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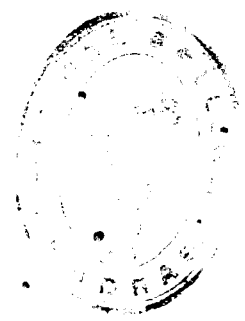

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THE AGRICULTURAL LEDGER.

1907—No. 1.

HELIANTHUS ANNUUS.

(SUNFLOWER.)

[*Dictionary of Economic Products, Vol. IV.*, H. 74-77.]

THE SUNFLOWER IN INDIA.

By DAVID HOOPER, F.C.S., F.L.S.

INTRODUCTION.

Numerous enquiries have been addressed to the Reporter on Economic Products during the past ten years in regard to the growth of sunflowers for economical purposes, the properties of the seed, and the manufacture of the oil. The enquirers were usually planters who desired information on the methods of cultivation and outturn in India, while the others were merchants desirous of finding a market for the seed and oil. The present *Agricultural Ledger* reviews the experiments in the growth of the sunflower in this country, and gives the commercial importance and uses of the products of this plant in other lands. If it does not stimulate the industry, it will at any rate serve as a guide to those who contemplate undertaking further experiments in the cultivation.

The sunflower is a native of Mexico, known as *tournesol* in France, *podsolnetchnik* in Russia, and *suriya phul* in India.

The Industry in Europe.

The sunflower industry first began to assume importance in Russia in 1830, and since that time has steadily increased. In that country it is most extensively grown in Kielce and Podolia, and the district of Birutch in Voronezh. In Italy its cultivation is confined to the neighbourhood of Pieve and Conegliano in Venetia. It has also been introduced into Hungary, Germany, and France. The production of seed in Europe a few years ago was estimated at 228,000,000 pounds from an area of 216,000 acres, or 1,325 pounds to the acre. In Tartary and China it is said to be cultivated in immense quantities, but no statistics are available.

INTRODUCTION.

The seed is the most useful portion of the plant, and this is commonly eaten raw or cooked or used for the extraction of oil. The oil-cake left after expression forms a valuable cattle food and a condition powder for horses. The leaves and the stalk have distinct food values, and when reduced to a sufficient state of fineness possess nutritive properties of a high order.

The sunflower stem has rather strong bast fibres, and the plant has often been suggested as a source of cellulose for paper mills. The amount of cellulose even in Indian-grown plants is comparatively high. The fibre is too weak and brittle, however, to be of value for cordage or textile purposes, and perhaps its highest value is obtained in its use for fuel, the ash being rich in potash.

Cultivation.

CULTIVATION in the United States.

The method of cultivating sunflowers for commercial purposes is best described by Dr. H. W. Wiley from the results of their growth in the United States. "As a rule the soils which are best suited for the growth of Indian corn (maize) produce the best crop of sunflowers. If the soil is not naturally fertile, liberal fertilisation must be practised in order to secure large crops. The character of the fertilisation depends upon the nature of the soil and the deficiencies of plant foods therein. The kind of fertilisation necessary to produce a good crop of maize will be found suitable for the sunflower. The soil should be prepared by careful ploughing, and the surface of the ploughed soil should be reduced to good tilth by the use of the harrow. Sunflowers are best planted by a drill in rows from 3 to 3½ feet apart. In order to secure a good stand the seeds may be placed by the drill 2 or 3 inches apart; but should they all grow, at least half of them should be cut out when the plants are thinned. The seeds should be planted deep enough to secure abundant moisture to germinate them; from 2 to 3 inches in depth when the soil is not too heavy will be found the best. With heavy, stiff soils, which are likely to become very hard on the surface after heavy rains, it is better not to plant the seeds so deep. The seeds should be planted as early as possible in the spring, as they endure very well a slight degree of cold. After the plants are well formed they should be thinned so as to stand at a distance of from 12 to 18 inches in the row. The cultivation should be of the ordinary kind, mostly superficial, and sufficient to prevent the weeds from growing and preserve the moisture during periods of drought. When the production of seed is sought, the best results are secured by limiting the number of seed heads on each plant to a very few. The superfluous heads, when formed, should be removed. No special directions need be given for the cultivation, since it is so much like maize as to be practically the same."

Russia.

In Russia the seed is drilled into lines 18 inches apart, and the plants are thinned out to 30 inches apart in the rows, thus giving

CULTIVATION.

about 11,000 plants to the acre. The quantity of seed required for an acre is five pounds.

Experimental culture in France gave a return of 1,778 pounds of seeds yielding 16 per cent. of oil and 80 per cent. of cake from an acre; but the product varies considerably according to soil, climate and cultivation, and the average may be roundly stated at 50 bushels or 1,150 pounds of seed from an acre and one gallon of oil from one bushel of seed. In America the yield of seed is from 800 to 1,500 pounds per acre.

Sunflower versus Safflower.

The sunflower in its cultural requirements and its products is related to another oil seed plant, grown also for its dye, in this country, namely the safflower (**Carthamus tinctorius**). A European writer has recommended safflower as a suitable plant to replace sunflower in Russia where the latter is subjected to insect ravages. Safflower survives in arid lands, shows a relative insensibility to frost, and is immune to insects and other parasites which decimate sunflowers. On the other hand safflower furnishes an oil-cake inferior to sunflower in consistence and taste. At the same time these undesirable matters residing as they do in the husk may be removed by decortication before the grains are pressed. The leaves of the safflower plant are extremely prickly, which make them difficult to handle, but it is possible to obtain by selection a variety which has no spines.

Harvesting.

The heads should be harvested before the seeds are quite ripe to avoid shattering and loss After drying, the seeds can be thrashed out or beaten with a flail, or, where large quantities are grown, the heads may be placed in a machine consisting of a rotating disc studded with iron nails. The seeds should be stored in bags in a dry place to prevent mould.

The Seeds.

The Seed.

There are three principal varieties now cultivated in Russia, known by the shape and size of the fruits (achenes), conventionally called seeds, one with large white seeds which are said to yield the largest amount of oil; one with small black seeds which are sweeter and regarded as best for eating; and an intermediate form with striped seeds, used both for eating and the production of oil.

Varieties

From experiments made in America it was found that the total weight of the seed is about equally divided between kernel and shell, a series of weighings giving from 41 to 60 parts of kernel in 100 of the seed. Inasmuch as the shell is rather an absorbent material it is important in the expression of the oil, that it should be removed so as to avoid the absorption which otherwise would take place; 100 seeds of the striped Russian variety weighed 6·99 grams, 100 seeds of the ordinary black variety weighed 10·60 grams.

In Indian-grown plants, 100 seeds from Coimbatore weighed 6·57 grams and 100 seeds from Behar weighed 10 grams.

SEEDS. Dr. Voelcker found the Kashmir seed to contain 45 parts of kernel and 55 parts of husk. The writer calculated the percentage of kernel in Behar seeds as 53·16, and in the Coimbatore seeds 44·68. The Indian-grown seeds, therefore, compare favourably with those produced in America and Europe.

Uses of the Seeds.

Uses. These are the most valuable part of the plant on account of their edible kernels and the superior quality of the oil prepared from them. In Russia the seeds are used largely for local consumption. They are sold by the farmer at 4 to 6 shillings per pound and are salted by purchasers, who retail them at 12 shillings per pound, at every street corner in the provincial cities. Sometimes they are roasted like coffee beans and are sold in large quantities at fairs, on feast days and holy days, under the name of "Semotchky." In some seasons the streets of St. Petersburg are littered with the empty husks. Sunflower seeds in Russia are, therefore, eaten as food, as are salted peas in Burma, monkey-nuts in India, and chestnuts in England.

Eaten raw and cooked.

For birds and poultry. Birds of all kinds thrive upon them, and they are specially employed in feeding caged birds and in fattening fowls for the table, and the diet has been said to increase their laying powers. In America the seeds are at present employed in feeding poultry and to some extent mixed with other fodder as a cattle food.

Cattle food. The oil-cake left after the expression of the oil forms a valuable cattle food, being superior in this respect to maize or linseed cake, while it is also said to act as a natural "condition powder" for horses owing to its easy digestibility and its great nutritive property. Sheep, pigs, rabbits and pigeons also fatten rapidly on the oil-cake.

Trade in oil-cake. As an instance of the magnitude of the industry, the production of sunflower seed oil-cake in the Northern Caucasus during the year 1906 was estimated to be from 50,000 to 60,000 tons. The price of the oil-cake was about £6·13 per ton in the spring, advancing to £7·10 during the summer months, and falling back to £6·13 in the autumn. Denmark and South Sweden are the principal buyers.

The Oil.

The oil. Sunflower seed oil in its pure state, on account of its palatability and sweetness, is said to be excellent for table use, for frying fish and other culinary purposes. In Russia it is already in use as an

Uses adulterant of, and substitute for, olive or salad oil for all domestic purposes. It may also be used for woollen dressing, lighting, and varnish and soap-making. It has recently been substituted for other fixed oils in the making of margarine.

OIL. The oil expressed in 1875 from seeds of plants experimentally cultivated in Bangalore proved a disappointment commercially, for its thinness made it useless for railway trains, it dried too slowly for paints, and, though in the Ordnance Department it was found to serve all requirements, the price was prohibitive.

The prospects of a trade in the seed outside the cultivated lands of Russia are not well established. In 1896 Sir Frederick Abel endeavoured to obtain a reliable opinion on the value of Indian-

England. grown seed from oil-crushers in England, but he found there was no likelihood of the seed competing favourably with other sources either in England or France. One firm of eminence stated that they purchased 100 tons of seed in the London market, but they would not touch it again; the results as regards yield for crushing being

Marseilles. very unsatisfactory. A sample of the Kashmir seed was also sent to one of the leading seed-crushers in Marseilles, who stated that there would be no sale for the seed in the market as it was too shelly and poor in yield of oil.

Behar. As an inducement to planters in Behar a market was said to have been arranged in 1901 to purchase oil at the favourable rate of ₹15 (20*s.* 0*d.*) per maund (=82⅔ lbs.), but, as we shall notice, the cultivation in that district has never gone beyond an experimental stage.

Mozambique A writer in the "Journal d' Agriculture Tropicale" for January 1907 records the case of a planter in Mozambique who sold a crop of sunflower seed in England in 1905 for fr. 20·5 (17*s.*) for 100 kilos (200 lbs.), a price which fully recompensed him. Later experience, however, showed that the market was limited, and that no purchaser could be found for large quantities of the seed.

Experiments in India.

Garden varieties. The sunflower (**Helianthus annuus,** *Linn.*) is known as *Suraj mukhi*, *Suriya mukti*, and *Suriya phul*, and grows everywhere in the plains and in the hills and occasionally runs wild. In "Firminger's Manual of Gardening" (fifth edition, 1905) Mr. Cameron says: "This well-known annual thrives well in India; the varieties **grandiflorus-plenissimus** and **californicus** are remarkable, the first for its enormous flowers, the second for its exceedingly double ones.....

The seeds should be sown in July, both on the hills and on the plains. The plant requires no particular treatment, and no care beyond attaching stakes to the tall growing plants to prevent them being blown down and uprooted."

Dr. Cooke in "Flora of Bombay" says the finest variety of the annual species is the **globosus-fistulosus**.

Berhampore. The first experiment on record made with sunflower oil is recorded in the Agri.-Horticultural Society's Journal, Volume ix,

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page 366. Mr. Michael Betts of Berhampore in 1855 obtained from 6 cottahs (480 sq. yds.) of land 9½ seers (= 19½ lbs.) of seed, which produced 15 chittacks (1·65 pint) of oil and 6 seers (= 12½ lbs.) of cake. The latter was greedily eaten by cattle. A report made at the time by Babu Ramgopal Ghose states :—"The oil from the sunflower seed is pretty well known. I do not think it can be produced at a cost which will enable it to compete with other oils of a similar character, and Mr. Betts' statement seems to bear this out. A seer and a half (about three pounds) of seed to a cottah (80 sq. yds.) of land is poor produce, and 10 per cent of oil from the seeds is a still more unsatisfactory result. Unless both the produce of the seed and the percentage of oil can be greatly improved it will not pay to cultivate the sunflower for its oil-seed."

Bangalore.

The experimental cultivation of sunflower was undertaken in Bangalore in 1873 for the purpose of testing its value in the reclamation of marshy land and its efficacy in removing malaria from swampy districts. The experiments proved that the malaria-dispelling virtues attributed to the plant did not exist, though the drainage which had to be employed before it would thrive naturally improved the climate of the district. The cultivation of the sunflower was continued up to the end of 1877 with the view of utilising it profitably in the extraction of the oil and other economic products from its seeds and stems. The reports proved that the cost of production of the oil did not permit of profitable cultivation.

Sibpur.

An experiment with Russian sunflowers was initiated by Mr. N. G. Mukerji in the Experimental Farm, Sibpur, in 1895. In the report of the Farm for 1896-97 the following account is given of the progress of the experiment : "Russian sunflower has grown on a plot having an area of one-tenth of an acre, first as a rain crop, and a second time in the cold weather. The outturn of the plot was 8½ lbs. in the rains, and 47½ lbs. in the cold weather. Birds appeared to be a great enemy of the crop, and a labourer had to keep constantly on the watch to prevent them from alighting on the crop and picking off the seed. Out of the 56 pounds of seed obtained, 50 lbs. were crushed and gave 4½ lbs. or 9 per cent. of oil. The yield of oil compared with that of the usual kinds of Indian oil-seeds was very low. The oil appears, however, to be clear and agreeable to the taste. The experiment of last year has shown that Russian sunflower can be grown with ease in Bengal. Whether its cultivation will pay is extremely problematical."

Coimbatore.

In 1904 the Superintendent, Central Jail, Coimbatore, made the following report on the cultivation of sunflower to the Inspector General of Prisons, Madras :—

"Experiments were made during last year with two varieties of sunflower, one the Giant Russian sunflower, and the other the garden or ordinary variety.

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The area sown with the Giant Russian seed was 12 acres, while the garden kind was sown in the borders of small gardens and along a water channel 100 feet long, planted 6 inches apart.

	lbs.
The total yield of both varieties as reaped was	396
Deduct for husk, light seeds, etc.	273
Balance kernel	123

Oil obtained 38 lbs. or 30·89 per cent.

No special manuring or other care was given to the Russian plants except weeding and watering as requisite, but it was noticed that the plants ran too much into stalk, thus injuring the yield of seed, due no doubt to the richness of soil. For commercial purposes or to raise a paying crop, it seems to me the Russian variety should be sown as a dry crop on moderately good soil with facilities for watering in case of failure of seasonal rains; the season, treatment, etc., for this crop should correspond with the sowing of gingelli (**Sesamum indicum**), which latter is never sown on richly manured soil but on moderately good land irrigated, if possible, or left as a rain-fed crop. The best crops of gingelli are obtained from the stunted and almost leafless plants, while those grown luxuriantly have a very large percentage of empty pods.

Coimbatore.

One Giant sunflower gave	1,644 seeds.
The ordinary garden one	744 "
Picked and selected, the yield was—	
For the Giant, good seeds	347
Ordinary garden	326
And the percentage of good to light seed was—	
For the former	21 "
For the latter	44

Behar.

In Behar a few experiments were conducted in the cultivation of Russian sunflower in 1900. Mr. T. Cox of Puddumkir, in the Champaran district, went into the matter carefully, employing seed imported from Odessa. Fifteen seers (30 lbs. 13 oz.) of seed were sown in 1 bigha (1,600 sq. yds.) of land in October. Twenty per cent. only germinated, which grew well, yielding plants of 5 feet in height and heads 12 inches in diameter. The crop was harvested in March; but on beating out the seeds it was found that nearly the whole of the seed was hollow and worthless.

Another 15 seers (30 lbs. 13 oz.) were put down in March 1901, and an outturn of 3½ maunds (= 288 lbs.) of seed was obtained in November from 2 acres of land planted. The plants did not grow so well as in the previous year, and the heads were only about half the size, though the proportion of empty seeds was small. The crop

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all along had a sickly appearance and many of the young plants were attacked by grasshoppers. Cattle would not eat the leaves and stalk. As a commercial experiment it was considered a failure.

A more recent experiment has been made in Behar by Mr. E. Hamilton Hudson of the Rajpore Indigo Concern. Two years ago some of the best sunflower seed was procured from Messrs. Sutton & Co. and sown in October 1905. The seed was kept from this crop and sown again next year, so that it should be acclimatised. From one-tenth of an acre 72 lbs. of seeds were obtained. The seeds were sound, and the oil expressed from them was of good quality. The cultivation was not costly. The seeds afforded 40 per cent. of husks and 60 per cent. kernels, and from the latter 30 per cent. of oil was expressed. The experiment was not considered a success, as more profitable returns were obtained from mustard and linseed.

Lieutenant J. F. Pogson, an authority on Indian agricultural subjects a generation ago, wrote to the Secretary of the Agri.-Horticultural Society of India in 1875, "I notice that attention is being paid to the oil which may be extracted from the seeds of the sunflower. I look upon this as time and money wasted. Oil and oil-seeds always command a good price, if the seed is sufficiently rich in oil, which the sunflower is not." Lieutenant Pogson, however, notices the leaves, stalks, and seed vessels of the sunflower to be available for conversion into manure; these he found to be superior to leaf manure, but inferior to megass.

We are thus led to conclude that sunflower is a costly crop to grow in India. The leaves and stalks are eaten by cattle, and they make a fairly good manure. The ashes of the stalks form a potash manure. As a garden plant yielding seeds for feeding home poultry, its preparation can be encouraged, but not as a regular oil-seed crop.

Chemical Composition.

Composition of seeds, kernels, and shells.

Dr. J. König gives the average composition of five samples of whole seeds and four of kernels. An analysis of the shells or hulls is added for comparison—

	Seeds.	Kernels.	Shells.
Oil	31·32	44·31	5·17
Albuminoids	13·67	26·28	5·16
Carbohydrates	18·03	16·44	23·92
Fibre	25·35	2·81	54·95
Ash	3·05	3·46	1·78
Water	8·58	6·70	9·02
	100·00	100·00	100·00

CHEMISTRY OF SEED.

Composition. American seeds.

The composition of sunflower seeds grown in the United States is recorded by Dr. H. W. Wiley in Bulletin No. 60, Division of Chemistry, United States Department of Agriculture—

	Wiley.	Babcock.
Oil	27·08	20·52
Albuminoids	14·07	15·88
Carbohydrates	20·94	18·71
Fibre	29·17	29·21
Ash	3·41	3·00
Water	4·43	12·68
	100·00	100·00

Kernels.

European sunflower seed from which the hulls have been removed contains—

	German.	Russian.
Oil	33·48	34·25
Organic substances (Including protein	54·04	54·39
	14·12	18·80)
Ash	2·86	3·56
Water	9·62	7·80
	100·00	100·00

Oil-cake.

The cake left after expression of the oil has the following composition :—

Oil	8·94
Albuminoids	21·68
Carbohydrates	19·05
Fibre	33·00
*Ash	9·33
Water	8·00
	100·00
* Containing sand	1·37

Indian-grown seeds.

The seeds of Indian-grown sunflowers do not much differ in composition from those cultivated in Europe and America. In 1896 a parcel of the seed grown in Kashmir by Colonel A. D. Anderson, R.A., was forwarded by the Reporter on Economic Products, Calcutta, to the Imperial Institute, London. At the request of Sir F. Abel, Dr. J. A. Voelcker of the Royal Agricultural Society undertook its examination, the results of which are as follow:—

Oil	28·01
Water	8·25
*Albuminoids	17·75
Carbohydrates	18·57
Crude fibre	31·77
†Mineral matter	3·65
	100·00
* Containing nitrogen	2·83
† Including sand	0·20

CHARACTERS OF THE OIL.

The amount of oil in the kernel itself, after removal of the husk, gave 44·07 as the percentage result.

The oil obtained from the seeds of the sunflower is a limpid oil of mild taste and pleasant smell.

The oil has drying properties but much weaker in action than those of linseed and poppy seed.

In samples examined in England the acidity varies from nothing to 5·6 per cent. calculated as oleic acid. The specific gravity at 15° C. ranges from 0·924 to 0·926, and the solidifying point is about —17°. The saponification value has been found to be between 188 to 194, iodine value 119·7 to 135,° and the Maumené test or the heat produced when mixed with sulphuric acid, 67·5 to 75. The fatty acids, which amount to 95 per cent., and consist chiefly of linolic with a small quantity of oleic acid, melt at 23,° possess a saponification value of 201·5, an iodine value of about 133°, and a refractive index (at 60°) of 1·4531.

Sunflower oil does not change colour with nitric acid, but cotton seed oil, if mixed with it, becomes brown with this reagent.

The oil obtained from seeds from plants grown in India has similar properties. The acid value calculated as oleic acid in four samples from Coimbatore ranged from 2·11 to 2·46 per cent.; the same value as that of a sample from Behar was 3·90. The other constants were so uniform that no analytical distinction could be observed between the oil from the Giant Russian sunflower and that from the common or garden variety.

Composition of leaves and stalks.

With regard to the composition of other parts of the sunflower plant Dr. Wiley has submitted to analysis the stalks, leaves, dried heads and husks, in addition to the seeds and kernels, the composition of which has been given above. It was noticed that the content of ash was uniformly distributed throughout the different parts of the plant. The leaves contained the greatest percentage, while the smallest was found in the shells of the seeds. The percentage of protein is high, as would be expected, in the kernels, while in the seeds and stalks it is very low.

Ash Constituents.

In order to determine the distribution of the various ash constituents of the different organs they were subjected to separate analysis. With the exception of the leaves where lime predominates potash is the principal mineral ingredient of the ash of the sunflower. The ash of the heads contains 54, the stalk 39, and the seeds 29 per cent. of this element. Lime and magnesia are important constituents in the leaves and stalks.

The principal acid in the ash is phosphoric, although the content is low in the stalks and naturally high in the seeds. If the kernels and hulls of the seeds be studied separately it is found that the percentage of phosphoric acid in the ash of the kernels is 50·84, while in the hulls it is only 6·83.

CONCLUSION

It is evident from the above data, including the composition of the sunflower itself, that it is a plant which makes considerable drain upon the three principal mineral plant foods, *viz.*, nitrogen, phosphoric acid, and potash.

Conclusion.

The following summary of the results of growing sunflowers in America is applicable in many respects to India:—

1. The sunflower is a plant which can be grown successfully over large areas.

2. From the chemical analysis of the whole plant it is evident that it is a crop making a considerable drain on the elements of soil fertilisation; therefore during cultivation it is necessary to maintain the fertility of the land.

3. One of the most valuable constituents of the plant is the oil which exists in the seeds.

4. The economic production of the sunflower plant is now confined almost exclusively to Russia, where it is an agricultural industry of considerable importance.

5. In the United States the sunflower is grown as an ornament and for the production of seeds, which are used chiefly for poultry and bird feeding, and for condimental and medicinal properties with farm animals.

6. The oil of sunflower seeds is not produced commercially in the United States. It is very palatable and, without refining, makes an excellent salad dressing. The residual oil-cake has a high nutritive value.

7. In the cultivation of the sunflower, the methods pursued for growing Indian corn are to be followed, and may be cultivated over almost as wide an area as Indian corn.

G. I. C. P. O.—No. 395 R. E. P.—2-10-1907—2,500—E. G.

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1907—No. 2.

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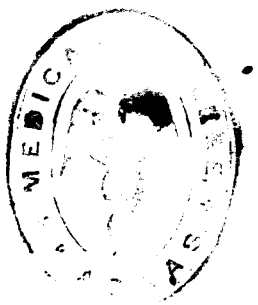
(Vegetable Product Series, No. 101.)



THE AGRICULTURAL LEDGER.

1907—No. 2.

TAMARINDUS INDICA.

(TAMARIND.)

[*Dictionary of Economic Products, Vol.* VI., Pt. III, T. 28-50.]

THE USES AND COMPOSITION OF TAMARIND SEEDS.

By DAVID HOOPER, F.C.S.

TAMARIND SEEDS WIDELY USED AS A FAMINE FOOD.

During an enquiry conducted in 1903-04 by the Reporter on Economic Products to the Government of India on foods used in times of scarcity and famine, the seeds of the tamarind tree were submitted as articles of general consumption from no less than sixty localities. It has been known for many years that the seeds are occasionally eaten by the inhabitants, but it was left for a systematic enquiry undertaken in all parts of India to reveal the extent and importance of the use of these seeds as an article of diet. In continuation of *Agricultural Ledgers* No. 7 of 1902, Nos. 4, 5 and 6 of 1904, and No. 2 of 1906, and preparatory to the publication of a complete list of Indian Famine Foods, the present Ledger deals with the description and composition, in this connection, of the above-named seeds.

The tamarind is one of the most beautiful of the common trees of India, and is frequently planted in avenues and topes. It flowers profusely in April and May; and the fruit ripens in the ensuing cold weather. A large tree yields five or six maunds (41 $\frac{3}{7}$—493 $\frac{5}{7}$ lbs.) of fruit. This is largely consumed, being a favourite ingredient in curries and chutnies and sauces, and is exported in bulk for medicinal purposes as East Indian tamarinds.

The fruit is a large flat pod, from four to six inches in length, filled with acid pulp, seeds and stringy fibrous matter. As sold in the bazar, the fruits contain, in one hundred parts, the following proportions of pulp, seeds and fibre:—

Pulp	55
Seeds	33·9
Shell and fibre	11·1

DESCRIPTION OF SEED.

It is thus evident that whenever the pulp is prepared for culinary purposes a large quantity of seed is removed, and in many of the town residences it is rejected as useless.

The following description of the seeds is taken from the "Pharmacographia." "The seeds are flattened and of irregular outline, being round, ovate or obtusely four-sided and about 6-10ths of an inch long by 3-10ths thick, with the edge broadly keeled or more often

slightly furrowed. The testa is of a rich brown, marked on the flat sides of the seed by a large scar or areole of rather duller polish than the surrounding portion which is somewhat radially striated. The seed is exalbuminous with thick, hard cotyledons, a short straight included radicle and a plumule in which the venation of the leaves is easily perceptible. The testa of the seed abounds in tannin, and after long boiling can be separated, leaving the cotyledons soft. The latter have a bland mucilaginous taste." One hundred seeds weigh 75·88 grams; the average weight of a seed is therefore 11·7 grains.

Uses.

USES.

Tamarind seeds are universally eaten by the poorer people of India during times of scarcity and famine, and are occasionally eaten by others at ordinary times.

The seeds have been received from the following places as a famine food.

Where considered a famine food.

Madras:—Anantapur, North Arcot, Bellary, Bhadrachalum, Chingleput, Coimbatore, Cuddalore, Cuddapah, Ganjam, Godavari, Kistna, Kurnool, Nilgiris, Vizagapatam and Yellavaram.

Central Provinces: Nagpur.

Central India: Bhopal, Bhopawar, Gwalior, Jhalawar, Malwa, Merwar, and Shahpura.

Bengal: Hughli, Monghyr, Manbhum, Murshidabad, Ranchi and Singbhum.

It would appear that as a food tamarind seeds are mostly consumed in the Madras Presidency and Central India. Kistna is the only place where it is reported that they are sold; the price given is six pies (0½*d*) for a bag of about 20 lbs.

PREPARATION FOR CONSUMPTION.

They are in great demand for the fruits by the Telegus of the Godavari district, and for this reason the tree is very valuable.

For edible purposes they are first roasted or soaked and boiled in water to remove the outer skin. After soaking in water, the brown skin is easily removed as in the blanching of almonds; and the white kernel is tolerably palatable. The kernels are dried in the sun, or roasted over a fire, and ground into flour. This flour may be at once made into cakes or chupattis, but when other cereal flour is available they are mixed in some suitable proportion before being baked into bread. In Ranchi the seeds and rice are fried and powdered and made into balls and eaten by the poorer classes. The Sonthals combine these seeds with mahwa flowers in their dietary.

Stated injurious effect possibly due to husk.

It has been reported from some districts that tamarind seeds used alone produce untoward effects. For instance, it is said that in Bhopal they produce depressing effects; in Anantapur and Cuddapah they cause constipation; in Bellary, North Arcot, diarrhœa; and in Jhalawar, inflammation. There is no doubt that if the husks are not entirely removed they are liable to cause irritation from the astringent and fibrous matter they contain, but as will be seen from the analysis of the almonds themselves they are comparatively nutritious and free from mechanically disagreeable ingredients.

MEDICINAL USES.

The seeds in some districts are regarded as medicinal. They are powdered and given for rheumatism in the Hindu system of medicine and are administered for herpes according to the Yunani system. Some people regard the seeds as stomachic. According to Wight a paste made of the seeds simply smeared on the skin has the property of promoting suppuration in indolent ulcers. They are also said to form a convenient poultice for boils.

USE AS SIZE.

The powdered seeds boiled in a small quantity of water make a tenacious glue or size used by wool-weavers, saddlers and book-binders. This is used to dress country-made blankets. According to Nesbit, in Burma, silk thread is dyed red on being dipped into boiling water into which the seeds have been thrown. Finally the seeds boiled to a glue are said to form a strong wood cement.

Composition.

COMPOSITION.

Analysis was made of the entire seeds, and also of the kernel without the brown covering. They had the following composition:—

	Seeds.	Kernels.
Water	10·50	9·35
Albuminoids	13·87	18·06
Fat	4·50	6·60
Carbohydrates	62·22	62·88
Fibre	5·36	·66
Ash	2·55	2·45
	100·00	100·00
Nitrogen	2·22	2·89
Phosphoric anhydride	·40	·55

COMPOSITION.

There is a decided difference in the composition of the shelled and unshelled seeds. The shells contain the undesirable constituents, namely, the tannin matter and fibre, and the kernels represent a nutritious food, white in appearance and with no disagreeable odour and taste.

Oil.

OIL.

Only present in very small quantities.

A statement appeared fifty years ago in the Journal of the Agri-Horticultural Society of India (Vol. IX, 1857, 1366), that a certain Captain Davis in experimenting with some jungle seeds pressed some seeds of the common Indian tamarind and obtained an oil of a fine-amber colour which he thought would prove a substitute for olive oil. The odour of linseed oil was attributed to the mill having previously been used for the extraction of linseed oil. The oil was favourably reported upon by Babu Ramgopul Ghose.

These statements were repeated in Exhibition Catalogues and standard works in oils, as that of Brandt, who states that the seeds contain 20 per cent. of oil of a thickly fluid nature. Another writer expresses regret that the oil has escaped the attention of natives. But no blame is attached to the natives of this country. Tamarind seeds are not oil-seeds. It was pointed out in "Pharmacographia Indica," 1890, that the dry seeds yield no oil by expression, and by solvents the yield was only 3·9 per cent. In the above analyses the seeds are shown to yield 4·5 per cent. and the kernels 6·6 per cent. of oil, a proportion not much above that found in the pulses.

Nature of oil.

The oil obtained by ether is thick and light yellow in colour. It solidifies at 15° C., and gave the following constants :—

Acid value	0·84
Saponification value . .	183°
Iodine value	87·1
Fatty acids	94·9
Melting point of . . .	46°

The fatty acids crystallised twice from alcohol afforded an acid melting at 74°5, resembling arachidic acid of ground-nut.

Elaidin reaction gives a buttery consistence. The oil is semi-drying, forming a skin only after 12 days.

(338)

G. I. C. P. O.—No. 751 R. E. F.—26-11-1907.—2,500.—J. E. J.

THE

AGRICULTURAL LEDGER.

1907—No. 3.

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(Vegetable Product Series, No. 102.)

THE AGRICULTURAL LEDGER.

1907—No. 3.

MYRISTICA SPP.

(NUTMEGS.)

[*Dictionary of Economic Products, Vol.* V., M., 884.]

THE FATS OF INDIAN NUTMEGS.

By DAVID HOOPER, F.C.S.

INTRODUCTION.

Wild nutmeg seeds are occasionally imported into England under the name of "oil nuts," and are supplied from Africa and South America where they are said to be available in large quantities. In view of the constant and increasing demand for oil seeds in Europe it would seem desirable to examine the seeds of wild nutmeg trees of India to learn particulars of the amount and quality of the fat they contain. It has been known for many years that these seeds are oleaginous, but no special investigation has been made of them. The subject has been re-opened by the receipt from Mr. H. Latham, District Forest Officer, South Kanara, of a sample of the seeds of **Myristica canarica**, with the interesting information that they are used by the villagers in making candles. The seeds and candles were exhibited at a meeting of the Asiatic Society of Bengal held in December, 1906. They point to a source of oil for illuminating and other domestic purposes, and if obtainable in sufficient quantity would doubtless form a minor forest product of some value.

Further quantities of the seeds of **M. canarica** have been received, and they have been examined with those of **M. malabarica**, which are already an article of commerce in Bombay. The results of the chemical examination of the seeds and fat of these two indigenous nutmegs are given in the following pages, and their composition is compared with that of wild nutmegs from other countries.

Myristica canarica, *Bedd.*

Syn.—M. FARQUHARIANA, *Wall.*

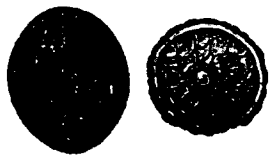
Vern.—*Pindi, pundee-kai* (KAN.) ; Candle-nut tree (ENG.)

References.—*Beddome, Flora, Sylvatica, t. 270; King, Annals Calcutta Botanic Gardens, 114, 367; Talbot, Systematic list, trees, shrubs, and wood climbers, Bombay, 165; Lawson, Records, Botanical Survey of India, Vol. 1, 68; Christy, New Commercial Plants, No. 8, 31.*

Habitat.—A large tree growing on the Western Ghats from the Konkan southwards, in Coorg, the Wynaad, Travancore and Tinnevelly. Beddome reports its occurrence in the dense moist forests in the plains of South Kanara, and that it ascends the South Kanara and Coorg ghats to 1,500 and 2,000 feet. It is also found in the Tambracherry ghat in the Wynaad, but not in North Kanara. Bourdillon describes it as an immense tree (160 feet high) of the evergreen forests of Travancore. Bourdillon and Lawson collected it at Colatoorpolay in South Travancore, growing on the drier slopes of the hills along with **M. attenuata** and **M. magnifica.** The tree flowers in February and the fruits ripen in November.

The Seeds.

Seeds. The nutmeg is almost round like a marble, about 1—1½ inch in diameter, downy when young but glabrous in age. As collected for use each seed is enclosed in a light-brown brittle shell, to which portions of the arillus or mace are attached. The kernel is loose inside the shell with a hoary white exterior and possessing the white and brown ruminated character of the albumen of ordinary nutmegs. The seeds weigh on an average 2·35 grams (36·26 grains) each. 100 parts of the seed yield 23·8 parts of shells and 76·2 parts of kernels.



Description.

From Mangalore. Mr. T. Christy in "New Commercial Plants" gives a figure of this seed in an article entitled "The Nutmeg Genus." He designates the nut M. Mangalore, and says:—"I have received specimens of a nutmeg from Mangalore, of which I cannot, so far, find a description." There is very little doubt that he refers to the seed of **Myristica canarica.**

Candles. Mr. Latham when forwarding the samples which had been collected in the Puttur Range, South Kanara, supported the identification of the *Pundi* or candle-nut tree with botanical specimens. At the same time he remarked :—"Oil is not extracted from the fruits, but they are crushed and pressed into joints of bamboo to form crude candles. No wicks are used."

The candles are quite black, and had evidently been charred during the process of manufacture. They were four to five inches

in length by one inch in thickness. Except for the charcoal present they had the same composition as the crushed seeds, and contained half their weight of oil. They burnt with a small clear flame, giving off no smoke, and eventually were consumed, leaving a white ash.

Myristica canarica.

Chemical Composition.

Composition of seeds and mace. The entire seeds and the mace had the following composition :—

	Seeds.	Mace.
Water	7·25	5·15
Fat	49·40	54·60
Albuminoids	7·31	6·22
Carbohydrates	14·65	28·48
Fibre	20·14	3·40
Ash	1·25	2·25
	100·00	100·00

The kernels, separated from the shells, afforded 64·76 per cent. of crystalline fat.

Characters of fat. The fat was light brown and crystalline. It gave a carmine-red colour in the cold with strong sulphuric acid. The following constants were obtained :—

Melting point	37·5°
Acid value	37·08
Saponification value	215·02
Iodine value	26·64
Fatty acids percentage	92·
Melting point	41°
Acid value	217·53

The fat saponified with great facility. The fatty acids after crystallising twice with alcohol (90 per cent.) afforded white crystals melting at 53°C., and giving an acid value of 246·1. The latter acid agrees, therefore, with myristic acid which has a melting point of 53·8° and an acid value of 245·5. To determine the proportion present of this acid, a lead salt was made of the combined fatty acids separated by saponification of the fat, and after digestion in ether, 70·8 per cent. was found to be insoluble and corresponded with lead myristate. Oleic acid was probably the only other acid present.

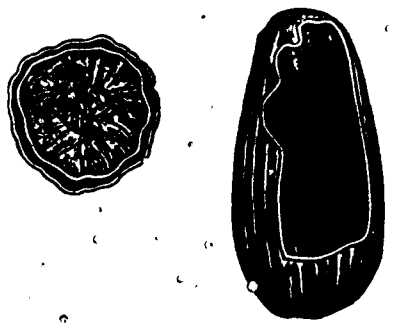
Myristica malabarica, *Lam.*

Vern.—*Kanagi* ; the nut—*pindi-kai* KAN.; The nut—*jangli jaiphal*, and *anjaiphal*, *kaiphal* ; the aril—*rampatri*, BOMB.

Habitat.—A tall evergreen tree growing in the forests of the Konkan, Kanara, Malabar and Travancore.

Seeds.

SEEDS. The fruit is oblong, tawny and hairy. The seed is much longer than that of the common nutmeg (**M. fragrans**), and quite as broad. Each seed is more than an inch and a half long and three-quarters of an inch in diameter. The shell is nearly black, wrinkled longitudinally, and the kernel within is of the same shape and full of light red resinous and oily juice.



Bombay mace. The arillus which is usually removed, and sold separately as "Bombay mace" or *Rampatri*, is reddish-brown. The lobes are longer and thinner than those of true mace, besides being twisted and folded into a cone at the top. The dried kernel and arillus have a slight fruity odour with scarcely any of the aroma and flavour of the true nutmeg.

Pundi Oil. The seeds when crushed and boiled in water yield a yellowish concrete oil, known as *Pundi* oil, used in medicine and for purposes of illumination. It is made into an ointment for allaying pain, and setting up a healthy action in sores and ulcers. It is also used as an external application for rheumatism, for which purpose it is rubbed into the affected part.

Used for adulteration. From a very early time the seeds have been used for the purpose of adulterating the nutmegs of commerce, and the arillus for adulterating commercial mace. There is a deficiency of aromatic essential oil in the Bombay products, which renders them unsuitable as a spice, and the question arises whether they could not be used for the extraction of the fat to be employed in making soap and candles.

The following results of a chemical examination show that the Bombay nutmegs yield a large quantity of fat, but it is accompanied by a reddish resin which becomes a strong colouring matter when mixed with alkalis. The purified fat is similar in composition to that of the fat of the **M. canarica**, and has special properties that could be utilised in the arts.

Chemical Composition.

The seeds of the **M. malabarica**, sold as *kaiphal* in Bombay, contained 32 per cent. of shells. The kernels were powdered and

analysed, as well as the mace or *Rampatri*, and the following results were obtained :— Analyses.

	Kernels.	Mace.
Water	6·90	4·07
Fat and resins	40·76	63·26
Albuminoids	6·50	7·31
Carbohydrates	42·18	20·80
Fibre	2·33	03·06
Ash	1·33	1·50
	100·00	100·00

The fats were both accompanied by red resins which in contact with alkalis, employed for the purpose of determining the acid and saponification values, afforded dark red liquors similar to iodine solutions. The purified fat of the kernels melted at 39°, and contained myristin, olein and free myristic acid. The fat of the mace was similar in composition, myristin constituting 40 per cent. of the total.

Genuine and false mace. Bombay mace differs entirely in its composition from that of genuine mace. The following analyses of the genuine and false spice made by Arnst and Hart in 1893, show the difference; one contains a considerable quantity of essential oil and little fat, the other contains much fat and only traces of essential oil. The dried substance contains :— Analyses.

	Genuine mace.	Bombay mace.
Fat	26·78	61·05
Essential oil	4·12	·27
Albuminoids	9·52	5·64
Carbohydrates	53·08	22·79
Fibre	4·52	8·79
Ash	1·97	1·46

The fats. This difference is observed not only in the composition of the crude material, but in the characters of the separated fats. E. Spaeth in 1895 determined the constants of the fat extracted from Bombay mace and compared them with those of genuine Banda mace with the following interesting results.

	Bombay.	Banda.
Melting point	31°	25° to 26°
Iodine number	51·3 to 53·5	78 to 80
Saponification number	189·4 to 191·4	170 to 173
Zeiss' refractometer degrees	about 48·5°	76° to 82°

It would seem that both these fats contain myristin and olein in varying proportions.

Myristica fragrans, *Houtt.* Cultivated in Penang, Malay Islands and Zanzibar. The true nutmeg.

True nutmeg.

The origin of the nutmeg and mace of commerce is alluded to in this place in order to draw attention to the fat which is sometimes sold. The expressed oil of nutmegs was formerly imported into India from Banda, and was known as *Jawitri-ka-tel* or oil of mace. It was brought into European commerce *vid* Holland, in oblong cakes having nearly the form of common bricks, but somewhat smaller and packed in monocotyledonous leaves, commonly called "fig leaves." At the present time much of the oil is manufactured in Europe, and put up in the same shape, but packed in paper. When discoloured and hardened by age, the oil is called "Banda soap." Oil of mace is manufactured by exposing imperfect and broken nutmegs, reduced to a paste and enclosed in a bag to steam, and then pressing the bag between heated iron plates. The yield is about 20 to 30 per cent.

Oil of Mace.

Uses.

Nutmeg butter is used in Europe in the manufacture of scented oils, perfumes and soaps, and as a flavouring agent in cooking and confectionery. A great point in its favour is that it does not turn rancid, even after long storage, on account of the small quantity of essential oil combined with it.

A few references will now be made to the foreign nutmegs that have been utilised for their fat.

Myristica Bicuhyba, *Schott. and* **M. officinalis,** *Mart.;*

Ucuhuba nuts.

These trees are natives of Brazil where they are known as *Ucuhuba* or *Bicuhiba*. The seed is similar to a large acorn in shape and colour.

The seeds yield 59·6 per cent. of fat, but if separated from the shells, the kernels alone contain 73 per cent. The fat is of a deep brown colour and is tolerably firm; it possesses a peculiar aromatic odour due to ethereal oil, and gives a beautiful red colour with sulphuric acid.

Composition.

Ucuhuba fat was examined by Dr. E. Valenta in 1889. It melts at 39° C. Treatment with steam removed volatile oils and acids. After treatment with steam the fat yielded 93·4 per cent. of fatty acids, 8·8 per cent. being in a free state. The fat acids melted at 46° and possessed a saponification equivalent of 219—220, and an iodine equivalent of 9·5, alcohol separated a resinous mass having somewhat the odour of Peru balsam.

The crystals which separated from the alcohol melted at 52-53·5°; their saponification equivalent was 245-245·4, and their iodine equivalent to O. They thus consisted of myristic acid. Fractional precipitation with magnesium acetate showed that oleic acid was the only other acid present. From the iodine equivalent, the

author concludes that the fatty acids consist of 89·46 per cent. of myristic acid and 10·54 per cent. of oleic acid. This is considered favourable to the use of the fat for making candles.

Myristica surinamensis, *Roland.*

This species is abundant in the West Indies. The seeds are about the size of a small marble, and are called *Cuango* nuts by the Spaniards.

Cuango nuts.

They have been imported into England in considerable quantity; their first appearance being at Liverpool in 1881, when they were offered as an oil seed. They have also been imported into Germany as a source of oil. An analysis was made of them by Prof. Voelcker, who obtained the following results:—

Analysis.

Fat	60·53
Moisture	4·74
Albuminoids	5·75
Carbohydrates	20·16
Fibre	7·13
Ash	1·69
	100·00

The fat is solid at ordinary temperatures having an agreeable taste and little, if any, odour. It is readily extracted from the nuts by hot pressing or by solvents. When fairly pure, it somewhat resembles cocoa butter.

The fat was examined by Reimer and Will in 1885. The shells weigh 16 per cent. of the seed. The kernels give to hot ether 73 per cent. of fat melting at 45°. Alcohol leaves 6·6 per cent. of a yellow insoluble substance, and the fat contains 6·5 per cent. of free myristic acid.

The fat consists of almost pure myristin and a caoutchouc-like resinous substance.

Other species of nutmeg of minor importance which have been used or exported for the sake of their fat may be briefly noticed.

Myristica angolensis, *Welw.*

A native of Gaboon, where it is known as *Combo*. The seeds are said to yield nearly three-quarters of their weight of a fatty oil. They have been imported into Liverpool from St. Thomas as an oil seed.

Combo seeds.

M. guatemalensis, *Hemsl.*

A native of Guatemala. The seeds are ovoid, about one inch long and half an inch broad, of a blackish colour, and enclosing

Suif de muscade.

a brown kernel. A specimen of the solid fat was exhibited at the Paris Exhibition of 1878, under the name of "Suif de muscade."

M. Otoba, *H. B.*

Otoba wax.

This species is a native of New Granada. The seeds are ovoid, about three-quarters of an inch long, and have a powerfully aromatic odour and taste. They yield a solid fat, which is known under the name of "Otoba wax," and is used by the natives in the treatment of skin diseases.

Myristica sebifera, *Sw.*

Myristica sebifera.

The tree is a native of Brazil, British Guiana and Cayenne. The oval seeds are about the same size as these of **M. canarica**. The seeds boiled with water yield about 26 per cent. of fat which is made into candles. This fat has been exported to some parts of Europe in the form of bricks, in considerable quantity, but is known only to a few manufacturers. It is used in soap-making, and candles made with it burn with an agreeable aromatic odour.

Myristica laurifolia, *Hook. f. and Thoms.*

Wild nutmeg of Ceylon.

This is the *Malabodde* or wild nutmeg of Ceylon. The nutmegs yield to pressure and boiling a very pure description of vegetable butter. It has been reported that the seeds are not found in sufficient abundance to make them worth the attention of merchants.

Conclusion.

Conclusion.

These few notes show that the wild nutmegs of India, like the wild nutmegs of foreign countries and the cultivated nutmegs of Malaya, yield a fat of considerable value to soap and candle makers. The question to be solved is in regard to the quantity of the material available. If the seeds of **Myristica canarica** could be obtained in large quantities when the tree fruits, there would be a ready market for them, since they compare favourably with seeds obtained from the same natural family in other parts of the world. The seeds and mace of the **M. malabarica** have also a certain economic value which it appears most desirable to extend.

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THE AGRICULTURAL LEDGER.

1907—No. 4.

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(Vegetable Product Series, No. 103.)

THE AGRICULTURAL LEDGER.

1907—No. 4.

ALEURITES MOLUCCANA.

(THE CANDLE-NUT.)

[*Dictionary of Economic Products, Vol.* I., 737-742.]

Account of an enquiry upon the Candle-nut tree (**Aleurites moluccana**) *in India.*

By R. ABBEY-YATES.

Aleurites moluccana, *Willd.; Fl. Brit. Ind. V., 384, Ind. Kew. I., 75.*

NAMES OF THE TREE.

THE BELGAUM OR INDIAN WALNUT; THE COUNTRY WALNUT OF JAMAICA; THE BANKUL NUT OF FRENCH COLONIES, KEKUNE; THE CANDLE-NUT.

Syn.—A. TRILOBA, *Forst.*

Vern.—*Akrót, Akola, Jangli-akrót,* HIND. BENG.; *Arkot,* SYLHET; *Akshota,* SANS.; *Khasife hindé, Jousebarri,* ARAB.; *Girdagáne hindi, Chghár maghse hindi,* PERS.; *Jangli, Eranda, Jelapa, Jangli ákhróta* or *ákrót, Jáphal, Sakhárám Arjún, Jáphala, Akhod,* MAR.; *Akhoda,* GUJ.; *Akrota,* CUTCH; *Náttu akrótu kottai,* TAM.; *Nátu-akrótu-vittu,* TEL.; *Nát-akróde,* KAN.; *Vadam,* MALAYALAM; *Kakkuna,* SINGH.; *To-sikya-si,* BURM.; *Kanyin, Mak yau lik, Mak man yaü,* SOUTHERN SHAN STATES; *Buah keras, Kanieri,* MALAY; *Shih leih,* CHINA. The names given in most parts of India to this tree are those which more properly belong to the Walnut, the *ákrót*. It is therefore advisable to add the word "wild," *e.g., Jangli-ákrót*.

An inquiry has been proceeding for some time in the office of the Reporter on Economic Products to the Government of India on the subject of this tree.

It was started at the instance of the authorities of the Imperial Institute, London, who desired to be furnished with specimens of the nuts and of the oil obtained therefrom.

The result of the inquiry so far has been only moderately successful,

ENQUIRIES FOR THE TREE IN INDIA.

The object of the present paper is mainly to record what has been done with the view to assist further investigation. Being a forest product, it seems appropriate that the inquiry should be taken up at the present stage by the Forest Department. The subject is not without interest, and it would be very desirable to determine once and for all whether the nuts and oil are ever likely to be utilised commercially in India.

A circular letter drawn up by the Officiating Reporter was sent to Directors of Land Records and Agriculture, Assam, Burma, and Bengal, to the Secretary, Board of Revenue, Madras, and to the Survey Commissioner and Director of Land Records and Agriculture, Bombay, inviting their co-operation in ascertaining the extent to which the tree is distributed. The following is an abstract of the replies received.

Assam.

Assam.—The Deputy Commissioner of Sylhet forwarded botanical specimens which were identified as those of **A. moluccana**. Five pounds of the nuts were subsequently received from the same officer, who stated that there were only a very few trees of **A. moluccana** in the station of Sylhet, and that the tree was not known to occur anywhere else in the district. From the Deputy Commissioner of Goalpara were received botanical specimens. These were followed by a supply of the roots with the intimation that samples of gum and oil prepared from the roots were not procurable in the district. The Deputy Commissioner of Nowgong furnished botanical specimens of **A. moluccana**, and stated that no oil was extracted from the nuts. Eleven pounds of the latter were subsequently received. Each of the following Deputy Commissioners reported that the tree was not found in his district, *viz.*, Garo Hills, Khasi and Jaintia Hills, Sibsagar, Darrang, and Naga Hills. The like information was received from the Political Agent, Manipur. The Deputy Commissioner of Kamrup furnished the statement that the tree does not grow wild in this district.

Madras.

Madras.—The Board of Revenue, Madras, communicated the information that the result of inquiries kindly set on foot by the Board was to the effect that the tree **A. moluccana** is not known to grow wild in any part of the Presidency. It has been planted in parts of the Wynaad and Travancore where it is said to thrive. The extraction of oil from the nuts does not seem to have been attempted hitherto, and the tree does not exist in sufficient numbers to render any endeavours in that direction worthy of trial.

A subsequent communication from the District Forest Officer, North Malabar, advised the despatch of 5 lbs. of the nuts of **A. moluccana** together with botanical specimens. This was followed up by a further supply of 35 lbs., and the intimation that oil from the nuts was not obtainable in the North Malabar Division.

ENQUIRIES FOR THE TREE IN INDIA.

A specimen plank to illustrate the timber of this tree was subsequently furnished by the same officer for deposit in the Indian Museum, Calcutta. The British Resident in Travancore and Cochin forwarded through the Board of Revenue, Madras, a couple of dozen seeds obtained from Mr. Ross of Bon-accord estate through the Dewan of Travancore. These were accompanied by a copy of a letter from the Conservator of Forests who explained that the tree does not occur in Travancore or Cochin in a wild state.

From Bengal and Bombay no information was obtainable.

Burma.

Burma.—A difficulty having been experienced in tracing the tree in Burma the Director of Land Records and Agriculture asked, with a view to aid further inquiry, for a sample of the nut which was duly supplied to him, together with a botanical specimen.

The following reports and specimens were subsequently received through the courtesy of the Director:—

Karenni, Southern Shan States.—The Assistant Political Officer forwarded botanical specimens obtained from the two four year old trees in the compound of the Lai Hka Pongyi Kyaung or Monastery, and reported that oil was not obtainable. The two trees in question were said to have been raised from seedlings brought from Yaunghwè.

The Deputy Commissioner of the Tavoy district reported that after enquiry through Forest Officers and District Officials the tree was not traced in the district.

Southern Shan States, Central Division.—The officer in charge furnished botanical specimens and fruits. He reported as follows: Oil is not extracted in this Division except by private medicine men. The tree is known throughout the Division as the "*Kanyin*". It has been observed wild on the mule road about 4 miles from Fort Stedman. The cultivated tree grows luxuriantly at 3,000, but falls off after 4,000 feet.

Southern Shan States, Kengtung.—The Assistant Political Officer of Kengtung State writes in his report to the Superintendent and Political Officer:—"During the course of my tour to the east of Kengtung, I found a great many trees of '*mak yau lik*' [**A. moluccana**] as many monks had planted trees near their monasteries. It grows well at elevations between 2,500 and 1,200 feet. The majority of Shans are not able to distinguish between this tree, *mak yau lik* and another species called *mak yau kai* [**A. cordata**] which occurs equally with **A. moluccana**. Oil is expressed from the nuts after they are pounded and steamed. Small quantities of the oil can it is said be got in certain places. It is used for rubbing in with vermillion on pillars in the 'Wats' or monasteries, and for mixing with lacquer in the manufacture of trays, betel boxes, etc. The requirement of the Shans for the oil are small, and a little seems to go a

REFERENCE FOR THE TREE IN INDIA.

Shan States.

long way. Judging from the number of fruits I saw on a young tree not ten years old, nearer 50 oz. of oil than the 1 or 2 oz. generally got from the nuts of a tree could be easily obtained. The tree appears to grow very quickly and to propagate itself freely. At present the oil is very rarely bought and sold, as those in want of the oil generally beg or take some of the oil or nuts. The oil is said to be occasionally sold in Kengtung at about Re 1 [1*s.* 4*d.*] per viss. The gum, root and bark are not used by the Shans.

To extract the oil the kernels are pounded in an ordinary paddy mortar, then placed in a small bamboo open basket and steamed on the top of a vessel. The basket is then placed in a piece of a bullock hide which is put in the press and the oil runs out into a vessel below.

Southern Shan States, Eastern Division.—The following is a report furnished by Mr. D. F. Gordon. Local Shan name *mak man yaü*. The tree is found in a cultivated state in groups of three or four. It is also said to occur wild, but the fruit of the wild species is not used. A very small quantity of the oil is extracted. In the town of Mong Nai, there is only one woman who makes a living by selling the oil and kernels: the oil sells at 10 annas [10*d.*] a viss [=3·65 lb.] and the kernels are sold at annas 4 per *byi* [¼ of a gallon]. In Lai Hka, where a large industry in lacquer work exists, it is said to be used in that industry.

The Assistant Political Officer, Kengtung, subsequently furnished a set of botanical specimens to illustrate the different species of **Aleurites** which occur locally.

These have been identified as under:—

No. 1.	*Mak yau Lik*, from a young tree raised from seed . . .	**Aleurites moluccana.**
„ 2.	*Mak yau Lik*, from Mong Kai, 3,050 feet	**A. cordata.**
„ 3.	*Mak yau Lik*, from east of Kengtung up to the peaks of the Mekaung at Kenglap, between 1,400 and 1,700 feet . .	**A. moluccana.**
„ 4.	*Mak yau Lik*, from east of Kengtung up to the peaks of the Mekaung at Kenglap, between 1,400 and 1,700 feet . .	**A. cordata.**
„ 5.	*Mak yau Lik*, from east of Kengtung up to the peaks of the Mekaung at Kenglap, between 1,400 and 1,700 feet .	**A. moluccana.**

The next step on the part of the Reporter's Office was the preparation of *Commercial Circulars* Nos. 1 and 2 of 1902-03 on

ACCOUNT OF THE TREE.

the subject of the two species **Aleurites moluccana** and **A. cordata.** These circulars contained translations of paragraphs from *Semler's Tropische Agricultur*, ii (1900) pp. 515-518 and from other sources.

"Candle-nut oil is obtained from **Aleurites moluccana (A. triloba)**, a tree belonging to the family Euphorbiaceæ. **A. triloba** and **A. moluccana** have been made separate species, on the claim that the former has its leaves three-lobed; but one finds on the same tree all manner of transitions between lobed leaves and leaves without lobes, wherefore the distinction has no value. The tree which yields in China and Japan the Tung oil belongs to the same genus, but it is quite distinct and constitutes a different section—**Elæococcus.**

Distribution.

"The home of the Candle-nut tree stretches from the Pacific Islands through the Malayan Archipelago to further India; and the tree is found perfectly naturalised in many parts of India Proper, in Madagascar and in the Mascarene Islands. It is abundant in the forests of New Caledonia, Tahiti, the Fiji Islands, Samoa and elsewhere in the Pacific, in Queensland, in New Guinea, and in many of the Malayan Islands. It appears to prefer a protected situation, whence it is common in woods and specially abundant in narrow valleys and gullies. It is prevalent up to the height of 2,600 feet above the sea and thence it becomes rarer and rarer up to 3,900 feet above sea level. Its roundish fruits are about the size of a small apple and consist of a thick fleshy rind, containing one or two more or less heart-shaped seeds, which are very hard shelled and of the size of a horse chestnut. The raw kernels are purgative, but when roasted they lose this property. The oil which is present to the extent of 60 to 66 per cent is almost colourless, rather thick and of agreeable taste and smell when cold pressed. If warm pressed it is brown and disagreeable in taste. It is a good but rather slow-drying oil. It is highly prized for burning with a clear bright flame. It serves well as a lubricating oil and for soap-making.

Oil.

Torches.

"The natives of the Pacific Islands roast or cook the nuts taken out of their rind until the shell can be broken with the slighest tap of a stone. They then remove the shells and thread the kernels on a splinter of bamboo or on the midrib of a cocoanut leaf. They then bind round 2 to 5 of such strings of fruits with bark or with leaves of the screwpine, and get a beautifully bright-burning but sooty and disagreeably smelling torch. Herein the origin of the name Candle-nut. These torches, because they burn so brightly, are commonly used in fishing at night. The soot serves in tatooing, and, mixed with the dark red sap of the bark, as a black colouring matter. The Islanders chew the gum which the Candle-nut tree

Gum and Nuts eaten.

ACCOUNT OF THE TREE.

yields, but this custom is disappearing. The half ripe fruits with salt have a delicate flavour, but the ripe nuts are unwholesome and only eaten in time of necessity.

Export of nuts.

"From Tahiti the French have been at some pains to try to place the nuts on the European markets, with, however, little result, in consequence of the want of an apparatus to shell the fruits on the spot. To do the shelling before shipping is essential: for the weight of each nut lies to the extent of two-thirds in the shell and one-third in the kernel; and the value of the product is not such as to enable the increase of freight due to shell to be borne. On the other hand, the method of shelling adopted by the Polynesian Islanders is too expensive to allow nuts so treated to compete with other oil-seeds on the European market. Yet, in many parts of the Malayan Archipelago, for instance in the little Island Sambara of the Sunda group, the nuts are an actual article of export, and a considerable source of profit to many hill tribes. Also from the Polynesian Islands every now and then small consignments of kernels are sent to the west coast of America where the oil is expressed and used in soap-making.

Analysis of nuts.

"A French chemist has made the following analyses of the kernels:—

Water	5·000
Oil	62·175
Nitrogenous material	22·653
Non-Nitrogenous material	6·827
Ash	3·345
	100·000

Specific gravity of the oil 0·940.

The analyses of the oil cake gave the following result:—

Water	10·25
Oil	5·50
Nitrogenous material (Nitrogen 7·65).	47·81
Non-nitrogenous material	24·04
Phosphoric acid	3·68
Potash	1·53
Magnesia Chalk, Silica, etc.	7·19
	100·00

"The analyses speak very favourably for the Candle-nut, especially when it is remembered that the oil meets with general approval.

"The oil cake has not the nutritive value of other kinds of oil cake; not even if we make allowance for the probable occurrence of fragments of shell in the analyst's material, and doing so estimate the amount of nitrogenous material at probably 9 per cent. and of

phosphoric acid at 4 per cent.; for it cannot be fed to cattle because of the way in which it purges. Its right use is consequently as a manure.

ACCOUNT OF THE TREE.

"Could it not enter into some ingenious head to design an apparatus to shell the nuts satisfactorily?"

Heuzé in his *Plantes Industrielles, Volume II, page 165* (Paris, 1893), adds a few facts which may be of interest to record. He calls the tree by its French name *bancoulier* and gives the names of the nuts in Réunion as, *noix de Bancoul, noix des Moluques, noix chandelles.* He adds "in the Sandwich Islands the oil is called *kekui oil*; in the Philippine *Lumbang oil;* in Ceylon *oil of kekuna;* in Jamaica *spanish nut oil,* 100 kilogr. of the nuts furnish 33 kilogr. of kernels and 100 kilogr. of kernels furnish 60 kilogr. of oil and 40 kilogr. of oil cake. The oil cake contains 9 per cent. of nitrogen.

French names.

Yield

"This oil is very drying; it is pale yellow with a slightly bitter taste; it solidifies at 3 degrees Centigrade; and its density is 0·92. In burning it emits a great deal of black smoke. It is used for illuminating purposes in painting, in the making of varnishes, and of soap. The oil cake is utilised as manure.

There flows from the trunk of **Aleurites** an odourless gum. The bark can be used for tanning."

Copies of the circular were furnished for distribution to the Director of Land Records and Agriculture, Burma, and it was hoped that their distribution might serve to direct the inquiry regarding the species of **Aleurites** met with in Burma to a profitable end.

No further correspondence has, however, taken place, except that the Settlement Commissioner and Director of Land Records and Agriculture, Burma, has communicated the fact that none of the officers in the Tenasserim Forest Circle have been able to obtain specimens of the oil and nuts of **Aleurites moluccana.**

TREE FOR ROAD-SIDES.

In Roxburgh's day the tree was evidently fairly common in Calcutta. Roxburgh's contemporary, Dr. Buchanan-Hamilton, found it growing near temples in Rangpur, but remarked that it was very rare in that District. In the present year, or say one hundred years later, the Reporter on Economic Products when on tour in Rangpur has found the tree at the station of Rangpur planted on roadsides.

In France and other European countries, the cultivation of useful trees, *e.g.*, fruit trees along the highways has been established for some time. In the Allier, for example, the European walnut trees are said to transform the roads into shady walks.

Might it not therefore be desirable to extend the cultivation of **Aleurites** as a shade tree by roadsides? Certainly about Rangpur they grow well in such a position and by means of the silvery backs of their leaves are very ornamental. In this connexion

PROPAGATION OF THE TREE.

the following remarks by Mr. John Cameron, F.L.S., may be found useful "Seeds germinate in about five weeks from the time of sowing, or a week earlier, if placed in fermenting litter such as leaves and bed-straw. When upwards of a foot in height, the seedlings should be planted out into large square pits at 25—30 feet apart. Being a gross feeder, the tree requires the exclusive use of a deep fertile soil, as when the roots of other trees encroach, the Belgaum walnut usually suffers and becomes stunted and unproductive in consequence."

A full and complete account of the oil will be found in *Vegetable Fats and Oils* by Louis Edgar Andés. In the opinion of Andés "the employment of this material in the oil industry is desirable, not only on account of its low price, but also by reason of the quality of oil it can be made to yield. Nevertheless, on account of its higher cost than linseed oil and the comparative rarity of its occurrence in commerce, there is at present no immediate prospect of the extensive employment of bankul oil."

The seeds were recently examined by Professor Wyndham R. Dunstan, whose report on samples received from Hongkong is here given in full from the *Bulletin of the Imperial Institute* V., (1907) p. 135:—

NEW REPORT ON OIL.

"A sample of the seeds of **Aleurites triloba** was forwarded for examination to the Imperial Institute by the Superintendent, Botanical and Forestry Department, Hongkong, with a letter dated the 6th April, 1906, in which it was stated that **Aleurites triloba** is one of the best shade trees in Hongkong, where it grows very quickly.

"The seeds of this tree, which is frequently referred to in technical literature as **Aleurites moluccana** (given as a synonym for **A. triloba** in the Index Kewensis) are commercially known as "Candle-nuts" and the kernels are already exported from Fiji, New Zealand, and Australia. The oil which they contain is used for soap-making, both in this country and on the Continent.

"The sample consisted of four pounds of the seeds, the kernels of which were nearly white and free from discolouration.

The oil was extracted by means of light petroleum and the kernels were found to contain 60·8 per cent. of oil, which is equivalent to a yield of 19·8 per cent. from the unshelled seeds. The oil dried on exposure to air in thin films in about ten days.

A number of analyses of Candle-nut oil have been made previously, and these show considerable variation in the principal constants recorded. The results obtained at the Imperial Institute by the analysis of oil extracted from the present sample of seeds, and those

obtained by investigators who have examined Candle-nut oil previously, are given in the following table:—

NEW REPORT ON OIL.

	Oil from **Aleurites triloba**, examined at the Imperial Institute.	Oil from **Aleurites moluccana**, examined by		
		Lewkowitsch.	De Negre.	Fendler.
Specific gravity	0·9274 (15°C.)	0·92565 (15·5°C.)	0·920 (15°)	0·9254
Acid value	1·72	...	...	...
Saponification value.	264·2	192·62	184—187·4	194·8
Iodine value	139·7	163·7	136—139	114·2
Hehner value	96·4	95·5	...	...
Wollny-Reichert value.	1·98	...	...	...
Titer test	17·8°C	...	20°—21°C.	1·8

These results indicate that the oil belongs to the class of drying oils typified by linseed oil, and would be suitable for the manufacture of soft soap and in the preparation of oil-varnishes, paints and linoleum and other similar purposes, to which oils of this class are applied industrially.

VALUE OF KERNELS.

Samples of the nuts were submitted to brokers, who stated that the *kernels* would meet with a ready sale at £12 to £13 per ton, but pointed out that the unshelled nuts could not be disposed of in this country."

G. I. C. P. O.—No. 1020 R. E. P.—5-1-1908.—2,250.—B. N. D.

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AGENT.

In Britain.

Mr. E. Arnold, 41 & 43, Maddox Street, Bond Street, London.
Messrs. Constable & Co., 16, James Street, Haymarket, London.
Messrs. P. S. King and Son, 2 & 4, Great Smith Street, Westminster.
Messrs. Kegan Paul, Trench, Trübner & Co., 43, Gerrard Street, Soho, London.
Mr. Bernard Quaritch, 15, Piccadilly, London.
Mr. B. H. Blackwell, 50 & 51, Broad Street, Oxford.
Messrs. Deighton Bell & Co., Cambridge.
Messrs. Henry S. King & Co., 65, Cornhill, and 9, Pall Mall, London.
Messrs. Grindlay & Co., 54, Parliament Street, London, S. W.

On the Continent.

Messrs. R. Friedländer & Sohn, Berlin, N. W., Carlstrasse, 11.
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Mr. Karl W. Hiersemann, Leipzig.
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Mr. Martinus Nijhoff, Hague, Holland.
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In India.

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(Vegetable Product Series, No. 104.)

THE AGRICULTURAL LEDGER.

1907—No. 5.

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ARGEMONE MEXICANA.

(MEXICAN POPPY.)

[*Dictionary of Economic Products, Vol. I., 1351—1358.*]

The seeds and oil of the Mexican Poppy (**Argemone mexicana**), *by* DAVID HOOPER, F.C.S.

The Mexican Poppy.

The present *Agricultural Ledger* brings together the latest information on the uses, composition and commercial prospects of the seeds and oil of an American weed naturalized all over India and other parts of the world. The Mexican Poppy or Gamboge Thistle (**Argemone mexicana**) grows in desert land and saliferous soils of the United Provinces and the Punjab, sometimes where few other plants persist. The plant yields an abundant crop of seed which is very oleaginous, and considering the demand for oil seeds at the present time, suggestions are made for utilising the oil and cake in the arts and agriculture. The ledger owes its inception to observations on the extensive use, in Behar, of oil of the seeds, which were made by the Reporter on Economic Products to the Government of India. The uses are two: one is as a remedy for skin diseases, the body being smeared with the oil, the other is for burning. Under normal conditions, it seems that not very much of the oil is burnt, but that it is quite a regular practice in the districts of Patna, Darbhanga and Mozufferpur to put by a supply to serve as a remedy in skin troubles: but in the current year bad crops had led to a considerable amount of want and many people were turning their hands to unusual avocations, among them the gathering of an amount of the seed of this plant far beyond what is customary. Everywhere in the districts named, in April, May and June last, women with a clumsy pair of tweezers were busy plucking the prickly pods just before they were ready to open and to scatter their seeds. The tweezers are made of two pieces of a split bamboo or of a bent piece

Gamboge Thistle.

Uses.

Method of collecting seed.

of hoop iron. The morning's gathering is spread out in the midday sun for the pods to open and the seed that is obtained is crushed in the ordinary oil press. In Chota Nagpur it has been observed that the seeds are sometimes collected into little heaps by ants, thus lightening the labour of women and children whose duty it is to gather them.

The Reporter on Economic Products collected at Dalsingh Sarai and Barh the samples of oil, which have been examined in part by Lieutenant-Colonel D. St. J. Grant, I.M.S., Chemical Examiner to the Government of the Punjab, and partly by myself, for the purpose of this account of the plant as one yielding an oil seed.

The Mexican Poppy is known by the following vernacular names :—

Vernacular names.

Bharbhand, kutaila, kutila, kantala, HIND.; *Shiel kanta*, BENG.; *Feringi* or *pila dhatura*, DEC.; *Datturi*, CAN.; *Biramc dandu*, TAM.; *Daruri, kandew*, MAR.

The plant is at once recognised by its yellow flowers, prickly leaves with white veins, and the yellow juice that exudes when the plant is broken.

Distribution.

Habitat.—The Mexican poppy is a native of Jamaica, the Carribean Islands and Mexico, from which last country the Spaniards brought it to Europe under the name of Fico del inferno or Fig of hell. It was introduced into India about three centuries ago, presumably as ballast from abroad, and is now found all over the country in every nullah and abandoned rubbish heap. Being an annual it springs up from seed in the cold season, spreads as a weed in waste ground and on newly turned soil, ascending to 5,000 feet in the Himalayas. In Sind it is found among field crops and about a mile inward along the Indus, and in some places, as Kotri, may be seen to cover large tracts. In the Punjab it has been introduced within recent years and is slowly extending. It has not been noticed as occurring much to the west of Lahore. In 1854, Edgeworth observed that it had not reached Multan, but in 1866, it was seen in the extreme south-west of that district near the junction of the Chenab with the Sutlej. It is abundant near Delhi, where an oil is extracted, and it is a typical plant of the nitre region of Hissar and Hansi. It is one of the principal plants forming the vegetation of Lakhimpur, Assam, and is an invading foreigner in Manipur. In many parts of the country, the plant is so abundant as to become a source of anxiety to the cultivator, and it was found to be doing so much harm to the young growth of Sednani Forest in Sind in 1899 that the department were compelled to take steps to suppress it.

Fico del Inferno.

Uses of seed and oil.

Medicinal uses.

Argemone oil has long been used in India in medicine. Ainslie informs us that the Hakims employed the oil as an external applica-

tion in such headaches as are caused by the sun, and the Vythians recommend it as a liniment for a scald head. Dr. Irvine of Patna says the oil stimulates indolent ulcers and eruptions, and others have applied it in cases of itch, ringworm and cutaneous diseases with beneficial results.

Medicinal uses.

The seeds are emetic, cathartic and acrid. The acrid and purgative properties of the seeds are contained in the oil. Opinions regarding the efficacy of the oil have differed in the past, but the balance of recent medical opinion is that in small doses of 10 to 30 minims it constitutes an active cathartic. This has recently been confirmed by Colonel Grant. It has been noticed that freshly prepared oil is more energetic and uniform in its operation than that which has been kept for some time.

Further uses of oil.

The oil is used for burning in the lamps in the Konkan and other parts of India. In South America the expressed oil is employed by painters and for giving a shining appearance to wood; it is probable, too, that the acridity of the oil will prevent the attacks of white ants and borers. It saponifies readily and gives a hard soap with soda.

It is not likely to take the place of castor oil in general practice, but the smallness of the dose is an advantage which is calculated to recommend it in some quarters.

Seeds Poisonous.

The seeds are poisonous if taken in quantity. In 1878, a case occurred in Bombay in which a number of people suffered from vomiting and purging after using sweet oil which had been adulterated with Argemone oil. The adulteration may be detected by the rich orange-red colour developed when strong nitric acid is added to the oil or mixtures containing it. In the same year samples of oil were received by the Punjab Chemical Examiner from Amritsar, Simla, and other towns which were said to possess irritant properties, causing purging and vomiting. The oil was stated to have been imported from the United Provinces and to have been made from *Siyal kanta* (jackal's thorn) the vernacular name for **Argemone mexicana.**

Adulteration detected.

Oil causes purging and vomiting.

Chemical composition.

The seeds are small, round, black, and roughish from pitted depressions; they are about the size of rape seed.

Analysis of seed.

They contain in one hundred parts, 36 parts of oil, 49 parts of carbohydrates, albuminoids and fibre, 9 of moisture and 6 of ash. W. H. Bloemendal examining ten samples of the seeds of Argemone from Curaçao and other countries collected in the Haarlem Colonial Museum, found the yield of oil to vary from 35 to 38·7 per cent., or an average of 37 per cent. (*Pharm. Weekblad.*, 1906, 14).

Yield of oil.

By ordinary pressure the seeds yield from 25 to 30 per cent. of oil, a quantity equal to that obtained from rape seed.

It has been stated that the narcotic property of the seeds is due to the presence of morphine, and Dragendorff isolated an alkaloid from them in 1868, and Peckolt in 1878 separated argemonine. In 1902 J. O. Schlotterbeck (*Journ. Am. Chem. Soc.* 24, 238) investigated the seeds and proved that morphine was entirely absent. He found two alkaloids present; one berberine and the other protopine. Peckolt's argemonine was identified with the latter base. The presence of notable quantities of potassium nitrate among the inorganic salts was indicated.

Colour, taste and odour of oil.

The oil has a light yellow colour, nauseous and acrid taste and a raw odour. O. Frolich (1871) obtained from the oil a hard soap with soda, and found in the soap liquor butyric, valerianic, acetic and a little benzoic acid. According to Flückiger (1871) the oil has the specific gravity of ·919 at 16·5°C., dries slowly and incompletely, and is not soluble in 6 volumes of ·90 per cent. alcohol. On keeping, the acid value increases, and the oil becomes more soluble in alcohol. It gives with nitric acid an orange-red colour which distinguishes it from other fixed oils.

The following constants have been recorded :—

Specific Gravity at 15°.	Acid value.	Saponification value.
·9247 Crossley and Le Sueur.	6·0 Crossley and Le Sueur.	190·3 Crossley and Le Sueur.
·9435 Bloemendal		200 Bloemendal.
·924 Grant		190 } Grant. 191 }

Iodine value.	Oleo-refractomer at 35°.	Refractive Index.
122·5 Crossley and Le Sueur	+ 65 Grant	1·4675 Crossley and Le Sueur at 35°
113·3 Bloemendal		1·452 Grant.
113 } Grant 111 }		

The oil afforded 95·07 per cent. of fatty acids melting at 22°.

Drying properties of oil.

The oil dries to a hard jelly, gaining during the process 8 per cent. of its weight, an amount which corresponds with that absorbed by poppy seed oil. It then ceases to give a red colour with nitric acid.

Conclusions.

The properties of Argemone oil as shown in the foregoing remarks and chemical reactions somewhat restrict it for general employment. Its acrid taste and active therapeutic action preclude its use for edible and culinary purposes. Although not so siccative as linseed oil, it has distinctly drying properties and could be used for paints and for caulking timber and boats when it is required to keep out damp and destructive insects. If obtainable at a sufficiently low price it would be most serviceable for soap making. The seed is said to sell in North Arcot for R1-4 to R2-1 per maund of 25 lbs., and in Northern India the price should be lower. The cake is unsuitable as a cattle food, but from its composition it would form an excellent bulk manure for cultivating exhausted soil. Large quantities of the seed are occasionally brought to the markets, but at present there is not much demand for it. The oil seed is not one that would be attractive to European commerce, but there are many ways in which the oil could be made serviceable in this country. The plant is so abundant that an unlimited amount of oil would be available should a demand arise.

Price of seed.

Manure for exausted soil.

G. I. C. P. C.—No. 1199 R. E. P.—11-1-1908—2,500.—J. A.

THE

AGRICULTURAL LEDGER.

1907—No. 6.

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(Vegetable Product Series, No. 105.)

THE

AGRICULTURAL LEDGER.

1907—No. 6.

CORCHORUS SPP.

(JUTE.)

[*Dictionary of Economic Products, Vol. II*, C., 1839—1924.]

THE RACES OF JUTE.

By I. H. BURKILL *and* R. S. FINLOW.

INTRODUCTORY.

The enquiry of which the present report is a result began in 1900 when Mr. P. C. Lyon, then Director of Land Records and Agriculture, Bengal, caused two of his staff, Babus H. C. Guha and Nibaran Chandra Chowdhuri, to tour through the jute districts collecting information about the races grown. The specimens collected were made over to Sir George Watt, Reporter on Economic Products to the Government of India, for study. Later Mr. Lyon and his successor Sir Charles Allen obtained seed of many of these races for cultivation on the Experimental Farm of His Highness the Maharajah of Bardwán. Just at the time of the inception of these experiments at Bardwán, the jute crop of 1901 caused in Calcutta an outcry that the fibre was deteriorating. Then it was that at the request of Sir Charles Allen and Mr. J. W. Mollison, Inspector-General of Agriculture, one of us in 1902 took up the interrupted work of Sir George Watt, studying first the Bardwán plots.

Alleged deterioration.

Shortly after this the Government of India referred to the Board of Scientific Advice the question of deterioration of jute and received the following reply:

"In the papers on jute submitted to the sub-committee for consideration and report it is made clear that of late years the quality of the jute fibre which comes into the market has deteriorated.

INTRODUCTORY.

Alleged deterioration.

The question to be considered is what may be the explanation of this fact. There are three possible explanations:—

1. That the plants which yield jute fibre—**Corchorus capsularis** and **C. olitorius**—have degenerated so that they do not now yield such good fibre as formerly.
2. That the plants which yield jute fibre have not degenerated, but that the fibre is either not now extracted with the same care as formerly, or is subjected to deliberate maltreatment in the way of artificial and fraudulent watering, which induces heating and discolouration.
3. That the plants which yield jute fibre have not degenerated, but that now as always there are jutes of different kinds. These kinds do not all produce fibre of equal quality suitable for the purposes of the jute trade: yet, as they are probably always the kind supposed to be most suitable to the conditions which prevail in different districts or parts of districts, it is probably often a question between growing these kinds which yield inferior fibre and not growing jute at all. Formerly it was possible for the jute trade to select from the produce of the districts most suitable to the cultivation of jute precisely those kinds most suited for the purposes of that trade. Now, it may be that the demand for jute fibre is so great that the trade is no longer able to choose what it will take, but has to be content to take what it can get.

With regard to the first possibility, the sub-committee beg to report to the Board that there is not only no proof that any degeneration in either of the jute plants has occurred, but there is strong evidence that the plants are now precisely as they were a century and more ago. The best kinds, now as then, if cultivated liberally, yield excellent crops; and their fibre, if properly extracted, is also excellent.

With regard to the second possibility, there is no indication that any radical change has come over the system of steeping and retting, but there appears to be proof that at times fraudulent watering, which induces heating and discolouration, is resorted to with the object of fictitiously increasing the weight of the fibre offered for sale. The remedy for this particular cause of deterioration obviously lies in the hands of the jute trade.

The sub-committee beg, however, to express the opinion that though this is no doubt the explanation of some of the deterioration observed and complained of, it does not explain it all, and in their belief the degeneration is largely due to the fact that whereas

INTRODUCTORY.

Alleged deterioration.

formerly only the best jute, or at all events the jute most suitable for purposes of the Dundee and Calcutta spinner, alone found a sale among jute dealers, now these dealers require so much jute that to fulfil their obligations they must purchase practically whatever jute is offered to them, knowing, as they do, that what one dealer refuses to buy another will come forward and secure.

To a certain extent perhaps the remedy for this state of affairs lies theoretically in the hands of the buyers. If they would decide only to purchase the jute most suitable for the purposes of spinners at Calcutta and Dundee, it is certain that very soon only jute suitable for these purposes would be offered for sale. But it seems clear that the matter has gone beyond the stage at which this policy is possible without at the same time incurring the risk of shutting down some of the jute mills because of a shortage in the raw material; this being the case, jute fibre must be purchased, to make up the deficiency, which has been extracted either from less suitable kinds of jute or from proper kinds grown in less suitable localities. The only thing likely to overcome the difficulty is to induce the cultivators who now grow kinds that are not the most suitable for the purposes of the spinner, to replace these by kinds that are suitable. In this Government is able to assist the trade by explaining to the cultivator what precisely the buyers' requirements are; and by further supplying the cultivators with seed of the most suitable kinds for the purpose in the various districts. In every case, however, it is necessary first to discover the most suitable kinds, in some instances it may be advisable to attempt by selection or otherwise to evolve new kinds more suitable for the purpose than any known kind."

THE NECESSITY OF DISCOVERING THE BEST KINDS.

We have quoted the Board's opinion in full because it exactly expresses the point at which our enquiry began. We set out to ascertain the various kinds of the jute plant cultivated in India in order that out of them might be picked the most suitable kinds for the various districts. Our task has proved no easy one, for the differences between race and race are minute and demand an attention to details that a systematic botanist rarely is required to give: they are too minute for herbarium work, and must be noted among the crops. Nor do we claim to have reached a final view, but only to a stage at which some opinions may be put forward tentatively for the general advancement of the enquiry.

Difficulties of our enquiry.

As already said we began work,—one of us first, the other later,—with a collection of notes made by Babus H. C. Guha and N. C. Chowdhuri, and with every facility for study at Bardwán that could be given to us.

Progress.

In 1902 we found that there were fifteen plots at the Bardwán Farm. We continued our work in 1903 upon a larger series at that

PROGRESS OF OUR ENQUIRY.

Farm. In 1904 besides the study of the Bardwán plots, augmented again by eight, tours were undertaken in the districts of Pabna, Bogra, Mymensingh, Dacca and Faridpur. In 1905 operations were interrupted, but began again in 1906 on a still larger scale. The Pusa Farm was put under contribution, so that with the Bardwán Farm we had two series of experimental plots for study: tours were made through the districts of Purneah, Dinajpur, Jalpaiguri, into the Darjeeling-Terai, to Goalpara, through Mymensingh again, in Dacca, Tippetah, Faridpur, Hughli and the 24-Pergannahs, and into Orissa. In 1907 tours were undertaken from Jalpaiguri to Rangpur, Dhubri and Serajganj, and in the districts of Nadia, Murshidabad, Rajshahi and Malda. The Pusa Farm was again of great use; but the variety experiment had been discontinued at Bardwán.

The volume of notes collected in these tours and from the farms has become considerable.

The Bardwán plots have been of the first importance to us: they were located in the flat low part of the Bardwán Experimental Farm, and were each of one twenty-fifth of an acre. The trouble there has been to make the ground absolutely uniform. Certainly it was not so in 1902, when the experiments began. But since then uniformity has nearly been established. The method used for testing the uniformity is the simple one of scattering over the area plots of one selected race and comparing their growth. The race selected has been an acclimatised Deswal of Serajganj, which in the Bardwán records is always referred to as "Farm seed." It was used first in 1904 as plots 10, 13, 20, 30, 40 and 47 of the series and was so used again in 1906. In August 1904 all these farm-seed plots were of exactly the same growth except 30, which was three inches shorter than the others, and in September 1906 Nos. 10, 13, 20 and 30 were all of the same height, but No. 40 was three inches less and No. 47 a foot taller.

VARIATION.

We must now enumerate the directions in which jute-plants chiefly vary.

Distinction of races by colour.

Colour. Plants exhibit four colour conditions:—

1. Red stem, red petioles, red fruits, bright yellow flowers.
2. Green stem, rosy petioles, rosy fruits, red on the outside of the flower-bud and bright yellow flowers.
3. Green stem, green petioles, green fruits, no red on the outside of the flower-bud, bright yellow flowers.
4. Ditto, with pale yellow flowers.

The constancy of some of these combinations suggests interesting Mendelian experiments.

Generally the ryots select enough to isolate No. 1, but not Nos. 2 and 3 and 4. No. 1 is their "Nál" or "Lál," *i.e.*, red, each of its kind; Nos. 2 and 3 are together the "Dhaula" or white; inter-

mediates are present, but usually not in any quantity. No. 4 we found to have been more or less completely isolated only in two races of the Bardwán Farm Experiments. **VARIATION IN COLOUR.**

It will be convenient in the course of what we have to relate, to denote the degree of selection by terms which have been defined to the reader; we shall speak of the selection which leaves Nos. 2, 3 and 4 mixed as selection to the usual degree, and we shall speak of selection which exceeds this as selection to an unusual degree.

Season. The effect of late sowing is to prevent the plant from growing to its proper height: late sown plants come into flower dwarfed at the same or almost the same time as they would have done sown early, unless the sowing is unreasonably late: in fact, the tendency may generally be stated to be towards flowering of a race at a constant time whatever the difference in the time of sowing may be. **CONSTANCY IN TIME OF FLOWERING.**

Early and late races.

In the fixing of the time of flowering, ryots in the past have certainly done a good deal of selection, so that races have diverged considerably. It is the side-shoots which flower: arrest them, and the plant becomes late. Thus straightness and tallness go hand in hand with lateness, though not quite entirely. The race Barapát of Jagannáthganj has been selected for straightness, while yet remaining early.

Side-shoots are pre-eminently flowering shoots.

When a plant is bitten down the side-shoots develop, and one of them may take the lead and may grow into a substitute for the main stem, but however like a main stem the side-shoot may become—and it is very like if the main stem be bitten down particularly early—there becomes apparent in these side-shoots their great tendency to flower, and it leads to the early formation of fruits: these fruits attract attention by being low down on the stem. In some districts, notably Mymensingh, the abundance of early fruits, well below the level of the leaves, catches the eye at once: these early fruits are accidents said to result from depredations of cattle, and are not a feature of any race.

Seed-formation is said to be less abundant the richer the soil. This is very probable; but we have had no means of testing the statement. **SEED FORMATION.**

Stature is a matter of several circumstances. There are races habitually tall, and races which are not so tall, if each be under its best conditions. When each in its turn is subjected to too much water or too little water, or sown too late, the stature becomes influenced for the worse. We have no irrefutable evidence yet that the effect of flooding differs in different races, but an abundance of native statements to that effect: for the cultivators say generally that some races are more tolerant of flooding than others: and that others again are much thrown back by water on the soil. **VARIATION IN STATURE.**

If this be the case and for the reason—that of necessity for the sake of the comparative experiment, endeavour was made to make the

VARIATION.

Bardwán field as even as possible—then the results of the Bardwán farm do not give the relative values of the various races, but only their relative values under the Bardwán conditions. And it was wise that the Government of Bengal tried experiments with the same races at Rangpur, and sent the seed to the Experimental Farm of Babu Brajendra Kishore Roy Chowdhury at Gauripur near Mymensingh, both places on higher land, and grew them also at Faridpur on more submerged land than at Bardwán; but it is unfortunate that we are not in possession of fuller records from these places. In 1904 one of us visited Faridpur, but the plots had just been reaped; and in 1906 one of us visited Gauripur, but the variety experiment had been discontinued.

Control of retting experiments.

We are further robbed of the chance of comparing the quality and yield of fibre as we should have liked to do, because the retting water at Bardwán, being still pools on the Farm, must have changed its composition enormously as the season progressed. **We propose to ret in future for comparative tests in a vat, controlling the water admitted as nicely as possible. Vats with a layer of warm jheel water in them and covered to shut out the light are ideal places for retting small quantities of jute.**

Meanwhile, though so much remains to be done, **we think that** much good may come from the publication of our results—and most especially so if those who deal in jute will freely criticise.

NUMBER OF RACES RECOGNISED.

At the risk of being tedious we find ourselves bound to give rather fully the observations which we rely on for our conclusions, because they will be required for further work; moreover, no one has gone over the ground before us and therefore every statement has to be established.

We have recognised five cultivated races of **Corchorus olitorius**—the long podded jute, and thirty-three of **C. capsularis**—the round podded jute. Further study may cause some of these to be split up into sub-races, but at the same time is likely to show that some which we are forced at present to keep apart are not distinct enough for separation.

CORCHORUS CAPSULARIS IN FARIDPUR.

Having made these preliminary remarks, we shall proceed to discuss first **C. capsularis** and then **C. olitorius**. Under each species we shall give first a discussion of the cultivated fibre plants and then any further information that we have to offer about plants grown for eating, and lastly about wild plants.

Race No. 1 Faridpur Aus.

It is useful to begin with the district of Faridpur, because it is central, and we have found more race-names to be used in it than in any other district. Taking first the green-stemmed races, and starting at the town of Faridpur, we find that there are at that centre early and late green-stemmed jutes respectively called Aus and Amon, or Deshi Aus (country early), and Deshi Amon (country

late). If a crop of Aus be examined, it will be seen that the fruits and petioles are at times reddish, at times green, the stems are however green, and never red. The ryots have selected it to what we call the ordinary degree, eliminating form No. 1 of page 44, but leaving the others mixed.

CORCHORUS CAPSULARIS.

The Aus of Faridpur is grown west of Faridpur towards Rájbári; and, for instance, about Pachuria and Goalundo.

It is fairly tolerant of water; but it is a mistake to think that it needs flooding. The lower corners of fields where the water gets at young plants are always the worst grown, though when already at full height, a great deal of water fails to kill it. In 1906 the floods of the end of August at their height left but a foot of its top out of water, but it took no harm, whereas **C. olitorius** alongside was killed.

Race No. 2 Faridpur Amon.

At Faridpur Amon or Amonia, the late green race, is found to vary like Aus, rosy-fruited and green-fruited plants occurring together in the crops. It is much more abundant than Aus, with which it shares the names of Desi and Desal and as well the name of Ghagri (meaning unknown to us).

While Amonia occupies a large area in northern Faridpur it is represented in southern Faridpur by the race Sutpát. The old mart Deora is within the region of Sutpát, and though now so decayed that we hardly find it on the maps, it has left in the jute-trade the name "Dourah" likely to be permanent for the type of fibre generally produced in Faridpur.

We now give tables comparing the behaviour at Bardwán and Pusa of plots of Amonia and Sutpát grown side by side. The Amonia seed came originally from Pangsa, and the Sutpát seed from Deora.

Bardwán Experimental Farm.

	Amonia of Pangsa.	Sutpát of Deora.
1904.		
August 10	*Just in flower*	Buds just appearing.
September 22	Out of flower; *some fruits quite ripe.*	Last flowers out; no fruits quite ripe.
1906.		
August 26	In flower, without fruits.	In full flower, *beginning to form fruits.*
September 15	A few flowers left; no ripe fruits.	Still in flower, no ripe fruits.

CORCHORUS CAPSULARIS.

Comparison of two Faridpur races.

Pusa.

1906.	Amonia.	Sutpát of Deora.
August 7	Not in flower	Hardly in flower.
August 26	Not yet at full flowering	Not yet at full flowering.
September 20	.....	In young fruit.
October 4	No fruits ripe yet	*A very few fruits ripe.*
October 31	Not quite ripe	*Dead ripe.*

1907 (Gonhri field).

July 23	Very first buds appearing	First buds appearing.
August 15	Coming into flower	Most of the plants still in bud, but some just forming fruits.
September 8	In flower, with young fruit	In flower, with young fruit.
September 23	Fruits of full size, but none ripe; *the leaves beginning to fall.*	Fruits of full size, but none ripe; leaves hardly falling yet.

The tables show that in point of time there is no real difference between Amonia and Sutpát, the differences that exist between the two races being chiefly in the greater branching of the latter, and perhaps the slightly greater height of Amonia.

The reader, who is not particularly interested in making a minute analysis of the races, to his own convenience may regard the two as one; but we, because we need to select from the better, prefer to separate them.

The name Sutpát means thread jute.

We have observed that Amonia and Sutpát have on the average rather smaller pods than most of the other races.

Race No. 3 at Madaripur.

This Sutpát is the Desi of Madaripur, where it is very commonly sown under this name or the names of Sutpát or Kauplá, or Desál Peti (Peti meaning little). It is grown on the sides of running waters where the silt is deposited on it and where the retting water is opaque with sediment: it is, as we have said, a somewhat branchy plant; and (i) because of the silt on its stems and (ii) its branches, it is not spoken of with praise by the cultivators, who reserve their still waters behind the river-channels for something that they prize more, *viz.*, their races Udhap and Belgáchi.

Race No. 4 Udhap of Deora.

Udhap (name meaning light or bright) is grown at Madaripur in the jheel waters and is prized. It is earlier than Kauplá or Sutpát of Deora, and does not branch. Udhap and Sutpát of Deora

were grown close together at the Bardwán Experimental Farm and at Pusa, with these results:—

CORCHORUS CAPSULARIS.

Bardwán Experimental Farm.

1904.	Udhap.	Sutpát.
August 10	*Just a few flowers open*	Buds just appearing.
September 22	*No flowers left;* fruits not ripe	Flowers left; fruits not quite ripe.

1906.		
August 26	*Most fruits well formed*	Beginning to form fruits.
September 15	*Last flowers left*, and first fruit nearly ripe.	Fully in flower; no ripe fruit.

Pusa.

1906.	Udhap.	Sutpát.
August 7	*Just in flower*	Hardly in flower.
August 26	In flower	In flower.
September 20	Last flowers left	In young fruit.
October 4	*A few* fruits ripe	A very few ripe fruits.
October 21	Plants dead ripe	.....
October 31	.....	Plants dead ripe.

1907 (Gonhri field).

July 23	First buds appearing	First buds appearing.
August 15	In flower and with young fruit.	Most of the plants still in bud, but some just forming fruit.
September 8	*Most of the fruits full size*	In flower, with young fruit.
September 23	*Just at the very beginning of fruit ripening; leaves falling a little.*	No fruits ripe yet; leaves not yet falling.

The Bardwán and Pusa experiments declare that Udhap is a little earlier than Sutpát.

Race No. 5 Belgachi of Madaripur.

Belgáchi (meaning of the mart Belgáchi)—the second superior race of Madáripur—is grown in the jheel waters with Udhap. It differs from Udhap in very little; its stem is green with a rosy flush. According to Babu N. C. Chowdhuri, who made notes at Hábiganj near Madáripur in 1899 for the Director of Land Records and Agriculture, Bengal, Belgáchi had not been grown long about

CORCHORUS CAPSULARIS.

that village. Grown by the side of Udhap, Belgáchi behaved thus:—

Bardwán Experimental Farm.

1904.	Belgáchi of Madáripur.	Udhap of Deora.
August 10	In young bud.	*Just a few flowers open.*
September 22	No flowers left; *a few fruits dead ripe.*	No flowers left; fruits not ripe.
1906.		
August 26	Beginning to form fruits	*Many fruits well formed.*
September 15	Last flowers open; plenty of nearly ripe fruit.	Last flowers open; first fruits nearly ripe.

Pusa.

1906.	Belgáchi of Madáripur.	Udhap of Deora.
August 7	Not in flower	*Just in flower.*
August 26	In flower and beginning to form fruit.	In flower with a few fruits.
September 20	In flower, and with fruits not quite full size.	Few flowers; some *fruits just full size.*
October 4	Fruits beginning to ripen	Fruits beginning to ripen.
October 21	.....	*Dead ripe.*
October 29	Dead ripe	.....

1907 (Gonhri field).

July 23	No buds yet on the green stemmed plants, but a few on plants with a reddish tinge.	*First buds appearing.*
August 15	A very few young fruits	In flower, and with young fruit.
September 8	In flower, and with young fruit	Much of the fruit of full size.
September 23	No fruit ripe yet; leaves not yet falling.	*Just at the very beginning of fruit ripening; leaves falling a little.*

Comparison of two Faridpur races.

Thus it is a very little later than Udhap. On August the 10th, 1904, at Bardwán it was half a foot taller than Sutpát; at Pusa on August the 6th, 1906, it was fifteen inches taller; at Bardwán on September the 15th, 1906, it was of the same height.

Bardwán Experimental Farm.

1904.	Belgáchi.	Amonia.
August 10	In young bud.	*Just in flower.*
September 22	No flowers left; a few fruits dead ripe.	No flowers left; a few fruits dead ripe.

Bardwán Experimental Farm—contd.

CORCHORUS CAPSULARIS.

1906.	Belgachi.	Amonia.
August 26	*Beginning to form fruit.*	In flower, without any formed fruits.
September 15	Last flowers open; plenty of nearly ripe fruit.	Last flowers open; no fruit quite ripe.

Pusa.

1906.	Belgáchi.	Amonia.
August 7	Not in flower	Not in flower.
August 26	In flower and *beginning to form fruit.*	Not yet at full flowering.
September 20	In flower and with fruits not quite full size.	.....
October 4	*Fruit beginning to ripen*	No fruits ripe yet.
October 29	*Dead ripe*	.....
October 31	.....	Not quite dead ripe.

1907 (Gonhri field).

July 23	No buds as yet	*Very first buds appearing.*
August 15	*A very few young fruits.*	Coming into flower.
September 8	In flower, and with young fruit.	In flower, and with young fruit.
September 23	No fruit ripe yet; leaves not yet falling.	Fruits of full size, but none ripe; *leaves beginning to fall.*

Comparing Belgáchi with Amonia, we find them practically synchronous. They are both later than Udhap, and the chief way in which they differ is that Belgáchi has been carefully selected so as to eliminate the rosy petioles and fruits, which are commoner than green, in Amonia. A second way is in the size of the fruits.

Kamarjani of Goalundo does not differ from No. 5.

The race Kamárjáni (meaning jute from Kamárjáni on the Bráhmáputra in the Mymensingh district) which is grown at Goalundo may be compared with Belgáchi. In time of growth when sown alongside that race it behaved thus:—

Bardwán Experimental Farm.

1902.	Kamárjáni.	Belgáchi of Faridpur.
August 28	Just in flower.	Just in flower.
1903.		
August 2	No sign of flowers	No sign of flowers.
September 10	Had been in flower about 14 days.	Had been in flower about 14 days.

CORCHORUS CAPSULARIS.

Bardwán Experimental Farm—contd.

	Kamárjáni.	Belgáchi of Faridpur.
1904.		
August 10	Just in bud	In young bud.
September 22	Out of flower; some fruits dead ripe.	Out of flower; a few fruits dead ripe.
1906.		
August 26	Beginning to form fruits	Beginning to form fruits.
September 15	Last flowers; no fruits quite ripe.	Last flowers; plenty of nearly ripe fruits.

Pusa.

	Kamárjáni.	Belgáchi of Faridpur.
1906.		
August 7	Not in flower	Not in flower.
August 26	Very few flowers indeed	In flower and *beginning to form fruits.*
September 20	In flower, with young fruit	In flower, with fruits not quite full size.
October 4	*Just a few fruits ripe*	Fruits beginning to ripen.
October 29	Dead ripe	Dead ripe.
1907 (Gonhri field).		
July 23	Buds just appearing	No buds yet on the green-stemmed plants, but a few on plants with a reddish tinge.
August 15	A few flowers	*A very few young fruits.*
September 8	In flower, and with young fruit	In flower, and with young fruit.
September 19	A few flowers left; much young fruit.	Much young fruit.
September 23	No fruits ripe yet; *leaves beginning to fall.*	No fruit ripe yet; leaves not yet falling.

In colour, size, as well as in season they are so similar that we regard the two as one race. The jutes of Kamárjáni are discussed on pages 76 and 88 forward; there the commonest race is Dháulá Aus equivalent to Serajganj Desoál, which, however, is not the same as this Kamárjáni of Faridpur.

The country names of red-stemmed jutes of the Faridpur district are Meghnál (from megh=a cloud, referring to the dark colour, and nál=iál, *i.e.*, red), Lálpát or Nálpát (red jute), and Sujimani (apparently meaning sun-bright jewel): together with these we have found the name of Bidya Sundár to be known at Faridpur, and the race so called was from imported seed.

CORCHORUS CAPSULARIS.

Race No. 6 Meghnal or Nalpat of Faridpur.

Comparison of two Faridpur races.

The names Meghnál and Nálpát undoubtedly belong to the same race. We have studied it in cultivation at Bardwán and Pusa, and so are enabled to institute exact and useful comparisons with other Faridpur races. It is a late race, but earlier than Amonia.

Bardwán Experimental Farm.

	Nálpát or Meghnál of Rájbári.	Amonia of Faridpur.
1902.		
August 28	In flower and *beginning to form fruits.*	Just in flower.
1903.		
August 2	Not yet in bud	Not yet in bud.
September 10	*Has been in flower about 25 days.*	Has been in flower about 20 days.
1904.		
August 10	Just in bud	*Just in flower.*
September 22	With nearly ripe fruit	No flowers left; *some fruit ripe.*
1906.		
August 26	In flower, and *with a little young fruit.*	In flower, without having yet formed fruits.
September 15	*No flowers left*; no fruits ripe yet.	A few flowers left; no ripe fruits.

Pusa.

	Nálpát or Meghnál of Rájbári.	Amonia of Faridpur.
1906.		
August 7	Not *quite* in flower	Not in flower.
August 26	*A few side plants have formed fruit.*	Just in flower.
October 4	*A very few fruits ripe*	No fruit ripe yet.
October 21	*Do ripe*	.....
October 31	.....	Not quite ripe.
1907 (Gonhri field).		
July 23	Very first buds appearing	Very first buds appearing.
August 15	Coming to *full* flower	Coming into flower.
September 8	*Much* young fruit	In flower, with young fruit.
September 19	*Fruit full size*	Few flowers left; much young fruit.
September 23	*Just at the very beginning of fruit ripening*; leaves beginning to fall.	Fruits of full size but none ripe; leaves beginning to fall.

CORCHORUS CAPSULARIS. Comparison of two Faridpur races.

Pusa—contd.

	Nálpát or Meghnál of Rájbári.	Amonia of Faridpur
1907 (South Pangabri field).		
	Plots Nos. 15 and 5.	
July 25	Just forming buds	*First flowers open.*
August 23	About full flowering	Many young fruits.
September 8	*First fruits of full size*	Still flowering; with plenty of young fruits.
September 23	*Fruits almost ripe; a little riper than on Amonia,*	No fruits ripe; but many full size; leaves just beginning to fall.

Sujimani is a name of a red-stemmed jute of Madaripur which is grown in the still jheel waters alongside of Belgáchi and Udhap. It seems to us that it is probably the Meghnál of Faridpur; but this is a point that we have not established.

In addition to the races named already, we have specimens called Dhapa, Dhupri and Kohap and Shani. Probably the first three names are connected with the word Dhup, meaning light. They are green-stemmed plants like Amon and Udhap.

Race No. 7 introduced.

We found a crop at Faridpur in 1904 called Parbatya (*i.e.*, highland jute), the seed for which was, the ryots said, introduced from Dacca way. There is no reason to doubt this, the plant being exactly the Dacca Parbatya. With Parbatya of the Dacca district we shall deal almost directly.

BAKARGANJ.

Race No 3 again.

Race No. 6.

One jute known to us from Bákarganj is Pechi pát or Sut pát or Cowpla pát, which is evidently the race of Madáripur, and another has reached us as Rakta bági or Shonamukti. It we believe to be Nálpát. The name Shonamukti is a very curious one: it means gold-tipped, while Rakta bági means deep red bági or jute: but the word bogi or bági is generally applied to **C. olitorius.**

DACCA.

Race No. 7 Dhalsunder or Dhaleswari.

Proceeding to the District of Dacca which faces Faridpur across the Padma, the great crop of the neighbourhood of Náráinganj is called there Dhálsundar or Dháleswári or Dhála pát. It is grown by the side of races called respectively Kájla or Kájli and Bidya Sundar. We have had under study at Bardwán and Pusa a plot labelled Dháleswári and a plot labelled Dhálsundar, both originating from the village of Narsingdi—and we have found them to be identical. Further, from Narsingdi has been sent seed called Parbatya. In the next table we compare the behaviour of all three and find them identical.

CORCHORUS CAPSULARIS. Comparison of three strains from Dacca.

Bardwán Experimental Farm.

	Dháleswári.	Dhálsundar.	Parbatya.
1903.			
August 2	No sign of flowers yet.	No sign of flowers yet.	No sign of flowers yet.
September 10	In flower; and with young fruit.	In flower; and with young fruit.	In flower, and with the *fruit not quite full size.*
1904.			
August 10	*Just coming into flower.*	In very young bud	Just in bud.
September 22	Out of flower; a few fruits quite ripe.	Out of flower; a few fruits ripe.	Out of flower; fruits not quite ripe.
1906.			
August 26	In flower; with a few young fruits.	In flower; with a few young fruits.	In flower; with a few young fruits.
September 15	A few flowers left; no ripe fruits yet.	A few flowers left; no ripe fruits yet.	The last flowers left; no ripe fruits yet.

Pusa.

	Dháleswári.	Dhálsundar.	Parbatya.
1906.			
August 7	Not yet in flower	Not yet in flower	Not yet in flower.
August 26	In full flower	In full flower with scarcely any fruit formed yet.	In flower with a *few young fruits.*
September 20	With young fruit	A few flowers left; with young fruit.	With young fruit.
October 4	A few fruits ripe	A few fruits ripe	A few fruits ripe.
October 10	About half the fruits ripe.	A fair number of fruits ripe.	About half the fruits ripe.
October 21	Plants dead ripe	Plants dead ripe	Plants dead ripe.
1907 (Gonhri field).			
July 23	No sign of flowers yet	*Buds appearing*	*Buds appearing.*
August 15	Just the first flowers	Coming into flower	Just in flower.
September 8	In full flower, and with a fair number of young fruits.	*Fruits attaining full size.*	*Fruits attaining full size.*
September 19	Fruits full size	Much fruits of full size.	Fruits full size.
September 23	Not quite at the beginning of fruit ripening; leaves beginning to fall.	*Just at the beginning of fruit ripening;* leaves hardly falling yet.	*Just at the beginning of fruit ripening;* leaves beginning to fall.

CORCHORUS CAPSULARIS.

In 1904 one of us was at Faridpur on August 29th, at Pachuria on August 30th, and at Náráinganj on September 1st—nearly consecutive dates; and on them Amon of Faridpur, Dháleswári of Pachuria, and Dháleswári of Náráinganj were all found to be at the same stage. Again on September 16th, one of us was at Náráinganj and on the 18th at Madáripur. At the last date Udhap and Belgáchi bore full-sized but not ripe fruit, and Dháleswari at Náráinganj was approaching the same condition. When we compare Dháleswári and Udhap we find that the latter is, by a little, earlier than the former, just as it is a little earlier than Amonia of Faridpur. In the next table we give our comparison of Dháleswári and Udhap in order to show this.

Dhaleswari and Udhap compared.

Bardwán Experimental Farm.

1904.	Dháleswári.	Udhap.
August 10	Just beginning to flower: six inches shorter than Baran.	Just a few flowers open; as high as Baran.
September 22	Out of flower, *just a few fr its dead ripe.*	Out of flower; fruits not quite ripe.
1906.		
August 26	In flower, with a few young fruits.	*Many fruits* well formed.
September 15	The very last flowers out; no ripe fruits yet; a very little shorter than Baran.	Last flowers open; *first fruits nearly ripe*; a very little shorter than Baran.

Pusa.

1906.	Dháleswári.	Udhap.
August 7	Not yet in flower; a very little shorter than Baran.	*Just in flower.*
August 26	In full flower	In flower and *with a few fruits.*
September 20	With young fruits	A few flowers left; *some fruits just full size.*
October 4	A few fruits ripe, nine feet high.	Fruits beginning to ripen.
October 10	About half the fruits ripe.	Most of the fruits are still unripe.
October 21	Plants dead ripe	Plants dead ripe.
1907 (Gúhri field).		
July 23	No sign of flowers yet	*First buds appearing.*
August 15	Just the first flowers	In flower and *with young fruit.*
September 8	In full flower, and with a fair number of young fruits.	*Much of the fruit full sized.*
September 23	Not quite at the beginning of fruit ripening; leaves beginning to fall.	*Just at the very beginning of fruit ripening*; leaves falling a little.

CORCHORUS CAPSULARIS.

Race No. 8 Kajla.

Kájla or Kájlí (the name means dark) is recognised by the cultivators of Náráinganj as rosy-stemmed. They grow it with the very similar (colour excepted) Dháleswári, sometimes mixed, but as often separate. It seems as if Kájla and the Dháleswári of Náráinganj represent current attempts at local improvement. Kájla has not been narrowly selected, but is rather variable. Ryots of Náráinganj have assured us that it is a little earlier than their Dháleswári, and we thought that borne out by examination of crops there, but in the experimental cultivation at Bardwán and Pusa it was on the whole synchronous in growth.

The relations of Desi of Narsingdi.

Desi at Narsingdi is grown on the river banks where the water is thigh-deep, while Dhálsundar is grown away back from the river where the level of the water is more constant. The stems have a rosy tint very generally, but selection hardly exceeds the ordinary degree, so that green-fruited, green-stemmed plants are present among the red-fruited and rosy-stemmed, but they are in a considerable minority. Cultivators at Narsingdi assured us that their Desi and Dhálsundar fruited at exactly the same time.

Desi of Narsingdi grown under name of Desi Nallya at Bardwan.

The Desi of Narsingdi, just as we saw it, has been grown in the Farm Experiments under the name of Desi Nallya, the so-called "Desi of Narsingdi" of the Farm being somewhat different, pure green and later.

Desi of Dacc as cultivated differs from the Desi of Narsingdi as seen at Narsingdi which was cultivated as Desi Nallya.

It is now necessary for us to show how the plants named "Desi Nallya" were earlier than those named "Desi of Dacca," and this we do in the following table:—

Bardwán Experimental Farm.

1903.	"Desi of Dacca" of *Farm Experiments.*	"Desi Nallya" of *Farm Experiments.*
August 2	Hardly in bud yet	Hardly in bud.
September 10	With very young fruits	*Fruits full size*; 7-9 feet high.
19 4.		
August 10	Hardly in bud	No sign of flowers.
September 22	No fruits quite ripe	No fruits ripe yet.
1906.		
August 26	Just in flower	*Beginning to form fruits.*
September 15	A fair number of flowers; still no fruits ripe.	*Last few flowers left; no fruits ripe yet.*

CORCHORUS CAPSULARIS.

Pusa.

1906.	"Desi of Dacca."	"Desi Nallya."
August 7	Not yet in flower	Not yet in flower.
August 26	Not at full flowering	In flower; with *a few young fruits.*
September 20	With a fair number of flowers, and with young fruit.	*A few flowers left;* no fruits ripe.
October 4	A very few fruits ripe	*Majority of the fruits ripe;* plants 8½ feet high.
October 10	A fair number of fruits ripe	*Plants dead ripe.*
November 2	Almost dead ripe	.....
1907 (Gonhri field).		
July 23	Just commencing to show buds	Just commencing to show buds.
August 24	In full flower; no fruits yet	*In full flower; some of the fruit of full size.*
September 8	Most of the fruits of full size	Most of the fruits of full size.
September 23	No fruit ripe yet; leaves not yet falling.	*Not quite at fruit ripening; leaves beginning to fall.*

Why Desi of Narsingdi may be doubtfully classed as Kájla, race No. 8.

The Narsingdi Desi Nallya by its rosy tint recalls Kájla. We shall therefore put our experimental results for these two side by side.

Bardwán Experimental Farm.

1903.	Desi or so-called "Desi of Narsingdi."	Kájla of Narsingdi.
August 2	Hardly in bud	The more red plants just in bud. The others hardly.
September 10	Fruits full size; 7-9 feet high	Fruits full size; 6-7 feet high.
1904.		
August 10	No sign of flowers; ten inches shorter than Baran.	Just in bud; six inches shorter than Baran.
September 22	No fruits ripe yet	No fruits ripe yet.
1906.		
August 26	Beginning to form fruits	Beginning to form fruits.
September 15	Last few flowers left; no fruits ripe yet; six inches shorter than Baran.	Last flowers left; no fruits ripe yet; twelve inches shorter than Baran.

CORCHORUS CAPSULARIS.

Pusa.

1906.	Desi Nallya of Narsingdi.	Kájla of Narsingdi.
August 7	Not yet in flower	Just in flower.
August 26	In flower with a few young fruits.	In flower with a very few young fruits.
September 20	*A few flowers* left; no fruits ripe.	Still with plenty of flowers; no fruits ripe.
October 4	*Majority of the fruits ripe;* plants 8½ feet high.	Most of the fruits still unripe; plants 8½ feet high.
October 10	*Plants dead ripe*	.....
October 19	.....	Dead ripe.
1907 (Gonhri field).		
July 23	Just commencing to show buds	Commencing to show buds.
August 15	In full flower	In flower.
September 8	Most of the fruits of full size	Many fruits full size.
September 19	Fruits full size	Most of the fruits full size.
September 23	Not quite at fruit ripening; leaves beginning to fall.	*Just at the beginning of fruit ripening;* leaves beginning to fall.

They show that Kájla had a tendency to begin flowering before Desi, but its flowering seemed to last longer. However, the differences are very small, and we feel bound to regard the two rather as one race

Race No. 10 Bidya Sundar.

The third Náráinganj race is Bidya Sundar, and is deep red in the stem and fruits. It flowers with the two preceding Náráinganj races; but did not become dead ripe until a little later. The name means "excellent knowledge."

Bardwán Experimental Farm.

1903.	Dháleswári.	Kajla.	Bidya Sundar.
August 2	Not in flower	Just in bud	Not in flower.
September 10	.....	Fruits full size	Just in flower.
1904.			
August 10	Just coming into flower	Just in bud	Just in flower.
September 22	Out of flower; a few fruits dead ripe.	No fruits ripe yet	Fruits not quit ripe.
1906.			
August 26	In flower with a few young fruits.	Beginning to form fruits.	In flower.
September 15	A few flowers left; no ripe fruits yet.	The last flowers left; no ripe fruits.	A fair number of flowers left; no fruits ripe.

CORCHORUS CAPSULARIS.

Comparison of three Dacca races.

Pusa.

1906.	Dháleswári.	Kájla.	Bidya Sandar.
August 7	Not yet in flower	Just in flower	Not yet in flower.
August 26	In full flower	In flower with a few very young fruits.	In flower with a few young fruits.
September 20	With young fruits	In flower with young fruit.	With young fruit.
October 4	A few fruits ripe	A few fruits ripe	A few fruits ripe.
October 10	About half the fruits ripe.	About half of the fruits ripe.	A fair number of fruits ripe.
October 17	Very nearly dead ripe	Very nearly ripe	.....
October 21	*Dead ripe*	*Dead ripe*	.....
October 29	.....	.....	Dead ripe.
1907 (Gonhri field).			
July 23	No sign of flowers yet.	Commencing to show buds.	No sign of flowers yet.
August 15	Just the first flowers	In flower	Coming into full flower.
September 8	In full flower, and with a fair number of young fruits.	*Many fruits of full size.*	Bearing young fruit.
September 23	Not quite at the beginning of fruit ripening; leaves beginning to fall.	No fruit ripe yet; leaves beginning to fall.	No fruit ripe yet; leaves beginning to fall.

Comparison of Bidya Sundar with Nalpat or Meghnal.

Comparing it with the Faridpur Nálpát or Meghnál we find that it is a very little later.

Bardwán Experimental Farm.

1903.	Bidya Sundar.	Nálpát of Faridpur.
August 2	No sign of buds yet	No sign of buds yet.
1904.		
August 10	*Just in flower*	Just in bud.
September 22	Fruits not quite ripe	Fruits not quite ripe.
1906.		
August 26	In flower	In flower, and with a few young fruits.
September 15	A fair number of flowers left; no fruits ripe.	*No flowers left*; no fruit ripe yet.

CORCHORUS CAPSULARIS.

Comparison of Bidya Sundar with Nalpat.

Pusa.

1906.	Bidya Sundar.	Nálpát of Faridpur.
August 7	Not yet in flower	Not quite in flower.
August 26	In flower with a few young fruits	A few side plants have formed fruit.
September 20	With flowers and with young fruit.	With a fair number of flowers; fruits not yet full size.
October 4	A few fruits ripe	A very few fruits ripe.
October 21	.....	*Plants dead ripe.*
October 31	Plants dead ripe	.....
1907.		
July 23	No sign of flowers yet	*Very first buds appearing.*
August 15	Coming into full flower	Coming into full flower.
August 24	In flower with young fruits	In flower with young fruits.
September 8	Bearing young fruits	*Much young fruit.*
September 23	No fruit ripe yet; leaves beginning to fall.	*Just at the very beginning of fruit ripening*; leaves beginning to fall.

Race No. 5—Belgachi—again.

Belgáchi of Dacca is essentially the same as the Belgáchi of Faridpur,—an improved race, selection of which has been carried beyond the ordinary degree, so that rosy-fruited plants are rare in it. It is something to be compared with Dháleswári, which we have already shown to be practically identical with Dhálsundar and Parbatya. With these it is practically synchronous. Than Desi it is evidently more selected, but otherwise not dissimilar as the following table shows.

Bardwán Experimental Farm.

1903.	Belgáchi of Dacca.	Belgáchi of Faridpur.	Desi of Dacca.
August 2	Hardly in bud	No sign of flowers	Hardly in bud yet.
September 10	Fruits *nearly full size*	.....	In very young fruit.
1904.			
August 10	Just in bud	In young bud	Hardly in bud.
September 22	A few flowers left; fruits not ripe yet.	.....	No fruits quite ripe.
1906.			
August 26	In flower	In flower *with a few young fruits.*	Just in flower.
September 15	Last flowers open; no ripe fruits.	Last flowers open; no ripe fruits.	A fair number of flowers left; no fruits ripe.

CORCHORUS CAPSULARIS.

Belgachi compared.

Pusa.

1906.	Belgáchi of Dacca.	Belgáchi of Faridpur.	Desi of Narsingdi.
August 7	Not yet in flower	Not in flower	Not yet in flower.
August 26	Coming into flower	In flower and *beginning to form fruit.*	Not at full flowering.
September 20	In flower	In flower and with young fruits.	With a fair number of flowers and in young fruit.
October 4	A very few fruits ripe.	Fruits beginning to ripen.	A very few fruits ripe.
October 10	Not many fruits ripe	.....	A fair number of fruits ripe.
October 29	*Dead ripe*	*Dead ripe*	.....
November 2	.....	.....	Almost dead ripe.

1907 (Gonhri field).

July 23	Just the first buds appearing.	No buds as yet on the green-stemmed plants, but a few on the plants with a reddish tint.	Just commencing to show buds.
August 15	Coming into full flower with a few young fruits.	In flower with a very few young fruits.	In full flower.
September 8	In flower with much young fruit.	In flower, and with young fruit.	*Most of the fruit of full size.*
September 23	No fruits ripe yet; leaves not falling.	No fruits ripe yet; leaves not falling.	No fruits ripe yet; leaves not falling.

1907 (South Pangabri field).

Plots Nos. 4 and 16.

	Belgáchi of Dacca, plot No. 4.		Desi, plot No. 16.
July 25	Buds appearing	.....	With buds.
August 23	A very few fruits formed.	.....	Hardly at full flowering yet.
September 8	Flowering, with many young fruits.	.....	Flowering, with many young fruits.
September 23	No fruits ripe yet; leaves not yet falling.	.....	No fruits ripe; leaves just beginning to fall.

Agniswar is Bidya Sundar.

Agniswár is apparently a rare crop of Narsingdi, Dacca, which does not differ from Bidya Sundar: Bidya Sundar is the Náráinganj name and Agniswár the Narsingdi. They differ from Dhálsundar chiefly in their red stems (*ag* = fire, *i.e.*, having the colour of fire).

CORCHORUS CAPSULARIS.

TIPPERA.

Race No. 7 again.

Race No. 8 again.

Race No. 10 again.

Race No. 11 Deodhali.

Race No. 12 Phuleswari.

Proceeding from Dacca to Tippera we find not unnaturally that several Dacca names and races go with us: Dháleswári or Dhálsundar is among the races, and both names are known for it at Chándpur and Hájiganj, though the first is best known. The race does not seem to have changed between Náráinganj and Chándpur.

Kájla is another name which reaches Chándpur. Discussing, just above, the Kájla of Náráinganj, we concluded that there it is not a fully selected race, varying greatly. We find reason to consider the Kájla of Chándpur exactly the same as the Kájla of Náráinganj.

Bidya Sundar, the third race of Náráinganj, is the Bidya Sundar of Chándpur. It is considered to give the finest fibre, and this is perhaps due to the practice of cutting it a little earlier than the others. It is plentifully seen all along the river banks from just below Náráinganj to Chándpur, but behind Chándpur at Hájiganj it was not seen by us as a pure crop, but only as a stray plant, here and there, among Dháleswári.

The names of Tippera strains which are not known to us as common with the Dacca district, are Deodháli and Phuleswári. Deodháli is said to mean "white like a god." It is said by Guha to yield fibre second to Bidya Sundar in quantity. We found it at Chándpur with a green stem and rosy fruits. Phuleswári we have not seen in the fields. Both Deodháli and Phuleswári have been grown in the experiments that we have watched. They, compared with Dháleshwári of Dacca, behaved as follows:—

Bardwán Experimental Farm.

	Deodháli.	Phuleswári.	Dháleswári.
1903.			
August 2	No buds	No buds	No buds.
September 10	Just in flower	Just in flower	*In young fruit.*
1904.			
August 10	In bud	Hardly in bud	In very young bud.
September 22	No fruits quite ripe	No fruits quite ripe	Out of flower; a few fruits ripe.
1906.			
August 26	In flower	Beginning to form fruits.	Beginning to form fruits.
September 15	Last flowers left; no ripe fruits.	Last flowers left; no ripe fruits.	The last flowers left; no fruits quite ripe.

CORCHORUS CAPSULARIS.

Two Tippera races compared with Dhaleswari.

Pusa.

1906.	Deodháli.	Phuleswári.	Dháleswári.
August 7	*Hardly in flower*	Only in bud	Not yet in flower.
August 26	A very few young fruits.	A very few young fruits.	Scarcely any fruit formed yet.
September 20	Still flowering; fruits not quite full size.	Still flowering; fruits not full size.	A few flowers with young fruits.
October 4	A few fruits just ripe	A very few fruits ripe	A few fruits ripe.
October 21	.....	.....	Dead ripe.
October 31	.....	Dead ripe	.....
November 2	Dead ripe	.....	.....
1907 (Gonhri field).			
July 23	Just showing buds	Just showing buds	No sign of flowers yet.
August 16	*Coming into full flower, and with a few young fruits.*	*Coming into full flower, and with a few young fruits.*	Just the first flowers.
August 25	In flower, with only a few fruits.	In flower, with a few fruits of full size.	In flower, with a few fruits of full size.
September 8	With much young fruit.	Much young fruit and *a few at full size.*	In full flower and with a fair number of young fruits.
September 19	A few flowers still; much young fruit.	*Most of the fruits of full size.*	*Fruit of full size.*
September 23	No fruit ripe yet; leaves not beginning to fall.	*A very little fruit ripe*; leaves not beginning to fall.	Not quite at the beginning of fruit ripening; *leaves beginning to fall.*

The conclusion from the comparison is that Deodháli and Phuleswári are synchronous and later races than Dháleswári. Deodháli does not differ from Phuleswári in anything except the colour of the flower. In 1904, they were not side by side at Bardwán; and they behaved somewhat differently, Deodháli outgrowing Phuleswári. In 1906 at Pusa, Deodháli again at first outgrew Phuleswári, but by very little; and they ended of equal height.

Dháli of Chándpur is apparently the same as Deodháli.

Race No. 3. Pechi, which we have not seen, may possibly be the Desál peti of Madáripur.

NOAKHALI. There is a very little cultivation of **C. capsularis** in the district of Noakháli, chiefly in the Thánnas of Rámganj and Lakhipur. It is generally called Nalita. We do not know what races are grown.

PABNA. The district of Paṫna is conveniently taken next. About Serájganj four races are grown: Barápát, Desoál or Deswál, Kákyá Bombái, and Náiltá or Lálí: the race Náiltá is rare at Serájganj; it

has not been in cultivation at Bardwán; but the three others have been cultivated and under observation since 1902.

CORCHORUS CAPSULARIS.

The races of Serajganj compared.

We will establish their relationships to each other first by a table:—

Bardwán Experimental Farm.

1903.	Barápát.	Desoál.	Kákyá Bombái.
August 2	*Flowers just open*	Very small buds	No sign of flowers.
September 10	.....	Pods nearly full size.	With half sized fruits.
1904.			
August 10	*Just in flower*	*In flower*	Not even in bud.
September 22	No flowers left; *many fruits deadripe.*	Out of flower; a few fruits dead ripe.	Still flowering; no fruits ripe yet.
1906.			
August 26	With young fruits	With some young fruits.	With some young fruits.
September 15	*Out of flower*; no fruits ripe yet.	Very last flowers open; no fruits ripe yet.	Very last flowers open; no fruits ripe yet.
1907.			
August 15	*In flower, more so than Desoál and Kákyá Bombái, with a few small fruits.*	In flower, no fruits	Just in flower, no fruits.
September 20	Almost out of flower; fruit of full size but not ripe; *leaves beginning to fall.*	In flower, with plenty of full sized but unripe fruits; leaves not yet falling.	Near the end of flowering, much fruits of full size, leaves not yet falling.

Pusa.

1906.	Barápát.	Desoál.	Kákyá Bombái.
August 7	*Just in flower*	Not in flower	Not in flower.
August 26	*Half the plants with young fruits.*	In full flower	Not yet in full flower.
September 20	Just a few flowers left, *fruits full size.*	Flowering still; some fruits full size.	Still in flower, no fruits full size.
October 4	Out of flower; *half the fruits ripe.*	Out of flower; a few fruits ripe.	Out of flower, fruits full size, a few ripe.
October 10	*Practically dead ripe.*	.....	.....
October 21	.....	Most of fruits almost dead ripe.	.....
November 2	.....	.....	Dead ripe

CORCHORUS CAPSULARIS.

The races of Serajganj compared.

Pusa—contd.

	Barápát.	Desoál.	Kákyá Bombái.
1907 (Gonhri field).			
July 23	Just the first buds	Buds just appearing	Just the first buds.
August 15	*In full flower*, with just a few young fruits.	Not yet at full flowering; some young fruits.	In flower, with a few young fruits.
September 8	Many fruits of full size.	Many fruits of full size.	In full flower and with plenty of young fruits.
September 19	Fruits full size	Last flowers; much full-sized fruit.	Some flowers left, young fruit.
September 23	*A general sprinkling of ripe fruits*; leaves beginning to fall.	Just a few fruits ripe and just beginning to lose its leaves.	No fruit ripe yet; leaves not yet beginning to fall.
1907 (South Pangabri field).			
Plots Nos. 17, 25 and 8.			
July 25	*Just in flower*	Just coming into bud.	Buds appearing.
August 23	*Getting out of flower*.	Coming into full flower.	Well in flower.
September 8	*Most* fruit full size	Some fruit full size	In flower with young fruits.
September 23	*About one-quarter of the fruits dead ripe; plants losing their leaves.*	No fruits quite ripe; leaves not falling yet.	No fruits ripe yet; leaves not yet falling.

Selection of Desoal into "Bardwan Farm-seed."

Desoál is not a highly selected race; and much variability is found in it, both in the colour of the fruits, and in the time of coming into flower, and fruiting. For this reason a little simple selection enables one to separate more than one race out of it. We consider as an incipient race the "Farm seed" of Bardwán. Its history is as follows:—In 1895 seed of Desoál was procured, and sown on the Bardwán Farm: at first it was not subjected to any particular selection, but after 1899 an idea was conceived that Desoál should be a certain type and thereafter for some years in thinning the plots young plants which did not conform to the type were pulled out. The present "Farm seed" of Bardwán differs a very little from Desoál. It has fewer rosy fruited plants, and under Bardwán conditions gives a better yield. In point of time there has been developed no difference.

Bardwán Experimental Farm.

	Bardwán Farm seed.	Desoál.
1903.		
August 2	No sign of flowers	Very small buds.
September 10	*Pods full sized*	Pods nearly full size.

CORCHORUS CAPSULARIS.

Bardwán Experimental Farm—contd.

	Bardwán Farm seed.	Desoál.
1904.		
August 10	Just in flower	In flower.
September 22	Out of flower; a few fruits dead ripe.	Out of flower; a few fruits dead ripe.
1906.		
August 26	In flower	In flower with some young fruits.
September 15	Very last flowers open; no fruit dead ripe.	Very last flowers open; no fruit dead ripe.

Pusa.

	Bardwán Farm seed.	Desoál.
1906.		
August 7	Not in flower	Not in flower.
August 26	Well in flower	In full flower.
September 20	Flowering still, fruits full size	Flowering still; some fruits full size.
October 4	Some of the fruits ripe	Out of flower; a few fruits ripe.
October 21	*Plants dead ripe*	Most fruits dead ripe.
1907 (Gonhri field).		
July 23	Not yet in bud	Buds just appearing.
August 15	*In full flower*, with some young fruits.	Not yet at full flowering; some young fruits.
September 8	Plenty of young fruits	*Many fruits of full size.*
September 19	Some flowers left; much fruit	Last flowers; much full-sized fruit.
September 23	No fruits ripe yet; leaves beginning to fall.	*Just at fruit-ripening*; leaves beginning to fall.
1907 (South Pangabri field).		
July 25	Showing buds	Just coming into bud.
August 23	Almost at full flowering	Coming to full flower.
September 8	Flowers few; fruits coming to full size.	Some fruits full size.
September 23	No fruits quite ripe; *leaves falling a little.*	No fruits quite ripe; leaves not falling yet.

Race No. 14 Barapat.

Barápát (large jute) is not truly a Serájganj race, and is very little known there; for instance, in 1907, we could find no crops of it, though perhaps we saw a few plants of it mixed with Desoál, and in 1904, we only found one crop. The ryots of Serájganj if asked to

CORCHORUS CAPSULARIS.

show Barápát will point out crops of Tosha, which is **C. olitorius**, and if asked for a different Barápát will say that Káká Bombái is also a "bará pát."

We have now to point out the relationships of the Pabna races to the Faridpur races. The only early Faridpur race 'Aus' not having been cultivated, we have no means of comparing it with Barápát. Desóál which follows Barápát in time is shown to be earlier than Amonia of Faridpur in the following tables:—

Bardwán Experimental Farm.

1903.	Desóál of Serájganj.	Amonia of Faridpur.
August 2	*With very small buds*	No sign of buds.
September 10	First fruits nearly full-sized	.....
1904.		
August 10	*In flower*	Just in flower.
September 22	Out of flower; a few fruits ripe.	Out of flower; a few fruits quite ripe.
1906.		
August 26	*Beginning to form fruits*	In flower, without formed fruits.
September 15	Very last flowers open; no fruits ripe yet.	A few flowers left; no ripe fruits.
1907.		
August 15	The very first flowers open	The very first flowers open.
September 20	Still flowering; with *very much* full-sized but unripe fruit.	Still in flower; with many fruits of full size.

Pusa.

1906.	Desóál of Serájganj.	Amonia of Faridpur.
August 7	Not in flower	Not in flower.
August 26	*In full flower*	Not yet at full flower.
September 20	Flowering still; some fruits full-sized.	.....
October 4	Out of flower; *a few fruits ripe*	Nof ruits ripe yet.
October 21	*Plants almost dead ripe*	.....
October 31	...	Plants not quite dead ripe.

CORCHORUS CAPSULARIS.

Pusa—contd.

	Desóál of Serájganj.	Amonia of Faridpur.
1907 (Gonhri field).		
July 23	*Buds just appearing*	Very first buds appearing.
August 15	*Not yet at full flowering; some young fruits.*	Coming into flower.
September 8	*Many fruits of full size.*	In flower with young fruit.
September 23	*Just at the beginning of fruits* ripening; leaves beginning to fall.	Fruits of full size, but none ripe: leaves beginning to fall.
1907 (South Pangabri field).		
Plots Nos. 25 and 5.		
July 25	Just coming into flower	With very first flowers.
August 23	*Coming to full flower*	Not yet at full flowering.
September 8	*Some fruits full size*	Still flowering; fruits not yet of full size.
September 23	No fruits quite ripe; leaves not falling yet.	No fruits ripe yet; leaves just beginning to fall.

Desoal of Serajganj compared with Udhap of Faridpur.

Of the Faridpur races we showed that Udhap is earlier than Amonia. As Desoál of Serájganj is likewise earlier than Amonia, it is profitable to compare it with Udhap: and on doing so we find that they are synchronous. The next table gives the results of the comparison.

The two are doubtfully distinct.

Bardwán Experimental Farm.

	Desóál of Serájganj.	Udhap of Faridpur.
1904.		
August 10	*In flower*	Just a few flowers open.
September 22	Out of flower; *a few fruits dead ripe.*	Out of flower; fruits not quite ripe.
1906.		
August 26	Beginning to form fruits	Many fruits well-formed.
September 15	Very last flowers open; no fruits ripe yet.	Last flowers open; first fruits nearly ripe.

CORCHORUS CAPSULARIS.

Pusa.

1906.	Desoál.	Udhap.
August 7	Not in flower	*Just in flower.*
August 26	In full flower	In flower, and *with a few fruits.*
September 20	Flowering still; some fruits of full size.	A few flowers left; some fruits just full size.
October 4	Out of flower; a few fruits ripe.	Fruits beginning to ripen.
October 10	Fruits of full size; most unripe.	Most of the fruits still unripe.
October 21	Plants almost dead ripe	Plants dead ripe.
1907 (Gonhri field).		
July 25	Buds just appearing	First buds appearing.
August 15	Not yet at full flowering; some young fruits.	In flower, and with young fruit.
September 8	Much of the fruit of full size	Much of the fruit of full size.
September 23	Just at the beginning of fruit ripening; leaves beginning to fall.	Just at the very beginning of fruit ripening; leaves falling a little.

Belgachi of Madaripur is later than Desoal of Serajganj.

Belgáchi, which we found to be later than Udhap, is later than Desoál.

Bardwán Experimental Farm.

1903.	Desoál of Serájganj.	Belgáchi of Madaripur.
August 2	With very small buds	No sign of flowers.
September 10	First fruits nearly full-sized	.....
1904.		
August 10	*In flower*	In young bud.
September 2	Out of flower; a few fruits dead ripe.	Out of flower; a few fruits dead ripe.
1906.		
August 26	Beginning to form fruits	Beginning to form fruits.
September 15	Very last flowers open; no fruits ripe yet.	Last flowers open; plenty of nearly ripe fruits.

CORCHORUS CAPSULARIS.

Pusa.

1906.	Desoál of Serájganj.	Belgáchi of Madáripur.
August 7	Not in flower	Not in flower.
August 26	In full flower	In flower and beginning to form fruits.
September 20	Flowering still, some fruits full size.	In flower, and with fruits not quite full size.
October 4	Out of flower; a few fruits ripe.	Fruits beginning to ripen.
October 21	Plants almost dead ripe	.....
October 29	.....	Plants dead ripe.
1907 (Gonhri field).		
July 23	Buds just appearing	No buds yet on the green-stemmed plants; but a few on plants with a reddish tint.
August 15	Not yet at full flowering; some young fruits.	A very few young fruits.
September 8	*Many fruits of full size*	In flower, and with young fruit.
September 19	Last flowers; *much full-sized fruit.*	Much young fruit.
September 23	*Just at the beginning of fruit ripening; leaves beginning to fall.*	No fruit ripe yet; leaves not yet falling.

Desi is Desoál, and the name Sánchia is said to be used also for Desoál.

We have seen a specimen labelled Kamárjáni from Salonga in the Pabna district, and it is reported to us to differ from Desoál in possessing a slightly reddish tint on the stems. So too had the Kamárjáni of Faridpur. Apparently, Kamárjáni of Salonga is Kamárjáni of Faridpur. Race No. 5 again.

Kákyá Bombái is late as we saw on page 65. It is a very much praised race of Serájganj, but not nearly so abundant as Desoál. Race No. 15 Kakya Bombai of Serajganj.

Not uncommonly Desoál and Kákyá Bombái are sown intermixed; such crops we have examined, the Desoál being in flower and forming young fruit when the Kákyá Bombái was still flowerless. These crops must be cut when one or other of the two is not at its best, but to the ryot the mixing means this:—that if the floods rise so as to suit Desoál, it does well, if they do not, Kákyá Bombái may possibly do well and therefore in either event he gets a moderate return.

Of the Faridpur races, later than Udhap and Desoál, that we have found, and with which we may compare Kákyá Bombái, the first to consider is Amonia.

CORCHORUS CAPSULARIS.

The result of a comparison of Kákyá Bombái with Amonia is to show that the two are synchronous. But we cannot reduce them to one race, for Amonia has more constantly rosy fruits than Kákyá Bombái, and other slight differences.

Bardwán Experimental Farm.

	Kákyá Bombái.	Amonia of Páigáá.
1903.		
August 2	No sign of buds	No sign of buds.
1904.		
August 10	Not even in bud	*Just in flower.*
September 22	Still flowering; no fruits ripe yet.	*Out of flower; a few fruits quite ripe.*
1906.		
August 26	*First fruits formed*	In flower; without formed fruits.
September 15	A few flowers left; no fruits ripe yet.	A few flowers left; no ripe fruits.
1907.		
August 15	Very first flowers open	Very first flowers open.
September 20	Last flowers; with much full-sized but no ripe fruit.	Much fruit of full size, but none ripe.

Kakya Bombai of Serajganj compared with Amonia of Faridpur.

Pusa.

	Kákyá Bombái.	Amonia.
1906.		
August 7	Not in flower	Not in flower.
August 26	Not yet in full flower	Not yet in full flower.
September 20	Still flowering; fruits not yet of full size.	.....
October 4	*A few fruits ripe*	No fruits ripe yet.
October 31	.....	Plants not quite dead ripe.
November 2	Plant dead ripe	.....
1907 (Gonhri field).		
July 23	Very first buds appearing	Very first buds appearing.
August 15	*In full flower*	Coming into flower.
August 24	In flower, without young fruits.	Flowers abundant and young fruits; a few fruits of full size.
September 8	Many fruits of full size	In flower with fruit.
September 23	No fruits ripe yet; leaves not yet falling.	Fruits of full size, none ripe; *leaves beginning to fall.*

CORCHORUS CAPSULARIS.

Pusa—contd.

	Kákyá Bombái.	Amonia.
1907 (South Pangabri field).		
July 25	Buds appearing	*With very first flowers.*
August 23	Well in flower	Not yet at full flowering.
September 8	In flower; with young fruits	Still flowering; fruits not yet of full size.
September 23	No fruit ripe yet; leaves not yet falling.	No fruits ripe; *leaves just beginning to fall.*

We give next a comparison of Kákyá Bombái with the two late races of Tippera—Deodháli and Phuleswári. The three are synchronous.

Bardwán Experimental Farm.

Kakya Bombai of Serajganj is synchronous with the late Tippera races.

	Kákyá Bombái.	Deodháli.	Phuleswári.
1903.			
August 2	No buds	No buds	No buds.
September 10	*With half-sized fruits*	Just in flower	Just in flower.
1904.			
August 10	Not even in bud.	*In bud*	Hardly in bud.
September 22	Still flowering; no fruit ripe yet.	No fruits quite ripe	No fruits quite ripe.
1906.			
August 26	A few young fruits formed.	In full flower	With a few young fruits.
September 15	Last flowers open; no fruits ripe.	Last flowers open; no fruits ripe.	Last flowers open; no fruits ripe.

Pusa.

	Kákyá Bombái.	Deodháli.	Phuleswári.
1906.			
August 7	Only in bud	Hardly in flower	Only in bud.
August 26	Not yet at full flowering.	A very few young fruits.	A very few young fruits.
September 20	Still flowering; fruits not yet full size.	Still flowering; fruits not quite full size.	Still flowering; fruits not quite full size.
October 4	A few fruits ripe	A few fruits just ripe.	A very few fruits ripe.
October 21	.....	*Dead ripe*	.....
October 31	.....	.....	Dead ripe.
November 2	Dead ripe	.....	.....

CORCHORUS CAPSULARIS.

Pusa—contd.

	Kákyá Bombái.	Deodhali.	Phuleswari.
1907 (Gonbri field).			
July 23	Just the first buds	Just showing buds	Just showing buds.
August 15	In full flower; with just a few young fruits.	Coming into full flower and with a few young fruits.	Coming into full flower and with a few young fruits.
September 8	Many fruits of full size	With much young fruit.	Much young fruit and a few of full size.
September 19	Fruit full sized	A few flowers still; much young fruit.	Most of the fruits of full size.
September 23	No fruits ripe yet; leaves not yet falling.	No fruits ripe yet; leaves not beginning to fall.	A very little fruit ripe; leaves not beginning to fall.

Race No. 16 Lali of Serajganj

Kàkyá Bombái is thus seen to be as late as any race.

Now the rare red-stemmed race of Serájganj remains. We found it at Serájganj to be called Láli and Náiltá by cultivators who had a stray plant here and there in their fields of Desoál: and as Náiltá it has been grown on the Experimental Farms. If we compare its behaviour with that of Desoál we get the following results:—

Bardwán Experimental Farm.

	Náiltá.	Desoál.
1903.		
August 2	Very small buds	Very small buds.
September 10	.....	Pods nearly full size.
1904.		
August 10	Very young buds	*In flower.*
September 22	A few fruits dead ripe	Out of flower; a few fruits dead ripe.
1906.		
August 26	In flower with a few young fruits.	In flower with a very few young fruits.
September 15	*Just out of flower*; no ripe yet.	Very last flowers open; no fruits ripe yet.

Pusa.

	Náiltá.	Desoál.
1906.		
August 7	*Just in flower*	Not in flower.
August 26	In full flower; a few plants beginning to form fruits.	In full flower.
September 20	*Just out of flower*; a few fruits full size.	Flowering still: some fruits full size.
October 4	Out of flower; a few fruits ripe	Out of flower; a few fruits ripe.
October 21	Quite ripe	Most fruits dead ripe.

CORCHORUS CAPSULARIS

Pusa—contd.

1907. (Gonhri field.)	Nailta.	Desoál.
July 23	The very first buds appearing	Buds just appearing.
August 15	In flower, but not at full flowering.	Not yet at full flowering, with some young fruits.
September 8	With many fruits of full size	Many fruits of full size.
September 19	With fruits of full size	Last flowers; much fruit of full size.
September 23	No fruits ripe yet; leaves beginning to fall.	Fruits beginning to ripen; leaves beginning to fall.

Nailta of Serajganj is almost the same as Meghnal of Rajbari.

We find that in point of time the two are identical. The Serájganj ryots will tell any enquirer that they do not willingly get the red-stemmed Náiltá into their crops, but that a seed gets mixed here and there. We found that in crops of Desoál one plant in about 10,000 was Náiltá.

Just as Desoál is to Udhap, so is Náiltá to Meghnál.

Bardwán Experimental Farm.

1904.	Náiltá.	Nálpát or Meghnál of Rájbári.
August 10	With very young buds	Just in bud.
September 22	Some *fruits are dead ripe*	With nearly ripe fruit.
1906.		
August 26	Beginning to form fruits.	In flower, with a few small fruits.
September 15	No flowers left; no fruits ripe yet.	No flowers left; no fruits ripe yet.

Pusa.

1906.	Náiltá.	Meghnál.
August 7	*Just in flower*	Not quite in flower.
August 26	Only a few side plants have formed fruit.	A few side plants have formed fruit.
September 20	*Flowers all over; fruits full size.*	Some flowers left; fruits not yet full size.
October 4	A fair number of fruits ripe	A few fruits ripe.
October 21	Plants dead ripe	Plants dead ripe.
1907 (Gonhri field).		
July 23	The very first buds appearing	Very first buds appearing.
August 15	In flower; but not at full flowering.	Coming into full flower.
September 8	*With many fruits of full size.*	Much young fruit.
September 23	No fruits ripe yet; leaves beginning to fall.	Just at the very beginning of fruit ripening; leaves beginning to fall.

CORCHORUS CAPSULARIS.

Náiltá showed itself just a trifle earlier than Meghnál.

So-called Tosha red of Bardwan Farm was Kakya Bombai.

A so-called "Toshá red of Serájganj," which was grown at Bardwán and elsewhere in the years 1904, 1905 and 1906, really was Kákyá Bombái, wrong seed having somehow been supplied.

? Race No. 25.

We have specimens labelled Nibtá and said to be a late Serájganj race differing from Kákyá Bombái in having a red stem. We have never seen alive any **C. capsularis** so-called; but it is possibly the same as the Lál Ámon of Rangpur. We shall under **C. olitorius** speak of another Nibtá from Serájganj.

When Hem Chunder Kerr wrote his Report on Jute in 1874 apparently Desoál was the only one of the above familiar names in use in the district of Pabna, but that other races were also grown there is evident. We notice with interest from page 4 of the appendix to his report that Barápát was then both **C. capsularis** and **C. olitorius** just as it is now.

MYMENSINGH.

Proceeding to Mymensingh, we take the Jagannáthganj race-names first, because that place is so near to Serájganj. There is an early race called Chhoran (or little), a race called Desoál or Dháuleswári, the names of Serájganj and Dacca mixing, Kamárjáni, Barán and Barápát.

The mart of Kamárjáni, north of Jagannáthganj we have been unable to visit ourselves; but we have caused it to be visited by one of our assistants. Its jutes—**C. capsularis** only—are Lál pát, Dháulá Aus pát, Lál Hematiyá, Dháulá Hematiyá, Bombái and Lál Karái.

On the higher land at the back of Jagannáthganj and Kamárjáni we get fewer races. About Jamálpur and Mymensingh one race prevails almost to the exclusion of others; it is Aus or Dháulá Aus; with it there are the very rarest crops of Dháulá Amon, Paknallyá, Parbatyá, and Chhotapát. From Gáiband near Kamárjáni we have obtained Lál Hematiyá and Lál Karái. At Gafargáon south of Mymensingh, we found nothing but Dháulá Aus.

The Dháulá Aus of Gafargáon and of Mymensingh is apparently the Dháulá Aus of Kamárjáni, and is the Desoál or Dháuleswári of Jagannáthganj, but differs little from the Desoál or Dháuleswári of Serájganj; lastly it does differ a little from the Parbatyá of Jamálpur as grown in the Farm Experiments.

Race No. 17 Aus of Mymensingh.

In the first place we may justify the grouping of Aus of Mymensingh, Dháulá Aus of Kamárjáni and Desoál of Jagannáthganj together. That the Aus and Dháulá Aus are the same we decided by having typical crops examined on the same day at Kamárjáni and Gáiband towards Jamálpur. That the Aus and Desoál are the same we decided by inspecting many crops on two consecutive days in 1904 about Mymensingh and Jagannáthganj.

That the Aus of Mymensingh is an earlier race than Desoál of Serájganj we see from study of the experimental plots.

CORCHORUS CAPSULARIS.

Dhaula Aus of Mymensingh is earlier than Desoal of Serajganj.

Bardwán Experimental Farm.

1903.	Aus of Jamálpur.	Desoál of Serájganj.
August 2	*Just in flower*	With very small buds.
September 10	*Fruits full size*	Pods nearly full size.
1904.		
August 10	In flower	In flower.
September 22	No flowers left; *many* fruits ripe.	Out of flower; a few fruits dead ripe.
1906.		
August 26	*With some fruits of full size*	In flower with young fruits.
September 15	Very last flowers left; no ripe fruits.	Very last flowers left; no ripe fruits.

Pusa.

1906.	Aus of Jamálpur.	Desoál Serájganj.
August 7	*In flower*	Not in flower.
August 26	*A very few fruits formed*	In full flower.
September 20	A few flowers left, with fruits of full size.	A few flowers left; some fruits full size.
October 4	*Most* fruits ripe	Out of flower; a few fruits ripe.
October 17	*Plants dead ripe*	...
October 21	.....	Most fruits dead ripe.

1907 (Gonhri field).

July 23	*Just in flower*	Buds just appearing.
August 15	*In full flower* with young fruits.	Not yet at full flowering; with some young fruits.
September 8	Much of fruit at full size	Many fruits of full size.
September 19	Most of fruit at full size	Last flowers; much fruit of full size.
September 23	*One quarter of the fruit ripe; plants losing leaves considerably.*	Just at the beginning of fruit ripening; and just beginning to lose leaves.

1907 (South Pangabri field).

Plot Nos. 20 and 25.

Aus of Mymensingh and Desoal of Serajganj compared.

July 25	*Well in flower*	Just coming into flower.
August 23	*Getting past full flowering*	Coming to full flower.
September 8	*Most* fruits full size	Some fruits of full size.
September 23	*Many fruits dead ripe*	No fruits quite ripe; leaves not falling yet.

CORCHORUS CAPSULARIS.

This great crop—the Aus of Mymensingh—which occupies such a wide area of ground, is not selected beyond the ordinary degree. Rosy and green-fruited plants are invariably intermixed, and not considered as distinct by the cultivators. The lands it occupies are generally high-lands. On no race more constantly than this are very early fruits formed low down on the stems; but it is not a characteristic of the race to form them, but a result of grazing animals which nip off a few young plants and make them to throw out their side-shoots prematurely.

Aus of Mymensingh compared with Dacca races.

It is earlier than the Dháuleswári of Dacca.

Bardwán Experimental Farm.

1903.	Aus of Jamálpur.	Dhálsundar.	Dháuleswári.
August 2	*Just in flower*	Not in flower	Not in flower.
September 10	*Fruits of full size*	In young fruit	.....
1904.			
August 10	*In flower*	In very young bud	Just coming into flower.
September 22	No flowers left; *many* fruits ripe.	Out of flower; a few fruits ripe.	Out of flower; a few fruits dead ripe.
1906.			
August 26	*With some fruits of full size.*	Beginning to form fruits.	In flower with a few young fruits.
September 15	Very last flowers left; no ripe fruits.	The last flowers left; no ripe fruits.	A few flowers left; no ripe fruits.

Pusa.

1906.	Aus of Jamalpur.	Dhalsundar.	Dháuleswári.
August 7	*In flower*	Not yet in flower	Not yet in flower.
August 26	*A very few fruits formed.*	Scarcely any fruits formed yet.	In full flower.
September 20	Few flowers left, *with fruits full size.*	A few flowers, with young fruit.	With young fruit.
October 4	*Most* fruits ripe	A few fruits ripe	A few fruits ripe.
October 10	.....	A fair number of fruits ripe.	About half the fruits ripe.
October 17	*Plants dead ripe.*	Majority of fruits ripe	Very nearly dead ripe.
October 21	.....	Dead ripe	Dead ripe.

Pusa—contd.

	Aus of Jamálpur.	Dhálsundar.	Dháuleswári.
1907 (Gonhri field.)			
July 23	*Just beginning to flower.*	Showing buds	Not yet showing buds.
August 16	Approaching full flowering.	Flowering plentifully.	In flower.
September 8	Much full-sized fruit	Much full-sized fruit.	With some full-sized fruits.
September 19	Full-sized fruits very plentiful.	Full-sized fruits very plentiful.	Full-sized fruits very plentiful.
September 23	*One-quarter of the fruits ripe; leaves markedly falling.*	Very few fruits ripe; leaves beginning to fall.	No fruits ripe yet; leaves beginning to fall.

1907 (South Pangabri field).	*Plots Nos. 20 and 10.*		*Plot No. 10.*
July 25	*Well in flower*	...	Approaching full flowering.
August 23	Getting past full flowering.	...	Getting past full flowering.
September 8	*Most* fruits of full size.	...	Many young fruits.
September 23	Many fruits dead ripe	...	Nearly half the fruits dead ripe; leaves falling somewhat.

CORCHORUS CAPSULARIS.

Aus of Mymensingh compared with Dacca races.

We may take conveniently as the next race the Chhotápát or Chhoran of Jagannáthganj, and to a small extent of Jamálpur.

Two different races have been grown at Bardwán as Chhotápát. In 1903 and 1904 the "Chhotápát" was a crop of an early green-stemmed plant, with red intermixed, the green very like Aus; but in 1906 the "Chhotápát" was a red-stemmed plant hardly differing from the Bhadya red of Jalpaiguri as grown at Bardwán. This red-stemmed Chhotápát has been grown also at Pusa. Mr. F. Smith, Deputy Director of Agriculture, Bengal, assures us that no new seed was brought in during the course of the experiments: it therefore seems as if the green-stemmed plants had been intruders, which were gradually selected out of the crops.

Race No. 18.

Taking the green-stemmed plant, we find that it behaved very like Aus, but was a little shorter. We believe that it is not truly Chhotápát.

A false Chhotapat.

Bardwán Experimental Farm.

1903.	False Chhotápát.	Aus of Mymensingh.
August 2	Just in flower	Just in flower.
September 10	Fruits full grown	Fruits full grown.

CORCHORUS CAPSULARIS.

Bardwán Experimental Farm.

1904.	False Chhotápát.	Aus of Mymensingh.
August 10	In flower	In flower.
September 22	No fruits ripe yet	No flowers left; *many fruits ripe.*

True Chhotapat compared with Aus.

The red Chhotápát, which we believe to be the true Chhotápát, compares with Aus as follows :—

Bárdwán Experimental Farm.

1906.	Red Chhotápát.	Aus.
August 26	Bearing full-sized fruits	Bearing full-sized fruits.
September 15	Last flowers left; no fruits ripe.	Very last flowers left; no ripe fruits.

Pusa.

1906.	Red Chhotápát.	Aus of Mymensingh.
August 7	*Well in flower*	In flower.
August 25	*Fruits more in number than flowers.*	A very few fruits formed.
September 20	*Out of flower*; fruits full size	Few flowers left, with fruits full size.
October 4	Plants almost dead ripe	Most fruits ripe.
October 17	Plants dead ripe	Plants dead ripe.

1907 (Gonhri field).

July 23	Just in bud	Just beginning to flower.
August 16	In flower, with many young fruits.	Approaching full flowering.
September 8	Most of fruits of full size.	Much fruit of full size.
September 23	One-half of the fruits ripe; leaves falling much.	One-quarter of the fruit ripe; leaves falling markedly.

CORCHORUS CAPSULARIS.

Bardwán Experimental Farm.

1902.	Barápát of Jagannáthganj.	Barápát of Serájganj.	Barán.
August 28	Began to flower before Barán.	Fruits nearly full size	Began to flower about August 23.
1903.			
August 2	*Flowers just opening*	*Flowers just open*	Not in bud.
1904.			
August 10	Just in flower	Just in flower	Just in flower.
September 22	Just a few flowers left; no fruits dead ripe.	*No flowers left; many fruits dead ripe.*	Just a few flowers left; no fruits dead ripe.
1906.			
August 26	With young fruits	A fair amount of young fruit.	...
September 15	*No flowers left*; no fruits ripe yet.	Very last flowers open; no fruits ripe yet.	Very last flowers open; no ripe fruits.

Pusa.

1906.	Barápát of Jagannáthganj.	Barápát of Serájganj.	Barán.
August 7	Just in flower	Just in flower	Just in flower.
August 26	Some plants have formed fruit.	Half the plants with fruit.	A few young fruits.
September 20	A few flowers left; fruits nearly full size.	Just a few flowers left; fruits full size.	A few flowers left; no fruits full size.
October 4	Out of flower, half the fruits ripe.	Out of flower, half the fruits ripe.	Out of flower, fruits full size, but none ripe.
October 10	.....	*Practically dead ripe*	.....
October 20	Almost dead ripe	.....	.....
October 31	.....	.....	Not quite dead ripe.

1907 (Gonhri field).

July 23	Rare buds	Rare buds	Rare buds.
August 15	At full flowering	At full flowering	At full flowering.
September 8	Very much full-sized fruit.	Very much full-sized fruit.	Much fruit not full-sized.
September 23	A general sprinkling of ripe fruits; leaves beginning to fall.	A general sprinkling of ripe fruits; leaves beginning to fall.	No fruit ripe yet; leaves beginning to fall.

1907 (South Pangabri field).

Plots Nos. 17, 22 and 1.

July 25	Just in flower	Just in flower	Plants with buds.
August 23	*Past full flowering*	About full flowering	Past full flowering.
September 8	Many fruits full size	Most fruits of full size	Fruits full size.
September 23	One-quarter of the fruits dead ripe; leaves falling.	One-quarter of the fruits dead ripe; leaves falling.	A few fruits dead ripe; leaves a little falling.

Barapat of Jagannathganj is Barapat of Serajganj and earlier than Baran.

CORCHORUS CAPSULARIS.

We have already shown that Barápát is a little earlier than Serájganj Desoál, and as Aus of Mymensingh is also a little earlier we may profitably compare the two.

Barapat of Jagannathganj compared with Aus of Mymensingh.

Bardwán Experimental Farm.

	Aus of Jamálpur.	Barápát of Jagannáthganj.
1903.		
August 2	Just in flower	Just in flower.
September 10	Fruits full size	.....
1904.		
August 10	*In flower*	Just in flower.
September 22	*No flowers left; many fruit ripe.*	Just a few flowers left; no fruits dead ripe.
1906.		
August 26	*Abundance of fruit; some full size.*	A fair amount of young fruit.
September 15	Very last flowers left; no fruits ripe yet.	Very last flowers left; no fruits ripe yet.

Pusa.

	Aus of Jamálpur.	Barápát of Jagannáthganj.
1906.		
August 7	*In flower*	Just in flower.
August 26	A very few fruits formed	Half the plants with formed fruits.
September 20	A few flowers left; fruits full-sized.	Just a few flowers left; fruits full-sized.
October 4	*Most* fruits ripe	Half the fruits ripe.
October 10	.....	Plants almost dead ripe.
October 17	Plants dead ripe	.....
1907 (Gauhri field).		
July 23	Just showing buds	Just showing buds.
August 16	About full flowering	About full flowering.
September 8	Most fruits full-sized	Most fruits full-sized.
September 23	*One-quarter of the fruit ripe; leaves falling much.*	A general sprinkling of ripe fruit, not quite so much as on Aus of Jamalpur; leaves beginning to fall.

CORCHORUS CAPSULARIS.

Barapat of Jagannathganj is later than Aus of Mymensingh and more selected.

Pusa—contd.

	Aus of Jamalpur.	Barápát of Jagannáthganj.
1907 (South Pangarbi field).		
Plots Nos. 20 and 22.		
July 25	*Well in flower*	Just in flower.
August 23	Getting past full flowering	Past full flowering.
September 8	*Most* fruits of full size	Many fruits full size.
September 23	Many fruits dead ripe	One-quarter of the fruits dead ripe; leaves falling.

We find Barápát to be later than Aus: and that it is a more selected and improved race. The fruits and petioles are, like the stem, almost always green, and the growth is better. In illustration of the better growth we may quote the much greater yields that Barápát has given at Bardwán than Aus.

Race No. 19.

Parbatyá of Jamálpur is the strain that we take next. Like Barápát, it is a more carefully selected crop of the Aus type such as might be a selection from Aus with the rosy-fruited plants largely eliminated. We had at one time thought it but Aus, but later investigations make us keep it provisionally distinct.

Compared with Aus it differed in behaviour being a very little later.

We believe that the crops which are grown at Jagannáthganj in the stiller water back from the river, and may be there called Kamárjáni, are Parbatyá. They stand a little higher than Desoál, have few rosy-fruited plants in them, and are a little later.

Bardwán Experimental Farm.

	Aus of Jamálpur.	Parbatyá of Jamálpur.
1903.		
August 2	Just in flower	Just in flower.
September 10	Fruits full-sized	Fruits full-sized.
1904.		
August 10	*In flower*	In bud.
September 22	*Just out of flower;* many fruits ripe.	A few flowers left; fruits ripe.
1906.		
August 26	*Abundance of fruit, some full-sized.*	Beginning to form fruits.
September 15	Very last flowers left; no fruits ripe yet.	Last flowers; no fruits ripe yet.

CORCHORUS CAPSULARIS.

Two Mymensingh races compared.

Pusa.

	Aus.	Parbatyá of Jamálpur.
1906.		
August 7	*In flower*	Just in flower.
August 26	Very few fruits formed	Flowering; *many* young fruits.
September 20	A few flowers left; *fruits of full size.*	*No flowers;* fruits not yet full-sized.
October 4	*Most* of the fruits ripe	Half of the fruits ripe.
October 17	Plants dead ripe	Plants dead ripe.
1907 (Gonhri field).		
July 23	Just showing buds	In bud.
August 16	About full flowering	At full flowering; with a little young fruit.
September 8	*Most* of the fruits of full size	Half of the fruits of full size
September 23	*One-quarter of the fruits ripe; leaves falling much.*	A general sprinkling of ripe fruit; leaves beginning to fall.

Parbatya of Jamalpur is not same as Parbatya of Dacca.

It is not quite the Parbatyá of Dacca which we find ourselves unable to separate from Dhálsundar.

Bardwán Experimental Farm.

	Parbatyá of Jamálpur.	Parbatyá of Dacca.	Dhálsundar.
1903.			
August 2	*Just in flower*	No sign of flowers	Not in flower.
September 10	*Fruits full size*	Fruits not quite full size.	In young fruit.
1904.			
August 10	In bud	Just in bud	In very young bud.
September 22	A few flowers left; *fruits ripe.*	No flowers left; fruits not quite ripe.	No flowers left; a few ripe fruits.
1906.			
August 26	Beginning to form fruits.	Beginning to form fruits.	Beginning to form fruits.
September 5	Very last flowers; no fruits ripe.	The very last flowers; no ripe fruits.	The last flower left no ripe fruits.

CORCHORUS CAPSULARIS.

Parbatya of Jamalpur compared

Pusa.

	Parbatyá.	Parbatyá of Dacca.	Dhálsundar.
1906.			
August 7	Just in flower	Just in flower	Not yet in flower.
August 26	*The number of fruits greater than the number of flowers.*	In flower, with a few young fruits.	Scarcely any fruits formed yet.
September 20	*Flowers over*; fruits not yet full size.	Flowers not over; fruits not full size.	A few flowers, with young fruit.
October 4	*Half of the fruits are ripe.*	Majority of fruits unripe.	A few fruits ripe.
October 16	.....	About half of the fruits ripe.	A fair number of fruits ripe.
October 17	*Plants dead ripe*	Majority of fruits ripe	Majority ripe.
October 21	.....	Plants dead ripe	Plants dead ripe.
1907 (Gonhri field).			
July 23	In bud	In bud	In bud.
August 16	At full flowering with a little young fruit.	In flower with a little young fruit.	In flower.
September 8	Half the fruit of full size.	More than half of the fruit of full size.	More than half of the fruit of full size.
September 19	Most of the fruit of full size.	Most of the fruit of full size.	Most of the fruit of full size.
September 23	A general sprinkling of ripe fruit; leaves beginning to fall.	A general sprinkling of ripe fruits; leaves beginning to fall.	Very few ripe fruits; leaves beginning to fall.

Race No. 20.

Barán of the Experimental Farms—later than Barápát,—was also a little later than Desoál of Serájganj.

Baran of Mymensingh compared.

Bardwán Experimental Farm.

	Barán.	Desoál.
1903.		
August 2	Not yet in bud	*Very small buds.*
September 10	.....	Pods nearly full size.
1904.		
August 10	Just in flower	*In flower.*
September 22	Just a few flowers left; no fruits dead ripe.	*Out of flower; a few fruits dead ripe.*

CORCHORUS CAPSULARIS.

Baran of Mymensingh is a little later than Desoal of Serajganj.

Bardwán Experimental Farm—contd.

1906.	Barán.	Desoál.
August 26	With a little formed fruit	With a little fruit formed.
September 15	Very last flowers; no ripe fruits	Very last flowers; no fruits dead ripe.
1907.		
August 15	The very first flowers out	The very first flowers out.
September 20	Last flowers; much full-sized but unripe fruit.	In flower, with much full-sized but unripe fruit.

Pusa.

1906.	Barán.	Desoál.
August 7	*Just* in flower	Not in flower.
August 26	Not fully in flower	*In full flower*, with some young fruits.
September 20	A few flowers left; no fruits full size.	Flowering still; fruits not full size.
October 4	Out of flower; fruits full-sized, but not ripe.	Out of flower; *a few fruits ripe.*
October 21	.....	*Plants almost dead ripe.*
October 31	Plants not quite dead ripe	.....
1907 (Gonhri field).		
July 23	Rare buds	Buds just appearing.
August 15	At full flowering	Not yet at full flowering; with some young fruit.
September 8	Not much full-sized fruit	*Many fruits of full size.*
September 23	No ripe fruits; leaves beginning to fall.	*Just at the beginning of fruit ripening*; and just beginning to lose leaves.

The great similarity of Barán to Kákyá Bombái must be pointed out. The differences between them are so slight that at present we unite them. Such a view is supported by the fact that the Barán of Jagannáthganj extending to Kamárjáni is there called Bombái.

In the next table Barán and Kákyá Bombái are compared.

Baran of Jagannathganj may be referred to Kakya Bombai provisionally.

Bardwán Experimental Farm.

1903.	Kákyá Bombái of Serájganj.	Barán of Mymensingh.
August 2	No buds	No buds.
September 10	With half-sized fruits	With half-sized fruits, *a foot higher than Kákyá Bombái.*
1904.		
August 10	Not even in bud	*Just in flower.*
September 22	Just a few flowers left; no fruits dead ripe.	Just a few flowers left; no fruits dead ripe; *a foot higher than Kákyá Bombái.*

CORCHORUS CAPSULARIS.

Baran of Mymensingh may be united provisionally to Kakya Bombai.

Bardwán Experimental Farm—contd.

1906.	Kákyá Bombái of Serájganj.	Barán of Mymensingh.
August 26	In flower, beginning to form fruits.	In flower, beginning to form fruits.
September 15	*Flowers all over*; no fruits ripe.	Very last flowers open; no ripe fruits; the same height as Kákyá Bombái.
1907.		
August 15	Very first flowers out	The very first flowers out.
September 20	Last flowers out; much full-sized, but unripe fruit.	Last flowers out; much full-sized, but unripe fruit.

Pusa.

1906.	Kákyá Bombái of Serájganj.	Barán of Mymensingh.
August 7	Only just in bud	*Just in flower*; six inches higher than Kákyá Bombái.
August 26	Not yet at full flowering	*A few young fruits.*
September 20	Still flowering; fruits not yet full size.	*A few flowers left*; no fruits of full size.
October 4	*A few fruits ripe*	Out of flower; a few fruits of full size, but not ripe. *A very little* higher than Kákyá Bombái.
October 31	.....	Not quite dead ripe.
November 2	Plants dead ripe	...
1907 (Gonhri field).		
July 23	No buds yet	*Rare buds.*
August 15	Well in flower with some young fruits.	At full flowering.
September 8	About full flowering	Much full-sized but not ripe fruit.
September 19	Still flowering; with young fruits.	*Most of fruits full-sized.*
September 23	No fruits ripe yet; leaves just beginning to fall.	No fruits ripe; leaves beginning to fall.
1907 (South Pangabri field).		
Plots Nos. 8 and 1.		
July 25	Beginning to show buds	Plants with buds.
August 23	At full flowering.	Plants past full flowering.
September 8	With flowers and young fruits.	Fruits of full size.
September 23	No fruits ripe yet; plants hardly yet losing leaves.	No fruits ripe yet; leaves not yet falling.

CORCHORUS CAPSULARIS.

Race No. 24.

We proceed now to the next race, Ámon of the district of Mymensingh, which is also called Dháulá Ámon at Jamálpur and Dháulá Hematiyá at Kamárjáni. The race is rare at all these places, and when found is generally mixed with Dháulá Aus, just as Toshá was found mixed with Desoál at Serájganj.

Race No. 21 perhaps race 16.

At Jagannáthganj there is a red-stemmed jute which occurs generally mixed with Desoál, and which is variously named as Rangi (*i.e.*, coloured) or Meghnál. It is apparently that red-stemmed plant which is commoner in the district of Bogra, and which may well be the Náiltá or Láli of Serájganj.

Very rare at Kamárjáni is Lál Hematiyá which differs from Dháulá Hematiyá in its red stem and red fruits. The names Kuchmadan (meaning not clear, but borrowed apparently from that of a red rice) and Nálpát are said by Babu N. C. Chaudhuri to be applied at Jagannáthganj to this Láli—a red counterpart of Barán, but we think from experience in the district of Bográ that they belong rather to race No. 20 just above—Rangi or Meghnál.

SYLHET.

The district of Sylhet contains in the Hábiganj subdivision the races of jute grown in Dacca and Tippera, and in the Sunámganj subdivision the races of Mymensingh. We are indebted for most of our information to Mr. H. A. Colquhoun, the Deputy Commissioner, and his subdivisional officers, Messrs. H. Moseley, H. L. Barua and N. Ahmad.

Races No. 7 and 12 again.

The commonest races in the Hábiganj subdivision are Dháuleswári and Phuleswári. With them are grown others called Bidya Sundar, Pechi and Parbatyá. Bidya Sundar is doubtless the red-

Race No. 10.

stemmed Dacca and Tippera race of that name: it is not abundantly grown; and it being apparently the only red-stemmed race of the subdivision, one sees how predominatingly green the crops are.

The identity of Pechi and Parbatyá are not to be settled without either inspecting the crops or cultivating plots from the district: and these things we have been unable to do.

The Moulvi Bazaar subdivision produces very little jute.

Race No. 17.

The Sunámganj subdivision, it seems, produces the Aus of Mymensingh and also a little red-stemmed late jute which may be

Race No. 10.

Bidya Sundar, but this is not certain All the higher lands, given to jute, are given to Aus, or as it is generally named Ausápát. Sometimes the late race is called Ámon.

BOGRA.

We have no more to say about Sylhet.

Up the river from Serájganj and Jagannáthganj is the jute mart of Fulchári in the district of Bogra where the commonest race is

Race No. 17 again.

called Dháulápát or Dháuleswári, and besides it are Kákyá Bombái (always here Kásh á Bombái) and Nálpát. Dháulápát is also called

Race No. 15 again.

Aus, and like the Aus of Mymensingh consists of plants with both rosy and green fruits and petioles. It is either the Desoál of Serájganj or the Aus of Mymensingh, probably the latter. Kákyá Bombái is the Kákyá Bombái of Serájganj, or the Barán, of Jagannáthganj.

CORCHORUS CAPSULARIS IN BOGRA.

Nálpát is apparently the Náiltá of Serájganj. It is often mixed with Dháulápát up to the extent of 50 per cent. of a crop.

Race No. 21 or 16 again.

At Bogra itself the same races exist: but Kákyá Bombái is very rare. The commonest race is Dháulápát or Aus, often called Tebrá Ausia. Kákyá Bombái is at the same time called Ámon or Tebra Ámoniá; and Nálpát becomes Kuchmardan, or Kuchni or Desi Meghnal.

Race No. 15 again.

Dháulápát under the name of Aus extends to the extreme western edge of the district of Bogra, where we have seen it at Sántahár. There at Sántahár we found a few plants of what apparently is the Kákyá Bombái, but we could not ascertain that this name is applied to it.

Race No. 17.

Hem Chunder Kerr gives nine names as in use for jute in 1874 in Bogra. His first name Joli is probably one of his many misprints and represents Jati. As this is the first district in which we meet with this rather widely distributed word, something may here be said about it. Its use extends northwards from Bogra into Assam and towards the Himalaya. It hardly expresses a race, but belongs to the species **C. capsularis** as distinguished from **C. olitorius.** Of the other eight names used by Hem Chunder Kerr, the following,—Aus, Amon, Meghlál and Kuchmardan—are in common usage there to-day and have been explained. Desi is another of his names and needs no explanation. Of the remaining three, one is Toshá which belongs to **C. olitorius** and the other two—Patnaipát (possibly an error for Madhaipat) and Numliápát—are unknown to us.

The word Jati.

RANGPUR.

The district of Rangpur is to be taken next. Unfortunately we have not been able to examine carefully crops anywhere but at Rangpur itself, where the early Aus seems particularly early. These early crops are Dháulá and Nál or Lál Bitri, the latter at Rangpur being rare as a pure crop, but not uncommon mixed with the Dháula Bitri. Dháulá Aus is a name used also for this race. Dháula Bitri has been in cultivation in the Farm Experiments under the wrong name of "Bitre red"; whereas in the next table it showed itself earlier than Desoál.

Dhaula Bitri of Rangpur.

The crops of Dháulá Bitri at Rangpur contain both green-fruited and rosy-fruited plants. In their appearance and time of flowering, etc., they suggest Dháulá Aus of Mymensingh, with which we will now compare the race.

Bardwán Experimental Farm.

1903.	Bitri No. 29 of the Farm Experiments.	Aus of Jamálpur.
August 2	In bud	*Just in flower.*
September 10	Pods just attaining full size	*Fruits full-sized.*

CORCHORUS CAPSULARIS.

Dhaula Bitri of Rangpur compared.

Bardwán Experimental Farm.

1904.	Bitri No. 29 of the Farm Experiments.	Aus of Jamálpur
August 10	In flower	In flower.
September 22	Out of flower; a few fruits dead ripe.	Out of flower; *many* fruits ripe.
1906.		
August 26	Abundance of fruits formed	Abundance of fruits formed.
September 15	Very last flowers open; *a few fruits dead ripe.*	Very last flowers open; no fruits dead ripe.

Pusa.

1906.	Bitri plot No. 29 of the Farm Experiments called "Bitri red."	Aus of Jamálpur.
August 7	Just in flower	*In flower.*
August 26	*Nearly half of plants bearing young fruits.*	A few fruits formed.
September 20	Flowers few; fruits of full size.	A few flowers left; fruits about full size.
October 4	Most of fruits ripe	Most of fruits ripe.
October 17	...	*Plants dead ripe.*
October 21	Plants dead ripe.	.....
	Bitri plot No. 30 of the Farm Experiments.	Aus of Jamálpur.
1907.		
July 23	*In flower*	Just showing buds.
August 16	*Some fruits already of full size.*	About full flowering.
August 25	A few fruits of full size, but most small, and many flowers.	*Many fruits of full size;* still with many flowers.
September 8	Fruits of full size	Most fruits of full size.
September 23	One-quarter of the fruits ripe; leaves falling markedly.	One-quarter of the fruits ripe; leaves falling much.

The result of the comparison is to show there is very little difference in point of time between the two, but pending further study we are unable to unite them together into one race because they grew somewhat differently at Bardwán and at Pusa.

We need not compare Bitri with the more selected races of the river banks such as Barápát.

Nál or Lál Bitri or Lál Ausa prevails in patches within some miles of Rangpur, on the west of the Tista river, *e.g.*, near Kaunia. Nál Bitri was grown at Bardwán as No. 40 in 1903 and No. 32 in 1904, in both years wrongly called Bitri white.

CORCHORUS CAPSULARIS.

Thereafter the seed was changed, and a Dháulá Bitri was grown in its place. From the Bardwán results of those two years and from examination of the crops at Rangpur we believe Lál Bitri to be synchronous in flowering and fruiting with Dháulá Bitri.

Bardwán Experimental Farm.

Dhaula and Lal Bitris of Rangpur compared.

1903.	So called Bitri red really Dháulá Bitri.	So called Bitri white really Lál Bitri.
August 2	In bud	*In flower.*
September 10	Pods just attaining full size	Fruits just full size.
1904.		
August 10	In flower	In flower.
September 22	Out of flower; a few fruits dead ripe.	Out of flower; a ew ruits dead ripe.

Lál Bitri is not the Náiltá or Láli of Serájganj but something earlier.

Lal Bitri is earlier than Nailta of Serajganj.

Bardwán Experimental Farm.

1903.	So called Bitri white really red Bitri.	Náiltá of Serájganj.
August 2	*In flower*	Very small buds.
September 10	Fruits full size	.....
1904.		
August 10	*In flower*	Very young buds.
September 22	Out of flower; a few fruits dead ripe.	A few fruits dead ripe.

Race No. 24.

If anyone will go among the crops at Rangpur, he will find pure crops of Dháulá Hetiá in small number amongst the many crops of Dháulá Bitri and will have no difficulty in recognising it by its lateness. If the time be the beginning of August, Bitri and Hetiá will be of about the same height, as cases of mixing show, but Hetiá will not be in flower and will not have reached its full growth. If the field under examination be an uneven one, part above water and part water-logged, the water-logged part will be comparatively badly grown, and short compared with the drier part.

This Dháulá Hetiá is found elsewhere in small quantities about the Rangpur district, but it gives way in a most remarkable manner to Lál Hetiá along the banks of the Tista, *e.g.*, towards Lálmonir Hát, and north-westwards.

Two strains from Rangpur called Hetiá have been grown at Bardwán since 1903, and a third since 1904, and all three at Pusa for the last two years; the first called 'white' was mixed red and green,

CORCHORUS CAPSULARIS.

the red predominating, and contained both early and late plants; while the second called 'red' was green-stemmed and a genuine Hetiá; and the third was not Hetiá, but an early crop.

Dhaula Hetia of Rangpur compared.

It follows then that the second of the above, called "Hewti red" (properly Dháulá Hewti), is the only strain which we can use for comparing with other races. We compare it first with Desoál and show it just a trifle earlier than that race.

Bardwán Experimental Farm.

1903.	So called "Hewti red" really Dháulá Hewti.	Desoál.
August 2	No buds	*With very small buds.*
September 10	Flowering; with some fruits nearly of full size.	First fruits nearly of full size.
1904.		
August 10	In bud	*In flower.*
September 22	No flowers left; very *many fruits dead ripe.*	No flowers left; a few fruits dead ripe.
1906.		
August 26	With young fruits	With the first young fruits.
September 15	*No flowers left;* no ripe fruit	Very last flowers; no fruits ripe yet.

Pusa.

1906.	So called Hewti red really Dháulá Hewti.	Desoál.
August 7	*Just in flower*	Not yet in flower.
August 26	*Half the plants with young fruit.*	In full flower.
September 20	*Flowers over;* fruits not yet of full size.	Flowering still; some fruits of full size.
October 4	*Most of the fruits ripe*	Out of flower; a few fruits ripe.
October 21	*Plants dead ripe*	Plants almost dead ripe.
1907 (Gonhri field).		
July 23	*Just in flower*	Buds just appearing.
August 16	*Most of the plants with small fruit.*	Not yet at full flowering; some young fruits.
August 25	*A few* fruits full-sized	A very few fruits full-sized.
September 8	Fruits of full size	Many fruits of full size.
September 23	*A very few fruits ripe;* beginning to lose its leaves.	Just at the beginning of fruit ripening; leaves beginning to fall.

Lál Hewti stands in the same relationship to Dháulá Hewti as Lál Bitri to Dháulá Bitri.

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GOALPARA.

The district of Goálpárá in its western or Dhubri end is a jute country. We have had in experimental cultivation no plots from Goálpárá; and what we have to remark rests upon our observations in the field. We have examined the crops about Dhubri and Bálájan. The prevalent crop near those places is of a green-stemmed rather early race. So prevalent is this race that many cultivators believe that it is the only race in the country-side and know it simply as "pát." But it is not the only race, for there are two others, Lálpát, which is rarely sown pure, but is a not uncommon impurity of the "Dháulápát," and "Hewti."

Race No. 26.

We have also examined crops of jute at the town of Goálpárá whither cultivators from the Pabna district have brought the Serajganj Desoál and with it an odd plant or two of Kákyá Bombái: and these have been sown alongside the prevalent Dháulá Aus of Goálpárá. The Dháulá Aus at Dhubri appeared to us to be not quite so early as the Dháulá Bitri of Rangpur. From an inspection on consecutive days of the crops at the two places, we found the latter to be earlier by about ten days than the former. This might be due to climate and cultivation, but in default of experiments we consider it best to count them as separate races. They are however selected alike to the ordinary degree, both containing rosy fruited as well as green fruited plants, and to some extent pale yellow flowered plants as well as bright yellow flowered. It is very probable that this Dháulá Aus or Dháulá Bitri—it gets both names—changes gradually towards the Rangpur side into the Rangpur Bitri and southwards into the Aus of Mymensingh.

Race No. 13 again.

This common Dháula Aus, as seen at Dhubri and Goálpárá, varies considerably in time of coming into flower, *e.g.*, it has not been selected enough to be consistent with itself even in that. It seems to extend through Kuch Behar into the Alipur Duárs.

Race No. 26 again.

The Lál Bitri or Lál Aus of Goálpárá has only been seen by us as a pure crop in some five or six instances. It was almost always more advanced than Dháulá Aus, even when mixed with it in an impure crop. For this reason we suspect it of being the Lál Bitri of Rangpur, and as we have been told kindly by Babu Peari Mohan Dutt, Vice-Chairman of the Local Board at Dhubri, that seed does come into Dhubri from Rangpur this is the more probably its origin.

Race No. 23 again.

Race No. 24.

Hetiá as grown at Dhubri seems to be the same as the Rangpur Hewtia. Dháulá Haimantiá, which is the same as Hetiá, and Lál Haimantiá occur as isolated plants in the Goálpárá crops.

JALPAIGURI.

Race No. 25.

About the town of Jálpáiguri the common jutes are green-stemmed; but red-stemmed are by no means rare. Along the Teesta southwards red jutes are more abundant, but northwards they disappear entirely. Both early and late green-stemmed plants

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are common about Jalpáiguri, towards some villages the one prevailing, towards other villages the other.

Dháula Dhádoyá at Jalpáiguri is very seldom pure, so very seldom that cultivators are apt there to say that there is only one Bhádoya which may be green-stemmed or red-stemmed. Both green and red-stemmed have been cultivated at Bardwán and Pusa. We proceed to a comparison of Dháulá Bhádya of Jalpáiguri with Dháulá Bitri of Rangpur, in which we find that the two grown side by side are to all intents and purposes identical.

We have examined crops at Jalpáiguri and Rangpur on consecutive days, and have noted some differences, *e.g.*, that the early Jalpáiguri race seemed not quite so forward as the Rangpur races; but in the face of the evidence from Bardwán and Pusa, we do not care to declare them separate races.

The early green-stemmed crops of Jalpaiguri and Rangpur compared.

Bardwán Experimental Farm.

1903.	Dháulá Bhádya of Jalpáiguri.	Dháulá Bitri of Rangpur (called in Farm Experiments Bitri red).
August 2	*Coming into flower*	In bud.
September 10	*Fruits of full size*	Fruits just attaining full size.
1904.		
August 10	Just in flower	*In flower.*
September 22	Out of flower; a few fruits dead ripe.	Out of flower; a few fruits dead ripe.
1906.		
August 26	With young fruits	*With full-sized fruits.*
September 15	No flowers; no fruits ripe yet	Very last flowers; a few *fruits dead ripe.*

Pusa.

1906.	Dháulá Bhádiya of Jalpáiguri.	Dháulá Bitri of Rangpur (called in Farm Experiments Bitri red).
August 7	Hardly in flower	*Just in flower.*
August 26	Half the plants with young fruit.	Nearly half the plants with young fruit.
September 20	*No flowers*; fruits of full size	Few flowers left; many fruits of full size.
October 4	Most of the fruits ripe	Most of the fruits ripe.
October 21	Plants dead ripe	Plants dead ripe.
1907 (Gonhri field).		
July 23	Just in flower	Just in flower.
August 15	About full flowering, with some small fruits.	Flowering, with *much young fruit.*
September 8	Fruits of full size	Much fruit of full size.
September 23	*One-quarter of the fruits ripe; leaves falling considerably.*	A general sprinkling of ripe fruits; leaves beginning to fall.

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Two Jalpaiguri races compared.

We next give a comparison of the Dháulá Bhádyá of Jalpáiguri with the Lál Bhádiya of Jalpáiguri to show them synchronous.

We may consider the Lál Bhádiya to be the same as the Lál Bitri.

Bardwán Experimental Farm.

1903.	Dháulá Bhádiya of Jalpáiguri.	Lál Bhádiya of Jalpáiguri.
August 2	Coming into flower	Just in flower.
September 10	Fruits full size	Fruits many, full size.
1904.		
August 10	Just in flower	Just in flower.
September 22	Out of flower; a few fruits dead ripe.	Out of flower; some fruits dead ripe.
1906.		
August 26	Forming fruits	With full-sized fruits.
September 15	Flowers all over; no fruits ripe yet.	Flowers all over; no fruits ripe yet.

Pusa.

1906.	Dháulá Bhádiya.	Lál Bhádiya.
August 7	Hardly in flower	Hardly in flower.
August 26	Half the plot with young fruit	Nearly half of the plot with young fruit.
September 20	Out of flower; fruits full size	Out of flower; fruits full size.
October 4	Most of the fruits ripe	Most of the fruits ripe.
October 21	Plant dead ripe	Plant dead ripe.
1907 (Gonhri field).		
July 23	Just in flower	With buds.
August 10	About full flowering but with some fruits of full size.	Much small fruit.
September 8	Fruits full size	Fruits full size.
September 23	One-quarter of the fruits ripe, leaves falling considerably.	One-half of the fruits ripe, plants losing their leaves very greatly.

We have already compared Dháulá Bitri with Aus of Mymensingh and found them synchronous: it is therefore to be expected, as Lál Bhádiya is synchronous with Dháulá Bhádya which is Dháulá Bitri, that tables will show Lál Bhádyá to be synchronous with Aus. We give these tables next. Our reason in including them is that we have subjected the Lál Bhádiyá to some selection, and it is the

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selected Bhádiyá which, grown on the Pangabri field at Pusa, is compared with Aus in the last part of the tables:—

Bardwán Experimental Farm.

1903.	Dháulá Bhádiya of Jalpáiguri.	Aus of Jamálpur.
August 2	Coming into flower	Just in flower.
September 10	Fruit full size	Fruit full size.
1904.		
August 10	Just in flower	*In flower.*
September 22	Out of flower; a few dead ripe	Out of flower; *many* fruits ripe.
1906.		
August 26	Forming fruits	Bearing full-sized fruits.
September 15	*Flowers all over*; no fruits ripe yet.	Very last flowers left; no fruits ripe yet.

Pusa.

1906.	Dháulá Bhádiya of Jalpáiguri.	Aus of Jamálpur.
August 7	Hardly in flower	*In flower.*
August 26	Half the plot with young fruit	A very few fruits formed.
September 20	Out of flower; fruits full size	A few flowers left; fruits full size.
October 5	Most of fruits ripe	Most of fruits ripe.
October 17	.....	Plant dead ripe.
October 21	Plant dead ripe	.....
1907 (Gonhri field).		
July 23	Just in flower	Just showing buds.
August 16	About full flowering, but with some fruits of full size.	About full flowering.
September 5	Fruits of full size	Most fruits of full size.
September 19	A few fruits ripe	Most fruits of full size.
September 23	One-quarter of the fruits ripe; leaves falling considerably.	One-quarter of the fruits ripe; leaves falling much.
1907 (South Pangabri field). *Plots No. 12 (being a selected strain) and 20.*		
July 25	Coming into flower	Some plants in flower.
August 15	In flower with some young fruits.	Just about full flowering.
September 8	With full-sized fruits	Much full-sized fruit.
September 23	Half of the fruits ripe; leaves failing much.	A fair amount of ripe fruit; leaves falling somewhat.

Lál Bhádiyá of Jalpáiguri then is to be counted the same as Lál Bitri of Rangpur. We have received a specimen from Jalpáiguri called Kharia which is apparently this. CORCHORUS CAPSULARIS. Race No. 23 again.

Hewtiá of Jalpáiguri consists of a green-stemmed and a red-stemmed race, the latter being the most abundant of all jutes on the banks of the Tista, opposite the town of Jalpáiguri, but the former abundant west of Jalpáiguri and in the Pátgrám subdivision. We are as nearly assured as it is possible to be by inspection of crops, but without experimental cultivation, that these Hewtias are the same races as are found in Rangpur. Races Nos. 24 and 25 again.

In the Darjeeling terai the chief race is Dháulá hewti (there called Dháulá Haimantiá), which gets more and more abundant as we go further and further from Jalpáiguri, while the red jute, Lál Bhádiyá, gets scarcer and scarcer, until at Siliguri there is only a very little of it indeed. DARJEELING TERAI. Race No. 24.

Very sparingly in the Darjeeling terai also occur Lál Haimantiá, which is Lál Hewti, and Dháulá Bhádiya. Race No. 25.

The jutes that occur west of Jalpáiguri have not been in cultivation at all, but by touring through the districts and by the kind help of the officers stationed in them, we have obtained the race names in use, and have been able to group them into the following table:— Race No. 22.

		Darbhanga.	Purneah.			
			Forbesganj.	Purneah.	Kissenganj.	Bársoi.
Early	Jut pát	Desi patwá or San patwá.	Sanpatwá.	Dhámar.		Bhádyá.
Early	...		Lál patwá.	Meghnál.	Lál Dhámar, Meghnal.	Meghnál.
Late	...		...	...	...	Dháulá Hewtiá.
Late	...		...	...	...	Lál Hewtiá.

		Dinajpur.				
		Ráiganj.	Gangarám-pur.	Dinájpur.	Parbati-pur.	Náwáb-ganj.	Thákurgáon.
Early	Dháulá Bhádyá.	...	...	Bhádyá.	Dháulá Bhádyá.	Dháulá Bhádya or Dhamar.
Early	Meghnál.	Meghnal.	Bhádyá.	Meghnal.	Meghnál.	
Late	...	...	...	...	...	...
Late	Hewtiá.	Hewtiá.	Haimantiá.	...	Hewtiá.	Hewtiá.
	...	...	...	...	...	...

We are particularly indebted for help to Mr. J. Vas, I.C.S., who, when Collector of Dinájpur, obtained for us information from the outlying places in his district which we have not visited. DINAJPUR.

In parts of the Dinájpur district red-stemmed jutes greatly prevail, the common one being an early red called Meghnál or Meghlál, while the early green-stemmed seems to be absent. Then Race No. 23.

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Race No. 22.

again in other parts red-stemmed disappear entirely before the green-stemmed races. A consecutive examination of crops at Dinájpur, Parbatipur and Jalpáiguri led us to consider the Dhálá Bhádyá in all three places as one race, and the same applies to Lál Bhádyá. The Hewtia or Haimantiá also of the first and last places is apparently one race.

At Parbatipur the crops are about 80 per cent. of a mixture of the two Bhádyas, 10 per cent. of Dháulá Haimantiá and 10 per cent. of **C. olitorius**. At Dinájpur red Bhádyá prevails. We believe that this is also the case at Thákurgáon, but we have no precise information.

PURNEAH.

In the district of Purneáh at Bársoi green-stemmed crops are prevalent, but it is very common for the two Bhadiyas to be grown mixed. All four,—Dháulá Bhádiyá, Lál Bhádiyá or Meghnál, Dháulá Hewti and Lál Hewti—are grown at Bársoi. At Kissenganj the crops are better than at Bársoi, and the green-stemmed early plant there called Dhámar is believed by many to be a different race from the Dháula Bhádiyá with which we have been dealing. It may be so; but we have not experimental evidence.

Races Nos. 22, 23, 24 and 25.

Races Nos. 22 and 23 or possibly races apart.

The only other race that we discovered near Kissenganj was a tall red-stemmed early jute called Lál Dhámar, which, if Dhámar is a race apart, is also a race apart, but of that we have no evidence.

At Purneáh, Dháulá Bhádyá and Lál Bhádyá are grown as at Kissenganj under the names of San patwá and Meghnál, and again at Forbesganj; but at Forbesganj there is really little but San patwá.

Races Nos. 22 and 23.

At Aráryá the word Hewti become Hetwá, perhaps on account of the similar sound of the word 'patwa'.

It is interesting to observe that at Forbesganj on the edge of the Nepál terái as in the Darjeeling terái a green-stemmed race is almost the only one grown. During the examination of many crops at Forbesganj we found a few dozen plants of Dháulá Hewti which had come in by accident, and which we take as evidence of the importation of seed.

The Bengal Government has established a seed improvement station at Purneáh, and there we examined crops of Serájganj Desoál and Kákyá Bombái. It was evident to us that the common jute of that country side is about 7--14 days earlier than Desoál, and of course much earlier than Kákyá Bombái.

BHAGALPUR.

In the district of Bhagalpur, there is a little jute produced in the northern subdivisions doubtless of such races as are grown in neighbouring parts of the district of Dinájpur.

DARBHANGA.

The most western jute crops known to us and not sown by planters are those near Ujiápur on the western part of the district of Darbhangá. The plant seems to correspond with Dháulá Bhádyá of Jalpáiguri.

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MALDA.

In the district of Máldá, as in Purneáh, jute is called Patwá, and **Hibiscus cannabinus** is called Amlá patwá; but jute in Máldá has only recently become a crop of any importance: formerly **Hibiscus cannabinus** was almost the only one of the two cultivated, but now it is not quite so abundantly grown. The cultivators except along the Ganges banks opposite Rájmehál know little of jute; the settled Santális do not grow it, and the Bengali Mohammedans, though they have recently grown a lot of it, have scarcely appreciated that there are different races of it. The crops again—with the exception of those on the Ganges churs, etc., opposite Rájmehál—are very much mixed,—early green-stemmed, late green-stemmed, early red-stemmed and late red-stemmed all being evident in most, together with intermediates that cross-fertilisation has produced. Never except opposite Rájmehál have we seen a pure crop, although in some crops the early element prevails and in some the late; and although some crops have more green-stemmed plants than others, and some have more red-stemmed. Not a few cultivators recognise red and green as characters of distinct races and sometimes they have an uncertain idea that one is better than that other; and perhaps sometimes a cultivator who picks his seed early, gets in consequence a predominance of early plants in the next crop; but that is by a chance only. Of recent years a good deal of seed has been carried from village to village by men anxious to try the crop.

Origin of mixed crops of Malda.

We think that but little seed has crept into Máldá from the Purneáh and Dinájpur districts; but much has come from Rájsháhi, mixed already as we see it in Máldá: and this mixture of earlier and later, reds and greens, is giving rise to a liberal supply of intermediates whereby the four extremes are being drawn closer together. We may call the mixture the Máldá mixed crop. In some places near English Bázár it was seen on a very heavy jheel soil and was not nearly so well grown as on higher land.

We found that in this mixture the Mohammedans near Máldá recognise the green-stemmed under the name of Dudhsár (milky), and the red under the name of Lál patwá (red jute) or Meghnál: they also use loosely the word Sánchia (n very faintly sounded) as more or less synonymous with Patwá, so that **C. capsularis** becomes Tita Sánchia and **C. olitorius** Mitha Sánchia. Only in a few crops near English Bazar was selection of seed really evident: several of these were of late red-stemmed, and one was of early green-stemmed. But near Muhipur, the crops were more predominatingly green, and on the low land at the intake of the river Máhánanda opposite Rájmehál the crops were approximately pure green-stemmed or approximately pure red-stemmed: and they were well grown. The cultivators of these are settlers from the Nadia district who are well accustomed to fairly good jute, and it is said that they procured their seed from down the river.

Nos. 13 or 1 and 2.

Nos. 15 and 24.

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According to Hem Chunder Kerr (page 16 of his Report) a jute called Muniasi was, in 1874, grown in Máldá together with a Náltá patwá. Náltá patwá is most likely one of the elements of the Máldá mixture, while Muniási is the pot-herb to be mentioned later on—page 104.

SONTAL PERGANNAHS.

The Máldá mixed crop is grown at Rájmehál and other places southwards between the Sontál hills and the river, especially on land a little raised above that given to the transplanted rice. Crops examined at Rájmehál were seen to have undergone a little selection in different ways; so that one might be predominatingly early and contain both red-stemmed and green-stemmed plants; another late but similarly with both red-stemmed and green-stemmed plants; while a third might be found red-stemmed entirely but containing both early and late plants.

BIRBHUM.

At Nálháti two small crops that we examined contained every one of the forms early and late, green and red, but in unequal proportions, so that in one red predominated, and in the other green.

RAJSHAHI.

In the district of Rájsháhi jute is, by a very little, better understood than in the greater part of the district of Máldá: that is to say, though at Rámpur Boáliá the mixture of races occurs as in Máldá, it becomes more common, especially east of Rámpur Boáliá, to grow crops in which early or late more strongly predominate, and as far east as Nattor we have seen nearly pure crops of early red and late green, while within a few miles of Rámpur we have seen a pure crop of late red-stemmed. At Rámpur Boáliá Meghlál is the name used for both early and late red-stemmed **Corchorus capsularis.** The green is often called Sánchia or Dhálá Sánchia.

Race No. 2.

Nos. 16 and 25.

We find much more **C. olitorius** in the district of Rájsháhi than in the district of Máldá; but to this plant we shall turn later.

MURSHEDABAD.

The district of Murshedabád adjoins the Sontál Pergannahs and faces the district of Máldá. In it, on the Ganges banks at Lálgolá, there are very wide stretches of **Corchorus capsularis,** all the four—early and late, green and red being present;—but a considerable effort has been made to keep the red out; so that the crops are predominatingly green, and chiefly they are late green.

Race No. 16.

The cultivators of Lálgolá are ignorant of the possibilities of races being early or late; and they call all their green-stemmed **Corchorus capsularis** by the name of Dudhsár or Dudhshár, and they call all the red Meghnál. The early red we may now identify: it is the pure early red strain found in the crops of Máldá, the Sontál Pergannahs, and Rájsháhi; which we found pure at Nattor, and pure again at Poradáha in the Nadiá district.

CORCHORUS CAPSULARIS IN MURSHEDABAD.

Berhampur is more in a region of **Corchorus olitorius** than of **C. capsularis,** but both species are present, though the better cultivators apparently have hitherto been in the habit of growing the first only. We have seen a few good crops of the second, and they are a new adventure. That good crops of **C. capsularis** can be grown is shown by the way in which one of Desoál has been produced in this year (1907) on the new jute seed farm near Berhampur.

South of Berhampur red crops are markedly preferred, and we find small patches of pure red **C. capsularis** here and there near the very limit of the district. The cultivators call the plant Tepári (meaning round) or Bhutkori (meaning ghost's cowries). The latter quaint name we thought when we first heard it near Berhampur to be spurious, but when next day at Palási, seventeen miles away, it was again used to us, and when later under the spelling of Botocari we recognised it in Hem Chunder Kerr's report as in use in Birbhum, it was obvious that we had to accept it. Tepári or Bhutkori the cultivators know to occur in two forms Lál (red) and Dháulá (green)—Lálpát and Dháulapát:—the two we found mixed at Berhampur, but we did not see the green south of Berhampur, it being apparently very rarely grown.

Race No. 16.

Race No. 13.

It is worth the remark in passing that local prejudices in favour of green or red are nowhere so strongly contrasted as in the district of Murshedabád. One may enter it at the south end where there is nothing but red-stemmed jute, and pass by some thirty-five miles of railway to Lálgolá in a region where red is discredited and the whole country side is covered with crops from which the ryots try to eliminate it. Let it be said, despite whatever the cultivators believe, that no one has yet proved that red-stemmed plants give stronger fibre than green-stemmed, or whiter fibre than green-stemmed, or more fibre, or ret quicker or more evenly, or that the reverse is the case. Experiment will now be turned to this, and not only will one point of economic interest be touched on thereby, but the scientist may find facts at the same time, which bear upon the value in the plants' economy of the red tints that nature provides so freely.

NADIA.

In the district of Nadiá which comes next we approach Faridpur again. With the exception of the south banks of the Ganges the whole district is a region of **C. olitorius,** and in the centre and much of the south there is little else. About Palási we find sparingly the Tepári or Bhutkori mentioned just above; other crops to the extent of 90 per cent. are red **C. olitorius.** In the north, we have studied the crops at Poradáha, where about 70 per cent. of them are of **C. olitorius** and 30 per cent. of them **C. capsularis.** Of **C. capsularis** we there found an early green race, an early red race, and a late green race, but

Race No. 16.

CORCHORUS CAPSULARIS. Race No. 2.

these were often rather mixed together. One of the first crops examined, for instance, was late green-stemmed with, scattered through it, isolated plants of early red-stemmed **capsularis**; another was of early red-stemmed with a few plants of early green intermixed and a certain number of intermediates. The late green race bears the name of Amonipatti, and the early green race may be called Dháleswar.

Races Nos. 17 and 13.

No crops of **C. capsularis** were found by us in the district at any other place, though we have been informed that there are some in the Chuádángá subdivision and also a few towards Nadiá town, which are called Sadu or Paturi, and that a race called Kamárjáni is grown at Kushtea.

As far as we can tell the early reds of Poradáha and Palási in Nadiá, of Nattor in Rájsháhi and in the mixed crops of Rámpur Boáliá, Máldá, Rájmehál, etc., are all one race, and probably it is the Láli of Serájganj. The early green which is present through the districts of Nadiá, Murshedabád, Rájsháhi, Máldá and into Birbhum and the Sontál Pergannahs may be a westward extension of Desoál of Serájganj or Aus of Faridpur or of both, and perhaps also of Kamárjáni. The late green which is so prevalent at Lálgolá and is abundant at Poradáha is very probably Amoniá of Faridpur and the late red of Poradáha, Palási, Rámpur Boáliá, and mixed everywhere in the Máldá mixed crop is probably the same as the Nibtá of Serájganj which is our No. 25. It may not be justifiably separated from the Meghnál of Faridpur, but so far as our evidence goes, Meghnál of Faridpur is a little earlier; and it is better to err at present on the side of too much 'splitting' than on the side of too much 'lumping':—we keep it as Race No. 25, while Meghnál of Faridpur is race No. 6.

Race No. 16. Race No. 11 or 1.

Race No. 2.

Race No. 25.

JESSORE. Race No. 5.

In the Jhenidáh subdivision of Jessore are grown races of jute called respectively Kamárjáni, Deshi and Sáda. Kamárjáni seems to be the same as the Faridpur Kamárjáni. How the names Deshi and Sádá are applied we do not quite know. In the south of the district we get very little **C. capsularis**, and what there is, is known simply as Sáda titá pát, being a green-stemmed race, and apparently the same as that so called in the neighbourhood of Calcutta.

Race No. 26.

KHULNA.

On the south of Jessore in the district of Khulna we are within the region where **Corchorus capsularis** almost entirely gives place to **C. olitorius**. The races of **capsularis** in Khulna are reported to us to be called Chattua and Deshi; we do not exactly know how the names are applied.

TWENTY-FOUR PERGANNAHS AND HOWRAH.

In the 24-Pergannahs, **C. capsularis** is chiefly called Tita pát: but Lanka gori, Himatpát, Hematgár, Kosta pát, Sanchi pát and Bominál are other names that we find in use. The old name of Ghi-nalita-pát which Voigt used in 1844 (Hortus Suburbanus, page

127) and which is quoted in U. C. Dutt's Materia Medica of the Hindus is rarely used now. Sádá titá pát, Sádá lanká gori, Himat pát or Hematgár all belong to an early green-stemmed race; Lál titá pát and Lál lánká gori both belong to an early red-stemmed race found generally in small quantity mixed with the Sádá titá pát and but rarely purposely cultivated. Hem Chunder Kerr's Sanchi ranga pát may well be the same red-stemmed race. His name Bugnal pát suggests Boginál or red bogi. The name bogi we know to belong to **C. olitorius**. The origin of the name Lanká gori is not clear; lanká means a chillie; but if the name were connected with that, it would only seem applicable to a red-stemmed race, and sádá lanká gori would hardly be reasonable.

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Sádá titá pát begins to flower before July is out. On some sides of Calcutta, particularly the west, there is none of it, all the jute being **C. olitorius**, but on others it is fairly plentiful. It is grown at intervals all the way down to Port Canning.

Lál titá pát is the exact counterpart of Sádá titá pát.

Race No. 27.

A late race had been seen by us in a small plot on the south of Calcutta, where the name Bomi was wrongly applied to it. It is apparently something brought in from another district.

HUGHLI.

There is a very little Tita or Teto pát in the Hughli district.

MIDNAPUR.

In the parts of the district of Midnapur, which adjoin the districts of Howrah and Hughli, cultivation of jute is much as in those two districts. **C. capsularis** is there called Titá pát and Hanumán pát. We do not know how Hanumán pát is distinguished from Titá pát, but in the Tamluk subdivision we believe that a difference is recognized. In the Contai subdivision the nature of the jute crops is somewhat different, and the names are quite different. **C. capsularis** is called either Koshta or Jhot-pát. It may be green-stemmed or it may be red-stemmed: if red-stemmed, the adjective lál is prefixed to the word Koshtá or to the words Jhot-pát. There is said to be a difference between Jhot-pát and Koshtá, but that difference has not been studied by us on the spot. Koshtá is said to grow taller than Jhot, to give fibre not quite so lustrous, and not to be grown as Jhot is for the leaves which are dried to be used as a fever medicine. If as is said in a report by Mr. N. Bagchi, Subdivisional Officer of Contai, sent to us, that Koshta grows as high as Baitri, which is **C. olitorius**, it is probable that not it but Jhot is the Titá pát of the 24-Pergannahs. The other two races from Midnapur are then apparently the same as the two Orissa races to follow.

Jhot possibly Races Nos. 26 and 27. Probable Races Nos. 28 and 29.

BALASORE. CUTTACK.

Lastly we come to the jute of Orissa. Nalita, a word very near to the Sanskrit Nádika, is the name adopted there for the jute plant, and the common name for **C. capsularis**, *viz.*, Pita nalita, is of course in meaning equivalent to the Titá pát of the neighbourhood

CORCHORUS CAPSULARIS.

of Calcutta. Of Pitá nalitá we have green and red-stemmed races, grown in not very pure crops. Of the green-stemmed race, some plants have green fruits and petioles, and others rosy fruits and petioles. It is far more abundant than the red-stemmed race. The red-stemmed may be called Nala pitá nalitá and the green-stemmed Dháulá pitá nalitá or Deotá pát. In one spot we found a later crop, red-stemmed, called to us Bará pát.

Race No. 30.

To ascertain absolutely the relationship of these three Orissa races to those north of them is not possible, as they have never been cultivated by the side of others, but we observed that the early races seemed synchronous with the races of Calcutta.

Provisionally. Races Nos. 28 and 29.

The late green-stemmed race has not been studied in cultivation, and we leave it with the provisional number 30.

C. capsularis grown for eating.

COMESTIBLE CORCHORUS CAPSULARIS.

Before leaving **C. capsularis** for **C. clitorius**, it is necessary to mention sundry races of the plant grown for eating, and not for fibre.

Race No. 31.

In the first place, there is an extraordinary race known as Chira or Muniási at Purneáh and Kissenganj, a plant only found in gardens, which has long very much toothed leaves, and attains a no greater height than about two feet: the stem is very red. What we believe to be exactly the same has been collected by Mr. D. Hooper, on a forest clearing—a Tipperah jhum—at Hazarikhil in the Chittagong district. The local use was not ascertained, but as it was only three feet high, it seems probable that it is a vegetable, and not a fibre plant. This race was long ago found by Buchanan Hamilton to be used as vegetable in Rangpur under the name of Marua. In a paper published in the Journal of the Asiatic Society of Bengal, 1907, p. 633, we call it **C. capsularis**, var. **Marua.**

Races Nos. 32 and 33.

Different from this race is the Chirá-mirá or Chiruá or Miruá of Jalpáiguri which in two forms — green-stemmed and red-stemmed — is to be seen in gardens about that town. It is a very well-known vegetable there, and when found is seen, unless too young, to have been plucked over for its tender shoots. These shoots are not bitter. The Jalpáiguri Chirá-mirá grows three feet high, and has shortly rovate leaves very distinctly rounded below. Red-stemmed and green-stemmed seem equally in favour. The plants seem to flower earlier than the Jalpáiguri Bhádoya—in fact as early as any jute. Hem Chunder Kerr (Report on the Cultivation of, and Trade in, Jute, 1873, page 15) names a Chiral naricha from Dinájpur which may well be the same as Chirá. The second half of the name is curiously like the word Narish, which (page 16) he says belongs to jute in the Chittagong hill tracts. We have named this comestible jute **C. capsularis**, var. **pyrifolia**.

COMESTIBLE CORCHORUS CAPSULARIS.

A third comestible jute we obtained in Jalpáiguri under the same names as the last, and we have named it **C. capsularis**, var. **corylifolia** on account of the shape of its leaves. They are cordate, and very distinctly doubly serrate, with the main nerves as in var. **Marua**, radiating from the base.

We have only seen these three pot-herb races, and only from the places named; but **C. capsularis** is grown elsewhere for food (*vide* Hem Chunder Kerr's Report, page 22, where the districts of Bankura, Birbhum (thana Bissenpur), Sibságar and the Chittagong hill tracts are mentioned as places where this is the case. The leaves of the bitter races are used widely in Bengal in the form of an infusion as a fever medicine or placed a few into the daily food under the belief that they ward off fever.

Corchorus capsularis wild or run-wild.

WILD CORCHORUS CAPSULARIS.

Corchorus capsularis has been seen by us or is recorded as wild (run-wild generally) from a number of places outside the jute-growing area.

Upper India and Gujarat.

Edgeworth in the Journal of the Asiatic Society of Bengal, xxi., 1853, page 27, mentions it as in fields in the Bánda district. Duthie records that he obtained specimens from Bundelkhand and Rohilkhand. The locality in Rohilkhand is recorded in the Dictionary of Economic Products, paragraph C, 1847, by Sir George Watt, as Judalpur on the banks of the Gumpti river: Judalpur in the district of Sháhjehánpur is intended, and some of the specimens (which were obtained by Duthie's collector Harsukh) seen by us were only two feet high; they were called Harrua or Harrawa. Stewart (Punjab Plants, 1869, page 26) said that it was not unknown in the wild state in the Punjab. Someone, name not recorded, collected at Harduár specimens of it which are preserved in the Royal Botanic Gardens, Calcutta. It is recorded by Atkinson (Account of North-Western Provinces, India, iv., page lxix.) as growing in the Agra division. The late Mr. C. Maries collected it at Gwálior. It was seen by us at Chharodi, west of Ahmedabád, five feet high as a weed on the edge of a juar field, in 1903. We have seen it from Surat. We have seen it to the north of Bombay near Bassein at Nalá Sopárá and Nirmal. It was common round a jheel at the latter place on bunds in 1905. In 1902 it was in a garden and near it at Nalá Sopárá.

Bombay.

Deccan.

It occurs in the Deccan at Poona. In the Bombay Gazetteer, xv., 1883, page 428, is included a list of the plants of North Kanara by Talbot, who mentions **Corchorus capsularis** as found sparingly on roadsides throughout the district, and we have received it from South Malabar. Lawson collected it at Madras.

WILD CORCHORUS CAPSULARIS.

Chutia Nagpur. On the Chutia Nágpur plateau it is rarely to be found; the late Mr. C. B. Clarke collected it at Ranchi in 1873, the Rev. A. Campbell sent it to Calcutta from Pokhuria under the Santáli name of Kashom ran. Mr. Campbell's specimens by their rounded leaves look very like the Jalpáiguri Chira-Mira.

Assam. Mr. C. G. Mackenzie Kennedy, Deputy Commissioner of Nowgong, in 1897, sent to the Reporter on Economic Products specimens of this jute which had been found wild, stunted, and which were confused under the name of Chaká-márá with **Melochia corchorifolia.** No fibre is extracted from either it or Melochia in that district. Chakámárá is the same word etymologically as Chiramira and the second half of it as Máruá, which belongs also to **Corchorus olitorius.** It has been seen by us in a very branched condition from Tingalibam in the district of Sibságar.

Masters recorded in 1848 that it was in the Angami-Naga hills (Journ. Agric. Hort. Soc., India, vi., page 41).

Burma. Kurz in his Contributions to a Knowledge of the Burmese Flora, page 130, says that **C. capsularis** is cultivated all over Burma. We have seen specimens which he collected on the Southern Yomas; and we have found it ourselves at Kyauktaga in Pegu, at Kamahat near Bhamo and at Myawadi in the Amherst district on the Siamese frontier. It was wild in each of these places, and at Myawadi fibre was said to be made from it by hand-stripping without retting.

Malay Peninsula. Still further south it occurs in Perak, whence various collectors have obtained it. Ridley (Malay Plant Names, in Journ. Roy. Asiatic Soc., Straits, 1897, page 257) gives a Malay name for it, *viz.*, Sunarong betina. It occurred wild in the morass of Parang in Java about 1820 and had been cultivated in other Malay Islands as long ago as the time of Rumpf., 1653—1702. It further occurs in cultivation in Formosa (*vide* Matsumura and Hayata in Journ. Coll. Science, Tokyo, xxii, p. 64).

The way the plant grows in these widely separated localities indicates how easy of cultivation it is. It is the need of stagnant water for retting which has limited the area over which it is cropped; and it is the abundance of jheels which has caused superior races to be selected in the jute centres along the backwaters of the great rivers of the Bengals.

REVIEW OF DISTRIBUTION OF RACES.

It is now well to put into the form of a table our results. We give them district by district, using capital letters for races which are very common and using italics for red-stemmed races. The table follows, early races to the left, and late races to the right. It has been a matter of some debate with us whether Dhaleswari No. 7 should be reckoned as mid or late: it is later than Udhap, but earlier

than Deodháli. We have decided to count it as late in this table, but it would not be wrong to count it as mid.

CORCHORUS CAPSULARIS. REVIEW OF DISTRIBUTION OF RACES.

Faridpur	Aus No. 1	.....	.....
			AMON No. 2.
			SUTPAT No. 3.
		UDHAP No. 4	.....
			Belgachi No. 5.
		Meghnal No. 6	.....
			[Parbatya No. 7.]
			PECHI-PAT No. 8.
Bakarganj	.....	.....	
		Shonamukti No. 6	DHALESWARI No. 7.
Dacca	.....	.....	*RAJLA* No. 8.
			Bidya Sundar No. 10.
			Desi No. 9.
			Belgachi No. 5.
Tippera	.....	.....	DHALESWARI No. 7.
			Kajla No. 8.
			Bidya Sundar No. 10.
			Deodnali No. 11.
			Phuleswari No. 12.
Pabna	.....	DESOAL No. 13	.....
	Barapat No. 14	.....	.....
		Lali No. 16.	.....
			KAKYA-BOMBAI No. 15.
			Nibta ? No. 25.
Mymensingh	AUS No. 17	.....	.....
	Chhotapat No. 18	.....	.....
	Barapat No. 14	.....	.....
		Parbatya No. 19	.....
			Baran No. 20.
			Amonia No. 24.
		Rangi No. 21	.....
Bogra	DHAULAPAT No. 17.	.....	.....
		Nalpat ? No. 21	.....
			Kashya Bombai No. 15.
Rangpur	DHAULA BITRI No. 22.	.....	.....
	Lal Bitri No. 23	.....	Dhaula hetia No. 24
		.....	*LAL HETIA* No. 26.

CORCHORUS CAPSULARIS. REVIEW OF DISTRIBUTION OF RACES.

Goalpara	. DHAULA AUS No. 26.	.....	.....
	.....	[Desoal No. 13].	.....
	Lal aus No. 23	.....	.....
		.....	Dhaula hetia No. 24 or haimantia.
		.....	*Lal haimantia* No. 25.
Jalpaiguri	. Dhaula bhadoya No. 22.	.....	.....
	Lal bhadoya No. 23.	.....	.....
		.....	Dhala heotia No. 24.
		.....	*LAL HEOTIA* No. 25.
Darjeeling terai	. Dhaula bhadoya No. 22.	.....	.....
	Lal bhadoya No. 23.	.....	.....
		.....	DHALA HAIMANTIA No. 24.
		.....	*Lal haimantia* No. 25.
Dinajpur	. DHAULA BHADYA No. 22.	.....	.....
	MEGHNAL No. 23.	.....	.....
Purneah	. SAN PATWA No. 22.	.....	Heotia No. 24.
	Meghnal No. 22	.....	.....
		.....	Dhala heotia No. 24.
		.....	*Lal heotia* No. 25.
Malda, Sontal Perpannahs and Birbhum.	.....	Dudhsar ? No. 13	.....
	.....	*Lal patwa* No. 16	*Lal patwa* ? No. 25.
Rajshahi	.....	Dhaula Sanchi No. 13.	Dhaula Sanchi No. 2.
	.....	*Megh lal* No. 16	*Megh lal* No. 25.
Murshedabad	.....	DUDHSAR No. 13.	Dudhsar No.
	.....	*Meghlal* No. 16	*Meghlal* No. 25.
Nadia	.....	Aus No. 13.	.....
	.....	*Kuchmadan* No. 16.	.....
		.....	AMON No. 2.
		.....	*Meghlal* No. 25.
24-Pergannahs	.....	Sada tita pat No. 26.	.....
	.....	*Lal tita pat* No. 27.	.....
Balasore and Cuttack	.....	Dhaula pita nalita No. 28.	.....
	.....	*Nala pita nalita* No. 29.	.....
			[Barapat No. 30.]

NORTHERN CROPS EARLY.

The table brings out graphically certain points. It emphasises the general lateness of the southern crops and the earliness of the northern crops. It emphasises the greater attention to selection that the ryot has exercised in the districts along the big rivers whereby he has there produced more races than elsewhere: and it emphasises the peculiar local prejudices in the matter of colour of the jute plant. These points are particularly interesting.

LOCAL GREATER SELECTION.

CHOICE OF RED.

It will perhaps be well to leave discussion of this red choice until **C. olitorius** has also been considered, and therefore we turn to the question of selection. We have shown how innocent of ideas regarding earliness and lateness the ryots of the newer jute districts are, so that they are content with a very mixed crop. Certainly in these mixed crops we get many intermediate plants which fruit along with the others and in the course of time would apparently make the mixture into one series. These intermediates the more skilled ryots of the Faridpur, Pabna and Dacca districts have tried to remove at least from their best crops. Thus it comes about that in those districts there is an ordinary race—the Desi or Desoál—and with it other better crops that on examination are seen to be less variable, *i.e.*, more carefully selected. This is well exemplified at Serájganj, where Kákyá Bombái has not the variability of Desoál, or at Madáripur, where Udhap has not the variability of Sutpát, or in western Mymensingh, where Parbatyá has not the variability of Aus.

SELECTION.

SELECTION IN CORCHORUS CAPSULARIS.

The specially selected races lie near the ordinary or desi races each in their own districts. For instance, the selected races of Faridpur are late like the country races, and in Jagannáthganj we get the early selected Barápát by the side of the early country Aus.

The tendency for the ryots in the North to grow earlier races than those of the south is no accident: it is connected with the climate, the rise of the rivers, and the needs of the particular kind of rice or other crop that alternates with the jute.

The branching habit has certainly been selected out of the best varieties.

It is a question if any do better in water than on moist land, but some are said to have been selected the more effectually to withstand the injurious effects of flood-water than others.

With the table above and after reading these remarks the reader who has perhaps been rather bewildered by the number of races that we have kept apart—tentatively—may perhaps feel satisfied in grasping the idea that the species **C. capsularis** is one which cultivators of it for fibre have broken up into four divisions, early green-stemmed, early red-stemmed, late green-stemmed and late red-stemmed, and, having done so, have proceeded to develop out of these four main divisions a number of local modifications, chiefly improvements.

CORCHORUS CAPSULARIS.

This view is simple, and it only rests to add that those who have grown **C. capsularis** for the pot have made other distinct races out of it, which could not well serve for fibre.

The local modifications just spoken of are of the first importance to any one starting to improve further.

Corchorus olitorius, Linn.

CORCHORUS OLITORIUS.

About Calcutta where **C. olitorius** is eaten as a pot-herb and **C. capsularis** considered a medicine, the first is called Mitha pát or sweet jute and the second Tita pát or bitter jute. The name Mithá pát becomes in Orissa Madhur nalita, with the same meaning (madhur-sweet; and nalita which is from the Sanskrit nádiká, having become the equivalent of pát).

The typical late races of Howrah, Hughli and the 24-Pergannahs, our Nos. 1 and 2.

Near Calcutta, all round Hughli and Barrackpur, and up to Kalna on the west side of the river or to Ránághát on the east we have two jutes grown extensively in adjoining plots. The one is green-stemmed and the other is red-stemmed; and the cultivators are at some pains to keep them separate. They are respectively Desi pát and Desi Lál pát.

In very many parts of their area **C. capsularis** is wholly absent, and it is quite unnecessary to use the word Desi as a distinctive adjective: in those parts the first becomes Sáda pát (white jute) and the second Lál pát (red jute), as for instance the custom is on the west side of Howrah and about Baráset.

Desi pat.

Desi pát and Desi lál pát differ in colour of stem only, and not at all in the time of ripening.

At Hughli no other races are grown, but at Bongong, besides these two, there seems to be a still later race called Bodan, which

Race No. 3.

on August 20, 1906, was not even in bud, whereas at Burdwan on August 10 Desi pát was in flower.

Bodan has green stems. We have not had an opportunity to study it properly.

The typical early races of Faridpur, Nadia and Murshedabad, our Nos. 4 and 5.

On the banks of the Ganges about Faridpur we have red and green-stemmed **C. olitorius**. Bagi or Bogi or Bomi is the name of both; if green-stemmed, it is Dháulesbogi or Bági, if red-stemmed it is Lál bogi or bagi or Nál bági. Bági or Bogi or Bomi, when used alone, generally mean the green-stemmed plants. It is said that the word Bági is derived from Bág or Bák a stock, but it is not clear why it should be applied.

At Rájbári, Pachuria, and other places in the west of the Faridpur district this plant is called Sutnalá (*i.e.*, thread reed).

Bági or Bomi spreads down through the Nadia district to meet the Hughli Desi pát near Ránághat, and spreads westwards in Murshedabád, where it predominates over other jutes.

CORCHORUS OLITORIUS.

We need now to compare the Desi pát of Hughli with the Bogi of Faridpur. The two were grown together at Bardwán and Pusa in 1902, 1903 and 1904, the latter under the name of Sutnalá of Rájbári. After 1904 the Sutnala of the Bardwán Farm was changed; either the seed of it and of a race called "Halbiláti" were interchanged, or more probably they were mixed by some mischance.

Bardwán Experimental Farm.

	Desi Lál pát of Hughli.	Sutnalá of Rájbári.
1902.		
August 28	Hardly in bud yet	*Early fruit nearly fully formed.*
1903.		
August 2	No sign of flowers	*In flower.*
1904.		
August 10	No sign of flowers	*In flower.*
September 22	In flower with some fruits full size, but none ripe.	Still flowering; *some fruits ripe.*

We shall use the above races as standards for comparison and may now take the jute area, district by district, in the order which we adopted for **Corchorus capsularis.**

Faridpur. Race No. 4. Race No. 5. Race No. 2

About Faridpur most of the crops of **C. olitorius** are of Dháulesbogi or Dháulesbági; but Lál bogi or Rangabogi is not uncommon. Rarer than either of these is a late red race called to us by a cultivator Meghnál or Nálpát, which race apparently is the same as Deshi lál pát.

At Goálundo the same three races of **C. olitorius** occur, and at Pachuria the first two. The names Emtál and Bomi are in these places sometimes substituted for Bogi. Round Madáripur the two Bogi páts occur, Dháulesbogi being by much the commoner. They are grown on the higher banks of the rivers close to the crops of Sutpát (for which see page 47 above).

Bakarganj

These two races further extend into the district of Bákarganj.

Dacca.

In the Dacca district the word Bogi is displaced by Bangi or Bhangi.

The origin of the word bangi is very obscure. It denotes cotton in Behar, and has apparently done so for a very long time. We trace its use for jute back in India clearly for only sixty-five years, *i.e.*, to O'Shaughnessy's Bengal Dispensatory, where it appears as bhungee (page 229); but then the literature of jute is very meagre before that date. Hem Chunder Kerr (Report on Cultivation of, and Trade in, Jute, page 14) said that the word coming from bhanga=**Cannabis sativa**, was not in use amongst the Bengalis. Whether he was right

CORCHORUS OLITORIUS.

regarding the origin of the word or not, we cannot say, but in saying that bangi was not in use, he was certainly wrong and inconsistent; for he himself quotes it on page 15 as in current use in the district of the 24-Pergannahs.

Rumpf's remarks (Herbarium Amboynense) lend a little colour to Hem Chunder Kerr's suggestion that bangi is derived from the name of the Hemp-plant, for they show that in the latter part of the seventeenth century people did not think jute and hemp very different, for instance Rumpf says that the plant grew like the hemp plant, and the fibre was used in Arakan much, so that it was called "Cannabis aracanica" and, where introduced into the Island of Bœton, Gandja.

However, it is unprofitable to pursue the name 'bangi' further since no meaning can be ascribed to it in any way connected with the characters of the races to which it is applied.

Bangi of Narsingdi, Dacca, has been cultivated at Bardwán; and compared with Sutnalá it behaved as follows. There is little doubt upon the identity of the two.

Bardwán Experimental Farm.

	Bangi of Narsingdi.	Sutnalá of Faridpur.
1902.		
August 28	With full-sized fruits	Fruit nearly of full size.
1903.		
August 2	In flower.	In flower.
1904.		
August 10	In flower and with young fruits	In flower.
September 22	With some fruits ripe	Still flowering; with some fruits ripe.

The Bangi as grown at Narsingdi is usually green; but we find there also tall red crops of a race called Deonallyá (meaning Divine reed-jute), and more sparingly similar green crops. These 'mixed' had been cultivated at Bardwán and were found exactly to correspond with Desi pát and Desi Lál pát of Hughli. We have seen excellently grown crops of them near Narsingdi; the plants as much as 15 feet high on September 17th just before cutting.

Races Nos. 1 and 2.

Halbiláti of Tippera is known to us only from the Bardwán Farm Experiments. It is a tall late green-stemmed or red-stemmed jute not appreciably differing from the Deonallyá of Dacca. It is unnecessary to give a table of the way in which the two behaved as regards flowering time, etc., for they were exactly the same.

Tippera.

The common name in Serájganj for **C. olitorius** is Toshá or Tosa, be it green-stemmed or be it red-stemmed. Both green-

Pabna.

stemmed and red-stemmed are besides often called Barápatá. These Serájganj plants are late; comparing them with Desi Lál pát, we get the following table, which indicates no differences:— CORCHORUS OLITORIUS. Races Nos. 1 and 2 at Serajganj.

Bardwán Experimental Farm.

	Tosha of Serájganj.	Desi Lál pát.
1902.		
August 28	Buds just mature	Hardly in bud yet.
1903.		
August 2	No sign of flowers.	No sign of flowers.
1904.		
August 10	No sign of flowers	No sign of flowers.
September 22	In flower; fruits not quite full size.	In flower, with some fruits full size, but none ripe.
1906.		
August 26	Just in flower	With flowers.
September 15	No flowers left; fruits not ripe yet.	No flowers left.

The same races extend to Jagannáthganj, Sarisibári, Kamárjáni and other places close to the river, but no **C. olitorius** is to be found towards Jamálpur. The word Tosha becomes Tolla at Jagannáthganj and is applied more strictly than Tosha at Serájganj to the green-stemmed plant; while the red becomes Pak Nallya or Nalita (*i.e.*, Pucca Nallya or Nalita, the genuine red jute).

Mymensingh. Race No. 1. Race No. 2.

Nibta is a name sometimes used for Tollá, and as at Serájganj the name Barápatá also: but there is also another Barápatá at Jagannáthganj (see page 67).

The crops of Pak Nallyá are not many, but very conspicuous in the neighbourhood of the first two of the places named above. The Jagannáthganj ryots keep the red and green-stemmed plants more apart than do the Serájganj ryots.

Pak Nallyá was grown at Bardwán and is still being grown.

C. olitorius is apparently very rare in the district of Bogra: we found none of it at Fulchári or Bográ when we were examining crops at those places, and have been unable to examine closely the crops which we saw elsewhere. But it has been reported to us by Babu Annadhanda Sen, Manager of the Jaipur Government Estates, that two races are known called respectively Dháula Kochan and Lal Kochan, and the specimens kindly sent to us are of the late green and late red races apparently identical with Toshá. In Rangpur again **C. olitorius** is very rare and so also in Goálpárá. We have not seen it in either district. In Jalpaiguri it is hardly grown as a field crop, but it is grown somewhat freely in gardens for eating, and is called Máruá, a name already met with as applied to **C. capsularis** (see page 104).

Bogra. Rangpur. Goalpara. Jalpaiguri.

CORCHORUS OLITORIUS.

Darjeeling. Dinajpur.

The cultivation of this Máruá occurs also in the Darjeeling Terái and in the northern part of the Dinájpur district. We have seen, at Dinajpur crops of **C. olitorius** grown partly for fibre and partly for eating, under the name of Amoná. They were very red-stemmed and late; apparently this Amoná is Toshá of Serájganj again. If red, in the Nawábganj subdivision of the district, it is called Lál Madái, and if green-stemmed Dhálá Madái: in the Gangarámpur subdivision it is called Bamukchi or Bomukti; and further it is reported to us also to be called Bábná in one part of Dinájpur.

Races 1 and 2.

Apparently Dinájpur only contains late red-stemmed and green-stemmed races, being our races Nos. 1 and 2.

Purneah.

At Forbesganj we found **C. olitorius** in gardens, grown for a vegetable; but never in fields. It was red-stemmed and called Lál pát or Meghnál. As a vegetable also the species is grown in gardens at Kissenganj under the name of Muniasi, at Araria as Gorson, at Purneah as Ghonka, but in a dwarf race, being only two feet high: also in gardens of the district of Bhagalpur is the same dwarf race grown for eating as Ghonka.

Bhagalpur.

Malda.

Races 4 and 5.

In the district of Máldá, **C. olitorius** is not a crop, but stray plants are found in the crops of **C. capsularis,** branched and early, and certainly equivalent to the Bogi páts of Faridpur. Cultivators there call them Hemtál. They may be either red-stemmed or green-stemmed. And again in the very north a race called Muniashi, which we have not seen, is a little grown: it may be the dwarf comestible race.

Rajshahi.

At Rájsháhi and Nattor, as well as between these places, a very considerable proportion of the jute crops is of **C. olitorius,** tall and late, called by the cultivators Barápát or Mitha Sánchi (sweet Sanchi or jute). It is both green-stemmed and red-stemmed and does not differ from races Nos. 1 and 2. When green-stemmed it is sometimes called Dudhrás. But again at Rájsháhi we have crops of early green-stemmed and red-stemmed **C. olitorius,** which are our races Nos. 4 and 5; the early red-stemmed is less abundant than the early green-stemmed. The Rájsháhi cultivators know very little about these races which they grow: many of them hardly understand that there are early and late races.

Sontal Pergannahs.

A few red and green-stemmed early plants of races Nos. 4 and 5 occur among the crops of **C. capsularis** at Rájmehál—accidental introductions only, just as they are in the district of Máldá.

Murshedabad.

Races Nos. 4 and 5.

In the district of Murshedabád **C. olitorius** is known at Lálgola in the north and called Emtál, but we found no crops of it there. At Berhampur and southwards, this species is plentifully grown, partly in the early races and partly in the late. At Berhampur the crops are of green-stemmed and red-stemmed early, intermixed, and with occasionally late green-stemmed plants in them also. The Bengali

CORCHORUS OLITORIUS.

Race No. 1.

cultivators speak of the plants as Nál pát or Meghlál pát and Dháulá pát, or the late green-stemmed at Dudhshár pát. In the very south of the Murshedabád district red-stemmed late crops occur plentifully, which are identical with the Desi Lál pát of Hughli, and may be called Kuchmardan pát.

Nadia.

Races Nos. 1, 2, 4 and 5.

The district of Nadiá produces all the four races—early green-stemmed and late green-stemmed, early red-stemmed and late red-stemmed: towards the south the crops are mostly late; whereas towards the north they are mostly early. South of Ránághát crops of the Desi pát and Desi Lál pát of Hughli are everywhere. North of Ránághát we get the Bogi páts of Faridpur, generally mixed as about Bágulá and Chuádángá, but more separate at Poradáha and places in the north. These early races are spoken of as Desi at Bágulá and Chuádángá.

At Bágulá the late green or Desi pát of Hughli, is mixed a little with the early, and is called Amona pát. At Chuádángá it is again present. At Pálási early races, mixed, are more common than late races, but both are present. The late races are called Bombái, and the early races Desi: red races are sometimes called Meghnál. At Poradáha there is a marked prejudice in favour of green crops, which results in the early crops being predominately green and the late crops generally wholly green. The late green is called Amona.

Jessore.

Race No. 2. Race No. 1.

In the district of Jessore are grown the Desi pát and Desi Lál pát of Hughli: and besides there seems to be at Bongong the still later race—our No. 3 above on page 110. This race needs further investigation before its existence can be definitely established. At Bongong the Desi Lál pát is generally called Kártiksál (ripe in Kártik or October), and the green-stemmed Dháulá pát or Gangájoli (white like Ganges water).

24-Pergannahs. Howrah. Hughli.

In the 24-Pergannahs there are only the two late races and so also in the districts of Howrah and Hughli. They are commonly called Desi pát, or near Calcutta, whither men from all parts of Bengal bring the words of their own districts, the names of Emtál and Bogi or Bomi are not strange. The name Himat pát is also used; and not infrequently to distinguish **C. olitorius** from **C. capsularis,** the adjective Mitha (sweet) is inserted, so that we get the expressions Desi Mithá pát and Lál Desi Mitha pát. Towards the Jessore boundary we get in use the names Kártiksál and Dháuli boran, the latter being applied in the same way as the name Dháulá pát mentioned above.

Roxburgh (Flora Indica, ed. C. B. Clarke, 1874, page 429) speaks of jute as much cultivated in Bengal at the beginning of the last century under the name of pat and adds that a reddish variety was called Bun pat (modern spelling ban pát). The name should mean "wild jute": but in the name Bangi was certainly the origin.

CORCHORUS OLITORIUS.

Hem Chunder Kerr, in his Report, page 15, and Appendix Ii has a long list of names used in the 24-Pergannahs, Bangi pát and Bangi Lál pát among them, as well as Bogi and Lakhipur bagi pat. He has also a Lakhipur dholi pat and a Lakhi phul pat. In respect to the names Lakhipur bagi and the Lakhipur dholi it does look as if a contrast was intended between the red (bagi) and the green (dholi) which would run on all fours with Roxburgh's use of ban (for bangi) as indicating a red-stemmed race. It is probable that the names in Hem Chunder Kerr's report are to be assigned thus :—to Desi pat, his Desi pat, Sada dhakai pat, Lakhipur dholi pat, Aman dholi pat and Lakhi phul pat, and to Desi lal pat, his Bangi lal pat, Rangri pat and Lakhipur bagi pat. The unqualified names of Bangi pat and Bogi pat may be the one or the other. What his Ghritá kánchán pát was, we do not know. However, this we believe, that, though the names are many, the races are but the few that we have described.

Midnapur.

In Midnapur **C. olitorius** is fairly abundant near the borders of the districts of Howrah and Hughli. Lanka Gurya, Laskar kani and Dulal are said to be its names used in the Tamluk subdivision. We have not sucessfully identified these three names with plants: but Lanka gurya is the same name as Lanka gori, and Lanka gori about Calcutta is not **C. olitorius** but **C. capsularis**.

Race No. 1

Race No. 2.

In the Contai subdivision **C. olitorius** is called Baitri pát and Balti pát. It is green-stemmed and late, being the same as the Hughli desi pat. Red-stemmed **C. olitorius** is also a little grown.

Balasore, Cuttack.

To Orissa extends sparingly the cultivation of green-stemmed late **C. olitorius**, which is there known as Madhur Nalita (*i.e.*, sweet reed-jute) or Nakreá Nalitá (*i.e.*, stick reed-jute) or Tarikani Nalita or Kusta Dhanialia (meaning of the last two uncertain). We found but a few crops of it in 1906 between Cuttack and Shishua and near the Baitaráni river towards Jájpur. They differed, varying from a reddish green to pure green.

Wild Plants and Races not grown for Fibre.

DISTRIBUTION OF C. OLITORIUS WILD OR GROWN FOR EATING IN INDIA.

Punjab plain.

The following are the places outside the jute cultivation area where the long podded jute is known to us to grow. It is recorded from Gujrat in the Punjab (Gazetteer of the Gujerat District, 1893, page 14) under the name of Bahárphali—a dwarf plant, eighteen inches high. It is common at Lyallpur in the Miánwali district, attaining on the best land as much as four feet in height. It has been sent to us recently from Dera Ghazi Khan on the Indus, where with **C. trilocularis** it is confused under the name of Sári Biplee. In 1888 Mr. J. F. Duthie distributed both species from that place under his number 7121; so that there has been no very recent

DISTRIBUTION OF CORCHORUS OLITORIUS.

introduction of it. We have no precise information regarding the kind of ground that it lives in nor its abundance.

North-Western Himalayas.

It grows at Kangra — a race with small leaves, of which we have not seen enough to report on.

Sir George Watt collected **Corchorus olitorius** at Suni on the Sutlej, north of Simla, altitude 2,000 feet, and a correspondent of his, Mr. E. R. Johnson, collected it below Simla at 4,000 feet. Both specimens are small, those from Suni being 2—3½ feet high, and those from 4,000 feet being only 1—1½ feet and in seed. Sir Henry Collett (Flora Simlensis, 1904, page 65) says that the plant occurs up to 4,000 feet, most frequently as an escape from cultivation, the leaves being eaten as a vegetable. T. Thomson collected it at Rámpur, which is still higher up the Sutlej than Suni. Sir George King collected it in Garhwál. Atkinson in the Gazetteer "Himalayan Districts, 1882, page 733, says that it is found in the Dehra Dun and is called Banphal,—a name thought by Dymock to be a corrupted form of Bhauphali, the well-known name of **Corchorus Antichorus**.

Nepal.

One of us has observed it twice wild at the upper limits of the sal forests of the Nepal terai—once under Niákot in the Trisuli Valley, and once between Bhimpede and Nimbuá-tár on the direct road from Raksál to Khátmandu. The plants were but two feet high.

United Provinces.

We have received specimens from Saharanpur of undoubtedly wild origin and of small size, attaining a height of two feet only. Kanji Lal in his Forest Flora of the (Dehra Dun) School Circle, North-Western Provinces (Calcutta, 1901, page 45) says that the plant is to be found wild at Dehra Dun and in large quantity in the Pathri Forest, Saharanpur Division. The wood is there used for making country matches. Edgeworth (in Journ. Asiatic Soc., Bengal, xxi., 1852, page 27) records obtaining it in the Banda district. Munro (Hortus Agrensis, 1844, page 9) said that it was sometimes cultivated near Agra: presumedly for eating.

Sind and Gujarat.

Murray (Plants and Drugs of Sind, 1881, page 64) records that it is found wild in Sind, and adds that it is called Bun pát (literally wild jute)—but see the probable origin of Ban phal above. Woodrow has collected it in Sind, locality not recorded. He has collected it also in Gujarat, locality again not recorded.

Southern Rajputana.

A very distinct race of **C. olitorius** is cultivated as a pot-herb in Alirajpur and Narsinghar under the name of Rajan or Badarizan. The first of these names is applied also to **Corchorus trilocularis**, which is there eaten by the Bhils as a vegetable. This form of **C. olitorius** that is eaten is only a couple of feet high.

Bombay.

At Bassein, north of Bombay, **C. olitorius** occurs plentifully on the bunds of rice-fields. No use is made of it. Natives sometimes call it Kangi, evidently in confusion for **Sida cordifolia**. Cooke (Flora of the Bombay Presidency, i., 149) quotes collections

DISTRIBUTION OF CORCHORUS OLITORIUS.

for it near Bombay of more than half a century ago. Our Bassein specimens are rather small.

Deccan hills.

We have seen it at Poona growing very branched as a weed in gardens. Cooke refers to it as a weed, and has himself collected it at Poona. Ritchie (teste Cooke) collected it at Belgaum and on the Rámghat, west of Belgaum. Talbot, Bombay Gazetteer, xv., page 428, records it as occurring at Tellapur. Perrottet collected it in the Shevaroy hills. Rice mentions it (Mysore and Coorg, i., 1877, page 55) as a vegetable of Mysore, put into curries and called Kotra goraji.

Ceylon.

Thwaites in his Enumeratio Florae Zeylanicae says that in the island of Ceylon it was "very common." This statement seems incorrect; for Trimen (Flora of Ceylon, i., page 182) says that he had never met with it. However, there is evidence that it has in Ceylon, for Moon collected it at Kalutara and Gardner at Bintenne.

Coromandel.

In the Godaveri delta we have seen it at Samalkot and Rajamundry, common there on lands not irrigated. At Rajamundry it was growing mixed with cotton and arhar above all irrigation. At Samalkot it was growing on the sides of raised footpaths. We have seen specimens from the Godavari district collected at Davypatnam by Gamble and from Adyar near Madras, both of which are small leaved and may well be the same pot-herb. Elliott (Flora Andhrica, 1859, pages 145 and 151) records it as growing in Ganjam, and names it Parinta. Mohideen Sheriff in his Materia Medica of Madras names the leaves as Punnak-kirai or Peratti kirai.

Chutia Nagpur and Gaya.

It occurs on the Chutia Nagpur plateau as shown by specimens collected at Gurhina in Lohadiga by Mr. C. B. Clarke—growing six feet high.* Haines has collected it in Singbhum. Buchanan Hamilton collected it in 1811 at Dariyapur in the district of Gaya.

Northern Bengal

Hem Chunder Kerr (Report on Cultivation of and Trade in Jute, 1874, page 39) speaks of considerable cultivation of this species of jute for eating in the Katwa subdivision of Bardwán.

Assam.

Masters in 1848 recorded that it could be found in the Angami-Naga hills (see Journ. Agric. Hort. Soc., India, vi., 41).

Burma.

In Burma, **Corchorus olitorius** has been found by us at Padáung on the lower Irrawaddy, south of Prome; at Monywa on the Chindwin, and at Momouk, east of Bhamo, just at the foot of the hills whereon the Chinese boundary runs. The plant grew about 4—5 feet high, and was much branched. From the Records of the Government of India, is reprinted in the Journal of the Agricultural and Horticultural Society of India, ix., 1857, page 17, a statement that it is wild near Rangoon. We have seen specimens collected

* The Bir-narchá mentioned as a pot-herb of Chutia Nagpur in the Dictionary of Economic Products, para. C, 1871, is *C. acutangulus*, Lamk.

CORCHORUS OLITORIUS REVIEW.

by Aubert and Gage in Minbu and by one of the Calcutta Botanic Garden Collectors. At the mouth of the Mu river near Myinmu, district of Sagaing, we also found it as a curiously developed plant spreading out along the ground. One of the specimens from Dera Ghazi Khan has branches spreading from the root; and it is not improbable that the similar habit of the plants in both these dry spots is a result of the dry climate.

Shan plateau. Malaya.

It is found on the Shan plateau and in the neighbouring parts of China. And it is found in Java and other Malay Islands. Rumpf records that two centuries ago it had been brought to Amboyna from China, and it was then in Arakan and Bengal. To make it a profitable crop has once or twice been attempted in Java, but failed, leaving apparently the plant established wild in the marshes of Parang in the province of Buitenzorg. It is called Djepon in Java. Tijsmann and Binnendijk (*Catalogus plantarum quae in Horto botanico Bogorensi coluntur, Batavia, 1866, p. 199*) speak of a dwarf variety as known to them in Java. Miquel records that it was in the Sunda Islands and Timor about 1850. It is said to occur in the Philippine Islands.

China.

Regarding China we have Rumpf's statement that the plant was introduced into Amboyna from China, and Loureiro's old statement (Flora Cochin-Chinensis, I, 1790, page 408) that it was cultivated in the province of Canton, the record of its occurrence in several places in Formosa (*vide* Indian Planting and Gardening, 1904, p. 212, and Matsumura and Hayata in Journ. Coll. Science, Tokyo, xxii., p. 64), and the statement of Franchet (Bull. Soc. Bot. de France, xxxiii., 1886, page 441) that the Abbé Delavay sent it from Ta-pin-tze in the province of Yunnan.

Levant and Soudan.

These remarks complete the eastward distribution of **Corchorus olitorius.** Westward of India we find it established as an important pot-herb of the Levant, under the name of Melokyeh in Cairo and Syria, or of Mouchlia in Crete.

Kotschy collected the plant in Kordofan. His specimens carry very long beaks to the fruit, which probably are marks of a distinct variety.

The plant, as we have seen it offered in the Cairo bazaars, is but two feet high at flowering. The interesting speculation that it is the Maluch which is mentioned in the Biblical book of Job need not be gone into here.

Corchorus olitorius does not offer the same difficulties to one studying it as **Corchorus capsularis** does. For in the first place we do not find that local improvements upon the four divisions of early green, early red, late green and late red have been made by the cultivators. So much so is this the case that we admit but five races besides a dwarf pot-herb, and the fifth of them—the very late race from Bongong—is of somewhat doubtful existence. In the second place **Corchorus olitorius** as a fibre plant has a much narrower distribution than **Corchorus capsularis**, a distribution

CORCHORUS OLITORIUS.

coinciding more or less with that of the late races of **C. capsularis.** Itself in its late races later than the latest races of **Corchorus capsularis,** it is still more markedly southern in Bengal proper than they. With its two early races it occupies a peculiar area—chiefly in the districts of Faridpur and Nadiá, in which they are found on the banks of the rivers, about the villages, where the flood but little comes. These early races are mature and ready for cutting just before the full flood-time arrives. The early and very high floods of 1906 caught them and killed them; but as a rule this does not happen. No doubt cultivation of these early races has been adopted in those places because they are so opportune in their ripening; and further the cultivator who makes his own cattle halters, and the like things, is indifferent to colour for that purpose and does not seek the more silvery less stout fibre of the many races of **Corchorus capsularis** which he might cultivate to ripen at the same time. However, this is but a partial and not a complete explanation of the local abundance of early **C. olitórius** in Faridpur and Nadia, and its great rarity a little way north of the river Ganges in the districts of Pabna, Dacca, Mymensingh, etc.

Distribution of races in Bengal.

Not very much trouble is taken with the early races: they are generally mixed together, red-stemmed with green-stemmed; and the plant very markedly branches at a height of about five feet. But with the late races much trouble is taken, and a visit to Hughli or almost any other centre of their cultivation impresses one at once with the way in which the red and the green are separated. Also in Nadia and Faridpur into which the late races sparingly penetrate, the crops of them when found are generally pure,—green-stemmed by itself, and red-stemmed by itself. However, at Serájganj and in the Dacca district this is by no means always so.

Commonly used names.

We give a table to indicate the names by which the four well-defined races most commonly pass in the various districts.

	Early green.	Early red.	Late green.	Late red.
Faridpur	Dháulesbogi	Lálbogi	.....	? Meghnál.
Bákarganj	Dháulesbogi	Lálbogi	.....	.....
Dacca	Dháulá bangi	Lál bangi	Dháulá Deonallyá.	Lál Deonallyá.
Tipperá	.....	.....	Halbilati	.....
Noákháli	.....	.....	.....	.....
Pabná	.....	.....	Toshá	Toshá.
Mymensingh	.....	.....	Tollá	Paknallyá.
Dinájpur	.....	.....	Dháulá Madai	Máruá or Lál Madái.
Purneáh	.....	.....	.....	.....
Máldá	Hemtál	Hemtál	.....	.....
Rájsháhi	?	?	Dudhrás	?
Murshedabád	Emtál	Emtál	Dháulápát	Lálpát.
Nadiá	Desipát	Desipát	? Sutnalá	?
Jessore	...	...	Gangájoli	Kártiksál.
24-Pergannahs	...	...	Desipát	Desi Lál pát.
Howrah	...	...	Desipát	Desi Lál pát.
Hughli	...	...	Desipát	Desi Lal pát.
Cuttack	...	...	Madhur Nalitá	.....

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

A List of the Vernacular Names applied to Jute in the East.

Agniswár, meaning very fiery, applied to Race No. 10 of **Corchorus capsularis** in Dacca.

Áhee pata, said by Hem Chunder Kerr to be used in Kamrup.

Ámana pat or Amoni pat, meaning late in season, applied in Dinájpur to Race No. 2 of **Corchorus olitorius,** and applied to Race No. 1 of **Corchorus olitorius,** in Nadia.

Ámón pát, meaning jute late in season, applied to Race No. 2 in Faridpur, and Nadia; also used in Sylhet.

Ámónia=Ámón, applied to **Corchorus capsularis** and in Nadia especially to Race No. 2.

Amos, said by Hem Chunder Kerr to be applied to **Corchorus capsularis** in Mymensingh, but almost certainly a misprint for Amon.

Aus, meaning early in season, applied to Race No. 1 of **Corchorus capsularis** in Faridpur, and to Race No. 17 in Mymensingh and Bogra.

Ausá pát, form of Aus pát used in Mymensingh and Sylhet.

Badarizán, a name applied to **Corchorus olitorius** in Southern Rajputana.

Bági, perhaps derived from bag, a stork, a name for Races Nos. 4 and 5 of **Corchorus olitorius** in Faridpur and Bákárganj; if unqualified it indicates Race No. 4. The name is also not unknown in the 24-Pergannahs.

Báhuphali, meaning little plant with many fruits, a name for more than one species of **Corchorus** in the Panjab, amongst them **Corchorus olitorius.**

Baitri pat, meaning unexplained, applied to Race No. 1 of **Corchorus olitorius** in Midnapur.

Báli pát, probably a corruption of beláti pát, meaning foreign jute, applied to Race No. 1 of **Corchorus olitorius** in Midnapur.

Bamukchi, applied in the Dinájpur district to Race No. 2 of **Corchorus olitorius.**

Bangi, a word of very uncertain origin, used in the districts of Dacca and Tippera to denote **Corchorus olitorius.** There are three possible origins for it: (1) that it denotes the jute of Bhanga in Faridpur, (2) that it is the same word as Bangi applied to Cotton in Behar, and (3) that it comes from Bhang meaning hemp. The word is still in use in the Dacca district for Races Nos. 1 and 2 of **Corchorus olitorius** and was formerly in use in the 24-Pergannahs for **Corchorus olitorius.**

Bangi Lál pát, said by Hem Chunder Kerr to be used in the 24-Pergannahs.

Ban-pát, meaning wild jute, a name recorded as used in Sind and Bengal for **Corchorus olitorius,** in the second instance perhaps for Bangi pát.

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Bauphal, applied to **Corchorus olitorius** in Garhwal, probably a corruption of Bahuphali or Bhauphali.

Bará Koshtá, quoted by Hem Chunder Kerr as a name for **Corchorus olitorius** in Pabna.

Barápát, meaning big jute, applied to Race No. 14 of **Corchorus capsularis** in Pabna and western Mymensingh, and also applied to Race No. 15 of **Corchorus capsularis**; again applied to Race No. 30 of **Corchorus capsularis** in Cuttack, and further to Races Nos. 1 and 2 of **Corchorus olitorius** in Pabna and Rajshahi.

Barápatá=Barápát.

Barán, meaning big, applied to Race No. 20 of **Corchorus capsularis** in western Mymensingh.

Belgáchi pát, meaning jute plant of Belgachi, applied to Race No. 5 of **Corchorus capsularis** in Faridpur and Dacca.

Bengál Márá, said by Hem Chunder Kerr to be used in Nowgong.

Beral, a name said by Hem Chunder Kerr to be used in Midnapur.

Bhangi, see Bangi.

Bhilan or Bilan, meaning 'of the marshes', applied in Faridpur to certain races of **Corchorus capsularis** grown in the bhils or marshes.

Bhut-kori, meaning ghost's cowries, applied in Murshedabad, Birbhum and Nadia to **Corchorus capsularis**.

Bhuri pát, communicated to us as a name of Faridpur, but probably meant for Barápát and indicative of Race No. 2 of **Corchorus capsularis**.

Bidyá Sundar, the words mean 'fine knowledge', but possibly bidya here has some other and obscure interpretation, applied to Race No. 10 of **Corchorus capsularis** in Dacca, Tippera and Sylhet.

Bilan, see Bhilan.

Bite pát, the name given by Hem Chunder Kerr for Baitri pat.

Bitri, meaning early, an adjective used in Rangpur to indicate early races of **Corchorus capsularis**.

Bodan, applied to Race No. 3 of **Corchorus olitorius** in Jessore.

Bogi=Bagi.

Bomi, applied to **Corchorus olitorius** in the 24-Pergannahs, and apparently derived from Bogi.

Bomukti=Bamukchi.

Botocari, Hem Chunder Kerr's rendering of Bhut-kori, as used in Birbhum.

Bugi, used by Hem Chunder Kerr for Bogi.

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Bugnal, a name quoted by Hem Chunder Kerr, probably incorrectly, as in use in the 24-Pergannahs for a race of **Corchorus capsularis**. The name suggests Bogi-nál, which would mean red Bogi.

Bun Muchki, spelling of Bomukti given by Hem Chunder Kerr as used in Dinájpur.

Bun pat, see Ban pát.

Bun phal, see Banphal.

Chaka Márá, an Assamese name for **Corchorus capsularis**.

Chánd pát, meaning silver jute, a name said by Hem Chunder Kerr to be used in Howrah.

Chat mára, said by Hem Chunder Kerr to be used in Lakhimpur.

Chattua, applied to **Corchorus capsularis** in Khulna.

Chhorán, meaning little, applied to Race No. 18 of **Corchorus capsularis** in western Mymensingh.

Chhotá Koshtá, used by Hem Chunder Kerr as a name for **Corchorus capsularis** in Pabna.

Chhotá pát, meaning little jute, applied to Race No. 18 of **Corchorus capsularis** in Mymensingh.

Chirá or Chirá-mirá, the edible **Corchorus capsularis** of Purneáh, Jalpáiguri and the Darjeeling-Terái. Mira is evidently the same word as Marua which see.

Chiral Naricha, a name quoted by Hem Chunder Kerr as applied in Dinájpur to an edible **Corchorus capsularis** doubtless Chira.

Chirua=Chira, pronunciation not uncommon in Jalpáiguri.

Choro pát, used by Hem Chunder Kerr as a name for **Corchorus capsularis** in Pabna.

Cowplá or kaupla applied to Race No. 3 of **Corchorus capsularis** in Faridpur and Bákarganj.

Deebri pat, said by Hem Chunder Kerr to be a name for a jute in Jessore.

Dehea pata, said by Hem Chunder Kerr to be used in Darrang.

Deodháli, meaning divinely white, applied to Race No. 11 of **Corchorus capsularis** in Tippera.

Desál, meaning 'country' and equivalent to Desoál and Desi, applied to Race No. 17 of **Corchorus capsularis**, in western Mymensingh.

Deshi Aus or Desi Aus, see Aus.

Desi pát, meaning 'country', applied generally to the commonest race in the district, to Race No. 3 of **Corchorus capsularis** in south Faridpur, to Race No. 8 in Dacca, to Races Nos. 4 and 5 of **Corchorus olitorius** in Nadiá, and to Races Nos. 1 and 2 of **Corchorus olitorius**, particularly No. 1, in Howrah, Hughli and the 24-Pergannahs.

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Desi Meghnál, applied to Race No. 21 of **Corchorus capsularis** in Bogra.

Desi Nallya, meaning country reed-jute, applied to Race No. 8 of **Corchorus capsularis** in Dacca.

Desi Lal pat, meaning country red jute, indicates in Howrah, Hughli and the 24-Pergannahs Race No. 2 of **Corchorus olitorius**.

Desál peti pat, meaning little country jute, applied to Race No. 3 of **Corchorus capsularis** in Faridpur.

Desoál or Deswál, meaning country, applied to Race No. 13 of **Corchorus capsularis** in Pabna.

Deo-nallyá, meaning divine reed-jute, applied to Races Nos. 1 and 2 of **Corchorus olitorius** in Dacca.

Dhálesbági or Dhálesbogi, meaning white bagi, applied to Race No. 4 of **Corchorus olitorius** in Faridpur and Bákarganj.

Dháleswári, meaning exceedingly white, applied to Race No. 1 in Faridpur, and apparently also in Nadiá, applied to Race No. 7 in Dacca, Tipperá and Sylhet.

Dháli, meaning white, an abbreviation of the name Deodhali.

Dhál Sundar, meaning beautifully white, applied to No. 7 of **Corchorus capsularis** in Dacca and Tipperá.

Dhamai, given by Hem Chunder Kerr as used in Máldá for **Corchorus capsularis** doubtless equivalent to Dhamar.

Dhámar, applied to a race, apparently No. 21 of **Corchorus capsularis**, in Purneáh.

Dhapa, probably meaning bright, a name reported from Faridpur for a race of **Corchorus capsularis**.

Dháulá Amon, meaning white late, applied to Race No. 24 of **Corchorus capsularis** in Mymensingh.

Dháulá Aus, applied to Race No. 26 of **Corchorus capsularis** in Goálpárá, to Race No. 17 in Mymensingh, and to Race No. 22 in Rangpur.

Dháulá Bhádiya or Dhála Bhadoya, meaning white early or literally of the month of Bhadar, applied to Race No. 22 of **Corchorus capsularis** in Purneáh, Dinájpur, Jálpáiguri and the Darjeeling-Terái.

Dháulá Bitri, applied to Race No. 26 of **Corchorus capsularis** in Goálpárá, and to Race No. 22 in Rangpur.

Dháulá Haimantiá, meaning white late, literally of winter, applied to Race No. 24 of **Corchorus capsularis** in Goálpárá, Dinájpur and the Darjeeling-Terái.

Dháulá Hewti, meaning white late, applied to Race No. 24 of **Corchorus capsularis** in Purneáh and Jalpáiguri.

Dháulá Kochan, meaning white Kochan, applied in Bogra to Race No. 1 of **Corchorus olitorius**.

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Dháulá Madái, applied in Dinájpur to Race No. 1 of **Corchorus olitorius**.

Dháulá pát, meaning white jute, applied to Race No. 17 of **Corchorus capsularis** in Bográ.

Dháulá Sánchia, meaning white sánchia, applied in Rájsháhi to the green-stemmed races of **Corchorus capsularis**.

Dhobsur, said by Hem Chunder Kerr to be applied to **Corchorus capsularis** in Mymensingh.

Dholi boran, applied to Race No. 1 of **Corchorus olitorius** in the 24-Pergannahs.

Dháulápát, meaning white jute, applied in Murshedabád to Race No. 13 of **Corchorus capsularis** and also to Races Nos. 1 and 4 of **C. olitorius**.

Dhules sepori, a name given by Hem Chunder Kerr as used in Tipperá; it is probably a mistake for Dháleswári.

Dhupri, meaning bright, a name reported from Faridpur for a race of **Corchorus capsularis**.

Djepon, the Javanese name for **Corchorus olitorius**.

Dudhsár, meaning like cream, applied in Máldá to a race perhaps identical with No. 13 or No. 1 of **Corchorus capsularis**.

Dudhshar=Dudhsar.

Dudhrás, applied to Race No. 1 of **Corchorus olitorius** in Rájsháhi.

Dulál, said to be applied to a race of **Corchorus olitorius** in Midnapur.

Emtál, applied to **Corchorus olitorius** in Murshedabád and the 24-Pergannahs.

Fulleshwári, see Phuleswári.

Gangajoli, meaning white like Ganges water, applied to Race No. 1 of **Corchorus olitorius** in Jessore.

Ghagri, possibly meaning round like a top referring to the fruits, applied to Race No. 2 of **Corchorus capsularis** and perhaps more generally to other races.

Ghi-nalita, a name found in old books which would mean "butter jute." In support of the genuineness of its use, there is the name, similar in meaning, of Ghrita Kanchan pát. Yet seeing that Bangi pát has apparently given rise in Bengal to Ban pat, why should not Bangi nalita have given rise to Ghi-nalita by the dropping of the misunderstood first syllable.

Ghrita Kanchan pát, the first two words meaning in Sanskrit golden butter, said by Hem Chunder Kerr to be applied to **Corchorus olitorius** (probably Race No. 2) in the 24-Pergannahs.

Ghonka, applied in Purneáh and Bhagalpur to the race Muniasi of **Corchorus olitorius** which is eaten (see p. 130).

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Gopal Choq, given by Hem Chunder Kerr as a name of **Corchorus capsularis** in Dinájpur.

Gorson, applied in Purneáh to the race Muniási of **Corchorus olitorius** which is eaten (see p. 114).

Halbiláti, applied to Races Nos. 1 and 2 of **Corchorus olitorius** in Tipperá.

Harruá or Harrawá, used in the United Provinces (Rohilkand) for **Corchorus capsularis.**

Hanumán pát, meaning Hanuman's jute, a name for **Corchorus capsularis** used in Midnapur.

Hematgár, applied in the 24-Pergannahs to **Corchorus capsularis.**

Hemtia, given by Hem Chunder Kerr as the name of a race of **Corchorus capsularis** in Dinájpur—the equivalent evidently of Haimantiá.

Hemtara, a word given by Hem Chunder Kerr as the name of a race of **Corchorus capsularis** in Murshedabád.

Hewti, Heoti, Hetiá or Hetwá, meaning late, an adjective used in Jalpáiguri and Goálpárá to contrast with Bhadcya.

Himtál, the equivalent of Emtál, used in Máldá for **Corchorus olitorius.**

Himatpát, applied to **Corchorus capsularis** in the 24-Pergannahs, and said also to be applied to **C. olitorius.**

Játi, a word used in Bogra, Rangpur, Jalpáiguri, Goálpárá and the Brahmaputra Valley to indicate **Corchorus capsularis.**

Játi Bhadoga, given by Hem Chunder Kerr as the name of a race of jute in Dinájpur: Bhadoga may be a misprint for Bhadóya.

Jhot pat or Jhut pat, the name for **Corchorus capsularis** in the district of Midnapur, possibly the origin of, or possibly derived from, the word 'jute'; if unqualified it means apparently Race No. 26 of **C. capsularis.**

Jhunt, said by Hem Chunder Kerr to be used in Cuttack.

Joli, used by Hem Chunder Kerr, and believed by us to be a mistake for Jati.

Kájia or Kájli, meaning dark, applied to Race No. 8 of **Corchorus capsularis** in Dacca and Tipperá.

Kákyá Bombái (origin unexplained), applied to Race No. 15 of **Corchorus capsularis** in Pabná and Bográ. Seeing that Kakya is pronounced Kashya in Bográ, it is possible that it and Koshtá have a common origin: while Bombái means of Bombay; but of course the race never came thence.

Kala Naricha, given by Hem Chunder Kerr as a name of **Corchorus capsularis** in Dinájpur.

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Kamárjáni pát, meaning jute plant of Kamárjáni in Mymensingh, applied apparently to Race No. 5 in Faridpur, northern Jessore and apparently also in Pabná and northern Nadiá.

Kanji, the name of **Sida cordifolia,** misapplied to **Corchorus olitorius** in the Thána district, Bombay.

Kártik sál or Kártik shál, meaning belonging to the month of Kartik or November, applied to Race No. 2 of **Corchorus olitorius** in Jessore.

Kashom ran, the Santali name for **Corchorus capsularis.**

Káshyá Bombái, the common pronunciation in Bogra of Kákyá Bombái.

Kauplá, applied to Race No. 3 of **Corchorus capsularis** in Faridpur and Bákarganj.

Khetra, a name said by Hem Chunder Kerr to be used in Midnapur.

Kochan, see Dháulá Kochan and Lál Kochan.

Kohap, a name reported from Faridpur for a race of **Corchorus capsularis.**

Kostá or Koshtá, widely used in the districts of Nadiá, Jessore, Khulná, the 24-Pergannahs, Howrah and Midnapur, and known in almost every district as a name for **Corchorus capsularis.**

Kotna Goraji, said to be the Mysore name of **Corchorus olitorius.**

Kuchiamuri, said by Hem Chunder Kerr to be a name in use in Mymensingh. The word looks as if denoting the 'márá' or jute of the Kuches.

Kuchmadan, applied in Bogra and western Mymensingh to Race No. 20 of **Corchorus capsularis,** and in Murshedabád and Nadiá to Race No. 5 of **C. olitorius.**

Kuchmardan pat=Kuchmadan.

Kuchni, applied to Race No. 21 of **Corchorus capsularis** in Bogra.

Kusta Dhanialia, said to be applied to **Corchorus olitorius** in Orissa.

Lál Aus or Lál Ausá, meaning red early, applied to Race No. 23 of **Corchorus capsularis** in Goálpárá and Rangpur.

Lál Bági pát, meaning red bági jute, indicates Race No. 5 of **Corchorus olitorius** in Faridpur, Bákarganj.

Lál Bhádiyá, meaning red early, or of the month of Bhadar, applied to Race No. 23 of **Corchorus capsularis** in Purneáh, Dinájpur and Jalpáiguri.

Lál Bitri, meaning red early, applied to Race No. 23 of **Corchorus capsularis** in Goálpárá and Rangpur.

Lál Ban pát, meaning literally red wild jute, but see Ban pat above—a name said by Hem Chunder Kerr to be in use in Howrah.

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Lál Dhámar, meaning red Dhámar, applied to a race apparently No. 23 of **Corchorus capsularis** in Purneáh.

Lál Haimantiá, meaning red late or of cold weather, applied to Race No. 25 of **Corchorus capsularis** in the Darjeeling-Terái and Goálpárá, and to a race of **Corchorus capsularis** in western Mymensingh.

Lál Hewtia or Lál Hetiá, meaning red late, applied to Race No. 25 of **Corchorus capsularis** in Jalpáiguri, Purneáh and Rangpur.

Lál Jhot pát, meaning red Jhot pát, a name in use for a race, probably No. 28 of **Corchorus capsularis** in Midnapur.

Lál Karái, a name said to be used in Mymensingh for a race of **Corchorus capsularis.**

Lál Kochan, meaning red, applied in Bográ to Race No. 2 of **Corchorus olitorius.**

Lál Koshtá, meaning red jute, a name in use for a race of **Corchorus capsularis,** probably No. 28 in Midnapur.

Lál Madái, meaning red madai, applied in Dinájpur to Race No. 2 of **Corchorus olitorius**.

Lál pát, meaning red jute, very loosely applied; applied in Murshedabád to Race No. 16 of **Corchorus capsularis,** to Race No. 6 in Faridpur, and to a race of **C. olitorius** that is eaten in Purneáh.

Lál Patwá, equivalent to Lál pát, applied to a race apparently equal to either No. 16 or No. 25 in Máldá.

Lál titá pát, meaning red bitter jute, a name used in the 24-Pergannahs for Race No. 27 of **Corchorus capsularis.**

Láli, meaning red, applied to Race No. 16 of **Corchorus capsularis** in Pabná.

Lanká Gori or Lanká Guriyá, meaning obscure, applied to **Corchorus capsularis,** in the districts of 24-Pergannahs, Howrah and Midnapur: also said to belong to a race of **Corchorus olitorius** in Midnapur.

Laskar Káni, said to be applied to a race of **Corchorus olitorius** in Midnapur.

Leha, given by Hem Chunder Kerr as in Dinájpur equivalent to Játi.

Lohkori mora or Loha Kori, said by Hem Chunder Kerr to be used in Darrang and Lakhimpur.

Lal Petre pat, a name occurring in Royle's Fibrous Plants, a mistake for Lál Bitri pát, and nothing to do with the Sanskrit for a leaf as Hem Chunder Kerr says.

Luckipore pat, said by Hem Chunder Kerr to be used in the 24-Pergannahs for a race **C. olitorius** (probably No. 1).

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

One fairly well-known Lakhipur is in the delta in Noákháli; another is in Goálpárá. But the name may be connected with neither of these.

Lucki Fool Bogi (Lákhi phul bogi), said by Hem Chunder Kerr to be used in the 24-Pergannahs for a race of **Corchorus olitorius.**

Madhur Nalitá, meaning sweet jute, a general name in Orissa for **Corchorus olitorius.**

Madhuri, a name given by Hem Chunder Kerr as used in Tirhut.

Márá or Morá, Assamese equivalent of Marua, see Bengal Mora. Chaka Mora, Chatmora, Lohkori Mora, Mitha mora, Pat mora, Tenga mora, Tíla mora.

Marna, given by Hem Chunder Kerr as a name for **Corchorus olitorius** in Dinájpur—probably a misprint for marua.

Máruá, a name for **Corchorus olitorius** in Jalpáiguri, the Darjeeling-Terái and Dinájpur; whence Buchanan Hamilton took the specific name for his **Corchorus Marua.** If qualified by Chira (*e.g.*, Chira Mira) it indicates the edible **C. capsularis,** or Chaka Mora of Assam.

Meghlál, equivalent to Meghnál, applied to Race No. 23 of **Corchorus capsularis** in Dinájpur, and to Races Nos. 2 and 5 of **C. olitorius** in Murshedabád.

Meghnál, meaning red cloud, applied to Race No. 6 of **Corchorus capsularis** in Faridpur, to Race No. 23 in Dinájpur and Purneáh, to Race No. 21 in western Mymensingh; applied to any red-stemmed **C. capsularis** in Murshedabád, and misapplied to **C. olitorius** in Purneáh and sometimes in Faridpur (to Race No. 2).

Melokyeh, the name in the Levant for **Corchorus olitorius.**

Merwah pát, said by Hem Chunder Kerr to be used in the Darjeeling district; doubtless Máruá or Miruá.

Miruá, equivalent to Chirua for **Corchorus capsularis** in Jalpáiguri, etymologically equal to Máruá.

Mitha Mara, given by Hem Chunder Kerr as used in Nowgong.

Mithá pát, meaning sweet jute, a general name in Lower Bengal for **Corchorus olitorius.**

Mithá Sánchiá or Sanchi, denotes **Corchorus olitorius,** as distinguished from **C. capsularis,** in the districts of Máldá and Rájsháhi.

Mora, see Mara.

Mora pata, said by Hem Chunder Kerr to be used in Kamrup and Lakhimpur; it is a curious combination of Márá (Assamese) and Pata (Bengali).

Mora sak, said by Hem Chunder Kerr to be used in Sibsagar.

Mouchlia, the Cretan name for **Corchorus olitorius.**

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Ranga bogi, meaning coloured bogi, applied to Race No. 5 of **Corchorus olitorius** in Faridpur.

Rangi, meaning coloured, applied to Race No. 21 of **Corchorus capsularis** in western Mymensingh.

Rangri pat, a name said by Hem Chunder Kerr to be used in the 24-Pergannahs.

Sádá Dhakái, said by Hem Chunder Kerr to be used for a race of **Corchorus olitorius** in the 24-Pergannahs.

Sádá pát meaning white jute, generally used in Lower Bengal to denote a green-stemmed race of **Corchorus.**

Sádá titá pát, meaning white bitter jute, applied to Race No. 26 of **Corchorus capsularis** in southern Jessore, the 24-Pergannahs and Howrah.

Sádu pát, meaning white jute, applied to a race of **Corchorus capsularis** in southern Nadia, probably Race No. 26.

San Patwá, applied to Race No. 22 of **Corchorus capsularis** in Purneáh.

Sánchi pat, applied in the 24-Pergannahs to Race No. 26 of **Corchorus capsularis.**

Sánchi Ranga, a name quoted by Hem Chunder Kerr as in use in the 24-Pergannahs, probably refers to Race No. 27 of **Corchorus capsularis.**

Sánchia, applied in Rájsháhi and in Máldá chiefly to green-stemmed races of **Corchorus capsularis**; but it is often used as exactly equivalent to pát. In Pabna it seems to be applied to the race Desoál

Sári bipli, a name for more than one species of **Corchorus** in the Punjab, among them **C. olitorius.**

Shádá pát, meaning white jute, applied in northern Jessore to a race of **Corchorus capsularis,** see Sádá pát.

Sháni, a name reported from Faridpur for a race of **Corchorus capsularis.**

Shona mukti, meaning golden tipped, a name reported from Bákarganj for a race of **Corchorus capsularis.**

Shukta pata, said by Hem Chunder Kerr to be used in Kamrup.

Sujmani, meaning sun bright jewel, applied to a race of **Corchorus capsularis,** very likely No. 6, in Faridpur.

Sunarong betina, given as the Malayan name for **Corchorus capsularis.**

Sutnalá, meaning thread reed, applied in Faridpur to Race No. 4, but we have found it inconsistently applied also to Race No. 1 in Nadia.

Sutpát, meaning thread jute, applied to Race No. 3 in Faridpur, Bákarganj.

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Tarikani Nalita, applied to Race No. 1 of **Corchorus olitorius** in Orissa.

Tati, given by Hem Chunder Kerr as a name for **Corchorus capsularis** in Dinájpur, but probably a misprint of Jati.

Tebra, a word used in Bogra to indicate **Corchorus capsularis.**

Tepári, meaning round, applied in Murshedabád and Nadia to **Corchorus capsularis.** Compare Ghagri.

Thachela, said by Hem Chunder Kerr to be a name in use in Noákháli.

Titá Mara or Téta Mara guti, said by Hem Chunder Kerr to be applied to **Corchorus capsularis** in Singbhum and also in Nowgong and Lakhimpur.

Titá pát or Teto pata, meaning bitter jute, commonly used in southern Bengal to denote **Corchorus capsularis.**

Tita Sánchia, denotes **Corchorus capsularis** in the district of Máldá.

Tolla, derived from dháula, meaning white, applied to Race No. 4 of **Corchorus olitorius** in western Mymensingh.

Tosa = Tosha.

Toshá, doubtfully derived from dháula (pronounced dhola), meaning white, applied in Pabna to Races Nos. 1 and 2 of **Corchorus olitorius.**

Udhap, meaning bright, is Race No. 4 of **Corchorus capsularis** in Faridpur.

SUMMARY.

SUMMARY.

In the above pages, after briefly enumerating some of the ways in which the two jute plants,—**C. capsularis** and **C. olitorius**—vary in response to external conditions, we have discussed district by district the several races, first of **C. capsularis,** and then of **C. olitorius,** which we are able to distinguish. Our criterion for judging them has been their behaviour in cultivation on the Bardwán Experimental Farm since 1902 and at Pusa during the last two years. We have ended by keeping apart thirty-three races of **C. capsularis** including three only grown to serve as a vegetable, and five races of **C. olitorius.**

That we have kept apart so many races of **C. capsularis** is partly due to the necessity of separating things only somewhat similar pending further study.

The races of **C. capsularis** may be tabulated as follows:—

EARLY.

Green-stemmed . . { Aus of Mymensingh.
Dháula Biti of Rangpur = Dháulá Bhádyá of Jalpáiguri, etc., and San Patwá of Purneáh.
Baráeát of Mymensingh and Pabna.

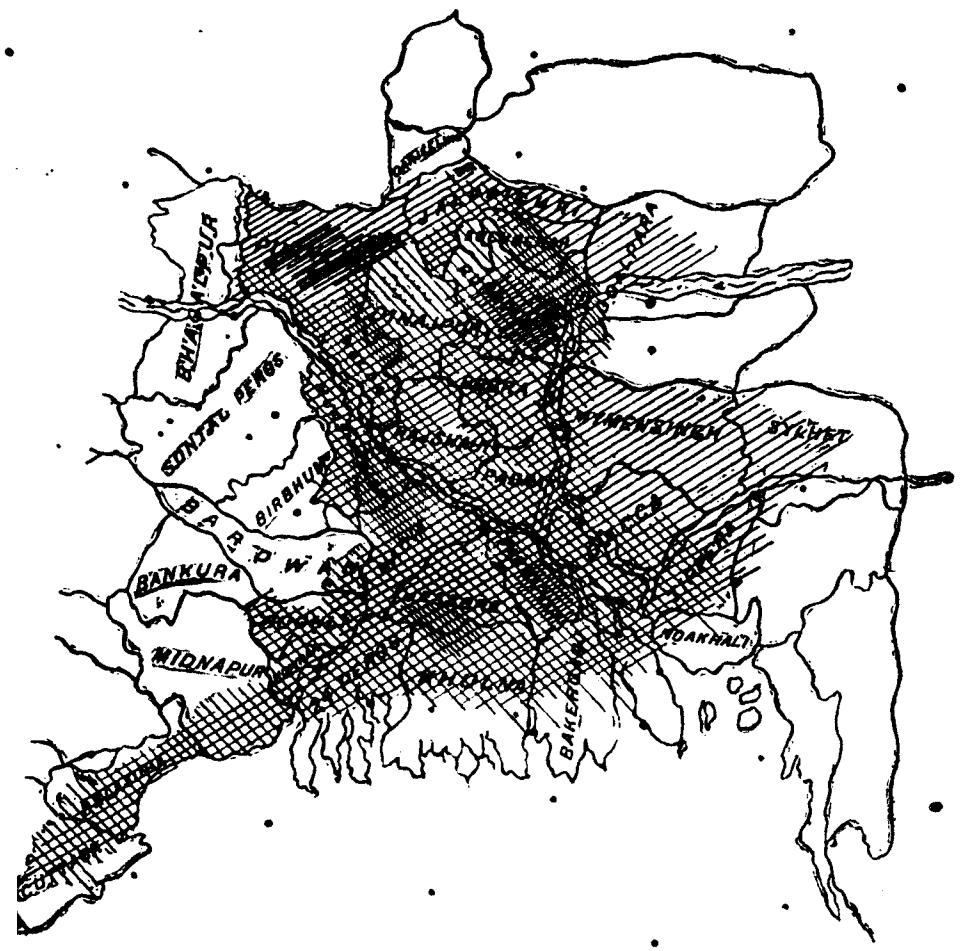
SUMMARY.

Red-stemmed		Chhotápát of Mymensingh. Lál Bitri of Rangpur = Lál Bhádyá of Jalpáiguri, etc. = the Meghnál of Purneáh.
	MID.	
Green-stemmed		Sádá Titá pát of Howrah, Hughli, etc. ? Dháulá Pitá Nalitá of Orissa. Udhap of Faridpur. Desoál of Pabná.
Red-stemmed		Meghlál of Faridpur. Láli or Náiltá of Pabná. ? Lál Titá pát of Howrah, Hughli, etc. ? Nál Pitá Nalitá of Orissa.
	LATE.	
Green-stemmed		Amon of Faridpur. Sutpát of Faridpur. Belgáchi of Dacca and Faridpur. Dháuleswári of Dacca and Tippera. Desi of Dacca. Deodháli of Tippera. Phuleswári of Tippera. Kákyá Bombái of Pabná and Bográ = Barán of Mymensingh. Dháulá of Rangpur, etc., = Hetiá or Dhala Haimantiá of Dinájpur, etc. Barápát of Cuttack.
Red-stemmed		Kájlá of Dacca and Tipperá. Bidyá Sundar of Dacca and Tipperá. Nál Hetiá of Rangpur, etc.

The races of **C. olitorius** are merely these :—

	EARLY.	
Green-stemmed		Dháles bogi of Faridpur and Nadia.
Red-stemmed		Lál bogi of Faridpur and Nadia.
	LATE.	
Green-stemmed		Desi pát of Hughli = Tosha of Pabna in part.
Red-stemmed		Desi lál pát of Hughli = Tosha of Pabna in part.
	VERY LATE. (Doubtful race.)	
Red-stemmed		Bodar of Jessore.

It will be at once noted from the above that red-stemmed races are fewer in number than green-stemmed. The curious unexplained local preferences for red-stemmed and green-stemmed races are illustrated in the accompanying map, wherein the shading from right to left indicates the cultivation of green-stemmed plants, and



The Jute area - cross shading in one direction indicates red stemmed races and in the other green stemmed races.

SUMMARY. shading from left to right, the cultivation of red-stemmed plants. The chief areas for red-stemmed plants are in northern Dinájpur, along the lower parts of the Tista river, along the big rivers below Jagannáthganj, Sára and Narsingdi, and near the lower parts of the Bhágirathi and other rivers of the districts of the 24-Pergannahs and Khulna. Except that red so greatly predominates in northern Dinájpur, these areas are all near large rivers. Green-stemmed races prevail to the exclusion of red in the north of the Purneáh and Jalpáiguri districts, in the Dárjeeling Terai and in Mymensingh except its western edge. All these are regions of higher lands.

Early races of **C. capsularis** are chiefly northern, and late races chiefly southern: early races of **C. olitorius** are chiefly confined to the districts of Faridpur and Nadia; while late races occur in the districts round, but chiefly southwards. Late **C. olitorius** is grown nowhere in those northern districts where late races of **C. capsularis** give way to early ones. So that taking both the species together it may be stated that the nearer the crops are to the heart of the delta of the Ganges the later are the races grown.

It is more than probable that the various races grown for fibre have been produced in India by local selection, the ryot having chosen what seemed to him desirable. He has not worked with the intelligence and success that would have attended Western efforts, but still he has worked, and the recognition of the superiority of some races has resulted in the application of curiously hyperbolic names to them.

As a sequel to the work that is embodied in this paper, we have planned and already commenced selection experiments for the evolution of better races, and further we are continuing work upon the points mentioned above as not cleared up. We ask for criticism from those engaged in the jute trade as it is certain to be useful to us.

Those interested in particular districts will find where they are discussed from the following brief index:—

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I. HENRY BURKILL,

Officiating Reporter on Economic Products to the Government of India.

ERRATA.

No. 2 (1907). Tamarindus indica.—The uses and composition of Tamarind Seeds—

Page 15, line 17 from bottom, *for* Nesbit *read* Nisbet.
" 16, " 8, *for* 1366 *read* 366.
" 16, " 9, *for* Davis *read* Davies.
" 16, " 14, *for* Ramgopul *read* Ramgopaul.
" 16, " 16, *for* Brandt *read* Brannt.

No. 4 (1907). Aleurites moluccana.—The Candle-nut tree :—

Page 33.—Table of Analyses, column 4, *for* De Negre *read* De Negri.

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