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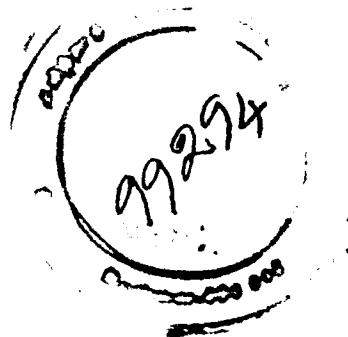
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OF

LITERATURE AND SCIENCE.

NO. 5.—NEW SERIES.

October—December, 1857.

I. Report upon the Oils of Southern India. By LIEUT. H. P. HAWKES, S. A. C. G.

The following Report upon the oils of Southern India has been drawn up from notes taken during the formation of a collection of oils for the Madras Government. The statistics have been furnished by the Civil and Military authorities throughout the Presidency.*

The subject may be conveniently arranged under the following sections.

- Sect. 1. Oil considered as an article of export trade.
2. Abstract of oil cultivation in the several districts of the Presidency.
3. A descriptive list of the oils of Southern India.
4. Remarks on the economical uses of oil in India.

* NOTE.—It will be observed that in many parts, especially in Section 3, this report is almost identical with that in Class IV. of the Jury Reports of the Madras Exhibition of 1855. This arises from the writer of the present paper having been requested to perform the duties of reporter in that section, and from his having embodied in that report all the information on this subject collected up to that date.

SECTION. I.

OIL CONSIDERED AS AN ARTICLE OF EXPORT TRADE.

Although the number of oil producing plants in Southern India, is very large, yet upon examination it will be observed, that of these but few are cultivated to any great extent; the larger proportion consisting of trees, shrubs, &c. growing in a wild state, the fruits of which are gathered by the poorer classes, and the oils expressed as necessity requires. These latter (with some exceptions) do not form articles of trade, nor are they usually procurable in the native bazaars.

Of animal oils, that extracted from the liver and other parts of various species of fish, chiefly on the Malabar Coast, now forms a source of considerable trade; whilst Petroleum is largely exported from our Burmese possessions to the manufacturing towns of Liverpool and Glasgow.

In taking a general view of these substances it seems advantageous to consider them under the following classes.

1st Class.—Those plants which are cultivated for the sake of their products.—Of these, the oil and cake form in some cases the only valuable part, whilst in others, as the Poppy, the plant serves many other purposes. This class includes the bulk of the oils exported from, and consumed in India, and comprises the following—Cocoanut, Gingeley and its varieties, Lamp and Castor,* Groundnut, Linseed, Ramtill, Mustard erroneously called Rape, and Poppy; the essential oils of Cinnamon (from the bark and leaf,) and Cassia, Cloves and Sandalwood.† Fish oil and Petroleum being also valuable commercial products will be considered in this Section.

First in importance is Cocoanut oil which is yearly exported to a large extent from Malabar and the Western Coast, and in smaller

* NOTE.—Throughout this report the word "Lamp oil" will be used to denote the oil obtained from the large seeded variety of the *Ricinus communis* used almost exclusively for burning in lamps, whilst the term "Castor oil" will be understood to refer to the medicinal product extracted from the *Ricinus communis* fructibus minoribus.

† For the Botanical names of these plants, see Section 3.

CHINGLEPUT.

As there are no exports from this district, the oils in most general request for local consumption are those chiefly grown. Gingeley is sown to the extent of about 3,700 acres, Lamp oil 830 acres, and Illoopoo is produced over about 890 acres of ground. In addition to the above, small quantities of Ground nut, Castor, Pinnacotay, Brumadundoo, Cât amunak and Neeradimootoo are produced, but not to a sufficient extent to form articles of trade.

COIMBATORE.

The Cocoanut oil used in this Collectorate is imported from Paulghaut. Gingeley and Lamp are grown for home consumption, Kurunj, Neem and Illoopoo trees grow wild, and the oils of the seed are extracted by the poorer classes.

CUDDAPAH.

Lamp oil seed is cultivated to the extent of about 75,000 acres, yielding 120 measures per acre, and Gingeley to the amount of about 10,000 acres, yielding 150 measures per acre. The Cocoanuts grown in the district are sold for culinary purposes, and the Cocoanut oil consumed on the spot is extracted from kernels imported from Canara.

Kurunj, Linseed, Safflower, Illoopoo and Cât amunak oils are prepared in small quantities.

GANJAM.

The relative proportion of land under cultivation in this district, with the following oils, appears to stand thus.

Cocoanut.....	12,093 acres.
Gingeley.....	6,738
Mustard.....	2,006
Ramtill.....	2,700

For some years past, large exportations of Gingeley oil have been made by French merchants.

The Ramtill is said to be chiefly used (on account of its cheapness) to adulterate the Gingeley and Castor oils, for this purpose it is mixed with those seeds before being put into the oil press.

Cocoanut oil is largely made at two places in the district, but little is exported except to Moulmein.

Kurunj oil, though rarely made, is sometimes exported to Madras. Mustard oil is extracted to a small extent, the seeds however are exported largely

TABLE OF EXPORTS.

NAMES.	1850-1.		1851-2.		1852-3.		1853-4.		1854-5.	
	Mds.	Rs.	Mds.	Rs.	Mds.	Rs.	Mds.	Rs.	Mds.	Rs.
Cocoanut oil..	0	45	0	0	26	260	31	273	34	261
Cocoanut kernels.....	0	0	0	0	10	15	*280	1,209	0	0
Gingeley oil..	46	348	36	0	4	34	11	87	160	187
Gingeley seed	41,659	51,433	60,257	100,430	145,537	242,561	107,205	174,952	92,592	150,431
Rape seed....	0	0	0	0	2,663	2,220	4,764	3,970	4,223	3,519
Lamp oil..	3	12	0	0	69	300	7	30	58	246
Lamp oil seeds	135	135	0	0	1,047	1,047	42	44	116	116
Ramtil..	661	551	34	28	2,250	1,857	769	642	1,014	845
Mustard oil..	6	0	0	0	0	0	0	0	0	0
Mustard seed.	8,697	13,045	5,311	7,966	19,110	28,058	3,462	5,248	7,874	11,812
Illoopoo oil..	318	2,123	0	0	0	0	12	82	48	323
Illoopoo seed.	0	0	0	0	24	12	0	0	0	0
Wood oil....	0	0	0	0	2	16	0	0	0	0
TOTAL..	51,538	67,697	65,639	106,923	170,732	277,276	116,588	187,209	106,121	168,892

* In addition to this, 20,000 dry nuts valued at 300 Rupees, and large quantities of the fresh nut for edible purposes, are produced annually.

GUNTOOR.

With the exception of a little Linseed, Lamp is almost the only oil plant cultivated in this district. The quantity of land under cultivation with this latter is 31,242 acres, the produce being about 4,400 candies, of which 1,400 candies have been annually exported by sea and land.

Linseed is sown rather extensively in furrows on the borders of fields in the Western Talooks.

Other oils, such as Cocoanut and Gingeley, are imported from Rajahmundry and other districts.

TABLE OF EXPORTS.

NAMES.	1850-1.		1851-2.		1852-3.		1853-4.		1854-5.	
	Mds.	Rs.	Mds.	Rs.	Mds.	Rs.	Mds.	Rs.	Mds.	Rs.
Lamp and Castor oil..	47	316	78	520	73	490	47	314	40	279
Lamp and Castor seeds	8,326	13,136	17,858	27,292	16,364	25,095	28,174	38,891	21,133	28,672
Linseed....	1,462	1,594	1,609	1,777	3,414	3,583	2,956	3,208	588	659
TOTAL..	9,835	15,046	19,545	29,589	19,851	29,168	31,177	42,413	21,75	629,610

KURNOOL.

Lamp oil is most largely produced in this district. The extent of cultivation is 26,200 acres, and the average crop (at 140 measures per acre) is 36,68,000 measures. Gingeley covers about 8,050 acres, the average produce is estimated at 80 measures per acre. Castor oil (medicinal variety) does not thrive well, and is therefore but little cultivated, Illoopoo and Safflower oils are produced in small quantities.

MADURA.

Gingeley and Lamp are the chief oil products of this district, the cultivation of each being 14,653 and 11,546 acres respectively. Illoopoo, Neem and Kurunj are extracted to the extent of from one to three thousand gallons annually, and Brumadundoo and Cat amunak in smaller quantities.

TABLE OF EXPORTS.

NAMES.	1850-1.		1851-2.		1852-3.		1853-4.		1854-5.	
	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.
Gingeley oil.. Cwt.	18	102	5	56	7	72	0	0	1	13
Gingeley seed. Cwt.	0	0	0	0	0	0	20	70	0	0
Lamp oil.... Cwt.	29	165	19	143	50	363	120	864	0	6
Lamp oil seed Cwt.	11	19	0	0	0	0	5	13	0	0
Margosa oil.. Cwt.	9	90	0	0	0	0	22	0	0	0
Total..	67	456	24	199	57	435	167	947	1	13

MALABAR.

This district, so rich in natural productions of every sort, yields a great variety of substances from which oils may be derived. Up to this time sufficient data as to the extent of cultivation,

&c. has not been obtainable, but the interest which has been evinced in elucidating this subject, will doubtless result in making known those oils which are likely to become valuable articles of trade.

The subjoined table will give the best idea of the ordinary products of the district.

TABLE OF EXPORTS.

NAMES.	1850-1.		1851-2.		1852-3.		1853-4.		1854-5.	
	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.
Cocoanut oil	47,726	147,983	68,931	213,966	104,368	3,23,674	132,176	406,347	158,100	549,701
Cocoanuts	2,637,712	5,340,493	37,676,345	492,735,38	38,089,800	4,98,096	2,549,977	6,333,490	28,965,500	378,855
Cocoanuts	116,300	448,143	130,391	511,133	155,232	543,308	128,356	500,312	95,504	375,992
Gingeley oil	10	123	0	0	40	383	860	6,350	370	2,671
Gingeley seed	671	2,143	0	0	670	1,467	3,663	11,767	617	2,711
Fish oil	3,029	12,461	7,242	29,786	21,046	84,577	47,067	234,657	5,865	81,538
Pinnacotay	160	457	260	875	506	1,300	922	2,414	651	1,611
Pinnacotay	0	0	0	0	0	0	724	2,282	45	144
seed	0	0	0	80	0	49	2	230	0	0
Cassia oil	0	0	0	0	0	0	251	469	13	233
Lemon grass	0	0	23	414	14	252	6	3,406	12	7,139
Sandalwood	12	6,098	19	9,383	21	16,145	0	167	0	8
oil	0	98	0	708	0	36	137	1,411	160	1,664
Croton oil	0	0	0	0	0	0	0	0	0	0
Croton seed	0	0	0	0	0	0	0	0	0	0
TOTAL	2,806,610	5,957,998	37,883,211	1,259,079,38	37,167,1,463,287	2,863,906	7,503,762	29,228,837	1,402,267	

MASULIPATAM.

Gingeley and Lamp oils are the staple products of this district, the former is said to be cultivated to the extent of about 10,000, and the latter about 15,000 acres. There are but few coconut plantations, this oil is therefore chiefly imported, but there is ample room for the introduction of this productive cultivation.

Fish oil is made for local consumption from fish caught on the Colar lake and on the coast, it is chiefly burnt in lamps by the lower classes, but the manufacture appears deserving of encouragement. Small quantities of Castor, Kurunj, Margosa and Brumadundoo are also made.

TABLE OF EXPORTS.

NAMES.	1850-1.		1851-2.		1852-3.		1853-4.		1854-5.	
	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.
Cocoanut oil	0	0	0	0	0	0	20	0	1	0
Cocoanuts	3	0	0	0	0	0	0	0	0	0
Gingeley oil	0	0	7	0	8	0	77	0	39	0
Gingeley	0	0	0	0	0	0	0	0	5	0
seeds	0	0	0	0	0	0	0	0	46	0
Lamp oil	0	0	2	0	7	0	37	0	48	0
Lamp seeds	9	0	12	0	230	0	42	0	6	0
Linseed oil	0	0	1	0	0	0	3	0	130	0
Ghee	57	0	36	0	1,209	0	427	0	0	0
Total	69	..	58	..	1,454	..	608	..	275	..

NELLORE.

Lamp-oil is grown in this Collectorate to the extent of 12,500 acres.

The cultivature of the Gingeley seed covers on an average about 1,000 acres. Margosa oil is made to the extent of about 1,600 Maunds, and Illoopoo about 5,000. Brumadundoo, Cucumber and Linseed are all produced to a limited extent in the Ongole Talook.

TABLE OF EXPORTS.

NAMES.	1850-1.		1851-2.		1852-3.		1853-4.		1854-5.	
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.
Gingeley oil	243	846	36	313	19	121	50	438	61	450
Gingeley seed	11,411	120,445	8,123	74,369	2,685	17,233	1,869	7,209	395	978
Lamp oil	197	1,549	239	1,897	187	1,470	168	1,275	163	1,196
Lamp seed	15,121	113,550	240,861	76,660	23,042	169,784	15,076	90,450	3,364	0
Linseed	0	732	117	669	242	1,426	127	741	17	25
Cucumber seed	0	0	0	8	14	59	11	44	0	4
Total	26,972	237,122	249,457	153,936	26,188	190,093	17,291	100,157	3,990	2,653

RAJAHMUNDY.

In this district the oil seeds principally grown appear to be those of Gingeley, Coconut and Lamp.

Of Lamp and Gingeley upwards of 14,000 acres each are said to be cultivated, and considerable quantities of the latter seed have within the last few years been exported to France. Cocoanuts are grown in various talooks, and might be planted to a large extent if necessary. Castor, Kurunj, and Margosa oils are also prepared for local consumption.

TABLE OF EXPORTS.

NAMES.	1860-1.		1861-2.		1862-3.		1863-4.		1864-5.	
	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.
Cocoanut oil... Mds.	1,673	3,330	2,420	5,094	2,139	5,108	5,132	10,692	1,758	5,651
Cocoanut fresh No.	996,308	13,096	420,368	5,495	495,560	6,494	1,521,369	19,907	917,474	11,770
Cocoanut dried Mds.	532	532	105	115	267	222	1,518	1,518	147	227
Gingeley oil... Mds.	1,088	2,082	1,248	2,510	4,087	7,862	3,508	7,574	928	2,914
Gingeley seed... Parahs.	52,589	110,884	42,279	98,564	72,274	163,215	107,812	312,978	40,922	183,461
Lamp oil... Mds.	2,509	4,142	2,612	2,833	10,705	119,725	1,885	3,265	3,917	8,203
Lamp seed... Parah.	2,598	4,960	8,765	7,824	39,985	52,785	2,871	5,801	9,778	84,404
Castor oil... Doz.	794	410	10	45	0	0	2	5	0	0
Linseed oil... Mds.	2	6	3	9	0	24	0	0	1	3
Wood oil... Mds.	38	132	14	42	28	84	0	0	105	217
Mustard seed... Mds.	1,094	544	1,371	1,175	1,035	523	190	88	0	0
Cotton seed... Mds.	0	0	0	0	1,039	259	2,703	666	1,093	873
Cinnamon seed Mds.	16	24	30	100	0	0	36	105	2	9
Total..	..	140,155	..	123,806	..	356,291	..	362,599	..	297,762

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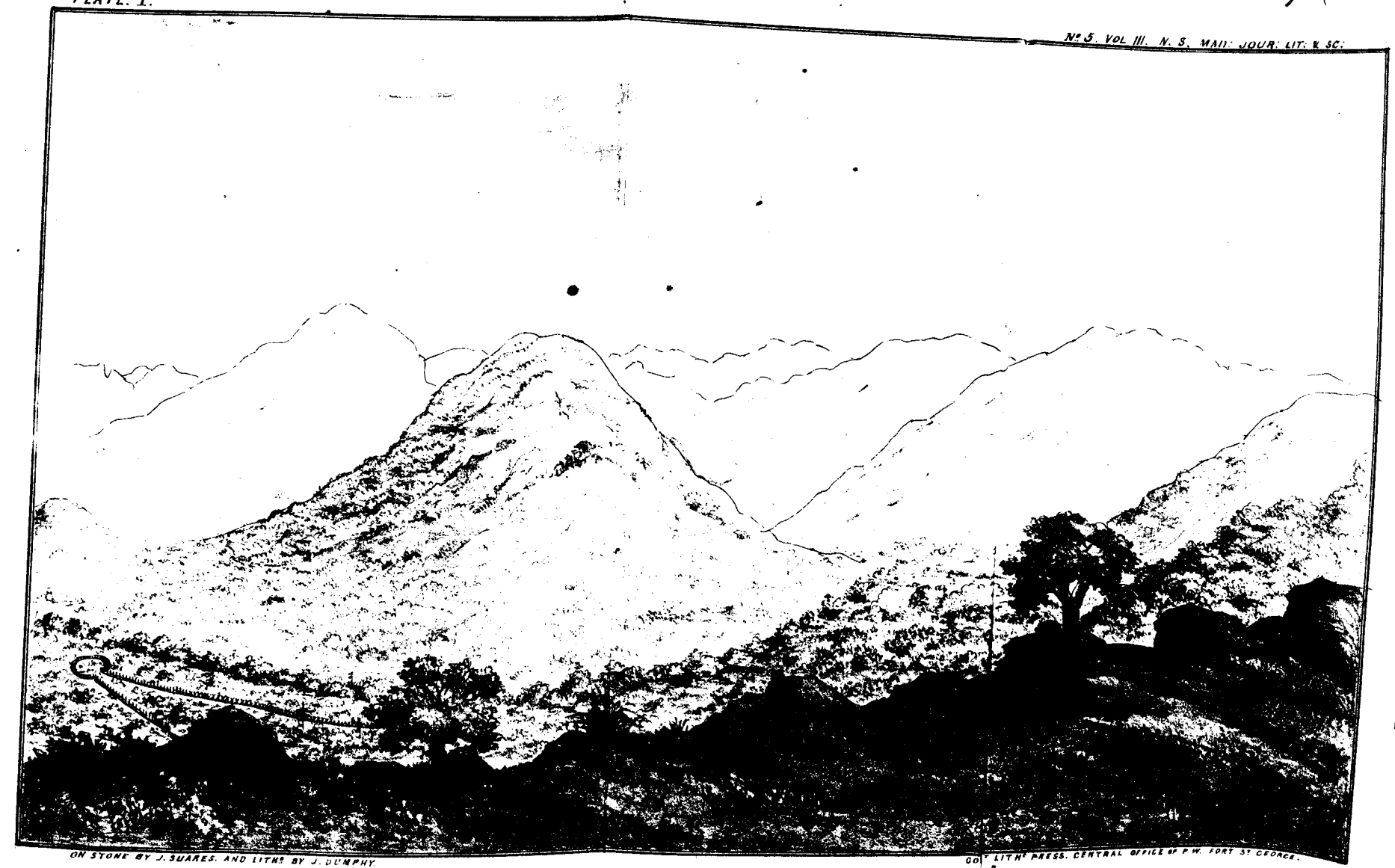
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PLATE. I.

No 5. VOL III. N. S. MAIL. JOUR. LIT. & SC.



ON STONE BY J. SUAKES. AND LITHS BY J. DUMPHY.

GO. LITH. PRESS. CENTRAL OFFICE OF P.W. FORT ST GEORGE.

VIEW OF THE VALLEY SHOWING THE SITUATION OF THE COOPUN.

quantities from Rajahmundry and Tanjore. During the last five years (from 1850-51 to 54-5) not less than 70,09,818 gallons, valued at 15,73,528 Rupees (according to the custom house valuation) have been exported from this Presidency, the demand having in the same time increased from 6½ to 21½ lacs of gallons. In addition to this, dried kernels have been exported from Mulabar alone to the value of 23,78,886 Rupees, and the fresh nut to the extent of Rupees 20,43,669, thus presenting a total of Rupees 59,96,085 in five years, or an average of nearly 12 lacs per annum on this one commodity alone. This is exclusive of the dried kernels and fresh nuts exported from Rajahmundry, Tanjore and Vizagapatam, which appear to be sent chiefly to other Indian ports.

Gingeley oil and its varieties are next in value as articles of commerce. They are very generally grown in all parts of the country, and enter more largely than any other oil into the home consumption of every class of natives.

They are exported in large quantities chiefly in the shape of seed. The quantity and value of oil and seed exported from the Madras territories for the last five years is as follows:—

Oil, gallons..	332,384..	Rs. 2,05,290
Seed, cwt..	19,54,209..	Rs. 23,96,894

Rupees..26,02,184

making an average of 5 lacs of Rupees per annum. Of this a very large portion is sent to France as will be seen by the following abstract of the quantity exported in 1852-53.

United Kingdom....	Seed. Cwt. 12,713	Oil. gall. 42,043
Ceylon.....	590	2,968
France.....	2,87,225	19,698
Pegu.....	741	3,593
Bombay.....	113	46
Malacca.....	33	27
Travancore.....	148	4,232
Bengal.....	0	
French Indian Ports. . .	0	
Mauritius and Bourbon..	0	

"Lamp oil" is grown very generally throughout the country. It was exported from Rajahmundry to the value of 32,607 Rupees in 1854-55; and from Guntoor, Nellore and Tanjore to the value of from 10 to 15,000 Rupees each yearly. Little, if any, is sent to England.

The total exports for the last five years are as follows:

Oil. Gall. 1,97,977 Rs. 98,875 | Seed. Cwt. 99,471 Rs. 1,13,370 making an average of about 42,349 Rupees per annum.

Castor oil, extracted from the small seeded variety of *Ricinus* is exported to a small extent for medicinal purposes.

Ground nut oil is exported chiefly from South Arcot and Madras. In 1850-51, the demand arose to no less than 1,10,566 gallons, but with the exception of the year 1853-54 the export has never subsequently much exceeded half that amount.

The abovementioned oils and seeds, until within the last few years comprised the bulk of the exports from this Presidency. Now however the following begin to be exported.

Mustard seed, to the amount of Cwt. 50,746, Rupees 11,5,477 has been shipped during the last five years, from the Ganjam and Vizagapatam Districts.

The cultivation and export of Linseed is on the increase. It is sent from the Guntoor, Nellore and Masulipatam Districts to the value of from 2 to 9,000 Rupees per annum.

The manufacture of Fish oil has lately become a very valuable source of industry. The trade is chiefly confined to the Western coasts, although small quantities for home consumption are made in the Northern Circars. Omitting the year 1854-55 which is unfavorable on account of the failure of fish, the average value of this export for the last five years, is Rs. 78,126.

Petroleum is sent from our Burmese possessions, but no correct statistics are at present available.

The oils of Cassia, Cinnamon and Sandalwood are chiefly exported from the Western Coast, the wood from which much of the latter is extracted, is obtained from Mysore.

2nd Class.—Those plants, &c. which grow spontaneously and are found in sufficient quantities to admit of the produce becoming an article of inland trade.

These are generally to be procured in large bazaars and include Margosa, Illoopoo, Pinnacottay, Kurunj, Coorookoo, Cat amunak, Piney tallow, Gamboge butter, the various Wood oils, the essential oils of Lemon grass, Roosa grass, Cageput and Camphorwood.

The increasing attention which has been given to this subject has resulted in the manufacture and export of the following oils, which were previously unknown to the market.

Piney tallow exported to the value of Rupees 4,350 in 1854-55 from Canara.

Lemon grass and Roosa grass oil exported from Malabar and Travancore (sometimes under the fictitious name of Oil of Geranium or Verbena.)

Gamboge butter, employed successfully as a lubricating agent for Railway carriages.

Illoopoo, Margosa and Pinnacottay exported to a limited extent for household purposes.

3rd Class.—Those plants &c. which grow spontaneously but to a limited extent in many parts of the country, the oils from which are sometimes extracted by the poorer classes for home consumption and are seldom procurable in the bazaar.

This class comprises the oils of Safflower, Belgaum walnut, Poovana, Neeradimootoo, Addale (*J. Glauca*), Country-cress, Cheeronjie, Cucumber, Melon and Pumpkin, Coorgapilly, Sterculia, Wild olive, Cheeroo pinnacottay (*Cal. colaba*), Sandal seed, Moorogana tallow, Naga Sumpaghy and Caat Urraloo.*

4th Class.—Those plants &c. from which small quantities of oil are extracted chiefly for medicinal purposes and perfumery, including Soap nut, Cashew nut, Ben nut, Cotton seed, Silk Cotton seed, Sweet Fennel, Rosebay, Malkunganee, Hemp Seed, Portia nut, Vis-

* For the Botanical names of these plants, see Section 3.

cid Cleome, Thortay, Fænegreck, Abelmoschus seed, Gutta Percha seed, Croton, Bryony, Colocynth, Wild cummin, Bonduc nut, Mimusops, Moodooga, Thevetia. Oodul, Garlic, Sunflower, Wild almond, Star arise, Gayapa, Nutmeg (wild). Thorny Trichilia, Cyperus, Thorn apple, Condamminee, Sand box tree, Saul seed, Eugenia, Belleric Myrobalan, Chebulic Myrobalan, Kikuel, Bergera Kœnigii, Balanites (Egyptiaca, Radish seed, Cabbage seed, Cardamom, Poondy, Cordia, Girghitly. Jogyhulloo, Nux Vomica, Marking nut, Cashew husk, Oleum nigrum, Tobacco seed, Alligator pear oil, Cinnamon tallow, Coccus oil, &c. &c. This class will also include, Neat's foot oil and oil of wax.

Excepting Croton oil which is manufactured for medicinal purposes to a small extent, none of the oils of the last two classes form articles of trade.

A reference to the table of exports will give a good idea of the extent of the trade in these commodities, the total value of oils and seeds exported for the last five years is as follows: (For the items vide Appendix A.)

Year 1850-1	Rupees	8,11,057	duty	24,331
„ 1851-2		6,42,439		19,273
„ 1852-3		11,31,578		33,947
„ 1853-4		15,58,222		46,746
„ 1854-5		11,41,617		34,248

A duty of 3 per cent. is levied on oils and oil seeds of all sorts, yielding an average annual revenue (for last 5 years) of 31,709 Rupees.

The quantity of the four principal oils annually imported into Great Britain is as under.

	Palm oil.	Cocoanut oil.	Castor oil.	Olive oil.
1848 Cwts.	510,218	Cwts. 85,463	Cwts. 4,588	Tons. 10,086
1849	493,331	64,452	9,681	16,964
1850	448,589	98,040	„	20,738
1851	608,550	55,995	„	11,503
1852	523,231	101,863	„	8,898

The total value of oils exported from India exhibits an annual increase, the demand however for the various items of which the whole export is composed, fluctuates considerably.

In 1848-49 the quantity of oil shipped was less than in the preceding year, but Linseed and Ground nuts first formed regular articles of export.

In 1849-50 the demand for Cocoanut oil was doubled, that for Ground nuts trebled, and that for Gingeley much increased.

In 1850-51 Gingeley was exported to twice the amount of the previous year, and Ground nut continued to be largely shipped. Fish oil, was also made in large quantities.

In 1851-52 there was an increase of one-third in demand for Cocoanut, and of 100 per cent. for Fish oil, but Ground nut declined to one-third of its former export, Gingeley oil and seed also decreased, the latter to the extent of nearly one half of the former demand. This was on the whole a bad year for this branch of trade.

In 1852-53 there was a further increase in demand for Cocoanut oil which now more than doubled its export for 1850-51, also an immense increase in the export of Fish oil of upwards of 300 per cent. Mustard was exported to five times its former figure and Lamp oil and Ground nut advanced, Gingeley oil and seed remained the same as in 1850-51.

In 1853-54 the demand for oils of all sorts consequent on the war rose to an enormous extent, the quantity of all oils exported and especially of Fish, Ground nut and Gingeley, increased largely.

In 1854-55 the demand decreased considerably in consequence of the large supplies sent the previous year.

A remarkable specimen of the rise and progress of a new branch of industry is to be seen in that of the manufacture of Fish oil, the export of which has increased from 3,500 gallons in 1847-48, to 7,21,095 gallons in 1853-54.

From the above summary it will, I think, be sufficiently evident that the discovery or introduction of *new* articles of produce however desirable, is by no means so indispensable as is so often supposed. Efforts should rather be made to extend and improve the

cultivation of those oil seeds for which there is already a steady demand. The oil cultivation seems in a remarkable manner to accommodate itself to the demand, and there is but little fear of a deficiency of supply as long as remunerative prices are offered.

SECTION II.

ABSTRACT OF OIL CULTIVATION IN THE SEVERAL DISTRICTS
OF THE PRESIDENCY.*

NORTH ARCOT.

The principal oils of this Collectorate are Gingeley and Lamp, both of which are cultivated very generally throughout the District. Castor, Cocoanut and Ground nut are produced to a limited extent.

The plants yielding Kurunj and Brumadundo also grow sparingly, the latter from its cheapness being frequently used in this and other collectorates to adulterate more expensive oils.

Exports, none.

SOUTH ARCOT.

Ground nut is the chief oil produced and exported in this District. Gingeley oil is also sent in tolerably large quantities to Europe, but the demand for both appears to fluctuate considerably. Mustard oil and seed have been lately exported, and the cultivation is on the increase. Cotton is grown on from 15 to 20,000 cawnies of land, but the oil of the seed is not extracted. Illoopoo oil is prepared to a limited extent and sold at Rupees 25 per Candy, and oil is obtained from both kinds of Physic nut and burned by the poorer classes.

* NOTE.—The difficulty of obtaining accurate statistics of Agricultural Produce in India is very great; the system of sowing several crops in one field also tends to augment the labour. Although therefore the following returns are believed to represent a very fair approximation to the average amount of cultivation and export, yet too much reliance should not be placed upon these figures. As regards prices also some idea may be formed of their fluctuation and of the impossibility of basing any calculations on such data, by a return received from North Arcot, in which the prices of the same oil are shown to vary to the extent of one-third in different towns of the district.

EXPORTS.

NAMES.	1850-1		1851-2		1852-3		1853-4.		1854-5.	
	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.
Cuddalore.										
Cocoanut Oil... Candies.	0	0	0	0	0	0	0	0	36	1,860
Cocoanut Kernels..... Do.	0	0	0	0	0	0	0	0	10	368
Gingely Oil... Do.	311	12,154	101	391	1	41	334	14,332	13	728
Gingely Seed... Garces.	0	109	0	92	0	0	0	0	0	0
Lamp Oil... Do.	0	0	0	0	0	0	0	67	0	0
Ground nut Oil Candies.	1,428	42,831	382	11,120	1,036	28,754	640	2,769	2,393	18,572
Ground nuts... Garces.	0	109	0	92	0	0	0	0	0	0
Mustard Oil... Candies.	0	0	0	0	0	0	0	24	0	0
Mustard Seed... Garces.	0	0	0	0	58	667	62	823	0	0
Pinnacotay Oil Candies.	0	0	0	0	0	26	0	0	0	0
Porto Novo.										
Gingely Oil... Candies.	3	149	5	354	8	329	0	0	0	0
Gingely Seed... Garces.	0	0	0	12	0	0	0	0	0	0
Lamp Oil... Candies.	0	0	0	0	0	20	0	28	0	0
Ground nuts... Garces.	0	0	0	3	0	140	1	154	0	0
Margosa Oil... Candies.	0	9	1	37	0	24	0	0	0	69
Total...	..	65,253	..	12,012	..	30,004	..	43,441	..	21,658

BELLARY.

The cultivation of Lamp and Gingeley seeds extends over 88,950 and 7,177 acres respectively. Linseed, Safflower and Illoopoo oils are obtainable in small quantities. The Cocoanut oil consumed in this district is chiefly made from imported nuts.

CANARA.

Cocoanut oil and kernels, Gingeley seed, Fish oil, Cassia and Sandalwood oils form the staple oil products of this district. Piney tallow has of late risen rapidly in demand. Fish oil is largely made and exported.

This district is moreover rich in oil bearing trees, many of the oils of which if obtainable in sufficient quantities, appear likely to become valuable. A list of some of these is subjoined.

TABLE OF EXPORTS.

NAMES.		1850-1		1851-2		1852-3		1853-4		1854-5	
		No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.
Cocoanut oil...	Candies.	6	311	18	838	20	914	23	1,062	103	5,932
Cocoanut ker...	Do.	82	2,384	152	4,085	60	1,945	20	857	83	2,117
nole	Do.	19	19	15	15	2	129	2	88	48	2,671
Gingely oil....	In. Mds.	2,376	4,397	1,908	2,584	2,352	2,584	4,052	5,382	3,778	9,046
Gingely seed....	In. Mds.	2	13	3	207	4	198	2	113	6	358
Castor oil.....	Candies.	2	0	0	0	19	19	0	0	0	0
Castor seed....	In. Mds.	0	0	53	1,137	1,144	18,214	2,998	61,264	75	1,988
Fish oil.....	Candies.	63	1,632	0	0	0	0	0	0	189	2,202
Linseed	In. Mds.	11	2,445	4	1,127	8	2,159	3	964	5	1,590
Cassia oil.....	Candies.	14	38,946	13	36,722	16	42,552	23	65,203	28	81,495
Sandalwood oil.	Do.	2	101	1	18	1	7	3	115	3	112
Pinnacotay oil.	Do.	0	0	0	6	0	7	1	23	71	4,350
Piney tallow...	Do.	0	0	0	0	0	0	0	0	0	0
TOTAL...		..	60,169	..	47,739	..	63,126	..	135,109	..	114,858

* Consequent on the failure of the fish the quantity of oil exported this year was small.

List of Medicinal and other oils, &c. produced in Canara.

VERNACULAR NAMES.	BOTANICAL NAMES.	REMARKS.
Mooroogana oil.....		? Used as a cure for cattle wounded by Tigers.
Araasinagoorhy oil....	Garcinia pictoria.	Lamps and Food.
Thoronagullo oil.....	Dalbergia.....	? For skin diseases
Kungan	Celastrus paniculata.	For ulcers and wounds.
Cat Ghairoo.....		? For sores in cattle.
Girghitly.....		? Extracted from the pulp of the tree and considered valuable in Rheumatism.
Nagasumpaghy.....	Mesua ferrea...	? For Lamps, sold at 4 Rs. per maund.
Thortay.....		? For sores.
Jogyhullo.....		? For skin diseases.
Poondy oil.....	Myristica Malabarica.	Of two sorts, extracted from the seed and fruit. For burning in lamps.
Sahcottay.....		? For skin diseases.
Mahnaloo.....		? For lamps.
Soorty (or Neeradimootoo).	Hydnocarpus inebrians.	For cutaneous diseases.
CatUrraloo(wildCastor)		? For lamps and in medicine.

SALEM.

Lamp and Gingeley are cultivated throughout the district, the former to the extent of 39,300 acres, yielding on an average 160 measures per acre, and of the latter 18,525 acres yielding 150 measures per acre. Ramtill is also cultivated in the Oosoor, Denkencotta and Tripatore talooks. Illoopoo, Cat amunak, Kurunj, Neem and Brumadundoo grow spontaneously, and the latter is said to be also cultivated to a small extent.

TANJORE.

Cocoanuts form the chief oil product of this fertile district, the quantity of ground under cultivation being estimated at 4,369 acres, producing on an average 5,447 nuts per acre.

Next in importance are Illoopoo grown over 6,000 acres, Castor occupying 1,193 acres, and Gingeley cultivated to the extent of 1,207 acres. Pinnacotay and Ground nut oils are produced to a limited extent. A great variety of Medicinal oils &c. are obtainable in this district.

TABLE OF EXPORTS.

NAMES.	1850-1.		1851-2.		1852-3.		1853-4.		1854-5.	
	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.
Cocoanut oil... Cwt.	54	549	169	1,712	125	1,264	64	647	18,104	19,194
Cocoanuts ... No.	41,375	580	29,375	384	0	0	0	0	0	0
Gingeley oil... Cwt.	623	6,288	455	4,588	556	5,609	1,085	10,966	202	2,765
Gingeley seed. Cwt.	67	175	81	226	265	691	7,654	20,925	0	0
Lamp oil. Cwt.	796	5,707	1,175	8,129	1,363	9,797	448	16,121	2,268	16,264
Lamp seed ... Cwt.	1	3	0	0	0	0	0	0	0	0
Illoopoo oil... Cwt.	8	27	4	36	12	111	0	0	3	35
Margosa oil... Cwt.	109	857	1,207	1,002	35	1,689	46	362	197	1,546
Pinnacotay oil. Cwt.	12	84	22	210	130	866	0	0	4	30
Pinnacotay seed Cwt.	10	19	46	108	83	153	10	30	12	21
Ground nuts... Cwt.	72	165	42	96	366	1,002	90	299	15	60
Total...	..	14,454	..	16,791	..	21,182	..	49,358	..	39,915

TINNEVELLY.

The oils in general demand for local consumption are here largely cultivated. Lamp to the amount of 34,785 acres and Gingeley 18,222 acres.

Illoopoo oil is procurable in large quantities (about 16,000 Gallons,) and if advances are made to the manufacturers of Wood oil, a good supply is obtainable, the quantity however at present extracted for home consumption is very small.

Castor, Safflower, Margosa, Pinnacotay, Kurunj, Brumadundoo, Cât amunak and Poovana oils are all procurable in quantities varying from 5 to 250 Gallons.

TABLE OF EXPORTS.

NAMES.		1850-1.		1851-2		1852-3.		1853-4.		1854-5.	
		No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.
<i>By Sea.</i>											
Gingeley oil.	Mercal	40	107	15	67	69	180	435	1,143	135	365
Gingeley seed.....	Do.	0	0	0	0	50	36	365	268	2,575	1,887
Lamp oil. ...	Do.	0	0	0	0	44	115	15	40	41	108
Lamp oil seed.....	Do.	6	3	0	0	2	1	30	40	56	28
Margosa oil.	Do.	5	12	43	107	94	236	21	52	68	170
<i>To Travancore.</i>											
Gingeley oil.	Mercal	1,094	2,872	691	1,553	1427	3,747	2,020	6,303	1,171	3,075
Gingeley seed.....	Do.	14,462	9,000	5,043	3,708	19,751	14,524	17,333	14,217	7,584	5,538
Lamp oil. ...	Do.	72	189	14	37	0	0	0	0	0	0
Lamp seed.....	Do.	363	148	190	94	0	0	0	0	0	0
Margosa oil.	Do.	19	48	0	0	0	0	0	0	0	0
Margosa seed	Do.	402	474	0	0	0	0	0	0	0	0
TOTAL.....		13,713	..	5,566	..	18,839	..	21,063	..	11,171	..

TRICHINOPOLY.

Most of the oils usually grown are produced in this district. The supply however being insufficient to meet the local demand, the deficiency is imported from Salem, Coimbatore and the neighbouring Collectorate.

VIZAGAPATAM.

According to the returns furnished from this district the following appears to be the proportion in which the several oils therein mentioned are cultivated. Owing however to the great difficulty of obtaining correct information, these numbers must be considered only as an approximation.

Lamp oil 40,000 acres, Gingeley 27,000 acres.

Mustard, 25,000 acres, Putty Gingealoo 10,000 acres.

Ramtill, 3,500 acres.

Illoopoo, Margosa, Brumadundoo, and Cât amunak oils are also procurable in quantities of from 200 to 1,000 maunds.

TABLE OF EXPORTS.

NAMES.		1850-1.		1851-2.		1852-3.		1853-4.		1854-5.	
		No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.
Cocanut oil.	Mds.	0	0	0	0	0	0	0	0	7	27
Cocanut seed.	No.	684,455	2,081	0	0	0	0	0	0	0	0
Gingeley oil.	Mds.	4,702	9,405	218	437	1,020	2,040	566	1,132	124	248
Gingeley seed.	Mds.	70,319	109,868	49,422	77,224	86,111	132,986	103,424	161,459	50,192	78,426
Rape seed.	Mds.	0	0	0	0	485,850	1,020	566	1,132	0	0
Rape seed.	Parahs	1,845	1,504	1,046	1,064	3,016	2,262	16,066	12,049	10,338	793
Lamp and											
Castor.	Mds.	57	115	1,083	2,126	917	1,834	738	1,477	16	33
Lamp seed.	Parahs	2,930	4,945	50	84	3,396	5,734	12,663	21,370	2,554	4,310
Mustard seed.	Do.	6,821	14,474	7,869	16,709	11,722	24,911	4,089	8,710	6,164	10,973
Avesa oil.	Mds.	0	0	0	0	0	0	0	0	0	0
Lenon grass.	Mds.	0	0	0	0	1	14	0	0	20	30
Croton oil.	Mds.	0	0	0	0	28	128	0	0	0	0
TOTAL...		142,982		98,834		176,773		209,727		94,840	

MALWA.

Opium being the staple product of this province, Poppy oil and seed (the former at 9 seers, and the latter at 25 seers per Rupee) are procurable to a very large extent. Poppy oil is here more generally used than any other both in Lamps and as food.

Mahowa oil selling at 1 anna 6 pie per seer, and a little Mustard oil are the only other oils made in this province, excepting two very inferior ones extracted from the seeds of the Ramayen and the Kunjee (*Dalbergia*?) and burnt in lamps by the poorer classes.

MYSORE.

Lamp and Castor, Gingeley and Ramtill appear to be the chief oil products of Mysore.

Most of the oils however in Classes 2 and 3 are procurable. Of these the Kurunj, Brumadundoo (largely used for lamps), Cat amunak and Neem are the principal, the latter is said to grow most plentifully in the Chittledroog Division.

The Poppy is cultivated in the Chickmugaloor talook, and Linseed, Safflower and Mustard in various parts of the country. Sandalwood oil is largely made. Cassia, nutmegs and pepper grow wild in the jungles.

The *Garcinia pictoria* is plentiful in the jungles in the West of Mysore, and yields a valuable solid oil. A very sweet tasted edible oil is also obtainable from the seeds of the *Chirongia sapida*.

SECTION III.

DESCRIPTIVE LIST OF THE OILS OF THE MADRAS PRESIDENCY.

CLASS 1.

No. 1. Coconut oil. (*Cocos nucifera*.)

The Coconut Palm grows almost every where within the tropics. It is plentifully cultivated in the districts of Malabar and Canara, Ganjam and Rajahmundry.

The oil is generally prepared from the dried kernel of the nut, by expression in the ordinary Native mills. When carefully made it is colorless, solid at low temperatures but possesses a rancid disagreeable smell.

When required for edible purposes, the kernel of the fresh nut is taken, rasped and mixed with a little boiling water. This yields

by pressure a milky fluid which, on being boiled until all the water has evaporated, produces a clear edible oil. Only just sufficient water to moisten the pulp should be added, as a larger proportion prolongs the operation and deteriorates the product. When fresh prepared, this oil is comparatively free from smell, but it speedily acquires an unpleasant odour; many attempts have been made to divest the oil of this smell, which renders it inapplicable for the perfumers' use, but only with partial success.

The prices of this oil vary most considerably in different parts of the country. For the quarter ending 31st October 1854, the maximum and minimum prices at nineteen large stations in all parts of the Presidency were Rs. 8-5-4 at Jubbulpore, and Rs. 2-14-0 at Bangalore, per maund. The average of twenty-one large stations in the Madras Presidency gives Rs. 4-9-5 per maund or about £41-2 per ton. The market value of "Cochin oil" in London in January 1855 was £46-10 per ton, the average being from £46 to £48.

It is used very largely in England in the manufacture of candles and soap. For the candle maker the stearine is separated from the olein, the former product being used for candles, for which it is most applicable on account of the high temperature required to fuse it. The olein is then made over to the soap boiler for conversion into soap. Soap made from Coconut oil is lighter than water, and consequently floats in that medium, whilst from its being the only soap which will dissolve freely in salt water it is usually called "Marine soap."

In India this oil is made into soap by boiling with a proper proportion of dhobies' earth, salt, saltpetre, quicklime, and water. It is also burnt in lamps by the higher classes, used for anointing the body, and in cookery.

The best oil is exported from Cochin and the neighbouring ports on the Malabar coast. It usually fetches 20s. per ton more than the Ceylon or Coromandel coast article. The average annual quantity exported from this Presidency from 1850-1 to 1854-5 is about 14,10,963 gallons. Of this by far the largest portion is sent to the United Kingdom and France, the remainder finding its way to Arabia, Mauritius, Bombay and the French (Indian) Ports.

The Coconut palm thrives best near the sea coast, although it sometimes grows favorably on inland plains, the soil of which contains a large proportion of siliceous and soda or salt which are the substances chiefly required for its nourishment. In South America salt is largely used as a manure. The tree begins to bear about the 7th or 8th year, the annual produce being from 70 to 100 nuts. At the Tanjore local Exhibition in March 1856, a bunch of Cocoanuts containing no less than 70 nuts on a single stalk was exhibited. Each tree is calculated to yield at least 2½ gallons of oil per annum, and the coir obtained from the nuts is estimated to yield one fourth of the value of the oil, whilst the oil cake is very valuable for cattle and as a manure. The Elephant beetle (*Oryctes Rhinoceros*) is a great enemy of this tree, it begins by nibbling the leaves into the shape of a fan, and then attacks the main shoot into which it bores, and unless speedily extracted, infallibly destroys the tree.

No. 2. Gingeley oil. (*Sesamum orientale*.)

The Sesamum and its varieties are grown throughout the country. So universal is the use of this oil, that its name in almost all the vernacular languages signifies "the oil."

The mode of extraction sometimes adopted is that of throwing the fresh seeds without any cleansing process, into the common mill and expressing in the usual way. The oil thus becomes mixed with a large portion of the coloring matter of the epidermis of the seed, and is neither so pleasant to the eye nor so agreeable to the taste as that obtained by first repeatedly washing the seeds in cold water, or by boiling them for a short time until the whole of the reddish brown coloring matter is removed, and the seeds have become perfectly white; they are then dried in the sun, and the oil extracted as usual.

In expressing this oil, the Natives of the Northern division always add the bark of the Tanghedi (*Cassia auriculata*), or the Babool gum to the seed to be pressed, this is probably done with a view of enhancing the value of the cake, which is used as an article of food for man and beast.

The value of this oil in England was £47.10 per ton in January 1855, and £49 to £53.10 in January 1856. In different parts of

the Presidency, the price of this oil varies from Rs. 1-5-0 to Rs. 6-0-0 per maund of 25 lbs. In South Arcot it is procurable at Rs. 27-12-5 per candy.

The prices per maund at the undermentioned stations, for the quarter ending 31st October 1854, were as follows:

	R. A. P.		R. A. P.
Arcot.....	3 8 0	Madura.....	5 8 3
Bangalore.....	3 7 3	Mangalore.....	4 1 8
Bellary.....	3 2 0	Nagpore.....	1 12 0
Berhampore.....	2 8 0	Palamcottah.....	4 12 0
Cannanore.....	6 0 0	Paulghaut.....	3 7 0
Cuddapah.....	2 13 0	Samulcottah.....	2 10 8
Jaulnah.....	2 6 0	Secunderabad.....	2 3 11
Jubbulpore.....	1 5 0	Trichinopoly.....	4 1 8
Madras.....	3 14 0	Vellore.....	3 14 0
Masulipatam.....	3 0 0	Vizagapatam.....	3 2 0

In England this oil is chiefly used for the manufacture of soap, and for burning in Table lamps, for which it is better suited than Coconut oil, owing to the lower temperature at which it congeals, although the light it gives is not so bright. In India it is chiefly used in cooking, for anointing the body, for making soap, for burning in lamps, &c. by the dyer to brighten and fix his colors.

The following tables will show the quantity and the destinations of the exports of this oil.

Year 1847-8.		Year 1848-9.	
Oil....	Gals. 19,520 Rs. 14,776	Oil....	Gals. 52,721 Rs. 36,294
Seed...Qr.	17,518 Rs. 160,134	Seed Cwt.	1,44,125 Rs. 299,412
Year 1852-4.		Year 1854-5.	
Gals.....	119,180 Rs. 73,635	Gals.....	17,139 Rs. 12,720
Cwt.....	1,198,079 Rs. 693,760	Cwt.....	167,324 Rs. 431,726
		Seed.	Oil.

Exported to the United Kingdom		Cwt.	Gals.
Ceylon.....	590 —	12,713	42,043
France.....	2,87,225		
Pegue.....	741 —		19,698
Bombay.....	113		
Malacca.....	33 —		3,593
Travancore.....	148		
Mauritius and Bourbon.....	.. —		4,232

No. 3. *Bastard Gingeley oil.* (*Sesamum orientale* var.)

The "second sort Gingeley" sometimes called "bastard Gingeley" is extracted from a variety of the *Sesamum* above mentioned. It differs but little from the true Gingeley; the quantity of oil yielded by an equal amount of seed is somewhat less, but there appears to be no difference in the quality of the product.

The following remarks upon the cultivation of the true Gingeley, and its varieties in the Rajahmundry district, have been furnished by F. Coplestone, Esq.

Gingeley, or first sort Gingeley. (*The black seed.*) This is the produce of the Hill-country called Reddyseema in the Rajahmundry district. It is generally sown at the commencement of the monsoon (June) and ripens in four months, 160 seers of seed yield 50 seers of oil which is clear and sweet. The current value of the seed is Rupees 50 per candy of 500lbs.

Bastard Gingeley, or second sort Gingeley, is the worst variety of this plant, the seeds are of mixed colors, white, red and black. It is usually sown in the month of Chyteari (April) and ripens in three months, 160 seers of seed yield 35 seers of oil, which is of a brown color and bitter. The current value of this seed is 35 Rupees per candy of 500lbs.

White Gingeley, is sown in the month of Myglam (January, February) and ripens in three months and a half. The oil is clean and sweet, 160 seers of seed yield 44 seers of oil, the current value of the seed is 44 Rupees per candy.

Pyroo Noorooloo is the red seed sown generally on the islands called Lunkaloo. It ripens in three months, 160 seers of seed yield 45 seers of oil. The current price of the seed is Rupees 42 per candy. The term "Pyroo" is applied to the season after the general harvest in January, viz. February, March, and April, and has no reference to these seeds except as indicating the time of their sowing.

The exports of this oil and seed are included in those of Gingeley.

No. 4. *Lamp oil.* (*Ricinus communis fructibus majoribus.*)

The oil obtained from the large seeded variety of the *Ricinus*

communis has obtained the above name from the fact of its being used almost solely for burning in the commonest lamps and for feeding torches.

For this purpose the seeds are sometimes partially roasted to coagulate the albumen and liquify the oil, and then pressed in the ordinary mill, or boiled with water, or the roasting process is omitted; in either case the coloring matter of the husks of the seed and other impurities gives the oil a dark color, and if the roasting process is carried too far, a slightly empyreumatic odour is communicated.

By carefully shelling the seed and rejecting all impurities, the Natives prepare a clear oil for medicinal purposes (by boiling) nearly equal to that extracted from the small seeded variety.

The price of this oil varies in different parts of the country from Rupees 1-10-0 to Rupees 3-13-6 per maund of 25 lbs. The average of nineteen large stations in all parts of the Presidency for the Quarter ending 31st October 1854, was Rupees 2-8-6 per maund.

It is chiefly used for burning in lamps, and from its viscosity and drying qualities only in those of the simplest description.

The average export of this oil for the last 6 years has been 97,561 Gallons per annum.

Lamp oil made into a kind of *palmine* by agitation with nitric acid, is largely used as a lubricating agent for Railway locomotives in India.

No. 5. *Castor oil.* (*Ricinus communis, fructibus minoribus.*)

The small seeded variety of the *Ricinus communis* is supposed to yield the best product, and is therefore universally employed in preparing the oil exported to Europe for medicinal purposes.

The fresh seeds after having been sifted and cleaned from dust, stones, and all extraneous matters, are slightly crushed between two rollers, freed by hand from husks and colored grains, and enclosed in squares of clean gunny or canvass. The packets of seed then receive a slight pressure in an oblong mould which gives an uniform shape and density to them. The "bricks" as they are

technically called, are then placed alternately with plates of sheet iron in the ordinary Screw or Hydraulic press. On the application of a gradually increasing pressure, the oil exudes through the pores of the gunny and is received into clean tins. Water in the proportion of a pint to a gallon of oil being added, the whole is boiled until the water has evaporated, the mucilage will be found to have subsided and encrusted, the bottom of the pan whilst the albumen solidified by the heat forms a thin layer between the oil and the water. Great care must be taken to remove the pan from the fire the instant the whole of the water has evaporated, which may be known by the bubbles having ceased, for if allowed to remain longer, the oil which has hitherto been of the temperature of boiling water or 212° , suddenly rises to that of oil or nearly 600° , thereby heightening the color and communicating an empyreumatic taste and odour. The oil is then filtered through blanket, flannel or American drill, and put into cans for exportation. It is usually of a light straw color, sometimes approaching a greenish tinge.

The cleansed seeds yield from 47 to 50 per cent. of oil. The following is the result of experiments made at Madras and Calcutta to ascertain the per-centage of oil in Castor seed (January 27th, 1853.)

Calcutta—1,400lbs. of seed yielded kernels and raw oil as follows:

	Kernels.	Oil.
1st sort	632lbs.	324lbs.
2nd sort	184lbs.	87½lbs.
3rd sort	164lbs.	76½lbs.

Making a total of 980lbs. of Kernels and 483lbs. of Raw oil from 1,400lbs. of seed.

Madras—1,400lbs. of seed yield raw oil as follows:

1st sort.	318lbs.
2nd sort.	88lbs.
3rd sort.	74lbs.

Making a total of 480lbs. of oil from 1,400lbs. of seed.

The cost of the Madras oil is as follows:—

1,400lbs. of seed at Rs. 3-5-0 per bag of 164lbs.	Rs.	27	3	4
Husking and selecting Kernels and cooly hire.....		3	11	9
Crushing, moulding, pressing, boiling.....		2	7	1
Filtering and Sundries.....		2	8	0
Overseer's pay, Godown rent.....		1	5	3
300 Empty Quart bottles, Corks, &c.....		34	4	8
Cleaning and Packing Charges.....		4	8	0

Total Rs. 76 1 0

* Deducting the price of the bottles, this gives an average of annas 1 pies 4½ per quart of first, second, and third sort oil.

This oil is chiefly used as a mild purgative, and by Natives for anointing the head. Soap of good quality may be made from it, but the cost and disagreeable smell which it communicates, preclude its general use.

The average export from the year 1849-50 to 1852-3 was 11,325 gallons per annum.

The method of extracting this oil by the boiling process is thus given by Ainslie. "The seeds are boiled for two hours in water, dried for 3 days in the sun, husked and pounded. They are then boiled in fresh water until the whole of the oil has risen to the surface."

Castor oil being entirely soluble in highly rectified alcohol of sp. grav. 825, any adulteration of it with other fixed oils may be ascertained by dissolving a sample in 8 times its weight of spirit, the fixed oil is not dissolved but floats on the surface. This however is not an infallible test.

No. 6. Ground nut oil. (*Arachis hypogaea*.)

The Ground nut or "Manilla" nut, and the oil extracted therefrom, has of late years been exported to a considerable extent. It is now grown in all parts of the Peninsula. The oil is seldom used by the Natives, although large quantities of the nut are eaten after being slightly roasted over a charcoal fire. The cleansed seeds yield about 43 per cent. of a clear straw colored edible oil possessing a

alight bean-like taste and smell, which makes a good soap, indeed it is a perfect substitute for olive oil in all its uses.

Its value in London in January 1855 was £47-10 per ton. In North Arcot, where it is largely cultivated, the oil is procurable at from Rs. 1-8-0 to 2-12-0 per maund. In the Nellore district the seed costs 1-8-0 per maund, and in Tanjore about 200 acres are cultivated with this plant yielding annually 75 candies of oil at Rs. 2-6-0 per maund. In the year 1848-49, 37,000 gallons of this oil were shipped, but in the two following years the exports exceeded 1,00,000 gallons. It however fell to 75,207 gallons in 1852-3.

According to Simmonds, 1,950 parts of seed give 1,405 of blanched kernels and 703 of oil, by cold pressure. It is produced to a very large extent in Africa, from whence England and France draw large supplies.

No. 7. *Linseed oil.* (*Linum usitatissimum.*)

The seed from which this oil is expressed has long been cultivated to a limited extent at Nagpore, Bellary, Guntoor and other parts of the Presidency. It is usually sown in furrows on the borders of fields, and the extent of cultivation is consequently difficult to ascertain.

The oil is seldom used for painting in India perhaps from an impression which seems to be general, that the oil obtained from Indian seed is inferior to that imported from England. It will however be found on experiment, that this arises from the former having been imperfectly freed from the mucilage which prevents its drying, or from some admixture of a non-drying oil.

In the year 1852-3 English Linseed oil to the amount of gallons 4,552 valued at Rs. 8,763 was imported into Madras, whilst at the same time 1,045 cwt. of the seed was exported hence, mostly to England. The fact that it can be made on the spot equal in quality and considerably less in price than the English article, needs only to be known to be taken advantage of. It would be necessary to guard against its adulteration with any of the greasy oils, which would of course infallibly destroy its drying properties.

The value of this oil in England was from £61 to £66 in January 1856. It is said to be procurable in Bellary at Rs. 3-8-0 per

maund. It was imported into England in 1851 to the amount of 608,986 Quarters.

Some energetic efforts have been made to improve the cultivation of Linseed in the Punjab chiefly for the sake of fibre. The Agricultural Society having obtained a grant of money from Government offered rewards for its cultivation, and a considerable increase immediately took place.

In 1853-4 there were 3,435 acres under cultivation in eight districts, whereas in the next year no less than 19,039 acres were so taken up, and it is estimated that the whole cultivation throughout the Punjab during that season was 50,135 acres producing 146,508 mds. of fibre, and the increased produce of seed is estimated at 130,000 mds. valued at 160,000 Rs. The seed sold by auction at an average rate of Rs 4-6 per maund of 80lbs." (*Spectator*, Oct. 14, 1856.)

The following extract from a late number of the "*Sindian*" newspaper, will give some idea of the progress made in Linseed cultivation in Scinde.

"We are glad to observe that the growth of Linseed in Scinde is attracting the attention of the authorities. Major Wormald tried an experiment at Jemadar-ka-Landee, and gives a very favorable report, which has been placed by the Commissioner in Scinde at the disposal of the Press. We have seen a specimen of the Linseed, and the following is a description of its culture and growth.

"At Landee, the quantity of land prepared for seed was 4,658 square yards, on which was sown 126lbs. of Linseed, part on the 28th October, and the rest on the 1st November 1856. In four months the crop was pulled up and stacked; and the produce was one thousand pounds of Linseed, being as far as may be judged, much above the average yield of flax crops in different parts of Europe, and certainly finer Linseed than any yet seen here. A sample of this Linseed has been forwarded to Mr. Warwick, a merchant in Kurrachee, who pronounces it to be very fine. It is intended that the sample be forwarded to Bombay, when an opinion will be formed on it by competent judges.

"The stalks of this seed grew strong, and ranged from two to three feet. No opportunity has as yet been afforded of converting the stems into flax, and as the stackage will not deteriorate from their quality, opportunity may be found to complete the experiment.

"Major Wormald, from past experience, considers the soil in the Mulleer Valley particularly suited for the growth of Linseed and Flax, and feels confident that if cultivated on a large scale a fortune might soon be realized.

"The ten-fold yielding of this valuable seed in the Mulleer valley, owing to rich soil, should operate as an inducement to the Commissioner to promote the growth of an article, that bids fair to make so respectable a figure in the revenue of the Province. The sample we have seen appears to possess the properties of the best kind. The seeds are small, bright, grayish-brown, slippery, elongated bodies, containing a full amount of that mealy, oleaginous albumen, which yields the oil in such abundance. In short we consider the specimen we have seen as well worthy the attention of those whose hearts are with the prosperity of Scinde."

No. 8. *Ramtill oil.* (*Verbesina sativa* or *Guizotia oleifera*.)

This sweet tasted edible oil is plentiful in the Mysore, Vizagapatam, Nagpore and Ganjam districts. It is used for nearly the same purposes as the Gingeley oil, and from its inferior quality and low price is frequently used to adulterate both this and Castor oil. It is exported from Ganjam.

The oil is said to mix with colors as well as linseed and to dry without litharge, although a little improves it.

No. 9. *Mustard oil.* (*Sinapis varieties*.) Improperly called "Rape" in India.

Five or six kinds of *Sinapis* are cultivated in various parts of Southern India. The seed is chiefly used as a condiment, but the oil which is sometimes extracted is much prized by the Natives, and apart from its edible qualities is supposed to possess many virtues. The different kinds of seed yield from 28 to 36 per cent. of a bright yellow edible oil, having a strong smell and a slight taste of mustard. The average price of Mustard seed in eighteen large stations, in all

parts of the Presidency for the quarter ending 31st October 1854, was Rs. 1-2-8 per maund of 25lbs., the maximum being Rs. 1-11-6 at Cannanore, and the minimum As. 10-6 at Nagpore. In Vizagapatam it costs Rs. 208 per sicca garce.

The oil is not exported, but the seeds have been annually shipped as follows :

Years	1847-8.	1848-9.	1849-50.	1850-1.	1851-2.	1852-3.	1853-4.	1854-5.
Cwt.	5,828	6,767	9,435	9,909	16,076	—	—	—

Although seldom procurable in the market, this oil is nevertheless generally made, and used in cooking and in the manufacture of pickles, condiments, &c. It is considered by the Natives superior to all other oils for anointing the body which it is supposed to invigorate.

In medicine it is sometimes given internally as a remedy for flatulent colic, but is more frequently applied as a rubefacient, and as a cure for burns and wounds.

Rape oil (*Brassica*) properly so called, was imported into England in 1851 to the amount of 107,029 Qrs. or 21,606 tons from France and Germany, the oil is valued at £34 per ton.

No. 10. *Poppy oil.* (*Papaver somniferum*.)

The Poppy is largely cultivated throughout Malwa and the Opium districts, where the drying oil obtained from the seed is more extensively used than any other, both in lamps and as food. The following statistics regarding the cultivation of the Poppy plant, are furnished by C. Timmins, Esq., Sehore.

"There are three lacs of beegahs under Poppy cultivation in Malwa, the average produce of seed per beegah being two maunds,* each of 40 seers, or 82lbs, which gives a total of 6,00,000 maunds of seed worth from Rs. 1 to 1½ per maund. From these six lacs, deduct 1½ seer per beegah required for seed, and there remains 5,90,623 maunds of seed for oil. The oil extracted from 1 maund of seed being about 13 seers, the above quantity of seed would yield a total of 1,91,952

* NOTE.—The seer in use here is more than three times the weight of the Madras seer. It weighs 32½ ounces, that of Bombay being 11½ oz., and Madras 10 ounces.

maunds of oil, which sells at from Rs. 4-8-0 to 5 Rs. per maund or £40-6 per ton. The whole of the oil at present made here appears to be consumed in Malwa. Mr. Anson, the first Assistant to the Governor General and Superintendent of the Opium department at Indore, concludes that 5,000 maunds might be available for export at Indore alone.

"The hire of a cart from Indore to Bombay would be about 20 or 25 Rupees. The carts are much smaller than those used in the Madras territory, and will carry from 20 to 24 maunds. There would appear to be no difficulty in establishing an export of this oil, provided there were a remunerating demand for it; the extent of supply must however be regulated by the demand for Opium, the high price obtainable for which alone supports this expensive and hazardous cultivation.

"Perhaps Calcutta presents greater facilities for the export of the seed or oil from the advantage of the water carriage afforded by the Ganges and other rivers of Bengal; but the railway now progressing from Bombay will materially facilitate the transit of goods from this part of India, but as before remarked the production of Poppy oil must ever be dependent on the demand for opium which may possibly be extensively affected by the extraordinary revolution now progressing in China.

By simple exposure to the rays of the sun, in shallow vessels, this oil is rendered perfectly colorless. It is supposed by the Natives to produce sleep and strengthen the brain. Poppy oil is peculiarly suitable for mixing with paints; "with white lead it leaves a beautiful surface which does not afterwards change by the action of light into a dirty yellow."

CLASS 2.

No. 11. *Margosa or Neem oil.* (*Asadirachta Indica* and *Melia azadirach.*)

Two species of the Neem grow in Southern India. The *Asadirachta Indica*, or white flowered Neem, is exceedingly graceful, and forms an excellent avenue tree. The *Melia azadirach* or Per-

sian lilac, is a tall wide-spreading tree, of quick growth, the branches of which are very brittle and liable to be broken in high winds. The blossoms are of a lilac color, possessing a very sweet smell, and the fruits as well as the extracted oil of both varieties are much alike.

A bitter principle prevails in all parts of the tree, and is present in the oil, which is much used by Native practitioners as an anthelmintic and vermifuge, and externally as a liniment in rheumatism, headache, &c. it is of a deep yellow color, unpleasant smell, and bitter taste; it forms an article of export, although the demand fluctuates considerably. Besides the uses above mentioned, it is also burnt in lamps, and is known in the market by the name of the "bitter oil."

No. 12. *Illoopoo and Mahowa oils.* (*Bassia longifolia et species.*)

Several varieties of the *Bassia* yield semi-solid oils known by these names. The *B. longifolia* is the most common in Southern India, and although the oil is seldom to be met with in the bazaar, yet large quantities of the seeds are gathered, and the oil extracted for private consumption. Excellent candles and soap may be made from it, and as a substitute for butter and for burning in lamps, it is much employed by the poorer classes. It is sometimes exported in small quantities.

The *Bassia butyracea* is abundant in the hills of Kumaon, and produces an oil known by the names of Fulwah, Phulwarah, Choolree fooliel and Phooliel ka tael. This solid oil dissolves readily in alcohol, and is said to keep an indefinite time without becoming rancid.

No. 13. *Pinnacotay oil.* (*Calophyllum inophyllum.*)

The fresh seeds of the "Alexandrian laurel" when shelled and subjected to pressure, yield a dark green oil of a peculiar odour. Old seeds yield a higher colored and thicker product. It is occasionally shipped in small quantities to Ceylon, but cannot be considered a regular article of export. It is burnt in lamps.

No. 14. *Kurunj oil.* (*Dalbergia arborea.*)

This oil, which in some parts of the country is used to a large extent in adulterating lamp oil, is expressed from the seeds of a

tree common in most parts of India. Its fluidity at ordinary (Indian) temperatures renders it very suitable for burning in lamps, whilst its comparative cheapness leads to its use as an adulteration with other more expensive oils.

No. 15. *Coorookoo or Brumadundoo oil.* (*Argemone mexicana.*)

This pale yellow limpid oil may be obtained from the round corrugated seeds of the "prickly poppy" which was originally introduced from Mexico in ballast, but now flourishes luxuriantly in all parts of Southern India. It is especially suited for lamps, and is also employed in the process dying red thread, and as an external application in cutaneous diseases. The seeds yield 12½ per cent. of oil.

W. Hamilton, Esq. M. D. remarks of this oil, "that the *Materia Medica* hardly presents a more valuable purgative, or one which answers so many apparently conflicting circumstances at one and the same time. In that excruciating complaint, so common in all climates, colic arising from constipation of the bowels, 30 drops of the oil taken upon a lump of sugar allay the pain as if by magic, throw the patient into a profound sleep, and after a little time produces a copious and unpainful evacuation of the bowels. The minuteness of the requisite dose, the instantaneousness of the relief, and the mild and gentle though effectual action it produces upon the intestinal canal, seem peculiarly to adapt it for cases of Cholera, superseding the use of Chloroform and Opium for subduing the cramps and mitigating the more urgent symptoms."

No. 16. *Cdt amunak oil.* (*Curcas purgans.*)

This oil has of late been exported to Europe as a substitute for Linseed oil, but the results of the experiment have not as yet transpired. The shrub is plentiful all over the Presidency, and the oil can be obtained in some parts of the country for little more than the expense of the collection of the seeds and cost of extraction. It is used by the Natives in lamps, &c.

"Under the name of "seed oil" it has been imported into England to the amount of nearly 1000 tons per annum from Lisbon, where it was first used by the contractor in lighting the public streets, and so useful was it found, that it soon usurped the place of all other oils. It has been found to answer in England for cloth dressing,

which in consequence of the irregular supply of olive oil makes it a valuable acquisition, the only objection to its employment being its highly drastic property." (*Simmonds.*)

No. 17. *Piney tallow.* (*Vateria Indica.*)

The *Vateria Indica* or Doopada tree, grows plentifully in the jungles of the western coasts, and besides the product under consideration yields a resin nearly equal to copal, and a valuable building wood. The oil which is perfectly solid even in hot climates, is prepared by cleaning the seeds, then roasting and grinding them into a mass. To five seers of seed 12 seers of water are added, and the whole is boiled until the oil rises to the surface. Remove the oil, stir the contents of the vessel and allow it to stand until the following day, when a further portion of oil will be found on the surface.

This substance has been pronounced by the Railway Agent very suitable for the lubrication of the wheels and axles of Railway carriages, it is not however at present procurable in sufficient quantity to be used for that purpose, except to order. It is equally applicable to the manufacture of soap and candles. The next mentioned oil is very similar in quality to the above.

No. 18. *Gamboge Butter.* (*Garcinia pictoria.*)

A semi solid oil obtained from the seeds of the *Garcinia pictoria*, growing abundantly in certain parts of Mysore and in the Western coast jungles, especially near Cooly Droog. The oil which is procurable in moderate quantities, is prepared by pounding the seed in a stone mortar, and boiling the mass until the butter or oil rises to the surface; or by first roasting the seeds, and then proceeding as above. Two and a half measures of seed should yield one and a half seers of butter.

In the Nugger division of Mysore it is sold at the rate of As. 1-4 per seer of 24 Rs. weight, or £36-6 per ton, it is used as a lamp oil, and by the poorer classes as a substitute for ghee. The butter thus prepared does not seem to possess any of the purgative properties of the Gamboge resin.

CLASS 3.

No. 19. *Safflower oil.* (*Carthamus tinctorius.*)

The *Carthamus* is principally grown for the sake of the dye yielded by the petals of the flower, oil is however plentiful in the seeds and is expressed to a small extent. In Europe it is in demand for the manufacture of fancy soaps, &c. It grows plentifully in black cotton soil in Mysore and Tinnevely. The oil which is of a clear yellow color, is edible.

No. 20. *Belgaum Walnut oil.* (*Aleurites triloba.*)

The tree which produces the Lumbang or "candle nut" grows plentifully in Hyderabad, Mysore and other parts, also in Ceylon where the oil is called "Kekune," and in the Sandwich Islands where it is named "Kickui." (*Simmonds.*)

The tree is very prolific, and the nuts yield so large a percentage of oil, that when strung upon a thin strip of bamboo and lighted, they burn like a candle. (*Riddle.*)

No. 21. *Pootana oil.* (*Sarcostigma Kleinii.*)

This oil is as yet known only in Tinnevely, Travancore and the Western coast. It has a very peculiar but not disagreeable odour, is burnt in lamps, and sold in the Tencausy talook of Tinnevely, at Rs. 4 per maund. It is known in Travancore under the name of Poovengah.

No. 22. *Neeradimootoo oil.* (*Hydnocarpus inebrians.*)

This tree is produced abundantly in Travancore, and is met with on the Eastern side of the Ghats, especially near Shencotta at the entrance to the pass leading to Quilon. The oil is also known under the various names of Jungle almond, Maroty, Tamans, Maravettie, Neervittie and Soorty. It is in great repute amongst Native medical practitioners, and the oil appears somewhat drastic. The kernel has much the taste of the Brazil nut, and the shell, although differing from it in other particulars, has the same corrugated surface. It might probably be found very useful in the arts, as it much resembles Almond oil, but is much thicker. The seed yields 44 per cent. of oil, and cost As. 2-6 per seer at Madras.

No. 23. *Addale oil.* (*Jatropha glauca.*)

This seed is somewhat smaller than that of the *ricinus*, which however it much resembles. It grows wild on waste lands in South Arcot, and is cultivated in Tinnevely, where the oil sells at Rs. 2-8 per maund. It is limpid, of a light straw color, and if procurable in sufficient quantities, would prove a very serviceable lamp oil.

No. 24. *Cress seed oil.* (*Lepidium sativum.*)

The Tamil name of the seeds of this plant, is the same as that of the Linseed, probably from its being like it of a mucilaginous nature. Its qualities and uses have yet to be ascertained.

25. *Cheeranjee oil.* (*Chirongia sapida* vel *Buchanania latifolia.*)

The kernels of this nut mixed with milk are eaten by the higher classes of Natives to promote fatness. They abound in a straw-colored, sweet tasted and limpid oil, which, although edible, is seldom extracted. The tree grows plentifully in Mysore, Cuddapah and other parts. Dr. Riddle states the method of separating the kernel from its shell to be as follows:

"The fruit, when ripe in May, is gathered and soaked in water to soften the outer pulp which is then rubbed off by the hand. The little nut, after being dried in the sun, is broken between a common 'chuckee' or mill, such as is used for grinding wheat, it is then shifted and winnowed."

No. 26. *Cucumber seed oil.* (*Cucumis sativa.*)No. 27. *Melon seed oil.* (*Cucumis melo.*)No. 28. *Pumpkin seed oil.* (*Cucurbita pepo.*)

The various species of the Cucurbitaceæ are extensively cultivated in the dry beds of rivers, or on sand banks in their vicinity, in all parts of India. The seed is sown in the hot weather, and the fruit perfected before the rains. Oil is made from the seeds in the Masulipatam and Gunttoor districts, but the bulk of the fruit is sold and eaten before it arrives at maturity.

No. 29. *Coorgapilly oil.* (*Inga dulcis.*)

The "Manilla tamarind" is extensively used in all parts of the

Presidency as a hedge plant. If permitted however, it grows to a small sized tree, the pods of which contain several flattened black seeds, from which an oil of the consistence of castor oil may be extracted.

No. 30. *Sterculia oil.* (*Sterculia fetida.*)

The seeds of this forest tree yield by expression a clear oil containing much stearine.

No. 31. *Wild Olive oil.* (*Pootrunjiva Roxburghii.*)

This tree grows plentifully in Mysore and Canara, the fruit much resembles an Olive, and the kernel contains an olive brown oil.

No. 32. *Cherreo Pinnacotay oil.* (*Calophyllum colaba.*)

A clear yellow oil obtained from this tree was forwarded to the Madras Exhibition of 1855 from Cochin.

No. 33. *Sandal seed oil.* (*Santalum album.*)

The kernel of the nut of the Sandal wood tree, yields by expression, a viscid oil, which does not give much promise of usefulness.

No. 34. *Moorgana tallow.* ()

This valuable substance, which, even at high temperatures, is perhaps the most solid oil with which we are acquainted, is produced in Canara. If procurable in sufficient quantity and at a moderate cost, it would be doubtless an excellent material for the manufacture of candles, &c.

On the Western coast it is used medicinally as a cure for cattle wounded by tigers.

No. 35. *Naga sumpaghee oil.* (*Mesua ferrea.*)

This oil is procurable in Canara, at Rs. 4 per maund. It is chiefly used as a Lamp oil, and as a healing application to sores.

No. 36. *Cát uraloo oil.* ()

An oblong, flattened and corrugated seed sent from Canara under the names of "Wild Castor seed" has not yet been identified. It yields a lamp oil.

CLASS 4.

No. 37. *Soapnut oil.* (*Sapindus emarginatus.*)

This oil is extracted from the kernels of the seed, and is used medicinally.

No. 38. *Cashew nut oil.* (*Anacardium occidentale.*)

The nuts of this tree yield by expression a very sweet tasted edible oil, much superior to European Olive oil, but not so cheap as the Ground nut oil. The nuts however being generally roasted and eaten, the oil is seldom expressed.

No. 39. *Ben nut oil.* (*Moringa pterygosperma.*)

This oil has long been considered valuable on account of the long period which it may be kept without contracting rancidity. This quality, as well as the very low temperature required to freeze it, renders it exceedingly useful to the watch maker and perfumer.

The tree grows in all parts of the country, and flowers at all seasons, the blossoms, green and ripe fruit being often seen on the same tree at the same time. The young leaves and green legumes are eaten both by Natives and Europeans, and the rasped root forms an excellent substitute for horse-radish, to which circumstance it owes its common name of "horse-radish tree." The oil is seldom manufactured in India.

No. 40. *Cotton seed oil.* (*Gossypium species.*)

The seeds of the various varieties of *Gossypium* contain a large proportion of oil, but the remains of the fibre adhere with such tenacity to the seed of almost all the varieties at present generally cultivated in India, that it is found to absorb the whole of the oil expressed, from which it cannot be separated without much difficulty. The oil is consequently never made in India, although the seed is a nourishing food for cattle. Should however, any of the varieties of Cotton with loose seeds, such as the *G. acuminatum* come into general cultivation, the oil would then become of much importance.

At present this oil is manufactured at Marseilles from seed imported from Africa, and could some cheap and easy method of ridding the ordinary cotton seed from the adherent fibre be de-

vised, thousands of maunds of seed which are now comparatively useless, could be worked up.

No. 41. *Silk Cotton seed oil.* (*Bombax.*)

A dark brown but clear oil, is obtained by expression from the seeds of the silk cotton tree, the pappus of which is sometimes used as a stuffing for pillows, although it is by some supposed to produce deafness.

No. 42. *Sweet Fennel oil.* (*Nigella sativa.*)

The black aromatic seeds generally known by the name of "Siah Danah" yield by expression a dark colored fragrant oil.

No. 43. *Rosebay oil.* (*Wrightia antidysenterica.*)

Various parts of this plant are reputed to possess medicinal virtues. The oil obtained by expression from the seeds, is of a deep red color and viscid consistence, probably possessing some of the medicinal properties of the seed.

No. 44. *Malkungunee oil.* (*Celastrus paniculata.*)

The oil expressed from the seeds of this shrub is of a bright scarlet color, and when mixed with other ingredients and subjected to destructive distillation, yields an empyreumatic product useful in Beri-beri.

No. 45. *Hemp seed oil.* (*Cannabis sativa.*)

Obtained by expression from the seed of the common hemp which is cultivated in several parts of the country for the sake of the intoxicating drugs it yields. In Russia the oil is much used for lamps but it is comparatively unknown to the Natives of India.

No. 46. *Portia nut oil.* (*Thespesia populnea.*)

From 8 to 10 per cent. of a deep red and somewhat thick oil is obtained by expression from the seeds of this tree, which grows in great abundance in the vicinity of Madras and other parts of the Presidency. It is extensively planted as an avenue tree for which its quick growth and the beauty of its flowers render it a general favorite, it is however very liable to injury from high winds (as may

be seen on reference to the Journal of the *Madras Literary Society*. No. 1. *New Series*.) The greater injury almost invariably suffered by trees grown from cuttings, has been frequently remarked. The wood is said to be capable of being worked, when fresh cut. The juice is used on the western coast as a remedy for various cutaneous affections.

No. 47. *Viscid Cleome oil.* (*Cleome viscosa.*)*

This warm and pungent little seed when subjected to a very powerful pressure, yields 13 per cent. of a light olive, green limpid oil.

No. 48. *Thortay oil.* (?)

Is obtainable in small quantities in Canara, it is a solid oil and used as a native remedy for sores.

No. 49. *Fenugreek oil.* (*Trigonella farnum græcum.*)

The fresh seeds of this plant are said to yield a small percentage of oil.

No. 50. *Abelmoschus oil.* (*Abelmoschus ficulneus.*)

In addition to its fibre, for which the plant is used, the seeds yield a small quantity of oil.

No. 51. *Gutta percha seed oil.* (*Isonandra gutta.*)

Yielded by expression. Oil but little known.

No. 52. *Croton oil.* (*Croton tiglium.*)

This well-known medicinal oil, the use of which as a drastic purgative appears to be on the decline, is seldom extracted in India, the powdered seed, being usually administered by native practitioners. It is also used in veterinary medicine.

Nos. 53 and 54. *Bryony and Colocynth oils.*

These plants grow wild in most parts of the country. The seeds are collected by shepherd boys, and boiled to obtain the oil, which is only used for lighting purposes.

* Now *Polanisia icosandra*, W. and A.—ED.

No. 55. *Wild Cummin oil.* (*Vernonia anthelmintica.*)

This black seed grows plentifully in Mysore, and yields an oil, which however is never prepared for sale.

The following oils being used only in Native medicine, an enumeration of their names will be sufficient.

No. 56. *Bonduc nut oil.* (*Guilandina bonduc.*)

No. 57. *Mimusops oil.* (*Mimusops elengi.*)

No. 58. *Moodooga oil.* (*Butea frondosa.*)

No. 59. *Thevetia oil.* (*Thevetia nerifolia.*)

No. 60. *Oodul oil.* (*Sarcostigma Kleinii.*)

No. 61. *Garlic oil.* (*Allium sativum.*)

No. 62. *Sunflower oil.* (*Helianthus annuus.*)

No. 63. *Wild almond oil.* (*Terminalia catappa.*)

No. 64. *Star anise oil.* (*Illicium anisatum.*)

No. 65. *Gayapa oil.* ————— ?

No. 66. *Wild nutmeg oil.* (*Myristica malabarica.*)

No. 67. *Thorny trichilia oil.* (*Trichilia spinosa.*) Empyreumatic.

No. 68. *Cyperus or Mat grass oil.* (*Cyperus juncifolius.*)

No. 69. *Thorn apple oil.* (*Datura stramonium.*) Empyreumatic.

No. 70. *Condamunnee oil.* (*Abrus precatorius.*)

No. 71. *Sand box tree oil.* *Hura creptans.* The seeds of this tree (which has been introduced from Jamaica,) yield by expression, a clear oil. The whole tree, abounds in poisonous matter, but it has not yet been ascertained whether the oil possesses similar properties, the tree grows in the Horticultural gardens.

No. 72. *Saul seed oil.* (*Shorea robusta.*)

In places where this tree abounds, the oil is expressed from the ripe seed, vulgarly called the "dammer tree nut."

WOOD OILS.

91 to 100. *Wood oils.*

The class of substances called "Wood oils" form the connecting link between the oils and resins of the natural kingdom. They consist of a volatile oil, holding in solution a resin, and are generally classed under the head of Balsams. They are obtained from various trees of the order Dipterocarpeæ, some of which also yield the dammers of commerce.

The mode of extracting the oil, is similar to that adopted for obtaining the solid resin. It is best described, in the words of a contributor to the Madras Exhibition of 1855, who says "About the end of the dry season, that is in March or April, several deep incisions are made with an axe into the trunk of the tree, and a good sized piece, scooped out. Into these holes, fire is placed and kept burning until the oil begins to run, when it is received into a bamboo, and allowed to run slowly drop by drop."

The oil, when freshly obtained from the tree and allowed to rest, separates into two layers, the upper consisting of a clear chesnut colored liquid balsam, and the lower being a flocculent deposit of the more solid resin, of a light ash color.

They are much used as natural varnishes for in-door work, but are very brittle, and require constant renewal. Perhaps the admixture of a certain proportion of some drying oil, would remedy this defect. They are said to be used also in the manufacture of Lithographic inks.

These oils are chiefly imported from our Burmese possessions and the Islands in the Straits of Malacca, and are usually known by the name of the districts, from whence they are brought.

The Camphor wood oil is a purely volatile substance, without any admixture of resin. It is the produce of the *Dryobalanops Camphora*. It is used in the Straits as a substitute for turpentine, and sells at 15 to 20 cents a bottle.

Many substances called „wood oil" by Native doctors, are little else than varieties of tar obtained by the destructive distillation

of chips of various woods. For the names of these see Index to Section 3.

MINERAL OIL.

101 *Petroleum or naphtha.*

Naphtha is a limpid colorless oil, which is collected in wells, or pits dug into certain clay soils in Media and Persia. It is also found in the European state of Parma, and is used to illuminate the city of Genoa.

A substance similar to this product is obtained during the process of making coal gas, and is called coal naphtha. It is a solvent of India rubber and is extensively used in the arts.

Petroleum is a more solid product, produced largely in our Burmese possessions near Rainanghong. It is burnt in lamps, and used instead of tar for shipping.

ANIMAL OILS.

102 and 103. *Fish oils.*

The only oil of any importance which comes under the head of animal oils, is fish oil, which is largely prepared on the Western Coast. For the mode of preparation, see "*Jury Reports Madras Exhibition of 1855*, page 39.

104 and 105. *Neats foot oil and oil of wax.*

These two oils are seldom prepared, the former is, however, sometimes used for softening leather, and the latter, which is an empyreumatic product, obtained by the destructive distillation of wax, is used in Native medicine.

VOLATILE AND PERFUMED OILS.

106 to 133.

Of these the only oils, made in any quantity, are those of Lemon grass, Roosa grass, Citronelle, Bishopsweed, Cinnamon, Cassia bark and Cajeput. Their properties and uses are well known. A list of the oils, in this class which are sometimes used to a small extent in Native medicine, will be found in the Index. The oil from the Guava leaf is said to be used in Ceylon.

The exports of Citronelle oil, from Ceylon are as follows :

1850	86,048oz.	£3,344
1851	114,959oz.	£5,742
1852	131,780oz.	£2,806

INDEX TO SECTION III.

VEGETABLE FIXED OILS.

CLASS. 1.	1 Coconut oil.	<i>Cocos nucifera.</i>
	2 Gingeley oil.	<i>Sesamum orientale.</i>
	3 Bastard gingeley oil.	<i>Sesamum orientale. variety.</i>
	4 Lamp oil.	<i>Ricinus communis. fr. maj.</i>
	5 Castor oil.	<i>Ricinus communis. fr. min.</i>
	6 Ground nut oil.	<i>Arachis hypogæa.</i>
	7 Linseed oil.	<i>Linum usitatissimum.</i>
	8 Ramtill oil.	<i>Guizotia oleifera.</i>
	9 Mustard or "rape" oil.	<i>Sinapis species.</i>
	10 Poppy oil.	<i>Papaver somniferum.</i>
CLASS 2.	11 Margosa or Neem oil.	<i>Melia azadirach, and</i> <i>Azadirachta Indica.</i>
	12 Illoopoo and Mahowa oils.	<i>Bassia species.</i>
	13 Pinnacotay oil.	<i>Calophyllum inophyllum.</i>
	14 Kurunj oil.	<i>Dalbergia arborea.†</i>
	15 Coorookoo or Brumadundoo oil.	<i>Argemone Mexicana.</i>
	16 Cât amunak oil.	<i>Curcas purgans.</i>
	17 Piney tallow.	<i>Vateria Indica.</i>
	18 Gamboge butter.	<i>Garcinia pictoria.</i>
CLASS. 3.	19 Safflower oil.	<i>Carthamus tinctorius.</i>
	20 Belgaum walnut oil.	<i>Aleurites triloba.</i>
	21 Poovana oil.	?
	22 Neeradimootoo oil.	<i>Hydnocarpus inebrians.</i>
	23 Addale oil.	<i>Jatropha glauca.</i>
	24 Cress seed oil.	<i>Lepidium sativum.</i>
	25 Chironjee oil.	<i>Chirongia sapida.*</i>
	26 Cucumber seed oil.	<i>Cucumis sativus.</i>
	27 Melon seed oil.	— melo.
	28 Pumpkin seed oil.	<i>Cucurbita citrullus.</i>
	29 Coorkapilly oil.	<i>Inga dulcis.</i>
	30 Sterculia oil.	<i>Sterculia fetida.</i>
	31 Wild olive oil.	<i>Putranjiva Roxburghii.</i>
	32 Cherroo pinnacotay oil.	<i>Calophyllum calaba.</i>
	33 Sandal seed oil.	<i>Santalum album.</i>
	34 Moorogana tallow.	
	35 Naga sumpaghee oil.	<i>Mesua ferrea.</i>
	36 Cât uralloo oil.	<i>Jatropha. —</i>

* Now *Buchanania latifolia*, W. and A.—ED.

† *Pongamia glabra*, W. and A.—ED.

CLASS. 4.	37 Soapnut oil.	<i>Sapindus emarginatus</i> .
	38 Cashew nut oil.	<i>Anacardium occidentale</i> .
	39 Ben nut oil.	<i>Moringa pterygosperma</i> .
	40 Cotton seed oil.	<i>Gossypium</i> sp.
	41 Silk cotton seed oil.	<i>Bombax malabarica</i> .
	42 Fennel flower oil.	<i>Nigella sativa</i> .
	43 Rosebay oil.	<i>Wrightea antidysenterica</i> .
	44 Malkungunee oil.	<i>Celastrus paniculata</i> .
	45 Hemp seed oil.	<i>Cannabis sativa</i> .
	46 Portia seed oil.	<i>Hibiscus populneus</i> .*
	47 Viscid cleome oil.	<i>Cleome viscosa</i> .
	48 Thortay oil.	
	49 Fœnugreck oil.	<i>Trigonella fœnum græcum</i> .
	50 Abelmoschus seed oil.	<i>Abelmoschus ficulneus</i> .
	51 Gutta percha seed oil.	<i>Isanandra gutta</i> .
	52 Croton oil.	<i>Croton tiglium</i> .
	53 Bryony oil.	<i>Bryonia callosa</i> .
	54 Colocynth oil.	<i>Cucumis colocynthis</i> .
	55 Wild cummin oil.	<i>Vernonia anthelmintica</i> .
	56 Bonduc nut oil.	<i>Guilandina bonduc</i> .
	57 Mimosa oil.	<i>Mimosa elengi</i> .
	58 Moodooga oil.	<i>Butea frondosa</i> .
	59 Thevetia oil.	<i>Thevetia neriifolia</i> .
	60 Oodul oil.	<i>Sarcostigma Kleinii</i> .
	61 Garlic oil.	<i>Allium sativum</i> .
	62 Sunflower oil.	<i>Helianthus annuus</i> .
	63 Wild almond oil.	<i>Terminalia catappa</i> .
	64 Star anise oil.	<i>Illicium anisatum</i> .
	65 Gayapa oil.	<i>Swietenia</i> ??
	66 Nutmeg (wild) oil.	<i>Myristica malabarica</i> .
	67 Thorny trichilia oil.	<i>Trichilia spinosa</i> .
	68 Cyperus bulb oil.	<i>Cyperus juncifolius</i> .
	69 Thorn apple oil.	<i>Datura stramonium</i> .
	70 Condamunnee seed oil.	<i>Abrus precatorius</i> .
	71 Sand-box seed oil.	<i>Hura crepitans</i> .
	72 Saul seed oil.	<i>Shorea robusta</i> .
	73 Eugenia oil.	<i>Eugenia</i> .
	74 Belleric myrabolan oil.	<i>Terminalia bellerica</i> .
	75 Chebulic. do. oil.	<i>Terminalia chebula</i> .
	76 Kikuel oil.	<i>Bergera kornigii</i> .
	77 Balanites Ægyptiaca oil.	<i>Balanites Ægyptiaca</i> .
	78 Radish seed oil.	<i>Raphanus sativus</i> .
	79 Cabbage seed oil.	<i>Brassica oleracea</i> .
	80 Cardamom oil (fixed.)	<i>Elettaria cardamomum</i> .
	81 Poondy oil.	
	82 Cordia or Nochie oil.	<i>Sebestena officinalis</i> .
	83 Girghitly oil.	
	84 Jogyhulloo oil.	
	85 Nux vomica oil.	<i>Strychnos nux vomica</i> .
	86 Marking nut oil.	<i>Semecarpus anacardium</i> .
	87 Cashew husk oil.	<i>Anacardium occidentale</i> .
	88 Oleum nigrum oil.	<i>Celastrus</i> &c
	89 Tobacco seed oil.	<i>Nicotiana tabacum</i> .
	90 Alligator pear oil.	<i>Persen gratissima</i> .
	90½ Cinnamon tallow.	<i>Cinnamomum Zeylanicum</i> .

* Now *Thespesia populnea*.—Ed.

CLASS. 2.	WOOD OILS.	
	91 Teakwood oil.	<i>Tectona grandis</i> .
	92 Wood oil from Pegu.	<i>Dipterocarpus alatus</i> .
	93 do. Rangoon.	do. ——— ?
	94 do. Chittagong.	do. ——— ?
	95 do. Moulmein.	do. ——— ?
	96 Shemanathee wood oil.	<i>Sethia indica</i> .
	97 Sissoo wood oil.	<i>Dalbergia sissoo</i> .
	98 Camphor wood oil.	<i>Dryobalanops camphora</i> .
	99 Wood oil.	—————
	100 Wood oil.	—————
CLASS. 1.	MINERAL OIL.	
	101 Petroleum and Naptha.	
	ANIMAL OILS.	
	102 Fish oil.	
	103 Fish liver oil.	
CLASS. 2.	104 Neats foot oil.	
	105 Oil of wax.	
VOLATILE AND PERFUMED OILS.		
CLASS. 1.	106 Cinnamon bark oil.	<i>Cinnamomum Zeylanicum</i> .
	107 Cinnamon leaf oil.	do.
	108 Cassia oil.	<i>Cinnamomum cassia</i> .
	109 Clove oil.	<i>Caryophyllus aromaticus</i> .
CLASS. 2.	110 Lemon grass oil.	<i>Andropogon schœnanthus</i> .
	111 Roosa grass oil.	<i>Andropogon iwarancusa</i> .
	112 Cajeput oil.	<i>Melaleuca cajaputi</i> .
	113 Camphor tree oil.	<i>Dryobalanops camphora</i> .
CLASS. 4.	114 Anise seed oil.	<i>Pimpinella anisum</i> .
	115 Fennel flower oil.	<i>Nigella sativa</i> .
	116 Nutmeg (wild) oil.	<i>Myristica malabarica</i> .
	117 Sassafras oil.	<i>Sassafras officinale</i> .
	118 Bishop's weed or omum oil.	<i>Ptychotis ajowan</i> .
	119 Cardamom oil.	<i>Elettaria cardamomum</i> .
	120 Cummin seed oil.	<i>Cuminum cyminum</i> .
	121 Spikenard or jatamansi oil.	<i>Valeriana jatamansi</i> .
	122 Cuscut root oil.	<i>Anatherum muricatum</i> .
	123 Tobacco leaf oil.	<i>Nicotiana tabacum</i> .
	124 Sweet flag oil.	<i>Acorus calamus</i> .
	125 Pepper oil.	<i>Piper nigrum</i> .
	126 Cubebs oil.	<i>Piper cubeba</i> .
	127 Lime peel. and leaf oil.	<i>Citrus limonum</i> .
	128 Orange flower, or neroli oil.	<i>Citrus aurantium</i> .
	129 Orange peel, and leaf oil.	do.
	130 Citron peel, and leaf oil.	<i>Citrus medica</i> .
	131 Mustard oil (volatile.)	<i>Sinapis species</i> .
	132 Sandal wood oil.	<i>Santalum album</i> .
	133 Guava leaf oil.	<i>Psidium pyrifera</i> .

N. B.—This list is not to be taken as by any means including the whole of our indigenous oil plants.

SECTION IV.

REMARKS ON THE ECONOMICAL USES OF OILS IN INDIA.

The value of the *commercial* oils of India, being already so generally known to Merchants and Manufacturers, both at home and in this country, any remarks on this head would be superfluous; it remains, however, to consider in what ways, we may become the consumers as well as the exporters of oils.

I would more particularly refer to their uses in the raw state for currying leather and making buff, for burning in lamps, for lubricating machinery, for anointing the person, and as an article of food,—to their value in a somewhat modified form, as a vehicle for paints, and varnishes,—and lastly to their employment in the manufacture of candles and soap.

Oil—as used for currying and buffing leather.—Experience has shown that the kinds of oil most suited for the preparation of leather, are those derived from the animal kingdom. Of these, fish oil, neats foot oil, and the solid fats of oxen, sheep and pigs, are those most generally used. Some one of these, or a mixture of several of them as the case may be, is rubbed over the underside of the tanned skin whilst still wet. The leather being then hung up in an airy loft to dry, the evaporation of the moisture enables the composition to penetrate through the substance of the hide until it appears on the surface or grain side. The beef, mutton and pigs fat used in this process are procurable with difficulty and at high prices.

At present, but little leather is curried in India, and the demand for these substances is consequently limited, but should this branch of trade rise into importance (of which there can be no reasonable doubt,) and should hides be tanned and finished on the spot, instead of being sent to Europe in the raw state, and re-imported when dressed, the supply of these substances will become of greater moment, and it will be a question for the practical manufacturer to decide, whether it is more to his interest to pay the current Indian prices, or to import his materials direct from Australia.

Fish oil, however, is procurable in abundance at reasonable prices,

indeed, the Indian article has entirely superseded the use of English oil, which, until the establishment of this manufacture on the Western coast, was imported at a high price for the use of the Government Buffing establishment at Hoonsoor.

A comparison of the price of the Indian and English article is shown below, and as regards quality, it has been found that the Native oil, if made with care, is fully equal to the English product.

Cost of English oil per gallon Rs. 2 4 0

Cost of Malabar oil per gallon Rs. 1 10 0

The saving thus effected in this one article alone, in this large establishment, is very great.

Oil—as used for burning in lamps.—Almost all the oils procurable in India, are burned to a greater or less extent by the native population in the rude contrivances which serve as lamps. For the finer description of European lamps, however, only the fluid non-drying oils should be used. Of these Cocoonut, Ground nut, Coorookoo, Kurunj, and a few others are to be preferred. The first is decidedly the best, but in cold climates, it requires to be mixed with a due proportion of some other oil to prevent its tendency to congeal at low temperatures. Drying oils, such as Castor, Lamp, and Linseed oil are unsuitable for these lamps, as the oil becoming viscid, clogs the tubes; they may, however, in common with many other sorts of oil, be burned with advantage in open vessels or night lamps. Some of them emit much smoke.

In the preparation of these oils for burning in lamps, much improvement might be effected. Excepting Cocoonut, the generality of oils as sold in the market, are contaminated with mucilage and extraneous substances, which much impair their burning qualities.

The usual mode of purifying oil, is to add to 100 parts of oil one part of Sulphuric acid, and agitate the mixture; the acid immediately attacks and chars the slimy parts of the oil. In half an hour add 50 parts of water with agitation, and allow the whole to settle for some days. Decant the clear oil, and wash with water to get rid of the acid. The same object may be effected in a less degree by keeping the oil for some time in a quiet place, this improves it by

allowing the mucilage to subside ; for this reason, old oil is preferable to new for lamps. The manufacture of oil gas for illuminating purposes must not be passed over in silence. Oil dropped on a red hot surface is instantly converted into gas, (oil gas) and with the aid of very simple machinery, can be made by the most inexperienced person. It was at one time made to some extent in England, but the high cost of the oil and other causes, led to its abandonment in favor of coal gas.

Oil,—as a lubricating agent.—Any of the fluid non-drying oils, may be used as lubricants for machinery. For fine work, the Ben oil (*Hyperanthera moringa*) being free from any disposition to rancidity, is to be preferred, but for Railway carriages, a more solid substance, such as Piney tallow or Gamboge butter is more suitable. At present, however, a composition prepared by agitating lamp oil with nitric acid, for which the maker holds a patent, is employed successfully. The Gamboge butter, has been reported on favorably, by the Railway agent, as “very clear and free from grit, and suitable for lubricating axles.” A more extended experiment with this substance is in contemplation. A locomotive engine is said to consume between eighty and one hundred gallons annually. A mixture of grease and tar is used for Native carts.

Oil—for anointing the person.—As an application for rendering the skin supple, which in tropical climates, is an almost indispensable necessary of life, any of the greasy oils will answer. Those generally preferred by the natives are Cocconut, Gingeley, and Mustard oils. The former has been sometimes used by the European perfumer in the manufacture of scented oils for the hair, but the difficulty of preventing its acquiring the well known disagreeable odour, or of disguising it with the most powerful scents, is the chief objection to its use. The Moringa or Ben oil, from the great length of time, it keeps without acquiring rancidity, is well suited to the perfumer's use.

Oils—as articles of food. Oil is largely used as an article of food in all tropical countries, and as the qualities of most edible oils are well known, little need be added on this head further than to recommend greater cleanliness in the expression, and a more profitable use of the oil cake ; which, however, valuable as a manure is

still more useful for fattening cattle. As an ingredient in salads and similar dishes, for which it is used to a limited extent by Europeans in India, there is every reason to hope, that the native product, will ere long entirely supersede the imported article. Numerous indigenous plants such as the Poppy, Mustard, Gingeley, Ground nut, Chironjje, Cucumber, Cashew nut, &c. yield oils fully equal to the best product of Italy, with the advantage of superior freshness. Indeed, they are even now frequently used in preference to the English oil, and the only bar to their general adoption, is the difficulty of getting them extracted, in a pure state by the native press.

It is a well known fact, that a large portion of the oil prepared from seeds yearly exported from India, is consumed as “salad oil” in Europe, and part finds its way back to India, under the same name, although the fresh product is procurable on the spot, at a tenth part of the price of the re-imported article. The amount of Salad oil imported at Madras during two years was as follows :

In 1849-50, Galls. 268, value Rs. 1,139.

In 1850-51, Galls. 399, value Rs. 1,809.

The imports of Olive oil into England in 1851 amounted to 20,788 tons of 252 gallons each.

Oil,—as used in the preparation of woollen cloths, &c.—As a dressing for woollen cloth, oil is seldom if ever used in India, nor indeed is it probable that it ever will be, many of the indigenous oils, are however well suited for this purpose.

Oil,—as a vehicle for paints, varnishes, &c.—Poppy and Linseed oils, are in general repute in Europe for paints and varnishes. The former may be cheaply prepared in the opium districts of India, and from its perfect clearness and limpidity (when bleached) it is most valuable to the portrait and miniature painter, whilst the price at which it can be made renders it available for more common descriptions of work. From the fact, of no vegetable oils, (except wood oils,) being used as ingredients in paints by the Natives of India, it has not yet been ascertained which of the many varieties procurable in various parts are useful for this purpose.

Linseed, as will be seen on reference, to the first part of this

port, is now becoming a large article of produce and export trade, the oil however still continues to be imported from England, for the public service and private use. Trials have been made of the relative value of oil, obtained from seed grown in the country, and of the imported article, the results of which, have established the perfect similarity of the two products, there are however several precautions to be observed, in the preparation of this oil, the neglect of which has caused the country article to be less esteemed. The oil must be obtained perfectly pure, and unadulterated by the admixture of any greasy oil, which would of course destroy its drying qualities and render it useless for paint, it should not therefore be prepared in a press which has been used for other oils, unless it has been first thoroughly cleansed, a matter of some difficulty with the ordinary native press. To render the oil *drying*, the process although very simple, is one which requires some practice to succeed fully. It is generally effected by boiling 100lbs. of Linseed oil with 1lb. litharge, and maintaining the mixture for an hour at a temperature of 100. Cent. Indian oil thus prepared, is perfectly equal to that obtained from England for paints and varnishes. The imports of Linseed oil, and the exports of seed for the last six years, have been as follows.

OIL IMPORTED.

In 1849-50	Gallons.	1,311	value Rs.	2,623	from England
1850-51	"	2,832		6,358	do.
1851-52	"	2,823		5,978	do.
1852-53	"	4,552		8,763	do.
1853-54	"	{ 6,505		13,060	do.
		{ 237		474	from Indian ports.
1854-55	"	{ 2,879		5,270	from England.
		{ 668		1,883	from Indian ports.

SEED EXPORTED.

1849-50	Cwt.	401	value Rs.	1,539
1850-51	"	801		2,271
1851-52	"	1,067		2,927
1852-53	"	1,106		3,275
1853-54	"	2,898		9,588
1854-55	Quarters	293		5,914

The imports of Linseed oil into England in 1851, amounted to Quarters 608,986.

As a great variety of pigments and of resins for varnishes are procurable in India, the present large item of imports under the head of "paints and colors" might be materially diminished.

The wood oils of India are in themselves natural varnishes, being composed of a mixture of a resin and a volatile oil, they are not however so durable as the Linseed oil varnish, being more brittle and liable to scale off, though they answer well for in-door work; the addition of a due proportion of any good drying oil, would perhaps render them more durable.

Oil,—as used in the manufacture of Candles and Soaps. We now proceed to consider oils in a higher state of manufacture, or when converted into candles and soap.

As regards the former article, it is doubtful whether candles can be manufactured in India at a sufficiently remunerating price to enable a local company successfully to compete with the imported article. This question indeed is one for the practical manufacturer to determine. Candles might be made with ease, but to make them cheaply would involve a large outlay for machinery, &c. The imports of wax and candles (almost entirely the latter,) and the exports of bees' wax are as follows.

IMPORTS.

1849-50	lbs.	62,720	Rs.	45,953	from England.
1850-51	{ lbs. —		Rs.	4,778	from England.
	{ lbs. —		Rs.	2,549	from Bengal and Bombay.
1851-52	{ lbs.	52,478	Rs.	28,720	from England.
	{ lbs.	6,272	Rs.	4,178	from Bengal and Bombay.
1853-52	{ lbs.	35,366	Rs.	18,213	from England.
	{ lbs.	2,977	Rs.	1,808	from Indian ports.
1853-54	{ lbs.	41,914	Rs.	21,690	from England.
	{ lbs.	4,255	Rs.	2,369	from Indian ports.
1854-55	{ lbs.	61,386	Rs.	31,523	from England.
	{ lbs.	10,194	Rs.	3,739	from Indian ports.

EXPORTS.

1849-50	lbs. 2,64,096	Rs. 1,12,270
1850-51	lbs. 3,13,697	Rs. 86,614
1851-52	lbs. 2,36,378	Rs. 95,286 to England.
	lbs. 1,07,260	Rs. 44,726 to Bengal and Bombay.
1852-53	lbs. 2,32,000	Rs. 99,713 to England.
	lbs. 65,609	Rs. 27,083 to Bengal and Bombay.
1853-54	Wax.	lbs. 48,000 Rs. 15,434 to England.
		lbs. 10,602 Rs. 3,760 to Indian ports.
	Candles.	lbs. 1,89,886 Rs. 76,834 to England.
		lbs. 19,776 Rs. 16,377 to Indian ports.
1854-55	Wax....	lbs. 85,615 Rs. 31,054 to England.
		lbs. 87,010 Rs. 35,646 to Indian ports.

IMPORTS RE-EXPORTED.

1849-50	lbs. 10,976	Rs. 4,048
1850-51	„ 2,412	„ 1,327
1851-52	„ 4,482	„ 3,266
1852-53	„ 6,660	„ 2,623 the larger proportion went to Pegu.

Soap.—The ingredients for making soap are ever at hand, and available to the most humble workman. Although the quantity of this substance used by the native population is, it is to be feared, very small, yet the trade would afford ample employment, to a large establishment. A large quantity of the common chunam or country soap, is imported from Bombay, and sold at 1 anna per lb., and upwards. The amount of hard soap annually manufactured in England is stated to be 53,400 tons, of which about 17,800 tons, are made from palm oil, which is imported for this and other purposes to the extent of 50,000 tons per annum.

We are not, however entirely without soap manufactories in South India; Messrs. Kohlhoff, and Prudhomme at Tanjore; Dr. Flynn, and C. Bauloo Moodelly, at Madras, make soap to a greater or less extent. Mr. Kohlhoff of Tanjore, who manufactures soap on a large scale, (chiefly from Illoopoo oil,) for exportation to the Mauritius, as well as for local sale, at 80 Rs. per candy, of 500 lbs., has kindly placed the following remarks on the relative value of soaps, made of various Indian oils at my disposal. I can also add my testimony, to the superiority of the soap made from Illoopoo oil,

according to his method over all other soaps; for a quantity of this soap, exhibited by Mr. Kohlhoff at the Madras Exhibition of 1855, was purchased and kept in an open place exposed to all weathers till the present time, (June 1857.) It does not appear to have sensibly diminished in weight, or to have been affected by heat or damp, but remains perfectly firm and good, whilst English bar soap, under the same circumstances has shrivelled up to two-thirds of its original size. I prefer it therefore to ordinary English bar soap, which does not stand the test of extremes of temperature, nearly so well.

Mr Kohlhoff observes—“ *Cocoanut oil soap* is of inferior quality, if exposed to damp it will melt away, and if allowed to dry it will shrink, wherefore it is the object of the manufacturer to prevent loss by making only such a quantity at a time, as he is likely to sell immediately. *Castor oil soap* is too clammy, and from its offensive smell, is unfit for use. *Gingeley and ground nut oil soap*, are like each other, they are certainly better than the *Cocoanut oil soap*, but not so good as that made from *Illoopoo oil*, which is decidedly superior to all. *Pinnay oil soap*, may be considered as good as that manufactured from Gingeley and Ground nut oils for washing linen, &c. but it has a dirty brown color which is unfavorable to the seller. *Margosa oil soap* is on a par with the above in utility, but may be classed with the Gingeley and Ground nut soaps in point of color, which will be a pale yellow, but the smell of the *Margosa soap* is unpleasant.”

The process of manufacturing the above mentioned soaps, is as follows: “Two cisterns being built one above another, two-thirds of chunam, mixed with one third of Fuller’s earth is pressed very tightly into the upper cistern. Water being poured thereon, the lye will slowly filter through, and be received into the lower reservoir.

About two-thirds or three-quarters of this lye (according to the nature of the oil, employed,) is mixed with the oil, and allowed to remain three days with occasional stirring. The whole is then boiled in a copper cauldron, until the soap separates from the lye water. A small quantity of pure cold water, is then poured in and stirred up to clarify. The soap is then poured into moulds, and cut into bars, when cold. When sufficiently dry, it is smoothened and ready for sale.”

APPENDIX A.

Abstract Statement of Exports of Oils and Oil seeds from Madras and the subordinate Ports, from 1850-51, to 1854-55.

DESCRIPTION.	1850-51.		1851-52.		1852-53.		1853-54.		1854-55.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Gallons.	Rupces.	Gallons.	Rupces.	Gallons.	Rupces.	Gallons.	Rupces.	Gallons.	Rupces.
Oil Coconut.....	6,56,118	1,44,912	9,56,937	2,11,639	14,57,741	3,18,656	17,97,450	3,89,722	21,41,573	6,08,530
" Gingely.....	77,252	48,055	46,193	26,722	72,607	43,628	1,19,180	73,636	17,139	12,720
" Lamp.....	26,093	13,387	24,475	11,979	51,048	29,927	60,770	26,014	45,555	27,009
" Castor.....	15,971	23,132	12,600	15,694	8,059	7,818	8,580	8,580	48	149
" Ground nut.....	1,10,566	52,510	31,027	14,765	57,207	23,003	82,866	61,700	45,361	31,467
" Mango.....	0	0	1,917	1,048	3,111	1,701	0	0	0	0
" Pinnacottay.....	0	0	0	0	0	0	0	2,287	0	1,200
" Fish.....	39,486	12,717	77,240	22,157	2,57,217	71,769	7,31,025	2,06,863	2,67,161	77,317
" Cassia.....	1,089	3,063	473	1,572	430	1,701	0	0	0	0
" Other sorts.....	0	0	0	3,766	0	3,967	0	2,060	0	2,101
Total.....	9,26,499	3,09,685	11,50,865	3,09,367	19,07,456	4,93,649	27,79,199	7,59,941	25,16,836	6,60,446
Seeds Gingely.....	2,27,779	4,37,185	1,09,414	3,02,559	2,51,613	6,31,664	11,98,079	6,93,760	1,67,334	4,21,726
" Lamp.....	6,011	12,347	6,125	9,963	73,215	54,228	7,076	17,632	7,944	19,160
" Castor.....	14,617	21,096	0	0	2,764	4,247	15,475	26,379	0	0
" Ground nut.....	796	1,728	0	0	0	0	0	0	367	1,307
" Linseed.....	801	2,271	1,067	2,927	1,106	3,267	2,898	9,588	1,308	6,916
" Mustard.....	9,908	22,097	3,636	9,319	16,057	34,048	18,078	29,259	3,098	10,044
" Pinnacottay.....	0	0	0	360	1,167	0	0	0	0	0
" Croton.....	0	0	0	0	0	0	0	0	145	1,443
" Other sorts.....	0	10,648	0	8,874	0	9,309	0	13,543	0	11,066
Total.....	2,60,626	510,372	121,611	3,33,072	3,46,584	6,37,929	12,42,930	796,281	1,90,394	4,21,056
Total value of oil and seed.....	..	811,057	..	6,42,426	..	11,31,578	..	15,56,922	..	16,41,817

APPENDIX B.

The total value of Oil and Oil Seeds, reported for the last 5 years, ending 30th June, 1855.

No. of de.	1852-53.		1853-54.		1854-55.		TOTAL.		AVERAGE.	
	Value of oil seeds.	Value of oil.	Value of oil seeds.	Value of oil.	Value of oil seeds.	Value of oil.	Value of oil seeds.	Value of oil.	Value of oil seeds.	Value of oil.
	Rs.	Ra.	Rs.	Ra.	Rs.	Ra.	Rs.	Ra.	Rs.	Ra.
7	108,924	594	276,682	489	186,721	180,210	1,018	167,874	168,892	4,638
8	98,843	4,791	171,987	2,610	209,732	101,615	101,978	21,033	700,263	805,361
9	132,441	25,054	225,536	21,534	343,986	365,550	17,022	222,879	239,901	86,282
10	29,580	490	28,678	314	42,089	42,413	270	29,342	29,612	1,010
11	261,716	12,494	188,505	7,814	98,447	106,201	6,757	9,042	14,799	41,209
12	12,012	29,178	827	30,005	41,977	43,442	21,229	429	21,668	159,432
13	17,058	19,338	2,681	21,419	28,107	49,363	39,837	239	40,076	116,791
14	0	199	435	456	873	966	172	2	2,117	106
15	0	175	532	570	1,238	1,989	634	1,916	2,550	2,699
16	47,739	64,178	4,948	69,126	128,876	135,109	98,494	16,364	114,658	375,079
17	1,269,142	420,157	1,042,871	463,028	654,146	849,262	1,503,408	643,110	759,366	1,402,456
18	20,19,67,838	577,245	19,42,152	2,519,397	888,002	17,57,431	26,45,433	827,915	13,09,068	21,36,983
19	..	..	..	..	..	..	..	..	..	..
20	19,67,838	577,245	19,42,152	2,519,397	888,002	17,57,431	26,45,433	827,915	13,09,068	21,36,983
21	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..
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* The quantity only is given, but no value.
 + Land frontier is not included in this.

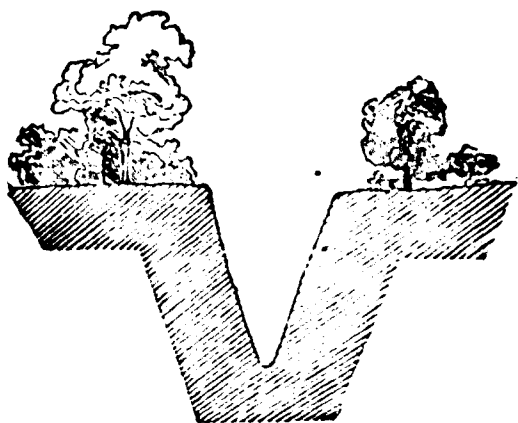
(Signed.) G. S. FONSECA,
Acting Secretary.

II. *Description of the method adopted in the Coimbatore District for catching wild Elephants. By CAPTAIN D. HAMILTON, Assistant Conservator of Forests.*

I beg to enclose some rough sketches (Plates I, II, III and IV.) referring to the late Elephant Hunt, which, with a brief description, may be of some interest, showing the method adopted in the Coimbatore District for capturing wild Elephants.

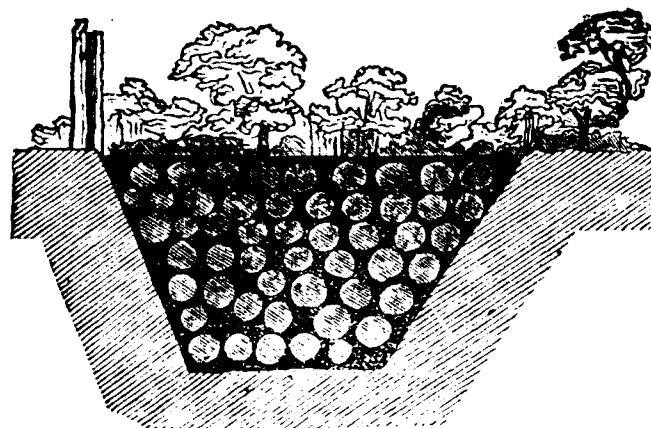
The spot selected for the hunt on this occasion, was at the entrance of a valley (vide Plate I) at the foot of the Neilgherries near Seermooogay, where are the remains of an old Coopum or Kraal. The situation was an excellent one, for the river on one side, and steep hills on the other, left only a narrow gorge at the entrance of the valley; so that once having got the Elephants into the valley, it appeared easy enough to drive them into the Coopum.

The Coopum consisted of a circular trench 280 feet in diameter,



(vide Plate III) the breadth of the ditch being 13 feet, narrowing at the bottom to a few inches; the depth 10 feet. The causeway at the entrance 17 feet broad was composed of blocks of light wood, and earth. The object of using wood was to enable the causeway to

be quickly demolished on the Elephants entering the enclosure. From the entrance strong palisadings were erected (vide Plate IV.) diverging in one direction towards the river, and in the other to the foot of the nearest hill, the length of the right palisading (looking from the Coopum) was 600 feet, that on the left 800 feet consisting of stems of trees firmly fixed in the ground and strongly bound together. 2,800 of these stems were used in forming the palisadings, beyond them strong abattis were laid down, extending on the right side 2,900 feet and on the left 3,200. For 400 feet on each side behind the palisading, a ditch 5 feet 7 inches broad and 3 feet 6 inches deep was dug; beyond this, a ditch 4 feet by 4 feet was continued, but on the inner side of the palisading and abattis, on the right side to the distance of 310 feet and on the left 180 feet.



This completed all the preparations with the exception that on the day of the drive, the whole of the palisadings were covered with green branches, to conceal them from the Elephants. All trees and bushes were left standing, and the causeway was made to look as like the natural jungle as possible, the ditch at the sides being carefully concealed by bushes.

It took several days to bring the Elephants into the valley, (vide Plate II) above the Coopum, as they have to be moved in the direction required, without alarming them. Parties had to be stationed, day and night watching certain passes, to stop the herd from

proceeding in any direction but towards the valley; at nights a line of fires are lighted for this purpose. On the day of the drive people are stationed at intervals outside the palisadings and abattis, to drive back the Elephants if they attempt to break through. Two small bon-fires are made on each side of the entrance, within the Coopum concealed by bushes, and the moment the Elephants enter two men are ready to rush in and light them; faggots which have been previously collected and piled near the entrance, are quickly thrown on and soon two immense fires are formed which effectually prevent the Elephants attempting to recross the causeway, while a number of coolies detailed for the purpose are demolishing it.

Muskets, rockets, crackers, tom-toms and horns are used in the drive, which combined with the shouting of several hundred men is enough to intimidate the boldest Elephant from charging back, but it is difficult to get Natives to believe this. Every thing depends on their having good leaders.

Besides those employed in guarding the enclosures, and driving a number of men are placed on the flanks beyond the arms or enclosures of the Coopum, as soon as the drive commences they light small fires, the Elephants have such a dread of fire, that if well-driven, on seeing the fires on each side of them, they are sure to make straight for the enclosure.

III. *Notice of the occurrence of Crystalline Limestone in the District of Coimbatore.* By H. F. BLANFORD, Esq. of the Geological Survey of India.

During the progress of the Geological Survey of the Neilgherry Hills in the months of June to November of the current year, my attention was called to some specimens of Crystalline Limestone collected by Dr. Cleghorn and Capt. Francis, Engineers. This discovery of limestone, which is of the greatest interest both in an economical and scientific point of view, induced me to avail myself of an early opportunity to visit the locality in question, in order to ascertain the nature and extent of the mass of limestone, from which the

specimens were obtained. The chief results of the examination are embodied in the following notice.

The whole surface of the district of Coimbatore as well as the Mysore table land, and indeed the greater part of S. Western India is composed of a vast spread of Schistose or foliated rocks, such as Gneiss, Hornblende Schist, Mica Schist, &c., a class of rocks termed Metamorphic by Sir Chas. Lyell, (although such a term must be regarded as premature until their really metamorphic nature in *all cases* be firmly established.) The mineral characters of these rocks are extremely varied, but they consist for the most part of Quartz, Feldspar, Hornblende and Garnet, intermixed in various proportions, one or more of these minerals being occasionally entirely absent. Mica which is one of the constituents of true Gneiss is only of exceptional occurrence in the district in question. The foliation (or system of *laminæ*) in which the constituent minerals of schistose rocks are arranged, is well marked over the greater portion of the Coimbatore district, but is far less distinct on the elevated plateau of the Neilgherry Hills, and occasionally disappears altogether, so that were it not that such non-foliated rocks pass invariably by insensible degrees into others in which a foliated character is distinctly discernible, they might be easily mistaken for Syenite, Greenstone or some other kind of Plutonic rock, an error into which previous observers have generally fallen. The foliation wherever apparent conforms to a general strike in the direction E. N. E., W. S. W. on the plateau of the Neilgherry Hills, and such is also its direction in the vicinity of Coimbatore. In other portions of the district it varies considerably and towards Bhovani it has a North Western strike. Granite veins of small size, are occasionally seen cutting through the foliated rocks, which form the surface of the low country, but on the hills generally no trace of Granite or any of the allied Plutonic rocks has been detected. A few small dykes of Basalt being the only intruded rocks of the elevated country.

About 5 miles to the south of the Civil station of Coimbatore, a low broken ridge of hills characterised by a peculiarly jagged outline occurs crossing the road to Palghat and running in an E.

N. E. direction. These hills consist of thin alternating bands of crystalline limestone and gneiss, the banded structure of which is absolutely coincident with the foliation. Here and there small contortions occur in the rock, which are rendered very strikingly visible by the erosion of the intercalated band of the limestone from atmospheric causes, and it is this unequal erosion which has given to the hills themselves the jagged appearance already alluded to.

The range of hills ceases suddenly about half a mile to the east of the road where the rock becomes much contorted, and an exposed surface of pure crystalline limestone, unmixed with Gneiss extends for the space of about 200 yards, between the hills and the cultivated land beyond. The limestone is largely crystalline, being composed of an agglomeration of small rhombohedrons of Carbonate of Lime, the characteristic cleavage of which is frequently very distinct. In color, it is usually of a pale mottled grey, frequently passing into pink, and occasionally becoming nearly white. It is intersected by a few minute veins of Granite, which have apparently been intruded while the limestone was in a molten condition, so that by slight movements in the fluid mass, they have been drawn out and twisted into peculiar thread like forms, resembling those frequently seen in the intermixture of two colors on the marbling trough of a bookbinder. In general, the rock is very compact and blocks or slabs, of almost any required size, might be quarried without much difficulty.

From this spot, which is the most easterly point at which the limestone is at present known to occur, it passes westwards forming a band of 30 or 40 yards in width in the substance of the schists, into which it graduates along its northern edge, forming the banded rock already described, while its vertical extent is probably very great. It has been traced for a distance of about 7 miles along the foot of the range of hills already mentioned, which to the West of the Palghat road, become very elevated and form a ridge of about 2,000 feet in height above the general surface of the surrounding country. At a point about 2 miles west of the village of Ittrumudday, the line of Railway from Madras to Beypoor, cuts

the band of limestone and passes to the westward along its outcrop, and in some of the small cuttings, good faces of the rock are exposed. The blocks obtained from the cuttings, are used for rubble work in the construction of the bridges, &c., on the line. Further to the west the limestone band penetrates the Walliar jungles, beyond which point it has not been traced, but it is not improbable, that it extends much further in the same direction.

It is unnecessary here to enter upon any theoretical considerations with respect to the limestone, as these will be treated of at length, in connection with the Geology of the surrounding country, in the Report now preparing for publication, in the "Memoirs of the Geological Survey of India," but a few words on the economic importance of the discovery may be here fitly added.

As a building material, limestone such as that now described is capable of a two-fold application. It may either be used in the form of rough or worked stone, or may be burnt in some form of kiln for the manufacture of lime and cement. As a building stone, the Coimbatore limestone would be perhaps one of the cheapest and most durable materials, that could be used. Being extremely soft and very massive, large blocks could be quarried and dressed with great ease, and as from the purity of the stone, it is but little liable to weather or decompose, as is seen on the mere inspection of the stone in situ, dwelling houses or public buildings constructed with it would require no stucco, and would thus present a more slightly and imposing exterior than an ordinary pukka building, and at the same time, a considerable saving in the expenditure for repairs would be effected. This saving alone would in a few years more than cover the original difference of cost. For internal decorations of a simple character, the limestone is well adapted, as it is susceptible of a high polish, and by employing slabs of various colors, very beautiful walls, pavements, &c., might be constructed. It would not be applicable for highly decorative work, such as small mouldings or carved ornaments, since owing to its largely crystalline structure, it would be liable to chip, but this very character imparts to it a transparency which would much enhance the beauty of a polished slab. It is, however, possible that extended

research might discover limestone, of a finer grain in some portion of the band.

For the manufacture of lime, the limestone is well adapted. The lime obtained from it would be very pure, and of the class termed rich limes which require the admixture of a certain amount of clay to make them set rapidly. Hitherto, kunkur only has been used for the manufacture of lime, in the Coimbatore district, and for local purposes this undoubtedly answers extremely well, but as it nowhere occurs in any great thickness, and is distributed in irregular patches over the surface of the country, the supply of lime obtainable from this source is limited. It is probable also that in the event of the limestone being quarried for building purposes on a large scale, the small fragments and chippings burnt on the spot and packed in casks or air-tight boxes, would be cheaper material for conveyance to a distance, than the kunkur which is not only a very bulky material, but in this district generally occurs on dry arid ground where but little fuel is available.

For the production of iron, the ores of which are abundantly distributed over some parts of the Coimbatore district, the limestone is eminently fitted, and the neighbouring jungles of Walliar and the Malabar Coast yield a plentiful supply of fuel.

Finally, the limestone is admirably situated as regards facility of transport to distant localities. The Railway from Madras and Salem to Beypoor, passes as above-mentioned for some distance along the band of limestone, so that the cuttings of the Railway are in the stone itself. Were quarries opened along the side of the line, the blocks of dressed stone might be placed on trucks in the quarry and transported without expense of reloading to any point on the line, while by transporting to the Cauvery and transferring to boats, the stone might be easily conveyed to Trichinopoly and other places in that district.

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sustained little or no injury, the native houses however in the town have been greatly damaged, and many of the roads were impassable this morning owing to the number of uprooted trees lying across them.

The following observations of the Aneroid Barometer were made during the day.

November 2nd, 6 A. M.	29.425
9 A. M.	29.35
Noon.	29.27
1 P. M.	29.2
4 P. M.	29.18
8 P. M.	29.185

November 3rd, 8 A. M. 29.45

4.58 inches of rain were registered during the day at the Civil Hospital.

VI. *On the line selected for the Madras Railway.* By COLONEL T. T. PEARS, Consulting Engineer.

(The Editors having learned that the article by Colonel A. Cotton in the 3d No. New Series, of this Journal, had elicited certain observations addressed to the Government, by the Consulting Engineer for Railways, on those portions which had reference to the Madras Line, applied to the Author for permission to insert them, on a question affecting so much the progress of this Presidency. The Paper not having been prepared in the 1st instance for publication, Col. Pears expressed some hesitation in complying with their request, but at last consented, disclaiming any wish to enter into controversy—Ed. M. J.)

My attention has been drawn to a report, printed in the Madras Journal of Literature and Science, No. 42, April to June 1857, by Colonel Arthur Cotton of the Engineers upon the subject of the proposed pier; but discussing mainly the subject of a break-

water, and alluding, incidentally, to the Madras Railway in the following terms.

"Without a harbour at either end and merely as a line connecting the East and West Coast of the Peninsula, I look upon this work as one of the least important lines on which 3 millions could have been spent, assuredly nothing of any consequence either in goods or passengers will ever be conveyed by it from one Coast to the other, and at least 200 miles of it are perhaps about the least productive line of country that a Railway could be carried through in India. Further, it is proved beyond all question that the passenger traffic is the main source of profit on Railways and that the great mass of passengers only travel a few miles (the average for all England is 13) that is they go to the next town and back—strange to say this Railway of 450 miles is not to pass through one of the few towns (only 7 and all but one very small) which lie near its route so that it looks as if the ultimate object had been to make a Railway not to carry the people."

As this expression of opinion, though not given in relation to any question proposed in the Railway Department, has been before Government, I consider it right to offer a few remarks upon it.

The Madras Railway is here spoken of as being without a harbour at either end, and, therefore, one of the least important lines on which 3 millions could have been spent. As there are no harbours on this Coast, and none deserving the name, unless it be Sedashegur on the other, south of Bombay, it would be difficult to say which would be the more important line that Colonel Cotton would have proposed. A natural harbour is doubtless a very good thing; but that in this part of the world, a considerable trade may be carried on without such, is proved by the large and increasing commerce of Madras. Moreover, the fact that Nature has denied harbours to the Peninsula of India, does not appear a sufficient reason for the Government denying its inhabitants the benefit of Railways to bring their produce to the Coast.

Colonel Cotton then goes on to state, that the Railway "is not to pass through one of the few towns (only seven and all but

one very small) which lie near the route," and observes, that it looks as if the object was to make a Railway not to carry the people. That the towns referred to are all, but one, very small, is a circumstance sufficient in itself, one would suppose, to account for the fact of which he complains, viz., that no great sacrifice has been made with the view of leading the trunk line of rail through them.

I have the highest respect for Colonel Cotton's public character and abilities, and of those who will read these remarks there are few probably who do not entertain the same feelings. It is impossible, that any observations can fall from an Officer of his character and position, without leaving their impression upon the minds of many, especially of those who have not been accustomed to the consideration of such subjects.

In reference to the passenger traffic, and in order to show its nature and importance, Colonel Cotton asserts, that it is proved beyond all question, that the passenger traffic is the main source of profit on Railways, and that the great mass of passengers only travel a few miles.

In the first place, I have never seen the former fact proved, and it is *prima-facie* opposed to Colonel Cotton's recorded opinions, upon the extreme cost of speed—the passenger traffic being carried at a much higher rate than the "goods." It is known too, that in England the receipts from goods have been increasing year by year, faster than those from passengers; and in the Parliamentary reports for 1855, it is stated that whilst in 1849, the proportion of the passenger traffic* to the goods traffic was as 53 to 47, (the passengers in excess), in 1855, the passenger traffic is represented by 44, and the goods traffic by 56. In Scotland the average receipts for goods traffic are very nearly two-thirds of the total traffic, and it is added "the preponderance of the goods traffic over passenger traffic is more marked in the manufacturing and mineral than in the agricultural districts," that is, in those very places where the collection of men in large towns would lead us to expect the contrary.

* i. e. the gross receipts.

Again, Colonel Cotton is, as far as I can learn, in error in naming 13 miles as the average distance travelled by passengers for all England of all classes. In the report for 1855, the average receipt from passengers (exclusive of season tickets) is 19·20 pence, the average fare per mile 1·28 pence. The average distance travelled is $\frac{19 \cdot 20}{1 \cdot 28} = 15$. For the United Kingdom it is 14·9.

But I follow this no farther, because I think it very unsound to build systems and theories for India upon English experience. Take for example the statement regarding the preponderance of passengers and goods traffic. If in one and the same country, as England, there be different lines of Railway, some making their chief profit from passengers, some almost wholly from goods (and one of the latter the Taffvale has been long distinguished as one of the most profitable works in England); if this be the case there, we may well look for a difference in this respect in different countries.

No two countries would be found to offer more different prospects to a Railway than England and India: the one confined within narrow limits with a dense and wealthy population, actively engaged in manufacture and as such collected in large towns, whose existence is secured by permanent and natural causes; the other a country of vast extent, with scanty and scattered population, wholly engaged in agriculture, or in commerce connected therewith—the few large towns scattered widely apart, existing in dependance upon accidental and ephemeral causes.

The difference between the aim and prospects of a Railway, or system of Railways, in a manufacturing and in an agricultural country is, as great as this, that in the one case the attention would be immediately directed to the large towns—the seat of mineral and manufacturing wealth—in the other the object would be to drain, as completely and cheaply as possible, a large tract of country of its agricultural produce.

The latter is the case with us here. The line running inland from Madras seeks thus to serve directly the inland districts of North-Arcot, Salem, Coimbatore, and Malabar; while until the

other lines are formed, it indirectly serves those of Mysore, Bellary, and Cuddapah on the one hand; Trichinopoly and Madura on the other.

The first point to be aimed at, therefore, is to get a good main line through these districts. If considerable towns are found in the way (Colonel Cotton says there is but one), the Railroad should be taken to them if it can be done, without disproportionate sacrifice of expense, either in increasing the length or the difficulties of construction.

What amount of sacrifice should be made with this object will depend upon circumstances now to be noted.

The size of the Town.

The probable duration of its existence.

The probable effect of its distance from the rail on the traffic of the line.

I shall first consider the last point, viz., the probable effect of the distance at which a line passes a town upon the traffic. This depends mainly on the passenger fares. It depends also on the character of the country and condition of the people, by which the average distance travelled by the inhabitants is affected.

Thus, if the fare by rail is $\frac{1}{2}$ the expense of travelling by road, it will cost a man, living three miles from a station the same in going to a point on the line 5 miles off in a direct line, whether he goes by high road or by rail. If the place be more than 5 miles off, it will be cheaper to go by rail if less, dearer.

Now the average distance travelled by rail by passengers in England is shown to be 15 miles. Colonel Cotton has stated it erroneously at 13, and has unreasonably, I think, taken this as a data for Railways generally all over the world, but nothing can be more clear than that in this, as in all other respects, but in this respect, preeminently, the traffic in this country must differ from that in England.

There, we have a large wealthy population dwelling within narrow limits, and a land thickly studded with populous Towns and

villages. On this vast expanse of country, large towns are few and far between, and the population scantier and more scattered.

According to our last half-yearly return, the average distance travelled on a line 65 miles in length was 38 miles: what will it be when we have it complete 450 miles? I have no doubt that the average will be above 30, even though the fares should be reduced as I trust they will.

That the line should pass $2\frac{1}{2}$ or 3 miles from Wallajahpur and 4 from Vellore does not, in my opinion, affect the traffic coming from those towns in the slightest degree. It may, but it is a question whether it does affect even the traffic between those two particular places. This depends on the fares also. A man can travel, even at the present high rates, cheaper and quicker by rail between those two towns than he can by the high road. All other traffic from them to any point on the line 10 miles and upwards, from each of their respective stations, would take to the rail.

But, is the short and insignificant passenger traffic, between those two towns, sufficient inducement to change the course of the line of Railway, and adopt one less beneficial to the districts at large, a worse and more expensive line, crossing the Palar at a much more inconvenient place, and cutting up a large amount of valuable land on the right bank of that river? I think not.

These towns do not in the least degree resemble the large towns of England. They possess not one element of permanency. These the only two of any considerable size along the line, owe their existence to causes that may cease at a moment, and will cease ere long.

In an agricultural country like this, the large towns are chiefly local market towns, or emporia of agricultural commerce. They are singularly uniform in size and importance; sacred temples, the contiguity of Civil and Military stations, being the circumstances that generally give one such town importance over another.

Take Vellore the largest town on the line of Rail. It owes its present extent wholly to three causes. It is a local agricultural mart, a Military station, and it is a rendezvous for a great portion of the traffic from the inland districts en-route for the coast.

It possesses no manufactures, no mineral deposits, not one element of permanency or stability. Of the three main sources of its present populousness, the Railway is certain to destroy one, to materially curtail another, while a few strokes of the pen, in the shape of an Extract Minutes of Consultation, would at once remove the third.

The effect of the Railway, had it run right through it, would have been precisely the same, as it will be now, entirely to destroy its business and importance as an emporium of trade, with the distant provinces, with Mysore, Bellary, Salem, &c. The same effect has been produced by Railways in England in numberless cases, some of which have fallen under my own immediate observation. The large traffic that now passes into Vellore from Salem, Bangalore, Mysore, and Bellary, will, as the rail advances towards those places, be conveyed at once through it, and the number of people now residing there, connected with this traffic, will disappear.

Had the line run right through these two towns, it would have been the same; nothing would be left them but the importance due to a Railway station, and even this would be a fall from their present condition, considered merely as local agricultural centres, since stations, on each side of them, within 6 or 8 miles, would draw away much of the business that, in the present state of the communications, passes into these towns.

Nothing will remain to give Vellore special importance, but its Fort and its Garrison; and it is not probable that the latter will ever be considerable.

The other towns near which the line passes are Gooriathum, Vaniembady, Tripatoor, Salem, and Coimbatore. To some of these it passes quite close, but the same principles apply. In some cases, as Salem, it appears a positive good that the station should be 2 miles away, on a high and apparently healthy spot, to which many traders will be attracted leaving the present town, which like many others in this country, seems to have been planted on the most unhealthy spot that could have been selected.

I think for the reasons I have now given that the present towns, existing wholly upon temporary and accidental causes, as

the proximity of roads, passes, European stations, &c. are by no means deserving of the same consideration that is due to such towns as Birmingham, Manchester, and Liverpool; to sea ports, or to the abodes of men clustered round, and upon, an inexhaustible supply of Coal and Iron.

These towns of ours have no local products, every article now brought out of them is due, not to the town itself, nor to the people in it, but to a tract of country of which it has hitherto been, but which the Railway station will in future be, the centre.

I would not needlessly compel the few who may remain, when the busy *through* traffic has disappeared and passed by the rail, to shift their dwellings to a station 2 or 3 miles off, but the sacrifice to them is inconsiderable, compared with that to the Company in selecting a worse and more expensive line, merely to accommodate a town and a group of people, destined to melt away under the operations of the Railway itself.

The Railway has to do with a great agricultural District, and whether it lies a few miles this side, or that, the business coming into it will be the same, depending, as the sphere of its operation depends, on its "rates and fares."

It has often occurred to me, as a thing to be borne in mind, that the distribution of the inhabitants of this country has not attained to any thing like a normal state. Had we laid down Railways in England 300 years ago, the lines then laid might have been useful even now, but they would certainly not be of the first importance.

We have seen within short spaces of time, collections of human beings rise and disappear with political changes; and we may be quite sure that whatever particular course they follow, few changes will be more marked than that which must follow the introduction of Railways through these agricultural districts, with stations at every 6 or 8 miles.

The men engaged in trade, however, distributed now, must and will cluster along the line. Such towns as Wallejahnuggur and Vellore, established under, and due to, a totally different order of things, must and will, to a great extent disappear.

Individuals may, and some must, of necessity suffer from such changes as these, but no man can doubt the ultimate benefit to the country; and if the change be necessary there is in this country some satisfaction in the thought, that a new, and, we may hope, a more enlightened and enterprising class will owe their rise to the Railways, while the opportunity will not be lost of introducing into the towns thus springing up a new, more healthy, and more civilized description of dwelling.

VII. *A List of Nilgherry Ferns. By the late DR. B. SCHMID.*

[These Ferns were partly collected by Dr. B. Schmid in the years 1831-35 for Professor Zenker of Jena; partly by Dr. Weigle for Dr. Kurr of Stuttgart, and the Lycopodiaceæ by Mr. Perrottet.

They were described by Professor Kunze, in the *Linnæa*, Vol. VIII., July 1851. The Professor's last labour before his death; The capital S. indicates that the plant was found by Schmid himself, and W. that it had been collected by Weigle.]

OPHIOGLOSSACEÆ.

1. *Ophioglossum Schmidii*, (Kunze,) Nova species, sent by S.
2. *Botrychium lanuginosum*, (Wallich) sent by S. and W.

GLEICHENIACEÆ.

3. *Mertensia dichotoma*, (Sw. syn. fil.) sent by S. and W.
Syn. *Gleichenia dichotoma*, (Hooker sp. fil. 1, p. 12.)

OSMUNDACEÆ.

4. *Osmunda regalis*, (Linn.) S. Baron Hügel found it in Emodus.

POLYPODIACEÆ.

5. *Acrostichum angulatum*, S. Blume in Java.
6. „ *decurrens*, (Desv.) Philippines and Nilagiri in Wallich's herbarium.)

3. *Gleichenia Hermannii*, Wall. 4. *Osmunda Leschenaultii*, Wall.—ED.

7. *Acrostichum stigmatolepis*, (Fée.) In Delessert's herbarium "from Nilagiri;" Perrottet.
8. *Leptochilus lanceolatus*, (Fée.) Perrottet in 1838.
9. *Hemionitis cordata*, (Roxb.) sent by S. and W. Hook. and Grev. ic. fil. t. 64. Rheede Hort. Mal. 12, t. 10.
10. *Gymnogramma totta*, (Schlechtendal). } Very little different
var: *mollissima*, (Kunze.) G. Schmidt, } from that of Ma-
(Zenker's manuscripts.) } deira and Abyssinia.
11. " *bifurcata*, (Kaulfuss' herbarium.) sent by S.
12. " *leptophylla*, (Desv.) sent by S. is smaller than the specimens from South Europe, Teneriffe, Madeira, Mexico, Egypt and Abyssinia.
13. *Ampelopteris firma*, (Kunze.) S. and Hugel, No. 2152.
14. *Grammitis attenuata*, Kunze.) S. Nov. species.
15. *Selliguea involuta*, (Kunze) Syn: *Grammitis involuta*. (Don, Blume, Hooker and Greville.)
" var: *cuspidata*, *Grammitis cuspidata*, (Zenker's Plantæ Indica) sent by S. and W.
Synn: *Loxogramma*, (Presl.) *Antrophyum*, (Blume.) Fl: Jav: p. 87.
16. *Polypodium* (Pleopeltis,) *mediusculum*, (Kunze.) Nov. sp. sent by S. and W.
17. *Polypodium* (Pleopeltis,) sent by W.
18. " *linearis* affine, S. also Nepaul.
19. " (*Phymatodes*.) (Presl.) Nov. sp: S. W. *sterile*.
20. " (*Drynaria*) *oxylodium*, (Wallich) S. W. in Nepaul, Wallich. in Emodus, Hugel.
21. " (*Drynaria*) *quercifolium*, (Linn.) S.
22. " *carpophyllum*, (Zenker's manuscript) S. W. Nov. spec.
23. " *pyrrhorachis*, (Kunze.) S. W.
24. *Niphobolus sticticus*, (Kunze.) Nov. sp. S. W. Leschenault, also from Emodus.
25. " spec. *sterile*, S.
26. *Blechnum orientale*, W.

21. The true Linnean species, Fl. Zeylanica.—ED.

27. *Asplenium* (*Actiniopteris*) *radiatum*, (Sw.) Syn: *Blechnum radiatum*, (Presl) S. Hook. Icon. t. 975.
28. " *Zenkerianum*, (Kunze,) Nov. sp. S.
29. " *falcatum*, (Retz) S. also in Ceylon and Java.
30. " *decurrens*, (Kunze) Nov. sp. S.
31. " *brachyotes*, (Kunze) W. also in South Africa.
32. " *opacum*, (Kze) Nov. sp. W.
33. " *camptorhachis*, (Kze) Nov. sp. S.
34. " *emarginato-dentatum*, (Zenker's M.S.) S. N. sp.
35. " *umbrosum*, (Klfs.) W. also from Brazil, Martius.
36. " *lunulatum*, (Sw.)
" var: *sphenolobium*, (Kunze) S. W.
37. " *fimbriatum*, (Kunze) Flora Af. Austr: Natal. Emodus.
" var: *leptophyllum*, (Kze) S. W.
38. " *furcatum*, (Thunberg, Kunze) S. W.
39. " *tenuifolium* (Don) S. W. larger than the Natal form.
40. *Allantodia solenopteris*, (Kunze) S. W.
" var: *pusilla*, (Kurr.)
41. " *Fieldingiana*, (Kze) Nov. sp. S. Fielding received it from Emodus.
42. " Species doubtful. W.
43. *Diplazium lasiopteris*, (Kze) W.
44. " *nigro-paleareum*, (Kze) S. N. sp.
45. " a juvenile, sterile specimen, the roots mixed up with one similar to *Pteris Blumeana* (Kze adds, I have not yet seen the like.)
46. *Pteris geraniifolia*, (Radd: fil: Brazil) S. W. also, Nepal, Chili, Java. Hook. ic. t. 915.
47. " *Cretica*, (Linn) S. W.
48. " *Blumeana*, (F. Ag.) S. W. (*Pteris normalis*, Blume, Java.)
49. " *lanuginosa*, (Bory) S. also Mascarenhas.
50. " *multi-aurita*, (F. Ag.) Leschenault on Nilagiri? grows in Ceylon.

29. Burm. Zeyl. t. 43; Rheed. Mal. 12, t. 18.—ED.

A List of Neilgherry Ferns. [no. 5, 1857.]

68. *Pteris palmata* (Hook.) S.
 69. *Adiantum Alcockii* (Bory) S.
 70. " *anthipium*, (Kze.) S. W. At the Cape, Australia.
 71. " *capillus canis*,
 var: 1, *normale*, S.
 2, *latissimum*, (Kunze) also Bory in Algeria, and
 Hay in Emodus.
 72. *Chalcidophora dubia*, (Don) Nepal, S. Kurr.
 " *furcata*, Hook and Grev :
 " *furcata*, var: *pallida-sulphurea* W. Kurr.
 Wallich in Nepal, Hay in Emodus; Hügel in Karli;
 Cuming in Luzon; Zollinger in Java.
 73. " *bulbosa*, (Kunze) S. "valde insignis," similar to
 Ch: *elegans* (Desv.)
 74. " *Dicksonioides*, (Endlicher) S. W.
 var: *phyllochaena*, (Kze.)
 75. " *resistens*, (Kze.) S. Nov. Sp.
 76. *Lindsaea cultrata*, (Sw) S. W.
 var: *pallens*, (Wallich's Catalogue).
 77. *Davallia tenuifolia*, (Sw.)
 " var: *B. segmentis latioribus*, S. W.
 78. *Nephrolepis tuberosa*, (Presl). S. W. also Bourbon, Java.
 79. *Aspidium* (*Cyrtomium*) *anomophyllum*, (Zenker, Plantae In-
 dicæ.) S. W.
 var: *macroptera* and *microptera*, but intermediate forms
 are not wanting.
 80. " *atratum*, (Wallich) S. W.
 81. " (*Nephrodium*.) *caudiculatum*, (Sieb.) W. Nov. Sp.
 82. " " *Xylotes*, (Kunze.) S. Nov. Sp.
 83. " " *ochtosis*, (Kze.) S. W. N. Sp. also
 near Mercara, found by the Revd. Mr. Metz,
 and sent to Hohenacker.
 84. " (*Dicharium* A. B.) *Donianum*, (Spr.) S.
 " Syn. *Wallichianum* (Spr.) " *paleacum* (Dcn.)
patentissimum (Wall.) *Lastraea patentissima*.
 Pr. tent. Pterid.

OCT.—DEC. 1857.] *List of Neilgherry Ferns.*

83

68. *Aspidium Weigleanum*, (Kze.) W. Nov. Sp. (*Nephrodium*
procerrum, Don. prod. fl. Nep.)
 69. " (*Nephrodium*) *Canariense*, (Al. Braun) perhaps
 the same.
 " Syn *Aspidium elongatum*, (Willd. Sp. pl. R. Brown in
 H. Kew; Hook. and Grev. ic. t. 234.
 70. " (") " a doubtful species. W.
 71. " (") *scabrosum*, (Kze.) Nov. Sp., S. W. (A
 tree fern?)
 72. " (*Polystichium*) *palmipes*, (Kze.) S. W.
 73. " (") *brachypterum*, (Kze.) S. W.
 var. *major*, *lase*, S. Metz (in Hohenacker.)
 74. " (") *subinerme*, (Kze.) W. N. Sp.
 75. " (") *tacticopterum*, (Kze.) S. Nov. Sp.
 76. " (") *mucronifolium*, (Bl. ? Java) W. Hay on
 Emodus.
 77. (over looked.)
 78. " (") *Wallichianum*, (Pr.) S. Syn. *Asp. seto-*
sum, (Wall.) *Polystichum setosum*, Schott.
 Hooker's *Asp. Wallichii* and Sprengel's
Asp. Wallichianum are both erroneous.
 79. " (") *parisifolium*, (Kze.) S. W. Syn. *Poly-*
stichum conifolium, (J. Sm.) Cuming,
 the specimens from the Philippine Islands
 are more robust.

CYATHEACEÆ.

80. *Alsophila crinita*, (Hook. ic. Plantarum t. 671.) S.
 81. " *latifolia*, (Wall.) Penang, Assam.
 " var. *Schmidiana*, smaller than the normal form.

HYMENOPHYLLACEÆ.

82. *Trichomanes Schmidiana*, Zenker's MSS. (in Dr. Taschmer's
 Dissertation) similar to *Tr. filicula* (Hook) Ni-
 lagiris? and still more to *Tr. intramarginale*,
 (Hook. and Grev.) ic. fil. t. 211. Perhaps a
 dwarfish form of *Tr. Schmidiana*, from Ceylon?

LYCOPODIACEÆ.

83. *Lycopodium aloifolium* (Wall. cat. 129) Spreng. monograph des Lycopodees, Hook. ic. fil. t. 223.
 84. „ *subulifolium*, (Wall. cat. 114) Perrottet.
 Syn. *Lyc. Nilagiricum*, Spreng. l. p. 58, n. 42.
 85. „ *serratum*, (Thunberg); Spreng. Perrottet, also in Java, Japan.
 86. „ *macrostachys*, Hooker's Herbarium, Spreng. l. I. p. 30, n. 496.
 Syn? *Lyc. Phlegmaria*, Kunze's Herbarium, given by Koenig from East India, also in Ceylon.
 87. „ *cernuum*, (L. Spreng. monogr. l. 79) Perrottet and Kurr.
 88. „ *clavatum*, (Linn. Spreng.) Hooker's Herbarium.
 89. „ *Wightianum*, (Wall. cat. 2184, Syn. *Lyc. sabin-aefolium*, Kunze) in fil. Zollinger.
 90. *Selaginella vaginata*, (Spreng.) Perrottet.
 91. „ *radicata*, (Spreng.) W. Perrottet.
 92. „ *caulescens*, (Spreng.) W.
 93. „ *gennula*, (Spreng. Voyage Bory.) Perrottet.
 94. „ *tenera*, (Spreng.) Syn. *Lyc. ornithopodioides*, (Wall. cat. 2186.)

CALICUT, 24th January, 1857.

*B. SCHMID.

* The Manuscript not being always legible, some errors may have crept into this interesting Catalogue.—Ed. M. J.

VIII. *A List of Neilgherry Mosses.* By DR. B. SCHMID.

[These were collected by Mr. Perrottet, described and named by Montagne in 1842, others found by Dr. B. Schmid, described and named by Dr. Charles Muller of Halle in Prussia, in the Botanische Zeitung, 1852-54. Mr. Perrottet collected principally about Kaitie, and at Neddoo-wuttam and Kotagiri. Dr. Schmid explored

exclusively in the basin of Ootacamund. The Mosses marked † were collected by Mr. Perrottet; those without a mark were collected by Dr. Schmid; those marked * were found by Mr. Perrottet and also by Dr. Schmid.]—Ed. M. J.

Class II. CLEISTOCARPI.

Tribe II. BRUCHIACEÆ.

Genus II. *Astomum*.

1. *Astomum denticulatum*, C. Müll.

Class III. STEGOCARPI.

Sub-class I. ACROCARPI.

Tribe VIII. FISSIDENTEÆ.

Gen. I. *Conomitrium*.

2. *Conomitrium serratum*, C. Müll, Synops. II. p. 527.

Gen. II. *Fissidens*.

3. *Fissidens Schmidii*, C. M. similar to *F. crispus*.

- * 4. „ *anomalus*. Montagne, Annales des Sciences Naturelles, 1842, No. 36.

Tribe XI. FUNARIOIDEÆ.

Gen. I. *Funaria*.

- * 5. *Funaria hygrometrica*, Hedwig.

- † 6. „ *physcomitroides*, Mont. about Kaitie.

Gen. IV. *Entosthodon*.

- * 7. *Entosthodon Perrottetii*, C. M. Kaitie.

8. „ *diversinervis*, C. M. a very fine species.

9. „ *submarginatus*, C. M.

Tribe XV. BRYACEÆ.

Gen. I. *Mielichhoferia*.

10. *Mielichhoferia Schmidii*, C. M.

Gen. II. *Bryum*.

- * 11. *Bryum Neilgherrense*, Mont. (Dr Schmid's specimens have larger nerves set.)

12. „ *Zollingeri*. Duby.

- † 13. „ *Montagneanum*, C. M. *Brachymenium pendulum*, Mont. Musc. Neilgh. No. 48.

14. „ *apalodictyoides*, C. M.

15. *Bryum lamprostegum*. C. M.
 16. " *porphyroncuron*. C. M.
 17. " *rugosum*. C. M. a pretty, remarkable species.
 18. " *exile*. Dz. et Molkh.
 19. " *flaccidisectum*. C. M. a pretty species.
 *20. " *argenteum*. L. very frequent on earth and wood.
 21. " *Schmidii*. C. M.
 †22. " *leptostomoides*. Mont. Dodabetta on Rhododendrons.
 23. " *clavariæforme*. C. M.
 24. " *velutæum*. C. M.
 25. " *trematodontum*. C. M.
- Tribe XVI. DICRANACEÆ.
 Gen. VI. *Dicranum*.
 26. *Dicranum involutum*. C. M.
 27. " *nivale*. C. M.
 28. " *flagelliferum*. C. M.
 29. " *albescens*. C. M.
 †30. " *caudatum*. C. M.
 31. " *tricolor*. C. M.
 32. " *erythronaphalum*. C. M.
 33. " *Schmidii*. C. M.
 34. " *nodiflorum*. C. M.
- Tribe XVII. LEPTOTRICHACEÆ.
 Gen. VI. *Angstromia*.
 35. *Angstromia phascoides*. C. M.
 36. " *Schmidii*. C. M.
- Gen. VII. *Leptotrichum*.
 †37. *Leptotrichum plicatum*. C. M. humid wood behind Avalanche.
 Gen. IX. *Trematodon*.
 38. *Trematodon Schmidii* C. M. a pretty species.
 39. " *paucifolius*. C. M. hitherto only found in Java.
- Tribe XVIII. BARTRAMIACEÆ.
 Gen. IV. *Bartramia*.
 †40. *Bartramia Roylii*. C. M.
 †41. " *macrocarpa*. C. M.
 42. " *dicranacea*. C. M.

- Tribe XIX. POTTIOIDEÆ.
 Gen. VII. *Barbula*.
 43. *Barbula orthodonta*. C. M.
 44. " *Schmidii*. C. M.
- Gen. VIII. *Ceratodon*.
 †45. *Ceratodon stenocarpus* Br. and Sch. about Neddoowuttam.
 Gen. XI. *Zygodon*.
 46. *Zygodon acutifolius*. C. M.
 47. *Zygodon tetragonostomus*. A. Br. Java, Blume.
 48. " *cylindricarpus*. C. M.
 49. " *Schmidii*. C. M.
- Gen. XIII. *Orthotrichum*.
 50. **Orthotrichum Schmidii*. C. M.
- Gen. XV. *Macromitrium*.
 †51. *Macromitrium Perrottetii*. C. M. Kailie.
 52. " *quarrubæum*. C. M.
 53. " *Schmidii*. C. M.
 54. " *Nilgherrense*. C. M.
 55. " *uncinatum*. C. M.
- Gen. XXI. *Grimmia*.
 56. *Grimmia Nilgherrensis*. C. M.
- Class III. STEGOCARPI.
 Sub-Class I. ACROCARPI.
 Tribe. LEUCOBRYACEÆ.
 57. *Leucobryum Nilgherrense*. C. M.
- Tribe MNIODEÆ.
 Sub-tribe POLYTRICHACEÆ.
 †58. *Polytrichum* (*Catharinella*) *Neesii*. C. M.
 †59. " (*Cephalotrichum*) *perichætiæ*. Mont.
 †60. " (*Pogonatum*) *microstomum*. R. Br. P. urnigerum Montg. in Musc. Perrottetii.
- Sub-Class II. PLEUROCARPI.
 Tribe. HYPOPTERYGIACEÆ.
 †61. *Hypopterygium* (*Euhypopterygium*) *Struthiopteris*. Brid.
 Syn. II. 4.
 †62. " (") *tenellum*. C. M.
 †63. " (*Rhacopilum*) *Schmidii*.

Tribe. MNIADELPHACEÆ.

- 64.
- Mniadelphus Montagneanus*
- . C. M.

Tribe. HYPNOIDEÆ.

Subtribe. NECKERACEÆ.

- †65. *Rhegmatodon orthostegius* Mont. Kaitie on bark of trees.
 *66. *Fabronia* (*Eufabronia*) *secunda*. Mont.
 67. " (") *Schmidii*. C. M.
 68. *Neckera* (*Euneckera*, *Rhystophyllum*,) *aequalifolia*. C. M. n. p.
 †69. " (*Entodon*) *plicata*. C. M.
 †70. " (") *Perrottetii*. C. M.
 71. " (*Pterigynandrum*) *julacea*. Schw.
 *72. " (") *Indica*. C. M.
 *73. " (*Harrisonia*) *macropelma*. C. M.
 74. " (*Papillaria*) *leuconeura*. C. M.
 75. " (") *plicaeifolia*. C. M.
 76. " (") *breviramea*. C. M.
 77. " (") *hispida*, n. sp. Dioica?
 78. " (*Pilotrichella* *Schmidii*. n. sp.
 79. *Pilotrichum* (*Meteorium*) *punctulatum*, n. sp.
 80. " (") *reclinatum*, n. sp.
 †81. *Hookeria* (*Lepidopilum*) *Utacamundiana*. Mont.
 *82. *Hypnum* (*Aptychus*) *subhumile*. C. M.
 *83. " (*Taxicaulis*) *albescens*, Schw.
 *84. " (*Isothecium*) *Buchanani*. Hook.
 *85. " (*Pliacaria*) *Neilgherrense*. C. M.
 86. " (") *paraphysale*, n. sp.
 87. " (*Tamariscella*) *blepharophyllum*, n. sp.
 88. " (") *pristocalyx*, n. sp.
 89. " (") *tamariscellum*, n. sp.
 90. " (*Hypnodendron*) *Schmidii*, n. sp.
 †91. " (*Anomodon*) *consanguineum*. C. M.
 †92. " (*Homomallia*) *secundum*. Mont.

(To be continued.)

IX. *Introductory Report on the Natural History of the Pearl Oyster of Ceylon.* By E. F. KELAART, M. D.

[This interesting Report is republished from the *Ceylon Overland Observer*, not only with reference to its intrinsic value, but also to its important bearings upon the Pearl Banks belonging to the Madras Presidency, which have long been in an unsatisfactory state.]—ED. M. J.

Having understood that some account of my researches into the Natural History of the Pearl Oysters of Ceylon, is desirable, even at this early period of my labours, I shall endeavour briefly to sketch a Report, that can only be considered in the light of an Introduction to a more extensive and prolonged series of observations; which, if means are afforded me, may be brought to a more speedy conclusion than I have any prospect of doing at present.

Before I proceed to detail the results of my researches, since I was commissioned by His Excellency the Governor, in March last, to undertake this desirable investigation, I have to acknowledge the great facilities which the *aquarium* gives, for the investigation of the natural habits of Molluscs, and other moderately sized fresh and sea water animals. Without glass aquaria and a powerful microscope, I should not perhaps have obtained even that information on the minute anatomy and habits of the Pearl Oyster, which is embodied in this Introductory Report. Soon after my appointment, I ordered out large glass aquaria and other apparatus, which will be of service hereafter, to myself, or to those who may be engaged years hence, in reporting to Government, from time to time, the natural condition of the Oysters in their various banks. In the mean time, I have made use of large glass globes and Ceylon manufactured aquaria, made of thick crown glass, Roman cement and slate, purchased from the Naval Store. Large chatties too, and tubs, are also in use. The Oysters thrive best in chatties, but these do not afford the same opportunity of seeing their habits as glass sided aquaria. I have also, in addition to the above named means of observation, had perforated wooden boxes, with a few Oysters in each, deposited in various

depths of the sea; and latterly, I have used large canoes (ballams) for the same purpose;—lastly, though perhaps of most importance, I have had unexpected facilities of observation among the several small beds of Oysters found in the inner Harbour of Trincomalie. They are found of all ages and sizes, and various depths and different kinds of banks; so that no Naturalist has perhaps ever had the same opportunities of observing the habits of the Pearly Mollusc, as I have at present.

I cannot do better, than correct at the outset, some popular errors regarding the anatomy of the Pearl Oyster; and this I may perhaps do most simply, by describing, in a popular form, the external and internal structure of the species of Mollusc producing the best Pearls of Ceylon.

The Mollusc, generally known as the Pearl Oyster, found in the Banks of Arripo, Chilaw, Trincomalie Harbour, and other parts of the Island, does not belong to the same *genus* as the edible Oyster of Europe, although, in its internal structure it has a resemblance to it. The Pearl Mollusc resembles more the Mussel tribe than the Oyster; more particularly, as it has, like the Mussel, a byssus or cable by which it attaches itself to foreign substances, or to others of its kind. The only source of information that I know of on this subject, available to the Ceylon student, is to be found in "Lebeck's Account of the Pearl Fishery of Ceylon, 1797," to be seen in the Appendix to Captain Steuart's book. The description Mr. Lebeck gives, is very imperfect, and excites a smile in the modern Naturalist; but this imperfection is excusable, in any account written in the infancy of the science of Conchology, and when the Microscope was scarcely ever applied to anatomical studies of shells; at least not in Ceylon. The most glaring error in that description is the mistaking of "bluish spots" on the foot for "eyes," and the "ovaria" for "lungs." This Mollusc has no eyes; and the lungs, or gills, are in the front, far away from the stomach, and occupy the middle space between the hinge and the anterior edge of the shell, easily seen when the valves are open; they look like four, or two pairs, of whitish (in a few specimens the gills are of a black color) semilunar combs or bands, stretched from side to side.

I have carefully examined Oysters of all ages, and have noted the structure of the shell, and of the animal within it: which will form the subject of illustration in a future Report. In this, I shall briefly describe the animal; as it is of the greatest importance, that a correct knowledge be first obtained of the animal structure, before a physiological account of its habits can be properly understood.

Meleagrina margaritifera, Lamarck.	Mytilus margaritiferus, Linn.
Pearl Oyster, Eng.	Avicula radiata, Leach.
Pintadine mere perle, Fr.	„ margaritifera, Sowerby.
Mutu Chipi. Tam. & SING.	„ meleagrina, Blainville.

Conchologists have long agreed, that Lamarck was right in separating the "Pearl Oyster," *par excellence*, from the old genus *Avicula*, of which there are several species in Ceylon, some producing valueless pearls of a dusky blue and blackish colour. The only description of the Pearl Oyster of Ceylon I have access to, is Lamarck's, in his "*Histoire Naturelle des animaux sans Vertebres*," and that, too, is only of the shell.

"*Meleagrina, testa subquadrata, superne rotundata, fusco virente. Albo radiata, lamellis per series longitudinalis imbricatis, superioribus majoribus.*"—Lamarck, vol. 7, p. 107.

The Ceylon shell is a variety of that above described. The white radiating lines are alternated with rays of a red or black colour. Doctor Templeton made it appear, that the Ceylon variety corresponded with Leach's description of his *Avicula radiata*. I am more inclined to believe, that they are only accidental or occasional varieties. The shell however, appears to attain a larger size in America, and in the Persian Gulph, than in the Seas of Ceylon. In the largest Ceylon shells, the red or black radiating lines become obsolete. If they are permanent varieties, they are both found in Ceylon. I have a faint recollection of having seen both varieties on the Pearl banks of Arripo. I had also a small perfectly white Pearl Oyster; this may be an Albino specimen or Lamarck's *Meleagrina albina*. *M. testa albidia, irradiata, obsolete squamosa; auriculis duabus semper distinctis*, originally found on the coasts of New Holland and Van Diemen's Land.

On removing the animal from the shell, the whole of the internal part is seen enveloped in a membrano-muscular covering, called the "mantle," and known popularly in Ceylon as the "skin." The free border of the mantle lining each valve, dips downwards, to meet with a similar veil on the opposite side; thus forming a kind of double fringed veil. The one set of tentacular fringe, in immediate contact with the shell, is composed of hairy tentacles, looking horizontally forwards; the other, about three-eighths of an inch apart from the former, and lining the edge of the mantle, from side to side, looks downward, and dovetails with the tentacles of the opposite flap of the mantle. These tentacles consist of a series of long and short flat filaments—the long ones having lateral filamentous projections. The tentacles are exceedingly sensitive; and one would almost give them the power of seeing; for not only the touch of a feather, but the approach of one when the animal is lively and in good health, makes them draw forwards, and perfectly shut out the intruder. As these molluscs have no organ of sight, I have no doubt that the delicate nerves which are distributed through the mantle and its tentacular processes, possess in some degree the sense answering to vision in other animals, as well as of touch; for an Oyster will be observed rapidly to close its valves on the approach to the aquarium of a lighted candle, or even the approach of a hand, or the shadow of a person, near the glass sides of a vessel in which it is confined. I should not, in a popular Report, advert to this physiological subject, but that the senses of the Oyster have a great deal to do with its habits, not only in the aquarium, but also in its native bed. Were it not for these delicate fringes surrounding the mantle, the softer parts of the Oyster would easily become the food of a host of carnivorous creatures abounding in the sea; and many more Pearls would drop out of the shell, than do now with such sentinels at the entrance of its external rim. The mantle is the only organ the animal has for the formation of the shell. The increase of the lateral dimensions of which, and the formation of the pearly nacre, and the Pearls, depending upon the condition of this important investment. If it is injured, the pearly matter is not secreted in such abundance over the shell, or if by some cause it becomes retracted

the shell does not grow rapidly, and the mother-of-pearl lining is jagged at the edge, and is not of the usual brilliant colour. However, its temporary retraction facilitates the ingress of sand and other irritating particles, which doubtless become the nuclei of many pearls, as will be hereafter observed. The forepart of the mantle is coloured and rayed like the shell. The colouring matter is secreted by glands found in these parts. The glandular secretion serves the purpose of increasing the lateral and longitudinal dimensions of the shell. It is after this is deposited, that the pearly secretion (nacre) is applied to the inner wall of the shell, which, concreting or solidifying, increases its thickness. The pearly fluid is secreted by nearly the whole external surface of the mantle. It will be thus clearly understood, that when a grain of sand or the larva of an insect is introduced between the mantle and shell, it will become covered over with the pearly secretion; which always going on, is augmented at the part where the foreign matter lies. This phenomenon I have detected with the aid of the Microscope in the very earliest stage.

About one and a quarter inch from the rim of the shell, is seen a pair of gills like four segments of a circle, or semilunar combs, stretching transversely from one side to the other, the convexity looking forwards. There is a vacant space between the concave surface of the gills and the body of the Oyster. The *adductor* muscle, called "*grizzle*," is now seen, covered over with a delicate membrane. This muscle is attached to the inner surface of both shells. On one side (the left, when the Oyster is placed with the hinge next the observer) is seen a short, conical, tubular, sharp-pointed prolongation; this is the terminal end of the intestines; it looks like a sharp-pointed claw. The intestine is short: leaving the stomach, it winds round the *adductor* muscle, and terminates, as I have just remarked, on the side opposite to where the mouth is placed. There is always an unclosed space, between the edges of the mantle, when the tentacles are brought together, admitting of the free passage of excrementitious matter; and it was through the same opening between the mantle, that I observed, on one occasion, the ova escape, in a cloudy stream, which continued to pass into the water for nearly 15 minutes. I failed to detect the

immediate part of the animal through which the ova found their exit; and I have not been able to detect a regular oviduct. The ovaria, when distended with ova, cover nearly the whole of the stomach, heart, and liver, and project even on the conical cæcal process of the stomach, and also on the base of the foot. The stomach is very small, placed in the centre of the liver; the oesophagus is very narrow, scarcely admitting a moderate sized probe; it is about 3 lines long. The mouth situated near the hinge, behind the foot and byssus, is a horizontal slit, of about 3 lines in length, in the duplicature of the lower pair of labial palps. These palps are large, broad, truncated anteriorly, and rounded on the sides; the inner surface plaited, or rather grooved. The sense of feeling, or touch, is no doubt by this rugose structure, greatly increased. The palps serve the animal as organs of touch, if not of taste; they also serve to collect food, and give the animal the power of rejecting indigestible particles of matter, or such substances as might prove injurious.

I have, through the Microscope, ascertained the kind of food Pearl Oysters live on. This consists of minute algæ or weeds, animalcules and shells, called Foraminifera. Diatoms also, those minute vegetables forms which can scarcely be detected with the naked eye, are found growing on the external surface of the shell; where a host of infusorial and microscopical objects likewise find a pasturage. So that the Oyster may be said to carry on its back, the food upon which it lives. The siliceous internal skeletons of these Diatoms, I have detected in the excrementitious matter of the Oyster. It will be a subject for future inquiry, whether any of these sharp-pointed skeletons do not permeate the coats of the mantle, and thus become nuclei of Pearls. I have, on examination of "seeding" pearls found the skeleton of a *Navicula*, (species of Diatom) among the ova; but whether this proceeded from the stomach of the animal, or got there by passing under the mantle, it was not possible for me to determine.

The Pearl Oyster, like other Bivalves, (*Conchiferæ*) are Monœcious, or rather hermaphrodites; though, properly speaking, they can neither be said to belong to one or two sexes, for, with the exception of the presence of ovaria (or egg bags,) no other sexual

organ has been yet discovered. Doctor Johnson, in his valuable work on Conchology, remarks on *Conchiferæ*, "that every individual is sufficient to its own felicity." But however correct this may be, regarding the feeling of sexual gratification, it is clearly established by M. Rudolph Wagner, that in some Acephalous bivalves, as likewise in *Tunicata*, *Gasteropods* and *Polyps*, the ovaries of some individuals contain a milk fluid, instead of ova; and that this milky fluid contains *spermatozoa* (seminal animalcules). I have now to add the Pearl Oyster (*Meleagrina Margaritifera*) as another of the bivalve species of Mollusc, which has individuals with spermatozoa or seminal fluid, in organs similar to those which in a larger number of individuals contain ova, or eggs. It will not, perhaps, be necessary further to discuss this important subject, than to remark, that the Native diver's idea, that "there are male and female Pearl Oysters," is not altogether fabulous. The important part which the male Oyster must play in the formation of banks of Oysters, is self-evident, if it can be clearly established, that the ova absolutely require the vivifying influence of a male fluid. I have not seen more than three or four individuals with this milky fluid, in 100 Oysters; nor have I yet satisfactorily made out any difference in the characters of the shells of the two supposed sexes. The Native diver's opinion quoted by Captain Steuart and Mr. Lebeck, viz., that "the large flat ones they call males, and those that are thick concave, and vaulted, they call females, "Peedoo Chippy," is not borne out by my microscopical observations. I found well formed ova in Oysters which were broad and flat. It is quite possible, however, that in the course of this investigation, some external marks may be discovered, by which the male Oyster can be distinguished from the female. From the very small number of males (about 3 to 100) to females, I can easily fancy, that if by some natural or artificial cause, the males are destroyed, the banks will not be enlarged; and that in time they will become extinct, i. e., supposing the majority of Naturalists are correct in their present view of the Dioecious character of Oysters. It is just as likely, that Mr. Garner's opinion will ultimately prevail; viz., "that the organs called ovaria, do at certain periods, secrete the seminal fluid,

which impregnates the ova contained in them and is then discharged as an excretion by the oviducts." To this observation of Garner I have to oppose the fact, that not a trace of ova was seen in the ovaria of the supposed male Pearl Oysters, which were distended with the milky fluid at the time when the ovaria of other Oysters were distended with ova.

The last, though not the least important part of the animal, is the foot. This important member, which has so many useful services to perform in acephalous molluscs, requires a more than ordinary consideration. It is that long, brown, leech-like member, which is seen when the animal is at rest coiled up in a corner on the right side, above the byssus which, when protruding out of the shell, and moving about, gives one the popular idea of a tongue. It is of a dark brown colour above, and whitish beneath; in middle age it is speckled. It is composed of longitudinal and transverse muscular fibres, the latter interlacing between the former, which proceed in two columnar masses from each side of the *adductor* muscle; between the bundles or fibres, are placed the abdominal viscera. From its base is sent off, posteriorly, a glistening white fibrous band; this is attached to the duplicature of the mantle, near the angle of the valves. Thus, the foot is seen to be admirably adapted for locomotive powers; and also serves, by its connection with the *adductor* muscles, to lengthen or shorten the cable or byssus. The foot, in a full sized Oyster, is about two and a half inches long when extended; at rest, it is not more than one and a half inch in length. It is broad at the base, tapering, to a conical point; the upper surface is rounded and smooth, the lower flattened and grooved. The groove extending from the base, terminates at the point in an oval cup-like fosset. This groove is lined by a secreting membrane, and is an exact mould for the formation of the byssus, at the will of the animal. When it finds a necessity for making one, the foot is protruded out of the shell, and with the tip it seeks out a spot, where it can rest the terminal disc of the groove. If not satisfied with the substance or position of the stone or any other matter on which it rests, it removes to another more suitable spot; for a few minutes (say five or six, if the animal is strong) it rests, and is then retracted within the shell,

leaving behind a strong fibre with an oval disc, of the form of the groove in the foot. This whitish fibre is attached to the base of the foot at one end, and to the rock, or to the shell of another Oyster, at the other. In a day or two, this fibre becomes of a bronzed greenish colour, and looks like hair, with a broad flattened oval root attached to the rock. This process is again and again repeated, at intervals of a few minutes, till a sufficiently strong cable is formed. In a large Oyster, removed from the sea, upwards of fifty such fibres form a thick strong cable or byssus, which is attached to the base of the foot by a bifurcated fleshy root. The animal cannot detach the byssus from the rock to which it is attached, but it has the power of casting it off its own body and leaving it behind, (like a ship letting slip her cable and anchor in a storm, and sailing off to sea) in order to make another byssus, either on the same rock, or on any other convenient place.

I observed all this process in the aquarium at a very early period of my investigations; and was not surprised to find, that the Pearl Oyster having nearly the same organs as the Mussel, should form and reform its byssus. But I was agreeably satisfied in learning by these observations, that Captain Steuart, in his valuable and interesting Monograph on the Pearl Fisheries of Ceylon, was incorrect in denying to the Pearl Oyster this faculty. He states, that "*it is not believed that the Pearl Oysters have the power to detach themselves, or to remove at their own will.*" I have not only satisfied myself, and many friends who have seen the Oysters in the aquaria which I have established, that the Pearl Oyster can detach or unmoor itself, but likewise that it walks away with its foot foremost, and the shell behind; and does not, as Captain Steuart observes, "*move with its hinges in advance.*" This "shuffling" movement alone attracted Captain Steuart's attention, but it is an unimportant one; as all bivalves without a byssus have it, and it is independent of the will of the animal, owing to the valves being opened and closed for the purpose of respiration. How imperfect must Captain Steuart, a candid inquirer, now say, have been his long observations, when the Oyster is seen, night after night, taking a walk round the inside of a chatty, or mounting the glass side of a vivarium, forming, here and there, a byssus. It is most unfortunate, that he and

others should not have made these observations, (which are so simple in their nature, but yet conclusive of the possibility "of translating Pearl Oysters from their original rocky beds to other more convenient locations.")

Who can tell what the results might have been, had Dr. Wright's views been carried out? I know of my medical brother's Report (made I believe in 1803), only from the brief notice taken of it in Mr. Boyd's observations, and quoted by Captain Stuart, in the Appendix to his work (page 55). Mr. Boyd's observations clearly indicate, that Dr. Wright proposed, some thirty years ago, the transplanting the animals to places convenient for fishing them, when they arrive at maturity. Either Dr. Wright did not observe the facility with which the Oyster reforms its byssus; or he was misunderstood by Mr. Boyd, who remarks further on, "that surely as the animal has not the power of regaining its adhesion, after it is once detached, it cannot, when once broken away from its attachment, fix itself again, and must either perish, or be carried away by the current."

Now, it is very gratifying to me to be able to speak positively on this subject; and this I do hopefully, as I have observed the Pearl Oyster detaching itself spontaneously from its old moorings, in a glass vivarium and attaching itself to another part of the glass vessel, not once only but have noticed, that some Oysters will go through this process a dozen times, in less than a month. In addition to the above related facts, I have successfully established a colony of Pearl Oysters near Fort Frederick, in the open sea, at various depths; and have also Oysters which have been living for several months in wooden boxes, finger glasses, glass globes, chatties, and large canoes, sunk in the sea. Some were thrown into the sea, after being removed from the inner harbour and kept in my house in chatties and tubs for two and three days. The byssus of most of them had been broken and torn from the rock. These they have cast off, and are now living attached to each other, and to pieces of coral, and to rocks, exposed to all the influences of the sea.

When an Oyster is first put into a vivarium, it sickens, i. e., the mantle becomes retracted, and a collapse is observed;—in a

few hours it revives, but with few exceptions, it is on the third or fourth day, that the portion of byssus attached to the foot of the animal is shaken or cast off, and the animal puts out its foot and forms another near the spot where it lies; or walks, by a snail-like motion of its foot, to, or up the side of the glass, to the level of the water, and there fixes itself. Some of the Oysters which were thrown into the sea, are now seen growing on the sides of rocks, four and five feet from the bottom.

I am not surprised at these results, for the edible Oysters, without a byssus, have been known for ages to bear translating with advantage. If Oysters in artificial beds in England can live and breed. I see no reason why the Pearl Oyster should not do the same, and like the edible Oyster, yield a large revenue; or prove remunerative to private individuals, who may undertake the establishment of new banks.

I have one other subject, connected with the interior economy of the Pearl Oyster, to report upon; and this the microscope which Government aided me in procuring, has enabled me to investigate very satisfactorily.

My observations commenced about the middle of March last; although I was not officially connected with the Ceylon Government till the first of May. I have ever since made monthly observations regarding the fecundation of Oysters; with the following results. In March, and all through April, May and June, every Oyster I opened, young and old, contained ova in the ovaria, except the few which had the seminal milky fluid; so that the *Meleagrina*, like the edible Oyster is in spawn almost from its birth, a precocity serving a useful purpose no doubt; and its practical bearing easily understood. From July to the present date, the Oysters examined did not all contain ova; some of the ovaria were only half full; others contained a very small quantity. It will be very interesting to proceed with these monthly examinations, and to ascertain, whether the Oyster is only in spawn at certain periods of the year; and, if possible, to determine whether it spawns more than once in twelve months. Nearly all the 100 Oysters from the Pearl Banks of Arripo, kindly sent to me by Mr. Vane, contained

ova, their form preserved, although saturated with arrack. Under the microscope the ovum is seen to be pear-shaped; each measured 3-1000 part of an inch in diameter, at its broadest part; longitudinally it is 6-1000 with a short pedicle attached. I have calculated, with the micrometer, the number of eggs contained in the ovaria of an Oyster of five or six years of age, and I find that there cannot be less than twelve millions. Leuwenhoeck states, that ten million eggs exist in one European edible Oyster. If we consider how few of these millions of eggs can arrive at the mature condition of a living Oyster, and the great demand that man makes upon the species for his gratification; we can only see in this great fact, the bountiful provision made by the Creator for a wise and beneficial purpose.

In concluding this first Report, I shall briefly recapitulate the important discoveries I have already made.

(a) The Pearl Oyster is more tenacious of life, than any bivalve Mollusc I am acquainted with. It can live even in brackish water, and in places so shallow, that it must be exposed for three or four hours daily to the sun, and other atmospheric influences.

(b) That it has locomotive powers, beyond any idea which can be formed from former observations.

(c) That the power of moving from place to place, is inherent, and absolutely necessary, in early life, for the due performance of the animal functions. This is obvious from the fact, that if a cluster of young Oysters stayed permanently in one place, adhering to each other, the growth of the animal, and particularly of the shell, would be prevented.

(d) That the Pearl Oyster will move about in search of food, if the locality, in which it is originally placed, is not rich in its natural supplies.

(e) That it will move from its original situation, if the water becomes impure, either from the decomposition of vegetable or animal matter, or muddy; and, probably too, if there is a large influx of fresh water.

(f) That if the water is agitated to an inordinate degree, the Oyster will leave its old mooring place and seek another.

(g) That a thunderstorm will kill some in an aquarium. (Query,) Have thunder storms similar fatal effects on Oysters lying deep in the sea?

(h) That the animal can unfix itself from its byssus; and that crabs, shrimps, and other creatures, force them to form a new byssus, by nibbling through the old one.

(i) That it can re-form its byssus at pleasure, if in good health and condition.

(j) That it can live for a long time, without forming a byssus; and that it will re-form a byssus when it has recovered strength.

(k) That the power of re-forming its byssus, is not to confine the young animal; but that the largest living Oyster I have seen, can re-form it in an aquarium, as well as in the depths of the sea, but not so actively as the young and middle aged.

(l) Pearl Oysters are gregarious in their habits. In placing several young Oysters in different parts of an aquarium, they will sooner or later be found attached to each other. The older ones have also this desire; but their heavy shells impede their motion, and they are contented to remain apart from their fellows.

(m) That taking the foregoing facts into account, there appears to be no reason why Pearl Oysters should not be translated from their native beds, and made to colonise other parts of the sea.

(n) That the young, as well as the old, are in spawn from March to September; and that probably there is no stated period for spawning.

The whole occupation of the Oyster, when fixed to a spot, appears to be, keeping its valves open, and admitting food to its mouth. For several hours the valves remain open, they then close for a few minutes, or for an hour or two, then open again. At night, the valves remain generally open till towards daylight, when they close, and remain so till the sun shines brightly over the horizon. It is during the early part of the night, or soon after sunset, that they exercise, when required, their locomotive powers. I have watched the Oysters in aquaria for nearly a whole night;

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and they appear to be then active in moving and attaching themselves to new localities. During the day, I have only seen, on one occasion, an Oyster form a new byssus. This nocturnal habit, is doubtless instinctive precaution; for should Oysters move during the day, they are more likely to become the food of fishes, and other animals which prey upon them. Their movements are instinctive, and guided by the sense of touch. Darkness suits them better than daylight, of the difference of which they are very sensitive.

Most of the Oysters in which I have found Pearls, had external marks of having been retarded in their lateral growth, and displaced in early life from their fixed position on a bank. I am inclined to believe, that Oysters which have abundance of food, and are not disturbed, remain fixed for the last two or three years of their growth to one spot. These are less likely to have a large proportion of pearl bearing individuals among them. This of course requires more extensive practical observation, either on the beds in the harbour of Trincomalie, or on the Pearl banks of Arripo.

With reference to the formation of Pearls, I have nothing new to add to the accounts found in the best modern books on the subject; except that one, which modifies the view taken by Sir E. Home; viz. that Pearls are formed from abortive ova. I believe the ova left behind in the ovaria, are not the nuclei of Pearls, but that the ova which escape through the distended coats of an overgrown ovarium, and are imbedded in the interstices of the mantle, become nuclei of Pearls formed in this situation. I have repeatedly examined seed, or young pearls, in process of formation; and with a magnifying power of 1.5 inch lens, I was able to see distinctly, the outlines of two and three ova through the first or superficial layer of nacre, surrounded by groups of ova. It can be readily understood how an overcharged ovarium will, by some accident, or spontaneous evolution, have its coats ruptured, allowing the ova to escape and become inserted in the contiguous attenuated parts of the mantle. As Pearls are more usually found imbedded in the mantle near the hinge, the most likely place where the ovarium is liable to rupture, I consider this very conclusive of the new theory I have here proposed. I may also observe, that I

have seen the vestiges, or cicatrices, in the mantle where the Pearls once existed. Though Pearls originate in the mantle, when large they work their way out, and lie loose between it and the shell; or become attached to the "Mother-o'-Pearl" surface of the latter. I have no doubt that Pearls can work their way out from this position, and be found entangled in the meshes of the byssus. I also consider it very possible, that an over-distended ovarium is one of the causes of Pearls being discharged from the Oyster and lost. If this be really the case, it will easily account for the singular fact, that a sample of Oysters, fished in the month of October, will yield a larger proportion of Pearls, than a batch of Oysters fished from the same bank in the months of April and May of the following year. These observations are somewhat suggestive, and can be improved upon by future investigation.

I have now drawn to a conclusion this Report, which, I fear, has extended to a greater length than will suit the patience of the reader. But the subject being one which has been so long neglected and so little understood, I hope that the Government which has engaged my services, if they do not consider my endeavours as already productive of some practical results, will, at least, see in these researches, glimpses of future success. It is due to Sir Henry Ward, here to acknowledge my grateful thanks, in which my brother Naturalists in all parts of the world, I am sure, will join for the gracious manner in which my humble services have been retained, for investigating, fundamentally and practically, the Natural History of a species of Shell, which from the darkest ages of the world to the present, has been considered of inestimable value in producing one of the richest of gems. Time was, when the product of Pearl Oyster fisheries founded cities in South America and the Red Sea. But what is the state of the Islands in the Red Sea, "whose merchants were princes"? They are now thinly inhabited by a miserable race of fishermen. The sites of some of the Oyster banks in South America are not even now known; they have been destroyed by being overfished. New beds are doubtless forming in localities to be yet known to future generations. Ceylon Pearl banks were once on the point of sinking into the same state, but for the subsequent observance of more caution. I was present

at two of the largest fisheries ever made off Arripo in 1835 and 1836. The Oysters fished during the first half of the fishery were full sized, and yielded a good price, most of the speculators making handsome profits. Government was encouraged to pursue the fishery; young Oysters were taken up; many of the purchasers, inflated with former gains, purchased readily, and were ruined; and, I believe, to this day, these over, or prematurely fished banks, have not been very productive, although twenty years have since elapsed. If the same incautions and unscientific plan were adopted on the Oyster banks in England, similar results would soon be perceived there. Not a "native" would be had in London, nor even a cultivated one seen any where. If Government desires to have a steady, and not a precarious revenue, from Pearl Oyster fisheries, let good laws protect the beds already known, and those that are now forming; and let means be adopted to secure their increase and growth. In one year more Oysters are consumed in England, than were fished on the banks of Arripo last year; and this consumption is repeated year after year, without exhaustion; simply because the natural laws having been once found out, they are allowed to operate fairly. It will indeed be a very great source of satisfaction to me, if any of the natural laws I have described in this Report, suggest to Government, an improved system of management.

My attention has also been directed to the Natural History of the Tamblegam Oyster, *Placuna placenta*. I have a few still alive, which were translated in May last. If this Oyster can be successfully translated, the whole of Batticaloa lake might be converted into a large Ostrearium. The *Placuna placenta* has no byssus, and can, therefore, be more readily transported. Their removal from their native beds, does not necessarily destroy the internal parts. About one-third of the Pearl Oyster (*Meleagrina*), die from being injured by the force necessarily applied when detaching them from the rocks to which they adhere.

I have also lately "doctored" some Pearl Oysters, according to the plan adopted by the Chinese, in the case of the large fresh water mussel; but which method, I believe, has never been attempted with the real Pearl Oysters. Time, and further experi-

ence, are required, to ascertain the results of this practice in Ceylon. Dr. Gray, of the British Museum, has, I believe, by the application of the same means, succeeded in producing Pearls in the edible Mussel or Oyster of England. It may therefore be hoped that I shall eventually succeed with the Pearl Oyster of Ceylon. All that I can at present say, is, that they do not die under the operation, and that they are still living, having also reformed new byssuses. This is the only way the period required for the formation of good sized Pearls can be ascertained. There are some other points in the natural habits of the Pearl Oyster, which I reserve for future Reports, as precipitate conclusions may mislead the Government.

X. *Report on the Tamblegam Pearl Oyster Fishery.* By E. F. KELAART, M. D.

The Oyster found in the Tamblegam lake, and from which Pearls are obtained, is the *Placuna placenta*, "Vitre Chinoise" of some French writers, and the "Window Oyster" of English travellers in China—the shells, from their semi-transparency, being used for windows. The *Placuna* belongs to the same family of Conchiferous Molluscs as the edible Oysters of Europe and of this country. It has no resemblance (except slightly in the animal structure), to the shells of the Arripo Oyster (*Meleagrina*.) When full grown the valves (shells) measure, at their broadest transverse diameter, from 5 to 7 inches; and their longest longitudinal diameter is about the same; some, half an inch more. They arrive at maturity sooner than the *Meleagrina margaritifera*, and like the Arripo Pearl Oyster, the young also have ova. I am not able from my own observation (having been only a few months engaged in these researches) to say, in how many years this Oyster arrives at perfection.

But from the appearance of shells of all sizes, and the history of the Tamblegam Pearl fisheries since 1839, I should say, that in three years, this bivalve Mollusc attains its adult age; and, that after that, it dies. It appears to thrive best in brackish water, but a large influx of fresh water (from rivers) kills them. Instances have been known, when a large number of young and old Oysters died in Tamblegam lake, during some very rainy seasons when the rivers which empty into the lake brought down an unusual quantity of fresh water. If ever the channel, which was once proposed to be cut through the neck of land which connects the lake with the Trincomalie harbour, is made, this cause of mortality will more rarely occur, perhaps never again exist.

From the flattened formation of the shells, Pearls are very liable to drop out when the animal reaches its full growth; I would therefore fix, as the best period for fishing, the time when the animal has closed its supposed two year's age, or when the shell measures from $5\frac{1}{2}$ to 6 inches in transverse diameter.

I have inspected the Tamblegam bank this week, and am sorry to report, that there is no prospect of even an average good fishery before the middle of 1859. The banks have been overfished. The Natcha Cooda bank is completely destroyed. The renter in 1856, left scarcely any Oysters behind, and this portion of the bank will consequently be unproductive for many years, possibly yield none again, unless Government should re-stock it.

Nothing could have been more prejudicial to the interests of the Government, than to have leased out the bank by the year. The Government Agents who could have acted so unwisely as to lease out to Native renters a small bank of Pearl Oysters for three consecutive years, without any stipulation as to the size of the Oysters to be fished, must have lost sight of the natural laws of reproduction and multiplication of species, known even to the Native divers. It is therefore very gratifying to observe, that the present Government Agent, Mr. Morris, takes great interest in my researches; that he is alive to the importance of the Naturalist's opinion, and has recommended that all young Oysters be thrown back into the lake; a measure which I had the opportunity of sug-

gesting to his Excellency the Governor in March last, but which, I believe, was only partially acted upon, during the last Pearl fishery at Aripo.

I watched the number of Oysters fished during the two days I was lately at Tamblegam (Keenear), and have to report, that there could not have been less than 30,000, on each day. More than two-thirds of this number were young, and had better have been left in the lake for another year or more. The renter is evidently making the most of the few months he has yet liberty to fish or rather ruin the bank. The Tamblegam Wanniah, and all the divers, whom I questioned on the subject, stated that in the early part of the present year, more than 50,000 Oysters were fished daily. It is therefore impossible to arrive at any other conclusion, than that the former renters misrepresented the state of their finances, from the Pearl banks, when they got Government to remit some portion of the rent, and had the fishery resold for a smaller sum, to another Native,—a relative, I am informed, of one of the original renters.

All Oysters are very prolific, and the *Placuna* is not an exception to the rule; for, at the lowest calculation, in three years, there must have been fished from this bank, upwards of 18 millions of Oysters, supposing that there were only 200 fishing days in each year. The renters' share must have been (allowing five shillings for each thousand Oysters) nearly £2,250, from which, deducting the three years rent, viz. £901, they must have derived a profit of at least £1,250. To this profit must be added another source of gain, (a very ingenious one) from the divers' share of Oysters. The diver is allowed half the quantity fished, but he is not permitted to sell the Oyster at the best market, or to the highest bidder. He is obliged to open the Oysters when fresh, and sell to the renter all the Pearls, at a fixed rate, which the renter takes good care shall be below the market value. Any plan therefore, which may relieve the diver of this grievance, will, I am sure, be thankfully welcomed by at least 20 individuals, whose chief means of living is by diving for Pearl Oysters.

Oysters of upwards of two years of age, (i. e. about six inches broad) are worth at least ten shillings a thousand, but if there is

any competition, they may be sold for even fifteen shillings a thousand; for although the Pearls they produce are about two-thirds less in value than those from the Aripo Pearl Oyster (*Malagrina*), the quantity obtained in 1,000 Oysters, is at least three times more than what is obtained in a similar number from the Aripo banks.

Upon these circumstances, I have to submit for the future guidance of Government, the following proposals:

1st. That the banks be allowed to remain undisturbed for eighteen months after the termination of the present fishery.

2nd. The future fisheries to be conducted by Government Officers, and the Oysters sold to the highest bidder.

3rd. That the fishery be held only for two or three months in the year; say April, May and June, and that a sufficient number of boats be employed daily, so as to have the matured Oysters during this fishing period.

4th. That the banks be carefully watched, and placed under the immediate supervision of the Tamblegam Modliar, to whom a percentage might be promised on the net profits of each fishery which yields to Government more than £500. I suggest this percentage, well knowing, that any extra work thus thrown upon a Native official, will be badly performed, unless paid for according to the value of his labour.

5th. That no Oyster under $5\frac{1}{2}$ inches broad, be allowed to be removed from the banks.

6th. That a fourth share of the Oysters fished be *bond fide* the divers' share, which they shall be at liberty to dispose of to the best advantage for themselves.

7th. That those parts of the Tamblegam lake which have been denuded of Oysters by over-fishing, be re-stocked with young Oysters, found in the shallow parts of the lake, or near its margin; which if left in their present position, are very likely to be clandestinely removed at night, although the banks may be strictly watched.

8th. That Government endeavour to fish up the Oysters by dredging, instead of the present pernicious method of divers walking over most parts of the banks, searching for them with their feet; by which means, they crush the young Oysters and destroy the spawn.

This Oyster, having no byssus, is not attached to any hard substance; nor is it cemented, like some of the edible Oysters, by the hinge, or by one of the valves, to any subject, but lies either flat on the mud, or is fixed loosely in a semi-vertical position, with the wedge-shaped hinge buried in the mud. It follows, therefore, that they can be removed with great facility with the ordinary Oyster dredge.

The young Oysters taken by the dredge can be returned immediately to the lake; or collected and then deposited in some suitable place, previously selected by the supervisor.

I have no doubt, in my own mind, that by proper supervision and care, the Tamblegam lake Oyster Fishery, may be made to yield in a few years, at least £1,500 every second year. For the last 18 years, the average annual revenue to Government was only £344.

In order to secure this revenue for future years, it is necessary that the present renter's proceedings be watched; and, that he be obliged strictly to observe the condition of his bond, viz: "That the Fishery of the said Pearl banks shall be *carefully* and *prudently* carried on by the Renter and others, his servants, so as to cause no *damage* or *injury* to the said Pearl banks."

If, in the opinion of the Government, the above condition does not enjoin the renter to prevent divers taking up young Oysters, I think it will be worth while to pay him £50 or more, and take his lease from him; for at the rate he is now fishing, and bringing up daily 5,000 or 6,000 young Oysters, scarcely more than eight months old, and which cannot yield more than six-pence worth of Pearl in each thousand, even if they do that, the bank, which now promises to give a tolerably good fishery in June 1859, may, like the Natcha Cooda bank, be unproductive for many years. I would therefore suggest, that a Government Officer be immediately sent to the fishery to prevent further mischief being done.

I cannot help again observing in this Report, that it is worthy the attention of Government, to stock the various salt lakes of Ceylon with this species of Oyster. The lakes of Calpentyn, Putlam, Batticaloa and Hambantotte, if stocked with the "Window Oyster," will yield a very handsome revenue. I have availed myself

of the present opportunity to remove about 1,200 middle-aged Oysters (which the renter gave me) to Yard Core in Trincomalee harbour, where the muddy bottom promises to be suitable for breeding them. But the experiment should be made on a larger scale, to test the full value of translating these Oysters to new localities; this I am not able to do from want of funds to meet the necessary expenses. I have already, in my former Report on the Natural History of Pearl Oysters, reported, that some of the Oysters, which were placed in other parts of the sea in May last, are still living.

SELECTIONS.

On a true Parthenogenesis in Moths and Bees; a Contribution to the History of Reproduction in Animals. By CARL THEODOR ERNST VON SIEBOLD, Professor of Comparative Anatomy in the University of Munich. Translated by WM. DALLAN, F. L. S., &c. London: Van Voorst. 1857. 8vo, pp. 110.*

Among the many revelations of modern science, few have attracted more attention, or excited greater interest among naturalists, than the phenomena of Parthenogenesis; whether, with Owen, we regard this term as the appropriate designation of the alternation of dissimilar generations; or, with Siebold (and this, in our opinion, is the more correct), we restrict its application to the production of offspring "sine concubitu" from perfectly formed mothers. With regard to the former, Chamisso, as early as the year 1819, found in the Salpæ (a group of tunicated molluscs) that many species which are associated in long chains give birth to insulated individuals, which in their turn produce concatenated offspring; and these remarkable observations have been confirmed

by all who have examined these and kindred forms; and from the researches of Sars, Steenstrup, Siebold, and others, we arrive at the conclusion, that, in many of the forms of lower existence, animals produce offspring, which at no one time of their development resemble their parents; but which, however, in their turn bring forth a progeny which revert in their form and nature to the parent animal, so that the maternal animal does not meet with its resemblance in its own brood, but in the descendants of the second, third, fourth, or even more remote degrees of generation; and this has been proved to be the case in many of the Medusæ, Claviform Polypes, Salpæ, many Entozoa and Aphides; and, according to the assertions of some naturalists, in all the lower classes of animals; so much so, that we cannot avoid inferring that many animals described as belonging to distinct species are but the alternate generation of known forms. The phenomena of alternation of generation differ essentially from metamorphic changes; in metamorphosis we have changes taken place in the same individual; while in alternation of generation, or metagenesis, different and many individuals arise and are separated from the parent; besides, in the course of metagenesis, in many instances metamorphosis also takes place. In metagenesis we observe that in one alternation are produced distinct ovaries and ova; in the others the development does not take place from ova, but by a process of gemination; and in the isolated Salpæ, a remarkable organ (*Stolenroligerum*) has been described, whence are developed the concatenated offsprings.

These facts have gone far to solve a difficulty felt by some opponents to the "development theory;" it has been stated by the ingenious author of the "Vestiges," that if animals have not been developed since the creation, our first parent should have had deposited in their structure either all the human entozoa or their ova. The phenomena of metagenesis, however, may lead us to infer, that all human entozoa may be but alternate forms of those animals found in other creatures or elsewhere, and this is actually the case with one entozoon (*Cysticercus fasciolaris*) which in one form is found in the cat, in another in the rat or mouse. In true par-

* Dublin Quarterly Journal of Medical Science, May 1857, p. 403.

thenogenesis, phenomena of a totally different nature are exhibited—phenomena, the belief in the occurrence of which, did it rest on individual or questionable testimony, would gain but slight assent among the learned, but when we find such an array of names of naturalists who have mainly contributed to the advancement of natural science, all bearing testimony to the facts as related by Siebold, we cannot withhold our belief, that in many cases perfect offspring can arise “sine concubitu,” from animals fitted for a union of the sexes, and that in one species of insects at least the sex of the offspring depends on the entrance of spermatie filaments into the egg.

In the study of this most interesting work, we are struck with the circumstance, that science is often retarded by general or sweeping assertions, although emanating from high authority. When Castellet, in 1795, reported to Rëaumur, that he had found that a moth of *Bombyx mori* (silk-worm) laid perfect eggs, though unimpregnated, he received the laconic reply—“ex nihilo nihil fit.” How different in a similar case was John Hunter's reply—“But did they hatch?” for naturalists have not long been familiar with the circumstance that unimpregnated females will sometimes lay eggs; but these have hitherto been supposed to have been invariably incapable of being developed into a perfect animal. A common example of this is the occurrence of pullets' eggs, but these are notoriously incapable of being developed by incubation. At first blush we might be led to infer that reproduction without fecundation was impossible, so contrary does it appear to the usual course of nature, both in the vegetable and the animal kingdom. We observe what careful precautions are taken that the spermatozoa should reach their proper nidus uninjured: how many provisions are found to hedge around the safety of the pollen! Exceptional cases, however, do occur in the vegetable kingdom. The *Cælebogyne*, for instance, a dioecious plant from Australia, has produced fertile seeds at Kew, although the female only is known to botanists; and M. Lecoq had deduced from some experiments of his own, that similar phenomena occur sometimes in hemp, spurge, &c. Our author seems to have been fully aware of the

great caution required in carrying on an investigation of this kind, and to have devised his experiments accordingly.

In his introduction, he describes the seminal receptacle found in female insects. The existence of such a receptacle in bees, explains how it is that a queen, fertilized by a single coitus, after discharging a number of eggs in the first year, may again, in the following year and still more subsequently, lay eggs capable of development, because the seminal filaments are preserved in this receptacle uninjured, and in a quantity sufficient for successive broods. Siebold reviews at length the cases of alleged true parthenogenesis or “*Lucina sine concubitu*,” which are to be found recorded by many observers, and shows that errors may have occurred in the observation of these cases; one of the earliest on record is that of Albrecht, who in 1701 wrote a treatise—“*De insectorum ovis sine prævia maris cum femella conjunctione nihilominus nonnunquam fœcundis*.” He took a brown pupa, which he preserved apart, and yet the moth evolved therefrom laid fertile eggs. He says:—“*Cum masculum huic papiloni haud adfuisse certus essem, et propterea ejus ova subventanea et sterilia esse judicarem, vix amplius eorum habui rationem relictis interim iisdem oscitantius et sine omni curh sub dicto vitro per totum tempus hyemale*.” Dr. St. Blancard is stated, too, in 1696, to have had a spider which for four consecutive years laid eggs from which young spiders escaped, “although no male spider had ever appeared in the business.” Dumeril, Bernoulli, Treviranus, Burmeister, and others have made similar observations, but in all these instances the possibility of mistake has been shown by Siebold. This author then enters upon experiments which he performed on some sac-bearing Lepidoptera, particularly *Solenobia lichenella* and *triquetrella*, and by taking every precaution he convinced himself, and doubtless his readers also, that true parthenogenesis occurred in *Pyschides*. Examples in the honey bee next came under his notice, and in these investigations he was greatly assisted by the distinguished apiarian, Dzierzon. From accurate observations of the habits of bees, as well as from careful dissections, Dzierzon arrived at the singular conclusion, that drone eggs require no fecundation, and that true parthenogenesis is normal in these insects.

In the "Bienenzeitung" of Eichstadt, 1845, he thus expresses himself:—"Presupposing what will be referred to and proved in the following numbers, that the queen (female bee), to become good for anything, must be fertilized by a drone (male bee), and that the copulation takes place in the air.—I express the conviction, from which all phenomena and mysteries may be perfectly explained, that the drone eggs do not require fecundation; but that the co-operation of the drones is absolutely necessary when worker bees are to be produced." Again—"In copulation the ovaries are not fecundated, but the seminal receptacle, that little vesicle or knot, which in the young queen is filled with a watery moisture, is saturated with semen, after which it is more clearly distinguishable by its white colour; the activity of the ovaries in the normal state commences only after copulation, but it is not necessarily caused thereby; hence many unfecundated queens lay no eggs at all, while others lay only drone eggs; and even workers do the latter, although, from their want of a seminal receptacle, I regard them as quite incapable of copulation. I am convinced that such eggs are sufficient for the production of drones, whilst the egg from which a queen or worker is to be developed must come in contact with the seminal receptacle." In another place he thus writes:—"The queen has it in her power to deposit an egg just as it comes from the ovary, and as the unfecundated mothers lay it; or, by the action of her seminal receptacle, to invest it with a higher degree, a higher potency of fertility, and awaken in it a more perfect being, namely, a queen or worker."

Baron v. Berlepsch, of Seebach, has also contributed much to establish this theory of Dzierzon and by liberally placing his hives, furnished with Dzierzon's moveable comb-supports, at the service of Siebold, enabled the latter fully to confirm Dzierzon's views. Baron v. Berlepsch also performed three *experimental crucis*:—in the first he contrived the exclusion of a queen at the end of September, when there were no longer any males, and this queen, early in the ensuing year, furnished 1500 cells with a drone brood, the subsequent accurate dissections of Leuckart proving that this queen was a virgin. The second experiment exhibited considerable ingenuity. Knowing that a high or a low tempera-

ture causes the movements of spermatozoa to cease and become inert, he subjected a queen to a very low temperature in an ice-house; she recovered, and afterwards laid thousands of eggs, yet from all these were only males evolved. The third experiment was performed with the crossing of Italian and German bees. These, although of the same species, are found to differ most remarkably in appearance and disposition, and in the mixed breed which resulted, the drone offspring without exception presented the same variety as the queen-mother, thus affording a very strong negative proof that drone eggs do not require the interposition of the male bee. This matter has, however, been subjected to further proof by Leuckart and Siebold, for they examined freshly laid eggs, and in numerous instances they detected spermatie filaments in or on worker-eggs, while none could be found in drone-eggs. The experiments of Siebold upon this point seem to have been conducted with great nicety and care. He says:—

"I soon convinced myself that there was no possibility of discovering the delicate seminal filament between the granulo-vesicular yolk-masses, the linear object to be sought for was too subtle to be capable of discovery with certainty amongst the many mutually-crossing outlines of the yolk vesicles; after various vain endeavours to render the interior of the bee's egg accessible to an inquiring eye, I came at last to the idea of employing an artifice which I had soon acquired by practice, and which allowed me to survey at least a portion of the inner space of the bee's egg with great clearness and tranquillity. I crushed a bee's egg quite gently with a very thin glass plate, and so that it was ruptured at its lower pole, opposite to the micropylar apparatus, and the yolk gradually flowed out at this spot, by which a clear empty space was produced at the upper pole within the micropylar apparatus, between the egg-envelopes and the yolk which was retiring downwards."

Having thus microscopically examined the new-laid eggs of bees, he arrives at the following conclusion:—

"Amongst the fifty female bee-eggs examined by me with the greatest care and conscientiousness, thirty furnished a positive result; that is to say, in thirty I could prove the existence of seminal filaments, in which movements could even be detected in three eggs; of the other twenty eggs, twelve were unsuccessful in their preparation."

There was some difficulty in procuring drone-eggs for the purpose of examination, as the season was late; however, as Baron v. Berlepsch spared neither trouble nor his hives (of which he had 104 in his bee colony), twenty-seven drone eggs were procured, and of these the author states:—

"I examined these twenty-seven drone-eggs, which might have been about twelve hours old, and which agreed perfectly both in their appearance and organization with the female eggs, with the same care and by the same method, with which I had treated the female eggs, and *did not find one seminal filament in any single egg, either externally or internally.*"

Three of these only were unsuccessfully prepared, and the same queen, both before and afterwards, laid eggs from which worker bees were developed.

In the latter part of his work, Siebold enters on the consideration of the occurrence of true parthenogenesis in the silkworm moth, and details some very interesting observations on these insects. On a patient review of this subject, we can hardly withhold our assent from the propositions laid down by the author, and these views are considerably enforced by the strange facts detailed by other observers in regard to the prevalence and the absence of one or other sex among insects. Leon Dufour has stated, for example, that he never obtained a male insect of *Diplotlepis galleæ tinctorum*, of the genus *Cynips*.

A priori we should say, that this was a topic from which we could expect nothing of practical utility of industrial application, and yet we are told that Dzierzon and other in the bee colonies have turned it to material advantage.

[The importance of the results contained in Von Siebold's work, induced Professor Goodsir, of Edinburgh to communicate an abstract to the Royal Society. Mr. Dallas, soon afterwards published an able translation of the work itself.]—ED. M. J.

On a mode of protecting Timber from Fire. By Mr. ABEL.

[This Valuable Memorandum is specially worthy of the attention of Residents in Burmah and the Tenasserim Provinces, where the frequent occurrence of fire has proved so destructive, and where any arrangement insuring protection against the conflagration of wooden or thatched buildings would be most important]—ED. M. J.

From F. A. ABEL, Esq., Chemist of the War Department, Woolwich, S. E., 30th July 1857; to the Secretary East India Company.

I have the honor to address you upon a subject which I have been strongly recommended by Colonel SANDHAM, Commanding Royal Engineer at Chatham, to bring to the notice of the Honorable Court of Directors of the East India Company.

During the late War, I was called upon by the Engineer authorities to suggest some simple, cheap, and efficacious means for protecting wooden hutting from fire, and at the same time, I was instructed by the Secretary of State for War, to examine into the merits of certain proposals laid before him for the same purpose.

The result of my experiments on this subject was the preparation of a protective material applicable even after the erection of huts, in the same manner as whitewash, tar, or paint, and which was shown to afford such important protection to wood in case of fire, that experiments upon a proper scale were ordered by Lord PANMURE to be tried at the principal camps in Great Britain, and, at the same time, permission was given me by his Lordship to patent the material of which permission, however, I declined to avail myself.

It was subsequently arranged by the Inspector General of Fortifications, that a full trial of the value of the material should be made by Colonel SANDHAM and myself at Chatham. The accompanying abstract from the professional papers of the Royal Engineers contains a copy of our joint report to Lord PANMURE on the results of these experiments to which I beg most respectfully to call the attention of the Honorable Court of Directors.

Unfortunately, by the time that the merits of the protective coating in question were properly established, the huts at the various camps had been already coated with tar or other materials which did not admit of removal from the wood, except at considerable expense.

The silicate of soda and lime coating has however been tried and applied to a small extent at Aldershot and at Alderney.

Fifteen tons of the silicate of soda have moreover been sent by Government to China for the purpose of coating the hutting.

The advantages of the material referred to for coating timber may be embraced under the following headings.

1stly. The simplicity of its application.

2ndly. The circumstance that it forms an excellent protective to wood against weather, and may therefore be employed as a substitute for tar or paint.

The colour of the coating itself is nearly white; a small admixture of an ochre serves to remove the glazing nature of the coat.

3rdly. The cheapness of the material, the cost of coating ten square feet not exceeding two pence.

4thly. The great efficacy of the coating as a means of protection against fire, as demonstrated by the experiments detailed in the accompanying report.

Although personally impressed with the idea, that a knowledge of the existence of the material in question, open to general use without reserve, and emanating indeed from Government itself, must be of importance to the Honorable East India Company, I hesitated to adopt the step I am now taking, until I had consulted Colonel SANDHAM, who urged me strongly to lose no time in bringing the subject to their notice.

I beg to enclose a copy of the directions for preparing timber with the material which have been drawn up by desire of the Inspector General of Fortifications and to state that it will afford me pleasure to give any further information on the subject that it is in my power to afford should the Honorable Court of Directors feel desirous of taking it into consideration.

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From F. A. ABEL, Esq., *Chemist of the War Department, Woolwich, S. E.*, 27th August 1857.

I have the honor to acknowledge the receipt of your letter of the 26th instant, informing me that the Court of Directors of the Honorable East India Company have directed copies of my communication of 30th ultimo, and of printed directions to be enclosed to the several Governments in India.

With reference to the concluding paragraph of your letter referring to my statement as to the employment of silicate of soda in China, I beg to observe that from the quantity sent out (15 tons) and from the correspondence which I had at the time on the subject with the authorities at the War Office, there is no doubt that the silicate and lime is to be used in China as the coating material for the wooden erections required at the stations there, and has not been sent out as a matter of experiment.

Having heard that the great risk of fire arises from the thatching employed for the roofs of hut buildings in India,—I am anxious to state for the information of the Directors and of the Government of India, that the silicate of soda admits of very simple application to the thatching as a protective material.

The thatching would require soaking for a short time previous to use in a solution of silicate, and the thatched roof when dry should receive a thin coating of lime or clay stirred to a cream with solution of silicate.

It would probably be found advisable to renew the exterior coating of wash after the rainy season.

I beg again to express my readiness to furnish every information which may be required on the subject.

Remarks on the Protection of Wood from Fire. By F. A. ABEL, Esq., accompanied by a Report from Colonel Sandham, R. E., and himself.

The attention of practical men has been for some years past directed, from time to time, to the importance of affording to wooden erections some degree of protection from the effects of fire; and

numerous plans have been proposed, and to some extent tested, for lessening the combustibility of wood, and for covering its surface with a protective coating more or less unalterable by fire.

The simple application of lime or clay-wash, for example, has been found to afford some slight protection to wood, although the tendency of such materials to peel off the surface of the wood (into which they do not in any way penetrate), by exposure to heat, and the rapidity with which the coating is destroyed by atmospheric influence, render them very ineffective agents.

Several processes have been patented, even recently, for the protection of wood from fire. Some idea of the general nature of such processes will be conveyed by the following extract from an official report made on this subject:—

"The importance of obtaining an effective method of reducing the combustibility of wood, or even of protecting its surface from fire, has led to an examination into some of the methods of accomplishing this, which have been lately patented, and of the general nature of which the following is a brief statement.

I.—"*Mr. Maugham's Patent* consists in saturating dried wood with an aqueous solution of phosphate of soda and muriate or sulphate of ammonia, in certain proportions.

"It is believed by the patentee that these salts will be so affected by each other, and by the action of heat, that the fibres of the wood will be protected by an incombustible coating, while a quantity of vapour will be generated by the volatilisation, and partial decomposition, of the ammoniacal salts, which will possess the power of extinguishing flame.

"The same objects are believed to be obtained by—

II.—"*Lieutenant Jackson's Patent Process*, by which wood is impregnated with a solution of salts of zinc and of ammonia.

"The same means are adopted in both of these processes for saturating the wood.

"It is packed into large cylinders from which the air is then exhausted, the liquid being afterwards forced in with a pressure of 150 to 200 lbs., which is maintained during one or two hours. •

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It is the same method as that employed in patent processes for preserving timber from decay.

"I am not aware whether *Mr. MAUGHAM's* process has been submitted to any extensive practical test. Numerous experiments were however instituted on *Lieutenant JACKSON's* process, under the direction of *Mr. BRUNEL*.

"Specimens of seventeen different kinds of wood were prepared; corresponding pieces being kept unprepared, and others covered with a coating of paint. Their powers of resisting fire were tested by piling the prepared, unprepared and painted specimens round a perforated sheet iron surface, filled to the top with a bright coke fire.

"In most cases the prepared wood resisted the action of fire for a longer period, and, when removed from the fire, ceased burning sooner than the unprepared specimens.

"It was also evident that light porous woods were more efficiently protected than those of a denser character.

"There is no doubt therefore that the combustibility of wood is more or less diminished by either of the above methods of treatment, although the protective action must be ascribed to the indestructible compounds with which the wood is to some extent impregnated, far more than to the vapours evolved by the decomposition of the small quantities of ammoniacal salts forced into the wood.

"Although by the impregnating process adopted in the above patents, the preparative solution is believed to be forced into the very centre of the wood, it is essential, if such a result is to be obtained, that the solution should be weak, since it is impossible to force strong saline solutions thoroughly into wood.

"It is evident that the protective action of the salt cannot, under these circumstances, be very powerful.

"Were it possible, on the other hand, to employ stronger solutions, the expense of the processes would be considerable.

"The necessity of costly apparatus for impregnating the wood is also a matter of serious moment."

The patentees of some of the wood-preserving processes go so far as to state that they are enabled to render wood incombustible or unflammable, and such statements have tended to lead to the presumption that a thoroughly effective protecting agent should have the power of depriving wood of its combustibility.

It will be readily understood, however, that even if a piece of wood could be most thoroughly impregnated with a solution of some strength, of matter unalterable, or at any rate only fusible, by continued exposure to heat, the amount of protective material thus deposited in the pores of the wood, although it might be considered to surround each particle of fibre, would not prevent the destructive distillation of the wood by the effect of heat, the result of which would be the disengagement of inflammable vapours from the wood, and its ultimate complete ignition, if maintained for a sufficient period in the vicinity of highly heated or burning matter; or, if on the other hand, the protective agent employed be convertible by heat into vapours possessing the property of extinguishing such fire as they may completely surround, such vapours might have the effect of partially or completely extinguishing the fire in a piece of ignited wood, *after its removal from the source of heat or fire*, but otherwise the volume of vapour generated from the preparation used, would be but slight, as compared with the inflammable vapours evolved from the over-heated wood, and would have no perceptible effect on the combustion of these, while the scorched, or charred, woody fibre would be less efficiently shielded from the effect of flame than by the coating formed from an indestructible preparation.

It does not therefore appear reasonable to expect more from the most efficient protective coating or impregnating material than—

1st. That it should considerably retard the ignition of wood, exposed for some length of time to the effect of a high temperature, or of burning matter in its immediate vicinity.

2nd. That if the vapours which the wood will emit, by continued exposure to heat, become ignited, the flames thus produced shall not readily affect the fibre of the wood, and shall cease almost directly on the removal of the wood from the source of heat; and

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3rd. That prepared surfaces of wood, when in actual contact with burning unprepared wood, shall have little tendency to ignite, and thereby cause the fire to spread.

In addition to such processes as those above referred to, in which the protecting material is forced into the wood by the application of considerable pressure, trials have been made with agents of different kinds, in solutions or baths, in which the wood was steeped, or allowed to soak, for some hours, so that it might be in a slight degree impregnated with the material, or that a superficial coating of the protective might, at least, be formed.

Some of these methods have been made the subject of experiments by order of Lord PANMURE, with a view to test their merits.

One, proposed by W. C. SALOMONS, of Paris, consisted in immersing the dried wood alternately, in two baths; the one containing three parts of acid sulphate of alumina, and one part of glue, dissolved in six parts of water; the other consisting of two parts of dry chloride of calcium, one part of glue, and seven parts of water.

The objects which the inventor wishes to attain, by the use of these solutions, are, firstly, to impregnate the wood slightly with one of the salts (the chloride of calcium, for example), and then, by immersion of the wood in the second bath, to effect the decomposition of the first salt by the second, in the pores of the wood.

Thus the chloride of calcium and sulphate of alumina should become converted into sulphate of lime, and chloride of aluminum; the former an almost insoluble substance, the latter a soluble deliquescent body, possessing the property of converting the glue, employed, together with the salts, into an insoluble body—a species of leather.

The pores of the wooden surfaces are therefore, by the treatment in question, to be filled up by particles of a substance nearly insoluble, and unalterable by heat, which, together with the soluble salt, also present, are to be protected and united by means of the precipitated glue, which dries up to a hard, horny substance.

The experiments made with this process showed that the glue employed in the solutions greatly impeded the penetration of the wood by the saline matter, and also caused the decomposition of the salts to be very partial.

The protective property of the coating formed on the wood, prepared by this process, was not found to be considerable, while the expense of the materials was great, as compared with others equally efficient.

The successful results obtained on the Continent by the application of alkaline silicates, as protective materials, led to an examination into the comparative value of the cheapest of these, the soluble silicate of soda, as an agent for decreasing the combustibility of wood.

The property possessed by the soluble alkaline silicates, of being readily softened by hot water, and thus converted into a state of solution, while they are but slightly affected by cold water, renders their application to wood, either in the form of a bath, or as a wash, very simple. Their dilute solutions being readily absorbed by wood the surfaces of the latter, as it dries, assume the form of a hard coating.

The experiments made in the first instance with the silicate of soda, and the results obtained, are described in the following extract from the official report :—

“ Various specimens of dry wood were prepared with silicate of soda, by being soaked for a few hours in a weak solution.

“ Upon examining the interior of these, after the removal from the bath and subsequent desiccation, the silicate was found to have penetrated about a quarter of an inch on all sides.

“ On piling the above over a fire, together with specimens of unprepared wood, and others that had been prepared by different processes, the superiority of the silicate of soda, as a protective agent, was fully established.

“ Some specimens of wood were then simply painted with a moderately strong solution of silicate, and afterwards placed, together with unprepared wood, in a pool of coal-tar naphtha some of the latter being thrown over the surfaces of the wood.

Upon the results of these experiments being reported, an order was issued by Lord PANMURE to have the proposed process for

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the protection of wood from fire, practically tested at some of the camps or stations.

It was ultimately arranged that a proper trial of the process should be instituted at Chatham, under the direction of Colonel SANDHAM, R. E.

The nature of the experiments performed at Chatham, and the results obtained, are detailed in the following official report :—

Report on Experiments at Chatham, from Colonel SANDHAM, R. E., and F. A. ABEL, Esq., 1st March 1856; to the Inspector General of Fortifications.

Sir,

We have the honor to inform you that some experiments with silicate of soda applied in conjunction with lime-wash, as a means of protecting wood from fire, and of retarding its combustibility, have been made at Chatham, on a sufficient scale to determine practically the value of this agent, if applied as a preservative to camp-huts.

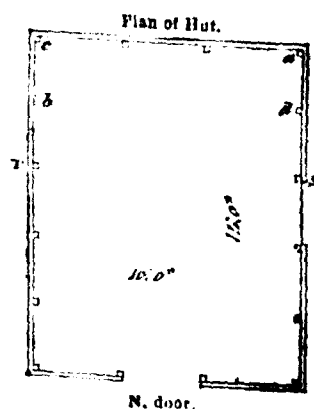
The following is an account of these experiments, and of the results obtained.

A small single-boarded hut was built in the model Battery, the material used in its construction being of the description usually employed for camp huts.

It was provided with one door, and a window-opening on one side, closed by a shutter.*

After the hut was completed, certain portions of it were prepared, on the 8th and 9th of January, with the silicate of soda in the following manner :

* The hut was 14 feet by 10 feet, 6 feet high at eaves, and 9 feet at ridge; it was constructed of $\frac{3}{4}$ inch deal weather boarding, on quarters and rafters of deal, 3 inch by 2 inch Door, 6 feet 6 inches by 2 feet 9 inches, of 1 inch deal, and window 3 feet by 2 feet, closed by a shutter of 1 inch deal. Floor of 1 inch deal, on dow 3 feet by 2 feet, the upper surface of floor being 6 inches above the fir joists, 4 inches by 2 inches, the upper surface of floor being 6 inches above the ground. Both sides of the walls from o to s, and from v to n, were prepared. The insides of the portions a b, c d were painted with common oil paint in three coats, that at a b being laid on the prepared part, while that at c d was laid on the unprepared part.



1st. The wood was washed over with a somewhat dilute solution of the silicate of soda, applied in the manner usually adopted for whitewashing walls.

2nd. After an interval of about two hours, a coating of thick lime-wash was applied, over that of the silicate.

3rd. On the following day, the prepared portions of the interior of the hut received, upon the lime, a second application of the solution of silicate of soda, a little stronger than that first applied.

Shortly afterwards the exterior prepared portion of the hut was similarly coated with the silicate.

The prepared wood therefore received.—

1st. A coating of dilute silicate of soda, which penetrated slightly into the wood, generally to the depth of about $\frac{1}{8}$ inch.

2nd. A coating of thin lime wash, and

3rd. A second coating of silicate of soda, which, acting chemically upon the lime, formed a hard protective coating with the latter on the wood.

Two opposite corners of the hut, with about one-third of each side, and a corresponding portion of the roof, were left unprotected.

One side of one of the unprotected corners of the hut received three coats of paint; a similar coating was applied, over the protective coating, to one side of a prepared corner. Some pieces of plank were also prepared with the silicate of soda, and lime, as described above.

Experiments with the prepared hut were unavoidably deferred until the 12th of February, 1856. During the interval the hut had been repeatedly exposed to very heavy rains; but although the light wood of which it was constructed was eventually completely saturat-

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ed with wet, the coating on the wood was not in the slightest degree injured, and could be removed, by knocking the wood, only in one or two places in the roof, where the surface of the boards was very rough, and the coating consequently less perfect.

EXPERIMENT 1.

A fire of wood, charcoal, and coke was kindled in a tall iron stove provided with numerous large openings in the sides, so as to admit of a great escape of heat in the neighbourhood of the boards.

“Immediately on the ignition of the naphtha, the wood was surrounded by flames, which soon fired the unprepared pieces, whilst those coated with the silicate only ignited after a time *at the edge*, and were scorched or baked by the heat, but not burned.

“A wooden hut, similar in construction to those at Aldershot, having been erected in Woolwich Marshes, for the purpose of testing the value of Phillips's Fire Annihilator, advantage was taken of the opportunity thus offered for trying, to some extent, upon a larger scale, the merits of the silicate as a protective.

“Shortly before the experiment took place, an application was made to me, by the officers of Royal Engineers, for the preparation, in some way, of a portion of the building with a protective agent.

“One part was painted, inside and out, with a mixture of lime and alum, which, however, was not found upon experiment to act as an efficient protective against fire.

“Another part of the hut was painted, inside and out, three times, with a solution of silicate of soda.

“Unfortunately for the fairness of the experiment, the building was constructed with a double boarding, so that it was only possible to coat or impregnate the planks, on one side. Nevertheless, the value of this agent was established beyond doubt.

“A large heap of shavings was lighted in the interior of the hut, against the coated portion of the wall. The flames played fiercely upon the latter for some minutes, but only succeeded in kindling one edge of a plank, and that portion did not blaze, but smouldered for a short time.

"By the heat of the fire, the salt was drawn to the surface of the wood, and fused, forming a glazing upon it.

"Subsequently, when the whole building was destroyed by fire, after unsuccessful attempts to extinguish it by means of the "Annihilators," the fierceness of the flames was such, that few materials could have withstood it: yet, of the exterior coated portion of timber, several planks remained.

"Upon examining these, the unprotected surfaces which had been directly exposed to the fire were found to be completely charred, but this charring had extended only to the point to which the silicate had penetrated from the other side of the plank.

"This experiment is considered to have proved that the silicate of soda is a very valuable protective agent, and that, even when simply applied as a paint, it will serve to protect wood for a considerable time from fire, and to retard greatly the spreading of a conflagration."

Shortly after the experiments above described were made, the possibility suggested itself of rendering the coating of silicate less destructible by exposure to wet, of increasing its efficiency as a protective, and of rendering its application more economical, by combining with its use that of ordinary lime-wash.

Some pieces of plank were prepared in the following manner; a dilute solution of the silicate of soda was first applied with a brush; when this had thoroughly soaked into the wood, and dried, a thick lime-wash (made by slaking some lime, and reducing the hydrate to a smooth wash of the consistence of thick cream) was applied, and lastly, after the planks had been exposed to the air for two or three hours, they were painted with a second solution of silicate of soda, somewhat stronger than that first used. The effects of the liquids thus applied, both upon the wood and on each other, will be more particularly pointed out in a report subjoined.

Several experiments, precisely similar to those described below, were made with the prepared planks, the results proving most satisfactorily that the protective coating resisted to a remarkable degree the action of heat, evinced no symptom of peeling off the highly heated surface of the wood, and protected the fibre to a great degree from the influence of flame playing upon its surface.

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The durability of the coating was tested by exposing prepared surfaces of wood to a continuous stream of water, and to heavy rains, for a considerable period. It was found that the rain had no effect upon the coating; in the other more severe test, the material was only to some extent removed, after a time, on that spot where the jet of water first impinged upon the wood.

A trial was made of the firmness of the coating, by applying heavy blows to the surface of the wood; the covering was only disturbed in one or two places, where the lime had been laid on rather too thickly.

The stove was placed in a prepared corner of the hut, at a distance of about 10 inches from the sides, and the fire was speedily raised to a sufficient degree to render the sides of the stove red hot in several places.

About one hour and a quarter elapsed, after the stove was well alight, before those portions of the sides nearest to the hottest parts of the fire evinced any symptom of igniting, although the wood was scorched, and to a great extent baked, in several places: those portions becoming at last so hot on the outside, that the hand could scarcely be placed against them.

At this point, the prepared side which had been painted, became ignited, the vapours emitted from it, by the baking of the wood, being very considerable. The remainder of the heated corner in flamed instantaneously, but the flame was not so powerful as that covering the painted portion.

After the first burst of flame from the prepared planks, produced by the ignition of the vapours baked out of the wood, the fire went down considerably and made but very little progress. Now and then a small burst of flame was seen on the outside, issuing from between the joints of the weather-boarding, but it was soon evident that the fire could only with great difficulty seize permanently on the prepared surface of the wood, and that it only spread very slowly by creeping along between the overlapping portions of the planking, which were unprotected, and between the quarter-

ings and the planks, where the surfaces of the wood could not be reached by the brush in the process of preparation.

Some pieces of plank, which had been piled against the stove in the building, having become inflamed, as also a small portion of the flooring, which was not prepared, a pail of water was thrown, from the doorway, at the stove, whereby the fire from the planks was extinguished; the water, however, scarcely reached the sides of the hut and did not affect the fire in the stove.

About an hour after the corner of the hut had been kindled, the stove, which had some time before partly fallen from some of its supports, so that it actually leaned against one side of the hut, protruded from the opening ultimately formed in the corner by the fire, which, though not interfered with, had confined itself almost to the immediate vicinity of the highly heated stove.

The latter was now removed from the hut through this opening, and a short time after, a little water was used to extinguish the fire which had been communicated to that part of floor over which the stove had been standing.

The fire which was burning here and there very slowly, in the corner of the hut, was left untouched.

EXPERIMENT 2.

Soon after the experiment above described had been commenced, and before the fire in the stove had produced any effect upon the hut, a pile of shavings and wood, with a little tar, was made in the opposite prepared corner of the hut, upon some loose prepared planks (laid down to save the unprepared flooring of the hut,) and, this having been kindled, a fierce fire was maintained for about ten minutes; the flames licking the sides of the hut and a portion of the roofing.

At the expiration of that time, the sides and upper corner of the hut were perceived to be burning in a few places, at the edges of the weather-boarding. A short time afterwards the pile of fire was withdrawn, upon which the prepared surfaces of the wood immediately ceased burning, and it was found that the fire had

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only to a slight extent seized permanent hold of the corner, in three places.

1st. At the bottom where two planks overlapped: the fire was soon extinguished spontaneously at this point.

2nd. About half-way up the corner between the back of the quartering and the weather-boarding, where the fire continued to smoulder on, consuming the unprepared portion of the wood in that spot.

3rd. In the upper corner, immediately under the roofing. At this spot, there was necessarily a considerable portion of wood (the backs of the joists, wall plates, and planking) which could not be reached by the preparation, and which therefore served as a hold for the fire.

It was interesting to observe how in this, as in the experiment first detailed, the fire slowly crept along those small portions of wood which had escaped preparation, in the protected corners (*i. e.*, the overlapping edges of the weather-boarding, and the backs of the quarterings); while the prepared surfaces of wood exhibited no tendency to carry the fire along, and were only consumed when in contact with other burning matter, or when surrounded for a length of time by flame from unprotected portions of the wood.

Although, at the expiration of about three hours, portions of the two opposite corners of the hut were still burning; and frequent gusts of wind served to fan the fire, it was found that the hut could be left, without fear of the fire spreading so as to become unmanageable.

Upon our returning to the hut, after the lapse of about half an hour, the fire was still found smouldering here and there in both corners, having extended very little farther along the unprotected portions of the wood, as above described, particularly between three of the joists, and in the corner immediately under the roofing.

The effects of the fire were watched for a short time longer, and the few burning places in the prepared corners were then extinguished by the application of a little water from a mop.

The above experiments showed that although the attempts to kindle the protected corners of the hut had ultimately succeeded, in one instance, by the maintenance of a fierce fire for several minutes against the wood, and in the other by the immediate vicinity, and even actual contact, of a highly heated stove with the wood, for a great length of time.—

1st. The prepared surfaces of wood, having been thoroughly baked, only burned as long as they were in close contact with burning, or highly heated matter, or for an instant when exposed to a powerful current of air; and did not possess any tendency to lead the fire along, this being only effected by the unprepared portion of the wood:

2nd. At any period during the four hours, for which time the fire was allowed to exert its uncontrolled effect upon the prepared portions of the hut, the burning parts of the building could have been with ease extinguished, by means of a couple of pails of water.

EXPERIMENT 3.

While the experiments with the hut were being carried on, some pieces of prepared and of unprepared planking were piled together in two similar heaps in the open air, and a fire of shavings and wood-chips was made up under them.

The comparative tardiness with which the prepared planks inflamed, and the difference in time required to effect the actual ignition of these and that of the unprepared planks was very evident, as was also the case with pieces of planks which had been piled up against the sides of the stoves in the building.

The prepared boards upon which the fire had been kept up in the corner of the hut were also examined, and found to be but little affected by their protracted contact with burning matter.

The wood had only caught at the edges, and was found smouldering there in two or three places.

By submitting the glimmering portion to the blast of a bellows, a small flame was produced, which went out immediately on the removal of the current of air.

EXPERIMENT 4.

In order to have convincing proof of the advantages of the preparation in retarding the ignition of wood, it was resolved to make experiments, similar to those described as Nos. 1 and 2; to observe the difference in time required for the ignition of the wood in the unprepared corners of the hut, and to ascertain the comparative power of the fire to extend, in these parts.

A fire was kindled in the stove placed in one of the unprotected corners of the hut. In about ten minutes after the stove had become thoroughly heated, the sides of the hut burst into flames, which at once rose to the roofing above, and kindled portions of it.

A heap of wood and shavings was lighted in the opposite unprepared corner, and in two or three minutes this portion of the hut was in flames.

The unprepared wood having been once kindled, the fire spread so rapidly as to be quite unmanageable in a few minutes, the flames completely filling the interior of the hut. But even under these circumstances, when the intense heat and fierce flames from the burning portions soon spread the fire to the prepared parts of the hut, it was remarkable how the flame crept along between the crevices and overlapping portions of the planks where the wood was unprepared, so that the prepared surfaces were always thoroughly surrounded by flame for a considerable time before they ignited. Some portions of the prepared planking, of which the wood had probably imbibed a rather larger quantity of silicate, in consequence of its greater porosity, offered great resistance to the fire to the very last.

We consider the experiments above detailed to have afforded conclusive proof on a practical scale, of the considerable power possessed by silicate of soda, applied simply as a coating, in conjunction with lime, of retarding the inflammability of wood.

It is, of course, impossible even by the thorough impregnation of wood with various substances, to deprive it of the property of burning; the only results to be attained by the use of a protective material are.—

1st. To shield the substances of the wood itself in a great degree from the effects of neighbouring fire, or of the vapours which will issue from over-heated wood, and burn on its surface, and.—

2nd. To deprive the wood to a considerable extent, of the power of carrying the fire along, thus rendering necessary the continued application of heat or fire from another source (such as an over-heated stove or unprotected portions of wood) in order to effect its thorough ignition.

An examination of the experiments just described will show that these results are obtained by the application of the silicate of soda to the wood. This substance may be obtained in any quantity at a very reasonable rate and the method of applying it is so simple, that the wood may be properly prepared with it by ordinary workmen.

It appears to us important that, if its application to new Camp huts should be determined upon, the wood to be employed in their structure should be completely coated with the preparation, before the erection of the buildings, in order to give the latter a fair chance of resisting the action of fire, reaching the wood from any quarter.

But even in buildings already erected, it is of importance that those portions which are in any way liable to possible exposure to heat or fire (e. g. the portions in the vicinity of stoves), should receive the very considerable protection which would be afforded by the application of the silicate coating, any covering of paint or paper having first been removed.

We beg to give it as our opinion that the efficiency of the protective agent in question has been sufficiently tested to obviate the necessity of further trials upon a large scale, and submit, in conclusion, that while the extensive employment of light wooden buildings for huts and temporary workshops, renders the application of some protective material to the interior of these, at any rate, a matter of great importance, it is of equal consequence that such an agent, if adopted for use in the service, should be easy of application and inexpensive, and that its employment should be as completely under the control of Government as that of any ordinary coating material.

The above report was accompanied by a communication relating to the cost of the application of the silicate coating, in which it was stated that, provided the silicate of soda employed has been prepared with especial reference to this application (i. e. so as to be readily and completely miscible with water,) one pound of the material is sufficient to prepare a surface of wood of ten square feet; while the wholesale price of the silicate, in the form of a syrup of a certain degree of concentration, is twenty pounds per ton; so that the cost of the silicate, required to prepare the wood, is at the rate of about two-pence for a surface of ten square feet.

Experiments are just now being carried on, with a view to impart to the silicate coating the appearance of paint, by combining the use of different colouring matters with that of the lime.

The following are the directions adopted for general guidance, in preparing wood with the coating of silicate of soda and lime.

DIRECTIONS FOR COVERING TIMBER WITH A PROTECTIVE COATING OF THE SILICATE OF SODA AND LIME.

Materials employed.—The silicate of soda, must be in the form of a thick syrup, of a known degree of concentration, as manufactured by Messrs. SIMPSON and Co., Kennington Road, London.

The lime-wash should be made by slaking some good fat lime, rubbing it down with water until perfectly smooth, and then diluting it to the consistency of thick cream.

Treatment of the Wood.—The protective coating is produced by painting the wood, firstly with a dilute solution of silicate of soda; secondly, with the lime wash; and lastly, with a somewhat stronger solution of the silicate.

The surface of the wood should be moderately smooth, and any covering of paper, paint, or other material should be first removed entirely, by planing or scraping.

A solution of the silicate, in the proportion of one part by measure of the syrup to three parts of water, is prepared in a tub, pail, or earthen vessel by simply stirring the measured proportion of the silicate with the water, until complete mixture is effected.

The wood is then washed over with this liquid, by means of an ordinary white-wash brush, the latter being passed two or three times over the surface, so that the wood may absorb as much of the solution as possible. When this first coating is nearly dry, the wood is painted with the lime-wash in the usual manner.

A solution of the silicate, in the proportion of two parts by measure of the syrup to three parts of water, is then made; and a sufficient time having been allowed to elapse for the wood to become moderately dry, this liquid is applied, upon the lime, in the manner directed for the first coating. The preparation of the wood is then complete. If the lime-coating has been applied rather too thickly, the surface of the wood may be found, when quite dry, after the third coating, to give off a little lime when rubbed with the hand. In that case, it should be once more coated over with a solution of the silicate, of the strength prescribed for the second liquid.

Directions for Covering Timber with a Coating of the Silicate of Soda and Lime, as a Protective from Fire.

MATERIALS EMPLOYED.

THE SILICATE OF SODA must be in the form of a thick syrup of a known degree of concentration, and is diluted with water when required for use according to the prescriptions given below.

The lime-wash should be made by slaking some good fat lime, rubbing it down with water until perfectly smooth, and diluting it to the consistency of thick cream.

TREATMENT OF THE WOOD.

The protective coating is produced by painting the wood, firstly with a dilute solution of Silicate of Soda; secondly with the lime-wash; and lastly, with a somewhat stronger solution of the Silicate.

The Surface of the wood should be moderately smooth, and any covering of paper, paint or other material, should be first removed entirely, by planing or scraping.

A solution of the Silicate, in the proportion of one part by measure of the syrup to four parts of water, is prepared in a tub, pail or earthen vessel by stirring the measured proportion of the Silicate

first with a very small quantity of the necessary water until a complete mixture is produced, and then adding the remainder of the water in successive quantities, until a perfect mixture in the requisite proportions is obtained.

The wood is then washed over with this liquid, by means of an ordinary white-wash brush, the latter being passed two or three times over the surface, so that the wood may absorb as much of the Solution as possible. When this first coating is nearly dry, the wood is painted with the lime-wash in the usual manner.

A solution of the Silicate, in the proportion of one part by measure of the syrup to two parts of water, is then made as above described; and a sufficient time having been allowed to elapse for the wood to become moderately dry, this liquid is applied, upon the lime, in the manner directed for the first coating. The preparation of wood is then complete. If the lime coating has been applied rather too thickly, the surface of the wood may be found, when quite dry after the third coating, to give off a little lime when rubbed with the hand. In that case, it should be once more coated over with a solution of the Silicate of the first-named strength.

(Signed) F. A. ABEL,

ROYAL ARSENAL WOOLWICH. *Chemist of the War Department.*

NOTE.—[The Marquess Origo, Commandant of the firemen at Rome, dipped the dresses of his men in a solution of Sulphate of Alumina and Sulphate of lime. Clothed in these suits, and their faces covered with incombustible masks, they traversed burning buildings without injury. *Journal of the Royal Institution of Great Britain*, 1831, p. 164.]—ED. M. J.

SCIENTIFIC INTELLIGENCE.

Scientific Mission to India.

An important paper has just been read to the Academy of Sciences on a mission sent to India and Upper Asia in 1854, by the King of Prussia and the East India Company. The members of the mission consisted of three brothers, MM. Herrmann, Adolphus, and

Robert Schlagentweit, two of whom, MM. Herrmann and Robert, returned in June last; the third, M. Adolphus, is still among the Himalaya mountains, and is expected soon to return, *via* the Panjab and Bombay. During the winter of 1854-55, these enterprising travellers visited the region lying between Bombay and Madras; in the following summer M., Herrmann explored the eastern parts of the Himalaya, the Sikkim, Bhootan, and Khasia mountains, where he measured the altitudes of several peaks. The highest of all the summits known throughout the world appears, by his measurements, to be the Gahoorishanka, situated in the eastern portion of Nepal—the same announced as such by Colonel Waugh, but called by him Mount Everest, because he had been unable to ascertain its real name in the plains of Hindoostan, where he effected his measurement. This peak is somewhat more than 29,000 feet in height, and bears another name in Thibet, where it is called Chingomari. The other two brothers penetrated by different roads into the central parts of the Himalaya, Kumaon, and Gurwhal; they then visited Thibet in disguise, entered the great commercial station of Gartok, explored the environs of Lake Manasarowr, and that remarkable crest which separates the waters of the Indus from those of the Dihong, often erroneously called the Burrampooteer. They ascended the Ibi-Gamine, 22,260 feet in height, that being an altitude never before attained in any part of the world. After having been separated from each other for a space of fourteen months, during which M. Robert ascertained that the table-land of Amarkantak, in Central India, which is generally stated to be 8,000 feet above the level of the sea, is not more than 3,300 feet in height, the three brothers again met at Simla, previous to commencing the operations intended for the summer of 1856. M. Adolphus, on leaving that place, crossed the Himalaya, went over Thibet, Baltistan, and visited the interesting spot where several mountain crests meet, and the Hindoo Koosh joins the range lying to the north of India. He then returned to the Panjab through the valley of Cashmere. MM. Herrmann and Robert proceeded to Ladak by different routes. Under good disguises, they were enabled to penetrate into Turkistan, proper by crossing the Karakoram and the Kuenlun mountains, and descending into the great

p. 169 of the last volume of this Journal. He had just been appointed to the Forest department, where his careful habits of inquiry, and his exactness gave the promise of his being a valuable assistant. Putting private feelings aside, we could not refrain as editing this Journal, from recording the early death of this earnest and hopeful Naturalist. It is worthy of remark, that Mr. Drew first suggested the preceding notice of Dr. Schmid, which he himself was well qualified to have undertaken, but it devolves upon the Editor to chronicle both the old and young.

III. MR. WALKER. Among the losses that have recently been sustained in the scientific circle of India, few are more to be regretted than the late HENRY WALKER, who filled the chair of Physiology and Comparative Anatomy, in the Calcutta Medical College. After two years of frequent illness and repeated warnings, which unfortunately were neglected, he was induced to leave India on Sick Certificate in March last. It was too late. Shortly after his arrival in London, he became rapidly worse, and sunk under an attack of the most recent form of his ailments, disease of the kidneys, on the 22nd May, 1857 at the age of 53.

Mr. WALKER was born of humble parents at Huddersfield, where he received his early education, and choosing the profession of Medicine, he served his apprenticeship to a Surgeon of that town. He afterwards prosecuted his studies in London, Paris and Berlin, where he was for three years, the pupil of the eminent Physiologist MULLER, and imbibed that taste for comparative Anatomy, which he afterwards pursued with such vigor.

It was not till 1839, when he had attained the mature age of 36, that he received his appointment to the Bengal Medical Service. His first employment was that of Civil Surgeon at Gowahatty in Assam, where he devoted himself with ardor to the study of Natural History. Two years later, he was nominated by Lord AUCKLAND, Surgeon of the Body Guard, in which capacity he accompanied Lord ELLENBOROUGH, in the Gwalior Campaign which led to his being appointed personal Surgeon to the Governor General, a post which he continued to fill under Lord ELLENBOROUGH's successor. He attended Lord HARDINGE throughout the Sutlej Campaign, for

his services during which he was thanked in the General Orders of 14th February 1846, and received the offer of the Superintending Surgeoncy of the Gwalior Subsidiary Force, one of the most lucrative posts in the service. Influenced, however, by a desire to take part in the organization of the Medical College, which had been for some time projected, he preferred waiting for the establishment of that Institution, which took place towards the close of the following year. He was then appointed Professor of Anatomy and Physiology, and notwithstanding an ill judged reduction of the salary, which left him in very straitened circumstances, he devoted himself with the ardor of his character to the advancement of the Institution and to the improvement of his class, resisting the temptations of private practice, which his high professional attainments would have ensured, that he might apply himself more exclusively to his Collegiate labors. In 1855, he was appointed Professor of Comparative Anatomy, in addition to the Department he already held, but he refused to be made Principal of the College out of delicacy to his colleagues, whom from a too scrupulous feeling he felt unwilling to supersede.

It was shortly after this, that his health began to fail, and he was only prevented by want of means occasioned by the niggardly salary attached to his appointment, from having recourse to the advice again and again urged upon him, of recruiting his shattered health by returning home.

Every year during the College vacation, he repaired to the Coast of Arracan, for the purpose of studying the numerous remarkable animal productions in which a tropical sea so richly abounds. His notes and dissections accompanied by elaborate drawings of Molluscs, Annelides and Radiated Animals were prepared with sedulous care and scrupulous accuracy. His researches among the naked Molluscs, particularly in the families of the *Nudi*, *Tecti* and *Infero-branchiata*, and the *Tunicata*, were rewarded by the discovery of numerous new and interesting forms, which he investigated with singular patience and success. The collections amassed during eight years of continued labour, contain a store of materials of the greatest value in some of the least known departments of Zoology, which he fondly hoped one day to give to the public himself, but

which it is hoped, will still be suffered to see the light. It is earnestly to be desired, that the task of editing his papers may be committed to competent hands, for we are well assured that if adequately treated, they will prove a lasting and worthy monument of one who was eminent not only for the zeal and ability which distinguish the votary of science, but for those high minded, disinterested and generous qualities that do honor to the man, and which in him were carried to an almost morbid extent.

NOTICES OF BOOKS.

Thwaites's Enumeration of the Plants of Ceylon.

Under the above title, we are happy to find from the Kew Miscellany, that Mr. Thwaites is preparing a work on the plants of Ceylon, giving a correct list of all the hitherto described species, together with generic and specific characters of such as are new. The enumeration will comprise (we understand) the Phanerogamia and Ferns. We should be glad to find, that it includes the lower orders of Cryptogamia also, for there is no man better able to undertake the Flora of that Island, or to develop the resources of the Colony.

The list of species, indigenous to the Island, as contained in the Peradenia Herbarium is nearly 3,000. Dr. J. D. Hooker, assists Mr. Thwaites in determining the correct nomenclature by verifying his species in the magnificent collection at Kew. The description of the new species will be in Latin, but the notice of "uses, &c." in English. Mr. Thwaites is now on a tour through Bintenne and the Eastern parts of the Island, enlarging his knowledge of their vegetable productions, with a view to a general introduction to the Enumeration.

Missionary Travels and Researches in South Africa, by David Livingstone, LL.D., D. C. L. London. John Murray, Albemarle street, 1857, 8vo. pp. 688.

The publication of Dr. Livingstone's *Discoveries*, has rendered it an easier task than usual to name the most important book of the year. The demand for copies has surpassed all experience in works of a similar description. We learn from the English Press that the avidity with which both the mercantile and the religious world have seized upon its information, may be expected, in time, to produce the most gratifying result. It is understood that Dr. Livingstone will depart for Loanda again immediately.

Of the *Tsetse*, a venomous fly, we have the following extraordinary history. This insect, the *Glossina morsitans*, "is not much larger than the common house-fly, and is nearly of the same brown colour as the common honey-bee; the after part of the body has three or four yellow bars across it; the wings project beyond this part considerably, and it is remarkably alert, avoiding most dexterously all attempts to capture it with the hand, at common temperatures; in the cool of the mornings and evenings it is less agile. Its peculiar buzz when once heard can never be forgotten by the traveller whose means of locomotion are domestic animals; for it is well known that the bite of this poisonous insect is certain death to the ox, horse, and dog. In this journey, though we were not aware of any great number having at any time lighted on our cattle, we lost 43 fine oxen by its bite. We watched the animals carefully and believe that not a score of flies were ever upon them. A most remarkable feature in the bite of the tsetse, is its perfect harmlessness in man and wild animals, and even calves so long as they continue to suck the cows. We never experienced the slightest injury from them ourselves, personally, although we lived two months in their *habitat*, which was in this case as sharply defined as in many others, for the south bank of the Chobe was infested by them, and the northern bank, where our cattle were placed, only 50 yards distant, contained not a single specimen. This was the more remarkable, as we often saw natives carrying over raw meat to the opposite bank with many tsetse settled upon it. The poison does not seem to be injected by a sting, or by ova placed beneath the skin, for when one is allowed to feed freely on the hand, it is seen to insert the middle prong of three portions, into which the proboscis divides, somewhat deeply into the true skin; it then draws

it out a little way, and it assumes a crimson colour as the mandibles come into brisk operation. The previously shrunken belly swells out, and if left undisturbed the fly quietly departs when it is full. A slight itching irritation follows, but not more than in the bite of a mosquito. In the ox, this same bite produces no more immediate effects than in man. It does not startle him as the gad-fly does; but a few days afterwards the following symptoms supervene: the eye and nose begin to run, the coat stares as if the animal were cold, a swelling appears under the jaw, and sometimes at the navel; and, though the animal continues to graze, emaciation commences, accompanied with a peculiar flaccidity of the muscles, and this proceeds unchecked until, perhaps months afterwards, purging comes on, and the animal, no longer able to graze, perishes in a state of extreme exhaustion. Those which are in good condition often perish soon after the bite is inflicted with staggering and blindness, as if the brain were affected by it. Sudden changes of temperature produced by falls of rain seem to hasten the progress of the complaint; but in general the emaciation goes on uninterruptedly for months, and do what we will, the poor animals perish miserably. When opened, the cellular tissue on the surface of the body beneath the skin is seen to be injected with air, as if a quantity of soap bubbles were scattered over it, or a dishonest awkward butcher had been trying to make it look fat. The fat is of a greenish-yellow colour and of an oily consistence. All the muscles are flabby, and the heart often so soft that the fingers may be made to meet through it. The lungs and liver partake of the disease. The stomach and bowels are pale and empty, and the gall-bladder is distended with bile. The symptoms seem to indicate what is probably the case, a poison in the blood; the germ of which enters when the proboscis is inserted to draw blood. The poison-germ, contained in a bulb at the root of the proboscis, seems capable, although very minute in quantity, of reproducing itself, for the blood after death by tsetse is very small in quantity, and scarcely stains the hands in dissection. I shall have by and by to mention another insect, which by the same operation produces in the human subject both vomiting and purging. The mule, ass, and goat enjoy the same immunity from the tsetse as man and the game."

Scarcely less surprising is his account of African Melons. "But the most surprising plant of the Desert is the 'Kengwe or Keme' (*Cucumis caffer*), the Water Melon. In years when more than the usual quantity of rain falls, vast tracts of the country are literally covered with these Melons; this was the case annually when the fall of rain was greater than it is now, and the Bakwains sent trading parties every year to the lake. It happens commonly once every 10 or 11 years, and for the last three times its occurrence has coincided with an extraordinarily wet season. Then animals of every sort and name, including man, rejoice in the rich supply. The elephant, true lord of the forest, revels in this fruit, and so do the different species of rhinoceros, although naturally so diverse in their choice of pasture. The various kinds of antelopes feed on them with equal avidity, and lions, hyænas, jackals, and mice, all seem to know and appreciate the common blessing. These Melons are not, however, all of them eatable; some are sweet, and others so bitter that the whole are named by the Boers the 'Bitter Water-melon.' The natives select them by striking one Melon after another with a hatchet, and applying the tongue to the gashes. They thus readily distinguish between the bitter and sweet. The bitter are deleterious, but the sweet are quite wholesome. This peculiarity of one species of plants bearing both sweet and bitter fruits occurs also in a red eatable Cucumber often met with in the country. It is about 4 inches long, and about $1\frac{1}{2}$ inch in diameter. It is of a bright scarlet colour when ripe. Many are bitter, others quite sweet. Even Melons in a garden may be made bitter by a few bitter Kengwe in the vicinity. The bees convey the pollen from one to the other."

Decandolle's Prodromus Systematis naturalis Regni Vegetabilis.—We have just received the second part of the fourteenth volume, comprehending Thymelæaceæ by Meisner, and Santalaceæ by Alph. deCandolle, two volumes more are expected to complete the Exogens. Professor Anderson undertakes the difficult task of elucidating the Salicaceous order. Dr. Buek of Hamburg, to whom Botanists were indebted for an admirable index of the first seven volumes, has now in the press a second index up to the end

of the 13th volume, thereby doing good service to the cause of Botany. It is computed that the 14 volumes actually completed, contain 50,509 species, arranged in 4,525 genera. The first volume was commenced in 1822. When the work is finished, we will have a complete systematical account of all plants known at the time of publishing the several volumes.

Hooker's Journal of Botany.—We find from the December Number of the *Kew Miscellany*, that Sir William Hooker's very useful Journal has ceased to appear. Under one form or another this veteran Botanist has published since 1827, much of his most interesting correspondence with men of Science and travellers of every grade and in every clime. We fear that the cessation of this periodical will be felt by very many besides ourselves. The Journal of the Linnean Society, and the Annals of Natural History in London, and the New Philosophical Journal in Edinburgh are now the remaining media through which communications on Natural History may be brought before the public.

Journal of the Proceedings of the Linnean Society.—Six numbers of this admirable serial have reached us, appearing quarterly and containing papers on Natural History read before the Society, and not inserted in its "Transactions." The Zoological and Botanical Papers are separately paged, so that either section may be taken separately.

The "Journal of Proceedings" for the present year is sold to the public at 12s. for the entire Journal, or 8s. for either the Zoological or Botanical section taken separately; the separate numbers being charged 3s. for the whole, or 2s. for either section. There are some valuable Zoological papers by Professor Owen and others—and a series of sketches of the Natural Families of Indian Plants, "*Præcursores ad Floram Indicam*," by J. D. Hooker, M. D., and T. Thomson, M. D., which we hope to give in the selections of our next number.

The Plant Scenery of the World; a Popular Introduction to Botanical Geography.—By John H. Balfour, A. M., M. D., &c., and Robert Kaye Greville, L. L. D., &c. with Illustrations.

We are enabled to announce with great pleasure the prospective appearance of this work, which is intended to illustrate something in the style of Humboldt's "Aspects of nature," the physiognomic effect of certain species, and families of plants in representing the scenery of different parts of the Globe. The descriptions will be accompanied with Chromo-lithographs of great artistic merit.

Any persons possessing drawings or photographs of interesting plants, such as would be easily recognized in a picture, will confer a benefit upon the authors by permitting them to be copied. The Editors of this Journal will be happy to receive, and forward any such contributions.

PROCEEDINGS.

The Managing Committee of the MADRAS LITERARY SOCIETY and Auxiliary of the Royal Asiatic Society, Thursday evening, November 12th, 1857.

After the usual accounts exhibiting the state of the Society's Funds, the Secretary read a letter from Lieut. H. P. Hawkes, drawing the attention of the Society to the facility afforded by the electrotype process for obtaining perfect fac-similes of Coins, Seal rings, Cameos, &c. The three specimens forwarded, one from a Gutta Percha Medal, one from a Cameo, and the third from a Cliche Medal were laid upon the Table and attracted much notice. The impression from the Medal especially was found to be very sharp, and the manipulation of all appeared very creditable.

Mr. Hawkes having understood that the Society had under consideration the advisability of purchasing the Stacey Collection of Coins, kindly proposed, should any coins be found wanting to complete a series, to make electrotype impressions of such of the missing coins as might be found in private Cabinets, and to complete the Society's collection.

Resolved to inform Mr. Hawkes that it was the Asiatic Society of Calcutta that had in contemplation the purchase of the Stacey

Collection, and that this Society was only requested to aid in the same. The Committee nevertheless appreciate Mr. Hawkes' kind offer.

Read a letter from Mr. H. Smith, Superintendent of the Government Press, soliciting the publication in the Society's Journal, of certain specimen copies of Plants* in illustration of a new development of Nature printing. In addition to the impressions forwarded with the letter, a large folio book of illustrations was laid upon the table, and attracted great admiration. In clearness, in sharpness of outline, and in accuracy of representation Mr. Smith's process particularly excels.

The most successful representations appear to be those of the Ferns, Grasses, and specimens requiring minute and delicate outline, like *Mollugo Cerviana*, the impression of which is admirable; or complicated details such as the reticulated venation of leaves. But Mr. Smith's excellence of manipulation has also enabled him to overcome the difficulty of printing from the most succulent and fleshy plants. The print of the common *Yercum* or *Madar* (*Calotropis gigantea*) is particularly happy and exhibits clearly all the botanical details. A leaf of the prickly pear (*Opuntia Dillenii*) is equally successful. He has even carried his experiments into the animal kingdom, and exhibits printed pictures of a Snake and a Bat, the characteristics of which are shown with surprising clearness.

Considerable discussion arose in the Meeting as to how far the discovery is due to Mr. Smith. Mr. S. in his letter gives a precise of the different processes of Nature printing that have been at various times resorted to, and claims for his own plan that it excels all others in simplicity and efficiency, and is capable of a much more extended application. Its distinctive peculiarity, he tells us, consists in the impressions being obtained direct from fresh unprepared plants. Mr. Burgass however recollects similar impressions being exhibited two or three years ago at the Polytechnic at Home, but not being aware of the exact *modus operandi*, which is part of

* Vide Plates 5 and 6 of this Number.

the point at issue, he cannot positively pronounce as to what credit Mr. Smith is entitled to in the question of discovery.

Major Wilson observed that the process referred to by Mr. Burgess was probably that exhibited by Mr. Cox at the Polytechnic Institution under the name of the Foliographic Press, for Printing from fresh leaves and plants. Major Wilson stated that one of these Presses was in his possession, and that he had frequently taken impressions of leaves with it, the process appearing to be identical in all respects with that described in Mr. Smith's paper. Major Wilson sent for the prospectus of Mr. Cox's invention, of which the following is a copy :—

"The Foliographic Press for printing from Nature being a new and exceedingly simple machine for printing *fresh leaves, ferns, feathers, lace &c.*, invented and sold by G. I. Cox, at 134, Great College Street, Camden Town, and the Royal Polytechnic Institution. Press, Roller, Pot of Ink, and Sheet of Carbonised Paper 5s. 6d. small; 8s. 6d. large."

Direction for use.

"Put a leaf between the fold of the Carbonised paper. Pass the Roller five or six times over each outside surface; open the fold and extract the leaf, which has now become impregnated with ink. Then place it between the fold of a clean sheet of writing paper, which is now to be introduced under the leather flap and pressed by passing the roller once over the surface, when an accurate and beautiful impression will be the result.

The carbonised paper is made by dabbing the ink evenly over the surface of ordinary writing paper, with a dabber made of wash leather.

It is advisable, previous to using a leaf, to roll it slightly between a sheet of blotting paper, to absorb the extraneous damp or moisture."

The Meeting were of opinion that the principle of both processes was the same, but Mr. Smith has the merit of having develop-

ed its application more fully, so as to obtain larger and finer pictures as well as of having extended it to more difficult objects, and particularly to reptiles and animals, which seems not to have been attempted before.

The Committee beg to acknowledge, with thanks, the receipt of the following books and papers :

From the Chief Secretary.

1. Geological Papers on Western India.
2. Atlas do. do.
3. Selections from the Records of the Madras Government, Railway Correspondence.
4. do do India No. 23 on Tea Cultivation.
5. Indian Journal of Arts and Sciences, Vol. 1, No. 4.
6. Cyclopædia of India, Parts 8, 9 and 10.
7. Description of the method of catching Wild Elephants in the Coimbatore District, by Captain D. Hamilton.

From the Government of Bombay.

8. Bombay Magnetical and Meteorological Observations for 1856.

From the Authors.

9. Note sur Les Rubaiyat de Omar Khaiyam par M. Garcin de Tassy.
10. La poesie Philosophique et Religieuse chez les Persans, d'après le mantic uttair, ou Le Langage des Oiseaux de Farid Uddin Attar par M. Garcin de Tassy.

The Managing Committee of the MADRAS LITERARY SOCIETY and Auxiliary of the Royal Asiatic Society, 10th December, 1857.

Mr. Elliot read a notice of the Gold Coins stated at page 114, Volume I, new series of the Journal, to have been found at Madura. They comprise 49 specimens, of which 28 have been bought for the Government Central Museum, 20 were purchased by a Gentleman at Madura and sent home, and a single one was obtained by Mr. Elliot himself. The whole are gold pieces of the kind called *aurei*, belonging to the times of the earlier Cæsars from Tiberius to Domitian, as follows :

Of Tiberius 6, Claudius 8, Agrippina 3, Elder Drusus 2, Younger Drusus 5, Nero 17, Caligula 1, Domitian 5, Nerva 2.

The Secretary read some interesting Remarks by Mr. Jesse Mitchell on the distribution of fresh water *Polyzoa*.

Mr. Mitchell observes that Professor Allman in his recent work entitled "a Monograph of the Fresh Water *Polyzoa*," has stated that although found at an altitude of 6000 feet, these *Infusoria* are not met with beyond the limits of the temperate Zone. Now, Mr. Mitchell has himself taken them in Madras, and gives a very interesting description of one he captured in considerable numbers adhering to the roots of the common Duck weed or *Lemna* in the month of September last.

These when placed in a Polyp-trough under a one inch objective, exhibited groups of *Polyzoa* inhabiting tubular cells attached to the root of the plant and to each other. The head of the animal which was transparent and hyaline and furnished with a double row of cilia upwards of forty in number, was protruded from the cell in the act of feeding, and the whole process of capturing, swallowing and digesting its prey was distinctly visible. It seemed to prefer the smaller kind of *Infusoria* rejecting the large *Rotatoria*, which were drawn into the vortex of the cilia by their rapid motion, an operation which it effected either by driving off the intruder by blows of the tentacula, or if this failed by retiring into the cell, when the vibratile action of the cilia was suspended and the unwelcome visitor escaped. Mr. Mitchell believes that both this and other species will be found abundantly on the roots of *Lemna* and other fresh aquatic Plants.

The Committee beg to acknowledge with thanks the receipt of the following books.

From the Chief Secretary.

1. Cyclopædia of India, Parts 11, 12, 13, 14 and 15.
2. A Treatise on the Small Pox, by W. C. Maclean, Esq., M. D.
3. Extract from M. C., relative to Silicate of Soda and Lime as a Protective from Fire.

4. Catalogue of the Government Central Museum.
5. Report on the Railway Department.
6. Report on the Civil Dispensaries.
7. On Indian Infanticide, by the Rev. John Cave Brown.
8. Report on a reputed Coal Formation at Kotah, by P. W. Wall, Mineral Viewer.

Extract from Meteorological Observations kept at the Madras Magnetic Observatory.

DAILY MEANS.

Date.	OCTOBER 1857.								NOVEMBER 1857.								DECEMBER 1857.								
	Barometer reduced to 32° Fahr.	THERMOMETERS.				Wind.	Rain.	Remarks.	Barometer reduced to 32° Fahr.	THERMOMETERS.				Wind.	Rain.	Remarks.	Barometer reduced to 32° Fahr.	THERMOMETERS.				Wind.	Rain.	Remarks.	
		Means.		Max.	Min.					Means.		Max.	Min.					Means.		Max.	Min.				
		Dry	Wet							Dry	Wet							Dry	Wet						Dry
1	Inches 29.831	84.9	78.1	95.6	79.2	s	0.032	Hazy	Inches 29.739	77.8	72.4	87.5	77.5	W by S	0.071	Ovcast	Inches 30.029	75.7	68.7	81.9	71.2	N E	...	Hazy	
2	851	82.0	77.0	92.5	72.4	N E	750	Clody.	851	75.8	76.2	87.6	77.5	W N W	0.13	Clody.	038	75.9	68.5	82.2	70.3	N E	...	do	
3				93.2	76.8	S S W			916	80.1	76.8	87.5	77.5	S by E		do	040	74.5	67.5	82.1	69.5	N N E	...	do	
4	880	83.1	77.2	94.6	79.1	W N W		do	921	79.7	76.6	86.2	77.5	S E	3.19	do	066	75.3	66.5	83.1	70.2	N E	...	do	
5	885	83.8	77.3	96.2	78.2	S S W		Hazy	919	79.7	76.6	86.2	77.5	S E		do				81.3	70.7	N N E	0.006		
6	866	84.0	77.7	92.9	79.8	S E		do	913	78.4	74.6	86.1	77.5	S E		Clear.	013	75.1	66.8	81.7	70.6	N N E	0.022	Clody.	
7	876	83.4	77.2	91.0	78.8	E		Clear.				86.6	77.5	N E			29.977	71.7	64.8	80.7	65.8	N		Hazy	
8	901	83.3	76.7	92.0	78.5	E by S		Hazy	961	77.7	72.0	83.6	73.5	N N E		Hazy	989	72.4	65.2	80.3	69.5	N by E		Ovcast.	
9	905	83.3	76.8	91.6	79.0	N		do	973	77.6	70.8	83.6	74.5	N N E		Clody.	987	71.3	65.1	80.1	66.3	N by E		Hazy	
10				90.9	79.4	E by S	0.13		949	76.2	70.7	83.1	71.5	N E		Hazy	923	71.3	66.8	75.2	68.8	N N W	2.02	Ovcast.	
11	860	79.0	75.4	88.6	75.4	N	3.391	Clody.	901	76.1	69.1	82.7	71.5	N E		Clear.	941	76.3	74.1	84.6	73.3	E N E	3.15	do	
12	833	77.0	74.8	85.8	75.4	N N E	0.667	Ovcast.	30.041	75.8	69.1	83.6	71.5	N E		Hazy				84.1	70.6	E by S			
13	881	79.5	76.3	88.3	77.1	N E	981	do	049	76.6	68.3	84.0	76.5	N E		do	30.024	75.9	73.7	83.2	73.6	N E	0.012	Hazy	
14	947	76.6	74.9	84.6	75.4	N by E	3.073	do				83.8	76.5	N	4.205	Clody.	037	75.7	72.7	83.4	72.3	N E		Clear	
15	891	76.8	74.8	85.2	75.1	N N E	1.292	do	017	75.2	71.7	80.8	73.5	N	0.900	Ovcast.	018	74.8	71.3	82.1	70.5	E by N		do	
16	884	79.3	76.5	88.0	76.7	E	0.152	Clody	022	77.0	74.3	84.3	74.5	N E		Hazy	009	73.0	68.9	81.9	67.4	?		do	
17				87.9	77.1	E			29.992	77.9	73.3	83.2	76.5	N N E		Ovcast.	026	74.1	68.2	82.6	68.4	E by N		do	
18	888	80.0	76.8	87.8	77.0	S E	0.022	Hazy	987	76.7	71.8	82.3	73.5	N by E	3.09	do	007	73.5	68.6	82.6	69.9	N E	3.80	Hazy	
19	835	80.2	76.4	88.8	77.2	E	2.08	Clody.	980	75.6	71.0	81.3	73.5	N N E		do				82.5	72.3	E N E	0.058		
20	879	80.5	77.0	88.1	77.3	N E	4.65	do	963	74.6	69.2	81.1	73.5	N		Clody.	29.997	74.6	70.7	81.7	72.3	N E		Ovcast.	
21	886	77.7	76.3	82.4	75.0	N N E	9.55	Ovcast.				80.5	73.5	N			30.015	76.0	69.1	81.6	74.1	N E		Hazy	
22	871	78.2	74.9	82.3	75.9	E by N	5.73	do	905	74.3	68.0	83.3	73.5	N N E	0.003	Hazy	021	75.5	68.4	81.6	74.1	N E		Clody.	
23	848	75.1	73.7	79.3	74.1	N N W	4.165	do	903	75.9	71.7	83.0	76.5	N N E		Clody	009	73.2	67.1	80.8	69.1	N N E		Hazy	
24				79.0	73.6	N W	18.039		929	75.8	70.3	82.5	76.5	N N E		Hazy	039	75.2	66.6	81.3	72.2	E N E		do	
25	740	75.0	74.5	78.2	74.4	N	2.813	do	896	74.3	68.8	82.2	69.5	N N E		Clear.	058	75.6	65.7	81.8	73.6	N E		Clody.	
26	760	76.7	74.9	81.3	75.7	N N W	0.125	do	892	74.2	69.4	84.1	73.5	N E		do				81.0	69.1	E N E			
27	793	78.4	75.1	86.3	76.5	?		do	949	76.2	72.1	84.2	73.5	N E		do	045	72.6	66.2	80.5	67.8	N N E		Hazy	
28	796	78.3	74.1	85.1	75.3	?		do				84.3	73.5	N E			063	75.1	68.4	81.2	72.3	N E		Clody.	
29	806	76.8	72.3	84.9	72.6	N N W		do	905	76.1	71.4	83.4	73.5	N N E		Clear.	079	74.0	68.4	81.6	69.2	N N E		Hazy	
30	784	76.3	72.2	80.8	74.4	W by N		do	999	75.1	68.7	82.6	73.5	N		do	083	76.0	70.6	81.8	73.5	N E		Ovcast.	
31				82.0	74.5	W N W	0.10	do										085	75.4	70.0	81.7	71.3	N E		Clody.
Mean.	29.854	79.6	75.7	87.3	76.4		37.726	Sum	29.948	76.6	71.7	83.9	73.5		5.820	Sum	30.023	74.4	68.4	81.7	70.6		0.995	Sum	Mean.

? This mark signifies that no Means can be taken owing to the variable state of the Wind.

Extract from Meteorological Observations kept at the Madras Magnetic Observatory.

HOURLY MEANS.

Gottingen Mean Time Noon	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Means
Madras Mean Time	41.5	41.6	41.7	41.8	41.9	42.0	42.1	42.2	42.3	42.4	42.5	42.6	42.7	42.8	42.9	43.0	43.1	43.2	43.3	43.4	43.5	43.6	43.7	43.8
1837																								
Oct. 29	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1
Nov. 1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1
Dec. 1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1
1857																								
Oct. 29	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1
Nov. 1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1
Dec. 1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1
1857																								
Oct. 29	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1
Nov. 1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1
Dec. 1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1

* The Numbers in these Columns are not observed but interpolated for the sake of obtaining the daily Means.

W. S. JACOB,
Hon'ble Company's Astronomer.

JAN.—MAR. 1858.]

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XI. Extract from Report on the Vegetable Products of the Pulney Hills. By LIBUT. R. H. BEDDOME, Assistant Conservator of Forests.

(Communicated by the Madras Government.)

I have completed my tour in the Pulney range, and have thoroughly explored all the slopes and the forests on them. In many places, there has at one time been a considerable quantity of Teak, and Blackwood (*Dalbergia latifolia*, and *D. sissooides*), also on the northern slopes, Cunggilium (*Shorea robusta*), almost all the large trees of these timbers have been long since felled. Teak and Blackwood saplings are yearly springing up, these are felled, when their scantling is about that of a man's arm, and used as posts, &c., the natives prizing the Teak especially as they say, that the white ants will not touch it. Whilst I was at Pulney, I saw ten young Teak saplings, none of them perhaps thicker than my arm, brought in by the woodcutters, and sold to an overseer as posts for a shed that he was building near the public bungalow, saplings that would have yielded magnificent timber years hence. On the slopes near Pulney, and between that place and Verupatchy, I observed a great quantity of timber cut and being carted away, chiefly Vengay, (*Pterocarpus marsupium*), and Veckalie (*Conocarpus latifolius*), some logs of good size. On the lower slopes in this direction, there is a scattering of Teak. There is also Blackwood, of this tree I observed a great many saplings, about the foot of the ghat which ascends to Cowajee, and for some way up the rocky slopes, they are being felled, however, by the wood cutters. I saw one large tree of this timber being carted away from the jungles, though I did not succeed in finding any trees of size, standing.

Ascending to Poombary from Pulney there is a very extensive alpine basin with high hills all round, in this, and the ravines and valleys formed by the spurs to the West of it, below Ulloorankunvay, I found no Teak: the timber, particularly in the large basin, has been much destroyed.

NOTE.—Dr. Wight visited the Pulney Hills, his observations will be found in this Journal, Vol. V. p. 260, (1837.)

The timber here is chiefly the following :

Pterocarpus marsupium. (Vengay.)

Conocarpus latifolius. (Veckalie.)

Grewia tiliæfolia (Tarradá.)

Emblica officinalis.

Briedelia.

Terminalias, 2 : scarce.

Acacia Sundra (Baga.)

Acacia odoratissima.

Dalbergia latifolia (Todakuttay) scarce and poor.

Of the two *Acacias*, I observed several trees that had been felled and were being cut into small logs.

On the slopes far down below Kookul in a northerly direction, the jungle has been much cut, there has at one time been a good quantity of *Cungilium* (*Shorea robusta*) in this locality, there are however, only a few poor trees now left standing. This timber is most greedily sought after by the Natives for house building. Further down on the spurs near the plains, and below a hill called the Koombootooke mallay, I found Teak.

I visited the Mungapatty valley, lying to the West of the Pulney range, here the timber has been much destroyed, to make way for cultivation. There is no Teak here. Down the slopes to the S. W. towards the Aggamullay hills, I found that the jungle had been much cut, the spurs in some places are pretty thickly wooded, but there is nothing of any value now standing. The slopes about Wollangum have been considerably cleared for cultivation. On the lowermost spurs and small rocky hills between this village and that of Vellay covay (near Periakolum) I found here and there straggling Teak trees, and signs of a good deal having been cut.

A good quantity of Teak has formerly been cut, about the pass from Periakolum up to the Kodakarnal, none however now remains.

All this Western portion of the Pulnies up to the Permaulmallay and Cowanjee comprizes the higher range, and is generally called the Verupatchy Hills.

The higher ranges are from six to seven thousand feet in height, the plateau at the top consists of undulating grassy Hills, similar to

the Neilgherries, the grass is short and every where dotted with beautiful Orchideous plants (amongst which *Platanthera Susannæ*, and *lutea* are very conspicuous,) *Ophelia*, *Exacum*, *Pedicularis*, *Gentiana* and many other plants peculiar to a high altitude. With the exception of the sholas, the higher ranges are free of any jungle or trees, save here and there a few scattered trees of "*Rhododendron arboreum*."

There are a good many sholas up the higher range, chiefly situated, where, there are springs or water-courses, some of these are very thick, and several of enormous extent, the three largest upon the higher range are. The Kookul shola (situated close to a village of that name) which extends over two hills, on the north Western face of the Pulnies. The Minmoordi cornal shola situated at Pattoor on the southern side, and a large shola situated between that and Kodakarnal. The timber in these sholas is extensively cut by the inhabitants of the Hills. The following are trees common in the sholas on the higher ranges.

Cyminosma pedunculata.

Millingtonia pungens.

Rhododendron arboreum.

Hedera obovata.

Hedera rostrata.

Hedera racemosa.

Mæsa Indica.

Myrsine capitellata.

Olea robusta.

" Sp.

Cinnamomum iners. (much felled by the Natives.)

Magnolia.—? (a magnificent tree)

Michelia Pulniensis.

Syzygium. Sp.

Dodonæa Burmanniana.

Rottlera peltata.

" *tinctoria*.

Pittosporum floribundum.

Bentinckia condapana.

Symplocos, Sp.

Lauracea.	4 large trees.	
Elaeocarpus oblongus.		} Enormous trees.
Monocera glandulifera.		
Monocera tuberculata.		
Kooragoo marum.	?	
Kooravoo.	?	
Velle Ore.	?	
Noorle.	?	
Wellatos.	?	(ploughs always made of this.)
Gnidium eriocephala.		

There were other trees not in flower, with which I am quite unacquainted, amongst these I have little doubt, there are valuable timbers to be discovered. The Lime and the Orange are also found apparently indigenous.

The chief products of the higher ranges are Rice, Mustard, Garlic, Wheat, Barley, Vendiam (*Trigonella Fœnum Græcum*.)

Tennay (*Setaria Italica*) together with Lablab vulgaris, Limes, Oranges, Peaches and a few Plantains are also grown. A great number of low country Natives, have settled on the Pulney Hills. The Hill tribes are the Poliards and the Koonoovers, these latter tribes are most abundant on the lower Pulnies.

From Cowajee which is situated at the foot of the Permaulmally, the highest peak of the Pulnies, I descended to the lower range of the Pulnies, or as they are often called the Tandigoody and Verupatchy Hill, they are I should judge about 4 to 5000 feet above the sea, or perhaps rather more. In the Arcpatty valley below the Permaulmally there is a good deal of scattered jungle, the timber has been largely felled; the timber most common there, is the *Terminalia chebula*, the Vengay, (*Pterocarpus marsupium*) and the Veckalie (*Conocarpus latifolius*.)

The vallies between Vilputty and Cowajee are more or less wooded, I here also found Cungilium (*Shorea robusta*) but no good trees of it left standing. The Warre bakke river runs through this valley and there is a fine fall. Near Pussinkud I saw a few large Teak trees, the only ones that have apparently escaped the general destruction. The slopes down to Tempollium are extensively wooded, and there is Teak and Cungilium, almost all destroyed, however,

the Cungilium is I know still cut, and I have no doubt the Teak saplings also when any are found worth cutting. On the slopes near Pullatoor, Sandal wood is also found in small quantities.

The lower Pulnies are much more wooded, than the higher range, they are almost every where covered with a rather stunted jungle of Trees. The following trees are most numerous.

Conocarpus latifolius (Veckalie.)	Erythrina Indica.
Terminalia chebula. Very abundant.	Sclerostylis atalantioides.
	Atalantia monophylla.
Bignonia xylocarpa.	Gmelina arborea.
Sterculia guttata.	Zizyphus xylopyrus.
Cathartocarpus fistula.	Grewia tiliaefolia.
Embllica officinalis.	Canthium umbellatum.

The trees are generally rather stunted, I observed a good quantity of the black dammer tree (*Canarium strictum*) towards Tyempollium. The hill people never extract the dammer, and are apparently ignorant of the uses of the tree.

The cultivation on these lower ranges is very considerable, compared to that of the higher ranges, about Pumukad and Tantigoody, all the vallies are under cultivation.

The chief products of the lower ranges are Turmeric, Plantains, Mustard, Castor Oil, Vendiam. (*Trigonella Fœnum Græcum*.)

Cumboo. (<i>Penicillaria spicata</i> .)
Ragee (<i>Eleusine coracana</i> .)
Varagoo (<i>Panicum miliaceum</i> .)
Tennay (<i>Setaria Italica</i> .)
Mangoes, Citrons, Limes, Oranges, Cardamoms.

The shola forests in the vicinity of Tandigoody and Perryoor are very extensive, and contain trees of enormous size. The black dammer and the wild nutmeg trees are abundant. These sholas, however, are daily disappearing before the Plantain groves. To prepare a Plantain grove, a large tract of shola is burnt down, this forms a fine soil for the Plantain, acres of fine shola are destroyed annually in this manner.

Near Tandigoody, Cardamoms are also cultivated to a great extent. To form a Cardamom grove the small trees and underwood are burned, but the larger trees are left standing.

The following plants yield valuable fibres for rope, &c., and are much used by the Natives in the lower ranges.

Kat murke nâr. (grows to a tree.).....Gnidia eriocephala.
Volca nâr.....Grewia Asiatica.
Surke nâr.....Grewia abutilifolia.

Artocarpus integrifolia is most abundant in all the sholas of the lower ranges, particularly at Perryoor and Paucheloor.

The following timbers are much used by the Natives here.

Nawâr (*Eugenia jambolana*.)
Maiglan..... (*Vitex alata*.)
Cottam pallam. (*Terminalia catappa*.)
Kammallâ.... (*Gmelina arborea*.)
Kaie.....? used for ploughs.

The timber of *Gmelina* is highly spoken of.

The mace round the wild nutmeg (*Palmanee Kam*) is used by Natives to color their teeth. A Beer is made from the raggee (*Elousine*) the flowers of *Vitex negundo* are used as a hop to ferment it with. Into the toddy which they draw from the *Caryota urens*, (a tree very abundant here,) they sling in some of the bark of *Olea robusta* which immediately causes fermentation.

Girardinia Leschenaultiana, a plant yielding a valuable fibre is most abundant here, the natives however, are ignorant of its use.

The leaves of *Dodonæa Burmanniana* are bound on swellings produced by Sprains, &c., it is said with great effect, a decoction of the leaves is given internally in cases of leprosy.

Polygonum Sp.....
Acalypha Indica.....
Flowers of *Kalanchoe grandiflora*..... } used medicinally.

The sholas are very thick about Paucheloor and less destroyed, apparently than at Pandigoody. The black dammer tree is very abundant here. There has at one time been a good quantity of Teak on the slopes between Periyur and Verupatchy and also on the

slopes below Paucheloor, it is now almost entirely destroyed. There is Blackwood also, which is still at times cut and carted into Dindigul and Madura for sale. I did not myself observe any large trees of this timber standing, and as I was over a great portion of these jungles, there cannot be much left.

Flora of the Pulney Hills, as observed in September and October, 1857. By LIEUT. R. H. BEDDOME.

RANUNCULACEÆ.

Clematis Gouriana,
" *Wightiana*,
" *Munroii*, sholas at Kodakarnal.
Anemone Wightiana,
Ranunculus reniformis,
" *Wallichianus*, common.
Naravalia Zeylanica,

MAGNOLIACEÆ.

**Michelia Pulniensis*, very common (Shemboo.)
Magnolia sp. a beautiful tree common in sholas.

ANONACEÆ.

Guatteria cerasoides,

SCHIZANDRACEÆ.

Hortonia sp. near Perryar.

MENISPERMACEÆ.

Cocculus villosus, lower slopes.
" *glaber*,
" *macrocarpus*? (only in fruit.)
Clypea hernandifolia, very common.

NOTE.—Local Catalogues such as this "Flora Pulniensis" are of great use, illustrating the Geographical distribution of the plants of Southern India, and are specially commended by Dr. Royle in his observations on Provincial Exhibitions.
—ED. M. J.

* *M. Nilagirica* (Zenker) in Hooker and Thomson's *Flora Indica*.

BERBERIDACEÆ.

- Berberis tinctoria*,
 " *Leschenaultii*, 5,000 to 8,000 ft.
 CRUCIFERÆ.

- Nasturtium Madagascariense*,
Cardamine Borbonica,
Sinapis juncea,
 CAPPARIDACEÆ.

- Gynandropsis pentaphylla*,
Cleome monophylla,
Polanisia icosandra,
Cadaba Indica,
Capparis horrida, } lower slopes.
 " *incanescens*, }
 " *grandis*, }

RESSEDACEÆ.

- Reseda alba*, common about Kodakarnal.

FLACOURTIACEÆ.

- Flacourtia sapida*, slopes towards Verupatchy.
Hydnocarpus inebrians,

VIOLACEÆ.

- **Viola odorata*, scentless. } very common on the higher
 " *Patrinii*, } ranges.
Ionidium enneaspermum,

DROSERACEÆ.

- Drosera peltata*,
Parnassia Mysorensis, common in moist ground near Kodakarnal.

POLYGALACEÆ.

- Polygala arillata*, { very common shrub, 5,000 feet and up-
 wards.
 " *Wallichiana*, { abundant in the grass on the highest
 ranges.
 " *ciliata*,
 " *rosmarinifolia*,
 " *Wightiana*?
 " *nov. sp.*? a small shrub, slopes near Periyur.

* *Viola Wightiana*, (Wall.)

CARYOPHYLLACEÆ.

- Stellaria media*, } moist places on the highest ranges,
Cerastium Indicum, } very common.
Arenaria sp.
Mollugo? sp.

MALVACEÆ.

- Urena sinuata*,
 " *lobata*, used by the Natives as a fibre.
Ravonia Zeylanica, covered with clammy pubescence.
Lebretonia procumbens, lower slopes.
Hibiscus micranthus, do.
 " *hirtus*, do. white variety.
 " *lampas*, very abundant.
 " *Surattensis*, lower slopes.
 " *aculeatus*, (Roxb.) This is *H. furcatus*, (W. and A.) but very
 different from *H. furcatus*, (Roxb.)
 a plant common in Central India.
 " *canescens*, slopes near Pulney.
 " *sp.* (near Vellay covay) erect, shrubby,
 covered all over with shining hairs,
 leaves cordate, serrate, 3-5 lobed,
 petioles the length to twice the
 length of the leaves, involucl 4
 to 7 leaved, generally 5, segments
 narrow, acuminate, calyx deeply 5
 cleft, segments 3 nerved, acuminat-
 ed, purple streaked. Flowers short
 peduncled, axillary, afterwards in
 terminal racemes, elongated. Seeds
 glabrous with a few tufts of hairs.
 Perhaps "*H. lunarifolius*" but the
 involucl is generally 5 leaved never
 10, the calyx is like that of "*canes-*
cens."
 " *criocarpus*, slopes towards Pulney.

Abelmoschus angulosus, W. A. The involucre is spathiform, and splits into 4 leaves, I have however often observed it in 4 leaves from the commencement, and never assuming the form of a spathe, I believe it to be the same as *Hibiscus tetraphyllus*, (Roxb.) which is common in central India.

„ *moschatus*,
Lagunea lobata,
Abutilon polyandrum, much valued as a fibre.
 „ *Asiaticum*, slopes.
 „ *Indicum*, do.
Sida humilis, do.
 „ *acuta*, do.

Sterculia guttata, BOMBACEÆ.
 yields a fibre, which is hardly distinguishable from that of "*S. villosa*," the valuable Elephant rope of the Anamallays.

„ *urens*,
Kydia calycina,
Eriochlæna Hookeriana, Lower ranges, very abundant.

Tropæolum sp. TROPÆOLACEÆ.
 very abundant. near Poombary, run wild?

Corchorus trilocularis, TILIACEÆ.
Triumfetta sp.
Grewia abutilifolia, (Surke nâr) used as a fibre.

„ *villosa*,
 „ *tiliæfolia*,
 „ *salvifolia*,
 „ *Asiatica*,
 (Valce nâr) used as a fibre. At the Anamallays, valce nâr is applied to *Sterculia villosa*.

Grewia hirsuta,
 „ sp.

Leaves roundish, rhomboid, 3 nerved, cordate at base, unequally toothed, slightly scabrous, peduncles axillary, 1, 2 flowered longer than petioles, bracteoid at base, sepals twice as long as petals, recurved, petals sharply bidentate, stigma 2 lobed, style clavate at apex, longer than stamens, nuts 1-3 shining.

ELÆOCARPACEÆ.

Elæocarpus oblongus,
Monocera tuberculata, } very large trees, in sholas.
 „ *glandulifera*, } Do. glands not always present.

DIPTEROCARPEÆ.

Vatica sp. (Cungilium) vallies amongst the hills and slopes. Wood much prized by the natives.

TERNSTROMIACEÆ.

Cleyera gymnanthera, sholas.
Cochlospermum gossypium,

OLACACEÆ.

Gomphandra polymorpha, near Poombary.
Stemonurus foetidus, do.

AUBANTHIACEÆ.

Atalantia monophylla,
Limonia acidissima, a very pretty wood.
 „ *alata*, in sholas.

Glycosmis pentaphylla,
Feronia elephantum,
Aegle marmelos,
Citrus sp.

{ A very prickly climber, with ternate leaves, the fruit is eaten.

HYPERICACEÆ.

Hypericum Hookerianum, very common, higher ranges.

- Garcinia sp. GUTTIFERÆ.
sholas.
- Hiptage Madablota, MALPIGHIACEÆ.
near Tandigoody.
- Cardiospermum canescens, lower slopes. SAPINDACEÆ.
" halicacabum, " "
Sapindus emarginatus, " "
Dodonæa Burmanniana, { from the plains to the highest level,
common also in the sholas.
- Millingtonia pungens, MILLINGTONIACEÆ.
in sholas, common.
- Melia azedarach, MELIACEÆ.
near Perryur.
Mallea Rothii,
- Chloroxylon Swietenia, CEDRELACEÆ.
lower slopes.
- Vitis quadrangularis, AMPELIDACEÆ.
" setosa,
" tenuifolia,
" sp. { gland-tipped, deep purplish, serrated
leaves.
" sp. Poombary valley.
" Rheedii,
" sp.
- Geranium affine, GERANIACEÆ.
very abundant.
- Linum Mysorense, near Shambaganoor, common. LINACEÆ.
- Impatiens Balsamina, BALSAMINACEÆ.
" arcuata,
" Leschenaultii, in drying, this species tinges the paper
a bright pink color. (Common at
Kodakarnal.)

- Impatiens albida, common in hill streams 5,000, to 7,000
feet, grows to 16 or 18 feet high,
flowers very large, of a delicate rose
color. I never saw them white as
described by Dr. Wight, nor does
his plate give much idea of the plant,
as it grows on these hills.
- " campanulata, in sholas very common, 6,000 to 7,000
feet, flowers beautifully mottled
with pink.
- " dasysperma, capsule slightly pubescent! this
species is readily known by the
curved mucro at the conjunction
of the 2 upper sepals.
- " nov. sp. sholas at Kodakarnal, 7,000 feet,
glabrous, leaves alternate, lanceo-
late acute, petioled, bristly serrate,
racemes as long or longer than leaves,
4 to 14 flowered pedicels, longer
than petioles with a large cordate
(convex on outside) bract at the
base of each. 2 upper sepals wing-
ed at their conjunction. Spur long,
incurved with gland-tipped point,
flowers of a uniform crimson. A
very beautiful sp: quite unlike any
described or figured.
- Impatiens Phœnicea.
Kodakarnal about streams, the whole
plant is sometimes quite glabrous,
7,000 feet.
- " tomentosa, the commonest species on the hills.
Kodakarnal in streams, 7,000 feet.
- " fasciculata, (summit of Permaulmally, in streams
8,000 feet.) Stems 4 angled, sul-
cated, slightly hairy, leaves opposite,
serrate, long petioled above a few

hairs, below glaucous, peduncles, longer than the leaves, smooth viscid, bearing 7-9 flowering racemes at their apex, pedicels with a gland tipped filiform bract at their base, lateral sepals small, spur rather long, capsule gibbous, streaked with purple. flowers very small pink. A very small species, the whole plant not more than 4 inches high.

Impatiens Pulniensis.

OXALIDACEÆ.

Biophytum sensitivum,
Oxalis corniculata,

ZYGOPHYLLACEÆ.

Tribulus lanuginosus, Lower slopes.

RUTACEÆ.

Cyminosma pedunculata, sholas. (very common.)

ZANTHOXYLACEÆ.

Toddalia aculeata, slopes towards Verupatchy.

PITTOSPOREÆ.

Pittosporum floribundum, Poombary (common.)

CELASTRACEÆ.

Celastrus Heyneana, (Poombary valley.)
Euonymus angulatus, (sholas) a very elegant small tree.

RHAMNACEÆ.

Zizyphus glabrata, slopes.
" *xylopyra*, "
" *(Enoplia)*, "

TEREBINTHACEÆ.

Semecarpus Anacardium,
Mangifera Indica, lower Pulney ranges.
Odina Wodier, do. do.

BURSERACEÆ.

Canarium strictum, { Abundant on the lower Pulneys,
yields a black dammer, the natives however never extract it.

Garuga pinnata,

Protium Roxburghianum, leaves pinnate.

" ? Leaves ternate, much used for hedges.

MORINGACEÆ.

Hyperanthera Moringa, about villages.

LEGUMINOSÆ.

Sophora glauca,

Crotalaria rubiginosa,

" *Wightiana*, several forms of this, if they are all one species.

" sp. Stipules wanting, leaves very narrow, linear, with their upper surface as well as whole plant densely covered with blackish hairs, vexillum with a tuft of hairs, otherwise similar to "anthylloides." Common near Poombary. (a form of anthylloides.)

" *anthylloides*,

" *Mysorensis*,

" *longipes*?

agrees well with the description of that plant, except that the legumes are pubescent, (a large shrub, common near Puttoor.)

" *paniculata*, slopes near Pulney.

" *superfoliata*, near Tandigoody.

" *junceae*,

" *Leschenaultii*, very common.

" *sericea*,

" *montana*, (Roxb.) (only differs from *sericea* in the stipules and bracts, but so far is constant.)

Crotalaria nov. sp. Herbaceous, erect, glabrous, leaves very (6. *Verrucosæ*,) narrow, linear, very obscurely nerved, tapering at the apex into a point. Stipules wanting, racemes terminal, many flowered, bracts adnate to the rachis, (as in the stipules of some *Phaseolæ*,) ovate with a long acumination, calyx cleft to the middle, upper lip bifid, legume with a short thick stalk, oblong, broader upwards, glabrous, many seeded. Flowers yellow, a very distinct species, apparently new, a rare plant.

Crotalaria elegans.

„ *Wallichiana*, very common.
 „ nov. Sp.? (6. *Verrucosæ*,) suffruticose, erect, leaves orbicular, smooth on the upper surface, under surface and stems densely covered with white woolly hair, stipules very large, lunate, transverse, racemes terminal, calyx (cleft to the middle, upper segment bifid,) pubescent, bracts ovate with a long acumination, legumes glabrous, many seeded, flowers yellow. 12 to 15 feet. Poombary ghât.

Crotalaria lanata.

„ (7 *Diffusæ*,) A very pretty procumbent species, with hirsute legume, very common amongst the grass at Poombary and elsewhere, with very long terminal racemes of large brilliant yellow flowers, perhaps a form of "*C. Evolvuloides*."
 „ nov. sp.? Herbaceous, erect, much branched, glabrous leaves lanceolate.
 „ Acuminated, attenuated at the base. Stipules wanting racemes terminal or

axillary, few flowered, bracts minute, calyx cleft to the middle, upper segment deeply bifid, legumes oblong, broader upwards, pubescent 12 seeded, flowers blue, (has much the appearance of *C. verrucosa* at a distance, but has no stipules, and the leaves differ much,) a rare plant, near Cowanjee.

Crotalaria coerulea,

This species is very common on the Anamallays.
 common.

„ *albida*,
 „ *viminea*,
 „ *globosa*,
 „ *umbellata*, near (Shambaganoor.)
 „ *Notonii*, near Vilputty.
 „ *clavata*, Periyur slopes towards Canavaddy.
 „ *Grahamiana*, Poombary valley (very common.)

Trigonella Fænum græcum, much cultivated.

Pycnospora nervosa, (not common.)

Indigofera viscosa,
 „ *pulchella*, a very common shrub.

„ *tenuifolia*,
 „ *trifoliata*.
 „ *parviflora*,
 „ *Wightii*,
 „ sp.

Clitoria Ternatea,

Dumasia congesta,

Shuteria vestita,

„ *glabrata*,

Notonia (Johnia) Wightii,

Pseudarthria viscida,

Tephrosia tinctoria,

„ *purpurea*,

very common.

} ? perhaps these 2 species might be united.

lower Pulnies.

„ „ very common.

- Smithia sensitiva*,
 „ *facemosa*? Poombary ghat.
Uraria hamosa, abundant lower ranges.
Desmodium triquetrum,
 „ *latifolium*,
 „ *Gangeticum*,
 „ *Wightii*?
 „ *recurvatum*,
 „ *gyrans*,
 „ *polycarpum*,
 „ *rufescens*, very common 4,000 to 7,000 feet.
 „ *strangulatum*, very common.
 „ *triflorum*,
 „ *parvifolium*,
Dicerma pulchellum,
Alysicarpus bupleurifolius,
 „ *styracifolius*,
Abrus precatorius,
Rhynchosia densiflora, lower slopes.
 „ (*Phyllomatia*), sp. { Calycine segments longer than the
 „ *suaveolens*, { 1 seeded legume.
 „ *Grahamiana*, at Punnikal.
Flemingia congesta,
 „ *Grahamiana*,
Phaseolus Pulniensis, a pretty sp. in the grass near Poombary and Kookul. Flowers lilac, large, fragrant.
 „ *trinervius*,
 „ *sublobatus*,
 „ sp. twining to a great extent, stipules adnate, stems strigose, leaves on long petioles, trifoliate, terminal one ovate oval, lateral ones obliquely ovate, very unequal sided, above harsh adpressed pubescence, below downy, peduncles longer than petioles, thickened, 3-4 flow-

- ered at apex, flowers from glandular knobs, legumes terete, covered with brown hairs. Flowers very large, lilac and fragrant, very common. Can this be *P. caracalla*? It is certainly wild.
 „ *trilobus*,
 „ sp. (Poombary valley) flowers white, legumes compressed.
Dolichos glutinosus, (Poombary valley.)
 „ *Sinensis*,
Lablab vulgaris,
Paroetus major, moist ground, higher ranges.
Canavalia gladiata,
 „ *virosa*,
 „ *mollis*,
Mucuna (Citta) atropurpurea, at Tandigoody.
 „ *prurita*,
Cantharospermum pauciflorum.
 „ *albicans*, (Poombary ghat.)
 „ ? sp. very long filiform racemes.
Dunbaria, sp. { Poombary ghat and Vellaycovay,
 { This sp. I cannot identify with any of Dr. Wight's, the calyx is not herbaceous, nor are the bracts 3 toothed, the vexillum is as much reflexed as in "*Kennedya*."
Cylista scariosa,
Cyanospermum tomentosum, Poombary valley,
Erythrina Indica,
Butea parviflora,
 „ *frondosa*,
Pongamia glabra,
Dalbergia latifolia,
 „ *sissoides*,
 „ *volubilis*,
 „ *paniculata*,

- Brachypterum scandens*,
Pterocarpus marsupium,
Inga xylocarpa,
Dichrostachys cinerea,
Prosopis spicigera,
Acacia Sunda,
 latronum,
 amara,
 odoratissima,
 speciosa,
 Intsia,
 pennata,
Guilandina Bonduc,
Cesalpinia mimosoides, *Perruv* (very common.)
 sepiaria,
Tamarindus Indica,
Cassia fistula,
 auriculata,
 occidentalis,
 Tora,
 absus,
 pumila,
 obtus, lower slopes,
Bauhinia Malabarica,
 racemosa,
 variegata, (at Vellaycovay.)
 RosACEÆ.
Rubus lasiocarpus, from 3,000 feet.
 rugosus, from 5,000 feet.
 gowreephul,
Fragaria elatior,
 Indica,
Potentilla Leschenaultii,
Rosa involucrata,
Photinia Lindleyana,
 SalicariACEÆ.
Ammania sp.

- Lagerstrœmia microcarpa*,
 COMBRETACEÆ.
Terminalia Catappa,
 Belerica,
 Chebula,
 tomentosa,
 paniculata,
Conocarpus latifolius,
Gyrocarpus Jacquini,
 MEMECTACEÆ.
Memecylon sp :
 MELASTOMACEÆ.
Sonerila Rheedii ?
Osbeckia Wightii,
 Leschenaultii,
 hirsutissima,
 Zeylanica,
 MYRTACEÆ.
Rhodomyrtus tomentosus, Very common, berries eaten.
Syzygium jambolanam,
 sp.
Eugenia sp.
Careya arborea,
 ONAGRACEÆ.
Jussiaea repens,
Ludwigia parviflora,
Cirœa sp. Common in grassy places near the
 large Kookul shola.
 CUCURBITACEÆ.
Coccinea Indica,
Bryonia Garcini, Lower slopes.
 laciniosa,
 scabrella,
 Hookeriana,
Momordica charantia,
Trichosanthes ?
 Dicecious ? Leaves 3-5 lobed, sca-
 brous above, downy beneath, with
 hard tipped serratures, female flow-
 ers racemes with large glandular

lacinate bracts, sometimes solitary, or 2 together in the axils of the leaves with one lanceolate bract, stigma 3-4 cleft, 3 sterile filaments inserted low down in tube of corolla. Male flowers with a large and more lacinate calyx, filaments 3 (rarely 4) quite distinct, inserted on the gibbous upper part of the tube, anthers united, corolla very hairy on the inside, tendrils 2-3 cleft, flowers white. Berry globose. At Tandigoody and Perryor. (Natchantalle.)

PASSIFLORACEÆ.

Passiflora Leschenaultii,

PORTULACACEÆ.

Trianthema decandrum,

CRASSULACEÆ.

Kalanchoe grandiflora, Flowers used medicinally.

*UMBELLIFERÆ.

Hydrocotyle polycephala, Sholas (very common.)

Sanicula elata,

Bupleurum ramosissimum, Abundant in the grass on the higher ranges.

Pastinaca sp. Do. do. do.

Pimpinella Candolleana, Do. do. do.

ARALIACEÆ.

Hedera rostrata, Sholas.

" *racemosa*, do.

" *obovata*, do. very common.

LORANTHACEÆ.

Viscum verruculosum,

" *angulatum*,

" *grossum*,

* *Hieracium pedatum*, (Wight) may be added, see Icon. t. 342.

Viscum moniliforme,

Loranthus (Symphyanthus) sp. nov. ?

" *loniceroides*,

" *buddleoides*,

" *sarcophyllus*,

" *amplexifolius*,

" *Candolleanus*,

" *cuneatus*,

" *Euphorbia*,

" sp. nov. ?

On "*Rhododendron arboreum*," very common, glabrous, leaves ovate, very obscurely nerved, thick, opposite, racemes axillary or terminal, many flowered, pedicels short, one small bract embracing the calyx. Calyx entire or nearly so, corolla glabrous, ventricose at base, equally 4 cleft to below the middle, segments cuneate linear, berry oblong, flower deep dull orange color.

at Cowangee.

common on the lower ranges.

common.

leaves with a transparent margin.

at Kodakarnal.

very common.

growing on *Euphorbia antiquorum*, near foot of hills.

Lower slopes growing on "*Salvadora Indica*" rarely on "*Cordia polygama*?" Glabrous, branches very woody, leaves nearly opposite or approximated in threes, very long, linear, often much curved, of a thick texture, short petioled attenuated at base, obtuse or slightly acute, racemes axillary, or from the axils of fallen off leaves, many flowered, pedicelled, one bract embracing the ovary, calyx entire or nearly so, corolla curved, apex split into 5 segments, one third the length of the tube, segments, linear acute, ovary oblong crowned with calyx, flowers whitish with the segments green.

CAPRIFOLIACEÆ.

- Viburnum acuminatum*, common at Poombary.
 „ *capitellatum*, „ „
Lonicera Leschenaultii, very abundant.

RUBIACEÆ.

- Nauclea parviflora*,
Mussaenda frondosa,
Gardenia lucida, (pissanee) in sholas.
Randia dumetorum,
 „ *uliginosa*,
Griffithia fragrans, slopes towards Verupatchy.
Wendlandia Notoniana, very common.
Hymenodyction excelsum,
Hedyotis stylosa,
 „ *articularis*,
 „ *pruinosa*, } higher ranges only.
 „ *monosperma*,
 „ *affinis*, } flowers very fetid.
 „ *Burmanni*,
 „ *Heynii*, } these 2 little plants are common in
 „ *dichotoma*, } hilly places in Central India.
 „ *aspera*, lower slopes.
Lasianthus venulosa, sholas Kodakarnal, (berries blue.)
 „ sp. Kookulsholas, (flowers very fetid, berries black.)
Canthium umbellatum, grows to a good sized tree. (lower Pulnies.)
 „ *parviflorum*,
Psychotrium ambiguum,
 „ sp. } sholas.
Grumilea congesta ?
Bigelowia lasiocarpa,
 „ *Roxburghiana*,
Spermacoce hispida,
Knoxia corymbosa, very abundant.
 „ *Wightiana*, in the grass near Poombary.

GALIACEÆ.

- Rubia cordifolia*, very abundant.
Galium asperifolium,
 „ *Requienianum*,

VALERIANACEÆ.

- Valeriana Leschenaultii*, Poombary ghat.
 „ *Hookeriana*, Cowangee hill streams.

DIPSACEÆ.

- Dipsacus Leschenaultii*, common.

CAMPANULACEÆ.

- Campanula Alphonii*, common.
 „ *fulgens*,
Wahlenbergia agrestis, very common.
 „ *perotifolia*,

LOBELIACEÆ.

- Lobelia trichandra*, a very common plant.
 „ *trigona*,

PYROLACEÆ.

- Pyrola* sp. Kodakarnal.

ERICACEÆ.

- Gaultheria Leschenaultii*, (Moorcherree) berries eaten.
Rhododendron arboreum, very abundant.

VACCINIACEÆ.

- Vaccinium Neilgherrense*, } common shrubs.
 „ *Leschenaultii*, }
 ? Poombary ghat, axillary spikes of green flowers.

ULMACEÆ.

- Celtis orientalis*, from the plains to the highest elevations.

STYRACEÆ.

- Symplocos Gardneriana*, sholas.
 „ *pendula*, Kodakarnal, banks of streams.

EBENACEÆ.

- Maba Neilgherrensis*,

AQUIFOLIACEÆ.

- Monetia tetracantha*,

APOCYNACEÆ.

- Carissa Carandas*,
Ophioxylon Neilgherrense, near Puttoor.
Vinca pusilla, fields.
Wrightia tinctoria,
Alstonia venenata,
Ichnocarpus frutescens,
Echites sp. slopes near Pulney.

LOGANIACEÆ.

- Strychnos nux-vomica*,
Gardnera Wallichiana, sholas.
Fagraea Coromandeliana,

ASCLEPIACEÆ.

- Hemidesmus Indicus*,
Holostemma Rheedianum,
Calotropis gigantea,
Sarcostigma brevispina,
 " sp.
Dæmia extensa,
Cynanchum pauciflorum, Kookul.
Tylophora mollissima, common.
 " *tenuissima*, sholas.
Hoya viridiflora,
 " *pauciflora*, a rare and beautiful parasite.
Ceropegia intermedia,
 " *acuminata*,
 " *tuberosa*, slopes towards Verupatchy.
 " *juncea*, lower slopes.
 " *elegans*,
 " sp. { Root fibrous, leaves remote, lanceolate,
 tapering to a long point, slightly
 hairy, covered with minute dots, ra-
 cemes cyme like, axillary, 2—6 flow-
 ered, flowers very large, greenish,
 upper part of tube and segments
 speckled with purple, segments of
 calyx, very narrow and acute,
 nearly allied to *C. Decaisneana*, a
 bulbous plant.

Caralluma?

{ Stem filiform, with a few narrow
 linear leaves near the apex, hardly
 two lines broad, flowers bell shaped,
 drooping, purple. (Poombary val-
 ley.) I unfortunately lost the only
 specimen that I found of this curi-
 ous little plant.

Boucerosia diffusa,

on rocks.

OROBANCHACEÆ.

- Eginetia pedunculata*, { flowers of a most lovely deep blue,
 parasitic on the roots of a grass.
Oligopholis tubulosa, Kodakarnal shola.
Campbellia sp. Tandigoody sholas.

GENTIANACEÆ.

- Gentiana verticellata*,
Ophelia elegans,
 " *Griesbachiana*, glands on the petals { higher ranges,
 most abundant
 in the grass.
 very hairy.
Halenia Perrottetii, borders of sholas common.
Exacum tetragonum,
 " *Perrottetii*, abundant near Poombary, a very
 beautiful species.
 " nov sp. { herbaceous, erect, glabrous, leaves
 opposite, broadly ovate, stem clasp-
 ing, 5—7 nerved, suddenly acumi-
 nated, 2 bracts about the centre of
 the peduncles, flowers very large of
 a deep blue. Poombary and Koda-
 karnal. (Introduced into gardens at
 the latter place.)

" *pedunculare*,
Canscora diffusa,

SOLANACEÆ.

- Solanum* sp. Shrubby, erect, leaves petioled, ovate
 lanceolate, acuminate at both ends,

stems and every part but the flowers covered with longish weak hairs, flowers axillary 2-3 together, on peduncles a little longer than the petioles, berries small, 6 seeded. In sholas, grows to 12 feet high.

Solanum ferox, higher ranges common.

„ *giganteum*,
„ *Indicum*,
„ *rubrum*,
„ *pubescens*,

do. do. do.

Lower slopes (flowers purplish.) \

Datura fastuosa,
Physalis minima,
„ *Peruviana*?

The Brazil cherry (so called,) is wild all over the hills; it has I suppose been introduced.

OLEACEÆ.

Olea robusta,

Bits of the bark are thrown into the toddy extracted from *Caryota urens*, to cause fermentation.

CORDIACEÆ.

Cordia myxa,
„ *polygama*?

Lower slopes,
„ „ near Chattrapatty.

*CONVOLVULACEÆ.

Evolvulus alsinoides,

Porana racemosa,

Convolvulus rufescens,

a rare plant, slopes near Cowangee.
common on the higher ranges, 6 to 7,000 feet.

Calonyction speciosum,

Ipomea Wightii,

(I have since found this sp. on the plains at Anamallay.)

valleys and slopes.
common at Puttoor and Poombary;
flowers very large, (the calyx and the leaves are much like those of *I. pilosa*.) 6 to 7,000 feet.

* Of these only 3, viz. *Ipomea Wightii*, *I. nov. sp?*, and *Convolvulus rufescens* inhabit the higher elevations.

Ipomea pilosa,
„ *hispida*,
„ *dentata*,
„ *striata*,
„ *staphylina*,
„ *pes tigridis*,
„ *pileata*,
„ *tuberculata*,
„ *obscura*,
„ ? *nov. sp?*

an enormous climber.

on the
slopes of the
hills and
in valleys.

Procumbent, stems, leaves and calyx strigose, leaves alternate, distant, narrow, cordate. flowers axillary, solitary, short peduncled, calyx with the 3 outer sepals, ovate, the 2 inner linear, and longer than the outer ones, 2 bracts below the calyx, capsule—, flowers lilac, rather large; in the grass near Puttoor, 6,000 feet.

Hewittia bicolor,

Slopes.

Pharbitis nil,

Lower Pulnies.

Rivea cuneata,

do. do.

„ *bona nox*,

Slopes.

Argyreia aggregata,

„

pomacea,

„

hirsuta?

„

Aniseia uniflora,

Alpine vallies 3,000 feet.

PLUMBAGINACEÆ.

Plumbago Zeylanica,

PRIMULACEÆ.

Lysimachia Leschenaultii, (very common.)

Anagallis latifolia, (fields.)

Micropyxia tenella, (Kodakornal.)

MYRSINACEÆ.

Mæsa Indica,

very common in Sholas.

Embelia Tajeeriam-cottam,

at Vilputty and Perryur.

Myrsine capitellata,

in sholas, common.

- Ardisia humilis*, sholas.
 „ *pauciflora* ? sholas at Kookul.
- JASMINACEÆ.
Jasminum revolutum,
 „ *brevilobum*, } higher ranges, all common.
 „ *rigidum*,
 „ sp. lower slopes.
- SALVADORACEÆ.
Salvadora Indica, lower slopes.
- EHRETACEÆ.
Ehretia aspera, Pautcheloor slopes.
 „ sp. „ „
Heliotropium Rottleri, lower slopes.
- BORAGINACEÆ.
Trichodesma Zeylanica, lower slopes.
Cynoglossum furcatum, higher ranges.
- LAMIACEÆ.
Ocimum sp.
Orthosiphon sp.
Plectranthus Wightii, common.
 „ sp. (obovate bracts.)
 „ sp.
Coleus barbatus, very common.
 „ *spicatus*, at Perryur.
Anisochilus albidus,
 „ *purpureus*,
 „ sp. on rocks, with silvery leaves.
 „ sp. a large shrub, with cordate serrate
 leaves, very common.
- Pogostemon rotundatum*,
 „ sp.
 „ sp.
Dysophylla auricularia,
Micromeria biflora, higher ranges, common.
Melissa umbrosa, sholas, common.
Prunella vulgaris, at Poombary.

- Scutellaria violacea*, very common.
 „ sp.
Leucas ternifolia, { Common in the grass on the higher
 ranges.
 „ *biflora*,
 „ *cephalotes*,
 „ sp. Lanceolate serrate leaves, dense capi-
 tate or axillary heads of flowers,
 whole plant densely covered with
 deflexed brown hairs.
- *Leonotis nepetæfolia*,
Teucrium tomentosum,
 VERBENACEÆ.
Stachytarpheta sp. Slopes near Pulney, most abundant,
 flowers blue,
 „ sp. common near Perryur, a handsome
 plant with lilac flowers, not unlike
S. mutabilis.
Bouchea ? Lower slopes.
Lantana Indica, Very common,
Vitex negundo, Perryur, flowers used to ferment a
 beer that the natives make from the
 Ragee.
 „ *alata*,
Premna Wightiana, } Slopes near Verupatchy.
 „ *cordifolia*,
 „ *tomentosa*,
Tectona grandis, Lower slopes.
Gmelina arborea, Wood much valued by the natives,
 Perryur.
- Elerodendron infortunatum*, Sholas.
 „ *serratum*, a very common plant.
Callicarpa Wallichiana, Sholas.
- PEDALIACEÆ.
Pedaliium murex, Lower slopes.
- GESNERACEÆ.
Klugia sp. (Lower lip of corol 3 lobed.)

Æschynanthus Ceylanica, A beautiful and rare parasite, the leaves are those of a *Hoya*.

Didymocarpus tomentosus, Very common, 500 feet up to 6000.

BIGNONIACEÆ.

Stereospermum sp. There is a tree of this sp. in the Madras Horticultural Garden, it does not appear to be described.

Bignonia xylocarpa,

ACANTHACEÆ.

Thunbergia fragrans, Very common.
Dyschoriste littoralis, (Lower slopes.)
Dipteracanthus patulus, " "
Phlebophyllum Kunthianum, { Very common in the grass on the higher ranges.
Stenosiphonium Rusellianum, near Kodakarnal.
Strobilanthes micranthus, Poombary in hedges.
Asystasia Coromandeliana,
 " sp. apparently } with bright yellow flowers.
 the same as the above. }
Barleria buxifolia, Lower slopes.
 " *cuspidata*, " "
 " sp. " "
 " *prionitis*, " "
 " sp. a very large shrub 15 to 20 feet high, with ovate lanceolate, acuminate leaves, perfectly covered with very large blue flowers; a very handsome sp. Poombary ghât, sholas near Vilputty.

Blepharis Madraspatensis,
Crossandra infundibuliformis,

Endopogon ??

very common.

This like "*Endopogon strobilanthes*" has the corolla of *Endopogon* but has 4 stamens; shrubby, leaves

opposite, ovate, serrate, generally very unequal in size, long petioled, minutely dotted and covered with a harsh pubescence, flowers from axillary peduncled capitate heads, surrounded by broad hairy bracts, flowers pale blue. Kookul, common in hedges close to the village.

Hemigraphis latebrosa,

Rostellularia procumbens, borders of sholas.

" sp.

Eranthemum montanum,

Adhatoda Vasica,

" *betonica*,

Rhinacanthus communis,

Rungia pectinata,

" ? a shrub in Kodakarnal shola.

Rhaphidospora glaber, lower slopes.

Andrographis Wightiana, in sholas.

" *Neesiana*, do.

" *paniculata*,

" *viscosa*, in sholas.

Leptacanthus ? in sholas below Kookul ghât.

SCROPHULARIACEÆ.

Verbascum ? { a pretty yellow flowered annual, common in the grass on the higher ranges.

Limnophila sp.

Torenia Asiatica, moist places, very common.

Vandellia crustacea,

Bonnaya sp. fields near Vilputty.

Buddlea discolor,

Striga densiflora,

" ? *orobanchioides*, ? yellow flowers.

Gerardia delphinifolia, very common.

Pedicularis Zeylanica, most abundant on the higher ranges.

UTRICULARIACEÆ.

- Utricularia Wallichiana*,
 „ *humilis*,
 „ *racemosa*,

NYCTAGINACEÆ.

- Boerhaavia procumbens*,
 „ *humilis*,
Pisonia aculeata, lower slopes.

AMARANTACEÆ.

- Achyranthes aspera*,
 „ *sp.*
Euxolus caudatus, lower slopes near Pulney.
Psilotrichum nudum, „ „ „
Æruea floribunda,
Amaranthus frumentaceus, (A flour is made from the seed.
Celosia pulchella,
 „ *argentea*,

CHENOPODIACEÆ.

- Chenopodium ambrosioides*, An abundant weed about Perryur.

POLYGONACEÆ.

- Polygonum Nepalense*, Kookul in fields.
 „ *Chinense*, Very common, used medicinally.
Rumex Nepalense, Kookul.

BEGONIACEÆ.

- Begonia dipetala*, Abundant.

LAURACEÆ.

- Cinnamomum iners*, Sholas very common.
Alseodaphne semicarpifolia, Sholas.
Cylicodaphne Wightiana,
Tetranthera tomentosa,
 and 3 other trees of this order.

MYRISTICACEÆ.

- Myristica sp.* (Palmanee kam.)
 „ *tomentosa*? the mace round the nut is used by
 the natives to color their teeth.

ELEAGNACEÆ.

- Elæagnus latifolius*, very common, the berries are eaten.

THYMELACEÆ.

- Gnidia eriocephala*, { grows to a tree in the Kookul shola,
 much used by the natives as a fibre,
 and called Kât murke nâr.

SANTALACEÆ.

- Thesium Wightianum*, near Kodakarnal.
Osyris Wightiana, the bark is eaten like suparee with
 chunam, it turns the saliva red, a
 common shrub.
Santalum album, near Pullatoor.

ARISTOLOCHIACEÆ.

- Aristolochia Indica*,
 „ *acuminata*,

EUPHORBIACEÆ.

- Euphorbia Rothiana*,
 „ *trigona*,
 „ *antiquorum*, { lower slopes.
 „ *tirucalli*,
 „ *Nivulia*,
Dalechampia velutina, common near Perryur.
Tragia involucrata,
 „ *sp.* densely covered with reddish hairs,
 (at Poombary common.)

- Acalypha Indica*,
 „ ?

a shrub, slopes towards Verupatchy.

- Macaranga Indica*,

- Claoxylon sp.*

{ Arboreous, diœcious, leaves opposite,
 oblong, lanceolate, attenuated at
 both ends, serrate towards apex,
 glabrous—below covered with re-
 sinous dots, spikes axillary, male
 flowers glomerate, (not amentace-
 ous), spikes about the length of
 leaves—styles 3, capsule tricoccous
 muricated.

- Givotia Rottleriformis*, very common.
Ricinus communis,
Rottlera peltata, a common tree.
 „ *tinctoria*,
Baliospermum polyandrum,
Briedelia spinosa?, lower slopes.
 „ sp. do.
Cluytia collina,
Phyllanthus, 2 species,
Melanthesa turbinata,
Embllica officinalis, very common.
Glochidion? { *Perryur*—a large shrub, opposite,
 lanceolate, shining, serrate leaves,
 dense amentaceous axillary spikes.
Sarcococca trinervia, very common on the higher ranges.
Roidia floribunda, { common about Tandigoody, a showy
 plant.
Macraea Rheedii? { leaves and stems covered with a few
 silvery hairs, especially below,
 margins ciliated.
 „ sp. { shrubby, erect, stems angled, glabr-
 ous, leaves nearly sessile, oval,
 whitish below, margins revolute—
 female pedicels half the length of
 the leaves.
 URTICACEÆ.
Urtica vesicaria, sholas at Tandigoody.
Laportea terminalis, a severely stinging plant.
Girardinia Lechenaultiana, stings severely. Flowers used me-
 dicinally, very common.
Elatostema cuspidata, abundant.
Pilea trinervia,
 „ sp.
Splitgerbera? with very large caducous stipules.
Pouzolzia, 3 species,
 Cannabinaceæ.
Cannabis sativa,

- MORACEÆ.
Dorstenia Indica, at Tandigoody.
Covellia? (*Ficus*), an enormous climber.
Ficus, 8 or 9 sp. all trees.
 ARTOCARPACEÆ.
Artocarpus integrifolia, abundant in sholas on the lower
 ranges.
Conocephalus niveus, common, lower range.
Trophis aspera, lower slopes, common.
 ANTIDESMEACEÆ.
Antidesma paniculata,
 PIPERACEÆ.
Peperomia Wightiana, very common.
 „ *Dindigulensis*,
 „ *reflexa*,
Piper attenuatum,
 „ *Wightii*,
 CHLORANTHACEÆ.
Sarcandra chloranthoides,
 DIOSCOREACEÆ.
Dioscorea tomentosa,
 „ *pentaphylla*, roots eaten.
 „ sp.
 SMILACEÆ.
Smilax Zeylanica, sholas near Cowangee.
 „ *maculata*, very common, a polymorphous species.
 CYCADACEÆ.
Cycas circinalis,
 ORCHIDACEÆ.
Liparis olivacea, on rocks.
 „ *atropurpurea*,
Oberonia Arnottiana,
 „ *verticillata*,
 „ sp. a minute sp. Permaulmally (on trees)
 8000 feet.

- Microstylis Rheedii*,
 „ *versicolor*,
Dendrobium filiforme, on trees in sholas on the Permaul-mallay.
Culogyne corrugata, on rocks near Vilputty. (A most beautiful plant.)
Pholidota imbricata,
Ania latifolia,
Eulophia ramentacea, rare, slopes between Kodakarnal and Velaycovay.
Vanda Roxburghii, lower slopes.
Saccolabium guttatum,
 „ *Wightianum*, at Poombary.
Erides Lindleyana, on rocks near Tandigoody.
Sarcanthus filiformis,
Cymbidium aloifolium,
Polystachya luteola,
Calanthe Perrottetii, very common in sholas. (A most beautiful species.)
Satyrium sp. very abundant all over the higher ranges, flowers a lively pink.
Platanthera Susannæ, at Kookul and Shambaganoor, very common in the grass.
 „ *lutea*, similar places to the last.
 „ *iantha*, Kookul ghât, a rare plant rather.
 „ *affinis*, near Kookul.
Peristylus exilis,
Habenaria peristyloides,
 „ *elliptica*,
 „ *plantaginea*,
 „ *longicalcarata*, the commonest Orchid on the hills.
 „ *montana*, common.
 „ *Lindleyana*,
Ate virens,
Josephia latifolia,
Spiranthes Australis, { apparently more than one species, in grass near Kodakarnal.

XYRIDACEÆ.

Xyris Indica,

COMMELYNACEÆ.

- Commelyna polyspatha*,
 „ *Bengalensis*,
Dictyospermum protensum, in sholas,
Aneilema paniculata,
Cyanotis cristata,
 „ *pilosa*,

JUNCACEÆ.

- Juncus* sp.
 „ sp.

MELANTHACEÆ.

- Disporum* sp.
Gloriosa superba,

LILIACEÆ.

- Lilium Wallichianum*, very abundant higher ranges.
Sansevieria Zeylanica, lower slopes.
Anthericum tuberosum,
Asparagus racemosus,
Phalangium sp.
Ophiopogon Indicus,
Peliosanthes sp.

PONTEDERACEÆ.

- Pontederia vaginalis*,

ZINGIBERACEÆ.

- Zingiber squarrosum*,
Curcuma montana,
Elettaria Cardamomum, much cultivated.
Hedychium coronarium, banks of streams abundant.
 „ „ variety with straw colored flowers.
Costus speciosus,

MARANTACEÆ.

- Canna* sp. Sholas at Tandigoody.

AMARYLLIDACEÆ.

- Crinum* sp.

HYPOXIDACEÆ.

Curculigo orchioïdes,
" sp.

ARACEÆ.

Arum sp. Poombary well.
" sp. Sholas near Kodakarnal.

PANDANACEÆ.

Pandanus odoratissimus,

PALMACEÆ.

Areca, (Kút pân.)
Caryota urens, Lower ranges, a fibre is made from
the peduncle.
Borassus flabelliformis, about villages, lower ranges.
Bentinckia condapana, Sholas.
Phoenix sp.
Cocos nucifera, rare about villages.

EQUISETACEÆ.

Equisetum sp. Poombary valley.

GRAMINACEÆ AND CYPERACEÆ.

Are both abundantly represented on these hills.

BRYACEÆ.

This order is abundant.

LYCOPODIACEÆ.

Five or six species,

OPHIOGLOSSACEÆ.

Several species,

POLYPODIACEÆ.

Between 40 and 50 sp. all I believe Neilgherry forms.
I have not attempted to name the Compositæ, in the above catalogue, there are many of the larger Neilgherry forms.

The above is not supposed to include nearly all the flora of the sholas (or moist woods) of the higher ranges, especially the trees, few of which were in flower at the period of my visit to these mountains.

XII. Notes of an excursion along the Travancore Backwater.

By CAPTAIN HEBER DEURY, 45th N. I.

During a recent trip by water from Trevandrum to Cochin, it struck me that a few notes descriptive of what may be seen in the course of a hundred and thirty miles of the Western Coast might not be altogether devoid of interest. The country I am about to describe lies within the kingdom of Travancore, the southernmost portion of Malayala, formerly known as the kingdom of Kerala, which comprised what is now designated Malabar and Canara, including the principalities of Travancore and Cochin. Travancore may be said to commence at Cape Comorin, and to include a narrow slip of territory lying between the Ghauts and the sea extending to within 20 miles of the town of Cochin, the total length being about 175 miles, and the breadth varying from 25 to 70 miles. The farthest distance, viz., from Cochin to a mountainous peak on the east boundary has been calculated at 75 miles, averaging about 35 miles throughout the entire distance, the total area comprising from 600 to 700 square miles, and within these limits is a country diversified by scenery of the most unparalleled beauty, rich and teeming with the products of nature. The high mountain land which forms its eastern boundary is covered with dense forests, while the periodical rains which render the soil so fertile, cause the most profuse vegetation to spring up, giving a charming appearance of freshness and verdure unknown to the inhabitants of the eastern coast.

As it is not my purpose to write a description of Travancore, I proceed at once to record such features or incidents as I noted in the journey recently undertaken. There are two routes on leaving Trevandrum for the north, one by the road, and the other by the canal. I chose the former, for the canal is long, tedious and uninteresting, whereas by land the distance is only eleven miles to Cunneapoaram, where you at once reach the open backwater. The road is through a fine semi-cleared jungle, rich in Botanical products, and though not thickly populated, a few villages occur at distant intervals, the largest of which are Ooloor and Wulleecotum. To a person arriving from the Coromandel Coast, the aspect of a vil-

lage in this part of the country cannot fail to excite surprise and interest, awakening associations of comfort and cleanliness, if not of a superior stage of civilisation, to which the tree-less and half-deserted villages on the other side of the Ghauts present a sad contrast. The great ambition of the Travancoreans, even of the lowest class, is to possess a garden, wherein they can grow with scarcely any trouble or expense, the few necessities of existence. Nature too flings her stores with such a liberal hand that little care is requisite in rearing the vegetable products which these people live upon. Hence it is that a Travancorean village is a series of huts, enclosed in gardens wearing an eternal verdure fresh and cheerful to the eye. The peculiar trees which succeed so well in this moist climate, combine to render the Nair cottages and gardens most picturesque and comfortable. In one small enclosure may be seen grouped together the graceful Areca Palm (*Areca Catechu*), the Jack tree (*Artocarpus integrifolius*), with the Pepper vine (*Piper Nigrum*) climbing up its bark. The Sago Palm (*Caryota urens*), the Talipot Palm (*Corypha umbraculifera*), besides the Cocoa palm, Plantain, Tamarind and Mango trees, &c. These gardens are protected by mud walls or hedges of different heights, and are traversed by little lanes and bye ways. That such too has been the custom for centuries, may be known from an ancient* book in my possession whose author describes them much as they are in the present day. Of the Nairs he records. "They inhabit no Towns, but dwell in houses made of earth invironed with hedges and woods, and their waies as intricate as into a laborinth." These Nairs—the principal inhabitants of Travancore—have, I am inclined to think, degenerated from that martial valour for which their ancestors were once so renowned. Lightly clad, and with a remarkable fairness of complexion, they appear to partake more of an effeminate disposition than that described by earlier writers. It is a known fact that a Nair cannot, as a rule, bear transplantation from his native soil. In a foreign country he pines away and dies; yet in former days the habits of the Nair were peculiarly military and he was trained to hardship and the exercise of war from his earliest youth. The above quoted author remarks on this point.

* Johnson's Relations of the most Famous Kingdom in the World. 4to. 1611.

"It is strange to see how ready the Souldiour of this country is at his weapons: they are all gentile men and tearmed Naires. At seven years of age they are put to school to learn the use of their weapons, where, to make them nimble and active, their sinnewes and joints are stretched by skilful fellows, and annointed with the oyle Sesamús: by this annointing they become so light and nimble that they will winde and turn their bodies as if they had no bones, casting them forward, backward, high, and low even to the astonishment of the beholders. Their continual delight is in their weapon perswading themselves that no nation goeth beyond them in skill and dexterity." This description would be more applicable to a Parthian horseman or Roman Athlete than to the mild and delicate looking Nair of the present day.

But the most peculiar feature in the domestic life of the Nair is in the institution of marriage, and the customs which result from his mode of observing this ceremony, so different from nearly all other nations of the world. The ceremony of marriage (the term is a complete misnomer,) is performed at an early age by one of the near male relations of the family, usually by a cousin. When the forms attendant upon this nominal union have taken place, all communication between the youthful pair ceases, and the girl returns to her relations. On arriving at or near the age of maturity, a more real ceremony is performed, when another husband presents himself, and this couple now become man and wife; but should the husband after a certain period not be pleased with the lady of his choice, he has the option of returning her to her parents or relatives, when both are at liberty to seek a fresh union in other quarters. No disgrace is attached to this proceeding, nor is the summary divorce and violent disruption of the marriage tie in any way illegal. There is in point of fact, no actual marriage such as we understand the sacred institution, and it is in consequence of a custom so abhorrent to our feelings of propriety, and one so subversive of everything which should create and strengthen the ties and relationship of domestic life, that in cases of heirdom either to the throne of the royal family, or the succession to property, the descent is recognised only in the female line. The nephew, not the son, becomes the heir. Truly the remark which Telemachus makes

to Minerva is most worthily appropriate to the Nair race.* From so strange a custom the moral tone of the inhabitants may be better conceived than† described. The same practice obtains, I believe in Nepaul.

Returning from this digression on the Nair race, I come again to speak of the road I was traversing and which I remarked was one full of treasures for the botanical collector. It is a garden of wild plants the whole way, for scattered on either side are

‘ The living herbs, profusely wild,
O’er all the deep green earth, beyond the power
Of Botanist to number up their tribes.’

In enumerating a few of the trees and shrubs, which are met with, perhaps I may convey some idea of the Flora of these parts. Among the most conspicuous trees are many fine specimens of the *Vateria Indica* with its large panicles of white flowers, and bright green leaves whose veins are so prominently marked. It is well known that this tree, (commonly called the Piney Varnish tree,) yields a valuable Dammer resin. The Piney Gum or Indian Copal, as it is sometimes termed, is much used in these parts for varnishing doors and window frames, candles have also been made of a solid oil contained in it. The experimental manufacture which was conducted by Dr. Wight succeeded, but the cost of transmission to England precluded the hope of profit. The Resin flows spontaneously or is procured by making vertical and horizontal incisions in the bark, from which in the course of 12, or 24 hours it exudes very freely. The Natives state there are two varieties of this tree, one growing at the foot of the hills yielding a different colored dammer, but this I suspect is a mistake; and there is little or no difference in the trees, but that the difference in the color of resin is owing to local causes, probably from the season in which it is procured. It is probable that the ‘green’ dammer is obtained

* “ Stranger! I tell thee true; my mother’s voice,
Affirms me his, but, since no mortal knows
His derivation, I affirm it not.”

Hom. Odys I. 216. Cowpers translation.

† For a full detail of this extraordinary custom of the Nairs, see Buchanan’s Journey Vol. 2. p. 411, 513.

from the *Vatica Tumbagaia*, a tree which I know from specimens before me, yields a dammer *resin of a beautiful light green colour. Another resin similar to the Piney is yielded by the *Canarium strictum*, a tree very plentiful at the base of these mountains but which has hitherto attracted less notice than it deserves. All the above trees belong to the natural families of Dipterocarps or Terebinths, both peculiar for yielding resin. Another handsome tree with dark green foliage growing here is the *Hebradendron gambogioides*. This and several *Garcinias* are common in these jungles. A considerable quantity of Gamboge exudes spontaneously in largish tears from the trunk, but the quantity procurable is much increased by incision. The Natives eat the fruit of some of the *Garcinias* with much relish. The *Embryopteris glutinifera*, or wild Mangosteen is here found. This tree is very like the Mangosteen in appearance, and if introduced in gardens would be very ornamental. The viscid juice which surrounds the seeds is used by carpenters as a useful glue, but the fruit is quite uneatable. The *Ailanthus Malabaricus* is not uncommon. The resin which exudes from the bark is known as Muttee pal, and is said to be a sovereign remedy in dysenteric affections. It has very balsamic properties. The *Calosanthes Indica*, *Macaranga Indica* and *tomentosa* are plentiful. The glutinous fluid which flows from the petioles and branches when broken off exudes from both the above species of *Macaranga*. The large leaves of *M. tomentosa* are hoary beneath with a soft white down, and are used in the bazars for wrapping spices, and similar articles, for purchasers. *Alstonia scholaris*, *Plumiera acuminata*, *Odina Wodier* and other large trees, are most deserving of mention, while conspicuous among lesser shrubs, is *Gloriosa superba* with its bright orange and yellow flowers so curiously arranged creeping from bush to bush, decidedly the most gorgeous of Indian creepers. The root is said to be poisonous. The *Memecylon amplexicaule* is a tropical shrub, which when its flowering stem of deep blue florets is in full blossom, cannot be sufficiently admired. The *Mussaenda frondosa* with its white calycine leaf, contrasting so strongly with its orange coloured petals, *Tabernaemontana crispa*,

* For information as to the varieties of Dammer, see Jury Report of Madras Exhibition.—ED.

Dodonaea angustifolia, and *Connarus monocarpus* are also in abundance here. This latter shrub has flowers of exquisite fragrance, and is constantly in blossom. The black seed is surrounded by a yellow pulpy aril which is used by the Natives in the following cases. There is a kind of worm which attacks their feet when bathing in tanks or walking in muddy places and by the application of the aril of this seed the worm is either destroyed or expelled. A pretty flowering shrub along the road side is the *Osbeckia aspera* and a smaller species the *O. virgata*. *Carissas* are very frequent, the *Holostemma Rheedii*, a charming creeper may occasionally be met with. It is the *Adakodien* of the Hortus Malabaricus. As a creeper for trellis work few *Asclepiads* could vie with its elegant flowers in beauty, *Asystasia Coromandeliana*, (a variety with yellow flowers like our English Primrose,) and a beautiful epiphyte the *Vanda spathulata* of a deeper yellow still are common. But I have no space to enumerate all the beauties of Floras that might be gathered in a ramble through these jungles. Among others may be found *Litsea Zeylanica*, *Careya arborea*, *Syzygium Zeylanicum*, *Ixora coccinea*, *Vitis lanata*, *Gratiola monniera*, *Cyanotis axillaris*, *Bryophyllum calycinum*, *Morinda exserta*, *Cullicarpa lanata*, *Smilax ovalifolia*, &c., &c. On reaching Cunneapooram, there is great abundance of the *Calophyllum spurium*, which tree is easily recognised by its young leaves being of a reddish brown hue, giving a singular appearance to the forests at the season of the year when they begin to sprout. At this time (October) the tree is in full flower.

At Cunneapooram the back-water commences. Here a hybrid kind of boat for the reception of the Palankeen was in readiness. This is called a Jangadum, and consists of two canoes lashed together with a platform over them. Upon this latter flooring the palkee is placed, and the whole is urged lazily through the water, two rowers and two men with long bamboo poles. The water here is rather wide in some places—but not deep. The banks are lined with the Cocoa palm and low brush-wood. There is no object of interest until you come to the town or rather village of Anjengo, formerly a place of some note in our early commercial relations with these parts, but now a desolate and almost deserted spot. Anjengo, a corruption of two Tamil words “Unjee Tenkal” the

five Cocoa trees. The remains of the Fort are close to the water edge, now filled with rubbish and jungle.

At Anjengo was for many years an English factory. It rose into importance upon the decline of Quilon, and was one of the last retained by us on this Coast. The Portuguese were the earliest possessors of the spot and the ruins of their Church still exist.* In its palmiest days Anjengo must have been a lively place. “The fortress,” says Forbes, “contained store houses, accommodation for the garrison and apartments for the chief who was a member of council at Bombay. The civilians and military officers resided in tolerable houses &c.” At the present day a few scattered houses tenanted by East Indians and Natives are all that remain of this once gay and merry station. The place still belongs to the East India Company, and is now chiefly famous for the manufacture in painted wood of the different castes of the inhabitants of the country. These are creditably executed, a male and female of each sect, about 3 or 4 inches in height, draped and ornamented, and on the whole faithful representations. A complete set costs about 40 or 45 Rupees. Great quantities of Lemon grass oil are manufactured at this place. The oil is distilled from the leaves of the *Andropogon citratus*, common in the country. As a remedy for rheumatism this oil is much valued. An East Indian located here is a fair Taxidermist, and keeps a collection of stuffed birds and animals for sale. Of the latter may be chiefly procured the wild Cat, (*Felis Chaus*), Civet, (*Viverra Zibetha*), Mongoose (*Ichneumon mungos*), Flying squirrel, (*Sciuroptera oral*), Malabar squirrel (*Sciurus maximus*) &c., and among the rest that curious fish the Sea horse (*Hippocampus*), which is caught in great numbers on the Coast.

One or two celebrated characters have claimed Anjengo as their birth place. Robert Orme, the Historian of Hindostan, first saw light in this remote spot. He was educated at Harrow School, became a member of Council at Madras, and died in England at the advanced age of 73 years. It was at Anjengo that was born Mrs. Elizabeth Draper, an East Indian, the wife of one of the Councillors of Surat, and the lady to whom Sterne addressed the well known “letters to Eliza.” I have heard of people stopping at Anjengo to

* Forbes' Oriental Memoirs.

visit Eliza's tomb, under the idea that the defunct lady reposes in the spot of her birth, but alas for the disappointed pilgrim, Eliza enjoys a marble monument in a church in Bristol, far from the land of her nativity.

A few miles beyond Anjengo the water communication ceases. A strip of elevated land about six miles in breadth runs out to the Coast, ending in an abrupt cliff of laterite about 250 feet in height. Travellers land at a small village called Coletotum, where bearers are in readiness to carry them to the opposite side where the back-water is again reached. The road used is partly the sea beach itself, and partly the summit of the cliff in land. About a quarter of a mile from Coletotum there is a Bungalow situated on the cliffs built by the Sircar for the accommodation of Travellers and from this spot the view is extremely beautiful. To the Eastward rises the magnificent line of Ghauts, to the South are the windings of the Back-water dotted occasionally with small Islands whose banks are adorned with thick groves of the Cocoa Palm, Mango, Jack tree, and other features of oriental scenery. The whole landscape is peculiarly striking and picturesque. To the west is the sea-board stretching from Quilon on one side to the low cliffs beyond Trevandrum on the other. I have said before that the cliffs here are composed chiefly of laterite and are known as the Verkullay cliffs. Immediately below the laterite formation of the surface are seen a series of various coloured clays and sandstones, and below them again a remarkable deposit of lignite which crops out in horizontal seams of some extent the base being washed by the breakers. This latter deposit extends for many miles along the coast being found at Cannanore, Mangalore, and other places.* It can be applied to no use as a fuel though of vegetable origin. Below the lignite some specimens of fossil limestone have been discovered by General Cullen. In several places, the laterite here assumes many curious forms having all the appearance of fossils, both animal and vegetable. It has not however, yet been proved that laterite is a fossiliferous deposit, and some persons are inclined to think that the result arises from the action of the rains on a clay highly im-

* A notice of this lignite from the pen of the late Capt Newbold will be found in Vol. xi. p. 239, of this Journal—ED. M. J.

pregnated with iron, which is perforated by certain minute insects and becomes indurated by exposure to the atmosphere. This is a curious point to be decided by Geologists. But the age, formation and history of the laterite is still a *questio vexata*, and until more light is thrown upon the origin of so extensive a deposit, we must remain in partial ignorance of its contents. A few scattered shrubs are seen on these cliffs. A species of *Barleria* with pretty blue flowers is frequent. It makes an excellent border plant in gardens. The *Pandanus odoratissimus* grows plentifully here also. There appear to me to be two distinct varieties of this shrub. One has a more bushy head, the leaves are darker colored and the spinal processes are disposed at shorter intervals than in the other, which is more open and lax in appearance and the spines are thickly set together. As a plant for binding the banks of canals, &c., it is invaluable. On the right hand side, about midway after leaving the Bungalow lies the village of Paroor, where there is a famous Pagoda and artificial tank. Near this is a mineral spring which deserves to be better known. The water of this spring was formerly brought to Anjengo for sale. It was near Paroor on the banks of the Attengal river, that a former *Rajah of Travancore encamped for ten years in order to dispute the passage of the Rajah of Quilon. His patience was rewarded after so long a delay by the capture of the latter Prince and the annexation of his territories to Travancore. Paroor too was the scene of an action in later times between the British forces and the troops of the Travancore Rajah commanded by the Dewan. A force moved out from Quilon under command of Colonel Chalmers: proceeding to Paroor, he made a successful attempt to dislodge the enemy from the situation. The Nairs though far exceeding in number the handful of British troops opposed to them, fled in confusion leaving several guns behind them. This took place during the troubles in 1809. Two or three miles beyond Paroor, the backwater appears once more in view and boats are in readiness at a place called Eddavah. This was formerly a Danish factory, and the English Governor of Anjengo built a villa there in which he occasionally came to reside. The village now consists of a few shops and fishermen's huts inhabited by Moplahs

* Bartolomeo's Voyage to East Indies.

and Christians. From Eddavah to Quilon the distance is about 12 miles, a journey performed by boats in 3 or 4 hours. There is nothing remarkable in the voyage unless it be several slightly elevated terraces at short intervals which have much the appearance of ancient sea beaches. The uniformity of level is remarkable, and the distance from the present sea line not being great, would perhaps occasion the Geologist no great difficulty in arriving at the history of their origin.

Quilon at present garrisoned by a Corps of Native Infantry, was formerly* a place of some importance. It is variously spelt. Collam, Coulam and Coilon, signifying in Tamil 'language' a tank." It was built, says Bartholomew, in 825 after Christ, and was formerly a city of considerable note. The natives of Malabar begin their era at the period of its foundation saying "so many years after the foundation of Collam." The Portuguese built a large and spacious fortress here, near the modern town of Tangancharey. It is now quite in ruins. Quilon at one time had an independent prince of its own known by the title of the Rajah of Tangancharey. He was subdued and taken prisoner by Vira-Martanda, Rajah of Travancore in 1764, when his territory was annexed to the latter kingdom.

One of the earliest accounts of Quilon is found in the travels of Marco Polo, who lived in the fourteenth century. Discoursing on the several products of this country, he especially alludes to the manufacture of Indigo which he asserts was made here of superior quality and in great quantities. He gives the process of its manufacture as follows. "They procure it from a herbaceous plant which is taken up by the root and put into tubs of water where it is suffered to remain till it rots, when they press out the juice. This again being exposed to the sun and evaporated leaves a kind of paste which is cut into small pieces of the form in which we see

Marco Polo's Travels, p. 410, Bohn's Ed.

* "About two hundred years ago, the Town was rich, and great and populous; traded to by many *Indians*, enlarged by the *Samorjn*, and able to number a hundred thousand inhabitants; of such repute it then was for situation, trade, and fidelity of the *Cowlamites*. But now, the period of her excellency is outrun; for *Calicut* first, and then *Goa* have not only monopolized but attracted the trade of this as well as other parts thereabouts." Sir Thomas Herbert's Voyage, p. 339, 1677.

it brought to us." This rude process of the early manufacture of Indigo is, as the English Translator has remarked, pretty correct. Indigo to a slight extent is still made at Quilon, though at the present day the place is more famous for its lace manufactory. That it was a place of bustling trade in early time is apparent from the author above mentioned for he says, "Merchants resort thither from various parts of the world such for instance as the kingdom of Mangi and Arabia, attracted by the great profits they obtain both upon the merchandise they import, and upon their returning cargoes. Many of the animals found here are different from those of other parts. There are tigers entirely black, and various birds of the parrot kind, some of them are white as snow, with the feet and back red, others of a diminutive size, &c." The 'black tiger' is the dark spotted cheetah found in the neighbouring jungles."—Bartholomew, who wrote some 3 or 400 years later, alludes to the commercial activity of Quilon. "In this city, there were formerly a great many weaving looms as well as manufactures of cotton and stone ware. Even at present the most ingenious artists reside at Collom. Cotton, pepper, ginger and other kinds of merchandise are carried hither by water, and deposited in ware houses." Probably Anjengo and subsequently Allepey eclipsed Quilon as a commercial emporium.

At one time a considerable force was maintained at Quilon including a European Corps with artillery. The grave yard at Tangencharey is filled with tombs of deceased officers and soldiers of a Queen's Regiment formerly stationed there. During the troubles in 1809, an action was fought here between the British and Travancoreans. This took place under Colonel Chalmers, then commanding the forces. He moved out to meet the enemy, who were approaching from the side of Trevandrum and were commanded by the Dewan in person, amounting to nearly 30,000 men with 18 guns. The engagement which ensued was of short duration. In less than five hours the insurgents were totally defeated losing nearly all their artillery and leaving a large number of slain on the ground. Such was the battle of Quilon.*

* The Nairs were again defeated here in a brilliant engagement by Colonels Picton and Stewart, who dispersed and utterly disorganised the rebel force and captured all their artillery in 1810.

The residency here, built by Col. Munro, is charmingly situated on a slightly rising ground overlooking the back-water. It is a lovely spot, and the park like appearance of the grounds at the back of the house add considerably to its beauty. The garden is spacious and well laid out, the walls skirting the water, and towards the south is a small bay on one side of which is seen the house allotted by the Sircar to the officer commanding the station and immediately opposite the house of John Liddell Esq., both prettily situated at the bank and surrounded with Casuarinas and other trees.

On leaving Quilon, the scenery of the back-water becomes more romantic and pleasing. Laterite cliffs, about fifty or sixty feet high, rise on either side enclosing little bays with calm and deep blue waters. These cliffs are very picturesque. Small shrubs among which are *Mussaenda*, *Ixora*, *Osbeckia*, &c. cover the broken sides and fallen fragments of rock half lying in the water, while the level summits are occupied by gardens, plantations, or small patches of cultivation. Immediately on leaving the Residency, will be seen on the left hand side at the apex of one of these jutting cliffs, a small obelisk enclosed by a group of Casuarinas. This was erected as a tribute of affection by a Captain Gordon to the memory of a favourite dog, which was drowned near the spot. Beyond this on another rising ground is a tiled Bungalow, charmingly situated in a bay known familiarly as Loch Lomond. An officer detached from the Nair Brigade to take charge of the out-posts formerly resided here. It has been unoccupied for many years, though occasionally made use of as a place for picnics and pleasure parties from Quilon. About half a mile beyond this the water opens out into a spacious and beautiful bay. Into this extensive sheet of water pours the Tiruvalla river, and there is an outlet to the sea at its Western extremity known as the bar of Neendacara. The extent of the bay is very considerable, enough to contain half the navy of England, and in fact it is one of the largest harbours in the Peninsula. Unfortunately the water is very shallow which has been the great drawback to its use: what improvements engineering science might accomplish under European superintendence it is impossible to say, but could this noble inlet from the sea

ever be made available for the purpose of ship building the advantages would be incalculable. The river would float down timber direct from the forests, and the possession of a harbour of refuge like this on the Western Coast would be beneficial in the highest degree to the interests of Commerce.

The banks of the water are covered with many interesting plants, and among them will be found *Bruguiera*, *Rhizophora*, *Cerbera Odollam*, *Dilivaria ilicifolia*, *Excoecaria Camettia*, *Scavola Taccada*, &c. The latter shrub (Rheede calls it *arbor excelsa*) contains a very acrid caustic juice of which the Natives are greatly afraid. With much difficulty I persuaded them to collect a small quantity. If the juice gets into the eyes the pain would be intense, perhaps causing loss of sight. Other trees* found here are *Alstonia scholaris*, *Calosanthus Indica*, *Terminalia catappa*, *Ailanthus Malabaricus*, while in the low lands and paddy fields *Sphæranthus hirtus*, *Utricularia*, *Sphænoclea Zeylanica*, and *Asteracantha longifolia* are common two or three miles beyond Quilon, the scenery becomes more tame and monotonous, the passage being sometimes through canals occasionally expanding into broad sheets of water. The sea beach at times is very near, the sandy hillocks peeping out here and there between the strips of jungle, or Cocoa palms and fishing villages. The sands are partly covered with *Ipomæa pes-caprae*, *Spinifex squarrosus* and *Dactylon lagopoides*. The singular Mangrove tribe is common along the backwater. It is curious to remark the wonderful provision of nature displayed in this family of plants for the preser-

* The Revd. E. Johnston lately furnished us with a list of Orchids found by him in the Travancore Forests, which appropriately finds a place here.—Ed. M. J.

Pholidota imbricata,
Eria pauciflora,
Calogyne corrugata,
Dendrobium filiforme,
———— *macrostachyum*,
———— *ramosissimum*,
———— *barbatulum*,
Bolbophyllum tremulum,
———— *Neilgherrense*,
Lichenora —————,
Arundina bambusifolia,
Vanda spathulata,
———— *Roxburghii*,
———— *Wightiana*,
Saccolabium Wightianum,
———— *guttatum*,
———— *papillosum*,

Saccolabium rubrum,
Cotonia macrostachys,
Erides Lindleyana,
———— *Wightiana*,
Sarcanthus pauciflorus,
Polystachya purpurea,
Cymbidium aloifolium,
———— *triste*,
Geodorum dilatatum,
Eulophia virens,
Josephia lanceolata,
———— *latifolia*,
Habenaria Jerdoniana,
Podochilus Malabaricus,
and others not determined.

vation of the species. Take for example the *Kandelia Rheedii* and see the long pendulous roots hanging from the boughs, perhaps the only instance of the kind where the seeds actually begin to germinate before falling from the parent branch. When of sufficient length, should they not reach the water, they drop off, and sink by their own weight in the soft muddy bottom, from whence the new plant springs up. Now were the seeds to drop off at once when ripe, as in other plants, the stream would naturally carry them away, but by this wise yet simple adaptation of means to an end, the plants have the power of increasing to an indefinite extent, in situations where their utility is required and appreciated. The mangrove tribe has an extensive range being found in all tropical countries in salt marshy places, along the shore of the sea.

About twenty miles from Quilon to the left hand is the village of Porcaad, the Dutch had a factory here, and it was formerly a very populous place, but its importance as a pepper depôt decreased on the rise of Allepey. Some miles beyond Porcaad, and within twelve miles of Allepey, on the right hand side at a place called Ambalapuley, the traveller will remark a curious stone image the size of life, standing half out of the water, and apparently in a running attitude. It has a singular appearance. I could never ascertain anything beyond its legendary history, for stories tell that it is the image of a murderer whose victim was a woman he had slain in the vicinity. After the commission of the foul deed, he attempted to escape by running through the water to the opposite side, but the hand of avenging justice turned him into stone on the spot, where he has remained ever since. The image of a man apparently in the act of running is very remarkable. Formerly the boatmen when passing by the haunted locality used to cross themselves and mutter the name of their patron Saint Anthony as they quickly glided by the image of the murderer.

Proceeding along from Ambalapuley there are extensive rice-fields on either side, as might naturally be expected in a tract of country so flat and so abundant in water. The physical configu-

The Mangrove tribe are most numerous at the Equator, as in Sumatra. Heller collected 17 species in the Tenasserim Provinces.—ED. M. J.

ration of Travancore is not favourable to the production of large quantities of rice except in certain parts. Patches of cultivation in the hollows between the undulating hills are met with far amid the interior forests to the very base of the hills, but it is only in level tracts like those near Allepey, and the Southern district of Graneel and Calcaud that very extensive sheets of rice cultivation occur. The rest of Travancore, in spite of its natural capabilities, is still allowed to remain desert and uncultivated. Why are all these fine lands permitted to exist in their primitive barrenness? With a noble water communication from one end of the country to the other, with creeks and rivers pouring into this inland sea from every side, yet no effort is made to take advantage of such admirable facilities for the development of the natural resources of the country. British enterprise is not wanting for the undertaking under favorable circumstances, but until sufficient protection is ensured to the speculator by the Native Government, Travancore must remain a sealed country in regard to trade and improvement, when it may be hoped that a happier era will dawn upon the people. General Cullen has proved by the successful establishment of gardens at different elevations, (Vailey Makay and elsewhere,) how well the cultivation of such products as the following prosper, viz., Potatoes, wheat, coffee, sugar, nutmegs, cloves, cocoa &c., all of which thrive and yield abundant produce.

Allepey, Aulopolay, or Alapushe, as it has been variously named, is the present commercial port of Travancore, and the principal depot for salt, Cardamoms, Pepper, Teak-wood and other products of the country. It is reached by a canal leading from the backwater nearly due west, the length being about three miles. This canal is entirely artificial, and is crossed by several bridges, facilitating trade and communication to and from the northern and southern sides. Previous to entering the canal there is a very deep basin, some 40 or 50 feet in depth, inhabited by alligators of enormous size, which may often be seen basking on the banks. It was in this pool that at the beginning of this century the reigning minister threw such hapless Europeans as chanced to fall into his hands, first sewing them up alive in sacks, and then indulging in the pastime of casting them into the deep waters to

become the prey of the monsters at the bottom. The banks of the canal leading to Allepey are fringed with several interesting plants. The *Lantana Indica*, with its pale pink, orange and white varieties of flowers, is strikingly beautiful. The scarlet festoons of the *Barringtonia acutangula*, and the gorgeous golden spikes of the *Cassia alata* are chiefly conspicuous, large specimens of the *Terminalia Catappa* overhang the banks, while the *Pandanus* so admirably adapted for retaining the soil and preventing its gliding into the water is plentifully planted. The large kind of dock, the *Colocasia hymphæifolia*, with its finely reticulated leaves is thickly growing at the waters edge. Of this latter plant, there are two kinds, to all appearance similar, but one is cultivated for the sake of its roots, which are eaten, while the other is not. The cultivated species is I believe the *Caladium ovatum*, the *Karinfola* of Rheede.

Important as Allepey is to the Travancore Government as a commercial depot, from the facility of an inland water communication, which enables the forest products to be brought to the very doors of the godowns established for their reception, yet undoubtedly its greatest advantage as an emporium arises from the singular natural breakwater formed in the open roadstead, and which consists of a long and wide bank of mud, the effect of which is so completely to break the force of the waves, that large vessels in the stormiest weather can securely anchor in the open roads, where the water is as calm as a mile-pond. It is this extraordinary deposit which has earned for Allepey the name of "mud bay." The origin of this deposition of so large a quantity of mud in the open sea about two or three miles from the shore, and so many miles from any bar or outlet from the backwater has never been satisfactorily accounted for. From the circumstance of there being no natural outlet for the vast accumulation of waters which are poured down from the various mountain streams into the basin of the backwater, nearer than thirty six miles on either side, it is not improbable that there exists a subterraneous channel communicating with the sea from the backwater through which the large quantity of mud is carried off and thrown up again by the sea in the form of a bank.

See Captain Coape's Voyage to the East Indies.

On examining the results of ninety-five excavations and borings of the alluvial land, it appears:—1. That the alluvium is of two principal kinds: first and chiefly, an argillaceous earth or loam, more or less mixed with fine sand of various shades of color, being the true Nile mud or sediment; and, secondly, pure quartzose sand, derived in a great measure from the desert, which is swept by violent winds through the gullies in the hills on either side, but chiefly from the Libyan range. 2. That the Nile sediment found at the lowest depth reached, is very similar in composition to that deposited by the inundation water of the present day. 3. That in no instance did the boring instrument strike upon the solid rock which may be presumed to form the basin between the Libyan and Arabian hills, which contains the alluvium accumulated through unknown ages, from the time when this depression in the earth's surface was formed, and the waters of the Nile first flowed through it. 4. That except minute organisms discoverable only by a powerful microscope, few organic remains were met with, and that those forms were recent land and river shells, and bones of domestic animals. 5. That there has not been found a trace of an extinct organic body. 6. That at the same levels great varieties in the alluvium have been found in adjoining pits, even when the distances between them are very moderate. 7. That there is an absence of all lamination in the sediment. When the author first undertook these interesting researches, he expected that sediment, slowly deposited on the land from nearly tranquil water, would present in sections a laminated structure—more especially as an able observer, the late Captain Newbold, stated that he had met with such an arrangement of the alluvial soil. It was therefore with no small surprise that on examining the soil from the excavations at Heliopolis, no such laminæ could be discovered, and in none of the excavations or borings has such a structure been met with in a single instance. There can be no doubt that a layer of sediment must be deposited upon the land, but as soon as the waters have subsided, the sun, the wind, and cultivation combine to break it up. From the earliest times when the Nile Valley was inhabited by man, the

alluvial land fertilized by the sediment from the annual inundation must have been cultivated in the returning seasons. The next following flood softens the hardened mud of the preceding year, and it is considered that this softening of the soil is one of the most fertilizing effects of the inundation. The very primitive and simple system of cultivation at the present day is, most probably, the same which has been followed for unknown ages, for it is said that in Egypt nothing changes. As the subsiding inundation level continues to expose to air and light the surface on which the sediment has been deposited in insulated patches of the uneven ground, the Fellah, wading in mud begins to throw seed upon them in contour lines, his light boat bringing to him his seed corn. As the retreating waters expose more land, as soon as it is sufficiently drained another zone of ground is sown, and so on until the lowest parts have received the seed, which must be cast before the surface begins to crack, and after it has been cast it is beaten down into the mud with a flat piece of wood attached to the end of a pole. During the dry season, when vegetation withers, and the underground water has subsided, the ground cracks in to numerous and deep fissures, forming the usual polygonal figures we see in dry mud or clay, affording receptacles for the flying sand. For three or four months in every year the surface of the valley stript of vegetation, in the state of a dry powder, is swept by violent winds, raising clouds of dust. By these combined causes, therefore, every trace of the deposited layer must be effaced. Instances of lamination and alternation of clay and sand, such as those mentioned by Captain Newbold, are not unfrequently met with on the banks of the river and at the entrances of canals, but they are local occurrences, caused by eddies and currents.

A further result of these researches is, that there are occasional accumulations of soil, the materials of which are only remotely derived from the inundation water and the storms of desert sand. In the neighbourhood of old buildings and on the sites of earlier buildings, where these have been constructed of crude bricks, the soil, to a considerable depth, may have been derived from the disintegration of these bricks. The soil thus derived would have

it into the case until it stands about $\frac{1}{8}$ th of an inch thick. When the mixture is on the point of hardening, cover it with a piece of white or colored paper previously cut to the required dimensions.

No. 2. *Entomology.* On an artificial method of preserving a collection of duplicates of *Lepidoptera* in a portable form.

Those who devote their spare hours to the study of the various branches of natural history in India, whether they prefer entomology, ornithology conchology or botany, cannot but have found, that the constant movements to which we are most of us subject, are a great impediment to these pursuits.

Collections of specimens in either of these branches are generally bulky, and the care, anxiety and expense involved in their transmission from place to place, do much to counterbalance the pleasure which these pursuits are calculated to afford. Any plan which tends to decrease the bulk of these collections, will, I am sure, be acceptable to collectors, and with this end in view, I proceed to recommend the adoption of a simple plan examples of which as a *pastime* many of us have no doubt seen, but of the *extended application* of which in the manner now proposed, I have never witnessed an example. We have our books of ferns, mosses and sea-weeds, and why should we not have a book of butterflies, which, independent of its portability and beauty, would be one of the most lasting ways of securing examples of these delicate insects.

I must premise however that the plan which is to a certain extent *artificial*, is intended to be applied simply and solely to the preservation of *duplicates*, and can never supersede or replace a collection of the perfect insects.

The mode of procedure is as follows. Chose a well bound blank book of convenient size, and having ready at hand a phial of isinglass size, (made by dissolving isinglass in alcohol) a pair of fine pointed scissors, and a camel's hair pencil, select the duplicate specimens which are not required in your cabinet, and cut off carefully the four wings close to the point of insertion. Lay then on a page of your book in the most natural attitude, and if you have two specimens of the same butterfly, show both the upper and

under sides of the wings. Trace the outline of the wings as they lie on the page with a fine lead pencil, then remove them gently with a camel hair brush, and cover the space within the pencil mark with a coat of size; replace the wings carefully, cover them with a piece of paper and press them with a marble slab or heavy weight. When dry remove the weight, and take away the skeleton of the wing, the whole of the delicate feathers will be found to have adhered to the paper in their natural order. With a brush and colors insert the body in the space between the wings, and give if necessary, a coat of size over the whole. The effect may be much enhanced by adding drawings of the larvæ and pupæ as well as of the plants on which they are usually found.

A collection of duplicates of many thousand specimens may in this manner be preserved within a very small compass, it has moreover the advantage of being indestructible by insects is very convenient for reference, and, although it can never supersede the cabinet, it forms a most convenient auxiliary to it.

SELECTIONS.

The Royal Society.

At the last meeting of the Society, a paper was read, entitled, *An Account of some recent Researches near Cairo, undertaken with the view of throwing light upon the Geological History of the Alluvial Land of Egypt*, by L. HORNER, Esq., V.P.R.S.

This communication, which followed a previous memoir on the same subject, details at considerable length the results of the examination of the various soils and other substances obtained by numerous borings and shafts sunk in the vicinity of the statue of Rameses and across the valley of the Nile, in the parallels of Memphis and Heliopolis. The following are the chief facts made known by the excavation shafts and borings.

nearly the same aspect as the natural deposit of Nile mud. In the excavation at Heliopolis crude bricks were seen to have been the origin of the soil, these by visible rectangular lines chequering the sides of the pit. This last appearance, however, must be a rare occurrence, for the action of the inundation water softens the bricks and causes them to melt, as it were, into a homogeneous mass.

And finally, in nearly every part of the ground penetrated, artificial substances have been found, such as fragments and particles of burnt brick and pottery, and in the area of Heliopolis and Memphis fragments of statues and other sculptured stones. By far the most interesting kind of this nature was obtained from the lowest part of the boring of the sediment at the colossal statue of Rameses at a depth of thirty-nine feet. The boring instrument brought up a fragment of pottery, now in the author's possession. It is about an inch square, and a quarter of an inch in thickness, the two surfaces being of a brick-red colour, the interior dark grey. According to Mr. Horner's deductions, this fragment, having been found at a depth of thirty-nine feet (if there be no fallacy in his reasoning,) must be held to be a record of the existence of man 13,375 years before A. D., 1858, reckoning by the calculated rate of increase of three inches and a half of alluvium in a century—11,517 years before the Christian era—and 7,625 before the beginning assigned by Lepsius to the reign of Menos, the founder of Memphis. Moreover, it proves, in his opinion, that man had already reached a state of civilization, so far, at least, as to be able to fashion clay into vessels, and to know how to harden it by the action of strong heat. This calculation is supported by the Chevalier Bunsen, who is of opinion that the first epochs of the history of the human race demand at the least a period of 20,000 years before our Era as a fair starting point in the earth's history.

An appendix to Mr. Horner's valuable paper contains, among other matters, a description of the microscopic organisms in the Nile sediment: and the memoir is accompanied by various plans of the excavations and borings, with sections of the alluvium pierced through.

The author acknowledges with gratitude the assistance he has

received during the course of these interesting researches, which have extended over several years from our Consul in Egypt, the Hon. Charles Murray—from the late Viceroy, Abbas Pasha—and especially from the able engineer, Hekekyan Bey, who was educated in England, and of whom Mr. Horner gives a very interesting biographical memoir. The entire expense of the researches carried on during three seasons, of some original surveys, and the preparation of various maps on a large scale, and many drawings, amounting altogether to a very considerable sum, have been, with great liberality, defrayed by the Egyptian Government. The expense of analysing the soils sent to England was met by a grant of money from the Royal Society.—*Saturday Review*, Feb. 23.

The Geographical Society.

At the meeting of the Bombay Geographical Society held on the 21st January, the following letter from Captain Burton was laid before the meeting. The various references contained in it were made at the suggestions of the Committee of the Society in the correspondence with Captain Burton, and with Government in December 1856 :—

Zanzibar, May 25th, 1857.

SIR,—I have the honor to acknowledge receipt of your official letter dated the 8th December 1856, conveying to me, by order of the Geographical Society of Bombay, certain suggestions regarding the expedition into Eastern intertropical Africa, which I have been appointed to lead, and to express my gratitude for their valuable instructions and recommendations.

During my last preparatory journey from Mombator, on the Panjan river and thence by land to Fuga, the capital of an interesting mountain district—Usambara—I left at Zanzibar for comparison a barometer in charge of Mr. Frost, Medical Officer to the Consulate, the instrument (by Adie) obligingly lent to me by the Secretary of the Bombay Geographical Society. It would have done scant service during a coasting voyage, and on a rough

mountain tour, so delicate an instrument would certainly have come to grief. I took with me four thermometers by Newman, of which one, a B. P. Thermometer, was rendered useless by the mercury setting in the upper bulb, consequent upon expansion of air carelessly left in it by the manufacturer. I have now in all four strong Nutt's Thermometers, in good condition, and two B. P. ditto, one used by Captain William Smyth, R. N. in crossing the borders, and kindly given to us by Colonel Hammerton. These even should the "Adie" be broken, and the instruments recommended by the Medical Board Bombay not arrive in time, will suffice to determine with tolerable accuracy the altitude of the Unyamisi Lakes. As regards sympisometers, they are found by the long experience of Naval officers, and the accurate hourly observations of a staff of recorders, to be useless by reason of their extreme sensitiveness on this coast within 6° or 8° N. and S. of the Line. This however might not be the case on land.

For a reference point of known pressure, I am happy to say we can now confidently apply to Zanzibar. Mr. Apothecary Frost, an able and accurate observer, has during the last ten months filled up Meteorological tables with the Barometer,—probably the same instrument sent by the Bombay Geographical Society in 1847,—with Thermometer attached and unattached, wet and dry bulb, vaporating dish, and with the rain gauge. As the Society seems to take an interest in these observations, I have the honor to transmit copies with which Mr. Frost has obliged me.

I now proceed to answer your letter paragraph by paragraph.

For enquiries into the hydrology of the region which we propose exploring, I shall be careful to provide myself with a dish and a gauge. The professionally learned however must not be exacting in their demands for observation. These African expeditions present peculiar difficulties. An expedition into the Eastern Interior is a small campaign, in which the traveller is set by all the troubles, hardships, and perils of savage warfare. He must despair of studying "infusoria," unless at least he have something else to do.

The Missionaries and all acquainted with the country have wondered at our using instruments at Usambara:—the dazzle of a sextant makes every man thirst for your blood. The climate also is hostile to the traveller in more ways than one. Captain Spike, my well tried and energetic companion, has twice suffered severely from sickness, jungle fever and catarrh,—in consequence of exposure to disc whilst taking observations. The simplest geographical operations become at times impossible. During our two days and two nights at Fuja, a dense poll of clouds overhung the sky, the rains had set in, though the half of February had not till elapsed; we never saw the sun, and we could not find even a star we had descended the hills. In these regions, the traveller's chief study must be to make things easy, to take all easy, and do only what is easy. I doubt the route crossing any great mountain ridge as you suppose: it leads, say the Arabs, with a steady rise and an occasional ascent, between the coast and lake. As regards our altitudes on the way, we can boil Thermometers and register the Barometer;—for objects off the line of march we must depend upon compass bearings, a Pedometer horse-line and vertical angles observed with a large or small sextant. I have the honor to forward a few specimens of the coast formation: but for the sickness which cut short our journey, our collection would have been less meagre. The mountain zone, like Zanzibar and its adjacent Islands, is a mass of corallines, often shelly and coated with red, yellow and black argillaceous soils, rendered fertile by decayed animal and vegetable matter. In some places there are distinct sea-beaches rising 100 to 150 feet above the alluvial plain. In others I could find none.

From Mombas to the Panjany river (the tract called in Sawahili "Mrima" or the Mountain Region) stretches a broken line of sandstone at some distance from the coast, and varying from 700 to 1,200 feet above the sea level. The interior is gneiss, quartz and sandstone, with detached hills of tufas and grey granite: the latter is so micaceous that the Belooch garrison cannot banish their belief that it contains gold. As at Madagascar no limestone appeared, and the result of enquiry is a doubt of its existence. I

inspected many wells and excavations upon the coast, and rarely saw either blue clay or tree roots underlying the gravel. The habitat of the Cocoanut is chiefly the Coralline coast, but it extends along the Panjany river, and bears fruit at least 30 miles from the sea; wherever it is found at any distance from the main stream the natives judge water to be near.

The ripe Copal (called Gum Animi in the London market) is the most interesting production of Eastern Africa. This semi-fossil is not generally "washed out of streams and torrents," but dug up especially during the rains by the Sawahili of the coast and the savages of the interior. There is, however, a kind of gum called by the natives—who deeming it the Egesta of whales, know no use for it—"Damar." Found upon the sea, especially about Cape Delgado, it floats, whereas copal sinks, in water: it may be unripe gum washed from the shore during the wet monsoon. The whole of this coast produces the real copal of commerce in different degrees of excellence. Specimens have been brought to Zanzibar from Brava and Magdishu (Magadoxo). Small quantities are found in the Rabai hills behind Mombas, and the tree grows in the jungle-patches which stud the range. From Panjany southwards for 80 miles it is plentiful, at distances varying from three hours' march to two days' journey from the coast. It would be impossible for us "to trace the position and circumstances of the extinct forest, of which it now constitutes the principal remains." Such an investigation would require at least two months' voyaging along and dwelling upon the fatal sea board. In most places, I am told, there is now no sign of a tree.

Of Gum Copal these regions supply two great varieties:

1. Raw, popularly called "Jackass Copal," is, I venture to opine, the gum which, exuding from the trunk or branches of the live tree when injured by elephant or man, fall to the ground, and either infiltrated, or was covered by successive layers of soil. Like a common resin it is softened by spirit, and becomes viscid in the solution used for washing ripe copal. This variety is exported in considerable quantities from Zanzibar to China, where, it is said, the people have discovered and retained to themselves the secret

of working it. At Bombay and Surat, it is made into an inferior varnish for carriages and palanquins.

2. The ripe or true copal—a semi-fossil, doubtless the product of forests overthrown by gradual decay by the upheaval of the coast or by some violent agency of the elements. This is proved by the fact, that pieces of the gum are met with embedded in wood, which crumbles to dust under the touch, and by its “goon-skin,” which is the impress of sand or gravel. There are many varieties of colour, caused probably by the embedding strata, the clearest and most transparent fetches the highest price; then follow the numerous and almost imperceptible gradations of light amber, lemon and dark yellow, red and tufas. I have seen a specimen of tender green. Sometimes the gum, like Sicilian amber, contains drops of water, bees, tics, flies and other insects, delicately and completely preserved, and disproving a remote antiquity.

Without entering further into theory, I will simply describe two visits which I made to the Copal-diggings. On the 10th May, I rode out from the Town of Zanzibar upon the Mony road. One mile east of the town lies a low sandy plain covered with sedgy grass, and pitted with holes two or three feet deep, from which copal had been dug. The place is about a mile from the shore, apparently but few feet above high-watermark, and bounded landwards by a sandy nullah. Passing the palace of Mony, some one hundred yards, I was shown a torrent bed, where during the rains copal is said to be brought down and picked up by slaves. Thence turning towards the interior we rode up the rising ground, to judge by the eye, about one hundred feet above the level of the sea, for a mile and a half into an estate, belonging to the prince, and called Rauzah. Here were many traces of copal diggings. The soil is a dark vegetable mould varying from a foot to a foot and a half in depth, based upon blue clay, the raised sea beach. This clay becomes exceedingly fat and adhesive, clogging the bar the deeper it is excavated; it is mixed throughout with fibres, said by the negroes to be roots of the Cocoanut tree half decayed, and of bright red: blood colored bits of earth also variegated the faint blue color, and at a depth of about two feet and a half, water began to

exude from the greasy walls of the hole. The copal is here found in the vegetable soil overlaying the blue clay.

On the 13th May, I started from Saadan, a haven on the mainland, opposite Zanzibar, in company with the Akida-ao, or Mucudum of the copal diggers. Passing over an alluvial plain, covered with rank vegetations, acacias, thorns and spear grass, after walking three miles I was shown the copal tree. It is growing in a thicket upon a flat covered with toddy and fan palms, but no cocos; it stands about thirty feet high, and measures in girth three feet. Gum exuded from the bark, and in securing the specimen of the wood herewith forwarded, we were pitilessly assailed by a large ginger-colored and semi-transparent ant whose very bite drew blood. The copal tree is rare on this part of the coast: within the space of several hundred yards I saw two only.

Another mile brought us to a distinctly defined sea beach rising about 150 feet in a swell from the plain, marked by a regular line of quartz and quartzose pebbles and crowned with luxuriant thickets. The soil is sandy, and here as on the flat below are frequent traces of the copal digger. Our guide was induced to cut a stick to sharpen it, and to scrape up the earth which produced several bits of gum. One of the slaves dug a pit about three feet deep; the color of the sand became redder as he went lower, crimson fibrous matter appeared, and presently the ground seemed to be half copal, half sand. He assured me that there is no subsoil but this red sand, and that his people never dig deeper than a man's waist.

The whole of this land from Panjan to Mboamaji may be called the copal coast: it affords an apparently endless supply of the gum. Copal is obtained by scraping the sand, even in places washed over by high tides, and often when digging holes, to fix the poles of houses, the people come upon it. That of Saadan is poor compared with the produce of Wandé and the Southern harbour. On the mainland it costs half price of what is paid upon this Island, and the lazy inhabitants of the villages can never be induced to dig whilst they have a handful of food remaining.

The copal tree (*Vateria Indica*? or *Hymenœa Vermicosa*?) is still found in the Island and on the mainland of Zanzibar. It is not

as was supposed a small and shrubby thorn nine foot high: from its towering stem canoes sixty feet long have been made and a single trunk has sufficed for the keelson of a brig. The green wood is gummy; whole flakes at times adhering to the saw. When dried it is well veined of a light tint, and has been used for the panels of doors: when oiled and polished it darkens to a yellowish-brown. Its small branches freshly cut make good and pliant sticks for chastisement.

I have the honor to forward the best specimens procurable of the superficial soils, in which the gum is chiefly found, the underlying blue clay, the red earth that is found mixed with the latter, a piece of copal, branch and leaves, and a bit of the gum here called "Damar." Unfortunately the copal tree was not in flower or fruit: the people assured me that it bears a berry not unlike a grain of Indian Corn.

The merchants of Zanzibar (mostly Germans and Americans) are not likely to throw away an ounce of serviceable copal, and they have consulted the ablest European Technologists upon the subject of preparing it to the best advantage. Supply certainly no longer meets demand, but that golden rule of political economy full of exceptions in civilised regions, in these latitudes becomes a sad fallacy. There is an inexhaustible supply upon the coast of East Africa, but "hands" are wanted. When there is little rain and the ground is hard, the lazy savage will not dig. Moreover "Kizkazy copal"—excavated in the N. E. or dry monsoon—annoys merchants by the difficulty of washing off the hard sand which adheres to its surface. Whenever upon the coast there is either a blood feud—and these are a legionary host—or a drought, or a famine, or a pestilence, the people strike work and dollars are offered in vain.

I must leave, Sir, to your ingenuity the task of remedying these evils. European labourers cannot be employed, the climate of East Africa, as has been abundantly proved is not less injurious to our constitutions than the worst parts of the Western coast. Indian coolies, the only procurable hands, would fear to face the wild men, some of whom I believe to be inveterate cannibals. If

they did summon courage they would loose their lives, and justly enough, for trespassing upon other people's property. A large gang (say 500) of good fierce negroes from Kilva (Quiboa) and the southern parts, might be taught to use a proper mattock instead of the child's plaything now employed, and each man would doubtless procure twelve or fifteen lbs. per diem; but the Imaum's Government would probably object, as a late treaty enables it to do. The Lawahili Mtũa Mkuba or mucedum of the copal diggers would require propitiation, and to prevent the labourers running away, it would be necessary to enter into arrangements with all the chiefs of tribes, villages, and harbours. It is to be feared that such an operation, commercially speaking, would not pay. Willingly therefore as I would wish that highest of meeds, the gratitude of my fellow countrymen, by reducing the price of carriage-varnish, I must fairly confess it to be beyond my powers. The sole remedy for the manifold diseases of this Bona Terra with its Malaguns is time:—perhaps an occasional East African expedition might be administered to advantage.

We have, I am happy to say, shaken off the miasmatic fever of the coast, and are ready to set out again when the rains show any signs of abating. Dr. Steinhäuser has not yet joined us, but we are in hourly hopes of the welcome event: his presence will be a no small comfort in a sickly climate, and where we must expect to suffer from the hardships, exposure, and various incidents of African exploration.

I have the honor to be, Sir,

Your most obedient Servant,

RICHARD F. BURTON, Bombay Army,
Commanding E. A. Expedition.

SCIENTIFIC INTELLIGENCE.

The Scientific Expedition of the Austrian Frigate "Novara."

His Imperial Austrian Majesty's Frigate *Novara* is now in the Indian seas on her voyage by circumnavigation, having arrived from the Cape of Good Hope and Rio de Janeiro. The vessel left Trieste in April 1857, with instructions to be absent for 3 years.

The staff of Savans attached to this exploring expedition is composed of the following gentlemen.

1. Dr. Carl Scherzer, known through his travels in Central and North America, performed in company with Mr. Moritz Wagner. The narrative of his visit to Nicaragua, Paraguay, &c., under the auspices of the British Government has been published both in German and English: he accompanies the expedition for the purpose of making Ethnological and Statistical Inquiries.

2. Dr. Ferdinand Hoch Stetter, Member of the Geological Institution of Austria, Physicist and Geologist to the Expedition, son of the traveller where Abyssinian plants were distributed to the subscribers to the *Uris itineraria*. This gentleman has published a variety of Geological and Mineralogical researches, amongst which is a Geological map of Bohemia. He is in charge of numerous sets of valuable lithographs, and of duplicate collections of minerals supplied by the Geological Institute of Vienna, with a view to reciprocal interchange with the Scientific Societies of Eastern Asia.

3. Dr. G. Franenfeld, the Custodian of the department of Invertebrate Animals in the Imperial Museum at Vienna. He accompanies the Expedition as 1st Zoologist, especially for the lower classes of animals. He is well known from his travels in Egypt, his Report upon Gall Nuts, his description of the parasites on Cheixoptira, &c., published in the Transactions of the Zoological and Botanical Association of Vienna. He is a most indefatigable Naturalist. Franenfeld and Hoch Stetter were specially selected by

the Academy of Sciences to accompany the Expedition, and it was not originally intended that there should be any other Naturalist. However, by order of the Archduke Ferdinand Maximilian, Lord High Admiral of the Indian Navy, and Prime Mover of the voyage of the *Novara*, Dr. Scherzer already named, and the following gentlemen were added.

4. Mr. J. Zelebor, in charge of the Ornithological Department, of the Imperial Museum, an able Ornithologist and Taxidermist, accompany the Expedition as 2nd Zoologist, specially for the higher classes of animals. He has travelled in Persia and Egypt, whence he brought back a remarkable collection of live animals. Mr. Zelebor was on the point of starting for the West Coast of Africa for the special purpose of bringing back a live specimen of that extraordinary monkey *Troglodytes Gorilla*, (the great Chimpanzee,) when he was ordered to join the Expedition of the *Novara*.

5. Dr. Schwartz, one of the Physicians on board, was added to the staff of Naturalists for the purpose of making Medical Inquiries and Botanical collections. He has already obtained many objects of great value, amongst which may be mentioned the skeleton of a Bushman from South Africa.

6. Mr. A. Felineck, of the Botanical Garden at Vienna, attached to the Expedition as Seed-Collector and Conservator of Vegetable Products.

7. Mr. Selleny, one of the most talented Painters in the Austrian Capital.

8. The whole Expedition is under the charge of Baron Wullersdorf, himself an eminent Astronomer and Physicist. He was formerly Director of the Observatory at Venice. These Naturalists have been furnished with printed instructions, compiled by the most eminent Savans in Austria. The venerable Humboldt himself contributed a long list of Physical and Geological Inquirenda. The Expedition will make a stay of some weeks amongst the Nicobay Islands, the two larger ones of which are to be surveyed. The Frigate will then proceed to Java, New Zealand, &c.

NOTES AND QUERIES.

[The following propositions have been submitted, relative to a system of Notes and Queries, by Lieutenant Hawkes, and we think their adoption will be followed by the receipts of much curious and interesting information.]

Measures are, however, about to be adopted whereby a less lengthened period will elapse between the receipt of, and reply to, any queries.

Any communications intended for insertion, in reply to the questions now submitted should be forwarded to the Secretaries of the Society with the least practicable delay.

All questions received will be published at the Monthly Meetings of the Society and entered seriatim in all future numbers of the Journal under the special head of NOTES AND QUERIES.]

RULES.

(1) Notes and Queries submitted by correspondents should be confined to those of a scientific and literary character; the queries should be put, and the answers given in the plainest and most concise form. As several communications will frequently be sent in answer to the same query, the substance only of these will be given; except where the answers differ in material points, when the opinions of each writer will be recorded.

(2) Correspondents in forwarding Notes or Queries should authenticate their letters, not only for the satisfaction of the committee, but chiefly as a means of communicating with the writer should further enquiry be necessary. The name of the correspondent will be appended to his first communication, and his initials to all subsequent notes, &c.

(3) Notes and Queries will be numbered separately and consecutively.

NOTE.

(1) *On Mr. Rarey's system of horse-taming.*—An American paper intimates that it is cognizant of the peculiar secret possessed by Mr. Rarey, and used by him in subjugating the most vicious horse. "The chief secret," according to the Advertiser, "consists in raising one of the forefeet of the horse doubling the knee and keeping a strap round the fetlock fastening the foot close to the

arm or shoulder, the horse then stands upon three legs. Having next put on a surcingle, pass a long strap or rein through the surcingle and fastening one end of it around the fetlock of the other forefoot, attach the other to the surcingle after the animal is thrown, so closely as to deprive it of the use of the limb. In this item the treatment may be varied in fastening, the second fetlock to the arm or shoulder, after the animal is down. This plan "says the Advertiser" is successfully practised by many skilful horsebreakers in Western New York, and the horse yields to the necessity of the case, his spirit of opposition is broken"—(From the *Home News*, 17th March, 1858.) H. P. Hawkes.

QUERIES.

(1) *On the effect of the venom of the Cobra on the Mongoose.*—Have any of our readers been witness of an encounter between a Mongoose and a Cobra or other venomous snake, if so what was the result? This query being put in the hope of ascertaining whether or not the Mongoose is naturally unsusceptible of the effects of the poison (as some suppose) it would be necessary therefore that the eye-witness should have satisfied himself that the snake was actually in possession of fangs and a poison bag uninjured, that the Mongoose was undoubtedly wounded, and that it was kept long enough after the encounter to prove the inertness (or otherwise) of the poison on its system. H. P. Hawkes.

(2) *The Damia extensa as an antidote for snake bite.*—Are there any well authenticated cases of the cure of the cobra bite, by the inward administration, or outward application by the *Damia extensa* (or *Cynanchum extensum*) which is called in Tamil *Veli-parutti* and *Ootamani*, and in Telugu *Gurutti*? H. P. H.

(3) *The Company's monogram.*—What is the meaning of the numeral 4 which surmounts the Company's monogram. H. P. H.

(4) *On the meaning of the word "Mylay."*—The word mylay, milay or meille is used in connection with many Indian coins, as the mylay fanam, cash, &c. What is its meaning? If derived from Mylapoor as some suggest, how can its presence on the most recent coins struck in Mysore, be accounted for? H. P. H.

(5) *A concretion found in teak trees.*—A peculiar concretion resembling lime or gypsum is occasionally found in the heart of teak logs. It generally collects in what carpenters call a "shake" in the wood, but with this exception the logs are perfectly sound, and no communication whatever with the external air has been observed. Is its chemical constitution the same as that of the "tabasheer" or bamboo salt. *H. P. H.*

(6.) *On the curing of tobacco.*—The very great difference in quality of the tobacco of various parts of India is said to be attributable *entirely* to the mode of curing. Is this correct? could any of our readers give a detailed account of the mode of cultivation, nature of cure, and more especially of the mode of curing adopted in their own neighbourhood. The process of curing the Lunka and Trichinopoly tobacco would be especially interesting. *H. P. H.*

(7.) *On Burmese coins.*—Do any bona fide Burmese coins exist? if not what is the currency in use? *H. P. H.*

Agricultural and Horticultural Society of India.

[At the request of the Committee of the Madras Branch of this Society, we insert the following notice of the Premia for 1858, offered by the Bengal Society.

The importance, in an economic point of view, of the subjects thus brought forward, cannot be exceeded by any intelligence of a scientific character.

We trust that the long continued exertions made by this Society, and by the Government of India, may yet eventuate in the development of those resources, in which India is so rich, and which if drawn upon more largely may yet be the means of advancing her national prosperity and the wealth of her inhabitants.

The Premia for Essays are particularly interesting, and we trust that the liberal prizes offered may produce works of general and popular utility. The Fibres, paper materials, and substitutes for Gutta Percha, are all subjects of importance to every one interested in this country, and we are confident, that our own Presidency will not be backward, in the development of these articles as commercial products.]

LIST OF PREMIA FOR 1858.

Premia for certain Articles of Raw Produce, &c., Fibres (substitute for Flax.)

For the production of any new vegetable fibre, which can be successfully applied to all the purposes for which flax is now used, and of which not less than 10 maunds to become the property of the Society.—Rs. 1,000, and Gold Medal.

Fibres (substitute for Hemp.)

For the production of a quantity of any vegetable fibre, which can be successfully applied to the purposes for which hemp is now used, and equally strong and durable, and of which not less than 10 maunds to become the property of the Society.—Rs. 500, and Gold Medal.

Fibres Rhea.

For the production of at least 25 maunds of Rhea fibre, the whole to be the produce of the party tendering it, and of which 5 maunds to become the property of the Society, to be accompanied by a detailed statement of the process followed in its cultivation and after preparation, and the cost of the same. The quality to be approved by the Society, and the fibre to be in a fit condition for the English market.—Rs. 1,000, and Gold Medal.

N. B.—In the event of there being more than one competitor, the premium to be adjudged to the best specimen.

Cotton (Exotic) long staple variety.

For the production of at least 10 maunds of good merchantable cotton, raised from foreign seed of the black-seeded long staple kind.—Rs. 1,000, and Gold Medal.

Cotton (Indigenous.)

For the production of at least 5 maunds of cotton raised from indigenous seed, of a quality superior to that now exported, and such as is likely to prove a substitute for the Upland Georgia or New Orleans cotton of the United States of America.—Rs. 500, and Gold Medal.

N. B.—The producer or producers of the above cotton must submit to the Society a statement of the mode of cultivation and cost of the same.

Substitute for Gutta Percha.

For the discovery and production to the Society of any new substance, the produce of India, which can be successfully used as a substitute for Gutta Percha.—Rs. 500, and Gold Medal.

Materials for Paper-making.

To the producer of at least 6 maunds of fibre suitable for manufacturing into fine paper, such as will prove an efficient and economical substitute for rags or other materials at present employed in India for that purpose.—Rs. 500, and Gold Medal.

Quinine-yielding Plants.

To the introducer of twenty healthy plants of South American Cinchonas, of the kind or kinds known to yield the best description of bark.—The Gold Medal.

Madder.

For the production of at least 5 maunds of Madder, raised in any part of India, of which 1 maund to be the property of the Society.—Rs. 500, and Gold Medal.

N. B.—This prize to be renewed for three years, in the event of a specimen or specimens not being sent in by 31st December 1858.

Substitute for Gunny Cloth.

For the production of a cheap and efficient substitute for gunny cloth, suitable for packing sugar or grain, of which a piece of 36 yards in length, by 2 feet 3 inches in breadth, or thereabout, to be submitted to the Society.—Rs. 500, and Gold Medal.

Premia for Essays on certain subjects.

For an approved Essay on the following subjects:—

1. For the best practical Essay on the production and relative cost of the various oil seeds of India, suitable for export.—A premium of Rs. 500.
2. For the best practical Essay on the present state of the cultivation of the date tree in Bengal, and on the best mode of in-

creasing its production and improving the manufacture of its sugar.—A premium of Rs. 500.

3. For the best practical Essay on the present mode of cultivating and manufacturing Indian fibre, yielding plants known in commerce, such as jute, sun, &c., with practical suggestions for their improvement.—A premium of Rs. 500.

4. For the best practical Essay on the present mode of cultivating and preparing the various tanning products of India, with practical suggestions for their improvement.—A premium of Rs. 500.

Prize for a Gardener's Vade Mecum.

To any person who shall produce on or before the 31st December 1858, the best practical treatise on gardening as applicable to Lower Bengal, or a Gardener's Vade-Mecum, the sum of Rs. 600.

The work must afford full directions for the culture of vegetables, fruits, and flowers, whether indigenous or such as have been introduced into Lower Bengal to the present time, giving practical hints on grafting, budding, pruning, and transplanting, with descriptions of soils and manures best adapted to certain plants; a calendar of operations in the kitchen, fruit, and flower garden, for every month throughout the year must be added, as also a copious alphabetical index.

N. B.—The Rules of competition for Essays the same as published in 1856.

A. H. BLECHYNDEN,
Secy. A. and H. Society.

METCALFE HALL;
Calcutta,
April 1858.

The Late Dr. Stocks of the Bombay Army.

We are indebted, for the following interesting notice of the late Dr. Stocks, to Vol. VI. of HOOKER'S JOURNAL OF BOTANY. In

giving it insertion we cannot fail to record our deep and sincere regret at the loss of one of the most distinguished Indian Botanists, we trust that Dr. Stock's researches, into the *Natural History, &c., of Scinde*, may not be lost; but, that their publication may be undertaken, by some one competent to present them to the public, with that care which their interesting nature and undoubted merit equally deserve.

Our contemporary thus records the death of *JOHN ELLERSTON STOCKS, Esq., M. D., BOMBAY MEDICAL SERVICE.

This event took place at the residence of a relative, where he was on a visit (with an unmarried sister), Samuel Watson, Esq., of Cottingham, near Hull (his native town) at the early age of thirty-four. He received his medical education at University College, London, and profited more than most students by Dr. Lindley's Botanical Lectures. He entered the East India Company's service on the Bombay Establishment, and was soon appointed Vaccinator in Scinde, and afterwards Inspector of Forests there. His travels in Scinde and Beloochistan were frequent and extensive, and he took advantage of them to improve his knowledge of the Botany of all this remarkable region, which he showed to have a close affinity in its vegetable products with Arabia and Egypt. His collections of specimens were very extensive, and well prepared; and the drawings, done by native artists, under his immediate inspection, are no less so. On Dr. Gibson's visit to England, about three years ago, Dr. Stocks was appointed during his absence to the important duties of Conservator of Forests and Superintendent of Botanic Gardens in Bombay, which gave further opportunity of pursuing his Botanical researches, both personally and by means of Collectors. His ambition now was to turn these large collections to account, and to come to England, where alone he could determine the correct nomenclature of the Genera and Species, and where he hoped to publish the new plants, and to distribute his specimens in the manner that would be most beneficial to the cause of Botany.

* Hooker's Journal of Botany, Vol. VI. p. 395.

Dr. Stocks accordingly came to England on furlough, bringing his collections with him, and made Kew his residence, and here he had been busily engaged since the early spring, in comparing them with authentic specimens in the Kew Herbarium, and preparing them for publication. Unfortunately his constitution had been undermined by his great labours in the unhealthy climate of Scinde; he was subject to intense neuralgic pains in the head and neck, and a change of air and scene was deemed desirable. He accordingly spent a few weeks with relations in the Isle of Man; and on his way thence to Cottingham he caught a cold, which was succeeded by fits of apoplexy which, in a very few days, terminated fatally, on the afternoon of Wednesday, the 30th August.

Dr. Stocks had brought to England materials, in a very forward taste, for a general work on the Natural History, manners, customs, arts, manufactures and commerce, agriculture, &c., &c., of Scinde, which it is yet hoped may be found worthy of publication. Great talent and great research had been bestowed on it, and the information it contains is much of the same nature as that of the late Dr. Francis Buchanan Hamilton's *History of the Mysore*, but possessing the further advantage of being written in a lively and agreeable style, and rendered doubly valuable from the amount of Scientific knowledge of the highest stamp brought to bear upon it. Few men of his years were more extensively read in all subjects connected with the improvement of India, than Dr. Stocks. In that country his death will be much felt, and sure we are that to his personal friends the loss is irreparable, for he possessed a most kind and amiable disposition.

Like Mr. Winterbottom, Dr. Stocks was more gratified by being useful to others than in coming forward as an author; and it was only by the urgent entreaty of his friends that he could be induced to appear in that capacity. Most, if not all, that has yet been printed from his pen, we have been privileged to publish in our Botanical Journals. In the "London Journal of Botany," Vol. vii. p. 539, will be found some notes on the Botany (chiefly economic) of Scinde, describing some of the numerous vegetable products he had presented to the Museum at Kew. At page 550 of the same volume, is a most lively and spirited letter, written during "a Bo-

tanical excursion to Shah Bilawul, in Beloochistan." In the present Journal or "Kew Garden Miscellany," Vol. i. p. 257, is an excellent Memoir on two Balsam-trees (*Balsamodendron*) of Scinde, *B. Mukul* and *B. pubescens*, with two plates. In Vol. ii. p. 303, will be found an excellent general sketch of the Botany of Beloochistan, written after a second journey into that country. In Vol. iii. are descriptions and figures of two new plants of Scinde. Vol. iv. contains descriptions of thirty-seven Beloochistan plants, chiefly new species. His last communication will be seen at p. 314 of the same volume "Notes on the Botany and the Government Gardens of Bombay."

PROCEEDINGS.

The Managing Committee of the MADRAS LITERARY SOCIETY and Auxiliary of the Royal Asiatic Society, held their usual Monthly Meeting at the Club House, on Thursday the 11th February at ½ past 6 o'clock P. M.

The Honorable Walter Elliot, Esq., in the Chair.

Read a Letter from M. Haidinger, Director of the Imperial Geological Institute of Austria, with a Memo. of Publications presented to the Society, viz:—

1. Transactions of the Imperial Geological Institute Vienna, Vols. I, III.
2. Annual Report of the Imperial Geological Institute, Vols. I, VI.
3. Natural Historical Transactions published by Haidinger, Vols. I, IV.
4. Notes on the Communications of the Naturalist of Vienna—Vols. I, VII.

These valuable works relate to the Natural Sciences generally but to Geology more especially, and are beautifully illustrated:

many of the Lithographs being coloured, and some of them are Chromo-Lithographs.

Read a letter from Mr. H. Smith, Superintendent of the Government Press on the subject of Nature Printing, in which Mr. Smith with reference to the remarks which took place in discussion at a former Meeting, claims for his process a greater degree of originality than was then supposed to be his due. Mr. S. points out that the essential difference between Mr. Cox's process and his consists in this, that the ink is applied directly to the object and that the impression is produced by vertical pressure, whereas in the other it is obtained by the action of Rollers. The correctness of this distinction was fully admitted, and the more clear delineation of Mr. Smith's impression was illustrated by examples which met with the Society's approbation.

It was resolved that the following Institutions should be added to the list of those with which the Society exchanges its publications.

- The Imperial Geological Institute—Vienna.
- The Royal Academy Science—Berlin.
- The Royal Society—Edinburgh.
- The Linnæan Society—London.
- The Royal Irish Academy—Dublin.

The Committee beg to acknowledge receipt of the following paper from the Chief Secretary, Report of the Vegetable Products of the Pulney Hills with Catalogue of the Flora, by Lieut. R. H. Beddome, Assist. Conservator of Forests. This interesting communication will appear in next No. of the Journal.*

The Managing Committee of the MADRAS LITERARY SOCIETY and Auxiliary of the Royal Asiatic Society, held their usual Monthly Meeting at the Club on the evening of Thursday the 18th March 1858.

The Honorable Walter Elliot in the Chair.

The usual monthly statement of the Society's Accounts was read and passed.

Mr. Elliot exhibited to the Meeting, specimens of the curious genus *Sagitta*, the precise position of which in the Animal Kingdom has not been determined, some, as Huxley, regarding it as approaching the Annelidæ, others, as the late Professor G. Forbes, considering it more closely allied to the Mollusca, while a third party are inclined to view its nervous system as exhibiting an affinity with Crustacea.

These were received from Captain Toynbee of the *Gloriana*, with a number of minute Pelagian shells also shown to the Meeting. Mr. Elliot regretted that the departure of the *Gloriana* prevented Captain Toynbee from exhibiting the numerous beautiful drawings, executed during his Voyage, of microscopic marine objects, indicating many new forms of Crustacea, Tunicata, Acalepha: and Mollusca, which he would otherwise have done. He had however transmitted through Mr. Elliot for presentation to the Society, a MS. Translation from the German of some portions of Vogt's letters on Zoology, relating to these families, which he had found of use in his own researches. It was resolved that these papers should be printed in the Journal.

Mr. Elliot also read letters to his address from Messrs. Herman and Robert Schlagentwait, the former giving an account of the progress made in completing their calculations and arranging their collections, the latter proposing some Rules for the Orthography of Indian Names which they have proposed adopting in their forthcoming Publications.

The printed list of the Materials forwarded with their letters, contains 43 Volumes, the result of their own labors, and 38 Volumes of Observations communicated by others, "a most precious portion of which they add, particularly distinguished for their accuracy, is from your Presidency."

The Title of their work as fixed by the Court will be "Results of a Scientific Mission to India and High Asia," and will consist of about 9 Volumes with 50 Plates, chiefly containing positive scientific matter, one Volume only being devoted to general descriptive Memoirs in the form of Humboldt's Views of Nature, and all personal adventures being excluded.

The following is a list of the 43 Volumes of their own observations &c.

Vol. 1. Itinerary.

Vols. 2, 3, 4. Route Books.

These Volumes treat of almost every portion of the British Possessions in the East of the Countries contiguous to them. The 4th Volume contains routes communicated by the Foreign Office, Calcutta.

Vol. 5. Comparison and correction of the Instruments.

Vols. 6, 7, 8. Topography and Trigonometrical Measurements.

Vols. 9, 10, 11, 12. Astronomical determination of Places and Magnetical Observations.

Vols. 13, 14, 15, 16. Hypsometrical Observations and indications of the Barometer.

Vol. 17, 18, 19. General Meteorology and degrees of temperature of the Air.

Vol. 20. Rain, Height of Clouds.

Vol. 21. Optical phenomena of the Atmosphere, Observations upon Dew, Glaciers.

Vol. 22. Degrees of temperature of Rivers.

Vols. 23, 24. Degrees of temperature of the earth at different depths.

Vol. 25. Observations on the Physical state of the Sea. Portions of Sea water and River water for analysis.

Vol. 26. Observations upon Springs. Cold and hot Springs.

Vols. 27, 28, 29, 30. Geological Observations.

Vols. 31, 32. Geological Collections.

Vols. 33, 34, 35. Hydrography of rivers.

Vol. 36. Observations on the temperature and depth of subterraneous waters.

Vols. 37, 38. Measurements of the different races of men.

Vol. 39. Geographical Vocabulary of the names of places. Etymological and Ethnographical Remarks.

Vol. 40. Zoological Remarks. Zoological Collection, Ethnographical Collections.

Vol. 41. Geography of Plants, periodical phenomena of plants. Snow limits.

Vol. 42. Diameter of trees. Names of trees and plants, also the use of plant. Collection of Plants.

Vol. 43. Letters and reports to His Majesty King Frederick William IV. and to the Honorable Court of Directors of the East India Company, and to Alexander Von Humboldt.

These are merely the Headings of the different Volumes. The detailed Catalogue is in the Library of the Society.

The Scientific observations have been made in all parts of the British possessions in the East and Highlands of Asia, and with every variety of instrument.

Among other matters of interest, Mr. Herman Schlagentwaite stated that he had prepared a valuable Ethnographic Series of Casts of Heads of the various Indian races amounting to about 25, which had been executed in copper by the Galvano-plastic process with great success, and a specimen of which he had forwarded by the Overland Mail, but it has not yet been received.

He adds that no tidings have been received of their brother Adolphe since May last, which was a source of great anxiety to them.

Mr. Robert Schlagentwaite's Orthographical Remarks related chiefly to the use of the proper equivalents for the letter * * * which English writers usually represent by *j* & *ch*, but which the Germans prefer expressing by *dz* & *ts*. This subject was referred for report to the Sub Committee of Papers.

Lieut.-H. P. Hawkes forwarded the first of a series of Papers which he proposes submitting to the Society, entitled "Notes on various subjects."

Those contained in the present communication are :

1. On the best material for lining entomological cases.
2. On an artificial method of preserving duplicate specimens of Lepidopterous insects in a portable form.

These were referred to the Sub-Committee of Papers.

Extract from Meteorological Observations

DAILY

JANUARY 1858.										FEBRUARY 1858.									
Date.	Barometer reduced to 32° Fahr.	THERMOMETERS.				Wind.	Rain.	Remarks.	Barometer reduced to 32° Fahr.	THERMOMETERS.				Wind.	Rain.	Remarks.			
		Means.		Max.	Min.					Means.		Max.	Min.						
		Dry.	Wet.							Dry.	Wet.								
	Inches.						Inch.		Inches.						Inch.				
1	30.134	74.4	69.6	81.7	70.4	NNE		Cloudy.	30.046	72.0	67.2	83.1	63.5	E		Clear.			
2				82.5	67.0	NNE			30.053	72.3	66.6	84.6	64.7	NNE		do			
3	30.39	72.9	68.4	82.2	67.2	NNE		Clear.	30.028	73.4	69.0	84.2	67.0	S		do			
4	30.04	72.4	66.8	80.8	66.6	NNE		Hazy.	29.983	74.4	69.5	83.1	67.5	SSE		do			
5	29.995	75.2	66.1	81.3	71.6	NNE		Cloudy.	30.075	73.3	67.3	84.3	66.5	SSE		do			
6	30.012	75.0	66.4	81.8	70.5	NNE		do	30.009	77.7	72.6	86.6	73.8	NNE		Hazy.			
7	30.01	73.7	65.5	81.9	69.5	NNE		do	30.006	78.0	73.5	85.7	72.5	NNE		do			
8	29.957	75.1	65.3	82.3	72.1	NNE		do	30.005	76.7	71.8	85.1	69.9	SSE		Clear.			
9				81.6	68.4	NNE		do	30.005	75.9	70.6	85.5	69.5	NNE		do			
10	95.5	75.5	69.4	82.9	75.9	NNE		do	29.982	76.8	72.0	86.6	70.6	NNE		do			
11	94.0	76.4	71.3	83.6	74.0	NNE		Overt.	30.041	76.6	67.9	83.9	69.7	N		do			
12	94.7	73.8	68.9	81.2	68.7	NNE		Hazy.	30.050	77.7	72.8	87.5	72.0	SSE		do			
13	97.6	74.9	69.0	82.7	69.9	N by N		do	30.062	77.8	72.7	85.7	72.8	N by S		do			
14	99.3	75.4	69.8	84.2	70.3	N by N		do	30.096	77.8	71.9	85.6	72.3	N		Hazy.			
15	30.002	74.1	69.4	82.7	68.7	NNE		do	30.041	76.6	67.9	83.9	69.7	N		Clear.			
16				80.5	67.1	NNE		do	30.066	76.7	67.3	84.4	70.0	N		Hazy.			
17	29.994	71.6	67.2	80.6	65.6	NNE		Clear.	30.034	75.5	67.0	84.0	67.0	N by N		Clear.			
18	96.3	71.1	66.7	80.9	64.5	N by N		do	30.000	73.5	66.8	83.8	65.9	N by N		do			
19	94.9	72.3	67.6	81.4	66.8	NNE		do	30.018	76.8	71.4	85.7	70.6	N		do			
20	94.3	72.0	67.3	81.8	65.3	N		do	29.974	77.6	71.7	86.4	74.3	N by N	0.020	Hazy.			
21	80.6	73.9	68.4	84.7	67.2	N		do	30.026	78.6	72.3	85.7	73.5	N by N		do			
22	91.9	74.4	70.1	83.1	68.5	S		do	30.018	76.8	71.4	85.7	70.6	N		Clear.			
23				83.1	67.9	NNE		do	29.974	77.2	71.1	86.6	70.0	N by S		Hazy.			
24	96.3	74.1	69.1	82.7	67.1	N by N		do	30.028	77.3	70.9	86.4	70.1	N		Clear.			
25	30.033	74.7	69.0	83.2	68.3	SSE		do	30.035	76.9	71.4	86.2	71.3	N		do			
26	92.0	75.0	69.2	83.8	69.3	SSE		do				87.7	72.3	NNE		do			
27	92.7	73.3	66.2	82.7	65.5	E		do	91.7	78.4	72.8	87.3	72.6	S		do			
28	95.1	74.3	68.3	82.7	68.0	E		do											
29	97.8	73.5	67.7	82.3	66.2	NNE		do											
30				85.1	75.6	NNE		do											
31	98.4	75.3	69.0	83.1	69.1	NNE		Hazy.											
Mean.	29.994	47.0	68.1	82.4	68.8	none.			29.997	76.2	70.3	85.5	70.1	0.020		Sum			

? This mark signifies that no Means can be taken

kept at the Madras Magnetic Observatory.

MEANS.

MARCH 1858.										APRIL 1858.										MAY 1858.									
Barometer reduced to 32° Fahr.	THERMOMETERS.				Wind.	Rain.	Remarks.	Barometer reduced to 32° Fahr.	THERMOMETERS.				Wind.	Rain.	Remarks.	Barometer reduced to 32° Fahr.	THERMOMETERS.				Wind.	Rain.	Remarks.						
	Means.		Max.	Min.					Means.		Max.	Min.					Means.		Max.	Min.									
Dry	Wet						Dry	Wet							Dry	Wet													
Inches	°	°	°	°	Inch.		Inches	°	°	°	°		Inch.		Inches	°	°	°	°		Inch.								
29.865	79.4	73.7	89.6	73.8	SSE	Clear.	29.891	83.3	76.9	93.2	77.1	SSE	Hazy.		29.776	84.3	78.6	94.0	80.0	SSE	0.014	Cloudy.							
85.8	80.3	74.3	89.6	74.7	SSE	do	874	82.4	75.8	96.5	75.9	SSE	Cloudy.		765	84.3	77.4	83.5	80.1	NNE	584	Overt.							
89.8	80.4	74.5	90.9	75.4	SSE	Cloudy.				91.9	74.5	SSE			765	84.3	77.4	83.5	80.1	NNE	596	do							
90.7	79.7	73.5	89.1	74.6	SSE	Clear.	853	82.8	76.7	93.7	78.3	SSE	Cloudy.		618	78.9	76.7	81.7	77.7	N	018	do							
91.2	78.5	72.7	88.4	71.7	SSE	do	859	83.5	77.7	93.5	77.4	SSE	Hazy.		729	78.1	75.1	88.8	77.4	S by W	004	Cloudy.							
			87.9	72.2	SSE		843	84.6	77.3	96.7	79.4	N by S	do		720	82.3	78.2	92.9	78.5	SSE		Hazy.							
92.2	78.7	73.3	88.1	72.5	SSE	do	806	83.4	77.1	94.6	77.0	SSE	Clear.		693	84.8	79.3	95.2	79.8	S	779	Overt.							
92.6	78.7	72.9	87.7	72.6	SSE	do	831	84.1	77.6	95.2	78.2	SSE	do					101.2	81.5	SSE									
91.4	77.7	72.0	86.8	71.3	SSE	do	822	85.5	78.3	99.9	78.3	SSE	do		733	88.8	78.6	93.7	79.0	S		Hazy.							
93.5	78.0	71.7	87.3	70.6	SSE	do				101.7	81.2	S by N	do		740	84.4	79.2	98.7	79.2	S by W		do							
95.3	79.2	73.5	88.4	73.4	SSE	do	788	87.2	79.8	99.6	82.4	S	do		658	85.6	79.1	96.2	80.3	S		do							
94.2	78.8	72.7	90.6	71.4	SSE	do	816	86.4	80.6	96.2	82.9	SSE	Hazy.		667	85.0	79.1	95.3	81.1	S by N		Cloudy.							
			90.1	72.2	SSE		816	85.5	79.9	94.9	81.7	S by N	Clear.		663	84.6	78.2	95.4	79.7	SSE		Hazy.							
94.3	79.5	73.7	89.4	74.4	SSE	do	840	85.2	79.6	94.5	81.4	SSE	Hazy.		683	85.1	79.0	94.4	80.3	SSE									
95.1	78.7	73.4	88.7	72.1	SSE	do	872	84.3	78.9	93.6	79.5	SSE	Clear.					94.8	82.1	SSE		Cloudy.							
92.8	80.2	74.7	90.3	74.7	SSE	do	894	84.3	78.7	93.7	78.9	SSE	Hazy.		702	87.9	77.7	100.8	84.6	S		Overt.							
92.7	80.8	75.2	90.6	74.3	SSE	do				94.6	79.1	SSE	do		677	85.6	77.6	94.5	82.2	SSE		do							
95.0	80.2	74.4	89.2	73.6	SSE	do	875	85.0	79.0	94.9	78.7	SSE	do		606	83.5	77.3	96.0	83.2	SSE		do							
97.7	79.9	73.3	89.6	73.0	SSE	Hazy.	857	84.9	78.1	95.0	78.8	SSE	do		616	85.3	76.6	97.6	79.2	S		Cloudy.							
			91.1	72.4	SSE		877	84.9	77.6	96.0	78.9	SSE	do		671	87.7	76.4	100.1	81.2	S by S		do							
95.7	79.5	73.7	90.8	72.1	SSE	Clear.	902	83.8	77.2	94.8	76.7	SSE	Clear.		700	87.2	78.3	100.2	81.1	S									
92.4	81.4	75.5	91.3	76.5	SSE	do	875	84.0	77.7	94.2	77.4	SSE	do					100.4	81.3	S		Hazy.							
92.6	81.6	75.5	91.4	75.5	SSE	do	809	84.3	77.5	94.1	77.5	SSE	do		740	87.5	77.3	103.7	81.3	S		do							
94.0	81.5	75.6	92.7	74.8	SSE	do				94.9	79.1	SSE			765	88.3	78.0	103.9	82.2	S		do							
90.5	80.9	75.3	91.3	74.4	SSE	do	772	85.6	79.1	95.6	80.9	SSE	Hazy.		775	88.2	77.7	104.0	83.1	S		do							
89.0	80.9	75.7	91.1	74.6	SSE	Hazy.	793	85.9	79.7	95.8	80.9	SSE	do		761	87.2	77.8	101.4	82.1	S		Cloudy.							
			91.1	74.5	SSE		814	86.0	79.5	95.8	81.1	S by S	Clear.		735	85.9	77.1	100.6	80.8	S		do							
86.9	81.9	76.2	91.9	77.5	SSE	do	836	84.4	79.3	98.3	81.9	NNE	0.279 Overt.		733	87.0	78.2	100.0	81.6	S									
86.2	82.3	76.1	91.7	76.1	SSE	Clear.	860	83.3	78.5	93.8	79.0	S	do					100.2	81.7	S		do							
82.3	82.8	76.8	92.7	76.9	SSE	do	831	83.5	79.2	92.4	79.7	S by S	192 Hazy.		798	87.9	78.4	100.6	72.3	S		Hazy.							
84.5	83.4	77.3	92.6	77.8	S by N	do									787	89.2	77.8	103.7	82.3	S									
29.913	80.2	74.3	90.1	73.9		none	29.843	84.6	78.4	95.0	79.1		0.832 Sum		29.713	85.2	77.9	97.1	80.9		3.031 Sum								
owing to the variable state of the Wind.																													

Extract from Meteorological Observations kept at the Madras Magnetic Observatory.

HOURLY MEANS.

Gottingen		P. M.		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		Means.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
Mean Time		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.			

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