The greatly elongated fingers, the arms, sides of the body and legs support the wing membrane. The knee is turned inwards and combined with the weak limbs make the animals helpless on the ground. They rest hanging head downwards and suspended by their hind legs but some species cling to rock faces with all four limbs. Except for a few large bats which are fruit eaters all others are insectivorous. The false vampires take in addition to insects, other bats, small birds, and lizards.

Two sub-orders are recognised, the Megachiroptera or fruit eating bats distinguished from the Microchiroptera or insect eating bats by dental characters and the form of the ear. The margins of the ears meet before they reach the head in the former and arise separately in the latter.

The fruit bats of the Indian region are grouped in one family, the Pteropidae. Three out of the five species occurring in India, are found in Maharashtra and occur throughout the State. The Fulvous Fruit Bat (*Rousettus leschenaulti* Desmaret 1820), a light brown, medium sized (up to about six inches in length) bat, lives in colonies of 2, to 2,000 individuals (in caves, ruins and wells). The flying Fox, *Pteropus giganteus* (Brunnich 1782), the largest among Indian bats with a wing span of about a yard, lives in large colonies in trees, often in the middle of busy streets of towns and villages and is normally seen only in such association with man. Except for the naked blackwings the body is rufous in colour. The Short-nosed Fruit Bat (*Cyanopterus sphinx* Vahl, 1797) is distinguished from the almost similar sized Fulvous Fruit Bat by the short ears with white margins and the divergent nostrils. Male, usually bright rufous above and yellowish below, sometimes tinged with olive, female and young yellowish-grey. Lives in small colonies of 6 to 12 animals in palm trees, among aerial roots of banyan and amongst foliage and the branches of trees. Exceptionally in old buildings. A nectar and fruit feeder, useful as a pollinating and seed dispersal agent, but like the other two species very destructive in fruit orchards.

CHAPTER 6
Mammals

Six families of the Sub-order Microchiroptera or insect-eating bats are recorded in the State.

The Rat-tailed Bats, *Rhinopoma hardwickei* (Gray 1831), and *Rhinopoma microphyllum* (Brunnich 1782) of the family Rhinopomatidae, are distinguished by their long slender rat-like tail which projects about $\frac{3}{4}$ its length from the inter-femoral membrane. Occur in dry areas and avoid the heavy rainfall districts of the Konkan and Western ghats. Roost during the day in caves, ruins and uninhabited dwellings in sexually segregated colonies of 4 to over 30 individuals. Feed mainly on flies and other soft-bodied insects.

The family Emballonuridae is represented by the Genus *Taphozous* or Tomb Bats. Medium sized bats with most species having a 'gular sac' or pouch under the chin and a flap of skin connecting the base of the forearm and fingers forming a pouch. The commonest species is the Bearded Tomb Bat, *Taphozous melanopogon* (Temminck) occurring in the Konkan, Deccan and Vidarbha districts of Maharashtra. The general colour is grey or brown of varying intensity. The male has a black beard under the chin. Roosts during the day in colonies of a few hundreds or thousands in dark caves and temples with a high ceiling, clinging to the walls or ceiling with all four limbs. An allied species *Taphozous longimanus* (Hardwicke) recorded in the Konkan and Ghats has the unusual habit for an insectivorous bat of roosting in exposed areas and is often found under the eaves of roofs. Two other species of Tomb bats *Taphozous theobaldi* and *Taphozous saccolaimus* also found in the State, are uncommon.

The false vampires of the Family Megadermatidae, *Megaderma spasma*, the Malay False Vampire and *Megaderma lyra*, the Indian False Vampire do not normally occur together, the former being rare and localized to a few places in the Ghats and the Konkan. The Indian False Vampire is widely distributed and favours drier areas of the State. It has the unique habit among Indian bats of feeding on other vertebrates such as small birds, bats, lizards and frogs. *Megaderma spasma* is more orthodox, feeding more or less exclusively on large insects. Both species roost in small groups in caves and dungeons, natural and man-made.

The family Rhinolophidae is represented by two genera, Horse shoe Bats, genus *Rhinolophus* and Leafnosed bats, genus *Hipposideros*. The two genera can be easily separated by the presence of central and vertical leaflets, the sella and lancet in *Rhinolophus* and their absence in *Hipposideros*. Three species of *Rhinolophus* occur, *R. rouxi*, *R. lepidus*, and *R. luctus*. *Rhinolophus rouxi* grey-brown, red-brown or rarely golden orange in colour is restricted in distribution to the Ghats and the heavy rainfall districts of the Konkan. Roosts singly, or in small groups or in large colonies in humid caves. *Rhinolophus lepidus* smaller in size than *R. rouxi* is more widely distributed and occurs throughout the State. The large-sized *Rhinolophus luctus beddeomi*

CHAPTER 6
Mammals

is found only in the forested tracts of the Ghats. The fur is long and wooly. Roosts singly or in pairs in caves.

The Genus *Hipposideros* has three species in the State, *Hipposideros speoris*, *Hipposideros bicolor* and *Hipposideros galeritus*. *H. speoris* is common in Bombay and Konkan and other districts to the South. Three colour phases are known, yellowish brown, yellow orange and grey—the colour of young animals. An eclectic species found in forest as well as open country, roosting in colonies of 20 to 2,000 individuals in caves and old buildings. *Hipposideros bicolor* is common throughout the State. Three colour phases occur, a fulvous type in humid areas, a pale grey type in dry areas and a golden-orange type in both areas. Resembles *H. speoris* in habits. *Hipposideros galeritus* is uncommon. This species also has two colour phases, a dark type in humid country and a pale form in dry areas. Usually roosts solitarily or in small colonies.

The family Molossidae has a single genus and species in the State. *Tadarida aegyptiaca*, the Wrinkle-lipped Bat, easily distinguished by the thick ears joined together, the wrinkled upper jaw, the narrow wings and the fleshy tail projecting out of the membrane for half its length. Roosts during the day in narrow deep crevices on cliffs and large buildings. An uncommon species recorded from the drier parts of the State.

The family Vespertilionidae is represented by six genera of small bats. *Myotis peshwa*, originally described from Poona, is rare and has been so far recorded only from Poona, Thana and Elephanta island. Nothing is known of its habits. Four species of *Pipistrellus* occur, *P. ceylonicus*, *P. mimus*, *P. coromandra* and *P. dormeri*. The species of this genus are small sized bats, *P. mimus* being one of the smallest of Indian bats. A common genus, the colour being usually dark grey, but *ceylonicus* shows extreme variation, brown rufous and dark grey individuals occurring in the same colony. *P. dormeri* is much lighter than other species being whitish below and grey above with almost transparent wings.

Tickell's Bat *Hesperoptenus tickelli* is known in the State from Bombay and Poona. A medium sized bat, in colour pale yellowish grey with grey head and a distinctive tuft of white hair at the base of the ears. Little is known of its habits. The yellow Bat, *Scotophilus heathi*, easily distinguished by its canary-yellow underparts, is very common and is the bat most often seen round towns and villages hawking at sunset. Roosts during the day in crevices and holes, on the ceiling, under a roof or in woodwork. The closely allied species *Scotophilus temmincki* is uncommon. *Miniopterus schreibersi*, a widely distributed species in the Palaearctic region has the unique habit of roosting in enormous colonies. The only known colony of this species in Western India located at Robber's cave, Mahableshwar, has over 1,00,000 individuals and is probably of considerable significance in

controlling the insect population of the area. The Painted Bat *Kervoula picta* with its bright reddish fur and black wing membrane is the most beautifully coloured among Indian bats. Though perhaps a common species in the heavy rainfall districts of the Konkan it is rarely seen. It is believed to roost singly or in pairs among dried banana and other large leaves. The flight is moth-like. Another species of vespertilionid which may occur in Maharashtra is the Club-footed Bat *Tylonycteris pachypus* which has been recorded from Belgaum. The fur is golden rufous in colour and the soles of the feet are expanded into fleshy pads, used, it is believed, for holding to the inside walls of hollow bamboos where they roost in small colonies of ten to twenty.

Order Primates

Apes and monkeys which in many structural and other features resemble man are grouped along with him in the order Primates. Characteristic features are the development of limbs into grasping organs and the high development of the brain among the more highly evolved monkeys and apes culminating in the mental evolution in man which sets him apart from other animals. Apes and monkeys usually live in troops of varying size.

Two families Cercopithecidae and Colobidae, each represented by a single species *Macaca radiata* and *Presbytis entellus* respectively, occur in Maharashtra. The Bonnet Macaque, *Macaca radiata*, a peninsular form is not uncommon in the State from Bombay southwards. Troops of this medium sized long tailed Macaque occur in forests, in the countryside and where they are not molested around human settlements. They are omnivorous and are often destructive in Orchards and cultivation. The Common Langur (*Presbytis entellus*) a long limbed, long-tailed monkey with the grey body in striking contrast to the black face is not uncommon in forests as well as in nearby towns and villages. Langurs live mainly on fruits, flower buds, and leaves and are destructive when living in the vicinity of orchards and cultivation.

The Rhesus Macaque (*Macaca mulatta*) of northern India is likely to occur in the north-eastern Vidarbha districts of the State. A troop, probably escape from captivity, occurs in the Powai lake area of Salsette Island. The Slender loris *Loris tardigradus*, though not so far reported is likely to occur in districts bordering Karnatak.

Order Pholidota

The scales which cover the body distinguish the Pangolins or scaly anteaters from all other Indian mammals. The scales are modified hairs. Coarse hair covers the underside of the body and occurs between the scales. The jaws are toothless and the food which consists of ants, termites and their eggs is licked up by the long glutinous tongue from nests broken open by the strong claws on the legs. A slow moving animal it relies for protection on its armour, rolling up into

a ball when frightened. Being a nocturnal animal it is rarely seen. Spends the day in burrows dug by itself. One species, the Indian Pangolin (*Manis crassicaudata*) is found in the State.

Order Carnivora

Eighteen species of six families of Carnivora or flesh-eating mammals occur. Varying degrees of diet specialization is seen in the group, some being exclusively meat eating and others omnivorous. In nature's economy the function of carnivorous animals is primarily as controls on the herbivores living on the vegetation, which forms the environment.

The Canidae or dog family is represented by three genera and four species. The Wolf, *Canis lupus pallipes*, a race of the species formerly widely distributed in temperate countries, was not uncommon in the Deccan and Vidarbha districts of Maharashtra in the early years of this century. Records are available of their occurrence near Poona and Aurangabad during the period. Their predatory habits make them one of the first animals to be destroyed as an area becomes settled and opened for cultivation. Wolves may still occur in small numbers in the remoter regions of the State. The Jackal (*Canis aureus*), a scavenger with an omnivorous diet, has adjusted itself to living with man, being found in forests as well as urban areas. Feeds on any animal it can overcome and also fruits. Said to be destructive to grapes in the Nasik area and is known to eat coffee berries when they are ripe. The Indian Fox (*Vulpes bengalensis*) is usually found in open scrub country and in cultivated area. Omnivorous it is a useful destroyer of rats and land crabs. Recently the Whitefooted or Desert fox (*Vulpes vulpes pusilla*) has been recorded in the Poona District. The Wild Dog (*Cuon alpinus*) is separated from other Indian Canidae by the presence of six instead of seven molar or grinding teeth in the lower jaw and in having 12 to 14 instead of ten teats as in the true dogs. Widely distributed in Asia, the Wild Dog is a purely forest animal in India. Nomadic, their presence in any particular forest area is not predictable. Though very destructive to deer they rarely, if ever, attack domestic stock. Hunt in packs or family parties. Now rare in Maharashtra State.

Of the four species of bears occurring in India only the Sloth bear (*Melursus ursinus*) is found in Maharashtra. The Sloth bear with its distinctive shaggy coat and long snout is found only in India. The colour is normally black but brownish animals are occasionally seen. Forest animals they prefer areas where outcroppings of rocks and tumbled boulders offer them shelter. Feed mainly on fruits and insects and are unerring botanists in their knowledge of the fruiting season of various forest plants. Their eyesight and hearing are poor and hence react violently when suddenly come upon in the Jungle. Becoming rare in Maharashtra State.

The Ratel or Honey Badger (*Mellivora capensis*) (Family Mustelidae) a squat, bear like animal though not uncommon throughout the Indian

CHAPTER 6

Mammals

controlling the insect population of the area. The Painted Bat *Kervoula picta* with its bright reddish fur and black wing membrane is the most beautifully coloured among Indian bats. Though perhaps a common species in the heavy rainfall districts of the Konkan it is rarely seen. It is believed to roost singly or in pairs among dried banana and other large leaves. The flight is moth-like. Another species of vespertilionid which may occur in Maharashtra is the Club-footed Bat *Tylonycteris pachypus* which has been recorded from Belgaum. The fur is golden rufous in colour and the soles of the feet are expanded into fleshy pads, used, it is believed, for holding to the inside walls of hollow bamboos where they roost in small colonies of ten to twenty.

Order Primates

Apes and monkeys which in many structural and other features resemble man are grouped along with him in the order Primates. Characteristic features are the development of limbs into grasping organs and the high development of the brain among the more highly evolved monkeys and apes culminating in the mental evolution in man which sets him apart from other animals. Apes and monkeys usually live in troops of varying size.

Two families Cercopithicidae and Colobidae, each represented by a single species *Macaca radiata* and *Presbytis entellus* respectively, occur in Maharashtra. The Bonnet Macaque, *Macaca radiata*, a peninsular form is not uncommon in the State from Bombay southwards. Troops of this medium sized long tailed Macaque occur in forests, in the countryside and where they are not molested around human settlements. They are omnivorous and are often destructive in Orchards and cultivation. The Common Langur (*Presbytis entellus*) a long limbed, long-tailed monkey with the grey body in striking contrast to the black face is not uncommon in forests as well as in nearby towns and villages. Langurs live mainly on fruits, flower buds, and leaves and are destructive when living in the vicinity of orchards and cultivation.

The Rhesus Macaque (*Macaca mulatta*) of northern India is likely to occur in the north-eastern Vidarbha districts of the State. A troop, probably escape from captivity, occurs in the Powai lake area of Salsette Island. The Slender loris *Loris tardigradus*, though not so far reported is likely to occur in districts bordering Karnatak.

Order Pholidota

The scales which cover the body distinguish the Pangolins or scaly anteaters from all other Indian mammals. The scales are modified hairs. Coarse hair covers the underside of the body and occurs between the scales. The jaws are toothless and the food which consists of ants, termites and their eggs is licked up by the long glutinous tongue from nests broken open by the strong claws on the legs. A slow moving animal it relies for protection on its armour, rolling up into

CHAPTER 6

Mammals

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CHAPTER 6
Mammals

Union, is rarely seen. Its colour is distinctive pale grey above and black below. An inhabitant of broken hilly country in all except heavy rainfall areas, it is omnivorous and in some parts of the country believed, but without substantive evidence, to exhume corpses. The only other representative of the family, the Smooth-coated Indian Otter (*Lutra perspicillata*) is found throughout the Indian Union. A plains animal it varies in colour from blackish to tawny brown. Mainly inhabits fresh water, but when living in estuaries goes out after fish into the open sea. Fish is their staple food and in hunting them families may combine.

The Family Viverridae, Civets and mongooses is represented by three genera and four species. The Small Indian Civet *Viverricula indica* (Desmarest), a tawny-grey or greyish-brown animal streaked and spotted above, is found throughout the State. Prefers long grass or scrub to live in. Feeds mainly on rodents, small birds and reptiles but eats fruits also. Occasionally destructive to poultry. Easily domesticated they are often kept for the extraction 'Civet' from the scent glands.

The more arboreal black or blackish-brown Palm Civet or Toddy Cat *Paradoxurus hermaphroditus* has an equally wide distribution but prefers wooded areas. It is also found in association with man and lives on rats and mice which are found in and around houses. Another species of Civet which may occur in the forests adjoining North Kanara is the Brown Palm Civet (*Paradoxurus jerdoni*) of the hill ranges of South India.

The Common Mongoose (*Herpestes edwardsi*) inhabits open scrub-land and cultivated area. Lives largely on small animals and is thus useful. However it is often destructive to poultry. The Ruddy mongoose (*Herpestes smithi*) is a forest dweller distinguished from the Common Mongoose by the black tip to its tail. Though there is no record, the Small Indian Mongoose (*Herpestes auropunctatus*) distinguished by its shorter tail and in the legs being similar in colour to the body is likely to occur in the North-western districts of the State.

The hyena, *Hyaena hyaena* (Family Hyaenidae), the sole representative of the family in India was not uncommon in the State in earlier years; however it is believed to be on the verge of extinction at present. Hyenas prefer areas of low hills and ravines and are commoner in open country than in heavy forests. Though mainly a scavenger it occasionally takes domestic stock and in exceptional circumstances becomes dangerous to human life. Hyenas were known to occur in Salsette Island, Bombay up to about 30 years ago.

Six species of two genera *Panthera* and *Felis* of the Family Felidae occur in the State. The cats as true predators act as controls on other animal populations. However, with the destruction of both the primary environment and the herbivores which fed on it, the cats particularly

CHAPTER 6
Mammals

the larger species, have either disappeared with the forests which held them or having taken to preying on domestic stock with which man replaced wild herbivores, were exterminated by man. The Tiger *Panthera tigris* for instance is now restricted to the eastern districts of the Vidarbha area and small forest area in south-west Maharashtra having disappeared from all other areas, where it was known to exist in 1920's. The Leopard *Panthera pardus* with its ability to adapt is capable of wider distribution but has also lost ground in most parts of the State. Time is not distant when it will be confined like the tiger to a few isolated forests in the State and will need protection. The Cheetah *Acinonyx jubatus* accustomed to living in open country has already become extinct in Maharashtra State (as well as in India) with the reduction in numbers or disappearance of its major food species the Blackbuck. The smaller cats which do not come into conflict with man's interest to the extent that the larger ones do, are not in an equally bad position, yet. The Jungle cat *Felis chaus* distinguished by its short tail, long legs and black pencils of hairs to its ear-tips was at one time widely distributed in the State. It preys on small mammals and birds and near villages may rob poultry runs. The Desert cat *Felis libyca ornata* has been recently recorded in the Poona District. Smaller than a Jungle cat it is distinguished by spots on the body and black rings on the terminal half of its tail. There is little information on its habits. The forest dwelling Leopard cat, *Felis bengalensis* is likely to occur in the forested tracts of the western Ghats and Vidarbha. Equal in size to a domestic cat but with longer legs, this beautiful cat which looks like a miniature leopard feeds on small animals and birds. Another species, the Rusty spotted cat *Felis rubiginosa* occurs only along the western ghats from Dangs southwards. Smaller in size than a domestic cat it is fawn grey with dark brown and rusty spots and bars. Frequents grassland, scrub, and jungle.

The herbivorous animals apart from the elephant are grouped under two orders, the Perissodactyla or Odd-toed ungulates and the Artiodactyla or Even-toed ungulates. The former is not represented in the State. The elephant (*Elephas maximus*) Family Proboscidae which occurred in the State in Historic times is now extinct in the State.

The Artiodactyla is represented by the families Suidae (Pigs), Tragulidae (Mouse Deer) Cervidae (Deer) and Bovidae (Wild oxen, sheep, Goats and Antelopes).

The pigs (Suidae) are non-ruminant ungulates with an elongated head having an abruptly truncated disc-like snout bearing the nostrils. The upper canines curve upwards and outwards and form, with the lower canines, the tusks, the organs of offence and defence. The Indian Wild Boar (*Sus scrofa cristatus* Wagner) is a race of the widely distributed species which occurs from Europe to Malaya. The Indian race is distinguished by its thinner coat and fuller crest on the back. Blackish grey or rusty brown in colour a full grown boar may reach

CHAPTER 6

Mammals

a height of 90 cm. at the shoulder and a weight of 230 Kg. The sows are smaller. Newborn piglets are striped. Wild boars live in grass, or scrub jungle or in forests and are destructive to crops in adjoining cultivated land. Omnivorous in diet, their sense of smell is acute. They are prolific, breeding at all seasons and four to six young are born at a time. Where their natural predators, the larger carnivores have been killed off, the herds or sounders could in former times become too numerous and destructive. They were found in all the forested districts of the State, but their numbers are greatly reduced in most parts of the State, owing to destruction by poachers, and holders of crop protection guns and unrestricted slaughter by forest tribes.

The Mouse Deer (Family Tragulidae) are distinguished from other ruminants by the presence of four well developed toes and the stomach having three instead of four chambers. The Indian Chevrotain or Mouse Deer, *Tragulus meminna* (Erxleben), a dainty little deer, occurring only in peninsular India below latitude 24°N., is distinguished from other deer in the State by the absence of horns in the male. However, the upper canines are developed into tusks. About 25 to 30 cm. in height at the shoulder its olive brown yellow-speckled coat provides effective camouflage for the animal. Flanks are white spotted, the throat has three white stripes and the lower parts are white. A forest animal, it is usually solitary and crepuscular. The young are born after the rains. Its present status is unknown.

The Muntjac or Barking deer prefers heavy forests and is usually solitary. Occasionally in pairs or family parties. Small sized deer ranging in shoulder height from 50 to 75 cm. The antlers of the male are on short, hair covered, pedicels extending down the sides as bony ridges. Tufts of bristly hairs replace the horns in does. Colour uniform brown. Horns are shed during the hot weather. Muntjac breeds throughout the year with a peak period during the cold weather. Usually one young is born. The call from a distance sounds like a dog's bark. The upper canines are enlarged and are more often used as a means of defence than the antlers. Greatly reduced in numbers during the last few decades.

The Chital or Spotted Deer (*Axis axis*) is an exclusively Indian animal. The stags shed their horns annually but this is not limited to any particular season of the year. The bright rufous-fawn coat spotted with white and the graceful antlers of the stag make them one among, if not the most beautiful deer. Herds were once common throughout the State and the deer used to be seen till recently even on Salsette Island. Uncontrolled poaching has now restricted them to the larger forests of the State, and there too the numbers are fast dwindling so that unless afforded protection, the species may be exterminated.

The Sambar (*Cervus unicolor*) is a typical forest species now restricted in scanty numbers to the well forested areas of the State.

CHAPTER 6

Mammals

The largest of Indian deer, an adult stag may weigh over 350 Kg. Stags with the best horns are believed to occur in the forests about the Narmada and Tapi rivers. The horns are shed in March-April and regrown by November. Ruts in cold weather and young are born in May-June. Poaching has taken toll of this species.

The Chinkara or Indian Gazelle (*Gazella gazella bennetti*) prefers broken country with nullahs and ravines, and with scrub or thin jungle. A small, dainty gazelle, light chestnut above and white below. The male attains a height of about 65 cm. at the shoulder. The horns average 25 to 30 cm. in male, much smaller in the female which may be hornless also. Little information is available on the present position of Chinkara in the State. They were once not uncommon in the Vidarbha and in areas of the Deccan above Krishna River. They are probably on the way to total disappearance.

The Nilgai (*Boselaphus tragocamelus*) avoids dense forests, its usual haunts being undulating country sparsely covered with trees and scrub. A large ungainly antelope, the adult males are iron-grey in colour, young bulls and females tawny. The nilgai received a certain amount of protection from its supposed resemblance to cattle, but this has not been significant and the species is on the verge of extinction in Maharashtra State.

The Four-horned Antelope (*Tetracerus quadricornis*) is, as the name suggests, unique as the only animal in the world with four horns. A small (65 cm. at shoulder) dull red-brown antelope, usually solitary or in pairs, occasionally in small family parties in forested country, throughout the State.

The Blackbuck, *Antelope cervicapra*, is an exclusively Indian Antelope and perhaps the handsomest of the group. Adult males black above contrasting strongly with the white of the belly; females and young males, fawn. The yearling buck has no spiral to the horn which develops in the second year. The adult colour is attained after the third year. The main rutting season is February-March. One or occasionally two young are born. An inhabitant of open scrub covered and cultivated plains, blackbucks were once common in herds of hundreds throughout the Deccan. Poaching and extensive cultivation have diminished their numbers and only a few pockets of populations now remain. They are now completely protected under the laws but unless the laws are effectively enforced, and poaching prevented, this species will soon cease to be a part of our fauna.

The Gaur or Indian Bison (*Bos gaurus*) is restricted to a few heavily forested districts in the Vidarbha areas of the State. A few may perhaps occur in the Ghat forests adjoining the Kanara district of Mysore. The Gaur prefers hilly country and rarely if ever enters cultivation. One of the largest among wild bovine, a bull may attain a shoulder

height of 195 cm. The massive horns average 85 cm. Gaur are very susceptible to live-stock disease.

The Wild Buffalo (*Bubalus bubalis*) formerly occurred in peninsular India as far west as 80° E. longitude but loss of suitable habitat to cultivation and disease contracted from domestic live-stock have now confined them to a small area in Madhya Pradesh. It is possible that a few may be seen in the Bhamragarh area of Chanda district adjoining Bastar in M.P.

The Order Lagomorpha has two families the Leporidae (Hares and Rabbits) and the Ochotonidae (Mouse hares), the former is represented in Maharashtra. The Order Lagomorpha is distinguished from the Order Rodentia (Rodents) in the presence of four instead of two incisors on the upper jaw. True rabbits do not occur in India. The Indian hare *Lepus nigricollis* has several races of which the Black-naped Hare *Lepus nigricollis nigricollis* occurs south of the Godavari and the Rufous-tailed Hare *Lepus nigricollis ruficaudatus* north of the river. Another race found in the State is *Lepus nigricollis simcoxi* in Berar. Hares are usually found in jungle and scrub country alternating with cultivation and are less numerous in heavy forests. In the neighbourhood of villages they occasionally become unclean feeders.

The Order Rodentia is the largest among mammal orders, containing more than half the living mammals and is more abundant in variety than all other mammals put together. Rodents are primarily vegetarian but many are omnivorous. They are easily distinguished from all other mammals, by the presence of the two large incisors separated by a large gap from the grinding teeth. Rodents are the most destructive among mammals and members of the family Muridae are very destructive to crops and to stored grains. Rodents occur in all types of habitats.

Three genera of Squirrels, family Sciuridae occur in Maharashtra. The Common Giant Flying Squirrel *Petaurista petaurista philippensis* is a forest species not uncommon in deciduous forests on the edge of evergreen tracts. It is nocturnal and becomes active late in the evening. The call which has a ventriloquistic effect is often heard throughout the night. Hides during the day in tree holes or among thick foliage on trees at considerable height. The parachute which enables it to glide between trees consists of a membrane stretching between the legs. Found throughout the forested area of Maharashtra. It lives mainly on leaf buds and fruits.

Three species of Palm squirrels of the genus *Funambulus* are found in the State. The Three-striped Palm Squirrel *Funambulus palmarum* is particularly common around houses in the countryside and is one of the animals most often seen and heard. It feeds largely on fruits but is also known to eat termites and occasionally eggs of birds. The Five-striped Palm Squirrel *Funambulus pennanti* the northern counter-

part of *palmarum* is known from Bombay and Salsette Islands and is said to extend to Dharwar. It has a low chirruping call quite different to that of the Three-striped Palm Squirrel but in other habits they are similar.

The Jungle Striped Squirrel *Funambulus tristriatus* has a softer and musical call than *palmarum* and is found in forested areas of the Western Ghats in Maharashtra and further south. In forest villages of Kanara, they are as common as are Three-striped Squirrels in more urban surroundings.

The Giant Squirrel *Ratufa indica* is a purely forest species found in the Western Ghats from the extreme south to the Dangs in Gujarat and also in the forests of peninsular India south of the Ganges. Several races based on coloration have been described. Giant Squirrels keep to the summit of high trees and seldom come to the ground. They are extremely agile in their movements and their loud rattling call is a distinctive indication of their presence in a Jungle.

The Porcupines, family Hystricidae, the largest of Indian Rodents, are easily recognised by their quills which are hair modified into spines. The Indian Porcupine *Hystrix indica* prefers rocky country but adapts itself to other situations and is found in forests and open country of moist and dry areas. By day it shelters in caves or in burrows. They are extremely destructive to crops.

The Family Muridae, Rats and Mice is of considerable importance to human economics from the damage caused to agriculture and stored products and the danger to health through transmission of diseases. Seven genera occur in Maharashtra.

The Indian long-tailed Tree Mouse, *Vandeleuria oleracea*, is a completely arboreal species having on the first and fifth toe of all four feet nails instead of claws, and the toes being partially opposable. Widely distributed in India, this chestnut coloured, active mouse feeds on fruits, buds, and tender shoots. Occasionally uses the nests of other animals for breedup.

The Soft-furred Field Rat *Millardia melitada* is peculiar to India and the pale brownish grey, dense soft fur and large rounded ears distinguish this rat. Lives mainly near cultivation, occasionally in heavy scrub or among rocks. In the deccan they favour the black cotton soil and are a pest to food crops and cotton. Periodically show enormous increase in numbers when their effect on crops can be disastrous.

The White-tailed Wood-Rat or Blanford's Rat *Rattus blanfordi* has a quarter of its tail white. Inhabits deciduous and evergreen forests, scrub jungle and bare hillsides, in peninsular India.

The Common House Rat, *Rattus rattus* a commensal of man, now found all over the world is believed to have had its original home in,

CHAPTER 6
Mammals

India or its neighbourhood. Numerous races have been described on the basis of colour. Broadly, two groups are noticeable, those which live wild being rufescent above and white below, believed to be the original colour of the species and those with a dull coat and dingy underparts, the colour of rats which live in human dwellings. House Rats are one of the main sources of destruction to stored grains and other food and the main vectors for plague, rat bite fever and other diseases. The brown Rat *Rattus norvegicus* is limited largely to sea-ports and can be distinguished from the Black Rat by its shorter tail, shorter than the head and body.

The Bandicoot *Bandicota indica*, is the largest among murine species found in association with man exceeding a foot in body length when adult. Seldom found far from villages and towns where it lives in gardens and outhouses. Their tunnelling activities are very destructive. Omnivorous in diet and susceptible to plague. When annoyed they erect their hair and grunt, a habit which distinguishes them from other rats except the lesser Bandicoot or Mole Rat *Bandicota bengalensis* which lives in fields, pasture lands, gardens and in forests. A smaller and brown instead of grey coloured animal, it excavates extensive burrows and has the habit of storing grain in specially excavated chambers along the course of its tunnels.

The Indian Bush Rat *Golunda ellioti* is widely distributed in India. About 4 inches in body length, this yellowish-brown rat is essentially a forest animal but ventures into cultivated land. The food consists of roots and other vegetable matter and it is said to be partial to the seeds of the *Lantana*.

Four species of mice occur in the State. The Indian field Mouse *Mus booduga* is widespread. The colour of the dorsal fur varies according to the habitat, being sandy brown in arid areas and dark greyish brown in moist country. Another common species is the Spiny Field Mouse *Mus platythrix* the fur in this mouse is almost entirely of flattened spine like hairs. A race of the Fawn-coloured Mouse *Mus cervicolor* has been reported from Chikalda and Asirgarh. It is uncommon. The House Mouse *Mus musculus* is a commensal of man. A dark to light brown miniature replica of the House rat, resembles it in many of its habits including susceptibility to plague.

The Indian Gerbil *Tatera indica* found throughout India from the Himalayas to the Cape is easily distinguished from rats and mice by the tail being clothed in hair as opposed to the naked tail of the rats. It varies in colour from reddish brown to greyish fawn and inhabits open plains. Its burrows are commonly found near cultivation. It feeds mainly on grains, roots etc. and can be extremely destructive to cultivation at all stages of growth. They also have the habit of storing large quantities of grains in their burrows. In the dry-season they eat,

CHAPTER 6
Mammals

in addition to the stored grain, roots, fruits etc. of wild plants, and are omnivorous.

Some species of Marine mammals of the Order Cetacea (Whales, Dolphins, and Porpoises) are occasionally stranded on the coasts of the State or may be seen off shore. Stranding records relate to the Blue Whale, *Balaenoptera musculus* and the Finner Whale or Common Rorqual *Balaenoptera physalus*. These giants of the sea which average over 75 feet in length occur in Indian seas during the southern winter. The commonest cetacean usually seen along the coasts and estuaries of Maharashtra is the Little Indian Porpoise *Neomeris phocaenoides* distinguished by the absence of a dorsal fin. In colour it is uniformly blackish. It grows to a length of about 4 ft.

CHAPTER 7—REPTILES

INTRODUCTION

THE REPTILES WHICH INCLUDE CROCODILES, TURTLES AND TORTOISES, LIZARDS AND SNAKES form an intermediate group between the amphibians and the birds and mammals, having, in fact, given rise to the more highly evolved birds and mammals. Reptiles together with the amphibians and fishes belong to the lower vertebrates whose temperature is mainly determined by that of their surroundings. In contrast, the birds and mammals have constant body temperature irrespective of the environmental temperature. However, reptiles are not completely dominated by their general environmental temperature and are able to maintain a certain amount of independence in their body temperature in relation to external temperature by movements within the different micro-climates of the environment. Modern reptiles are predominantly terrestrial and are even found under extremely dry climatic conditions. Their skin, protected by hard scales, is far more resistant to desiccation than that of the lower amphibians. Modern reptiles are in number of species and variety of forms only a remnant of the numerous species that had trod the earth during the Mesozoic era or the age of reptiles .225 to 70 million years ago—a period during which existed the largest land animals, some exceeding 23 metres in length and 13 metres in height. (The last 70 million years form the age of mammals).

In the Indian subcontinent with its varied climatic conditions over 444 species of 140 genera from 23 families of reptiles are known to occur. The largest number of species are found in the humid areas of eastern India and south-west India, particularly in the hills. In Maharashtra 97 species of 56 genera and 19 families have been recorded.

LIST OF REPTILES OF MAHARASHTRA

Order Loricata

Family *Crocodylidae*

<i>Crocodylus palustris</i> Lesson	..	..	Indian crocodile or Mugger
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Order Testudines

(Turtles and Tortoises)

Family *Chelonidae*

..	..	Marine Turtles
<i>Eretmochelys imbricata</i> (Linnaeus)	..	Hawksbill Turtle

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CHAPTER 7 Reptiles

CHAPTER 7
Reptiles

<i>Chelonia mydas</i> (Linnaeus)	..	..	Green Turtle
<i>Lepidochelys olivacea</i> (Eschscholtz)	..	..	Loggerhead Turtle
Family <i>Emydidae</i>	..	..	Freshwater Turtles or Terrapins
<i>Geomyda trijuga trijuga</i> (Schweigger)	..	..	Pond Tortoise
<i>Kachuga tectum tentoria</i> (Gray)			
Family <i>Testudinidae</i>	..	..	Land Tortoises
<i>Testudo elegans</i> Schoepff	..	..	Starred Tortoise
Family <i>Trionychidae</i>	..	..	Freshwater or Mud Turtles
<i>Lissemys punctata granosa</i> (Schoepff)			
<i>Trionyx leithi</i> Gray			

Order Squamata

Sub-order Sauria	..	..	Lizards
Family <i>Geckonidae</i>	..	..	Geckos
<i>Cyrtodactylus dekkanensis</i>	..	..	Ground Gecko
<i>Cyrtodactylus albobasiciatus</i>			
<i>Cnemaspis kandiana</i>			
<i>Hemidactylus maculatus</i> Dum & Bibr.	..	..	Rock Gecko
<i>Hemidactylus triedrus</i> (Daudin)	..	..	
<i>Hemidactylus brooki</i> Gray	..	..	House Gecko.
<i>Hemidactylus gracilis</i> Blanford			
<i>Hemidactylus albobasiciatus</i> Grandison & P. W. Soman			
<i>Hemidactylus frenatus</i> Schlegel			
<i>Hemidactylus leschenaulti</i> Dum & Bibr.			
<i>Hemidactylus flaviviridis</i> Ruppel			
<i>Hemidactylus giganteus</i> Stoliczka			
Family <i>Eublepharidae</i>			
<i>Eublepharis macularius</i> (Blyth)			
Family <i>Agamidae</i>	..	..	Lizards
<i>Sitana ponticeriana</i> Cuvier	..	..	Pan-throated lizard
<i>Calotes versicolor</i> (Daudin)	..	..	Bloodsucker, Common Calotes
<i>Calotes rouxi</i> Dum & Bibr	..	..	Forest Calotes
Family <i>Chamaeleonidae</i>			Chamaeleon
<i>Chamaeleon zeylanicus</i> Laurensi			
Family <i>Scincidae</i>			Skinks
<i>Mabuya macularia</i> (Blyth)			

CHAPTER 7
Reptiles

<i>Mabuya carinata</i> (Schneider)	..	..	Common Skink
<i>Mabuya trivittata</i> (Hardwick & Gray)			
<i>Riopa punctata</i> (Gmelin)			
<i>Riopa guentheri</i> (Peters)			
<i>Riopa lineata</i> (Gray)			
Family <i>Lacertidae</i>			
<i>Cabrita leschenaulti</i> (Milne-Edwards)			
<i>Cabrita jerdoni</i> (Blyth)			
<i>Ophisops beddomei</i> (Jerdon)			
<i>Ophisops jerdoni</i> (Blyth)			
Family <i>Varanidae</i>			Monitor Lizards
<i>Varanus bengalensis</i> (Daudia)	..	..	Common Monitor (Marathi-Ghor- phad) Snakes
Suborder Serpentes			
Family <i>Typhlopidae</i>	..	..	Blind Snakes
<i>Typhlops porrectus</i> Stoliczka			
<i>Typhlops braminus</i> (Daudin)			
<i>Typhlops acutus</i> (Dum & Bibr)	..	..	Beaked Blind Snakes
Family <i>Uropeltidae</i>	..	..	Rough-tails
<i>Uropeltis macrolepsis</i> (Peters)	..	..	Mahratta Rough-tail
<i>Uropeltis phipsoni</i> (Mason)	..	..	Phipson's Rough-tail
Family <i>Boidae</i>			Pythons and Boas
<i>Python molurus</i> (Linnaeus)	..	..	Indian Python
<i>Eryx conicus</i> (Schneider)	..	..	Russell's Sand Boa
<i>Eryx johani</i> (Russel)	..	..	John's Sand Boa
Family <i>Colubridae</i>	..	..	Colubrid Snakes
<i>Acrochordus granulatus</i> (Schneider)		..	Wart Snakes
<i>Elaphe helena</i> (Linnaeus)	..	..	Trinket Snake
<i>Ptyas mucosus</i> (Linnaeus)	..	..	Dhaman or Rat Snake
<i>Argyrogena fasciolatus</i> (Shaw)	..	..	Banded Racer
<i>Coluber graciliis</i> (Gunther)			
<i>Coluber ventromaculatus</i> Gray & Hardwicke			
<i>Liopeltis calamaria</i> (Gunther)		..	Bridal Snake
<i>Coronella brachyura</i> (Gunther)			
<i>Oligodon taeniolatus</i> (Jerdon)	..	..	Kukri Snake
<i>Oligodon arnensis</i> (Shaw)			

CHAPTER 7
Reptiles

<i>Dendrelaphis tristis</i> (Daudin)	..	..	Common Indian Bronze-back
<i>Lycodon travancoricus</i> (Beddome)	..	..	Travancore Wolf-snake
<i>Lycodon striatus</i> (Shaw)	..	..	Striated Wolf-snake
<i>Lycodon flavomaculatus</i> Wall			
<i>Lycodon aulicus</i> (Linnaeus)	..	..	Common Wolf-snake
<i>Sibynophis punctatus</i> (Dum & Bibr.)			
<i>Xenochrophis piscator</i> (Schneider)	..	..	Checkered Keelback
<i>Amphiesma stolata</i> (Linnaeus)	..	..	Striped Keelback
<i>Amphiesma beddomei</i> (Gunther)	..	..	Beddome's Keelback
<i>Macropisthodon plumbicolor</i> (Cantor)	..	..	Green Keelback
<i>Boiga trigonata</i> (Schneider)	..	..	Indian Gamma
<i>Boiga ceylonensis</i> (Gunther)	..	..	Ceylon Cat Snake
<i>Boiga forsteni</i> (Dum & Bibr.)	..	..	Forsten's Cat Snake
<i>Psammophis condanarus</i> (Merrem)	..	..	Sand Snake
<i>Psammophis longifrons</i> (Boulenger)			
<i>Psammophis leithi</i> (Gunther)			
<i>Ahaetulla nasutus</i> (Inacepede)	..	..	Common Green Whip Snake
<i>Enhydris sieboldi</i> (Schlegel)			
<i>Cerberus rhynchops</i> (Schneider)	..	..	Dog-faced Water Snake
<i>Gerardia prevostiana</i> (Eyedoux & Gervais)	..	..	
Family <i>Elapidae</i>	..	..	Poisonous Snakes
<i>Bungarus fasciatus</i> (Schneider)	..	..	Banded Krait
<i>Bungarus caeruleus</i> (Schneider)	..	..	Common Indian Krait
<i>Callophis melanurus</i> (Shaw)	..	..	Slender Coral Snake
<i>Callophis nigrescens</i> Gunther			
<i>Naja naja</i> (Linnaeus)	..	..	Indian Cobra
<i>Ophiophagus hannah</i> (Cantor)	..	..	King Cobra
			Hamadryad
Family <i>Hydrophiidae</i>			Sea Snakes
<i>Praescutata viperina</i> (Schmidt)			
<i>Enhydrina schistosa</i> (Daudin)			
<i>Hydrophis spiralis</i> (Shaw)			
<i>Hydrophis cyanocinctus</i> (Daudin)			
<i>Hydrophis lapemoides</i> (Gray)			

CHAPTER 7
Reptiles

<i>Hydrophis mamillaris</i> (Daudin)			
<i>Hydrophis caerulescens</i> (Shaw)			
<i>Hydrophis fasciatus</i> (Schneider)			
<i>Lapemis curtus</i> (Shaw)			
<i>Microcephalophis gracilis</i> (Shaw)			
<i>Microcephalophis cantoris</i> (Gunther)			
<i>Pelamis platurus</i> (Linnaeus)			
Family <i>Viperidae</i>	..	..	Vipers
<i>Vipera russelli</i> (Shaw)	..	..	Russell's Viper ; Daboia
<i>Echis carinatus</i> (Schneider)	..	..	Saw-scaled Viper ; Phoorsa
<i>Trimeresurus malabaricus</i> (Jerdon)	..	..	Malabar Pit-Viper
<i>Trimeresurus gramineus</i> (Shaw.)	..	..	Bamboo Pit Viper

Family *Crocodylidae*—Of the three species of crocodiles occurring in the country only the mugger or Indian Crocodile *Crocodylus palustris* Lesson is found in the State. The mugger is found where suitable conditions in the form of perennial rivers, ponds and lakes are available. In areas where water sources dry up during the summer they aestivate in the mud or migrate, normally at night, to water elsewhere. They feed largely on fish but also take any animal that they can overcome. The stomach of a specimen shot at Powai lake near Bombay held 60 large water beetles and a couple of 'Chilwa' (*Chela* sp.) and an eel. Crocodiles unlike most other reptiles are not mute and during the breeding season occasionally roar. The eggs up to 20 in number are laid during the rainy season in holes in sand. The incubation normally takes about 40 days but the period may vary according to temperature. The young when hatched are 250 mm. in length. The heavy demand for their skins (of the under belly) has reduced their number all over the State and unless protected there is the danger that they will be exterminated, in the process of providing material for fashionable shoes, handbags, belts etc.

The Order Testudines includes the turtles, tortoises, terrapins and fresh-water turtles. All tortoises and turtles are recognised by the bony shell which encloses the body composed of the carapace dorsally and ventrally the plastron. The carapace is immovably attached to the ribs. The order has come down the ages with little change. Of the 29 species in the Indian region, 9 are recorded from within the State and along its coasts.

The family Chelonidae or marine turtles distinguished by their paddle shaped forelimbs is represented by three species. The Hawksbill turtle, *Eretmochelys imbricata* (Linn.) grows to a maximum length of 850 mm. and some specimens have been recorded weighing more than 50 Kg. This species is uncommon along the States' coasts.

SHORT NOTES ON
REPTILES

CHAPTER 7
Reptiles

Feeds largely on molluscs and fish. The tortoise shell of commerce is the carapace of this animal. The Hawksbill is edible but sometimes its flesh is believed to become poisonous after feeding on certain types of marine weeds.

The Green Turtle *Chelonia mydas* (Linn.) has not apparently been recorded from the Maharashtra coasts, but the species is known further west and is recorded as breeding in the Karachi area. It feeds mainly on algae but also takes molluscs, crustacea and fish. The female comes to particular beaches when ready to lay eggs. The eggs which may number up to 200 are laid in holes scooped out in sand above the high tide line. After the laying of eggs, the nest hole is neatly covered with sand. The young on hatching burrow their way out and return to the sea. Tagged specimens have shown that turtles range over a wide area of the ocean but return to the same beach for laying their eggs. The Green Turtle is of commercial importance being the basis for turtle soup. This and their habit of returning to the same beach have led to their unrestricted slaughter.

The Ridley Turtle *Lepidochelys olivacea* reaches a maximum length of one metre. It is more widely distributed than the Hawksbill and the Green turtles and is said to be particularly abundant in the vicinity of the Andamans and off the coast of Ceylon. The Ridley is known to breed along the Bombay coast and there are records of their laying eggs on Marve beach, Malad, during the monsoon. The young when hatched are uniform dark brown or blackish above and paler below. Ridelys feed mainly on crustacea and molluscs.

The family Emydidae includes the freshwater tortoises and terrapins, distinguished from land tortoises by their more or less flattened limbs and webbed toes. Two species occur in Maharashtra. The pond tortoise *Geomyda trijuga* (Schweigger) is found throughout the State in streams, ponds and other suitable areas. In colour the carapace is dark brown to blackish in the adult. The young are brighter above and fishes. The eggs are laid in a hole about 80 mm. deep near water, to which the young move on hatching. Incubation is approximately two months. Reaches a shell length of 220 mm, breadth 150 mm. and depth of 80 mm.

Another species found in the Mahanadi, Godavari and probably the Krishna river systems is *Kachuga tectum tentoria* (Gray). Usually the young have small black dots and an orange or red vertebral streak but with age the shell becomes darker and markings less conspicuous. A well defined red patch occurs behind the ear. It is believed to feed on vegetable matter and is very active in its movements. The flesh is alleged to be poisonous.

Members of the family Testudinidae, Land Tortoises, can be easily separated from the freshwater tortoises or terrapins by the cylindrical limbs, domed shell, and absence of web between the digits. A single

CHAPTER 7
Reptiles

species *Testudo elegans* Schoepff, the Star Tortoise occurs in Maharashtra. Attains a length of 250 mm. with a breadth of 160 mm. and depth of 120 mm. The females are larger than the males. The shell is black above with yellow aureola on the vertebral and costal shields from which yellow stripes radiate. Nocturnal, it feeds principally on grass, fallen fruits or flowers, but animal matter is also taken. Eggs are laid in holes scraped out by the female near vegetation and so well covered with earth that it is difficult to locate the spot. The Starred Tortoise occurs throughout central and southern India extending as far as Sind in the west and south to Ceylon.

The freshwater turtles or mud-turtles, Family Trionychidae, have their carapace covered with soft skin, and forelimbs paddleshaped. The head and neck are completely retractile and jaws are concealed by fleshy lips. Two species occur in the State. The Soft Terrapin *Lissemys punctata granosa* (Schoepff) inhabits rivers, streams and ponds and can often be seen basking on stones projecting above the water. Timid and difficult to approach, it feeds mainly on frogs and fish and other water organisms but may come out at night seeking decaying organic material. It is particularly destructive to fish. The eggs are buried in holes on banks and the young are common during the monsoon. This species is widely eaten and is believed to be a cure for anaemia. Leiths Turtle *Trionyx leithi* Gray is also common in the rivers and ponds of peninsular India. The young are grey and marked with four well defined ocelli or spots. The head is greenish with a well defined black longitudinal streak from between the eyes to the neck. This turtle attains a carapace length of 700 mm. Feeds mainly on frogs and fishes and other water organisms. Usually lies buried in the mud, leaving only the head uncovered and thus hidden, seizes its prey by a sudden and rapid movement of the long neck.

Lizards and snakes are among the most highly evolved of living reptiles and are grouped under two sub-orders Sauria (Lizards) and Squamata (Snakes) of the Order Squamata.

Lizards are by far the most conspicuous and most abundant among modern reptiles. As a rule lizards can be separated from snakes by a combination of characters which are : presence of four limbs, a non-retractile tongue, presence of eyelids and ear openings. One or more of these characters all of which are absent in all snakes are present in all lizards. All Indian lizards are non-poisonous. 28 species of 12 genera and 8 families of lizards occur in Maharashtra.

The Geckos family Geckonidae are distinguished by the absence of symmetrical shields on the head, immovable eyelids, a short broad tongue covered with villose papillae. Skin soft, with granules and rarely imbricate scales dorsally. 14 species occur in Maharashtra. The Ground Geckos, *Cyrtodactylus dekkansensis* (Gunther), and *Cyrtodactylus albofaciatus* (Boulenger), distinguished by their angularly bent undilated digits, are usually found under rocks and stones in hill country.

They feed mainly on small insects. The commoner *Cyrtodactylus dekkensis* is reddish brown above with white, brown-edged transverse bands upon the back and tail. A curved mark on the nape extends to the eyes. Whitish below. In size it reaches a total length of 110 mm., of which, the head body is 63 mm. The genus *Cnemaspis* is restricted to the hills of south India only. In Peninsular India a single species, *Cnemaspis kandiana* has been recorded in Mahabaleshwar.

The Rock and House Geckos of the genus *Hemidactylus* are distinguished by the strong dilatations of their toes which enable them to crawl on smooth surfaces. The largest species occurring in Maharashtra is the Rock Gecko *Hemidactylus maculatus* Dum. and Bibr. which is not uncommon in caves, rocks and on trees in forest tracts in the State. It reaches a body length of 115 mm. and the tail may attain a length of 130 mm. In colour dark brown with darker markings on the back. The young are much lighter and have lines and bars on the body and on the tail. The Gecko *Hemidactylus triedrus* (Daudin) is often seen in association with termite nest and appears to feed largely on termites. Found up to 4,000 feet throughout peninsular India and Ceylon. Brown above with white bands and tubercles. Usually a broad dark brown-edged white bar along the sides of the head. Lower parts whitish. It reaches 80 mm. in total length of which the tail is 30 mm. Among the house Geckos, *Hemidactylus brooki* Gray, *Hemidactylus frenatus* Schlegel, *Hemidactylus leschenaulti* Dum. and Bibr. and *Hemidactylus flaviviridis* Ruppell, *brookii* is the commonest. However, it is also found away from buildings in forest and scrub country and near river banks under stones, and similar situations. *H. brooki* and most other House Geckos are widely distributed in India and south-east Asia, apparently being carried along with man's effects. *Hemidactylus leschenaulti* is also equally common on tree trunks and prefers trees like the banyan and the tamarind on which its greyish-brown markings are cryptic. A larger species than *brookii* and *frenatus* (length 166 mm.) it is common in south peninsular India. The more or less similar sized *Hemidactylus flaviviridis* is commoner in the north but has been recorded at Bombay as a house Gecko. A recently described species *H. albofasciatus* from the Koyana valley is closely related to *H. prashadi* which occurs further south. This species is usually found under stones in rocky scrub-country. *H. gracilis* is an uncommon species recorded from the Vidarbha area of the State.

The Fat-tailed Geckos, Family Eublepharidae, are distinguished from other Geckos by their movable eyelids. *Eublepharis macularius* (Blyth) has short, cylindrical digits, with transverse lamellae and claws partly concealed between the scales. Back tubercular. Tail segmented, shorter than the head and body and much swollen at the base. The adult is greyish brown above and may reach 300 mm. in total length. Nocturnal in habits it is a voracious feeder on insects, chiefly crickets, and spiders and scorpions being quite indifferent to their sting. It is recorded from Poona northwards.

Lizards of the Family Agamidae are largely Asian in distribution and of the 19 genera occurring in India, only 2 genera and three species occur in Maharashtra. Agamid lizards can be recognised by the presence of movable eye lids and the absence of symmetrical shields on the head, but the best character to separate them from other lizards is the teeth which are acrodont (on top of jaw) and heterodont (differentiated e.g. incisor, canine). The commonest representative of the family is the Garden lizard or Blood Sucker, *Calotes versicolor* (Daudin) found throughout India. Normally they are brownish above with darker transverse bars and spots upon the back and sides. Specimens from western India may attain a body length of 140 mm. and a tail length of 350 mm. Like other agamids it is largely insectivorous but has been known to take young birds and there is also a record of its eating unripe beans. During the breeding season between June and August, the male when excited turns yellow while the sides of the head, throat and the neck become brilliant red hence the name blood sucker. The males are territorial and during courtship and while threatening other males nod their head up and down. Up to 15 eggs are laid in soil by the female. The Forest Calotes, *Calotes rouxi* Dum. & Bibr. occurs in the forests of the Western Ghats. This species is easily distinguished from the common calotes by the presence of an oblique curved fold in front of the shoulder, extending nearly across the throat. During the breeding season the upper part of the head and the neck becomes bright red contrasting strongly with black or dark brown of the rest of the body.

Another common agamid in the State is the Fan-throated lizard *Sitana ponticeriana* Cuv. distinguished from all other agamid lizards by the presence of only 4 instead of 5 toes. The Fan-throated lizard is much smaller than the *Calotes* and is dark brown above with a series of darker black edged spots along the middle of the back. In the breeding season the fan like appendage on the throat of the male becomes bright blue-black in colour and this is displayed by folding and unfolding during courtship. The lizard can cover short distances at speed on two legs. Mainly an inhabitant of dry, open country, it is fond of basking on the sand even during the hottest part of the day.

Two other agamids are likely to occur in the State. The Flying lizard *Draco dussumieri* Dum. & Bibr. has been recorded from North Kanara in Mysore and *Psammophilus blanfordianus* (Blanford) is known to occur in eastern districts of Madhya Pradesh and may also be found in adjoining Vidarbha.

The family Chamaeleonidae is represented in India by a single species *Chamaeleon zeylanicus* Laurenti which is found throughout peninsular India, south of the Gangetic plain. Chamaeleons are easily distinguished by the opposable toes on their limbs, the long club-shaped tongue, the independently movable eyes and the casque on the posterior part of the head. The tail is prehensile. It grows to a length of 175 mm. head and body, with a tail of 200 mm. Normally the colour in life is green varying from pale green to nearly black, but under excitement the body

may become mottled with transverse blotches or bands of yellow or blue black. The food consists of insects and their larvae. In search of prey, the eyes move independently and when a prey is located, the head is turned towards it and both eyes focused on it and approaching closely the tongue is shot out with amazing velocity and accuracy. It is arboreal but the eggs are laid by the female in soil.

The Skinks, family Scincidae are cosmopolitan in distribution and among the 18 genera found in the Indian subcontinent, two with six species are known from Maharashtra. Skinks are distinguished by the presence of symmetrical shields on the head, and of imbricate scale-like papillae on the tongue. The body is covered with cycloid, imbricate scales. They are usually found among grass and soil. Skinks are insectivorous. The three species occurring in Maharashtra are oviparous. The common Skink *Mabuya carinata* (Schneider) is found throughout the country and is the species that is most often seen. Brown or black above with uniform dark brown or black spots or streaks. During the breeding season the flanks of the male become scarlet and the belly yellow. Another common species *Mabuya macularia* is uniform light brown above, occasionally spotted with black. *Mabuya trivittata* Hardwicke & Gray has been recorded from Nasik, Nagpur and Poona. Greyish brown above with three broad black-edged yellow longitudinal stripes, extending the whole length of the body and to the base of the tail. This species is uncommon.

Skinks of the genus *Riopa*, of which three species *Riopa punctata* (Gmelin), *Riopa guentheri* (Peters) and *Riopa lineata* (Gray) occur, are snake-like in appearance with their long slender body and tail and diminutive limbs. They are largely subterrestrial and are not commonly seen.

The Lacertid lizards Family Lacertidae, are more common in the African than the Oriental region. The tongue is deeply forked anteriorly and scales on the back are much differentiated from the scales on the belly. The head has symmetrical shields. Of the 4 genera in Indian region, two *Cabrita* and *Ophisops*, each represented by two species, occur in Maharashtra. The two genera *Cabrita* and *Ophisops* are distinguished from each other by the eyelids being free in the former and fused together in the latter. Small lizards living in sandy or rocky ground usually in dry country. *Cabrita lechenaulti* (Milne-Edwards) *Cabrita jerdoni* Beddome, occur in Vidarbha. *Ophisops jerdoni* Blyth in Vidarbha and *Ophisops beddomei* (Jerdon), in South Maharashtra.

Monitor lizards of the family Varanidae are confined to the old world, being found in the warm areas of southern Asia, Africa, and Australia. They are carnivorous and eat any animal that they can overcome and largely live on birds and their eggs, small mammals, reptiles and their eggs and large insects. They take carrion. They are at times destructive to poultry but are particularly useful because of the large

number of rats and mice which they destroy. A single species, *Varanus bengalensis* (Daudin) occurs in Maharashtra. Found both in remote forests and in the outskirts of villages. This species may attain a body length of 750 mm. with a 1000 mm. tail. They can move fast and when chased usually take refuge in the hollow of a tree or by climbing up the trunk. Their ability to climb nearly vertical surfaces is said to have been used in former days for assaulting forts. The 'Ghorpad' is eaten and the skin is of commercial use.

The sub-order Serpentes, Snakes, can be distinguished from lizards by a combination of characters : the body is elongated and limbless or with vestiges of a hind pair ; eyes are lidless and ear opening is absent ; the two halves of the lower jaw are not fused but united by ligament and movable independently. The tongue is deeply forked and retractile into a sheath and in snakes is mainly an organ of smell. Snakes inspite of their uniformity of shape have adapted themselves for life under different environmental conditions unlike other snake-like reptiles and amphibia which are terrestrial and subterranean. Of the 226 species of 68 genera and 9 families recorded from the Indian sub-continent, 60 species of 36 genera and 7 families occur in Maharashtra.

The family Typhlopidae or Blind Snakes is widely distributed in the tropical zone of the old and new worlds. Small, worm-like snakes with highly polished scales they are usually found below the soil or in decaying wood or vegetation. Three species occur in Maharashtra. *Typhlops braminus* (Daudin) the Common or Brahminy Blind Snake, is the species most often seen in gardens under stones and debris. In colour, brown or blackish above, lighter below, the snout and tail end being usually whitish. Occasionally a number of them may be seen together. It grows to a length of 170 mm. The similarly coloured but larger (285 mm.) *Typhlops porrectus* Stoliczka has been recorded from Bombay. The Beaked Blind Snake, *Typhlops acutus* (Dum. & Bibr.), the largest of all Oriental species (up to 600 mm.) has been recorded from Salsette Island, Thana District and the Western Ghats. In colour it is brown above and paler below and the back and side scales may have a pale yellow centre.

The family Uropeltidae or Roughtails is peculiar to southern India and Ceylon. Small snakes from 30 to 60 cm. in length and subterrestrial in habit. Tail very short ending in a peculiar shield, on the characters of which the genera are based. They are largely restricted to heavy rainfall areas of the Western Ghats and feed mainly on earthworms. Two species *Uropeltis macrolepis* (Peters) and *Uropeltis phipsoni* (Mason) occur in the State. The former is restricted to the Bombay hills between 18 and 19° Lat. It is very common at Mahabaleshwar during the rains and a variety has been described from that area. *U. phipsoni* is more widely distributed and is known from Bombay Hills to the Anamalais in Kerala.

The Pythons and Boas family Boidae are the largest among present day snakes, some of the larger forms occasionally exceeding 8 metres in length. The Pythons are old world snakes whereas Boas are mainly new world forms. All are non-poisonous and kill their prey by constriction, the prey being asphyxiated to death. Two genera *Python* & *Eryx* occur in India and both are represented in Maharashtra. The Indian Python, *Python molurus*, the largest among Indian snakes exceptionally attains a length of up to 6 metres. Specimens exceeding 4 metres are now rare. Inhabits forested country preferably well watered. Feeds on any animal it can overcome and swallow but prefers mammals. Breeds during the cold weather. The number of eggs varies considerably and may exceed 100 in number. The eggs are incubated by the female. Yellowish, greyish or brownish above with large, darker, black-edged spots dorsally and on flanks; yellowish below.

The Sand Boas of the genus *Eryx* are, compared to the Pythons, small snakes hardly exceeding a metre in length. Easily distinguished from the python by the presence of small scales instead of shields on the head. The two species Russel's Sand Boa *Eryx conicus* and John's Sand Boa *Eryx johni* that occur in India are found in the State. Russel's Sand Boa is yellowish, brownish or greyish above with a dorsal series of brown black-edged spots. John's Sand Boa is usually uniform grey, yellowish or dark brown above but occasionally has dark transverse bands. Both are sluggish, largely sub-terrestrial snakes which subsist mainly on small mammals.

The Family Colubridae has the largest number of genera and species. A cosmopolitan family, its members are terrestrial, arboreal, and aquatic. 30 species of 20 genera occur in Maharashtra. The Wart Snake *Acrochordus granulatus* differs from all other colubrids in the absence of ventral shields. Dark grey or blackish in colour with whitish crossbars which become indistinct with age. A thoroughly aquatic species preferring estuaries, it feeds exclusively on fish. Viviparous.

The Trinket Snake *Elaphe helena* represents a genus widely distributed in Asia and N. America. A distinctively marked snake with the forepart of the body beautifully ornamented with 3 or more white islets in a pattern, enclosed by black cross-bands; the 'trinkets' may extend to the tail. Posteriorly the crossbars are replaced by two black bars on the flanks. Usually found in or near jungles at altitudes between 1,500 to 6,000 ft. The Rat Snake or Dhaman *Ptyas mucosus* is widely distributed throughout India. Diurnal and often seen in uninhabited areas. Varies in colour, being olive-green, brown, yellow or greyish above. Excitable, it is among Indian snakes unique in producing occasionally a mewling noise when cornered and at bay. Rat snakes have been recorded upto 3.6 metres in length. Feeds largely on rodents, and is not poisonous, contrary to popular belief.

Three species of Racer snakes occur. *Argyrogena fasciolatus*, the Banded Racer so called from the young being ornamented with black

crossbars on an olive brown back ground. The crossbars become obscure with age. A peninsular form it is more common in the Konkan than elsewhere in its range and from its habit of erecting the forebody and flattening its neck like the cobra is often mistaken for one. It is, in fact, considered the female of the cobra in the Konkan. Grows to over 3 ft. in length. Of the other two Racers, *Coluber ventromaculatus* a light grey snake with black crossbars is a west Asian form, found in Bombay, Poona, Deolali which are approximately the eastern limits of its distribution. *Coluber gracilis* is a rare form known mainly from near Bombay. A light greyish brown snake, with narrow white black-edged crossbars, it grows to over one metre in length.

The Reed Snake *Liopeltis calamaria* a small (about 45 cms.), brown, greyishbrown or green snake with a pair of black lines dorsally, occurs mainly on the hills of the south and in Ceylon. It has been recorded from Mahabaleshwar and Matheran. Another uncommon species is *Coronella brachyura*, an olive brown snake about 60 cm. in length known only from Poona District and near Bombay in the State. The genus *Oligodon*, Kukri snakes, so named from the shape of some of the maxillary teeth are found mainly in eastern India and the hills of south India. Two species *Oligodon arnensis* and *Oligodon taeniolatus* occur in Maharashtra, the latter mainly a hill form. Beautifully marked, small snakes, 60 cm. or less in length they feed mainly on eggs of other reptiles and spawn of amphibians.

The Bronzebacks, genus *Ahaetulla* are slender, arboreal snakes living entirely on trees and bushes and only occasionally descending to the ground. The common Indian Bronzeback *Dendrelaphis tristis* is bronze-brown, or purplish brown above, light grey, greenish or yellowish below, with a distinct buff flank stripe. Feeds mainly on tree-frogs and lizards. Grows to slightly over 1.3 metre in length.

The Wolf Snakes, genus *Lycodon* are so named from the presence of an enlarged tooth both in the upper and lower jaw resembling the canine teeth in wolves. Small snakes hardly exceeding 75 cm. in length. The Common Wolf Snake *Lycodon aulicus* the commonest and most widely distributed of Indian Wolf Snakes is often confused with the poisonous Krait. It is seen in and around human habitations more commonly than any other Indian snake. Brown or greyish brown above barred with white. Feeds mainly on geckos and other lizards. The Travancore Wolf Snake *Lycodon travancoricus* occurs in the Western ghats as far north as Matheran. The Striated Wolf Snake *Lycodon striatus* has the same distribution as *L. aulicus* in Maharashtra. *Lycodon flavomaculatus* is a rare species known only from a few localities.

The genus *Sibynophis* is represented by a single species *Sibynophis subpunctatus* a small, light brown, black-spotted snake.

CHAPTER 7
Reptiles

The Keelbacks snakes (from the raised keel like structure on the scales) are found in or near water. The Checkered Keelback *Xenochrophis piscator* is one of the commonest snakes of the plains and low hills. Dorsally yellowish or olivaceous with black spots, whitish or yellowish below. It feeds on frogs and fishes. Length up to 1.3 metre. An equally if not more common species is the Buffstriped Keelback *Amphiesma stolata*. An olive green or yellowish brown slender snake barred or spotted with black above and with a buff or yellow stripe along the flanks. Margins of scales pale blue, a colour seen only when the snake is excited and flattens its body. Length up to a metre. Feeds on frogs and toads. *Amphiesma beddomei*, a hill species, is confined to the Western Ghats between 3,000 and 7,000 feet and occurs from Mahabaleshwar southwards. Another species that may occur in the State is *Natrix monticola* a comparatively rare species recorded from Talevadi to Travancore.

The Green Keelback, *Macropisthodon plumbicolor* is bright grass green above. Juveniles have two black V-shaped marks on the neck which is bright yellow or orange in between. The markings disappear with age. A timid snake, it has the habit of flattening its body when alarmed. Feeds mainly on toads. Length 75 cm. Another species likely to occur in south-west Maharashtra is *Rhabdops olivaceus* but no information is available on its habits. Olive or yellow brown above with four series of black spots.

The genus *Boiga*, Catsnakes, as they are commonly known from their vertical pupil and nocturnal habits are represented by three species. All have grooved teeth (fangs) at the back of the mouth and are mildly poisonous. The Indian Gamma *Boiga trigonata* is widely distributed in the Indian region. In colour, yellowish or grey brown above with a vertebral series of V-shaped black-edged spots. Arboreal it feeds largely on birds and tree lizards. Length up to a metre. An intrepid snake it assumes an attitude of attack characteristic of the genus, throwing forepart of the body into a figure of eight and briskly vibrating its tail. The Ceylon Cat snake, *Boiga ceylonensis* is found on the Western Ghats. Slightly longer in total length than *trigonata* it is greyish brown above with oblique spots or bars. Forsten's Cat snake *Boiga forsteni* the largest among the three, reaches a length of over two metres. Brown or reddish brown above with black spots or cross-bars on the back interspersed with white spots.

Three species of Sand Snakes of the genus *Psammophis* occur. Sand snakes are also back fanged colubers and are mildly poisonous. *Psammophis condanarus* is widely distributed in the Indian region. Olive or lighter above with 4 to 5 brown longitudinal stripes. Length upto 120 cm. *Psammophis longifrons* appears to be restricted to Maharashtra, greyish above gradually fading into brown. More or less similar in length to *condanarus* but stouter. Leith's Sand Snake *Psammophis leithi* is more common in desert areas. It has been

CHAPTER 7
Reptiles

recorded from the Deccan (Poona). Yellowish brown above with four dark longitudinal stripes, median pair bordered with black spots. Length upto 90 cm. All Sand Snakes feed mainly on lizards.

The genus *Ahaetulla*, Whip Snakes is represented by a single species the Common Green Whip Snake *Ahaetulla nasutus*. A slender green tree snake it is widely distributed in India and countries to the east. The pointed projecting snout is distinctive. Feeds on lizards, small birds and mammals. Length up to 266 mm. Another species likely to occur is the Brown Whip Snake *Ahaetulla pulverulentus*, not uncommon on the Western Ghats from N. Kanara southward. *Ahaetulla* is also a genus with fangs at the back of mouth and is mildly poisonous.

The sub-family Homalopsinae, Freshwater Snakes, are represented by three genera with a single species each, in the State. All are mainly aquatic and have provision to close their nostrils. They are back fanged and mildly poisonous. Feed more or less exclusively on fish. Viviparous. The commonest species in the tidal creeks of Maharashtra is the Dog-faced Water Snake, *Cerebrus rhyncops* a greyish, brown or olive snake with dark spots or cross bars above. Grows to a length of 60-90 cm. The other two species *Gerardia prevostiana* and *Enhydrina sieboldi* are uncommon. The former, a small grey or brown snake about 60 cm. in length is usually seen along the coast and tidal rivers. The latter, a whitish or buff snake with spots of dark brown has been recorded from Bombay. It grows to about 90 cm. in length.

The family Elapidae includes all the poisonous snakes, other than vipers, whose bite could be fatal to man. The fangs, which are canaliculate, are placed at the front end of the mouth. The elapids are found throughout the tropical and the subtropical regions of the world. Four genera occur in India and all are represented in Maharashtra, *Bungarus* Kraits, *Callophis* Coral snakes, *Naja* cobra and *Ophiophagus* King cobra.

The Common Krait, *Bungarus caeruleus*, (Marathi—Manyar) is widely distributed. A lustrous blue black or black snake, white barred on the back. Grows to over 1.3 metre in length. Not uncommon near human habitation. Feeds largely on other snakes and is active at night. The poison is a neurotoxin and kills through paralysis of respiratory centres. The poison is also haemotoxic leading to severe internal haemorrhage. The poison is considered to be four to five times more virulent than cobra venom. The Banded Krait *Bungarus fasciatus* is likely to occur in eastern Vidarbha. A handsome black and yellow banded snake, larger and longer than the Common Krait, but equally poisonous. No record yet of its biting people.

The Coral Snakes are small, less than 60 cm. and beautifully marked. Sluggish and gentle by nature, though poisonous, they are not known to bite. Feed on other snakes. Two species occur in Maharashtra. *Callophis melanurus* scarcely exceeding 1 foot in length is chestnut

above, each scale with a brown or black spot. Head and nape black, tail black banded. Ventrally red, crimson towards the tail. *Callophis nigrescens*, a hill form is blackish or greenish-blue above with 3 to 5 black stripes. It occurs along the Western Ghats as far north as Panchgani (near Mahabaleshwar).

The Indian Cobra (*Naja naja*) (Marathi—Nag) is found in all types of habitat from heavy jungles to populated town. Old masonry is specially favoured; white ants nests in the countryside are often a favourite haunt. The hood, spread when the snake is excited, is distinctive. Three varieties occur in India; (1) with a spectacle mark on the hood found throughout peninsular India; (2) with a single round mark on the hood found in east India and countries to the east; and (3) without any markings on the hood, found in north west India. In colour it may be yellowish olive brown, dark brown, or black. Adults are usually from 1.35 to 1.65 metres in length. Longer specimens occur but are rare. In disposition it is not an aggressive snake and if disturbed will erect its forebody and hiss but if it is not molested, will move away. Young are more aggressive than adults. Feeds principally on rats, frogs and toads, less frequently on birds and eggs; occasionally takes other snakes. Breeding season extends over several months and eggs, 12 to 22 in number, are laid in May to July. The mother usually coils round the eggs. The poison fangs are small less than 8 mm., but strong. The poison is a rapidly absorbed neurotoxin and death, as in krait poison is due to asphyxia. Death from a bite is not inevitable, the result being dependent on several factors, the main being the amount of poison discharged into the wound.

The King Cobra *Ophiophagus hannah*, the largest among the world's poisonous snakes is an uncommon snake, usually found in heavy jungles. The maximum length recorded is 5.4 metres but usually specimens about half the size are seen. Black or olive in colour, uniform when adult but banded with white when young. Has the characteristic hood of the cobras. Feeds mainly on other snakes.

The Sea Snakes, Family Hydrophiidae, occur along the coast from Persian Gulf to the Islands of Oceania. The body is compressed and the tail is paddle shaped. Two subfamilies are recognized, the thoroughly aquatic and viviparous Hydrophiinae, are off shore species. The Laticaudinae are littoral and largely oviparous. All sea snakes are poisonous but the potency of the venom varies, some being more powerful than the cobra venom. There are no records of bites from sea snakes. They feed on fish, some species living exclusively on eels. Of the 12 species likely to occur off the coasts of Maharashtra, *Enhydrina schistosa*, *Hydrophis spiralis*, *H. cyanocinctus*, *H. mamillaris*, *H. caeruleus*, *Lapemis curtus*, *Microcephalophis gracilis* and *Pelamis platurus* have been collected from around Bombay Island.

The Vipers, Family Viperidae, are widely distributed being absent only in the Australian Region and to its east. The poison fangs reach

their highest development in Vipers, being so large that they lie horizontally when the mouth is closed and are erected by movements of the jaw bones when the mouth is open and the snake is ready to strike. Two sub-families are recognised, Viperinae (True Vipers) and Crotalinae (Pit Vipers) distinguished by the presence of a sensory pit between the eye and the nostril. Both subfamilies are represented in Maharashtra, Viperinae by the genera *Vipera* and *Echis* and Crotalinae by *Trimeresurus*.

The Russell's Viper, *Vipera russelli*, (Marathi Ghonus), a thick set, sluggish viper grows up to 1.5 metres in length. The colour pattern is distinctive being brown with three series of large rounded or oval black and white margined spots. Widely distributed it occurs in all types of country. Feeds mainly on rats and mice. Viviparous 20 to over 60 young being born at a time. The poison acts mainly on the blood and the vasomotor centre.

The Phoorsa, *Echis carinata*, pale brown, greyish or sandy with a vertebral series of pale dark edged spots, hardly exceeds 60 cm. in length. Widely distributed it is more common in dry areas. Extremely abundant in Ratnagiri District, over a lakh being collected within a period of a week in 1890. An aggressive snake when excited it has the habit of rubbing the sides of its body against each other, forming a characteristic figure of eight in the process and producing a hissing or rasping sound. Recorded as ovoviviparous in India. The poison acts, like Ghonus poison, mainly on the blood and on the vasomotor centre. Feeds on arachnids and other arthropods, small mammals, reptiles and amphibians.

The Pit Vipers, sub-family Crotalinae, are found both in the old and new worlds. The pit, situated on the side of the head between the eye and the nostril is a heat sensor organ which assists the snake in capturing prey. Two species of Pit Vipers, *Trimeresurus gramineus* Bamboo Pit Viper and *Trimeresurus malabaricus*, Malabar Pit Viper occur in Maharashtra. Both are greenish above with or without spots or markings. Forest species, usually in the hills. They feed mainly on small mammals and lizards, frogs. Viviparous. The poison is not fatal to man.

The Krait (Manyar), Cobra (Nag), Russell's Viper (Ghonus) and *Echis* (Phoorsa) are the four dangerously poisonous snakes commonly found in Maharashtra (apart from Seasnakes). Antivenin is available against all the four types of snake poison.

CHAPTER 8—AMPHIBIA

THE AMPHIBIANS CONSIST OF THREE WELL-DEFINED TYPES grouped in three Orders, Caudata (Salamanders and Newts), Gymnophiona (Caecilians) and Salientia (Frogs and Toads). These orders have certain characters in common. They are cold blooded vertebrates having a smooth or rough glandular skin and lacking fur, feather, and/or scales found in dry-skinned, truly land vertebrates. A primitive type of scale occurs embedded in the skin in some caecilians.

The most remarkable factor in the life of amphibians is their breeding habit. It is a well-known fact that, among land vertebrates, only amphibians begin their lives in water as tadpoles. It is during the breeding season, coinciding with the monsoons in India, that the normally circumspect frogs and toads throw all caution to the winds and the male makes its presence known by its loud call, a sound which, at night in well-watered country, is a continuous roar as thousands of frogs and toads of different species give tongue to advertise their presence in the selected breeding site.

The manner of deposition of the eggs varies ; many frogs lay them in a frothy mass. Among the tree frogs the eggs are usually not laid in water, but in a situation which would enable the developing young to be released into water. The egg mass hardens into a crust on the outside in these species. The toads lay their eggs in gelatinous strings of varying lengths which are loosely twined round water-weeds by the movements of the female. The number of eggs laid by one female may be as high as 2000 in Indian species ; those which have an abbreviated larval life lay a smaller number varying with the period of the larval life.

Amphibians are relatively defenceless animals and seek safety in crevices and other shelters when faced with danger or remain immobile depending on their cryptic coloration to escape detection. The skin secretions also give a certain amount of protection, but many predators are immune to their effect.

Amphibians are beautifully adapted to life in their particular environment and usually it is possible to 'place' a species by a superficial examination ; for instance burrowing species have well-developed

CHAPTER 8
Amphibia

CHAPTER 8

Amphibia

metatarsal tubercles, the spades they use for digging, while tree frogs have large adhesive discs, and aquatic species have extensive webbing on the toes.

The bulk of the food consumed by amphibians consists of invertebrates, mainly insects. They also feed on any animal, including others of their kind, which they can overcome.

Two regions in India have a very rich amphibian fauna, the Western Ghats and the Eastern Himalayas. Of the 130 species of 23 genera known in India, 22 species of 10 genera occur in Maharashtra. Species of the Order Caudata are absent in this region.

LIST OF AMPHIBIA OF MAHARASHTRA
ORDER GYMNOPTERA

Family : CAECILIDAE

1. *Indotyphlus battersbyi* Taylor.
2. *Ichthyophis subterrestris* Taylor.

ORDER SALIENTIA

Family : BUFONIDAE

3. *Bufo melanostictus* Schneider, *cham beduk*. (Marathi).
4. *Bufo stomaticus* Lutken.
5. *Bufo koynaensis* Soman.

Family : MICROHYLIDAE

6. *Microhyla ornata* (Dum. & Bibr.)
7. *Uperodon globulosum* (Gunther).
8. *Ramanella variegata* (Stoliczka).
9. *Ramanella montana* (Jerdon).

Family : RANIDAE

10. *Rana cyanophlyctis* Schneider.
11. *Rana limnocharis* Boie.
12. *Rana tigrina* Daudin.
13. *Rana malabarica* Bibr.
14. *Rana rufescens* (Jerdon).
15. *Rana breviceps* Schneider.
16. *Rana leithii* Boulenger.
17. *Rana beddomii* (Gunther).
18. *Rana temporalis* (Gunther).
19. *Nyctibatrachus humayuni* Bhaduri & Kripalani.

beduk. [Marathi]

Family : RHACOPHORIDAE

20. *Philautus bombayensis* Annandale.
21. *Philautus glandulosus* (Jerdon).
22. *Rhacophorus leucomystax maculatus* (Gray).

SHORT NOTES ON SPECIES.

The Caecilians, Family Caeciliidae, are fossorial, limbless amphibians, like snakes in general appearance, for which they are often mistaken. The head, except for the lack of annulations, is not distinguished from the body. The eyes may or may not be visible externally. A short tentacle is present between the eye and the nostril. The body has series of annulations. A short tail may be present or not. The

CHAPTER 8

Amphibia

caeciliidae are the most primitive among amphibians and are found only in the tropical regions of Asia, Africa and America. Very little is known of these secretive creatures. Two genera, each represented by a single species occur in the State, of these *Indotyphlus* is so far known only from Khandala (Poona District). *Indotyphlus battersbyi*, a slender earthworm-like species is seen under stones on grassy hill-sides at Khandala during the rains. One species of *Ichthyophis*, *I. subterrestris* has been recorded from Alibag, Kolaba District. The genus is not uncommon in heavy rainfall regions and is likely to occur in other areas of the State. They have limited burrowing capacity useful only in soft earth and are found in swampy areas, decaying vegetation, under fallen tree trunks etc. They are usually less than a foot in length.

The Toads, Family Bufonidae, are more or less cosmopolitan in distribution. Of the three genera in India, one, *Bufo* is represented in the State. Toads of the genus *Bufo* are easily recognised by their warty skin and the presence of two well-marked glands behind the head, the paratoid glands. They are true land animals and except during the breeding season are not seen in water. Three species occur, *Bufo melanostictus*, *Bufo stomaticus* and *Bufo koynaensis* recently described from the Koyna Dam area (Satara District). The Common Toad *Bufo melanostictus* is widely distributed and is the largest and commonest species in India. It is equally at home in almost all the biotopes found in the country and occurs from sea-level up to 6,000 ft. in the hills. A prolific breeder, the eggs embedded in translucent strings are laid in ponds, ditches and rain-water pools at the beginning of the monsoon. Predominantly insect-eaters they consume a large number during their night hunts and are thus of economic importance. *Bufo stomaticus* is easily separated from *B. melanostictus* by the absence of cornified, bony ridges on the head. This species prefers a drier habitat and is not so widely distributed as the Common Toad. In colour it is grey or olive above, rarely uniform, being more often marbled with darker markings, ventral side and upper lip white.

The Narrow-mouthed Frogs, family Microhylidae are distinguished by the small head in relation to the body. They are not uncommon but being fossorial, are rarely seen, except during the breeding season. Many species live more or less exclusively on ants and termites and are often seen in association with termite colonies. The family is widely distributed and occurs in the tropics of both hemispheres. Three genera occur in Maharashtra. The genus *Microhyla* is represented by a single species *Microhyla ornata*. This pretty little microhylid is the commonest species of the family and one of the smallest, rarely exceeding 25 mm. in snout to vent length. It occurs in dry as well as heavy rainfall areas. The pattern on the back which may be bright pink or of varying shades of brown is distinctive. The transparent tadpoles are seen in rain water pools during the rainy season. The genus *Uperodon* is represented by a single species *Uperodon globulosum*

CHAPTER 8
Amphibia

the Balloon Frog, so named from the rotund shape of the body. In colour it is uniform brown or grey above and white below. A completely fossorial species, it is not seen above ground except during the breeding season, at the break of the monsoon. At other times of the year they are usually found in termite nests, termites being their main food. They are excellent burrowers and using the large shovel shaped tubercle on the heel of their foot rapidly burrow into the soil. Two species of the genus *Ramanella* occur in the State. *Ramanella variegata* a small microhylid, less than 40 mm. in snout to vent length. In colour brown with lighter marblings or spots and white below. Recorded from eastern Vidarbha districts. *Ramanella montana* more or less equal in size to the former has been recorded from the heavy rainfall areas of western Maharashtra from Bombay southwards. In colour it is brown above and below, with darker spots above and white spots or blotches ventrally. Little information is available on the habits of this species. Another microhylid frog likely to occur in the State is *Kaloula pulchra taprobanica* which has been collected at Khanapur in Belgaum District. This species is easily distinguished in having only the tips of the fingers and not of the toes, dilated into discs.

The family Ranidae which includes the true frogs, (the best known among amphibians) and allied species has a world wide distribution excepting regions of extreme climatic conditions and some oceanic Islands. Two genera occur in the State *Rana* and *Nyctibatrachus*, the latter being endemic to the Western Ghats. Species of the family can be distinguished by the presence of teeth on the upper jaw, and the tongue being bifid at the tip. The pupil may be horizontal or vertical. All species breed at the beginning of the monsoon, laying their eggs in permanent, semipermanent ponds and streams. The genus *Rana* is represented by nine species assigned to three subgenera. The commonest and most easily seen species of Indian frogs is the Skipper, *Rana cyanophlyctis*, a medium sized frog rarely exceeding 60 mm. in snout to vent length. Almost all ponds, shallow stretches of rivers, rain water pools have their quota of this species easily recognised by their habit of skipping over the water like a ricocheting stone. Another common species but not so dependent on water is the Grass Frog, *Rana limnocharis* an almost equally abundant and widely distributed species. Unlike the more aquatic Skipper, *R. limnocharis* does not have its toes fully webbed. A small sized frog usually between 20 and 60 mm. in snout to vent length, it is in colour, grey or brown of varying intensity often with a yellowish vertebral streak. The largest among Indian amphibia attaining a snout to vent length of 162 mm. or more is the Indian Bullfrog (*Rana tigerina*). It is widely distributed though not so common as the Skipper. In colour it is usually brown with varying degrees of green on the body. Usually associated with large bodies of water, the frog in spite of its fully webbed toes remains outside but in the immediate vicinity of water where its colour blends with its surroundings. Feeds on insects and any other animal it can

CHAPTER 8
Amphibia

overcome. The Bull Frog is the source of frogs' legs for export and such large numbers are collected every year that there is the danger that the species will become rare if the selective collection of large breeding animals is continued at the present rate.

Two other large sized frogs likely to occur in the State and which may also form part of the commercial catches are *Rana crassa* indistinguishable from *Rana tigerina* except by the large metatarsal tubercle and *Rana hexadactyla* a completely aquatic species, common in south India and recorded on the west coast up to Goa.

A distinctive species which is not uncommon in the forested tracts of the Western Ghats of the State is the Fungoid Frog *Rana malabarica*. In colour it is bright orange red, yellowish red or crimson on the back with black flanks and ventrally white, uniform or spotted or marbled with black. It attains a snout to vent length of 87 mm.

Two species of burrowing frogs *Rana rufescens* and *Rana breviceps* occur in the State. Like other burrowing amphibia these are usually seen only during the monsoon and are distinguished by the large metatarsal tubercle on their foot—the tool used in burrowing. *Rana rufescens* which occurs along the Western Ghats from Bombay to Kerala is a small sized frog 35 mm. in snout to vent length, in colour brown above with darker spots or marblings and occasionally patches of red on the fore and hind legs. *Rana breviceps* is larger, reaching a snout to vent length of 65 mm. and is more widely distributed. A squat toad-like frog, light or dark brown or grey above, occasionally spotted or marbled darker; ventrally whitish with the throat brownish.

Rana leithii and *Rana beddomii* are forest species of the Western Ghats distinguished by the presence of a small finger-like papilla on the tongue. The toes are enlarged into discs. *Rana leithii* originally described from Matheran, Kolaba District, occurs from Salsette Island up to Mahabaleshwar from where it is replaced by *Rana beddomii*. Both are small sized, active frogs not uncommon during the monsoon season.

Rana temporalis, another forest species of the Western Ghats, has been recorded from Mahabaleshwar. In colour it is brown of varying shades above, often with a black band; ventrally white. Attains a snout to vent length of up to 81 mm.

The genus *Nyctibatrachus* is peculiar to the Western Ghats and till the discovery in 1952 of *Nyctibatrachus humayuni* at Khandala, was thought to be restricted to the southern ranges of the Ghats. The genus is distinguished from *Rana* by the vertical pupil. The numerous folds on the skin give a wrinkled appearance to these frogs. Humayun's Wrinkled Frog *Nyctibatrachus humayuni* is not uncommon at Matheran, Khandala and Mahabaleshwar. Usually seen near hill streams in well forested areas it attains a snout to vent length of up to 46 mm. and is brownish black above paler below in colour.

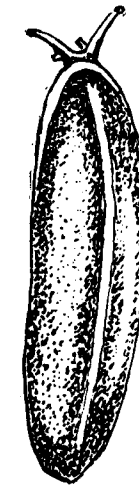
CHAPTER 8

Amphibia

The Tree Frogs, family Rhacophoridae, are represented by two genera *Philautus* and *Rhacophorus*. The tree frogs are separated from frogs of the family Ranidae by the presence of an additional cartilaginous phalange on their toes. The large discs on the toe and the slender form of the body and legs assist the animals in their arboreal existence.

The Genus *Philautus* is represented by two species *Philautus bombayensis* not uncommon at Khandala and Mahabaleshwar during the monsoon. The call of the male of this tiny bush frog, hardly exceeding 20 mm. in snout to vent length, is a feature of the forests and nearby scrub lands of the Ghats during the rains. *Philautus glandulosus* has been recorded from similar surroundings at Mahabaleshwar.

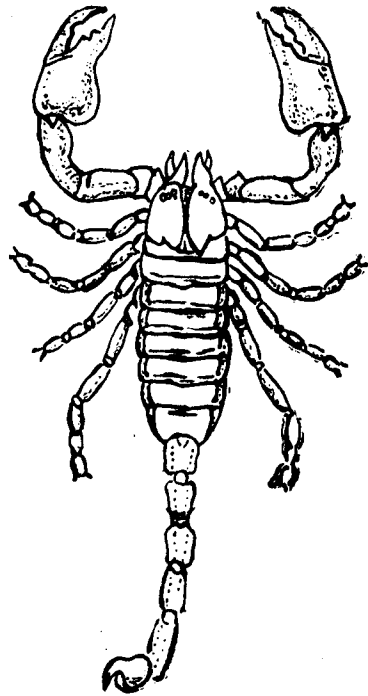
The genus *Rhacophorus* is represented by a single species *Rhacophorus leucomystax maculatus* found in the plains as well as the hills. A slender, medium sized, tree frog, which often takes up residence in humid surrounding in houses. In colour grey or yellow above, the species has the ability to change its colour according to its surroundings. The eggs are laid above water in a frothy mass which hardens on contact with air, and the tadpoles on hatching fall into the water for further development.



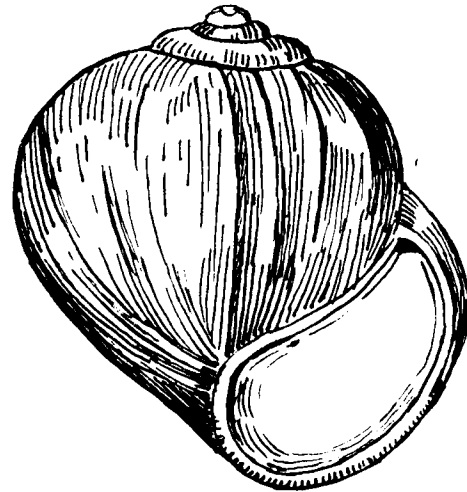
Slug (Mollusca)



Freshwater Leech



Scorpion



Land Snail
(a) Operculum

CHAPTER 9—LAND AND FRESHWATER INVERTEBRATES

THIS PART DEALS WITH LAND AND FRESHWATER FORMS OF THE PHYLUM PROTOZOA, Porifera, Coelenterata, Platyhelminthes, Nematoda, Annelida, Arthropoda (insects and spiders excepting) Mollusca, occurring in Maharashtra. There is not much published literature on these invertebrates for reference and whatever has been published, is all scattered, to which access is not easy. This account, therefore, cannot claim to be exhaustive ; a list of references is given at the end.

Parasitic forms have been left out of the list of species appearing under each phylum excepting the phyla Protozoa, Platyhelminthes and Nematoda wherein mention has been made of the commonest forms affecting man.

Protozoa are microscopic organisms which are generally defined as unicellular animals. All the functions of animal life, are performed by a small undivided mass of protoplasm. There are about 15,000 named protozoans in the world of which 310 species of freshwater and soil forms have so far been known from India. Those occurring in Maharashtra are as under :

SYSTEMATIC LIST OF SPECIES

Class : *Rhizopoda*

Order : Lobosa or Amoebozoa.

Freshwater rhizopoda with blunt and lobose pseudopodia. Some of them are parasitic.

1. *Amoeba proteus*
Habitat : Found in mud, in freshwater ponds and ditches.
2. *Entamoeba gingivalis* (Gros)
Habitat : gums of human beings in and around teeth.
3. *Entamoeba coli* (Grasse)
Habitat : lives in the colon of human beings ; harmless.
4. *Entamoeba histolytica* Schaudinn
Habitat : Found in the mucus membrane of colon of man, causing dysentery.

CHAPTER 9
Land and Freshwater
Invertebrates

PHYLUM PROTOZOA
(FIRST ANIMALS)

CHAPTER 9

Land and Freshwater
Invertebrates

5. *Entamoeba nana* (Wenyon & O'Connor).
Habitat : in the large intestine of man ; harmless.
Class : Ciliata.
Subclass : Protociliata—Parasitic forms generally found in the Amphibia.
Subclass : Euciliata.
Order : Holotricha Stein.
Suborder : Gymnostomata.
Family : Holophryidae.
6. *Urotricha* sp.
Habitat : Soils of Bombay.
Family : Didiniidae.
7. *Mesadinium pulex* (Claparede and Lachmann)
Habitat : Freshwater.
Locality : Bombay.
Family : Butschliidae.
Parasites in the guts of ungulate mammals.
Family : Amphileptidae.
8. *Litonotus fasciola* (Ehrenberg) Wresniwski.
Habitat : Dirty water
Locality Bombay.
Tribe : Hypostomaba.
Family : Nassulidae.
9. *Nassula* sp.
Habitat : Fresh water.
Locality : Bombay.
Family : Chlamydodontidae.
10. *Chilodonella cucullulus* (O. F. Muller)
Habitat : Freshwater Ponds
Locality : Bombay
Sub-order : Trichosomata.
Family : Plagiopylidae.
11. *Plagiopyla* (?) *carteri* (Kent)
Habitat : Freshwater
Locality : Bombay.
Family Colpodidae.
12. *Colpoda cucullus* (O. F. Muller)
Habitat : Soil
Locality : Bombay.
13. *Colpoda steinii* (Maupas)
Habitat : Soil
Locality : Poona, Bombay, Nagpur.
Family : Parameciidae.

CHAPTER 9

Land and Freshwater
Invertebrates

14. *Paramecium aurelia* (Ehrenberg)
Habitat : Freshwater.
Locality : Bombay
Sub-order : Hymenostomata.
15. *Frontonia leucas* (Ehrenberg)
Habitat : Freshwater
Locality : Bombay
Family : Ophryoglenidae.
16. *Ophryoglena flava* (Ehrenberg)
Habitat : Freshwater among *Nitella*.
Locality : Bombay
Family : Pleuronematidae.
17. *Balantiophorus elongatus* (Schewiakoff)
Habitat : Soil
Locality : Bombay
18. *Balantiophorus minutus* (Schewiakoff)
Habitat : Soil
Locality : Bombay
Family : Urocentridae.
19. *Urocentrum turbo* (O. F. Muller)
Habitat : Freshwater
Locality : Bombay
Sub-order : Astomaeaba.
Parasites of Annelids—in their alimentary Canal.
Order Spirotricha.
Sub-order : Heterotricha.
Family : Stentoridae.
20. *Climacostomum virens* (Ehrenberg) (Stein).
Habitat : Freshwater.
Locality : Bombay
21. *Shentorella* sp.
Habitat : Freshwater
Locality : Bombay
Sub-order : Entodiniomorpha.
All parasitic forms—parasitizing the alimentary canal of ruminants.
Family : Oxytrichidae.
Conostomum affine (Stein).
Habitat : Soil
Locality : Bombay
23. *Pleurotricha grandis* (Stein)
Habitat : Pondwater and infusion of dry leaves.
Locality : Bombay
24. *Oxytricha* sp.
Habitat : Freshwater

CHAPTER 9

Land and Freshwater
Invertebrates

- Locality : Bombay
Family : Euplotidae.
25. *Euplotes charon* (O. F. Muller)
Habitat : Freshwater
Locality : Bombay
Order : Peritricha.
The majority are bell-shaped attached forms.
Sub-order : Sessilia.
Tribe : Aloricata.
Family : Vorticellidae.
26. *Vorticella convallaris* (Linnaeus)
Habitat : Freshwater
Locality : Bombay
27. *Vorticella microstoma* (Ehrenberg)
Habitat : Freshwater.
Locality : Bombay
28. *Vorticella* sp.
Habitat : Freshwater.
Locality : Bombay
Family : Epistylidae.
(Stalked forms).
29. *Epistylis galea* (Ehrenberg)
Habitat : Freshwater, or aquatic plants.
Locality : Bombay
Tribe : Loricata.
Peritricha possessing a test or lorica.
Family : Vaginicolidae.
30. *Pyxicola carteri* (Kent)
Habitat : Freshwater.
Locality : Bombay.
Class : Suctoria.
- In this class cilia are present in the young stages of the animals, which are budded off from the sedentary adults.
Family : Acinetidae.
31. *Tokophrya quadripartita* (Clapereds and Lachmann)
Habitat : Freshwater : attached to *Epistylis plicatilis* or to water plants or *Paludina* and other freshwater molluscs.
Locality : Bombay
32. *Acenata tuberosa* Ehrenberg.
Habitat : Freshwater.
Locality : Bombay
Family : Podophryidae.
33. *Podophrya fixa* (O. F. Muller).
Habitat : Fresh and salt water
Locality : Bombay

CHAPTER 9

Land and Freshwater
Invertebrates

34. *Sphaerophrya pusilla* (Claparede and Lachmann).
Habitat : Freshwater.
Locality : Bombay

Among the Flagellates the following forms occur commonly in Maharashtra.

1. *Euglena* sp. Found floating on rainwater pools etc. as green scum on the surface.
Locality : Bombay
2. *Volvox* sp. Found in freshwater ponds as a small green sphere which may be 1/10" in diameter. This sphere is a colony of a number of individuals.
Locality : Bombay

The Phylum Porifera meaning pore-bearers, includes the simplest of the many-celled animals. The known number of sponge-species in the world has been estimated at 4,500 but of these only 150 species live in freshwater (Spongillidae) and the rest are entirely marine. The following freshwater species occur in Maharashtra :

PHYLUM PORIFERA
(SPONGES)

SYSTEMATIC LIST OF SPECIES

Order : *Halichondrina*

Siliceous sponges in which the horny skeleton is much reduced or absent and the spicular skeleton is more definitely reticulate or netreined.

Family : *Spongillidae*

Freshwater Halichondrina.

1. *Spongilla lacustris* var. *proliferus* (Annandale)
Grows in rain water pools.
Locality : Igatpuri, Western Ghats.
2. *Spongilla alba* var. *bengalensis* (Annandale)
Grows on gravel, rocks.
Locality : Island of Bombay, Igatpuri, Western Ghats.
3. *Spongilla cinerea* (Carter)
Grows on grass roots in pools and stones at the edge of tanks.
Locality : Nasik
4. *Spongilla crateriformis* (Potts)
Usually found adhering to water plants like *pistia* and *Limnanthemum*.
Locality : Igatpuri Lake, Western Ghats (altitude ca. 2,000 ft. or 610 m.)
5. *Spongilla carteri* (Carter)
Grows in ponds and lakes.
Locality : Island of Bombay, Igatpuri, Western Ghats (altitude ca. 2,000 feet or 610 metres).

CHAPTER 9

Land and Freshwater
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CHAPTER 9

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Locality : Island of Bombay, Igatpuri, Western Ghats (altitude ca. 2,000 feet or 610 metres).

CHAPTER 9

Land and Freshwater
Invertebrates

6. *Spongilla bombayensis* (Carter)
Grows in lakes.
Locality : Island of Bombay, Igatpuri Lake, in the Western Ghats.
7. *Spongilla perviridis* (Annandale)
Locality : Koyna and Yenna rivers in Satara District, stream at Medha, rocky artificial pools in Satara District and at Karla in Poona District.
8. *Spongilla sumatrana* var. *rivularis* (Annandale)
Grows side by side with *Spongilla perviridis*.
Locality : On the rocks in the river Yenna at Medha, Satara District.
9. *Spongilla sumatrana* var. *indica* (Annandale)
Locality : Nasik and Igatpuri.
10. *Spongilla sumatrana* var. *gravellyi* (Annandale)
Locality : Koyna river at Taloshi, Satara District.
11. *Ephydatia meyeri* (Carter)
Grows on stones, brickwork etc. at the edge of water.
Locality : Island of Bombay.
12. *Dosilia plumosa* (Carter)
Found floating on the surface of water soon after rains ; not fixed on any solid body.
Locality : Igatpuri Lake ; the Godavari at Nasik.
13. *Corvospongilla lapidosa* (Annandale)
Grows on stones at the edge of tanks, lakes etc.
Locality : Igatpuri Lake ; the River Godavari at Nasik.
14. *Corvospongilla ultima* var. *spinosa* (Annandale)
Locality : Yemma river at Medha, Satara District.

PHYLUM COELENTERATA (HYDRUS, JELLYFISH AND CORALS)

This phylum includes hydras, sea-anemones, jellyfishes and corals. There are about 9,000 known species in the world and all except a few species are marine. The following freshwater species occur in Maharashtra.

Class : Hydrozoa.

Order : Hydroida.

Naked Hydrozoa reproducing their kind by means of buds, or eggs or fission ; no alternation of generations.

Family : Hydridae.

Small elentheroblastea in which the mouth is surrounded by hollow tentacles. No permanent colonies are formed. Reproduction is by budding.

Systematic List of Species

CHAPTER 9

Land and Freshwater
Invertebrates

1. *Hydra vulgaris* (Pallas). Found in stagnant water, in ponds containing aquatic vegetation ; attached to plants like *Lemna* (Duckweed) and *Limnanthemum*.

Locality : Island of Bombay.

Order : Trachylene.

These are hydrozoa which exist only as medusae, the poly stage being absent.

Suborder : Trachymedusae

1. *Limnocyclus indica* (Annandale) : This has so far been collected from the Yenna and Koyna, the tributaries of the Krishna river. In the Yenna, it occurs in pools, at Medha about 2,200 feet, (670 m.), above sea level as also in pools at Kelghat at the head of the deep valley. In the Koyna it is found in pools at Tambi, at Vela, at Bemnoti and at Patan, at Dhoni as also in the tributaries of Krishna, Varna and Panchganga at Karad, both these tributaries taking their sources from the Western Ghats.

This phylum includes flatworms of which there are about 9,000 forms so far known in the world. They comprise the free living freshwater, marine, and land planarians (Turbellaria), parasitic flukes (Trematoda) and the parasitic tapeworms (Cestoda).

SYSTEMATIC LIST OF SPECIES

Class : Turbellaria.

Order : Tricladida.

Sub-order : Palludocola (Freshwater forms).

1. *Planaria* sp. Locality : Stagnant rainwater pools and other freshwater tanks around Bombay.

Sub-order : Terricola (Land forms).

2. *Ripalium prosperina* (Humbert) Locality : Mahabaleshwar, Western Ghats (Ca. 3,500 feet or 1,070 m.), Poona District.

Class : Trematoda.

Order : Prosotomata.

Sub-order : Distomata.

Superfamily : Fascioloidea.

1. *Fasciola hepatica* Linnaeus Livers of sheep and goats in Maharashtra.

2. *Fasciolopsis buski* (Lankester) (Giant Intestinal Fluke of man).

Locality : Kandivli, Bombay.

Class : Cestoda.

Order : Cyclophyllidea.

Superfamily : Taenioidea.

Family : Taeniidae.

CHAPTER 9

Land and Freshwater
InvertebratesPHYLUM NEMATODA
(THREADWORMS)

3. *Taenia solium* (Linnaeus). This is the common or Pork Tape Worm in man.

The Nematodes or Threadworms are either parasitic or free-living and about 10,000 known species of them in the world have so far been listed. Some of the well known parasites in this group are—

1. Large intestinal Roundworm of man, *Ascaris lumbricoides* (Linnaeus) inhabiting the large intestines.

2. The Filaria Worm *Wuchereria bancrofti* (Cobbold) which lives in the blood of man causing filariasis, and

3. The Guinea Worm *Dracunculus medinensis* (Linnaeus)

These are occasionally met with in Maharashtra.

Free living worms inhabit soil, freshwater and the sea and its shore.

PHYLUM ANNELIDA
RINGED ANIMALS.

This phylum includes earthworms, leeches and other ringed animals of which some live on land, a few in freshwater and a few others in the sea. Their known species roughly total about 7,000.

Systematic List of the land and freshwater forms occurring in Maharashtra.

Class : Chaetopoda.

Order : Oligochaeta (Earthworms)

Sub-order : Archioliogochaeta.

Series : Naidina.

Family : Naididae.

Small aquatic worms seldom exceeding an inch in length.

Setae usually to four bundles per segment—two dorsal and two ventral. Dorsal bundles are sometimes wanting.

1. *Chaetogaster bengalensis* (Annandale). Commensal on several species of freshwater snails like *Limnaea* sp. and on sponges *Spongilla carteri* and *Ephydatia fluviatilis*.

Locality : Satara, Western Ghats.

2. *Chaetogaster spongilliae* (Annandale). Feeds on organic debris of decaying parts of sponges ; movement by wriggling.

Locality : Khandala, Western Ghats, Poona District, in *Spongilla crateriformis*.

3. *Nais communis* Piguet var. *punjabensis*. Length 2.14 mm. Segments 18-32. Light brown. Found inhabiting tubes abandoned by insect larvae.

Locality : Khandala, Western Ghats, Poona District.

Genus *Pristina* Ehrbg.

Prostomium prolonged into a mobile proboscis. Dorsal bundles beginning in ii, consisting of hair setae and needles with simple or bifid point.

CHAPTER 9

Land and Freshwater
Invertebrates

4. *Pristina longiseta* Ehrbg., f. typica.
Length : 3.5—5.5 mm. 20-33 segments. Whitish ; no eyes.

Locality : Bombay.

Genus *Aulophous* Schmarda

Prostomium well-developed, rounded, ventral setae beginning in v or vi.

5. *Aulophorus furcatus* (Oken).

Length 6.16 mm. Diameter 0.2 mm. 35-40 segments.

Locality : Bombay, Khed, Poona District, in a hot spring.

Family : Enchytraeidae.

Small worms, aquatic or terrestrial in habit, whitish or pinkish in colour ; setae mostly in four bundles per segment ; dorsal and ventral ; setae similar in form.

6. *Enchytraeus indicus* (Stephenson)

Length 4 mm. brownish : segments 31.

These worms are found in the egg membranes of the pond. snail—*Pila globosa*.

Locality : Bombay.

Family : Moniligastridae.

Setae simple ; pointed, sigmoid ; 4 pairs per segment.

7. *Drawida barwelli* var *impertusa* Stephenson

Length 45 mm. diameter 3.5 mm. segments 130 : blotch olive.

Locality : Bombay.

Family : Megascolecidae.

This is the largest family of earthworms.

Setae simply pointed ; four pairs per segment or numerous ; clitellum beginning with or in front of XV.

8. *Megascolides prashadi* (Stephenson)

Length 42 mm. dia : 4 mm. segments 140.

Sakarwari on the way to Mahabaleshwar.

9. *Megascolex konkanensis* (Fedarb)

Locality : Bombay.

10. *Megascolex mauribii* (Kinb).

Locality : Bombay.

Genus : *Pheretima*.

Setae numerous on each segment. This genus is one of the commonest in India.

11. *Pheretima elongata* (E. Perrier)

Locality : Bombay, Manmad.

12. *Pheretima hawayana* (Rosa)

Locality : Bombay.

13. *Pheretima houletti* (E. Perrier)

Locality : Bombay.

CHAPTER 9

Land and Freshwater
Invertebrates

14. *Pheretima lignicola* Stephenson
Locality : Bombay.
15. *Pheretima posthuma* (L. Vaill)
This worm is well-known in India since it is commonly used as
-the type for elementary study in colleges in Western and
Northern India.
Locality : Bombay.
16. *Pheretima suctorica* Mich.
Locality : Bombay.

Genus : *Perionyx* E. Perr.
Setae numerous (more than eight) per segment in rings which are
almost closed.
17. *Perionyx millardi* (Stephenson)
Locality : Bombay, Talegaon, Kalyan, Virar, Igatpuri.
18. *Perionyx minimus* (Stephenson)
Locality : Bombay.
19. *Perionyx pullus* (Stephenson)
Locality : Bombay.

Genus : *Ochtochaetus* Bedd.
20. *Ochtochaetus (Ochtochaetoides) beatrix* Bedd.
Locality : Bombay.
21. *Ochtochaetus (Ochtochaetoides) ganeshae* (Stephenson)
Locality : Ganeshkhind near Poona.
22. *Ochtochaetus (Ochtochaetoides) montanus* (Stephenson)
Locality : Panchgani, Western Ghats.
23. *Ochtochaetus (Ochtochaetoides) paliensis* (Stephenson)
Locality : Poona.
24. *Ochtochaetus (Ochtochaetoides) prashadi* (Stephenson)
Locality : Kalyan near Bombay ; Sakarwari on the way to Maha-
baleshwar.

Genus : *Ramiella*.
25. *Ramiella pallida* (Stephenson).
Locality : Panchgani and Mahabaleshwar in the Western Ghats.

Genus : *Eudichogaster* Mich.
This is one of the dominant genera in Western India.
26. *Eudichogaster ashworthi* Mich. var. *kinneari* (Stephenson).
Locality : Nasik.
27. *Eudichogaster indicus* (Bedd.)
Locality : Thana, Bombay.
28. *Eudichogaster mullani* (Stephenson)
Locality : Bombay.

CHAPTER 9

Land and Freshwater
Invertebrates

29. *Eudichogaster poonensis* (Fedarb)
Locality : Poona.
30. *Eudichogaster prashadi* (Stephenson)
Locality : Poona.
31. *Eudichogaster trichochaetus* (Stephenson)
Locality : Palghar (North of Bombay).

Genus : *Erythraeodrilus* Stephenson.
32. *Erythraeodrilus anomalus* (Stephenson)
Locality : Bombay.
33. *Erythraeodrilus inornatus* (Stephenson)
Locality : Talewadi, Kolhapur District.
34. *Erythraeodrilus kempfi* (Stephenson)
Locality : Talewadi, Kolhapur District.

Genus : *Dichogaster* Bedd.
35. *Dichogaster affinis* (Mich.)
Locality : Bombay.
36. *Dichogaster bolani* (Mich.)
Locality : Bombay, Bassein Road.
37. *Dichogaster bolani* var. *malabarica* Stephenson
Locality : Bombay.

Genus : *Ocneradrilus* Eisen.
38. *Ocneradrilus (Ocnerodrilus) occidentalis* (Eisen)
Locality : Bombay.

Genus : *Eudrilus* E. Perr.

Setae closely paired.
39. *Eudrilus eugeniae* (Kinb.)
Locality : Poona.

Family : *Lumbricidae*.
Normal setae 'S' shaped, usually eight per segment, seldom more.
The number of Lumbricidae in India is very small.

Genus : *Pentoscolex* Schmarda.
40. *Pentoscolex corethrurus* (Fr. Mull).
Length 60-120 mm dia. 4 mm Segments 90-212.
Locality : Bombay, Poona.

Order : *Hirudinea* (Leeches)
Vermiform and bisexual. Provided with a sucker at both
extremities. The Hirudinea are divided into two sub-orders :
Rhynchobdellae and Arhynchobdellae.

CHAPTER 9

Land and Freshwater
InvertebratesSub-order : *Rhynchobdellae*.

Marine and freshwater leeches with colourless blood, with a protrusible proboscis and without jaws. The mouth is a small median aperture situated within the anterior sucker or rarely upon its anterior rim.

Family : *Ichthyobdellidae*.Genus : *Placobdella* K. Blanchard.

Flattened body. Parasitic on turtles, frogs and fish.

1. *Placobdella emydae* (Harding)

Locality : Satara District.

Genus : *Hemiclepsis* Vejdovsky.

Medium, typically with 2 pairs of eyes. Mouth-opening within the anterior sucker.

2. *Hemiclepsis marginata* (O. F. Muller)

This is chiefly a fish-parasite but also attacks certain molluscs-
L. amellidens sp.

Locality : Igatpuri, Western Ghats, Bombay.

Genus : *Paraclepsis* Harding.

Medium size, 3 pairs of eyes, Mouth-opening subterminal.

3. *Paraclepsis praedatrix* (Harding)Parasitic on the freshwater tortoise-*Emyda granosa vittata*.

Locality : Igatpuri Lake, Western Ghats, Bombay.

Sub-order : *Arhynchobdellae*.

The jawed leeches or leeches without a protrusible proboscis.

In this Suborder the Hirudinea may be said to reach their most complete and perfect expression. The typical leeches belong to this sub-order fully adapted for a sanguivorous or a predaceous habit and with a few exceptions, all of the largest forms as well as those most intimately affecting human welfare. They are freshwater or terrestrial, never so far as known truly marine.

Family : *Hirudinae*.

As a group these leeches are of a medium to a very large size, some of them attaining a length of 15" or even 18" and a width of 1 when fully extended. These are variously called ; jawed leeches, ten-eyed leeches, blood-suckers etc.

The smallest forms are found among the highly specialised land leeches.

Sub-family : *Hirudinae*.4. *Hirudo birmanica* (Blanchard)

Locality : Bombay.

CHAPTER 9

Land and Freshwater
Invertebrates5. *Hirudinaria (Poecilobdella) granulosa* (Savigny)

This is the common Paddy-Field or Buffalo-Leech or Medicinal Leech of the Western India. It occurs in the plains and foothills between about 50-2,000' above sea level. It appears only rarely below 500'. Throughout its range it occurs in marshes, swamps, ponds, tanks, ditches, and the smaller streams but seldom in rivers.

This phylum—the largest—includes animals with jointed limbs such as the crab, the prawn and the lobster (Class : Crustacea), the millipedes and the centipedes (Class : Myriapoda), the butterflies, grass-hoppers and the rest of all insects (Class : Insecta), the spiders and scorpions (Class : Arachnida) and the worm-like Peripatus (Class : Onychophora) which is very rare, if not absent, in our country. The known world species are estimated to number 9,230,000.

PHYLUM ARTHRO-
PODA (JOINTED
LEGGED ANIMALS)

Only those forms of arthropods living on land and in freshwater in Maharashtra are listed below, excluding the Class Insecta and Spiders of the Class Arachnida which are dealt with separately.

SYSTEMATIC LIST OF SPECIES

Class : Crustacea.

Sub-class : Branchiopoda.

Order : Notostraca.

1. *Triops asiaticus* (Gurney)

Locality : Panchgani, Satara District.

Sub-class : Copepoda.

Order : Cyclopoida.

2. *Paracyclops vagus* Lindberg

Locality : Pandharpur, Sangli, Aurangabad.

3. *Ectocyclops medius* Kiefer.

Locality : Pandharpur, Aurangabad.

4. *Cyclops (Microcyclops) karvei* Kiefer et Moorthy

Locality : River Krishna, Sangli.

5. *Cyclops (Microcyclops) diminutus* Lindberg

Locality : Powai Lake, Salsette, Bassein.

6. *Cyclops (Microcyclops) tricolor* Lindberg

Locality : Bombay, Powai Lake, Bhima River, Pandharpur.

7. *Cyclops (Microcyclops) indolusitanus* Lindberg

Locality : Bhima River, Pandharpur.

9. *Eucyclops semidentatus* (Lindberg)

Locality : Vihar and Powai Lakes, Salsette Island, Bombay,
Pandharpur.

10. *Eucyclops microdentatus* (Lindberg)

Locality : Aurangabad.

11. *Cyclops (Metacyclops) gracilis* var. *margaretae* (Lindberg)

Locality : Bassein, Bombay, Pandharpur.

CHAPTER 9

Land and Freshwater
Invertebrates

12. *Cyclops (Metacyclops) dengizicus* (Lepechkin)
Locality : Bandra, Bombay.
13. *Cyclops (Metacyclops) rovi* sp. nov.
Locality : Bandra (Bombay)
14. *Cyclops (Metacyclops) var. communis* (Lindberg)
Locality : Pandharpur, Aurangabad.
15. *Cyclops (Microcyclops) varicans* Sars. var. *pachyspina* Lindberg
Locality : Nagpur, Chanda, Aurangabad, Bombay, Powai Lake, Salsette, Ghatkopar, Lonavla, Karla, Malavli, Kurudvadi, Pandharpur, Vengurla, Savantwadi.
16. *Cyclops (Microcyclops) varicans* var. *subaequalis* (Kiefer)
Locality : Pandharpur.
17. *Cyclops (Microcyclops) davidi* var. *subtropicus*
Locality : Powai & Vihar Lakes, Ghatkopar (Bombay)
18. *Halicyclops canui* sp. nov.
Locality : Bandra (Bombay)
19. *Halicyclops thermophilus spinifer* (Kiefer)
Locality : Bandra, Kurla (Bombay).
20. *Macrocyclus distinctus* (Richard)
Locality : Pandharpur, Powai Lake, Salsette, Bombay.
Sub-class : Malacostraca.
Series : Eulmalacostraca.
Order : Decapoda (Land Crabs only).

1. *Gecarcinus (Gecarcinus) jacquemontii* (Milne-Edwards)
This is distributed over the Thana and Kolaba districts and also over the tracts of the Deccan immediately to the east of the Sahyadri range. These are the only parts of India where this species occurs. It is locally known as "Mutpya" from its resemblance to the fish. The colour varies from light to dark brown, chelipeds markedly unequal in both sexes but most so in the adult male. In a large male the Carapace is 15/16" long and 2" broad and 7/8" deep.

2. *Paratelphusa (Barytelphusa) guerini* (Milne-Edwards).
This species is to be found in Thana and Kolaba districts and in the Deccan. It also exists in other parts of India. It is of various colours, dark brownish with yellowish border, whitish etc. The dark brownish are invariably females; those intermediate in colour both males and females while the whitish are invariably males. The eye stalks are very prominent, white in colour with black hip. The female has a very broad abdomen. Its local name is "khekada".

Chelipeds are much more unequal in the male than in the female.

CHAPTER 9

Land and Freshwater
Invertebrates

3. *Paratelphusa (Barytelphusa) jacquemontii* (Rathb.).

This is one of the largest and fattest species and the commonest Indian type. It is also found in Thana and Kolaba districts and the Deccan. Its general colour is dark brown. The abdomen of the female is broad. The animal has a formidable look. It is locally known as "chimburi".

The Chelipeds are not very unequal in the female but are considerably so in the adult male. The species attains a large size. In the largest male the carapace is 3" long and 4" broad and the hand of the larger cheliped is 4".

Class : Myriapoda
Order : Chilopoda (Centipedes)
Tribe : Pleurostigma

1. *Scolopendra* sp.
Tribe : Notostigma.

2. *Scutigera* sp.
Order : Diplopoda (Millipedes)

- 1 *Spirostreptus* sp.
Zephroniidae (Pill-Millipedes)
- 2 *Arthrosphaera atrisparsa* (Butler)
Locality : Bombay District.
- 3 *Arthrosphaera zebraica* (Butler)
Locality : Bombay.

Order : Symphyla

Scutigera unguiculata var. *indica* Gravely

Class : Arachnida
Family : Buthidae

1. *Buthus tamulus tamulus* (Fabricius)
Colour variable : tail yellow or reddish yellow.
Locality : Satara, Kolhapur.
2. *Buthus tamulus concanensis* nov.
Locality : Ratnagiri.
3. *Buthus rugiscutis* (Pocock)
Slightly smaller than the preceding species and rougher with a thicker tail. Colour varying from reddish yellow to yellowish brown.
Locality : Mahabaleshwar, Satara.
4. *Buthus rugiscutis nigratus*
Upper side of body black : chelae yellow, upper side of tail yellow.
Locality : Panchgani, Satara District.
5. *Buthus pachyurus* (Pocock)
Uniform black or brownish black.
Locality : Nasik, Satara

CHAPTER 9

Land and Freshwater
Invertebrates

6. *Butheolus bicolor* (Pocock).
Upper side of trunk deep bluish green; legs mostly clear yellow.
Locality : Western Ghats; Khandala Tal. and Wai Tal. in Satara District, Poona Region.
7. *Isometrus europaeus* (Linn)
Colour yellow varied with black. This is an introduced species.
Locality : Bombay only.
8. *Isometrus acanthurus* (Pocock)
Variegated yellow and black, yellow predominating.
Locality : Matheran.
9. *Scorpiops montanus satarensis* (Pocock)
Blackish; legs yellowish or reddish.
Locality : Mahabaleshwar, Satara District.
Family : Scorpionidae.
10. *Palamnaeus fulvipes bombayensis* (Pocock)
Locality : West Khandesh; Talegaon; Chalisgaon in East Khandesh; Niphad; Chandor; Sinnar; Yeola; Malegaon; Nandgaon and Kalwan in Nasik. This is the largest scorpion in the State.
11. *Palamnaeus xanthorus* (Pocock)
In colour resembling small specimens of *fulvipes*.
Locality : Khatao Taluka in the Satara District.
12. *Palamnaeus phipsoni* (Pocock)
Uniform blackish green or brown.
Locality : Bombay, Matheran, Kolaba, Ratnagiri, Nasik Ghats, Dindori in Nasik, Kolhapur.

Order : Uropygi

Sub-order : Urotricha (Whip Scorpions).

Whip-Scorpions are found in damp places beneath stones or pieces in the crannies of rocks or of termites' nests or other crevices where shelter and protection from sunlight are secured. Some of the species live in burrows with their young. The female carries the eggs encased in a glutinous membrane attached to the lower side of the abdomen.

Sub-order : Tartarides

Cephalothorax covered above with two plates—a posterior smaller, wider than long and an anterior much longer than wide. Occur beneath stones, the debris of leaves etc.

Order : Amblypygi.

These arachnids are intermediate between the whip-scorpions and true spiders; much resemble the whip-scorpions in their habits being

CHAPTER 9

Land and Freshwater
Invertebrates

found under stones, fallen tree trunks, crevices of rocks, or termites' nests. They cannot dig burrows. The eggs are carried attached underside of the abdomen as in the whip-scorpions.

1. *Phrynichus phipsoni* (Pocock)

Locality : Bombay.

Order : Solifugae.

These arachnids are remarkable for their amazing agility. Though principally desert forms they are also met with in forests. They are nocturnal and are strictly carnivorous. Some species dig holes in the ground and the females live there during breeding season for the protection of their young and themselves.

1. *Galeodes orientalis rufulus* (Pocock)

Locality : Pimpalner in East Khandesh and Shirpur in West Khandesh; Eastern Poona.

2. *Galeodes indicus obscurior* (Pocock)

Locality : Pimpalner, East Khandesh, Nasik.

3. *Gluviopsis atratus* (Pocock)

Locality : Poona Ghats; Pimpalner in East Khandesh.

The Phylum Mollusca meaning soft-bodied animals includes snails, slugs, clams, oysters, squids and octopuses whose known species are estimated at 40,000—a total exceeded only by the Phylum Arthropoda. Most of them are marine in their habitat but a few live in freshwater and a few others inhabit land.

Land and freshwater forms occurring in Maharashtra are systematically listed below :

Class : Gastropoda (Univalves)

Order : Pectinibranchiata

Sub-order : Taenioglossa

Family : Tiaridae (Melaniidae)

Sub-family : Tiarinae

Genus : *Tiara*Subgenus : *Melanella*

Shell obovate : Spire scarcely larger than the aperture which is entire; Inner lip much thickened.

1. *Tiara (Melanella) riqueti* (Grateloup)

Alt : 16, diam. 7 mm. Aper. alt. 8, dia. 4 mm.

Locality : Bombay.

Sub-family : Paludominae

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CHAPTER 9

Land and Freshwater
Invertebrates2. *Paludomus obesa* (Philippi)

Shell oblong globose : Spire shorter than the aperture : inner lip very thick.

Alt : 13.25, dia. 10 mm.

Locality : Khandala—in small streams—Poona District.

Family : Littoridae

Sub-family : Cremnoconchinae.

3. *Cremnoconchus syhadrensis* (Blanford)

Shell ovate : depressedly turbinate with large aperture.

Atl : 7, dia. 7 mm.

Aper : alt. 5, dia. 4 mm.

Locality : Western Ghats—on wet rocks.

4. *Cremnoconchus carinatus* (Layard)

Shell somewhat globose.

Alt : 7.5, diam. 5 mm.

Locality : Streams in the Mahabaleshwar hills.

Family : Paludestrinidae (= Hydrobiidae)

Sub-family : Bithyniinae

5. *Bithynia evezardi* (Blanford)

Shell narrowly unibiculate, ovately conical, whitish horny, covered with an olive epidermis, spire conical. Aperture oval, subangulate operculum normal.

Alt. 3.75, maj. 3.25 mm., min. 2 mm., Aper. Alt. 2, dia. 1.5 mm.

Family : Viviparidae

Sub-family : Viviparinae.

6. *Vivipara bengalensis* (Lamarck)

Shell elevatedly conical, thin, greenish, banded with dark green. Alt. 38, dia. 24 mm., Alt. 44., Dia. 29.5 mm.

Locality : Bombay.

Family : Pilidae (= Ampullariidae)

Subfamily : Pilinae

7. *Pila nux* Reeve.

Shell oblong conoid : large, holostome with calcareous operculum—Largest of the freshwater snails.

Locality : Bombay.

Alt. 30, dia. 23 mm.

CHAPTER 9

Land and Freshwater
Invertebrates8. *Pila dolioides* (Reeve)

Shell ovate, thin, spire short, sharp, aperture very large.

Alt. 56, diam. 47 mm.

Locality : Bombay.

8a. *Pila globosa* (Swainson)

Shell globose : spire depressed : surface smooth ; Aperture oblong oval :

H : 47 mm. : DM — 42 mm. : dm. 32 mm.

AH — 33 : AW — 20 mm.

Locality : Adjoining parts of Poona, Poona, Bombay and its suburbs.

Order : Pulmonanata

Sub-order : Hygrophila

Family : Limnaeidae

Sub-family : Limnaeinae

9. *Limnaea accuminata* (Lamarck)

Locality : Found in abundance at Khandala in pools containing aquatic vegetation.

10. *Limnaea accuminata* var. *nana*.

The shell of this form is very small and rather thick, of a blackish colour with longitudinal striae strongly developed.

Locality : Khandala, Poona District. ca. 2,500 feet or 760 m.

11. *Limnaea chlamys* (Benson)

The shell has an oblique body whorl and a peculiar curvature of the outer margin of the aperture.

Locality : Satara—in the artificial ponds of the old fort on the hill-top immediately above the town.

12. *Limnaea pinguis* (Dorhn)

Shells narrow and of small size and pale in colour ; striae well-developed.

Locality : Khandala—in Ponds—Poona District.

Sub-family : Planorbinae

Shell sinistral, spire flattened or elevated.

13. *Planorbis (Indoplanorbis) exustus* Desh.

Scarce in the hilly country although abundant in plains.

Locality : Khandala—in ponds—Poona District.

CHAPTER 9

Land and Freshwater
Invertebrates

14. *Planorbis (Indoplanorbis) labiatus* (Benson)
Locality : Khandala—ponds—Poona District.
15. *Planorbis (Indoplanorbis) exustus* var *brunneus* (Gray)
Shell subglobose, high, smooth, Alt. 8.25, Dia. Maj. 12.5 mm.
Locality : Bombay.
Family : Melaniidae
16. *Melania tuberculata* (Muller)
Locality : Yenna River ; Igatpuri Lake (Nasik District)
Khandala, Western Ghats, Poona District.
17. *Melania scabra* (Muller)
Locality : Yenna River ; Karla, Poona District.
Class : PELECYPODA (Bivalves)
Order : Tetrabranchia
Sub-order : Mytilacea
Nil.
Sub-order : Submytilacea
Family : Unionidae
Subfamily : Unioniae
Genus : *Parreysia*
Subgenus : *Parreysia* (sensu stricto)
18. *Parreysia (Parreysia) corrugata* (Muller) var. *nagpooreis* (Lea)
Diam. Long. 30.46 mm, dia. 22.75 mm.
Locality : Nagpur, Poona, Yenna River, Medha (Satara Dist.)
19. *Parreysia (Parreysia) cylindrica* Annandale
Locality : Yenna River, upper Krishna watershed at Medha.
Genus : *Lamellidens*
Shell dark-coloured ; Teeth well-developed.
20. *Lamellidens marginalis* (Lamarck)
Locality : Bombay, Yenna River, Medha (Satara District)
21. *Lamellidens marginalis* var *cylindrica* (H. & T.)
Locality : Igatpuri Reservoir, Nasik District. (alt. 2,000 feet)
Subfamily : Sphaeriinae
22. *Pisidium bombayanum* Theobald
Locality : Western Ghats.

CHAPTER 9

Land and Freshwater
Invertebrates

Class : Gastropoda (Land Operculates)

Order : Pulmonata

Sub-order : Geophila or Stylomatophora

Group : Agnatha

Family : Testacellidae

Subfamily : Streptaxinae

1. *Ennea bicolor* (Hutton)
Subcylindrically turreted, smooth, yellowish white, seven whorls,
spire with very obtuse apex : $7 \times 2 \times 1\frac{1}{2}$ mm.
Locality : Common throughout Maharashtra
Family : Zonitidae
Subfamily : Ariophantinae
2. *Ariophanta laevipes* (Mul.)
Thin depressed low-spined shell with prominent oblique striations
and thin spiral lines in between ; 5 whorls. $28 \times 23\frac{1}{2}$ mm.
Locality : Common in Bombay gardens, Bandra, Kanheri Caves,
Salsette.
3. *Ariophanta bajadera* Pfr.
Thin translucent pale greenish to brownish shell with obtuse
spire, 4-4 $\frac{1}{2}$ whorls. Maj. diameter $27\frac{1}{2} \times$ min. $22 \times 18\frac{1}{2}$ mm.
Locality : Maharashtra State, south of Narmada, ranging east to
Nagpur ; common on the Western Ghats, Bhimashankar ca.
3,800 feet.
4. *Ariophanta intumescens* (Blanford)
A large duller shell than *A. bajadera*, $32 \times 26 \times 23$ mm.
Locality : Common in Mahabaleshwar.
5. *Euplecta subdecussata* Pfr.
Thin, turbinate shell with a conical spire and obtuse apex.
6 whorls. App. $14 \times 12 \times 9$ mm.
Locality : Bombay
Subfamily : Macrochlamyinae
6. *Macrochlamys tenuicola* (H. Adams)
Thin yellow turbinate shell with a subconical spire ending in
an obtuse apex $5\frac{1}{2}$ to 6 whorls, $9 \times 8 \times 7$ mm. approximately.
Locality : Bombay, the Western Ghats, Khandala, Satara.

CHAPTER 9

Land and Freshwater
Invertebrates

7. *Macrochlamys pedina* Bs.
Thin conoid translucent shell with a low spire.
 $6\frac{1}{2}$ whorls, $30 \times 25\frac{1}{2} \times 13\frac{1}{2}$ mm.
Locality : Common in Bombay, Khandala, Bhima-Shankar (Western Ghats) ca 3,800 feet.
8. *Macrochlamys neherensia* Bs.
Shell with a slightly convex spire with a flattened apex. 6 whorls.
 $5 \times 4 \times 2$ mm.
Locality : Mahableshwar and Khandala
9. *Eurychlamys platychlamys* Blanford
Smooth conoid shell with a low spire apex obtuse.
Major diameter $11 \times$ minor $9\frac{1}{2} \times 5\frac{1}{2}$ mm.
Locality : Common in Bombay and its neighbourhood.
10. *Mariaella dussumieri* (Gray)
Thin white ovate shell with the apex forming a small point at the right side and near the posterior end.
Locality : The Eastern Ghats upto Mahableshwar
Family : Endodontidae
Subfamily : Thysanotinae
11. *Pupisoma evezardi* (Blanford)
A thin conoidly ovate shell with thin raised hair-like oblique lines on all the $4\frac{1}{2}$ whorls. Spire cylindrical below and apex blunt $2.7 \times 2 \times 1$ mm.
Locality : Khandala (Poona District)
Subfamily : Camaeninae
12. *Planispira crassicostata* (Benson)
 $13 \times 10 \times 4$ mm.
Locality : Poona
13. *Planispira footei* (Stoliczka)
 $13.3 \times 11.2 \times 6$ mm.
Locality : Bombay.
14. *Chloritis propinque* (Pfeiffer)
Conoid depressed shell with $4\frac{1}{2}$ whorls. $19 \times 15 \times 11$ mm.
Locality : Bombay, Satara, Khandala, Mahableshwar, Poona.

CHAPTER 9

Land and Freshwater
Invertebrates

15. *Chloritis leithi* (Gude)
Thin conoid shell depressed and transparent with a narrow chestnut supra peripheral band and with 4 whorls. Low spire and sunken apex. $4.5 \times 11.5 \times 7$ mm.
Locality : Bombay
Family : Enidae.
Shell perforate, from shortly ovate and ovate conoid to fusiform-cylindrical. Aperture elongate generally equalling $\frac{1}{3}$ or $\frac{1}{4}$ of the total height.
16. *Pupoides coenopictus* (Hutton)
Cylindrico-pyramidal brown shell with 6 whorls and obtuse apex.
Length 4—4.5 mm. and dia. nearly 2 mm.
Locality : Bombay Island.
17. *Cerastus abyssinicus* (Pfeiffer)
A shell with an elongated spire and with 7 whorls. 21×11 mm.
Supposed to have come along with *Aadansonia digitata*.
Locality : Poona and Bombay Island.
18. *Cerastus jerdoni* (Reeve)
A dirty olive-brown shortly ovate shell with a short acuminate spire. 6 whorls. Length 18 mm. dia. 11.5 mm.
Locality : Poona.
19. *Cerastus jerdoni* var. *redfieldi* (Pfeiffer)
Length 20, dia. 11 mm.
Locality : Poona.
20. *Cerastus monssonianus* (Petit)
Spire conical, length 16 mm. dia. 9 mm.
Locality : Bombay Island, Khandala, Sholapur.
21. *Cerastus densus* (Pfeiffer)
Locality : Poona
22. *Cerastus distans* (Pfeiffer)
Conical spire, 7 whorls, length $22\frac{1}{2}$, dia. $10\frac{1}{2}$ mm.
Locality : Poona
Genus : *Rachisellus* : Shell elongate-oblong, last whorl, shorter than the spire.
23. *Rachisellus bengalensis* (Lamarck).
Length 22 mm., dia. 10 mm.
Locality : Bombay

CHAPTER 9

Land and Freshwater
Invertebrates

24. *Rachisellus praetermissus* (Blanford)
Length 19 mm. dia. 10 mm. whorls 7.
Locality : Bombay
25. *Rachisellus punctatus* (Anton)
Length 10 mm. dia. 5 mm. Apex. 4.5 mm. $\times$ 3 mm.
Locality : Poona, Bombay Island.
Genus : *Edonardia* : Rounded, conical with comparatively small last whorl, generally brown.
26. *Edonardia orbus* (Blanford)
Length 10 mm. dia. 5 mm. Apex $3\frac{1}{2} \times 2\frac{1}{2}$ mm.
Locality : Poona
Genus : *Opeas* : Shell small, thin, apex large, obtuse and rounded and convex and flattened whorls, aperture small, ovate.
27. *Opeas gracile* (Hutton)
Transparent thin shell with a gradually tapering spire : 12 whorls.
Aperture larger than broad, semi-ovate, 13.5×3.5 mm.
Locality : Poona, Bombay Island.
Genus : *Zootecus* : Shell rather small, pale or white, perforate cylindric with a conic or cylindric summit, 7-10 compact whorls.
28. *Zootecus insularis* (Ehrenberg)
Subcylindrical apex, shell striped, transversely semioval aperture. $5\frac{1}{2} \times 1\frac{1}{2}$ mm. 7-8 whorls.
Locality : Poona, Bombay Island.
Family : Ferussacidae.
Genus : *Glessula* : The shell is imperforate, ovate-conic, brown and glossy and usually without strong sculpture, obtuse apex. Aperture irregularly oval.
29. *Glessula hebes* (Pfeiffer).
Length 17-22 mm. Aperture $4-4\frac{1}{2}$ mm. $\times$ $2\frac{1}{3}$ —3 mm. Dia. 5 mm.
Locality : Mahableshwar
30. *Glessula fairbanki* (Benson)
Length 12 mm. Aperture $3 \times 2\frac{1}{2}$ mm.
Locality : Mahableshwar.
31. *Glessula chesoni* (Benson)
Length 37 mm., Dia. 15 mm. Apex 14×8 mm.
Locality : Mahableshwar, Igatpuri, Torna & Purandhar (Poona District).

CHAPTER 9

Land and Freshwater
Invertebrates

32. *Glessula tornensis* (Blanford)
Elongate spire with an obtuse apex 7—7½ whorls.
Length 25 mm. Dia. 14 mm. Apex. 12×7 oblique.
Locality : Torna Hill, Poona District.
33. *Glessula textilis* (Blanford)
Ovate-oblong shell, rather solid and translucent, smooth and polished with close vertical and horizontal lines of greyish yellow. Conoidal elongated spire with an obtuse apex. Whorls 7.
Length 26 mm. dia. 12 mm. Apex $10\frac{1}{2} \times 7$ mm.
Locality : Mahableshwar.
34. *Glessula notigena* (Benson)
Obtuse apex 9-10 whorls.
Length 20 mm., Dia. 7 mm. Apex 6×4 mm.
Locality : Mahableshwar, Khandala, Poona and Bombay.
35. *Glessula singhurensis* (Blanford)
Elongate conical spire with subacute apex. Length $12\frac{1}{2}$ mm. Dia. 4.4 mm. Apex $4 \times 2\frac{1}{2}$ mm.
Locality : Sinhgad Fort near Poona.
36. *Glessula orophila* (Reeve)
Shell conically ovate, spire acuminate, 7 whorls, deeply arched and truncated aperture 18 mm. $\times$ 9.5 mm.
Locality : Mahableshwar.
37. *Glessula arthuri* (Benson)
A translucent shell with ovate-conical spire and obtuse apex. 7½ whorls. Length 19 mm. Dia. 10 mm. Apex 8 millimeters.
Locality : Mahableshwar.
38. *Glessula pulla* (Blanford)
Spire elongate and subconical with an obtuse apex. 7-8 whorls. Length 7 mm. Dia. $2\frac{3}{4}$ mm. Apex $2 \times 1\frac{1}{2}$ mm.
Locality : Bhimashankar (Western Ghats) ca. 3,800 feet.
39. *Glessula sattarensis* (Hanley and Theobald)
Tower-like spire with an obtuse apex. 7 whorls.
Locality : Satara, Maharashtra State.
40. *Glessula brevis* (Pfeiffer)
Conico-ovate shell with a conical spire and obtuse apex. 6 whorls. Length 8-9 mm. Dia. $5-5\frac{1}{2}$ mm.
Locality : Poona.

CHAPTER 9

Land and Freshwater
Invertebrates

41. *Glessula lyrata* (Blanford)
Ovate and tower-like shell, pyramidal spire with an obtuse apex.
7½ whorls. Length 12 mm. Dia. 5½ mm. Apex. 4 × 2½ mm.
Locality : Mahabaleshwar, Khandala (Western Ghats)
42. *Glessula lyrata* Var. *matheranica* (Blanford).
Length 10 mm., Dia. 4½ mm.
Locality : Matheran.
43. *Glessula rugata* (Blanford)
Tower-like shell with a conical elongate spire with an obtuse apex.
7 whorls. Length 6 mm. Dia. 2 mm. Apex. 1½ × 1 mm.
Locality : Sinhgad near Poona, Purandhar (Poona District)
44. *Glessula beddomei* (Blanford)
Locality : Bhima-Shankar (Western Ghats) ca. 3,800 feet.
Family : Succineidae.
Genus : *Succinea* : Shell imperforate, oval, thin, horny, more or less translucent with a short, conical spire.
Aperture large, oblong.
45. *Succinea collina* (Hanley and Theobald)
Conico-oval shell with a scaly spire and with an acute apex.
3 whorls. Length 17 mm. Dia. 10 mm. Apex 13 mm. × 9 mm.
46. *Succinea collins* var. *aurantica* (Pfeiffer)
Locality : Mahabaleshwar, Torna Hills (Poona District)
47. *Succinea collins* var. *refocornea* (Pfeiffer)
A rock-inhabiting species.
Locality : Mahabaleshwar, Torna Hills (Poona District)
48. *Succinea vitrea* (Pfeiffer)
Ovately conical shell with a conical spire. 3 whorls. Aperture oblique. Length 12 mm. × 8 mm. × 5 mm.
Locality : Bombay Island.
49. *Succinea subgranosa* (Pfeiffer)
Shell elliptical and oval with a small spire. 3 whorls. Oblique aperture. 8½ mm. × 5 mm. × 4 mm. Apex. 6 × 4 mm.
Locality : Bombay.
Genus : *Lithotis* : Shell earlike and ovate, thin, with a very short spire. A keel extends from the apex to the aperture with a corresponding furrow internally. Whorls 1 ¼—2½
Aperture large and ovate.

CHAPTER 9

Land and Freshwater
Invertebrates

50. *Lithotis ruficola* Blanford
Ovate shell with a plain spire. Maj. dia. 7 mm. Min. dia. 5 mm. Length 2½ mm.
Locality : Khandala (Poona District)
51. *Lithotis tumida* (Blanford)
Ovate shell with a small thin spire and thin apex. 2—2½ whorls. Oblique aperture. Length 6½ mm. Dia. 5 × 3 ht. aperture 5½ mm. × 4 mm.
Locality : Sinhgarh, Poona District.
52. *Lithotis tumida* Var. *subcostulata* (Blanford)
Locality : Purandhar, Poona District.

SLUGS

Slugs are naked snails without even the trace of an external shell. In some, however, an internal shell may be present. There is a muscular foot traversing the entire animal on the ventral surface, with the help of which the animal performs its locomotion. Only one species noted in Maharashtra.

Family : Vaginulidae.

53. *Vaginula alte* (Ferussac)

Locality : Bombay

Order : Prosobranchia.

Family : Cyclophoridae.

Subfamily : Cyclophorinae.

Genus : *Cyclophorus* : Shell globose-turbinate, depressed or discoid ; Peristome continuous, expanded or straight ; operculum corneous, thin, narrowly coiled, more or less concave, externally smooth ; edges of whorls not raised.

54. *Cyclophorus altivagus* (Benson)
Dia. Maj. 31 mm. Min. 26, Alt. 24 mm. ; Apex. 17 mm. large 15 lat.
Locality : Mahabaleshwar.
55. *Cyclophorus* (*Glossostylus*) *stenomphalus* (Pfeiffer)
Dia. Maj. 35 mm., min. 28 mm., alt. 24 mm.
Locality : Elephanta Island near Bombay, Bhima-Shankar (Western Ghats) ca. 3,800 feet.
Genus : *Cyathopoma* : Shell small, umbilicated, pyramidal, turbinate or depressed-turbinate generally with spiral lirae, periostracum thick. Operculum convex on the inner side, multispiral, normally truncate conoid, composed of two laminae, the inner membranous, outer calcareous, very concave, the edge of whorls free, occasionally beautifully ornamented.

CHAPTER 9

Land and Freshwater
Invertebrates

56. *Cyathopoma deccanense* (Blanford)
Dia. maj. 3 mm., min. 2½ mm., alt. 2½ mm. Apex. 1½ mm.
Locality : Khandala & Bhimashankar (Western Ghats, Poona District).
Genus : *Nicida* : Shell imperforate, ovate, without radial costulae, smooth and spirally liriate, shining last whorl not constructed, columellar tooth absent ; operculum corneous, indistinctly multispiral.
57. *Nicida liricincta* (Blanford)
Long 2 1/3 mm., Dia. 1 3/4 mm., Apex. 2/3 mm.
Locality : Khandala (Western Ghats 2,000 feet)
Genus : *Opisthostoma* : Small pupoid, narrowly umbilicated ; last whorl constricted and turned backwards and upwards at an acute angle ; when it becomes inflated, and either attached to the penultimate whorl or solute ; Peristome double ; operculum thin, corneous composed of a few whorls.
58. *Opisthostoma fairbanki* (Blanford)
Dia. including peristome 1.5 mm. without peristome 1 mm., alt. 1.3 mm. Aperture Dia. 0.5 mm.
Locality : Khandala (Western Ghats, Poona District).
Genus : *Cyclotopsis* : Shell widely umbilicate, depressed or depressed-turbinate, furnished with spiral lirae ; aperture subrotundate ; Peristome thin ; operculum multispiral double, the inner membranous, outer calcareous, edges raised.
59. *Cyclotopsis semistriata* (Sowerby)
Maj. dia. 12 mm., min. 10 mm. Alt. 5.75 mm.
Locality : Poona.
60. *Cyclotopsis spurca* (Grateloup)
Ht. 15 mm., dia. 20 mm.
Locality : Bombay.

REFERENCES

1. Annandale, N. (1911). The Fauna of British India, including Ceylon and Burma—Freshwater Sponges (Hydroids and Polyzoa).
2. Annandale, N. and Prashad, B. (1919). Fauna of Certain Small Streams in the Bombay Presidency. Rec. Ind. Mus. 16:139.
3. Baylis, H. A. (1936-39). The Fauna of British India including Ceylon and Burma—Nematoda, Vols. I and II.
4. Bhatia, B. L. (1936)—Nematoda, Protozoa (Ciliophora), Fauna of Br. India, Ceylon and Burma.

CHAPTER 9

Land and Freshwater
Invertebrates

5. Bhatia, B.L. (1938)—Nematoda, Protozoa (Sporozoa), Fauna of Br. India, Ceylon and Burma.
6. Blanford, W. T., and Godwin Austen, H. H. (1908). Fauna of British India including Ceylon and Burma. (Mollusca, Testacellidae, and Zonitidae).
7. Chatterjee, K. A. (1952). Human Parasites and Parasitic Diseases.
8. Gude, G. K. (1914). The Fauna of British India including Ceylon and Burma, (Mollusca—Trochomorphidae—Zanellidae).
9. Gude, G. K. (1921). The Fauna of British India including Ceylon Burma, (Mollusca—Land Operculates).
10. Harding, W. A. and Percy Moore, J. (1927). The Fauna of British India including Ceylon and Burma—Hirudinea.
11. Karande A. A. and Inamdar, N. B. (1961). Some observations of the Biology of the Conchostracan Branchiopod (Crustacea), *Leptestheriella gigas* Karande and Inamdar, 1960. JBNHS 58(1), 92.
12. McCann, C. Notes on the Common Land Crab *Paratelphusa (Barytelphusa) guerini* of Salsette Island. JBNHS 39 (3), 531.
13. Pocock, R. I. (1900). The Fauna of British India including Ceylon and Burma. Arachnida.
14. Pocock, R. I. (1900)—A Monograph of the Pill-Millipedes (Zephronidae) inhabiting India, Burma and Ceylon. JBNHS XII, 269.
15. Preston, H. B. (1915). The Fauna of British India including Ceylon and Burma (Freshwater Gastropoda and Pelecypoda).
16. Rensch, II, (1955). On some Indian Land Snails, JBNHS Vol. 53(2), 163.
17. Southwell, T. (1930). The Fauna of British India including Ceylon and Burma, Vol. I and II. Cestoda.
18. Stephenson, J. (1923). Cestoda Oligochaeta.
19. Tiwari, K. K. (1951). Indian species of the Genus *Apus* (Crustacea, Branchiopoda) with description of two New Species. Rec. Ind. Mus. Vol. 49.
20. Tonapi, G. T. and Leela Mulherkar (1963). On the Freshwater Mollusca of Poona. JBNHS 60, (1), 103.
21. Wagle, P. V. (1924). Land Crabs of Bombay Presidency. Bull. No. 118, Dept. Agr. Bombay.

INDEX

	PAGES		PAGES
<i>Amphibia</i>	389-94	Muscicapidae, 317-19, 343;	
Bufonidae, 390, 391;		Nectariniidae, 319, 347-48;	
Caecilidae, 390-91;		Oriolidae, 316, 339-40;	
Microhylidae, 390-92;		Otididae, 311, 326;	
Ranidae, 390, 392-93;		Paridae, 319, 345-46;	
Rhacophoridae, 390, 394.		Pelecanidae, 308, 321;	
		Phaethontidae, 308, 321;	
<i>Birds</i>	307-50	Phalacrocoracidae, 308, 321;	
Accipitridae, 309-10, 323-24;		Phasianidae, 310, 324-25;	
Alaudidae, 315-16, 338;		Phoenicopteridae, 308, 323;	
Alcedinidae, 314, 335;		Picidae, 315, 337;	
Anatidae, 308-09, 323;		Pittidae, 315, 338;	
Apodidae, 314;		Ploceidae, 320, 348-50;	
Ardeidae, 308, 322;		Podicipedidae, 307;	
Artamidae, 316, 340;		Polceidae, 320, 348;	
Bombycillidae, 316-17, 341;		Procellaridae, 308, 321;	
Bucerotidae, 315, 336;		Psittacidae, 313;	
Burhinidae, 312, 329;		Pterocletidae, 330;	
Campephagidae, 317, 342;		Pycnonotidae, 317, 343;	
Capitonidae, 315, 337;		Rallidae, 310-11, 325-26;	
Caprimulgidae, 314;		Recurvirostridae, 312;	
Charadriidae, 311, 327-28;		Rostratulidae, 312, 328-29;	
Ciconiidae, 308, 322;		Sittidae, 319;	
Columbidae, 313, 331;		Strigidae, 313-14, 333;	
Coraciidae, 315, 336;		Stercorariidae, 312, 329;	
Corvidae, 316, 341;		Sturnidae, 316, 341;	
Cuculidae, 313;		Sulidae, 308, 321;	
Dicacidae, 319, 347;		Thresionnithidae, 322;	
Dicruridae, 316, 340;		Trogonidae, 314, 335;	
Dromadidae, 312, 329;		Turnicidae, 310, 325;	
Emberiziidae, 320, 350;		Upupidae, 315, 336;	
Falconidae, 310;		Zosteropidae, 319, 348.	
Fregatidae, 308, 322;			
Fringillidae, 320, 350;		<i>Fishes</i>	1-66
Glareolidae, 312, 329;		Acanthuridae, 20;	
Gruidae, 310, 325;		Ambassidae, 12, 54;	
Haematopodidae, 311, 327;		Amphipnoidae, 54;	
Hirundinidae, 316, 338-39;		Anabantidae, 55;	
Hydrobatidae, 308, 321;		Anguillidae, 53;	
Irenidae, 317, 342;		Antennariidae, 24;	
Jacaniidae, 311, 326;		Apogonidae, 12;	
Laniidae, 316, 340;		Atherinidae, 12.	
Laridae, 312, 329-30;		Bagridae, 52;	
Meropidae, 315, 336;		Balistidae, 24;	
Motacillidae, 319, 346;		Batrachoididae, 24;	
Vf 3481-28			

PAGES

Belonidae, 10, 32, 53;
 Blenniidae, 20;
 Bothidae, 23;
 Bregmacerotidae, 10;
 Callionymidae, 20;
 Carangidae, 13;
 Carcharhinidae, 3;
 Cepolidae, 19;
 Chaetodontidae, 19;
 Chanidae, 8;
 Chirocentridae, 8;
 Cichlidae, 19;
 Claridae, 52;
 Clupeidae, 6, 47;
 Cobitidae, 51;
 Congridae, 9;
 Coryphaenidae, 15;
 Cynoglossidae, 23;
 Cyprinidae, 47;
 Cyprinodontidae, 54;
 Dactylopteridae, 22;
 Diodontidae, 24;
 Drepanidae, 18;
 Dussumieridae, 6;
 Echeneidae, 23;
 Eleotridae, 21;
 Elopidae, 6;
 Engraulidae, 7;
 Elphippidae, 18;
 Exocoetidae, 10;
 Fistularidae, 11;
 Gerridae, 16;
 Gobiidae, 21, 55;
 Hemirhamphidae, 10;
 Holocentridae, 11;
 Horaichthyidae, 11;
 Istiophoridae, 21;
 Katsuwonidae, 21;
 Labridae, 19;
 Lactariidae, 13;
 Lagocephalidae, 24;
 Lalidae, 12;
 Leiognathidae, 15;
 Lethrinidae, 17;
 Lobotidae, 15;
 Lutianidae, 15;
 Mastacembelidae, 55;
 Mergalopidae, 6;

Menidae, 15;
 Mobulidae, 6;
 Mugilidae, 11;
 Mullidae, 18;
 Muraenesocidae, 9;
 Muraenidae, 9;
 Myliobatidae, 5;
 Nandidae, 55;
 Nemipteridae, 15;
 Notopteridae, 47;
 Odontaspidae, 3;
 Ophichthyidae, 9;
 Ophiocephalidae, 54;
 Orectolobidae, 3;
 Osphronemidae, 55;
 Ostraciontidae, 24;
 Pempheridae, 18;
 Periophthalmidae, 22;
 Platacidae, 18;
 Platycephalidae, 22;
 Plectorhynchidae, 16;
 Plotosidae, 8;
 Poeciliidae, 54;
 Polycanthidae, 55;
 Polynemidae, 12;
 Pomacanthidae, 19;
 Pomacentridae, 19;
 Pomadasysidae, 16;
 Priacanthidae, 13;
 Pristidae, 5;
 Psettidae, 18;
 Psettodidae, 22;
 Rachycentridae, 15;
 Rhinobatidae, 4;
 Rhinopteridae, 6;
 Saccobranchidae, 52;
 Scatophagidae, 18;
 Sciaenidae, 17;
 Scolopsidae, 16;
 Scomberomoridae, 20;
 Scombridae, 20;
 Scorpaenidae, 22;
 Serranidae, 13;
 Schilbeidae, 52;
 Siganiidae, 20;
 Sillaginidae, 13;
 Siluridae, 52;
 Sisordae, 53;

PAGES

Sparidae, 18;
 Soleidae, 23;
 Solenostomidae, 11;
 Sphyrnidae, 11;
 Sphyrnidae, 4;
 Stromateidae, 21;
 Syngnathidae, 11;
 Synodidae, 8;
 Tachysuridae, 8;
 Theraponidae, 13;
 Thunnidae, 21;
 Torpedinidae, 6;
 Tricanthidae, 24;
 Trichiuridae, 20;
 Trygonidae, 5;
 Trypauchenidae, 22;
 Zancidae, 20;

Insects

119-293

Acraeidae, 141, 224;
 Acridiidae, 123, 197;
 Aeolothripidae, 138, 218;
 Aeshnidae, 123, 195;
 Agaristidae, 145;
 Agromyzidae, 164, 254;
 Aleurodidae, 130, 209;
 Amathusiidae, 140, 222;
 Andrenidae, 175, 268;
 Anobiidae, 183, 279;
 Anthicidae, 276;
 Anthocoridae, 138, 216;
 Anthribidae, 286;
 Aphidiidae, 131, 210;
 Apidae, 176, 268, 269;
 Aqaristidae, 231;
 Arbelidae-Inderbelidae, 155;
 Arbelidae, 241;
 Arctiidae, 145, 230;
 Ascalphidae, 139, 219;
 Asilidae, 252;
 Belostomatidae, 138, 217;
 Bethyloidae, 260;
 Bibionidae, 162, 250;
 Blattaria, 126;
 Bombycidae, 155, 240;
 Bombyliidae, 163, 252;
 Bostrychidae, 183, 279;
 Braconidae, 167, 259;

PAGES

Brenthidae, 190, 286;
 Bruchidae, 190, 285;
 Buprestidae, 181, 276;
 Calamoceratidae, 160, 247;
 Calliphoridae, 165, 255;
 Campodeidae, 121;
 Capsidae, 137, 216;
 Carabidae, 177, 271;
 Cecidomyidae, 162, 249;
 Cerambycidae, 186, 282;
 Ceratopogonidae, 162, 250;
 Cercopidae, 129, 208;
 Chalcididae, 167, 260;
 Chalcidoidae, 260;
 Chironomidae, 250;
 Chloropidae, 164, 255;
 Chrysidae, 168;
 Chrysomelidae, 187, 283;
 Chrysopidae, 139, 219;
 Cicadidae, 128, 206;
 Cicindelidae, 177, 271;
 Cimicidae, 137, 216;
 Cleridae, 181, 275;
 Coccidae, 131, 210;
 Coccinellidae, 182, 278;
 Coenagruidae, 122, 194;
 Collecidae, 176;
 Compodeidae, 192;
 Conopidae, 164, 254;
 Coreidae, 134, 212;
 Corixidae, 138, 217;
 Cossidae, 155, 241;
 Cucujidae, 182, 277;
 Culicidae, 161, 249;
 Curculionidae, 190, 286;
 Cyrtidae, 163, 252;
 Danaidae, 139, 221;
 Dermestidae, 181, 276;
 Dolichopodidae, 163, 253;
 Drepanidae, 156, 242;
 Dytiscidae, 178;
 Dytiscidae, 272;
 Elasmidae, 168, 260;
 Elateridae, 181, 276;
 Embiidae, 126;
 Empidae, 163, 253;
 Endomychidae, 182, 277;
 Ephemeridae, 121;

PAGES

Epiplemidæ, 155, 240;
 Erotylidæ, 182, 277;
 Erycinidæ, 141, 224;
 Eumenidæ, 172, 265;
 Eupterotidæ, 152, 237;
 Evanidæ, 167, 260;
 Forficulidæ, 201;
 Formicidæ, 169, 261;
 Fulgoridæ, 128, 206;
 Geometridæ, 153, 238;
 Gomphidæ, 122, 195;
 Gryllidæ, 125, 199;
 Gyrinidæ, 178, 272;
 Haematopinidæ, 128;
 Halictidæ, 175, 268;
 Heliiothripidæ, 138, 218;
 Hemerobiidæ, 139;
 Hemerobidæ, 220;
 Henicocephalidæ, 136, 215;
 Hepialidæ, 160, 247;
 Hesperiidæ, 143, 229;
 Hippoboscidæ, 166, 257;
 Histeridæ, 180, 274;
 Hodotermitidæ, 127, 204;
 Hydrometridæ, 136, 215;
 Hydrophilidæ, 179, 272;
 Hypsidæ, 152, 236;
 Ichneumonidæ, 166, 259;
 Insects, 119-293;
 Japygidæ, 121, 192;
 Jassidæ, 130;
 Kalotermitidæ, 127, 204;
 Labiduridæ, 125, 201;
 Labiidæ, 126, 201;
 Lampyridæ, 180, 274;
 Lasiocampidæ, 155, 241;
 Lepismatidæ, 121, 192;
 Leptoceridæ, 161;
 Libellulidæ, 123, 195;
 Limacodidæ, 155, 242;
 Lucanidæ, 186;
 Lycaenidæ, 141, 224;
 Lycidæ, 180, 274;
 Lygaeidæ, 134, 213;
 Lymantriidæ, 151, 235;
 Machilidæ, 121, 192;
 Mantidæ, 127, 203;
 Megachilidæ, 175, 268;

Meloidæ, 181, 275;
 Melyridæ, 181, 275;
 Membracidæ, 129, 207;
 Menoponidæ, 128;
 Micropezidæ, 164, 255;
 Molannidæ, 161, 247;
 Muscidæ, 165, 256;
 Mutilidæ, 168, 261;
 Myrmelionidæ, 139, 219;
 Naucoridæ, 138, 217;
 Nemestrinidæ, 163, 251;
 Nemopteridæ, 219;
 Nepidæ, 138, 216;
 Nitidulidæ, 182, 277;
 Noctuidæ, 145, 231;
 Notonectidæ, 138, 217;
 Notodontidæ, 153, 238;
 Nycteribiidæ, 166, 257;
 Nymphalidæ, 222;
 Nyphalidæ, 140;
 Oestridæ, 164, 255;
 Oligotomidæ, 126;
 Panorpidae, 139;
 Papilionidæ, 142, 227;
 Passalidæ, 282;
 Paussidæ, 179, 273;
 Pediculidæ, 128;
 Pentatomidæ, 132, 211;
 Philopteridæ, 128;
 Phloeothripidæ, 139, 219;
 Pieridæ, 143, 227;
 Pipunculidæ, 164, 253;
 Plangeniidæ, 121;
 Platypodidæ, 191, 287;
 Polymitarciidæ, 121;
 Pompilidæ, 172, 264;
 Potamanthidæ, 122;
 Projapygidæ, 121, 192;
 Psychidæ, 155, 240;
 Psychodiadæ, 161, 248;
 Psylidæ, 130, 209;
 Ptinidæ, 183, 279;
 Pulicidæ, 166, 258;
 Pygidicranidæ, 125, 201;
 Pyralidæ, 156, 243;
 Pyrrhocoridæ, 135, 214;
 Reduviidæ, 136, 215;
 Rhinotermitidæ, 127, 204;

PAGES

PAGES

Saldidæ, 137, 216;
 Saturnidæ, 154, 239;
 Satyridæ, 140, 221;
 Scarabacidae, 183, 280;
 Scollidæ, 168, 261;
 Scolytidæ, 191;
 Sericostomatidæ, 161, 247;
 Sesiidæ, 159, 246;
 Simuliidæ, 162, 250;
 Sphegidæ, 173, 266;
 Spingidæ, 152, 236;
 Staphylinidæ, 179, 273;
 Stephanidæ, 167, 260;
 Stratiomyidæ, 162, 251;
 Syntomidæ, 144, 230;
 Syrphidæ, 164, 253;
 Tabanidæ, 162, 251;
 Tachinidæ, 165, 256;
 Tenebrionidæ, 182, 278;
 Tenthredinidæ, 166, 258;
 Termitidæ, 127, 204;
 Tettigoniidæ, 124, 199;
 Therevidæ, 163, 252;
 Thripidæ, 138, 218;
 Thyrididæ, 156, 243;
 Tineidæ, 159, 246;
 Tingidæ, 136, 214;
 Tipulidæ, 161, 248;
 Trichogrammatidæ, 260;
 Trogositidæ, 181, 277;
 Trypetidæ, 164, 254;
 Uranidæ, 155, 240;
 Vespidae, 173, 265;
 Zygaenidæ, 156, 242

Land and Freshwater Invertebrates. 395-423

Family

Acinetidæ, 398;
 Amphileptidæ, 396;
 Buthidæ, 409;
 Butschliidæ, 396;
 Chlamydodontidæ, 396;
 Colpodidæ, 396;
 Cyclophloridæ, 421;
 Didinidæ, 396;
 Enchytraeidæ, 403;

PAGES

Endæ, 417;
 Endodontidæ, 416;
 Epistylidæ, 398;
 Euplotidæ, 398;
 Ferussacidæ, 418;
 Hirudidæ, 406;
 Holophryidæ, 396;
 Hydridæ, 400;
 Ichthyobdellidæ, 406;
 Limnaeidæ, 413;
 Littoridæ, 412;
 Lumbricidæ, 405;
 Megascolecidae, 403;
 Melaniidæ, 414;
 Moniligastridæ, 403;
 Naididæ, 402;
 Nassulidæ, 396;
 Ophryoglenidæ, 397;
 Oxytrichidæ, 397;
 Paludestrinidæ, 412;
 Parameciidæ, 396;
 Pillidæ, 412;
 Plagiopylidæ, 396;
 Pleuronematidæ, 396;
 Podophryidæ, 398;
 Scorpionidæ, 410;
 Spongillidæ, 399;
 Stentoridæ, 397;
 Succineidæ, 420;
 Taeniidæ, 401;
 Testacellidæ, 415;
 Tiaridæ (Melaniidæ), 411;
 Unionidæ, 414;
 Urocentridæ, 397;
 Vaginicolidæ, 398;
 Vaginulidæ, 421;
 Vorticellidæ, 398;
 Viviparidæ, 412;
 Zonitidæ, 415;
 Phylum Annelida, 402-07;
 Phylum Arthropoda, 407-11;
 Phylum Coelenterate, 400-01;
 Phylum Mollusca, 411-23;
 Phylum Nematoda, 402;
 Phylum Platyhelminthes, 401;
 Phylum Porifera, 399-400;
 Phylum Protozoa, 395-99;

	PAGES
<i>Mammals</i>	351-69
Bovidae, 355;	
Canidae, 353-54;	
Cercopithicidae, 353, 360;	
Cervidae, 354-55;	
Emballonuridae, 352, 358;	
Erinaceidae, 352, 356;	
Felidae, 354, 362-63;	
Hyaenidae, 354, 362;	
Hystriidae, 355, 367;	
Leporidae, 355;	
Manidae, 353;	
Megadermatidae, 352, 358;	
Molossidae, 353, 359;	
Muridae, 355-56, 367-69;	
Mustelidae, 354, 361-62;	
Pteropidae, 352;	
Rhinolophidae, 352-53,	
358-59;	
Rhinopomatidae, 352;	
Sciuridae, 355, 366;	
Soricidae, 352, 357;	
Suidae, 354, 363-64;	
Tragulidae, 354, 364;	
Tupaiidae, 352, 356;	
Ursidae, 354;	
Vespertilionidae, 353, 359;	
Viverridae, 354, 362;	
<i>Marine Invertebrates</i>	67-118

Acartiidae, 82;
 Acontiphoridae, 73;
 Acteonidae, 106;
 Actiniidae, 73;
 Aeginidae, 72;
 Aequeoreidae, 72;
 Alonidae, 111;
 Amphiperatidae, 102;
 Amphiruridae, 113;
 Ampithoidae, 88;
 Anomiidae, 108;
 Anthosomatidae, 84;
 Aoridae, 88;
 Aphroditidae, 77;
 Architectonicidae, 99;
 Arcidae, 107;
 Arénicolidae, 79;

Asterinidae, 113;
 Atyidae, 106;
 Balanidae, 85;
 Bomolochidae, 83;
 Bopyridae, 87;
 Bougainvillidae, 71;
 Buccinidae, 103;
 Bugulidae, 75;
 Bullidae, 106;
 Bursidae, 102;
 Calanidae, 82;
 Calappidae, 92;
 Caligidae, 83;
 Callianassidae, 91;
 Calyptraeidae, 101;
 Cancellariidae, 105;
 Capulidae, 101;
 Cardiidae, 109;
 Caridae, 89;
 Cavolinidae, 107;
 Celleporidae, 76;
 Centropagidae, 82;
 Cerithiidae, 100;
 Cerithiopsidae, 100;
 Chaetopteridae, 79;
 Chamidae, 109;
 Chloraemidae, 79;
 Chondracanthidae, 85;
 Chthamaliidae, 86;
 Cirratulidae, 79;
 Clavidae, 71;
 Clausidiidae, 82;
 Clypeastridae, 113;
 Conidae, 105;
 Corallanidae, 86;
 Corophiidae, 88;
 Crangonidae, 90;
 Cucumariidae, 113;
 Cyclostrematidae, 98;
 Cymatidae, 102;
 Cymothoidae, 87;
 Cypraeidae, 101;
 Dexaminidae, 88;
 Diadumenidae, 73;
 Dichelesthidae, 84;
 Diaptomidae, 82;
 Donacidae, 110;
 Dorippidae, 93;

PAGES

Dromiidae, 92;
 Echiuridae, 80;
 Edwardsiidae, 72;
 Eirinidae, 72;
 Electridae, 75;
 Ellobiidae, 107;
 Epitonidae, 100;
 Ergasilidae, 83;
 Eucalanidae, 82;
 Euchaetidae, 82;
 Eudactylinidae, 85;
 Eurydidae, 86;
 Euryphoridae, 84;
 Fasciolaridae, 104;
 Finellidae, 100;
 Fossaridae, 100;
 Gammaridae, 87;
 Garidae, 110;
 Geryoniidae, 72;
 Glaucomyidae, 111;
 Goneplacidae, 95;
 Grapsidae, 95;
 Haliactinidae, 73;
 Haliotidae, 97;
 Haloclavidae, 72;
 Harpidae, 105;
 Hesionidae, 77;
 Hippidae, 92;
 Hippolytidae, 89;
 Hydatinidae, 106;
 Hydrobiidae, 99;
 Hymenosomidae, 93;
 Idoteidae, 87;
 Janthinidae, 100;
 Laomedidae, 91;
 Laternulidae, 112;
 Lernaecidae, 85;
 Lerneopodidae, 85;
 Leucosiidae, 92;
 Leucothoidae, 87;
 Limidae, 108;
 Littorinidae, 99;
 Lucinidae, 109;
 Lyssianassidae, 87;
 Lymnaeidae, 107;
 Magilidae, 103;
 Maiidae, 93;
 Marginellidae, 105;

	PAGES
Mariametridae, 113;	
Membraniporidae, 75;	
Mitridae, 105;	
Monstrillidae, 83;	
Muricidae, 102;	
Myidae, 111;	
Mytilidae, 108.	
Naobranchiidae, 85;	
Nassariidae, 104;	
Naticidae, 101;	
Nereidae, 78;	
Neritidae, 98;	
Nuculidae, 107;	
Nuculanidae, 107;	
Ocypopidae, 95;	
Oithonidae, 82;	
Olividae, 104;	
Onchobothriidae, 74;	
Ophiactidae, 113;	
Ophiochitonidae, 113;	
Ophiothrichidae, 113;	
Ostreidae, 108;	
Otobothriidae, 73;	
Paguridae, 90;	
Palaemonidae, 90;	
Palinuridae, 90;	
Pandoridae, 112;	
Paracalanidae, 82;	
Parthenopidae, 93;	
Patellidae, 97;	
Pectinidae, 108;	
Pedicellinidae, 75;	
Pelagiidae, 72;	
Penaeidae, 88;	
Pennaridae, 71;	
Pennellidae, 83;	
Perodermatidae, 85;	
Petricolidae, 110;	
Phialuciidae, 71;	
Pholadidae, 111;	
Phyllobothriidae, 73;	
Phyllodocidae, 78;	
Pinnidae, 108;	
Pinnotheridae, 95;	
Planaxidae, 100;	
Podoceridae, 88;	
Pontellidae, 82;	
Porcellanidae, 91;	

PAGES

Poricellariidae, 75;
 Portunidae, 93;
 Potamididae, 100;
 Pterobothriidae, 73;
 Pyrenidae, 103;
 Pyrulidae, 102;
 Retusidae, 106;
 Rhopalonematidae, 72;
 Ringiculidae, 106;
 Rissoidae, 99;
 Sabellidae, 79;
 Sapphirinidae, 82;
 Scaphandridae, 106;
 Scyllaridae, 90;
 Semelidae, 110;
 Sergestidae, 89;
 Serpulidae, 79;
 Siphonariidae, 107;
 Solenidae, 111;
 Sphaeromidae, 87;
 Spionidae, 79;
 Strombidae, 101;
 Syllidae, 77;
 Synaptidae, 113;
 Tachidiidae, 83;
 Talitridae, 88;
 Tellinidae, 111;
 Temnopleuridae, 113;
 Temoridae, 82;
 Terebellidae, 79;
 Terebridae, 106;
 Teredinidae, 112;
 Thalassinidae, 92;
 Thraciidae, 112;
 Tiaridae, 99;
 Tironidae, 87;
 Tonnidae, 102;
 Trapeziidae, 108;
 Triphoridae, 100;
 Trochidae, 98;
 Tubulariidae, 98;
 Turbinidae, 98;
 Turridae, 105;
 Turritellidae, 99

PAGES

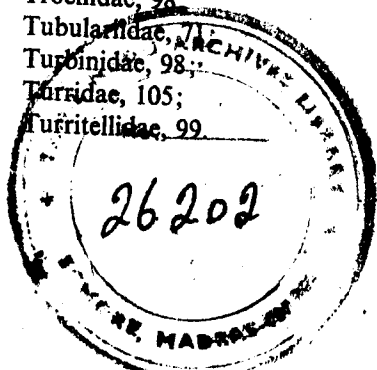
Ungulinidae, 108;
 Veneridae, 109;
 Vesiculariidae, 75;
 Volemidae, 104;
 Xancidae, 104;
 Xanthidae, 94;
 Xenophoridae, 101;

Reptiles 371-87

Agamidae, 372, 379;
 Boidae, 373, 382;
 Chamaeleonidae, 372, 379-80;
 Chelonidae, 371-72, 375-76;
 Colubridae, 373-74, 382;
 Crocodylidae, 371, 375;
 Elapidae, 374, 385-86;
 Emydidae, 372, 376;
 Eublepharidae, 372, 378;
 Gecknidae, 372, 377-78;
 Hydrophiidae, 374-75, 386;
 Lacertidae, 373, 380;
 Scincidae, 372-73, 380;
 Testudinidae, 372, 376-77;
 Trionychidae, 372, 377;
 Typhlopidae, 373, 381;
 Uropeltidae, 373, 381;
 Varanidae, 373, 380-81;
 Viperidae, 375, 386-87.

Spiders 295-0

Argyopidae, 297, 301;
 Ditynidae, 297, 299;
 Eresidae, 296, 299;
 Filistatidae, 297, 300;
 Hersiliidae, 298, 302;
 Lycosidae, 298, 305;
 Oecobiidae, 297, 300;
 Oxyopidae, 299, 306;
 Pholcidae, 297, 300;
 Salticidae, 299, 306;
 Scytodidae, 297, 299;
 Tetragnathidae, 297-300;
 Theridiidae, 297;
 Thomisidae, 298, 303.



■ ■ ■
 821