BENGAL ECONOMIC MUSEUM.

REPORT

ON THE

DYES AND TANS OF BENGAL

COMPILED BY

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PREFACE.

It is necessary to prefix to this report a few words to explain its origin and nature and the long delay in its appearance.

The enquiry upon which it is based, and the similar enquiries in the other provinces of India, originated in certain experiments made by Mr. Thomas Wardle, F.G.S., on modes of dyeing the wild silks of India. In submitting a report on these experiments to the Secretary of State (1st February, 1875), Mr. Wardle drew attention to the lack of information regarding Indian dye-stuffs, and impressed upon His Lordship the desirability of instituting an exhaustive enquiry into the subject. Acting on this suggestion, the Secretary of State directed the Government of India to "take steps to collect information on the various dye-stuffs of Indian growth and production, and to collect and forward to the India Office working samples of dye-stuffs, as well as of tusser and other wild silks, in order that Mr. Wardle may be in a position to continue his experiments" (11th March, 1875). The Government of India accordingly directed all Local Governments and Administrations to institute these enquiries in their respective provinces, and to collect working samples of dye-stuffs as well as of the tusser and other wild silks. The Government of Bengal placed this enquiry in the hands of the Central Committee of Management of the Bengal Economic Museum. The scope of the enquiry is sufficiently indicated in the following extract from a letter of instructions from the Secretary to the Government of India, Department of Revenue, Agriculture, and Commerce, to the Secretary to the Government of Bengal, No. $\frac{2}{12}$, dated Simla, 25th May, 1875 :—

> "I am desired to request that particular attention may be paid to the collection, so far as may be practicable, of facts under the following heads :—
>
> (1) Scientific and local vernacular names of the dye-stuffs produced in the province.
>
> (2) Average approximate extent of cultivation annually in each district for the last five years.
>
> (3) Cost and profits of cultivation.
>
> (4) Season and methods of cultivation.

(5) Average estimated quantity of the dyes produced during the last five years.

(6) Proportion of the quantity produced which is absorbed locally and which is placed in the market. What are the principal markets to which the dyes are forwarded?

(7) Methods locally employed for extraction of the dye.

(8) Uses for which each dye is commonly locally employed (viz. nature of fabric), and processes of application generally practised. Under this head should be given a full account of the mordants locally employed, and it should be stated what shades of colours are produced, by what combinations, and whether the colours are permanent or fleeting.

(9) Average price of each merchantable dye-stuff, according to quality, in the market.

(10) Total annual trade in each kind, stating the countries of import and export.

(11) To what extent is European capital employed in the production and manufacture of indigo and other dyes.

His Excellency in Council also requests that attention may be directed to the subject of the competition of aniline dyes with dyes of local production. It should be stated how far this competition has been successful, what are the prospects of Indian dyes in Bengal, and whether any measures seem to be required for the encouragement of this branch of industry.

I am further to request that the fullest information available on the subject of tans of Indian production may also be furnished."

Circulars requesting information under these heads were sent to all Commissioners of Divisions in July, 1875, and the replies, as received, were forwarded to the Secretary to the Committee of the Economic Museum, "in order that the materials obtained may be digested and the Government favoured with a general report on the subject." Further enquiries arising out of these replies were made, either indirectly through the Government of Bengal, or directly by the Secretary to the Committee of the Museum through its organisation of Local Committees in the various districts. Mr. H. H. Locke, the Secretary to the Museum Committee, was at great pains to correct the innumerable inaccuracies and discrepancies in the returns received; and for that purpose, and also with a view to eliciting additional information, carried on enquiries for several years. In these enquiries particular attention was directed to the less known dyes, or those prepared simply for local or home use and never finding their way into the market, as ample information regarding such dye-stuffs as indigo, lac, safflower, turmeric, myrabolans,

was already available. The result was the accumulation in the Museum of a mass of letters containing new and interesting detailed information regarding the dyes of Bengal. In the case of many unknown dyes, Mr. Locke took the trouble to obtain from the district officers growing specimens of the plants producing them, which Dr. King, of the Royal Botanical Garden, Seebpore, kindly identified. In November, 1877, and March, 1878, four cases containing samples of Bengal dye-stuffs and a collection of 108 samples of fabrics dyed therewith (Appendix B) were despatched to the Secretary of State. But owing to a variety of causes into which it is needless to enter here, chief amongst which was that the Museum staff was constituted on a scale totally inadequate to the variety of work expected of it, nothing was done at the work of compilation, in spite of repeated pressure from the Government of Bengal at the instigation of the Government of India. At last, in 1880, the Government of India, despairing of the deferred report from the most important province of India, ordered the reports received from the other provinces to be worked up into one account, and Mr. Liotard, of the Agricultural Department, drew up his "Memorandum on Dyes of Indian Growth and Production," from which Bengal and Coorg are omitted. During the years 1880, 1881, and part of 1882 the small Museum staff was almost altogether employed on work connected with the Melbourne International Exhibition of 1880 and the Calcutta Exhibition of Indian Art Manufactures held in the early part of 1882, and it was found impossible to do anything towards the compilation of this report. When I took over charge of the Museum office at the end of May, 1882, on Mr. Locke's departure on furlough, the compilation of this long-delayed report was amongst the many arrears that it fell to my lot to work off. A clerk had been specially employed for a month in making abstracts of the correspondence, which had been partially indexed, and various incomplete tables had been drawn up: but this was all that it had previously been found possible to do. During the year in which I have officiated as Secretary, I have done my best to compile this sadly-delayed report, undertaken as far back as 1875, with as little delay as possible; but as I have only been able to devote to it the leisure left after many more exacting occupations, I have found it impossible to complete it under a year, which perhaps may not be considered an excessive time for the task, taking into account the great amount of detail contained in it, and that the only special assistance I have had is that of a clerk employed for two months in making abstracts of the correspondence.

This statement will make many obvious shortcomings in the report intelligible. As it had been so long delayed, all other considerations had to yield to the necessity of getting it issued as soon as possible. The statistics sent up by the various district officers abound in all kinds of striking discrepancies and inaccuracies; but as they were collected several years ago by officers no longer resident in these districts, it would have been impossible to rectify these by further enquiries without considerable additional delay; and I have therefore contented myself with reproducing the statistics as I found them, merely drawing attention to the more important errors and inconsistencies. Further, the information placed in my hands as a basis for the report was already five or six years old, having been collected during the years 1875-77. Where it was possible to extend this information to the present day without much trouble, I have done so; but where, as was generally the case, to do so would have required a fresh series of enquiries, still further delaying the report, I have judged it best to enter the information in our possession, merely drawing attention to its date. It must then be clearly understood that this report, published in 1883, relates generally to the state of things from 1875 to 1877, so that in many points it may already be obsolete. It must also be understood that it makes no profession of being a complete account of Bengal dyes and tans. I have confined myself almost exclusively to the special information contained in the returns referred to, and have not thought it necessary to incorporate matter from other sources already available, except where this was advisable in order to make the account here given readily intelligible. This will explain the fragmentary entries under many of the dyes.

As this report is virtually a supplement to Mr. Liotard's Memorandum above referred to, containing for Bengal information corresponding to that therein given for the rest of India, I have thought it advisable to follow in the main his classification for convenience of reference, without troubling to enquire whether a better could not be devised. I have, however, entered the methods of dyeing with the various dye-stuffs under the dye-stuffs concerned, instead of separately according to the nature of the fabric. The dyes are classed according to the colour they give when employed alone. Methods of dyeing compound colours, such as green, orange, &c., will be found described under the dyes which give the component colours. Thus methods of dyeing green with indigo (blue) and turmeric (yellow) will be found referred to both under "indigo" and "tur-

meric." The vernacular names given are those reported by the district officers as in actual use in their districts, and the original spelling of the district reports is retained. Many dye-stuffs had not been identified, the native names alone being given. Some of these I have succeeded in getting identified, but there are a good many remaining unknown, which I have simply entered under their native names. I have not been able to find any complete record of those cases in which growing specimens of the dye-producing plants were sent down to Calcutta for identification, and in many cases I have found nothing to show how the scientific name of the specimen as entered on the Museum labels was arrived at. For these reasons I must claim some indulgence if, as is probable, there are many errors in the report in the identification of specimens.

In Appendix A I have drawn up a list of all the identified vegetable dyes of which information has been obtained in the course of the enquiry of which Mr. Liotard's Memorandum and this report are the results, with references to the pages where the methods of dyeing will be found described.

As the scope of the original enquiry included information regarding tans of Indian production, a chapter has been added on "Tans and Tanning in Bengal." But the information obtained was found to be exceedingly fragmentary, and this chapter makes even less profession than the rest of the report to be a complete account of its subject. It is to be considered merely as a collection of the fragments of information in the files of the Economic Museum.

The publication of this report completes the enquiry set on foot eight years ago by the Secretary of State, and Mr. Liotard's Memorandum and this volume contain the special information so collected. The object of the enquiry was to obtain sufficient data upon which to base experiments as to the possibility of developing and improving methods of dyeing with native Indian dyes; and although this object may have been lost sight of, owing to the long delay in the completion of the enquiry, it is to be hoped that the project may be revived. There can be no doubt that amongst the vast number of Indian dyes there are many that might be developed into flourishing industries, and there can be equally little doubt that this development will never take place through the native dyers themselves, who are content to follow generation after generation the primitive methods handed down to them by their predecessors. The number of trained technical chemists in India is too small to hope for anything from them, and it

might not be out of place to suggest that great results might follow if Government would send out to this country one or two trained chemists or scientific experts in dyeing to conduct a series of experiments with the special object of developing native dyeing industries. Improvements in these cannot be hoped for from the private enterprise of European firms, nor from the efforts of native dyers themselves, and the course recommended seems the only one likely to lead to any tangible result.

In conclusion I must express my obligations to Dr. G. King, Superintendent of the Royal Botanical Garden, Seebpore, who, as a Member of the Committee of the Economic Museum, was of frequent service to Mr. Locke, in advising him as to the course of the enquiry, and who identified many of the specimens of dye-producing plants forwarded. Mr. L. K. Brace, Curator of the Herbarium, Royal Botanical Garden, Seebpore, has also kindly identified several specimens for me. I am indebted, too, to Dr. G. Watt, Bengal Educational Service, for many useful hints and suggestions, and for the identification of many specimens. I must also express my obligations to several firms in Calcutta whom I have consulted whilst the work has been going through the press, and who have been kind enough to read over those parts of the proof relating to the dyes of which they possessed a special knowledge. These are Messrs. W. Moran & Co. (indigo), Messrs. W. Haworth & Co. (lac), Messrs. Struthers & Co. (turmeric), Messrs. Duncan Brothers & Co. (safflower), and Messrs. C. H. Bailey & Co. (cutch). Lastly, I must acknowledge my indebtedness to Babu Nagendra Nath Dutt, the clerk employed, as above mentioned, for two months in making abstracts of the correspondence upon which this report is based, whose careful and accurate work has considerably lightened the labour of compilation.

HUGH W. M'CANN.

August, 1883.

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ERRATA.

Page 3, lines 7 and 8, for "Nos. 12183 and 12184, silk thread," read "No. 12183, silk yarn, and No. 12184, cotton yarn."

„ 3, line 24, for "p. 140" read "p. 142."

„ 4, line 9, for "palna" read "palua."

„ 16, line 4 from bottom, for "p. 125" read "p. 126."

„ 20, line 20 from bottom, for "achu" read "achhu."

„ 20, line 9 from bottom, for "Rallum, রল্লম," read "Rállum, রাল্লম."

„ 25, second footnote, for "20 maunds" read "200 maunds."

„ 34, line 17, for "yarns" read "woollen yarns."

„ 39, line 12, for "pp. 143, 152," read "pp. 145, 154."

„ 40, line 14 from bottom, for "pp. 152, 153," read "pp. 154, 155, 156."

„ 48, line 7 from bottom, for "p. 141" read "p. 142."

„ 49, line 20 from bottom, for "*Polygonum sp. ?*" read "*Fagopyrum esculentum.*"

„ 55, line 14 from bottom, for "p. 151" read "p. 153."

„ 56, line 8, for "p. 138" read "p. 139."

„ 66, line 18, for "p. 155" read "p. 158."

„ 88, line 24, for "achchu" read "achhu."

„ 89, line 3 from bottom, for "p. 152" read "p. 154."

„ 91, line 20, for "p. 152" read "p. 154."

„ 91, line 6 from bottom, for "sequi-oxide" read "sesqui-oxide."

„ 108, line 1, for "fo" read "for."

„ 127, line 23, for "Nux Vomica" read "Nux-vomica."

„ 133, line 12 from bottom, for "places" read "prices."

„ 139, last line, for "obtained" read "obtained."

„ 162, line 2, for "asur" read "asan."

CHAPTER I.

Dye-stuffs giving Red Dyes.

1. Cæsalpinia Sappan.
2. Carthamus tinctorius.
3. Mallotus philippinensis.
4. Morinda tinctoria.
5. Morinda citrifolia.
   Var. *M. bracteata.*
6. Morinda angustifolia.
7. Morinda persicæfolia.
8. Morinda sp.
9. Nyctanthes Arbor-tristis.
10. Oldenlandia umbellata.
11. Rubia cordifolia.
12. Lac-dye.

13. Cassia Fistula.
14. Erythrina indica.
15. Hibiscus Rosa-sinensis.
16. Peristrophe tinctoria.
17. Pterocarpus santalinus.

18. Gerimati.

1. Cæsalpinia Sappan, *Linn.*—Nat. Ord. LEGUMINOSÆ. BAKAM.

Bakam or Bakkam, বকম, ৯৭৪, ﺑﻜﻢ, বক্কম.
Tairi, Tari, or Tori (Behar).
Lati (fruit), (Maldah).

The only district of Bengal in which this tree is reported to grow abundantly is Cuttack, more especially in Jagatsinhpur and Sálípur and Gurjats. Much of the wood is exported hence to Calcutta and the Deccan. In several other districts it is cultivated to a slight extent, and in many is found wild, but not in any abundance, except, perhaps, in Balasor. In Balasor it is stated to grow wild, especially in the hill territories to the west of the district, and every village is said to have its supply of bakam-trees with which to furnish itself with the colouring matter for *ábir* powder. The only districts for which the extent of area under cultivation is given are Faridpur and Jessor. In Faridpur it is said that about 5 bighas of land in small plantations are sown with bakam: in Jessor 199 bighas of land are under cultivation. Nearly all the other districts import sappan-wood from Calcutta, which receives it from Burmah and Siam, and also from Cuttack and Jessor. But in nearly all the plant is either found occasionally growing wild in the jungles or else is here and there cultivated. In those districts in which it only grows to a slight extent, it is the imported sappan-wood alone that is used for dyeing purposes.

Particulars of growth.

Where the plant is cultivated, the seed is sown in April or May in well-tilled ground. After the plants have appeared above ground, very little care is required. The trees come to maturity in about 20 years, attaining a height of about 40 feet, and are cut down in January. The sappan-wood grown in Bengal is said to have all the properties of Brazil-wood, but to be less dense, and incapable of polish.

BAKAM.

Very little information has been obtained regarding the cost and profits of cultivation of this tree, or the average quantity of bakam-wood produced in those districts where the tree is cultivated for its dye. The Collector of Faridpur states that as the tree takes at least 20 years to come to maturity, the rent of the land for these 20 years may be considered as the sole cost of cultivation. Estimating this at Rs. 3 per bigha per annum, the rent for 20 years amounts to Rs. 60. On an average a bigha yields 50 maunds of the wood, sold locally at Rs. 5 per maund. This gives Rs. 250 as the return from each bigha in 20 years. Deducting the rent, we arrive at Rs. 190 profit for 20 years, or, say, over Rs. 9 per bigha per annum. The Collector remarks that it is thus as profitable a crop in the long run as any of the ordinary crops cultivated by the ryots.

Cost and profits.

In Jessor, where there are about 200 bighas of land under cultivation, the cost of cultivation is estimated at Rs. 5 per bigha, and the profit at Rs. 20 per bigha. The average annual produce is given as 1,000 maunds of the wood, of which 938 maunds are consumed locally and 62 maunds exported to Calcutta. The average price at which the wood sells in this district is given at Rs. 2 per maund, which is lower than the price stated in any other district. In the 24-Parganás the cost of cultivation is given at Rs. 30 per bigha, and the profit at Rs. 70 per bigha.

It will thus be seen that in the three districts from which estimates of cost and profits have been received there are the widest discrepancies: most probably the estimates are untrustworthy. The method by which the figures are arrived at is given in the returns from Faridpur, but not in those from Jessor and the 24-Parganás. The only district besides Jessor from which an estimate of the quantity produced has been received is Maldah, in which about 7 maunds of the dye are said to be produced annually for local consumption.

The average price of bakam-wood varies from Rs. 2 to Rs. 8 per maund, according to the district. The price in Maldah is given at Rs. 80 per maund, and in Monghyr at Rs. 1½ per seer, or about Rs. 60 per maund; but these are probably mistakes for Rs. 8 and As. 1½, which would agree fairly well with the run of prices elsewhere.

Price.

Extraction of the dye and processes of dyeing.—The process of extracting the dye is very simple. The *wood* is either cut into small pieces or else pounded into a powder in a native mortar (dhenki), and is then boiled in water for from 5 to 8 hours.

Before being cut up or pounded, the wood is stripped of its bark, which is not apparently generally used for the extraction of dye. However, in some parts of Bengal the *bark* alone seems to be used for this purpose, if we may rely upon the information given by the Commissioner of the Rájsháhí and Kuch Behar Division, who writes—"Bakam is a scarlet dye obtained from the *bark* of the bakam-tree, which grows in the Rájsháhí and Maldah districts. To extract the dye, the *bark* is boiled till the water attains the necessary consistency and tint." In Monghyr the *legumes* of bakam, locally called "tairi," are also used to produce a dye, the process of extracting which is given

below. In the 24-Parganás it is stated that the dye is generally made from the *pith* alone, which is torn into small strips and boiled in water.

Dyeing.

The liquid obtained by boiling the wood as above is of a pale *red* colour. Cloth or yarn to be dyed red is sometimes simply steeped in this infusion for about half an hour without the use of any mordant. (Nos. **12183** and **12184**, silk thread dyed by Calcutta native dyer: No. **12968**, cotton, Balasor.) The following details of the process of dyeing thread in the Rájsháhí district are given by the Collector:—

> "12 chittacks of bakam-wood are cut into small pieces and are boiled in 25 seers of water till 10 seers alone remain. The solution is put aside, and the same wood again boiled in another 25 seers of water down to 10 seers. These two portions of 10 seers each are then well mixed together, divided into two equal portions, and allowed to cool. The thread is then left in one of these solutions for 3 or 4 hours, wrung out, and dried. It is then treated in precisely the same way in the other solution, and finally acquires a deep *brick-red* colour."

Alum as mordant.

But *alum* is sometimes employed as a *mordant* to fix the colour, being added to the water in which the pounded bakam-wood is boiled. In Cuttack the wood is boiled with both *alum* and *turmeric*; in Maldah, with *alum* and *tori* (seed-pods of another species of *Cæsalpinia*, see p. 140).

Black dye from seed-pods.

The *legumes* of *Cæsalpinia Sappan*, locally called *tairi*, are used in Monghyr to give a blackish dye with *hirakosh* (protosulphate of iron):—

> "Pound ½ chittack of *tairi* and put it in a seer of cold water. After 2 or 3 hours rub it well with the palms of the hand. In the same way pound and put in cold water a small bit of *kasis*, known in Bengal as *hirakosh*: mix the liquids together and dip the cloth in the resulting solution. The resulting colour is a *blackish grey*. To dye 60 yards of cloth 1 yard wide, 1 seer of tairi and 2 chittacks of kasis are required.
>
> (No. 11173, cotton.)

Combinations with other dyes.

The only combinations of bakam with other dyes to produce compound colours of which information has been received from Bengal are—

(i) Chaikatha (bark of *Piper Chaba*) and bakam give a light brownish *red* (?). (Nos. **11345** and **12967**, cotton.)

(ii) Lodh or nidhu (bark of *Symplocos racemosa*) and bakam give a brownish *purple*. (No. **11347**, cotton.)

These two combinations are used in the Balasor district. The specimens were dyed by steeping for half an hour in an infusion prepared by boiling the dye-stuffs in equal proportions for 8 hours.

(iii) Safflower (*Carthamus tinctorius*), bakam, and alum give a dark *purplish brown*. (No. **6679**, cotton, Darbhangah.)

(iv) Bakam, indigo, and alum give a *bright purple*. (Nos. **12185**, silk thread, and **12186**, cotton thread, dyed by Calcutta native dyers.)

Abir powder.

In Balasor and Dacca, and probably in other districts, bakam is used for colouring ábir or phag, the well-known red powder used during the holi festival.

BAKAM. The Collector of Balasor gives the following account of the preparation of the ábir powder:—

"Every village almost has its supply of bakam-trees from which to furnish itself with ábir. A fair-sized tree can be purchased for Rs. 4 or Rs. 5, and will give colouring matter for 8 or 10 seers of the powder. This home-made powder is practically without competition, and it is thus made. A bakam-tree is stripped of its branches, which are cut up and boiled in water, to which lodh (bark of *Symplocos racemosa*) is added. The roots of the palna, called also anahuldi, or, in Bengal, banhuldi (*Curcuma Zedoaria*), are dried and pounded fine. The powder so obtained is strained through a fine cloth and then mixed with the bakam water. It is alternately mixed with the water and dried until the desired colour is obtained. The powder is then thoroughly dried, and is ready for use. Its colour is a dark pink; it is very cheap, and can be purchased at the holi season at from 3 to 4 annas per seer."

A similar process, adopted in the Maimansinh district, is described under *Curcuma Zerumbet*, p. 87.

KUSUM. ## 2. Carthamus tinctorius, *Linn.*—Nat. Ord. COMPOSITÆ.

Kusum, কুসুম, ಕುಸುಮ, كسم, કુસુમ।

Safflower is cultivated more or less extensively in all parts of Bengal, generally as a subsidiary crop along with other more paying crops, but in many districts by itself. The principal districts in which it is grown to any extent by itself are the Dacca districts (especially Faridpur): in nearly all other districts it is grown as a subsidiary crop. The following estimates have been received as to the extent of the area under cultivation in various districts:—

Areas under cultivation.

Bardwán	...	about 1⅓ acres.	
Bánkurá	...	„ 4 or 5 bighas.	
Midnapur	...	„ 15,000 acres.	
Jessor	...	„ 18 bighas.	
Maldah	...	„ 60 to 1,000 (₹ 100) bighas.	
Pábná	...	„ 40 bighas.	
Dacca Division	...	„ 35,000 bighas.	(11,550 acres.)
Faridpur	...	„ 1,000 „	
Chittagong	...	„ 1½ acres.	
Tipperah	...	„ 521 „	(in 1876: varies greatly from year to year.)
Patná	...	„ 162 „	
Gayá	...	„ 2,262 „	
Darbhangah	...	„ 300 „	
Champáran	...	„ 160 „	
Monghyr	...	„ 2,000 „	(5,000 bighas.)
Santál Parganás	...	500 bighas.	
Hazáribágh	...	100 „	
Lohárdagá	... Palámau,	50 to 60 acres.	
	... Chutiá Nágpur,	50 bighas.	

These figures are in many cases only the very roughest approximations, as in most of these districts *kusum* is grown as a subsidiary crop broadcast with others; and it is obviously in such cases almost impossible to estimate what extent of land would be covered by it alone.

Details of cultivation.

As regards the season and methods of cultivation, there does not seem to be anything distinguishing Bengal from the rest of India in this matter, and the general description of the methods of cultivation in India given in Mr. Liotard's Memorandum applies fairly well to Bengal. It is in all districts a *rabi* or cold-weather crop, that is, a crop sown towards the end of the monsoon and coming to maturity about January or February. The time of sowing varies in different districts from the latter end of September to the earlier part of November. In the Dacca Division the sowing lasts apparently till the beginning of December; in Chittagong the safflower seed is sown in the months of December and January. It appears to be everywhere raised from seed, and not from cuttings planted out. Where it is raised as a subsidiary crop, it is sown broadcast indiscriminately with the principal crop, and never apparently in separate drills, as seems to be the case in other parts of India. It is sometimes sown on the borders of other crops, serving when grown as a hedge to separate fields of different owners. It seems to be sown indiscriminately with any cold-weather crop: in Hazáribágh, with wheat, gram, or mustard; in Chittagong, with tobacco and chillies; in Chutiá Nágpur, between opium fields; in Midnapur, sometimes with cotton (kapas); in Monghyr, with wheat, barley, oats, mustard, poppy, and cheena; in Maldah, with lentils. In the Patná Division it is reported that there are two kinds of kusum, called respectively *bhuilee* and *kutela*, the former being by far the better quality. Bhuilee is grown in potato and paddy fields; kutela, on the borders of corn fields. These are possibly the same two varieties as those reported in Mr. Liotard's Memorandum as occurring in Berar under the names of bodki (without thorns) and kâti (with thorns), the former of which gives the better dye. Where it is sown with other crops, the method of cultivation proper for these is followed; no change being made on account of the safflower. When sown by itself, the soil is first well broken up by ploughing three or four times. The seed is then sown broadcast. In most districts it seems to grow best in low-lying lands near rivers. From Dacca we are told that low lands along the banks of rivers and canals are best suited to the cultivation of safflower, and that it grows luxuriantly on any lands left uncultivated for a year or two. The Collector of Murshidábád reports that safflower is cultivated on the churs of the Ganges and the Bhágirathi, and that the finest crops in the district are produced in the sandy loam of the Gangetic alluvium between Aurangábád and Dhulián. From Tipperah we are told that newish chur lands are the favourite soil. In other districts, however, high lands seem to be preferred for the cultivation of safflower. Thus in Hazáribágh the safflower is cultivated on high lands alone; and in Jessor, where it is grown on both high and low lands, the plant seems to come more rapidly to maturity on the high lands than on the low, as the blossoms are plucked in the former case in Phálgun and Chaitra (February and March) and in the latter in Baisákh (April). The plant shoots up vigorously, attaining the height of about a foot in a month's time: it eventually grows to the height of about 3 feet.

Soils most suitable.

KUSUM.

The amount of attention required after sowing seems to vary greatly in different districts and in different soils. In some districts irrigation is required, in others not. For example, in Lohárdagá the safflower fields are twice irrigated: in the Dacca Division, however, it is specially mentioned that no irrigation is required,—only digging and weeding. In some districts, as Lohárdagá, it is freely manured with cowdung and ashes. In Dacca weeding takes place in December and January, before the plant begins to flower. In districts where the soil is good and only small patches of land are sown with safflower, no care whatever is taken of the crop, which is left to take care of itself, or only occasionally irrigated until it flowers. Rain is beneficial to the plant when about a foot high, and injurious afterwards, especially when in flower (Jessor). Sometimes, when the plant is a foot high, the heads are cut off, so as to cause it to branch more and yield a larger number of flowers. The flowers first appear at various times from December to February. They are at first of a bright yellow colour, reddening a little afterwards. The petals of the flowers are plucked three or four times in the season to form the dye-stuff: the capsules containing the seeds are left to ripen, which they do in about 15 days. The stalks with the capsules are then plucked, dried, and thrashed, and the seed collected for the purpose of extracting from it a fine clear oil, used by the lower classes for cooking purposes and lighting. This is the only oil used in many places by the lower classes for burning. In several districts, where safflower is cultivated only to a small extent in patches here and there, it is cultivated more for this oil than for the dye which can be extracted from the flowers. The leaves of the young plant are also eaten as a vegetable by the poorer classes, and the ashes of the plant are in several places used by village washermen as a substitute for fuller's earth in bleaching clothes.

Statistics of cultivation.

The figures obtained from the several districts showing the cost and profits of cultivation and the average annual yield for the five years preceding 1875 are to a large extent untrustworthy. Where the flower is only grown as a subsidiary crop, it is obviously a matter of the greatest difficulty to estimate the cost and profits of cultivation per bigha or acre; and there are equal difficulties in estimating the yield of safflower dye where the plant is only cultivated here and there in small patches for local consumption. The degree of untrustworthiness of the figures is sufficiently indicated from the following table, in which all the information received is entered. In cases where two sets of returns have been received, the earlier, and presumably less accurate, figures are entered within brackets after the more recent returns.

	Approximate area under cultivation of safflower.	Estimated cost of cultivation per bigha, or per acre, or per maund of flowers produced.	Annual yield.	Yield per bigha or per acre.	Selling price, or total sum realised per bigha or per acre.	Profit per bigha, or per acre, or per maund.
Bardwan Division.						
Bánkurá	4 to 5 bighas...	Rs. 10 per bigha	8 maunds ...	.....	Rs. 12 to 14 per maund ...	Rs. 11 per bigha.
Midnapur	15,000 acres ...	.....	.....	.....	,, 20 ,, ,, ...	.....
Húglí	.....	.....	.....	.....	,, 35 to 40 ,, ,, ... (Price of safflower imported from Calcutta.)	.....
Presidency Division.						
Jessor	18 bighas ...	Rs. 7 per bigha	20 maunds ...	.....	Rs. 32 per maund	Rs. 25 per bigha.
Rajshahi and Kuch Behar Division.						
Pábná	40 bighas ...	Rs. 5 per bigha	.....	.....	Rs. 40 per maund	.....
Dacca Division.		Rs. A. P.			Rs. A. P.	
Dacca	35,000 bighas...	Ploughing and sowing 1 4 0 Plucking ... ... 2 8 0 Preparing cakes ... 0 8 0 Total per bigha ... 4 4 0	5,000 to 6,000 maunds of flower per bigha. (15,000 to 16,000 maunds.)	6¼ srs. of flower } per 3 mds. of seed } bigha	6¼ seers, at annas 12 per seer ... ... 4 11 0 3 maunds of seed, at annas 12 per maund 2 4 0 Dried stalks sold as fuel ... ... 0 8 0 Total ... 7 7 0	Rs. 3-3-0 per bigha.
Faridpur	1,000 to 1,600 bighas.	Rs. 2 per bigha	1,600 maunds of flower (in 5 years?)	10 seers of flower per bigha.	Rs. 7-8 to 10 per 10 seers ...	From Rs. 5-8 to Rs. 8 (exclusive of profits from oil from seed).
Chittagong Division.						
Tipperah	521 acres ...	Rent ... ... 3 12 0 Labour ... ... 13 13 0 Seed ... ... 1 0 0 Total per acre ... 18 9 0	17,360lb of flower	33lb of flower per acre.	33lb at annas 5 or 6 per lb ... ... 12 0 0 Oil and stalks ... 16 0 0 Total ... 28 0 0	Rs. 9-7 per acre.
	(8,000 bighas	Per bigha 2 8 0	3,000 maunds ...	14 seers per bigha ...	.....	Rs. 12 to 13 per bigha.)
Chittagong	1½ acres.	Rs. 8 per acre (?)	2 maunds	.....	Annas 10 per seer	.....
Patna Division.						
Patná	162 acres ...	Rs. 27 per acre	.....	2 mds. 5 srs. flowers 8 mds. seed } per acre	3 seers per rupee, flower ...	Rs. 25 per acre.
Gayá	2,262 acres ...	Rs. 10 ,, ...	.....	1 maund 20 seers, seed	3 to 4 seers per rupee, seed ...	Rs. 6 per acre.
Sháhábád	.....	.....	.....	.....	4 seers per rupee (flowers?)	.....
Darbhangah	.....	.....	.....	10 srs., flower 5 mds. seed } per acre	2 seers flower per rupee ...	Rs. 11 per acre.
		(Rs. 4 ,, ...	.....	Ditto	2½ seers flower per rupee ... 1 maund seed ,, ,, ... }	,, 4 ,,)

	Approximate area under cultivation of safflower.	Estimated cost of cultivation per bigha, or per acre, or per maund of flowers produced.	Annual yield.	Yield per bigha or per acre.	Selling price, or total sum realised per bigha or per acre.	Profit per bigha, or per acre, or per maund.
PATNA DIVISION—*contd.*						
Muzaffarpur	.....	.....	.....	1 maund 4 seers flower, 3 maunds 10 seers, seed } per acre.	4 seers flower per rupee ...	Rs. 18 per acre.
		(Rs. 5 per acre	.....	50 seers flower, 3 maunds 30 seers seed. } per acre.	Ditto ditto	„ 17 „).
Séran	.....	.....	2,000 maunds ...	.....	4 to 6 seers per rupee	.....
Champáran	160 acres ...	Rs. 3-8 per acre	.....	15 seers flower	4 seers flower per rupee ...	Rs. 2-4 per acre.
BHAGALPUR DIVISION.						
Monghyr	2,000 acres ...	Rs. 10 per bigha	200 maunds ...	.....	2 seers per rupee	Rs. 10 to Rs. 50 per bigha.
	(5,000 bighas	Cost of 5 seers of seed per acre ... ... 0 4 0 Other expenses of cultivation ... ... 3 0 0 Total per acre ... 3 4 0	5,000 maunds ...	1 maund per acre (bigha?)	Rs. 6 per maund.)	
Bhágalpur	.....	Cost of cultivation and seed per bigha. 9 0 0	.....	1 maund flower, 3 maunds seed } per bigha.	1 maund flower ... 15 0 0 3 maunds seed ... 9 0 0 Total ... 24 0 0	Rs. 15 per bigha.
Maldah	60 to 1,000 (? 100) bighas.	Ploughing ... ... 0 8 0 2½ seers seed ... 0 4 0 Weeding ... ... 0 4 0 Cutting-off tops of plants ... ... 0 2 0 Removing flowers ... 0 4 0 „ plants ... 0 8 0 Thrashing and collecting seed ... ... 0 8 0 Total ... 2 6 0 per bigha.	Not more than 100 maunds in 5 years.	10 seers flower, 1 maund seed } per bigha.	10 seers flower ... 2 0 0 1 maund seed ... 3 12 0 Total ... 5 12 0 per bigha.	Rs. 3-6 per bigha.
Santál Parganás ...	500 bighas ...	Rs. 3 per bigha	160 maunds (in 5 years?)	.....	Re. 1 per seer	Re. 1 per bigha.
ORISSA DIVISION.						
Cuttack	.....	.....	.....	.....	Re. 1 per seer of 105 tolas ...	.....
CHUTIA NAGPUR DIVISION.						
Lohárdagá Palámau ...	50 to 60 acres	Rs. 4 per maund	900 maunds (in 5 years?)	.....	Rs. 14 to 16 per maund ...	Rs. 12 per maund.
Lohárdagá Chutiá Nágpur.	50 bighas ...	„ 3 to 5 per bigha	18½ maunds ...	.....	2½ to 3 seers per rupee ...	Rs. 3 to 5 per bigha.

Examination of statistics.

The most cursory examination shows such obvious inconsistencies in these tables that it is questionable whether it is worth while reproducing them, or attempting to deduce any but the most general results from them. It is clear that in many districts no care whatever has been taken to make the returns sent up mutually consistent; and where fresh returns more carefully compiled have been called for, the only result has been to introduce new inconsistencies. Thus in the first return from Monghyr the area under cultivation is given as 5,000 bighas and the average yield as 5,000 maunds per annum, or one maund per bigha; in the second return from the same district the figures are altered to 2,000 acres and 200 maunds per annum, no attempt whatever being made to explain the huge discrepancy between 5,000 maunds and 200 maunds. The second return gives, taking 5,000 bighas as the area under cultivation, about $1\frac{2}{5}$ seers as the yield per bigha; the selling price is given at 2 seers per rupee; so that $1\frac{2}{5}$ seers would realise about 13 annas, which, seeing that the cost of cultivation is stated to be Rs. 10 per bigha, would leave a somewhat negative margin of profit. The profit, however, is put down as from Rs. 10 to Rs. 50, the latter a higher figure than in any other district. In Tipperah, again, the area under cultivation is given in the first return as 8,000 bighas; in the second as 521 acres; whilst the cost of cultivation is given at first as Rs. 2-8 and afterwards as Rs. 18-9 per bigha. The Collector states that the area varies from year to year, but this will scarcely explain the difference between 8,000 bighas and 521 acres.

Again, an examination of the figures leads to the conclusion that many of the district officers have sent up the total outturn during the five years preceding 1875 instead of the annual outturn taking an average over these five years. In some cases this is stated, so that there can be no misunderstanding; but in other cases it is only an examination of the statistics that leads to this conclusion. Thus in Faridpur, if 1,600 maunds are the annual produce of, say, 1,300 bighas, we get an outturn of nearly 50 seers per bigha, which is just five times what is stated. In the Santál Parganás, if 160 maunds is the annual produce of 500 bighas, this would give a profit of nearly Rs. 10 a bigha with the figures stated: the profit is given as Re. 1 per bigha. In Palámau, again, if from 50 to 60 acres produce 900 maunds annually, this gives about $5\frac{1}{2}$ maunds as the annual produce of a bigha, whilst, as will be seen below, the average yield per bigha elsewhere is under 1 maund: so that here again it is probable that 900 maunds is the total outturn for the five years.

Again, the cost per acre in the Patná district is Rs. 27 and the profit Rs. 25, so that the sum realised by the sale of the produce of each acre is Rs. 52. The produce of an acre is given as 2 maunds 5 seers of flower and 8 maunds of seed. The flower sells at 3 seers per rupee, so that 2 maunds 5 seers would realise about Rs. 28, leaving Rs. 24 to be obtained by selling 8 maunds of seed: the price of the seed would then seem to be Rs. 3 per maund in order to make the figures consistent. In Gayá the price of seed is 3 or 4 seers per rupee, or from Rs. 10 to Rs. 13 per maund, which is certainly a

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mistake, being about four times as great as the highest price recorded elsewhere. In Muzaffarpur, taking the first returns, which are complete, and do not sensibly differ from the second, the produce of 1 acre is 50 seers flower and 3 maunds 30 seers seed. Fifty seers flower, at 4 seers per rupee, realise Rs. 12½. The cost per acre is Rs. 5; profit Rs. 17, giving Rs. 22 realised per acre. This gives Rs. 9½ to be realised by the sale of the seed—3 maunds 30 seers of seed at Rs. 9½ give about 16 seers per rupee. So that in the same Division the price of seed would be as follows:—

	Rs.	
Patná	3	per maund.
Gayá	10 to 13	„
Muzaffarpur	2-8	„
Darbhangah	1	„

Similar discrepancies will be observed in the cost of cultivation, the average yield per acre, and the profits.

We may summarise the figures as follows:—

The cost of cultivation varies from		Rs. 2 to Rs. 10 per bigha.
The average outturn	„ „ ...	4 seers to 1 md. of flower per bigha. 1 md. to 3 mds. of seed „
The selling price	„ „ ...	Rs. 6 to Rs. 40 per md. for flower. As. 12 to Rs. 4 per md. for seed.
The profit	„ „ ...	Rs. 3 to Rs. 15 per bigha.

In this no account has been taken of those returns which are altogether in excess or defect of those from other districts, and so presumably erroneous.

Trade in safflower.

It will be seen from above that the great safflower-producing district of Bengal is the Dacca district, which produces between 5,000 and 6,000 maunds of flower annually. Nearly the whole of this is forwarded to Calcutta for export. It is estimated that about 75 per cent of the safflower exported from Calcutta comes from the Dacca district. In former years the annual produce of the Dacca district amounted to between 15,000 and 20,000 maunds, or about three times as much as at present. The Collector of Dacca remarks (4th July, 1877):—"This decrease is, no doubt, owing to the bad prices now ruling, which makes the cultivation unremunerative. The statement in the margin shows the prices obtainable during the last eight years, and it will be observed that both for the fine and good middling qualities they have declined during that

Leading Prices of Safflower at Dacca for 8 years from 1870 to 1877.

QUALITIES.	1870, in April.	1871, in April.	1872, in April.	1873, in April.	1874, in April.	1875, in April.	1876, in April.	1877.
	Per maund.							
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Fine	93½	72	63½	55	40	Not mentioned.	30 to 35	40
Good middling...	87	62	60	45	35	24 to 27	18 to 26	32
Ordinary or inferior.	Not mentioned.	32½	36	30	20	Not mentioned.	Not mentioned.	28

period considerably more than 100 per cent." The same fall of prices and consequent decrease in cultivation and production is noted from other districts. Almost the whole of the safflower produced in Faridpur and Tipperah is also sent by way of Dacca to Calcutta for export. The other districts which are said to forward safflower to Calcutta for export are Midnapur, Monghyr, Maldah, and Cuttack, but the information from these districts is vague and unsatisfactory. The Collector of Midnapur merely states that the "raw substance from which the dye is extracted is believed to be exported in large quantities to Calcutta," but no figures are given, although the total area under safflower cultivation is stated to be as much as 15,000 acres. The discrepancies in the Monghyr returns have been already noticed. In the first return it is stated that the 5,000 maunds annually produced are generally used for home consumption, being very inferior in quality to the produce of Lower Bengal; in the second return it is stated that the 200 maunds annually produced are nearly all exported. The Collector of Maldah states that a portion of the small annual yield of safflower (about 20 maunds) is exported to Calcutta, and this is probably also the case with other distirots, although not expressly mentioned. Generally in districts where only a small area is under safflower cultivation, it is grown exclusively for home use. Palámau in Lohárdagá is said to import about 600 maunds annually from Patná, but no reference to so considerable an export is made in the information derived from Patná. A small quantity finds its way from the district of Sáran into Nepál and the North-West Provinces, and from Cuttack safflower is said to be exported to Southern India.

Exports of safflower.

The information summarised above refers, it must be understood, to the state of things up to the year 1877. The decline in the cultivation of safflower, consequent upon the fall of prices and the diminished export, has apparently gone on steadily since.* This is clearly shown from the following tables, extracted from the Annual Accounts of the Trade and Navigation of British India, from which it will be seen that whilst in 1873-74 the total quantity of safflower exported from India was 13,206 cwt., valued at Rs. 7,58,906, the quantity exported in 1881-82 was only 2,293 cwt., valued at Rs. 94,754. Safflower is free of duty on export: imported safflower was subject to a duty of 7½ per cent up to 5th August, 1875, then reduced to 5 per cent, and altogether removed on 9th March, 1882.

* The following corroborative information has been received through Messrs. Duncan Bros. and Co. (June, 1883):—"There are no lands under safflower cultivation in Tipperah and Faridpur this year, as this crop does not now pay the growers. In the Dacca district the outturn of this season's crop will not exceed 600 maunds of flower. At a rough estimate 1 bigha yields 1 maund of flower and 2½ maunds of seed: 7 or 8 seers of seed yield 1 seer of oil, which sells at annas 15 per maund."

Exports of Safflower.

Year.	India.		Bengal.		Bombay.		Madras.		British Burmah.		Sindh.		Countries to which exported.	Quantity.	Value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.			
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.		Cwt.	Rs.
1873-74 ...	13,206	7,58,906													
1874-75 ...	14,222	6,50,827													
1875-76...	4,080	1,63,528	4,025	1,63,645	14	205	3	50	38	228	.....	.....	United Kingdom ...	2,679	1,11,683
													United States	655	24,934
													China—Hong-Kong ...	223	9,419
													Japan	174	8,705
													Straits Settlements ...	332	8,533
													Other Countries ...	17	255
1876-77...	7,662	3,04,672	7,613	3,03,425	48	1,225	.....	.....	1	20	.....	2	United Kingdom ...	5,588	2,27,601
													United States	1,271	47,044
													China—Hong-Kong ...	553	22,832
													Straits Settlements ...	210	6,198
													Other Countries ...	40	997
1877-78...	3,698	1,48,806	3,548	1,45,236	37	703	.....	.....	113	2,867	.....	.....	United Kingdom ...	968	47,397
													Austria	43	1,971
													United States	1,013	44,475
													China—Hong-Kong ...	876	28,634
													Japan	134	5,736
													Straits Settlements ...	637	19,839
													Other Countries ...	28	756
1878-79...	4,977	1,86,711	4,424	1,83,431	553	3,280	.....	.....	.....	.....	.....	.....	United Kingdom ...	3,929	1,45,463
													China—Hong-Kong ...	745	30,761
													Japan	71	3,146
													Straits Settlements ...	230	7,301
													Turkey in Asia ...	2	40
1879-80..	2,411	1,81,456	2,265	1,77,266	145	4,158	.....	.....	1	32	.....	.....	United Kingdom ...	770	64,342
													United States	621	54,897
													China—Hong-Kong ...	286	14,153
													Japan	450	37,933
													Straits Settlements ...	270	9,354
													Other Countries ...	14	277

1880-81...	6,675	3,51,157	6,463	3,46,042	207	4,828	.....	.....	5	287	.....	.....	United Kingdom ...	4,893	2,75,083
													Austria	54	2,923
													France	121	6,854
													United States ...	327	13,000
													China—Hong-Kong ...	260	9,731
													Japan	295	16,032
													Straits Settlements ...	690	25,839
													Other Countries ...	35	795
1881-82...	2,293	94,754	2,277	94,368	13	266	.....	.....	3	120	.....	.....	United Kingdom ...	1,429	67,269
													China—Hong-Kong ...	407	13,630
													Japan	85	3,381
													Straits Settlements ...	360	10,174
													Other Countries ...	13	300

Imports of Safflower.

Year.	India.		Bengal.		British Burmah.		Bombay.		Countries whence imported.	Quantity.	Value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.			
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.		Cwt.	Rs.
1875-76	10	152	10	112	.....	40	.....	.....	United Kingdom	.....	40
									Straits Settlements ...	10	112
1876-77	28	479	.....	.....	.....	.....	28	479	Persia	28	479
1877-78	.....	2	.....	2	.....	.....	.....	.....	France	.....	2
1878-79	21	210	.....	.....	21	210	.....	.....	Straits Settlements ...	21	210
1879-80	10	144	.....	.....	.....	.....	10	144	Persia...	4	72
									Other Countries	6	72
1880-81	68	2,330	.....	.....	51	2,042	17	288	Straits Settlements ...	51	2,042
									Other Countries	17	288
1881-82	.....	6	.....	.....	.....	.....	.....	6	Aden	.....	4
									Persia...	.....	2

KUNUM.

It will be seen that Bengal still continues to export by way of Calcutta nearly the whole of the safflower exported from India. The table shows that the declared value of exported safflower decreased uniformly from about Rs. 57-8 per cwt. in 1873 to about Rs. 37-8 per cwt. in 1879; in 1879-80 it suddenly rose to Rs. 75-4 per cwt.—double of what it was in the preceding year, owing to the crop being small and there being at the same time a more active demand than usual in the home market. The result was, apparently, a temporary stimulus to the safflower trade, as is shown by the rise in the quantity exported in the following year. Prices, however, again declined, and the quantity exported in 1881-82 is the smallest on record. This rapid disappearance of safflower from the export trade is due apparently to the fact that the colours produced by the dye, though bright and beautiful, are very transient, and no sure means of fixing them has as yet been discovered, coupled with the greater cheapness of aniline dyes, which have really driven safflower out of the market. And, no doubt, although there is no information on the subject, aniline dyes have also largely diminished the local consumption of safflower.

Preparation of the dye and processes of dyeing.—After the flowers are plucked, they are either simply dried or else made up into balls or cakes. The latter course is always adopted where the flowers are intended for export: generally when intended merely for local use the flowers are simply dried; but in this case also they are sometimes made up into balls. Where the flowers are simply dried, this is done by first pressing out as much moisture as possible and then spreading the flowers on mats to dry in the sun: sometimes, for convenience of keeping, they are rolled into balls by adding a very small quantity of water after they are well dried. These balls are sometimes rolled up in castor-oil leaves (Palámau). When intended for export, the dried flowers are made into cakes as follows. It is necessary to extract the yellow colouring matter, the presence of which would detract from their value in the market. The yellow colouring matter is soluble in water, whilst the red is insoluble: and this fact is made use of to get rid of the former. For this purpose the flowers after gathering are pressed slightly, and then placed in earthen vessels filled with water and left for from 12 hours to a day. They are then carried in baskets to the nearest tank or river, and there trampled well on mats with the naked feet, being kept well moistened with water during the process. This trampling is continued at intervals for three or four days. The water is at first coloured *yellow*, but this changes to *red* about the third or fourth day. When this occurs, the flowers, being then in a pulpy state, are made up into balls or cakes, which are dried in the sun and are ready for the market. This is the method as adopted in Faridpur, and the only differences in other districts are in detail. The trampling in Dacca is said to be done every morning for three days; in Jessor the flowers are washed three times a day. From Maldah we are told that the petals are first dried in the sun and then ground before the trampling, which is done on a reed mat placed on a wooden trough,

Drying for home use.

Making into cakes for export.

into which water is continually poured whilst this trampling or kneading with the feet goes on. So that safflower, as used locally, contains the yellow colouring principle as well as the red, whereas the safflower of commerce has been freed from the yellow colouring principle before being made into cakes. The safflower cakes of commerce seem to be frequently adulterated with such ingredients as rice-flower, jute-cuttings, and turmeric.

Before giving details of the methods of extracting the dye and the process of dyeing as followed in Bengal, it may be as well to give the following quotation from the article on "Dyeing" in Ure's Dictionary:—

Safflower a substantive colour.

"Safflower is a truly *substantive* colour, that is, a colour in dyeing which no mordant is required, but the dye in its natural hue is fixed within the fibre without forming any combination within the stuff. It has no affinity for any base or substance capable of forming a mordant; its solvent is an alkali, but in this dissolved state it does not form a dye. The mode of proceeding is, first, to extract the dye from the vegetable in which it is found by soda or potash, which is afterwards neutralised by an acid previous to dyeing, which acid renders the colouring matter insoluble, but in so fine a state of division that no precipitation can be seen for some time, and the stuff immersed in this imbibes the colour within its fibre, its lightness assisting this action, as the precipitate will remain suspended in water for days before subsiding."

Local dyeing with safflower.

The methods of extracting the dye employed in the various districts of Bengal are in all essentials similar to that described in Mr. Buck's Report on the Dyes and Tans of the North-West Provinces. It is first necessary to extract the yellow colouring principle from the dried flowers. This is done in pretty much the same way as in preparing the safflower cakes of commerce, only much less carefully. The flowers are first well pounded and then steeped in cold water. The water is strained off through a cloth, and more water is added until the water filtering through becomes red instead of yellow. The yellow water thus obtained is generally thrown away, but is sometimes kept to be used in preparing more complicated dyes from the safflower. When the yellow principle is thus eliminated, some alkaline substance is then added to the flowers along with water in order to dissolve the red colouring matter, and the whole well mixed and pounded together. This is done either by rubbing the flowers and alkali well with the hands or by stamping them with the feet. The substance containing

Alkali used.

the alkali is generally sajimati (fuller's earth); but potash itself (Darbhangah), wood ashes, burnt plantain rinds, and water in which burnt plantain rinds and tamarind have been well soaked (Chittagong), are also employed. In Patná 1½ chittacks of potash or 2 chittacks of dhailah saji (Meetapore Jail) are added to 1 seer of the flowers; in Chutiá Nágpur, 2 chittacks of wood ashes to 1 seer of the flowers; in Dinájpur, from 1 to 2½ chittacks of carbonate of potash to 1 seer of the flowers: the quantity of the alkaline substance to be added is not stated from other districts. When the alkali has been sufficiently mixed with

KUSUM. the flowers, the water is strained through a cloth, and is of a deep red colour. The straining is sometimes done merely through a bamboo basket (Midnapur). The water passing through after the first straining forms the best dye: it is called "jaithi" (Chutiá Nágpur). Other tinctures are obtained by pouring fresh water on the safflower; these are of inferior quality. To these red liquids some acid is invariably added before they are used for dyeing (see passage from Ure's Dictionary above quoted). This is generally lime or lemon juice. In Chutiá Nágpur the proportion of lime juice is 8 chittacks to 1 seer of "jaithi." In Midnapur the juice of tamarinds is sometimes added instead of lime juice. In some districts the acid is added along with the sajimati or plantain ashes before the straining (Patná, Santál Parganás), and in others the safflower seems to be *boiled* with water for the extraction of the dye (Húglí, Palámau, Monghyr).

Acid used.

The cloth to be dyed is merely steeped in the dye-tincture so obtained. Different shades of red are given by steeping for a longer or shorter time, or by employing one or other of the red tinctures resulting from successive strainings. Thus, quoting from the description of the process in Chutiá Nágpur (Lohárdagá):—"The deepest colour will be obtained by adding 8 chittacks of acid lime juice to 1 seer of 'jaithi' (the first water strained through) and steeping the cloth twice. If a lighter shade is wanted, the same quantity of acid is added to the water passing through at the second straining." Harra, the fruit of *Terminalia Chebula*, is sometimes used to assist in fixing the colour. None of the colours so obtained seem to be permanent, although some are more lasting than others: they are said to last only a few weeks, or to fade rapidly after a few washings. The dye obtained in the Chittagong district by adding safflower to water in which tamarinds and the ashes of burnt plantain rinds have been well soaked is said to be "semi-permanent." For cloth dyed various shades of red with safflower alone, see Museum Specimens, Nos. **6670, 6671, 6677, 7548,** and **13785,** all cotton.

The yellow tincture first obtained seems to be rarely used as a dye: the information on this head is, however, uncertain. From Balasor it is reported that "yellow-dyeing is done by the Musalmáns settled in the towns, and the colour is said to be extracted from safflower, and from *kamalá-gundi*, the dust round the seeds of the *Mallotus philippinensis*." From Cuttack it is merely reported that "safflower is used for dyeing cloth red and yellow." From Murshidábád the Collector states that "the flower naturally yields a fine orange dye, but when the solution is treated with an alkali the result is a fairly permanent one." The Collector of Maldah gives as a formula for a yellow-dye used in his district "safflower, tamarind, and sajimati." This is probably a mistake, as the same combination is used in Midnapur to produce red. In Patná the yellow tincture, called *pewurree* water, can be purchased from cloth-dyers in the bazar for one anna per gurrah, and is used in dyeing *green* with indigo (see p. 125).

Yellow dye.

The yellow dye first obtained and the red subsequently eliminated are used together to produce the deep orange colour called *nárangi* (Chutiá Nágpur). The cloth is first steeped in the yellow

lye, then in the "jaithi" water. To produce *kakraiza*, a dark neutral int, *harra* and *protosulphate of iron* are well pounded and kept in ontact with clay for three days; they are then steeped in "jaithi," and inally boiled in a little of the same colour. The only remaining combiations of safflower with other dye-stuffs mentioned in the returns on which this report is based are—

Safflower and turmeric, giving a saffron *yellow* dye. (No. 6678, cotton, Darbhangah.)

Safflower, bakam, and alum, a dark *purplish brown*. (No. 6679, cotton, Darbhangah.)

Safflower with indigo, *greens and purples*. (*Vide* under Indigo.)

Details of the processes employed in the district of Monghyr to produce pomegranate red (sorukh or kusumi), golábi or rose colour, nárangi or orange colour, and zurd or yellow, will be found in Montgomery Martin's "Eastern India," vol. II., pp. 268-269. This dates as far back as 1838; but as the Collector of Monghyr refers to it as being still applicable, it is here appended:—

"In order to dye the pomegranate-red (sorukh or kusami), for three turbans 40 cubits long by 1 wide, take of the flowers 3 seers (84 s. w.) or 6lb 7⅛ oz., value Re. 1; of impure carbonate of soda (saji), 6 chhataks, almost 13 oz., value ¼ anna; of turmeric 1 chhatak, 2½ oz., value ¾ anna; of any vegetable acid, lime juice, mango, or tamarind, to the value of ¾ anna. Wash the flowers on a cloth strainer with six pots of water, each containing about 15 seers (32lb 5⅛ oz.), until the water comes off clear. This water is called *pili*, and is used in dyeing green with turmeric and indigo. In about an hour after wash the same flowers with another six pots of water. This water is called *dohol*, and is of no use. Then squeeze the water from the flowers, add the soda, and rub them together. Then place them on the strainer, and with 1 or 1¼ pot of water wash out the colour, which is called *sahab*, and is the proper dye. In this dip the three turbans and knead them in the dye. Then take out the cloth and add the turmeric and acid; then put in the cloth again, and having soaked it wring and dry it in the shade. The same operation is repeated with fresh flowers on the two following days. If the colour is wanted lighter, a little more water is added to the sahab; and if a bad cheap colour is wanted, give the cloth only one or two dips instead of three.

"The best golábi or rose colour is given thus. After having extracted the sahab colour as above, the dyer adds to the same flowers another pot of water, which extracts a colour called *pachuya*, that dyes four turbans of the same size. They are first dipped in the dye, then taken out and an acid added, and then dipped again and dried in the sun. Each turban brings to the dyer 2 annas, and the acid costs ¾. A paler rose colour is given by taking ¼ seer of the sahab colour, adding 5 seers of water, and using this dye as the other. The dyeing three turbans of a bright pomegranate brings the dyer Rs. 4-8, and the four turbans of a rose colour brings 8 annas, in all Rs. 5. The cost is Rs. 3-6¾.

"Nárangi or orange colour, and zurd or yellow, may be given either with the flowers of the singgarhar or of the tungd, both nearly of the same quality and used in the same manner; but each turban requires 4 chhataks (8⅓ oz.) of the former, while 6 chhataks (13 oz.) of the latter are necessary. The flowers are boiled in 3 seers (each 2lb 2⅓ oz.) of water to 2 seers. When cooled, add 1⅓ seer of the sahab colour prepared as above from safflower and 1 seer of water. In this dip the cloth, wring it, add some vegetable acid, and soak the turban in the mixture for 24 minutes; then wring and dry it in the shade. This makes an orange of different shades, according to the quantity of cold water added. Each turban pays for dyeing 4 annas The yellow colour is given in the same manner, only that no sahab is

KUSUM. added, and that in place of acid 1 chhatak of alum, worth ½ anna, is employed. The flowers are boiled with 4 seers of water to 3 seers. If a light yellow is wanted, a little cold water is added to the dye when cool."

KAMALA. 3 **Mallotus philippinensis**, *Müll. Arg.* (Rottlera tinctoria, *Roxb.*)—Nat. Ord. EUPHORBIACEÆ.

Kamalá.
Dholasindur (Bírbhúm).
Rori (Lohárdagá).
Sinduri (Darjiling).

Seed-powder ... { Kamaláguri or Kamalágundi, কমলাগুঁড়ি, ಅಮಲಗುಂಡಿ. Basantagundi.

This tree is nowhere cultivated for the sake of the powder which its capsules yield, but is found wild in the Bardwán, Orissa, Chutiá Nágpur, and Rájsháhí Divisions, and probably in most parts of Bengal. In Orissa it is found, though apparently not in any great quantity, in the jungles on the hills from Morbhanj to Khurdhá. In the Rájsháhí Division it is said to be common on the lower Himalayas and adjoining plains. Mr. Gamble in his "Trees, &c., of Darjíling" states that it is found on the hills to a height of 4,000 feet.

Growth.

The wood of the tree seems to be used as fuel. The red powder, which constitutes the dye-stuff, is found immediately inside the capsules of the ripe fruit. The plant blossoms at the end of autumn, and the fruit grows in bunches, each fruit being about the size of a large pea, but three-cornered. The fruit is ripe in January and February, and must be gathered before the heat of the sun cracks the outer covering so as to let the powder fall out or be washed off by rain. The fruit is dried in the sun, and the powder is then beaten out and collected. The *roots* are said to be also sometimes used to give a red dye (Dr. Schlich). The following extract from a report received from Bírbhúm would seem to show that at one time this plant was to some extent cultivated for its powder:—"Formerly kamaláguri-trees grew in abundance in Bhandibon and the adjacent villages, where the weavers were in the habit of paying a certain rent for them, but now they are not taken care of, as the weavers have given up dyeing tussar and silk."

As the plant is nowhere cultivated, the only expense in connection with obtaining the dye-stuff is the labour of collecting it. From Puri we are told that the cost of this is Rs. 3 per maund.

Prices and trade.

The selling price of the powder varies apparently very much in different districts. The figures received are—

Bánkurá	...	Rs. 7 to Rs. 10 per maund.
Midnapur	...	„ 40 „
Lohárdagá	...	„ 20 „
Mánbhúm	...	„ 8 „
Cuttack	...	Re. 1 for 1 Cuttack seer of 105 tolas (=$1\frac{5}{16}$ seers), or Rs. 30-8 per maund.
Puri	...	Rs. 10 per maund.

The differences of price in neighbouring districts, such as Bánkurá and Midnápur, Lohárdagá and Mánbhúm, Cuttack and Purí, are so striking as to throw discredit upon the figures.

There seems to be a slight export of kamalágundi powder from Orissa into the Madras presidency. About 200 maunds annually are said to be exported from Bánpur, in the Purí district, to Ganjam.

There is no information regarding the quantity of kamaláguri actually collected for dyeing purposes in any district except Bánkurá, where 25 maunds is given as the average annual produce of the district.

Processes of dyeing with kamaláguri.—The kamaláguri powder is used for dyeing silks, and occasionally cottons, a brilliant yellow, although its own colour is red. The powder is only very sparingly soluble in either hot or cold water, but is completely dissolved in alkaline liquids, forming a dark red solution. The resinous yellow colouring matter may be separated from this red solution either by neutralising with an acid or else by mere exposure to the air.

Development of yellow colour.

In Bengal the red powder is dissolved by the addition of a solution of various alkaline ashes, obtained by burning plants, and the development of the yellow colouring principle is in no case brought about by the addition of acids, but merely by allowing the cloth steeped in the red liquid to dry by exposure to the air. It is said not to require a mordant, but frequently *alum* is added for that purpose. The colour is sometimes heightened by the addition of *turmeric*.

Details of the processes adopted in various districts are as follows:—

Dissolve the ashes of kántánaté (*Amaranthus spinosus*) in water: filter and boil the liquid. Add to the liquid, as the boiling goes on, *kamalágundi* powder, and afterwards *alum*. When the boiling has continued for some time, dip the cloth in the hot liquid and allow it to remain till it has absorbed the colour: then wash and dry. The proportions of the ingredients are, for 1 seer in weight of the silk or cotton cloth—

5 seers kántánaté ash,
½ seer kamalágundi,
2 chittacks alum,

and just enough water to cover the cloth. (Cuttack, Nos. 11552 and 11954, both cotton.)

The silk or cotton to be dyed is first boiled for about 10 minutes in an *alkaline* solution: this part of the process is called "kharai," from "khar," which means "alkali." Fresh water is then boiled, and a little *alum* is thrown in during the boiling. When the alum is completely dissolved, *kamaláguri* powder is mixed with the water. Into this dye-mixture the silk or cotton, prepared as above, is dipped three or four times. (Midnapur.)

The *kamalágundi* powder is boiled in water, and to this are added taj (bark of *Cinnamomum Tamala*), jatamansi (root of *Nardostachys Jatamansi*), and kuchoor (root of *Curcuma Zerumbet*). (Lohárdagá.)

In the following, *turmeric* is added in addition to the alkali, with or without *alum*:—

Mix 1 seer of the *ash* of plantain leaves or the leaves of nishinda (*Vitex Negundo*) with 12 seers of water: filter through a cloth. To the solution add 1 seer *kamaláguri* and boil. When the solution has boiled

KAMALA.

over twice or thrice, add ½ chittack powdered *turmeric* and 1 chittack *alum*, and boil again thoroughly. To test whether the boiling has advanced far enough, put a drop of the solution on the finger nail: if the nail is stained, the dye is ready. The silk cloth is then dipped in this, and the whole set aside for a day. The cloth is then washed with pure water and dried. (Bírbhúm.)

Potash or sajimati is dissolved in water: solution filtered, and the *kamalágurí* added along with a little *turmeric*. (Bánkurá.)

The *kamalágundi* is mixed with *turmeric* and treated with *potash* and *alum*. (Purí.)

There are two specimens of yarn in the Economic Museum dyed a very beautiful orange with latkan (*Bixa Orellana*) and kamalágurí, but the method is not stated. (Nos. 12181, 12182, see p. 72.)

The various species of *Morinda*, the roots of which yield a red dye, are not very readily distinguishable from one another, and indeed they are sometimes all grouped together under the one specific name *Morinda citrifolia*, Linn. In the enquiry of which this report is the result, growing plants were in many cases forwarded from the various districts, and these were carefully identified and named by Dr. King, of the Royal Botanical Gardens, Seebpore. In other cases, however, the name given by the local authority forwarding the specimens of the dye has apparently been accepted without further enquiry. It is impossible at this date to ascertain in what cases the labels on the Museum specimens may be relied on as giving the correct scientific name of the corresponding plant, and in what cases the scientific name has no other authority than that of the local officer who despatched the specimen. Under these circumstances it is probable that the information below may frequently be entered under the wrong specific name, but it is impossible now to ensure any greater accuracy.

AL OR AICH.

4. Morinda tinctoria, *Roxb.*—Nat. Ord. RUBIACEÆ.

Ál (Behar).

Ách, আচ, Aich, আইচ (Western, Central, and Eastern districts, and Chutiá Nágpur).

Auch, আউচ (Southern districts of Rájsháhí Division, parts of the Bardwán Division, and Maimansinh).

Achu or Achhoo, আঅ, আছু, আছু (Orissa).

Aoosh (Rájsháhí).

Asukari (Nowgong).

Chaili or Chalee or Chyli (Lohárdagá, Mánbhúm, Singbhúm, and Santál Parganás by the Santáls).

Hardi (Darjíling ?).

Dáruharidrá,* দারুহরিদ্রা (Northern parts of the Rájsháhí Division—Darjíling, Jalpáigurí, Kuch Behar, and Dinájpur).

Malancha (Bákarganj).

Bankatari (various jungle tribes in the Santál Parganás).

Kat or Kashtha mallika (better classes in the Santál Parganás).

Rallum, রল্লুম (the Kookies of Tipperah).

Suranji (the general trade name).

* The *dáruharidrá* of Dinajpur, &c., is in many cases *Morinda citrifolia*, Roxb. A growing plant was forwarded from one district and identified by Mr. Scott, of the Royal Botanical Gardens, Seebpore, as *Morinda citrifolia*. As, however, the *dáruharidrá* seems to be generally *Morinda tinctoria*, and the same processes are adopted in dyeing with either, all the information received regarding *dáruharidrá* from these districts has been embodied under *Morinda tinctoria*.

Growth and cultivation.

This small tree seems to grow in most parts of Bengal in sufficient quantity to meet the demand for the dye, which is almost entirely local, and it is consequently cultivated to only a slight extent. The only estimates received of the area under cultivation are the following:—

Nadiyá ...	...	1 bigha.	
24-Parganás	...	50 bighas.	
Dinájpur ...	...	450 bighas	(Bírganj ... 42 bighas Thákurgáon ... 200 bighas.)
Sáran ...	...	18 acres.	
Darbhangah	...	4 kathas.	
Balasor ...	...	10 acres.	

It is, however, cultivated in many other districts, but only to a slight extent, and in such a manner that the area under cultivation cannot be ascertained. It is occasionally grown for home use in gardens, sometimes in small patches in homesteads or betel-nut plantations (Kuch Behar). In Orissa it is everywhere allowed to grow as a weed in the weavers' homesteads for use in dyeing, the weavers being in general the dyers in that part of the country. In far the greater part of Bengal the plant is not cultivated at all, being found in sufficient quantity in the jungles.

In Bengal the plant is everywhere, except in Orissa, propagated by slips or cuttings, and not from seed, as would seem from Mr. Liotard's Memorandum to be the case in other parts of India: in Orissa, although generally grown from cuttings, it is occasionally raised from seed. It grows in all soils, but best in rich soils: the soil best suited to its growth is ordinary black soil with a slight admixture of sand. In the Darbhangah district the best soil is that locally called "baugar." The method of cultivation as followed in the Patná Division, from which fullest particulars have been received, is as follows:—The slips or cuttings from the previous crop, about a foot and a quarter long, are laid down from January to April (Paush to Chaitra) in a bed, so as to form a stock, and are watered regularly every third day until the rains set in. At periods varying from middle of June (Darbhangah) to September (Sáran), these slips are transplanted into a field previously carefully prepared for the purpose by ploughing and weeding. About a fortnight after transplanting the field is weeded; the plants are watered regularly until new leaves shoot out, after which nothing in the way of cultivation is done for over three years, but the plant is left to mature of itself. A moderate quantity of rain is necessary for the perfection of the plant, both excess and deficiency being injurious. In the cold weather following the third year, by which time the plants have attained a height varying from 2 feet to 8 feet, according to the quality of the soil, whilst the straight, spindle-shaped roots extend into the ground to a depth of 3 or 4 feet, the roots are dug up, generally in January and February. At the same time the portion of the plant above ground, except the upper part, is cut into slips of about a foot and a quarter in length, which form the cuttings from which the plant is propagated as above and the next crop secured.

In other parts of Bengal where the plant is cultivated, after the fields have been carefully ploughed and weeded, deep trenches are dug

AL OR AICH. and the soil from these formed into parallel ridges, generally a little over 3 feet apart, but in Bákarganj only 18 inches. On these ridges the cuttings or slips are planted at a distance of about 18 inches apart. In Bákarganj apparently the trenches between the ridges are filled with fine earth, and the cuttings planted in these furrows, instead of on the ridges as elsewhere. In the Bírganj jurisdiction of the Dinájpur district the plant is only cultivated on the strips of land around fields devoted to other purposes. In this district the plant is propagated by cuttings from the roots of mature plants, 3 to 4 inches long, instead of slips from the stem. The period of planting out the cuttings, the amount of care devoted to the growing plant, and the number of years allowed to elapse before the roots are dug up, vary considerably in different districts. In all districts except those of the Patná Division, and sometimes in Kuch Behar, the cuttings are at once planted on the ridges, without being first grown in a bed and subsequently transplanted to the fields. This planting of slips takes place about the beginning of March in Bákarganj, from April to June in Dinájpur, in the beginning of July in Orissa, in June in Nadiyá, and in August in the 24-Parganás. There is probably some error in the returns from these last two districts, as the period of planting can scarcely differ so widely in two districts so close together.

In the Nadiyá district considerably more attention seems to be devoted to the growing plant than elsewhere. The slips being planted in June, the soil about their roots is dug up and loosened in September and February, and kept carefully free from weeds in the intervals between these diggings. This process of digging is, apparently, repeated every half-year until the plant is mature.

The period required for the maturing of the roots seems to vary considerably in different districts, depending, no doubt, on local peculiarities of soil and climate. In the Patná districts and in Bákarganj the roots are ready for digging up at the beginning of the fourth year after the planting of the cuttings; in Dinájpur and Kuch Behar the roots attain maturity in either three or four years; in 24-Parganás in about five years; and in Nadiyá the plant is said to be fit to yield the dye in ten years. If this latter statement be correct, taken along with the more elaborate digging and weeding required in the cultivation of ach in this district, it would seem to imply that the soil of Nadiyá is less adapted than that of any other part of Bengal for this particular plant. Where the plant grows wild, there seems to be generally no special season for digging up the roots: the soil about them is turned up and a few of the roots cut off, the plants being left standing.

It must be understood that the plant is still young when the roots become best suited for dyeing purposes, and that if allowed to grow it would ultimately attain the height of a large mango-tree, but the roots after the first three or four years no longer yield the dye in any quantity. The height attained by the tree when the roots are best suited for dyeing purposes is given variously as 2 to 3 feet (Patná), 6 to 8 feet (Darbhangah), 6 to 8 cubits (Dinájpur): the circumference of the trunk is stated to be half a cubit (Dinájpur).

AL OR AICH.

The Collector of Balasor states that achhu is considered to be a most exhausting crop to land. After a crop of achhu, land has to lie fallow for from three to five years. As a consequence, a very high rent (Rs. 10 per acre) is charged for achhu land.

As regards the average quantity of root obtained from each tree, in the Dinájpur district we are told that each tree produces on an average 1 seer of root. The Collector of Balasor states that an acre grows from 2,000 to 4,000 plants, producing from 5 to 10 maunds of achhu. This would give about 1 seer of root for 10 plants, which would seem to imply that the plant is only one-tenth as productive in Orissa as in Dinájpur. But the Orissa returns are probably inaccurate.

Statistics.

The following table embodies all the figures that have been received as regards the cost and profits of cultivation, the average outturn, and the selling prices of the root. The figures in italics are not included in the returns sent up from the districts, but have been calculated from the other columns.

District.	Approximate area under cultivation.	Estimated cost of cultivation per bigha or per acre.	Total average annual yield.	Yield per bigha or per acre.	Selling price.	Total sum realised per bigha or per acre.	Profit per bigha or per acre.
Bardwan Division.							
Birbhúm	.....	.....	.....	.....	Rs. 3 to Rs. 6 per maund.		
Presidency Division.							
Jessor	.....	.....	50 maunds in 5 years.	.....	Annas 10 per maund.		
Nadiyá	1 bigha ...	Rs. 50 per bigha spread over 10 years.	60 maunds ...	60 maunds ...	Rs. 2 to Rs. 2-8 per maund.	60 *maunds, at from Rs.* 2 *to Rs.* 2-8 *per maund = Rs.* 120 *to Rs.* 150.	Rs. 100 per bigha. *Rs.* 70 *to Rs.* 100.
24-Parganás	50 bighas ...	Rs. 55 per bigha (5 years)	.....	40 maunds (?)	Rs. 3 to Rs. 3-12 per maund.	40 *maunds, at about Rs.* 3-8 *per maund = Rs.* 140.	Rs. 85.
Rajshahi and Kuch Behar Division.							
Dárjíling	.....	.....	250 maunds ...	.....	Rs. 6 to Rs. 20 per maund.		
Kuch Behar	.....	.....	.....	.....	Annas 2 to annas 4 per seer.		
Dinájpur	450 bighas (150 acres).	Rs. 100 per bigha spread over 3 to 4 years.	30,000 maunds	66⅔ *maunds* ...	.....	66⅔ *maunds, at Rs.* 3 *per maund = Rs.* 200.	Rs. 100.
Sub-divisions— Bírganj	42 bighas ...	.....	.....	.....	Re. 1 to Re. 1½ per maund; sometimes double this.		
Thákurgáon	200 do. ...	.....	12,000 to 13,000 maunds.	.....	Re. 1 to Re. 1-4 per maund.		
Bográ	.....	.....	.....	.....	Annas 3 to annas 5 per kacha seer.		
Dacca Division.							
Bákarganj	.....	Rs. 7* per bigha spread over 3 years.	.....	7 maunds per bigha.	Rs. 5 per maund...	7 maunds, at Rs. 5 per maund = Rs. 35.	*Rs.* 28.

Patna Division.							
Patná (Hájipur)	.....	Rs. 175 per acre (3 years)	.....	.....	.....	Rs. 435 per acre ...	Rs. 260 per acre.
Sáran	18 acres ...	Land rent for 3 years ... ... Rs. 32 Planting and watering slips ... ... 9 Transplanting slips 7 Weeding ... ... 2 Digging up roots for the dye-stuff ... 160 Per acre ... 210	.....	30 maunds per acre.	Rs. 14 to Rs. 18 per maund.	30 maunds, at Rs. 16 per maund = Rs. 480.	Rs. 270 per acre.
Darbhangah	4 cottahs = ⅛ bigha.	.....	.....	15 maunds per bigha.	Rs. 3 to Rs. 6 per maund.		
Bhagalpur Division.							
Monghyr	.....	.....	.....	.....	3 to 4 seers per rupee.		
Orissa Division.							
Balasor	10 acres ...	Rs. 50 per acre	100 maunds ...	5 to 10 maunds per acre.	4 annas per seer ...	5 *to* 10 *maunds, at* 4 *annas a seer* = *Rs.* 50 *to Rs.* 100.	Rs. 120 per acre.
Cuttack	.....	.....	.....	.....	3 annas per seer of 165 tolas.		
Chutia Nagpur Division.							
Lohárdagá, sub-division Palámau.	.....	.....	200 maunds in 5 years.†	.....	Rs. 10 to Rs. 15 per maund.		
Mánbhúm	.....	.....	.....	.....	Rs. 4 to Rs. 5 per maund.		

* Previously given as Rs. 2 per bigha.
† Dr. Schlich, Conservator of Forests, gives 20 maunds as the *annual* outturn in the Palámau forest division.

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In the returns from the 24-Parganás 40 maunds is given as the total outturn from the whole district. We have assumed this to be a mistake, and taken 40 maunds per bigha as the outturn, as by this means alone it is possible to make the other figures given mutually consistent.

Discrepancies in statistics.

In the Dinájpur figures the price of the root is not stated; but from the figures given of cost and profits, the 66⅔ maunds yielded per bigha must be sold at Rs. 3 per maund. The selling price in the two sub-divisions of Dinájpur, Bírganj and Thákurgáon, is given at Re. 1 to 1½ and Re. 1 to Re. 1-4 respectively; but in the former case the price is said to be sometimes double that stated, and, no doubt, the Dinájpur returns have been compiled on the supposition of this higher price.

The figures from Balasor are obviously erroneous. At the price given the produce of an acre would yield between Rs. 50 and Rs. 100 only, whereas since the cost of cultivation is given at Rs. 50 and the profit at Rs. 120 per acre, the total yield from an acre must be Rs. 170. The Bákarganj figures are so completely different from any of the others as to throw grave doubts on their accuracy.

Again, there are other obvious discrepancies in these returns. It seems unlikely, for instance, that in Palámau the price of ach should be from Rs. 10 to Rs. 15 per maund, whilst in Mánbhúm, a neighbouring district, it should be from Rs. 4 to Rs. 5.

Summary.

Omitting returns which differ so widely from the others as to throw doubt upon their correctness, as, for example, those from Bákarganj and Balasor, we may sum up these figures as follows:—

Cost of cultivation varies from Rs. 50 to 100 per bigha (distributed, of course, over several years).

Average outturn	...	10 maunds to 65 maunds per bigha.
Selling price ...	...	Re. 1 to Rs. 18* per maund.
Profit ...	...	Rs. 85 to Rs. 100 per bigha.

It will thus be seen that the cultivation of al is fairly remunerative. The Collector of Balasor remarks that "a weaver by cultivating an acre of achhu is able to recoup himself for all charges of cultivation as well as to supply all his home requirements."

Different qualities of root.

The selling price depends on the fineness of the root, the thin roots being by far the most valuable. In some places the bark stripped from the stem of the plant, as also the twigs, are used for dyeing purposes, the dye they yield being much inferior to that given by the roots. In Maimansinh the juice of the leaves seems to be occasionally used as a dye (No. **10836**, cotton, reddish brown). From Sáran the following details of the prices of different qualities of the dye-stuff are given:—

Roots from $\frac{1}{32}$ inch to $\frac{1}{16}$ inch thick, Rs. 16 to Rs. 18 per maund.
„ „ $\frac{1}{16}$ „ to $\frac{1}{8}$ „ „ 14 to „ 16 „

* Dr. Schlich, Conservator of Forests, reports that for Bengal in general the price varies from Rs. 6 to Rs. 20 per maund. But as Rs. 20 is higher than the price mentioned in any one district, we have omitted it from this summary.

Roots thicker than ½ inch are thrown away as worthless. From Darbhangah these details are given :—

	Rs.
Roots (jintoran)	6
Bark (chhar)	4
Twigs (powar)	3

Trade between districts.

As stated above, the plant is generally grown solely for local use, and there is in consequence very little trade in it between one district and another. Of the total annual produce of the Dinájpur district, 30,000 maunds, ⅝ths are exported to Purniah, Jalpáigurí, and Rangpur, adjoining districts; ⅜ths of the produce of the Sáran district (540 maunds) is exported into Tirhut; part of the produce of the Darbhangah district is exported to Benáres and Patná: all the dye produced in the Nadiyá district is sent to Calcutta. A certain quantity also finds its way from the Patná Division into the North-West Provinces. The Collector of Bákarganj reports that in that district the ryots sell the roots to mahajans, who export it to the North-West Provinces and the Panjáb for its dye, and that the annual export to the North-West Provinces is from 12,000 to 15,000 maunds. There is no other mention of trade in this dye between one district and another.

No particulars have been received relating to the competition of aniline or other foreign dyes with aoh, except from Bákarganj, the Collector of which reports that in his district it was formerly cultivated over 10,000 to 12,000 bighas of land, but that owing to the import of foreign dye-stuffs (? aniline) its cultivation has now almost ceased.

We may here insert the following extracts from a paper in the Asiatic Researches, vol. IV, (1795), entitled "On the plant *Morinda* and its uses," by W. Hunter, as embodying the first full account of its cultivation and use in dyeing:—

"Although the plant which is the subject of this essay be not a new species, yet, as it is cultivated to a great extent in *Málwa*, and forms an important branch of the commerce of that province, I hope a particular description of it, with some account of its culture and use, will not be unacceptable to the Asiatic Society.

"The *ádl* is a tree of a middling size; the *root* branchy; the *trunk* columnar, erect, covered with a scabrous bark.

"In *Málwa* it is called *ál*, and in *Oudh* it has the name of *atchy*.

"The plant grows best in a black rich soil, free from stones, in situations moderately moist, not too high, yet sufficiently elevated to prevent the water of the rains from stagnating, and where there is near at hand a supply of water for the dry months. It is sown about the middle or end of *June*, after the rain has begun to fall. The ground requires no manure; it is ploughed twice, or, if tough and hard, three times. The seed is sown either broadcast or in drills, according to the fancy of the cultivator. The ground is then ploughed over again and harrowed. In one *beegah** of ground are sown from 1¼ to 2½ *muns*† of seed. In fifteen or twenty days the young plants spring up; the field is then carefully weeded, and the ground stirred with an iron instrument. This operation is repeated at proper intervals during the first year, and in the dry months of that year (that is from *January* till *June*) the ground is three or four times laid under water. After the first year it requires no further care. In a year the

"* A measure of one hundred cubits square."

"† The *mun* of this country is sixteen *seers* of eighty rupees weight each."

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plant grows to the height of one or two feet, according to the quality of the soil. In the third year, sometimes in the second, it bears flowers and fruit. The flowers appear in *June*, and the fruit ripens in *September* or *October*; but the fruit of those young trees is not used for seed, as it is said not to produce vigorous plants. In the months of *February* and *March* following the third year, the plants are dug up. They dig to the depth of three or four feet; the root, which is the only valuable part, extending so far into the ground. The wood of the plant is only used for fuel. Sometimes the necessities of the husbandman oblige him to dig the crop in the second, or even at the end of the first year; but the root is obtained in much smaller quantity and less rich in colouring matter than if it had remained the regular time. The crop is not much affected by the excess or defect of the periodical rains. When it is dug at the end of the third year, one *beegah* yields from four to six *maunies** of the root in a wet state. These are spread on cloths and dried in the sun for three or four days, at the end of which time there remains of dried root one-third or one-fourth part of the original weight.

"As the colouring matter resides chiefly in the bark of the root, the small twigs, which contain little wood, bear a higher price than the larger pieces.

"Therefore, the roots, when dug up, are separated into three kinds—coarse, medium, and fine. The coarse sells for one rupee per *mun*, the medium two or three rupees, and the fine four rupees per *mun*, or four seers for a rupee.

"In particular fields they leave trees for seed, at the distance of four, five, or six cubits. In six years they yield fertile and vigorous seeds. The trees, when of that age, are about six inches in diameter and twelve feet high (branches included); but they continue fruitful for many years, and are said to grow to a size not much inferior to that of a *mango* tree. When the fruit is ripe, it is gathered, laid in heaps on the ground, and covered up with straw or other rubbish for fifteen or twenty days, in which time the pulp rots and is consumed. It is then put into a basket and washed by repeated affusions of water to separate the seeds and free them from the remains of the pulpy matter. The husbandman who cultivates this plant generally takes care to have on his ground a sufficient number of trees for seed. If he is unprovided with these, he may purchase the seed immediately after it is prepared for four or five rupees the *mun*; but if he neglects to purchase till the season of sowing arrives, he may be obliged to pay at the rate of two seers per rupee.

"In the ground on which *dl* has grown, they sow wheat or other grain for five or six years; and it is observed that the grain sown on this ground thrives remarkably, and, while the trees left for seed continue small, grain of any kind may be sown in their interstices; but *dl* would not thrive there.

"The expense to the cultivator varies considerably in different villages. In one, where the plant is cultivated to a considerable extent,† the pateil, or zemindar, gave me the following account of the expense attending the cultivation of one *beegah*:—

		Rs.	A.
To the Collector of the district	... ...	10	0
To the pateil	... ...	1	0
To writers, &c., servants of pateil	... ...	0	10
To digging up the root‡ ...	... ...	15	0
	Total ...	26	10

"Now supposing, agreeably to the foregoing account, that a good crop is six, and a bad one four, *maunies*; that each *mauny* yields when dried 3½ *muns*, and that in this dried root the coarse at one rupee, the medium at two, and the fine at four, are in equal quantities, then the value of the good crop will be Rs. 49 and that of the bad one Rs. 32-10-8. The first of these leaves Rs. 22-6, the other Rs. 6-0-8, from each *beegah*. The medium, Rs. 14-3-4, we may

"* The *mauny* contains twelve *muns* of this country weight."
"† *Khelana*, 7¼ miles from *Oujein*."
"‡ For digging a space sixteen cubits long and 3½ cubits broad, the labourers are paid 4½ pice, at 80 to the rupee."

estimate as the profit of the husbandman, out of which he is to maintain himself and his cattle for three years. In this account I have not included the expense of seed, as the cultivator is generally supplied with it from his own trees. Had he been obliged to purchase it, we must have added eight rupees to the expense of cultivation; but as the crop sustains no damage by remaining in the ground, the cultivator can dig it up at his leisure; and therefore he generally saves, by his own labour, great part of the expense above stated for digging. AL OR AICH.

"In another village,* the cultivator has the land on much easier terms, only paying three rupees for the crop or one rupee yearly to the Collector. Therefore, the other expenses being supposed the same, the crop only costs him Rs. 19-10, besides his own maintenance and that of his cattle.

"Besides the consumption of the root in the manufactures of this province, large quantities of it are exported to *Guzerat* and the northern parts of *Hindostan*. I have not been able to learn the exact value of this exportation, but have reason to believe that it amounts annually to some lakhs of rupees. The dealers, who come from those places (especially *Guzerat*) to purchase, advance money to the cultivator, and when the crop is ready buy it either on the ground or after it is dug up. In the first case they dig a small portion of the field and, according to the quantity it yields, form a judgment on the value of the whole.

"The method of dyeing with this root is as follows: the cloth to be dyed is thoroughly washed and scoured with an extemporaneous kind of soap-lie made by mixing the oil of sesamum with the fossile alkali. Then, supposing the cloth (which is generally of a thin texture) to be twenty-six cubits long and one cubit broad, the quantities of ingredients will be as follows:—

"Take of large *her*† in powder three ounces, mix it well with four pounds of water. In this the cloth is to be thoroughly wetted, so that the absorption of *her* may be as equal as possible. It is then to be squeezed and spread in the sun for about 48 minutes to dry, taking care that no drop of water fall upon it. The cloth, when dried, is of a cream colour. It is kept in this state for four or five days, that the particles of the *myrobalan* may be more firmly attached.

"Then take of powdered alum two ounces, dissolve it in ℔ ij of water; wet the cloth thoroughly and equally in this solution. Wring it and strike it gently on a smooth stone, then spread it for 24 minutes in the sun to dry. When dried it is of a pea-green colour; when perfectly dry, it is kept for four days, and then washed in cold water. To the manner and degree of washing, we are told, great attention is to be paid, as an error, either in excess or defect, would spoil the colour. When washed, it is dried in the sun.

"The cloth thus prepared is ready to receive the colour, which is prepared in the following manner. Put 3½ gallons of water into an uncovered copper vessel and set it on a gentle fire; when it is something more than lukewarm, put in the cloth, along with the colouring ingredients, which have previously been thus prepared. Take of *dl* from one to two seers, according to its quality, powder it, and rub it with two ounces of oil of *sesamum* to each seer; add of the flowers of *D,hawry*‡ one-eighth of a seer to each seer of *dl*, or, instead of *D,hawry*, one ounce and a half of *purwds*§ in powder.

"The cloth and colouring ingredients are continued on the fire with a gentle heat, gradually increased, for about three hours. Towards the end the water is made to boil strongly. By taking up a little of the water and examining its colour, as it is dropped in the vessel, they judge of the success of the process. It ought to be of a clay-colour, or a little deeper. If it proves very red, the colour would be spoiled, and the remedy is to add a larger proportion of *D,hawry*. During this process the cloth is continually moved by lifting part of it with a

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"* *Bindwasa*, about the same distance from *Oujein* as the former."

"† The *chebule*; *myrobalani maximæ oblongæ angulosæ*. C. B."

"‡ A shrub which grows wild on the hills and on the banks of the rivulets, where they are formed of a grassy sod. The flowers are of a beautiful red colour, and are gathered both for the use of the dyers and of the apothecaries, who give an infusion of them as a cooling medicine. They lose their colour in drying, and only yield a slight brownish tincture to water; so that the benefit derived from them in dyeing with *dl* seems to depend merely on their action as an astringent, which is confirmed by the substitution of *purwds*, a strong astringent, as an equivalent to *D,hawry*.

"§ A kind of gallnut, containing the exuviæ of a small insect, found on a species of the *Mimosa*. In *Malwa* it is called *purwds*, in *Marwar*, *succoor*, and in the country about *Monghyr*, *purwds*. This being a stronger astringent, we are told that an exact attention to the proportion of it is more necessary than to that of the *D,hawry*.

[illegible]

[illegible] of the [illegible].

[illegible] is almost [illegible] process [illegible]. The most [illegible] days in a mixture [illegible]; it is [illegible] and dried. Sometimes [illegible] instead of being merely *steeped* in [illegible] is occasionally omitted. Thus, in [illegible] thread for dyeing is sometimes prepared [illegible] six days in water containing powdered [illegible] Lohardaga thread is sometimes simply well [illegible] seed and then dried. Some other kind [illegible] may be used instead of, or in addition to, the castor-seed: [illegible] the alkaline earth called khar (क्षार), or some other

kind of alkaline earth, may be employed instead of, or in addition to, the sheep or cowdung. In Balasor the thread is prepared for dyeing by being steeped in the juice of thoroughly ripe pumpkins or water-melons (boital or kudoo, and panikakháru), in the proportion of 1 seer of thread in ½ seer or 16 ounces of pumpkin juice. The following processes of preparing the cloth are employed in the districts mentioned:— AL OR AICH.

Thread well rubbed with a mixture of charred *castor-oil seed* reduced to a paste with water and *cowdung*, and kept in this paste for two days. It is next steeped and rubbed daily for 21 days in water made from the ashes of the bhoosa of *sirgonja* (the oil-seed *Guizotia oleifera*), boiled in this ash water, and finally rinsed in cold water. Proportions: one seer thread, one seer castor-oil seed, two chittacks cowdung. (Lohárdagá.)

Cloth first cleaned and dried; then mix the *ashes of plantain* bark and leaves with a quantity of water sufficient to wet the cloth to be dyed; to this add *castor-oil seed* fried and pounded, and mix well, and afterwards mix with this decoction *mustard oil*. Steep the cloth in this for one night; in the morning wash the cloth in this same decoction, and dry it. Repeat this process of steeping and washing the cloth in the same water, and subsequently drying, every day for 15 days. Then wash the cloth in fresh water. On drying, it is ready to receive the dye. Proportions: one seer of castor seed for every 60 yards of cloth, one powa of mustard oil for every seer in weight of cloth. (Dinájpur.)

Cloth steeped in a mixture of *mustard oil* and *cowdung* for one night. Next day it is dried in the sun, and the next night is steeped in water containing the *ashes of plantain leaves*. Next day it is again dried, and on the third night is again steeped in water containing plantain ashes. Next day it is washed in soft water and dried in the sun. Proportions: cloth one seer, mustard-oil one powa, and cowdung one powa. (Bákarganj.)

Cloth or yarn is steeped three or four times in a mixture of *oil* (castor-oil?) and *country salt* (the ashes of plants, खार), dried and washed as often in soft water. (Kuch Behar.)

Cotton thread is first mixed with *oil* and *alkali*, and kept in this state for a month. It is then well washed and dried. (Jalpáigurí.)

Cloth or thread is steeped in a mixture of cold water, *castor-oil*, a little *cowdung*, and any of the *alkaline ashes* (the ashes of plants) used by washermen. At intervals the material is rubbed vigorously about in this mixture, then taken out and dried in the sun, and again replaced. This is continued for four or five days, when it is washed in cold water, and finally dried in the sun. (Cuttack Tributary Mehals.)

Preparation of dye.

The dyeing solution is prepared by cutting the roots, or sometimes only the bark of the roots, into small pieces, pounding them well, or grinding them in a *dhenki*, and steeping or boiling in water. Generally the material to be dyed, prepared as above, is boiled with the roots in water, but sometimes, after the roots have been treated as above, they are taken out and thrown away, and the cloth or thread is simply boiled in the water containing the dye extracted by the above process from the roots (Dinájpur).

Auxiliaries employed.

A great variety of substances are used as mordants or auxiliaries: these are lodh bark or leaves, *Symplocos racemosa* (Lohárdagá, Monghyr, Balasor), bhauria or bhauli leaves, *Symplocos lucida* (Dinájpur, Kuch Behar), latkan bark, *Bixa Orellana* (Kuch Behar), sood tree bark (?) (Santál Parganás), myrabolans, *Terminalia Chebula* (Patná Division, Monghyr), turmeric, *Curcuma longa* (Sáran, Darbhangah, Monghyr),

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alum (Bírbhúm, Dinájpur, Nadiyá, Patná Division), dhao flowers, *Woodfordia floribunda* (Darbhangah, Monghyr), babul, *Acacia arabica*, gum arabic, and other gums (Darbhangah, Monghyr), lime (Bográ), saltpetre (Monghyr), bohari, *Cordia Myxa* (Darjíling), geru, *i.e.*, red-ochre (Darbhangah), thalthelang bark and leaves, *Acacia Intsia* (?) (Jalpáigurí). Different combinations of these substances are employed in various districts. They may be applied to the cloth after the cleaning process described above before the application of the dye; they may be mixed with the dye before the cloth is steeped or boiled in it; they may be applied to the cloth along with the materials used for cleaning and bleaching the cloth; or, again, the materials required for preparing the cloth, these mordants and accessories may all be made into one decoction along with the dye-stuff, and the cloth at once steeped or boiled in this complex liquid. Most of these materials seem to act as mordants in fixing the colour, generally modifying the intensity of the red dye produced: the gums are of course employed to give tenacity to the colours. These various processes are illustrated in the following detailed accounts of ál-dyeing as practised in the districts specified.

In many cases no mordant or auxiliary is used in addition to the materials employed for cleaning the cloth previous to the application of the dye. In these cases the root is either pounded fine, or ground, and put into water. This may be boiled first, and the cloth then steeped in the hot liquor, or the cloth may be boiled along with it, or again the cloth may first be well steeped in this cold decoction and afterwards boiled with it. The varieties in these processes are set forth in the following detailed accounts :—

The cloth, prepared as above explained, is boiled in water along with the powdered bark of the *ach* roots and then left to steep in this solution until it has cooled. (Bardwán, No. **11241**, cotton.)

The roots, bark, and woody tissue, together or separately, are cut into small pieces and pounded, water is added, and the whole well boiled. Into the hot liquor resulting the cloth is then placed to steep for a quarter of an hour, taken out, and dried. If the woody tissue of the roots without the bark be taken, a light colour is obtained. (No. **11193**, cotton, dirty yellow.) If the bark and woody tissue are both taken, a darker colour results. (No. **11192**, cotton, dirty brownish red.) The addition of *lime* causes the colour to be bright red. (Bográ.)

The bark of the *ach* tree is pounded in a fine powder and a sufficient quantity of water added. Into this the cloth, prepared as above, is placed, and the whole boiled for about five hours. The cloth is then removed, dried in the sun, washed in pure water, and dried again. (Hazáríbágh.)

Bark roughly broken up and boiled with water. When cool, the cloth to be dyed is steeped in the liquor. (Palámau in Lohárdagá.)

Roots of plant ground very fine and boiled with water. The extract is a deep red solution, which is used for dyeing. (Bánkurá, No. **11009**, cotton, dark red.)

The powdered roots are boiled in water to produce the dye. (24-Parganás, No. **10501**, cotton, dark red; Jessor, No. **10964**, cotton, pink.)

The bark of *achhu* root is pounded into a fine powder, and a sufficient quantity of water added. In this the prepared cloth is placed and allowed to steep for about 24 hours; the whole is then boiled gently for about two or three hours. The cloth is then removed, and dried in the sun, washed in pure water, and dried again. (Cuttack Tributary Mahals, Nos. **10966**, wool, and **11557**, cotton, reddish brown.)

In some cases the materials necessary for the cleaning and bleaching of the cloth are mixed with the dye in one decoction in which the cloth is steeped: thus—

Bark of *aek* root (*chaili*) is placed in cold water along with pounded *castor-seed* and *cowdung* and allowed to macerate. The decoction is afterwards boiled with the material to be dyed. (Singbhúm, No. **10968**, cotton, pale red, and No. **10969**, cotton, purplish red.)

In the following cases the mordants or other accessories are applied to the cloth after it has been cleaned as above and before it is dipped into the dye solution:—

A solution is made by boiling 1 seer of *lodh leaves* and 2 seers *wood-ashes* with 4 seers water. This is filtered from the residue by making a small hole in the bottom of the gurrah. The thread, after being well rubbed with charred *castor-oil seed* and dried, is steeped in the lodh solution and dried. This steeping and drying is done four times. 2 seers of *chyli* root bark are then boiled in 4 seers of water. Into this solution the dried cloth is dipped and steeped until the proper depth of colour is obtained. (Lohárdagá.*)

Cloth is first soaked in a preparation of *hurra* berries (*Terminalia citrina?*); after partial drying it is soaked in a mixture of *saltpetre*, *turmeric*, *lodh*, *babul* and other gums: to this the ál roots and *dhao flowers* are finally added, and the whole boiled. (Monghyr, No. **10848**, cotton, dark red, with up-country ál; No. **10849**, cotton, darker red, with Hájípur ál.)

Cloth first soaked in *myrabolan* water and dried. After that it is soaked in, or stamped with, a thin mixture of water, *lodh* bark, *turmeric*, and *alum*, and again dried. It is then lightly washed and dried. It is then put into a vessel containing powdered ál root in water. This is boiled until a red of the required depth is produced. The cloth is then removed, dried, washed, and dried again.

Six yards of cloth require—½ seer lodh bark.
1/16 seer turmeric.
3 tolas alum.
¾ seer ál powder. (Sáran, No. **11216**, cotton.)

Cloth is put into water along with *myrabolans*, which give it a dirty yellow colour. It is then dried and treated with water and *alum*. It is then boiled in a vessel containing powdered ál in water. (Patna, No. **10489**, cotton, dark red, ál alone; No. **10490**, cotton, bright yellow, ál with hurrah; Nos. **6672** and **10962**, cotton.)

Cloth is steeped in a mixture of hurra (*Terminalia Chebula*), *lodh bark*, turmeric (*Curcuma longa*), *alum*, *geru* (red ochre), and *gum arabic* for three or four days, after which it is washed in cold water. It is then boiled in a vessel containing ál bark, pounded into a fine powder, mixed with *dhao* flowers and a sufficient quantity of water. The boiling is continued for five hours. The cloth is then removed and dried in the sun; it is then again washed in cold water and dried (5 seers ál, 1 seer dhao flower, 1 seer hurra; ½ seer turmeric, ½ seer alum, ½ seer lodh, ¼ seer geru, 1 seer gum arabic.) (Tájpur in Darbhangah district.)

In the following case these dyeing auxiliaries are applied to the cloth along with the materials used for cleaning and bleaching the cloth before the application of the dye:—

The cloth is steeped in a mixture of *castor-oil* and *myrabolans* for three or four days, after which it is washed in cold water. It is then boiled for

* In the information regarding chyli root received from Lohárdagá, the scientific name is said to be *Morinda exserta*. But as the chaili root of the neighbouring districts of Manbhúm and Singbhúm is *Morinda tinctoria*, the Lohárdagá chyli is assumed to be the same. Of the *Morinda exserta* of Roxburgh and others, Hooker remarks in the "Flora of British India," vol. III, p. 156:—"Under Roxburgh's descriptions are included various forms of *Morinda* with exserted anthers, of which some are referable to *citrifolia* and others to the varieties of *tinctoria*; and as the character of the anthers is sexual, this form must be abandoned even as a variety, as Thwaites has pointed out."

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five hours in a vessel containing finely powdered ál bark mixed with *dhao* flowers and a sufficient quantity of water. Cloth is then removed and dried in the sun; again washed in cold water and dried. (Darbhangah, No. 11052, cotton, dark-red.)

In the following these auxiliaries are made into one solution with the dye, in which the prepared cloth is steeped or boiled, or else they are added to the dye whilst the process of dyeing is going on:—

Root of ach is pounded up with powdered *alum* and boiled, in the proportion of 1 chittack alum to ½ seer ach. The cotton to be dyed is steeped in this solution. The second day the same quantity of fresh ach root is powdered and boiled with ½ chittack alum; the cloth is again steeped in the resulting solution. The same thing is repeated the third and fourth days, except that on the third day ¼ chittack of alum is taken, and on the fourth ⅛ chittack, ½ seer of fresh ach being used daily to give a fresh solution. After four days' dyeing the process is complete. (Bírbhúm, No. 10971, cotton, pinkish red; Nos. 4655 and 3517, yarns.)

The thread, prepared as above by rubbing with charred *castor-oil* seed and *cowdung* and steeping in water containing the ashes of the bhoosa of *sirgooja*, is then steeped in a solution made by boiling 2 seers of *lodh* leaves in 7 seers of water until 5 seers remain and adding 1 seer powdered *chyli* root bark. In this solution the thread is well rubbed and then left to steep for 24 hours; 1 seer of fresh water is then added, and the whole boiled till nearly dry. The thread is left in this for 12 hours, removed, rinsed in cold water, and dried in the shade. A fresh solution of ½ seer chyli root bark in lodh leaf water is made, in which the thread is again boiled and then left to steep for 12 hours. It is again removed, washed in cold water, and dried in the shade, and is of a fine permanent red colour. (Lohárdagá.)

Roots of dáruharidrá cut into pieces 2 or 3 inches long, ground in a dhenki and steeped in water. For 5 seers of ground root 6 seers of water are used. The roots are then taken out and reground and replaced in the same water. This operation of grinding and steeping in water is repeated three or four times, after which the roots are removed from the water and thrown away. In the dye solution thus prepared 2 seers of thread or cloth, sometimes cleaned as above explained, sometimes without cleaning, is steeped for a day. Then 1 powa of the powder of the dry leaves of bhauri (*Symplocos lucida*) is mixed with the dye solution, and the whole boiled in an earthen pot and then left to cool. When the decoction is quite cool, the cloth is removed, washed in cold water, and dried. The whole operation is repeated three or four times, using fresh materials each time. (Dinájpur, No. 11335, cotton, brownish red; No. 11576, cotton, red; No. 11166 and No. 11340, cotton.)

Roots ground in a dhenki so as to extract the juice, with which the powdered dry leaves of *bhauri* are mixed. The cloth, cleaned as above, is kept in the juice for one night; on the following day the whole is boiled. The boiling is repeated on the second and third day, when the cloth will have acquired the proper colour. (Goseya, sub-district of Dinájpur.)

Roots washed and ground into powder, which is mixed with a small quantity of water and left to soak in it for three or four days. Powdered leaves of *bhauri* are then mixed with the water. More water is added, and the liquid filtered from the residue through a cloth sieve and boiled. The cloth to be dyed is first rubbed with *oil* and the *ashes* of *plantain leaves* and bark, then washed, and afterwards steeped in the dye solution thus prepared. (Bírganj, sub-district of Dinájpur.)

To dye 1 seer of erendi thread, pound 1 powa of *alum* and mix it with 4 seers of water; steep and boil the thread in this, and then dry in the sun. Take 4 seers of dáruharidrá root, cut them into pieces, clean and grind in a dhenki, then add 4 seers of water. After the roots are well soaked in this water they are taken out and thrown away. The thread is then steeped in the dye solution remaining and boiled with

it until the whole of the solution is boiled away. A second dye solution is formed as before from fresh roots: the thread is again boiled in this, and whilst the boiling is going on the spittle resulting from the chewing of ordinary *pán*, that is, of betel leaves with areca nut, lime, and catechu, is spat into the water. The thread is then removed and dried. (Hábrá, sub-district of Dinájpur.)

Dáruharidrá and dried leaves of *bhauri* are pounded together by a dhenki or chham. Water is added, and in this the material to be dyed, if endi thread, without any preparation, if cotton thread, prepared as above, is soaked and boiled for one or two hours, taken out, and dried. (Jalpáigurí.)

Dáruharidrá is cut into pieces and boiled in water with endi thread. The thread is then dried and again boiled in water with leaves of *thanthelang*. The thread is again dried and boiled in water with dáruharidrá cut into small pieces. It is then kept wet in the same state for 6 hours, after which, when dried in the sun, it has acquired a *yellow** colour. (Jalpáigurí.)

Pound 1 seer of the roots of malancha with 1 chittack of *lodh* bark and steep the whole in water. In this infusion the cloth, prepared as above, is steeped once every day for three days, and has then acquired a deep red colour. (Bákarganj, No. 11243, cotton, red.)

Bark of fresh roots of dáruharidrá is bruised and steeped in water along with a small quantity of the powdered bark of the latkan-tree (*Bixa Orellana*). In this tincture the cloth or yarn, prepared as above, is steeped, and the whole boiled. The cloth or yarn is then removed and washed. This process is repeated two or three times before the colour is fixed. If powdered *bhauli* leaves are used instead of the bark of latkan, the resulting colour is a deeper red. (Kuch Behar, No. 12776, cotton, pale brownish pink, latkan; Nos. 12777, cotton, and 12778, woollen yarn, dark red, bhauri.)

Root of ach and bark of *sood* (?) are pounded together and well mixed with water. The material to be dyed, prepared as above, is put in this, and the whole well stirred up and left alone for 20 or 30 hours: it is then boiled, and after cooling the cloth is removed and washed in cold water and dried. The result is a light shade of red. By repeating the process three or four times a deeper colour is secured. (Santál Parganás.)

Bark and roots of the plant are ground very fine and mixed with *lime* and the *ashes* of burnt plants and *castor seeds*. This mixture is left in water for four or five days, and then boiled for a short time. The thread to be dyed, prepared as above, is then steeped in this decoction and afterwards dried. (Santál Parganás.)

Roots of achu steeped in water and mixed with the ashes of burnt *achan* wood or of the roots of *chakaiphang*. The cloth is soaked in this dye for three nights, fresh dye being prepared each night, and then boiled in the same liquid, and finally washed in cold water. (Tipperah, Nos. 11202 and 11203, cotton.)

Roots cut into small pieces and crushed in a dhenki. The crushed roots are then pressed between the palms of the hands until the juice exudes. This juice is then mixed with a little *alum*, which causes it to assume a fine red colour. (Nadiyá.)

Bark of hardi pounded up and soaked in water; then mixed with *ashes* of some tree (generally plantain ashes, which contain a large proportion of salts), and with the green leaves of the *Cordia Myxa* (bohari), and boiled down. In this dye tincture the article to be dyed is steeped, taken out and washed, and then repeatedly steeped and washed again until a colour of sufficient intensity is obtained. (Darjíling district. ?)

The pounded roots of achhu, *lodh* bark, and *kharpani* † are boiled together, and a little castor-oil is added. The thread, prepared as above, is

* This is probably a mistake for *red*, as it is stated that thanthelang merely heightens the colour produced by dáruharidrá itself.

† Kharpani, ଖରପାଣି, ଗାଢ଼ଘାଣ, which plays an important part in all dyeing operations in Orissa, is the result of boiling down plantain leaves

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steeped in this infusion. By repeated soakings, the colour is deepened. The colour is permanent. The proportions are—

Thread, 1 seer :—achhu,	1¼	seer or	40 oz.
lodh,	⅛	„	4 „
kharpani,	¼	„	8 „
castor-oil,	⅛	„	4 „

(Balasor, No. 4017, cotton yarn, dark red ; No. 4018, cotton, pink.)

The following specimens in the Economic Museum have been received from the districts specified ; but beyond the fact that they are dyed red with ál no information is given :—

Nos. 10491, 10806, cotton, Mánbhúm.
No. 10787, cotton, Midnapur.
„ 10833, cottor., Balasor.
„ 11061, woollen yarn, Purí.

Ál does not seem to be much used for the preparation of compound colours. Mention of such use is, however, made from the Balasor district, where a very dark permanent *blue* colour is imparted to cloth by leaving the pounded roots of *achhu, lodh*, and *indigo* rejections mixed with *kharpani* to soak for a week ; water is added as required. The proportions are—

Thread 1 seer :—achhu,	2 chittacks	or	4 oz.
lodh,	1	„	2 „
indigo rejections,	4 chittacks		8 „
kharpani,	2 chittacks		4 „

(No. 4016 cotton, blue.)

By repeated soaking in the tincture the blue becomes almost black.

A similar method of dyeing blue with *indigo, aoosh wood, lime, and sajimati* in Rájsháhi will be found described under Indigo, p. 124. Another method of dyeing blue with *indigo, dáruharidrá*, and *gur* is described on p. 123. (Dinájpur).

It is reported from Sáran that "cloth dyed black is prepared in ál to render the colour fast," but no particulars are given.

Juice of leaves used as ink.

In addition to its use as a dye, the juice of the leaves of this plant is also employed as an ink. We are informed from Maimansinh that pundits who keep a *tal* occasionally grow one or two plants round their houses and use the juice of their leaves as ink in writing Sanskrit on palm leaves. To extract the juice for this purpose a handful of leaves is first squeezed in the hand, then placed in the sun for a quarter of an hour, and the juice then extracted by pressure. A piece of cloth dyed with the juice from the leaves (No. 10836, cotton, reddish brown) has been received from Maimansinh, although it is not evident from the letter whether the juice of the leaves is occasionally employed in the district for that purpose, or this is only an experiment.

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5. Morinda citrifolia, *Linn.*—Nat. Ord. Rubiaceæ.

Achhu (Purí).
Aich, আইচ (Húglí, Midnapur).
Ach, আচ (Midnapur).

In the three districts Purí, Húglí, and Midnapur, the plant called achhu, aich, or ach would seem to be not the *Morinda tinctoria*,

as elsewhere, but apparently the *Morinda citrifolia*, a species differing very slightly from the *Morinda tinctoria*. Apart from this difference, all that is said above relating to the cultivation of ach and the methods of extracting the dye from the roots or root-bark applies equally to this species of *Morinda*. It is found growing wild in the jungles of the Purí district, and is also cultivated to a slight extent in various sub-divisions of that district, but no estimate is attempted of the area under cultivation. In Húglí the plant is grown to some extent in the neighbourhood of Baidyabatí, the estimated area under cultivation being 100 bighas; but the Collector states that the cultivation of the plant is gradually decreasing, owing, it is said, to the cost of cultivation. In Midnapur the area under cultivation is estimated at 10,000 acres. ACH.

Growth and cultivation.

From Purí we are told that this species of *Morinda* grows best in ordinary soil, with perhaps a slight admixture of sand. The soil commonly called *baliza mati* by the natives is said to be the most favorable. It is, like the *Morinda tinctoria*, cultivated by slips or cuttings, which are planted out in ridges at the beginning of the rainy season, about June or July (Purí), or at the beginning of the cold season, October or November (Midnapur). The ground is previously prepared by ploughing and digging, and the plants are inserted on the ridges about two or three cubits apart. In Purí from 300 to 400 plants occur in a *mán* of land, and the plant is grown frequently in very large fields of two or three *máns* in extent. The plants are watered regularly until the new leaves shoot, but afterwards they require very little care or attention: they grow to the height of three or four cubits in two years' time. From Purí we are told that the roots are partly dug up in the second year, but only come to perfection in the third or fourth year; from Midnapur, that they mature generally in two years, when their roots are dug out; and from Húglí, that they take three or four years in maturing.

Cost and profits.

No information of the cost and profits of cultivation is given from Purí or Midnapur, but the Collector of Húglí gives the following figures:—

Cost of making the ridges, weeding, and tending the plants for three or four years	Rs. 50 per bigha.
Yield of root	20 to 25 maunds per bigha.
Selling price	Rs. 8 to Rs. 9 per maund.
Profit at end of four years	Rs. 150 per bigha, or Rs. 38 to Rs. 50 per annum.

He also states that there is a very small quantity of fine root produced, which sells at from Rs. 25 to Rs. 30 per maund. The Collector of Midnapur states that the average price of the root in his district is Rs. 20 per maund. The price of ach in two neighbouring districts like Midnapur and Húglí can scarcely differ so widely as this. If these figures can be relied on, comparing them with those for *Morinda tinctoria*, it would seem that whilst the cost of cultivating this species of *Morinda* is to some extent less than in the case of *Morinda tinctoria*, the profit is considerably higher; also that whilst the root in general sells at pretty much the same rate, the finer varieties fetch a much

AICH. higher price than in the case of *Morinda tinctoria*. The yield per bigha is pretty much the same in the two cases.

The aich produced in Purí is all consumed locally, but a large quantity of that produced in the Húglí and Midnapur districts finds its way to Calcutta. In the former district all that is locally consumed is by the dyers of Chandernagore.

As in the case of *Morinda tinctoria*, the dull red colouring matter of this species resides chiefly in the root-bark, the roots themselves being yellow and giving a yellow dye.

The roots are cut into small pieces and boiled or steeped in water; a little *alkali* is mixed with the liquid so obtained before its being used as a dye for cotton yarns and cloths. In Midnapur there is a special class of the people, called *jugi*, exclusively engaged in the production of aich dye.

Preparation of dye.

In the Midnapur district a red dye for home use is produced by boiling the juice of small green *jack fruit* with *aich* root and *lime*. With this red dye cloth and the jute used in tying bomb are dyed.

In the same district aich is used in preparing a *purple* dye as follows: Equal quantities of *indigo*, *sajimati*, *lime*, and pieces of *aich* root are steeped in water in a covered pot for four days. The mixture ferments and froth collects at the top. This froth is removed, and yarn and cloth previously dyed red are steeped in this liquid two or three times, acquiring a purple colour (p. 125).

HURDI. VAR. *M. bracteata*, sp. *Roxb.*

Hurdi (Paharia).
Huldikung (Lepcha).

This species of *Morinda* seems to be used as a dye in the Darjíling district. All the information about it is contained in the following note by Dr. Schlich, Conservator of Forests for Bengal:—"A large shrub found in the Terai and lower hills, chiefly between the Mahánandá and the Tístá rivers. The bark of the roots gives the *hurdi* dye, which is of a red or yellow colour. It is exported into the plains." (Gamble's "Trees, Shrubs, &c., of Darjíling," page 49.) This form is reduced to *Morinda citrifolia* in Hooker's "Flora of British India."

BAN HARDI. **6. Morinda angustifolia**, *Roxb.*—Nat. Ord. RUBIACEÆ.

Ban hardi or hardi (Nepalese and Lepchas in Darjíling district).
Chengrung or chenung (Garo Hills).

The only districts from which we have information of this species of *Morinda* being used as a dye are Darjíling and the Garo Hills (Assam). In both these districts the plant grows wild, and is apparently never cultivated. In the Darjíling district it grows very abundantly "in the open jungles, especially on the drier ridges, from the bottom of the hottest valleys up to about 3,500 feet." It does not grow at higher elevations. No particulars as to its growth have been received from the Garo Hills, except that the roots are dug up in the cold season.

The Lepchas do not apparently use the root for dyeing purposes themselves, but in seasons of great scarcity, or when much impoverished,

collect it and carry it for sale to the háts at Matgarha and Darjíling. BAN HARDI
At Matgarha it fetches from Rs. 4 to Rs. 5 per maund; at Darjíling, from Rs. 2 to Rs. 2-8 per maund. In the Garo Hills it is sold in small quantities in the háts at about As. 2 per seer.

Methods of dyeing.

In Darjíling the dye is prepared by pounding the bark of the root and boiling it in water; it is then strained, and the water boiled over again to the required consistency. In the Garo Hills the cotton thread which is dyed with chengrung undergoes a preliminary process of cleaning, resembling that usual elsewhere in *ál* or *ach* dyeing. The thread is rubbed well with pounded *sesamum* seed and the leaves of *bambi* or *daggal* (*Sarcochlamys pulcherrima*, pp. 143, 152), and then left alone for two days; it is then well washed. The dye solution is made by pounding the roots, steeping them in water, and then boiling three or four times in succession. Into this decoction, when cool, the thread prepared as above is placed, and the whole heated gently, but not boiled, in a pot. When the liquor is cool, the thread is removed and again washed. It is then again steeped in the dye liquor, heated, taken out, and washed, and this is repeated two or three times until the colour is sufficiently fixed. (No. **12444**, cotton yarn.) The Garos do not dye their clothes with this: the thread is first dyed in the way described, and is afterwards woven into cloth.

7. Morinda persicæfolia, *Ham.* (M. lanceolata)—Nat. Ord. Rubiaceæ. HULDIKUNG.

Dala hurdi (Paharia).
Huldikung (Lepcha).

This species of *Morinda* also grows in the Darjíling district, and is said to give a dye similar to that given by the *Morinda bracteata* mentioned above. (Gamble's "Trees, Shrubs, &c., of Darjíling," page 49.)

In addition to the information given above relating to the widespread use of various identified species of the genus *Morinda* as dyes, there are also several reports from the Chittagong Division regarding a dye-stuff in extensive use there, which undoubtedly belongs to the same genus; but unfortunately sufficient information has not been received to lead to the definite identification of its species. It very probably belongs to some one of the four species mentioned above, but it is not impossible that it may be a distinct species. Dr. King, to whom dried specimens of the flowers, fruit, and leaves of rung-gach were forwarded for identification, writes:—"Rung-gach is a species of *Morinda*, probably *angustifolia* or *exserta*, but the specimens are in too bad a state to say exactly what species. But there is no doubt as to its being a *Morinda*." (September, 1878.) Mention of the use of rung-gach in dyeing red will be found in Lewin's "Hill Tracts of Chittagong," p. 122.

8. Morinda sp. ?—Nat. Ord. Rubiaceæ. RUNG-GACH.

Rung-gach.

The Commissioner of the Chittagong Division reports that there is no regular cultivation of this plant, which grows wild in the jungle. It is, however, grown by a class of weavers near Hátházári station, generally on the banks of tanks and in the enclosures of homesteads. The areas covered, if grouped together, might amount to about 9 acres.

RUNG-GACH. The land is first thoroughly tilled, and then ridges are made about two feet high, in which slips or cuttings of the plant are inserted 3 or 4 feet apart. Nothing else is said about the cultivation of the plant.

It is also stated that no profit is obtained in the first year of planting, but that in subsequent years an acre of such land yields a profit of Rs. 40 (annually ?), the cost of cultivation being Rs. 20. It might be inferred from this that part of the roots of the plant was dug up every year after the first, the plant being allowed to go on growing; but this is at variance with what is stated in a subsequent letter from the Magistrate of Chittagong, who says that "the roots are taken when the plants are some six or seven years old."

The whole produce is used locally.

In dyeing with rung-gach, as in the case of other species of *Morinda*, the cotton cloth or yarn is subjected to a preliminary process of cleaning, resembling those given in detail above. Two processes are given:—

1. For cleaning 5 seers of thread, put 5 seers of *ashes* in an earthen pot, in the bottom of which a hole is made; 5 seers of water are added, which is distilled through this whole; 5 chittacks of *karan oil* are then mixed with the distilled water: the thread is well soaked in this, then rubbed hard, and dried. The process is repeated from the beginning every day for five days, except that no karan oil is mixed with the distilled water after the first day. On the 6th day the thread is kept in cold water for two hours and then washed in the usual way by dashing it against a wooden board. It is then dried, and is ready for the application of the dye.

2. The thread or linen is to be boiled sufficiently in water to take off any grease or dirt that may adhere to it. It is then washed in cold water and dried. It is then thoroughly soaked in a mixture of one part *mustard oil* and three parts of a solution obtained by mixing either *imlit ash* or *mustard plant ash* in water, allowing the ash to settle, and then decanting the clear solution. After being well soaked, the thread or linen is kept out of air under cover for two days and then exposed to the sun for three days. It is then again soaked in fresh imlit ash or mustard plant ash solution twice daily for three days, and exposed again to the sun for three days. In the morning and evening the linen is put out in the dew. This exposure to the sun and dew is in some cases carried on for as long as a month. It is afterwards washed in cold water, and is ready for the dye.

The dye is prepared by cutting the roots of the rung-gach into small pieces and pounding or grinding them, then adding water. The substances used as mordants or auxiliaries are *kharula bark, imlit ash, ash of the kalai, mirtinga, or akorjya bamboo* (pp. 152, 153). The following details are given:—

Cut 5 seers of the roots of *rung-gach* into small pieces and wash with water: then pound them well. After the first pounding, wash the roots in a pot containing 5 seers of water; pound and wash again in the same water, repeating the process eight times, till the water is quite red. Then take 2½ chittacks of the powdered dry bark of the *kharula* tree and add it to this tincture. Soak the thread, cleaned by the process (1) above, in this, and dry it. Then for seven successive days boil the thread in this dye solution for an hour or so, and afterwards dry it. The proportions of the ingredients here given are for 5 seers of thread. (No. 11239, cotton, dark red.)

Cut the roots of *rung-gach* into small pieces and pound into a powder; digest the powder well with water, and then strain through a cloth. Do

the same thing with the bark of the hill tree *kharula*. Mix together the two filtered liquids: the result is the red dye tincture which is used for dyeing thread before it is woven. (No mention is made of any preliminary process of cleaning the thread.) RUNG-GACH.

Powder the root of *rung-gach* and add to it the solution of the ash of *imlit* tree prepared as above in sufficient quantity to cause the solution to assume the required colour, or the ash of the *kalai* bamboo or of the *akorjya* bamboo may be substituted for the imlit ash. The linen prepared as above (2), and still wet after its last washing, is soaked in this tincture and then kept out of the air for two days. It is then exposed to the sun for from three to five days. The process may be repeated from the beginning until the required intensity of colour is produced. (No. 13581, cotton.)

In the following additional process the materials required for cleaning the cloth are mixed with the dyeing materials to form one solution:—

Pound ½ seer of roots of *rung-gach* into a pulp; add to it ½ seer of *mustard oil* and ½ seer of the ash obtained by burning either the young shoots of the *mirtinga* bamboo or of the *kalai* bamboo or the green wood of the *imlit* tree. These are well mixed together: in the mixture 1 seer of thread is soaked and kept in it for three days, after which it is dried and washed with pure water to get rid of the oil. The result is a fine red colour.

The Commissioner of the Chittagong Division reports that since the introduction of foreign dyes and Manchester goods the cultivation of the rung-gach has considerably decreased. Its value in 1875 was said to be in consequence only half of its former value.

9. Nyctanthes Arbor-tristis, *Linn.*—Nat. Ord. OLEACEÆ. SINGRAHAR.

Sepháliká, শেফালীকা (Bardwán and Chittagong).

Sewli or Seoli, শিউলী (Bardwán, Presidency, Bhágalpur, and Chutiá Nágpur Divisions).

Shinghar, Singrahar, سنگرهار, শিংশার, [illegible] (Rájsháhí, Dacca, Orissa, Behar, and Chutiá Nagpur).

Harsinghar (Behar and Chutiá Nágpur).

Growth and cultivation.

This shrub grows plentifully in all parts of Bengal, but seems to grow in greatest perfection in hilly jungles. It does not appear to be anywhere cultivated for the dye which is yielded by the corolla of its flowers, but is extensively grown in gardens as an ornamental shrub, and on account of the beauty and faint sweet perfume of its flowers, which are used in Hindoo worship, being sacred to Siva. It is propagated in June or July, either by cuttings or else from seed, which has to be plentifully manured with cowdung. It requires little care after being planted, and flowers when two or three years old, from July to October. The flowers open at sunset and fall off in the morning, when they are gathered from the ground by women and children and used either for the dye or for necklaces for women, or else in the worship of the household deities. The corolla-tube is orange, and the limb white: the dye is only obtained from the orange corolla-tubes.

SINGRAHAR.

The dye is generally made only for local use, and is very sparingly sold in the bazars. The prices given are—

Prices and trade.

	Rs.	A.	P.	
Patná	1	12	0	per seer.
Sáran	0	11	0	„
Darbhangah	0	5	6	„
Monghyr	0	13	0	„
Cuttack	0	3	0	„ (or 4 annas per seer of 105 tolas).

There seems to be very little trade in this dye-stuff between district and district, but most of that produced in the Santál Parganás is said to be exported to Calcutta, whilst from Palámau 300 maunds out of 900 maunds produced in the five years preceding 1875 is said to have been exported to Gayá, Patna, and Benáres, in which districts the dye seems to fetch a larger price than elsewhere.

Preparation of the dye and process of dyeing.—The white limb of the flower is carefully picked off, and the orange corolla-tubes remaining are well dried in the sun, sometimes for two or three days, and kept till required. The process of dyeing is of the simplest possible description, and is almost everywhere the same. The dried flowers are either boiled in water or merely steeped in hot water, until the colour is extracted; the liquid is then generally strained through a cloth. The proportion of water to be employed is variously given as forty times the weight of the dye-stuff (Húglí), 4 quarts of water to 1lb of dye-stuff (Hazáribágh), 15 seers of water to 1 seer of the flowers (Lohárdagá), 1½ seers of water to 1 seer of singrahar (Dinájpur); but most probably no fixed rule is anywhere adopted. The boiling is carried on until from ⅔rd to ½rd of the water remains.

Extraction of dye.

The fabric to be dyed, generally silk, sometimes previously well drenched with water, is steeped in this liquid either whilst it is still hot or after it has cooled; it is sometimes boiled with the dye-solution. It is then dried in the shade. The resulting colour is bright *orange*, the shade of which is deepened by further immersions in the liquid. Half a seer of sephalika is sufficient to colour 60 yards of cloth of a yard in width. (Húglí.)

Dyeing.

The specimens of cloth thus dyed in the Economic Museum are Nos. **6681, 6668, 7546,** and **11209,** all cotton.

The colour thus obtained is very fleeting, and no means of fixing it appears to be known. In Murshidábád, however, a little *lime juice* is added to the dyeing liquid, which seems to render the colour less transitory; and in Dinájpur *alum* is added for the same purpose, in the proportion of ½ tolah of alum to 1 seer of the flowers (No. **13786,** cotton); in Purniah *milk* is added to the water in which the singrahar is boiled; and in Jessor a little *turmeric* and *lime* is said to be added to vary the shade.

Auxiliaries employed.

From Bhágalpur mention is made of combinations of singrahar with kusum (*Carthamus tinctorius*), with *kasis* (protosulphate of iron), with *indigo*, with kuth (*Acacia catechu*) and *sajimati*, with huldi (*Curcuma*

longa), and with *indigo and huldi*; but the colours are not stated, nor are details given, except in the case of the combination of singrahar with kusum, in which it is only stated that the kusum is soaked in cold water and the singrahar boiled. SINGRAHAR.

10. **Oldenlandia umbellata**, *Linn.* (Hedyotis umbellata, *Lamk.*)—Nat. Ord. RUBIACEÆ. SURBULI.

Surbuli.

Although the root of this plant does not seem to be used at all in Bengal for the dye which it yields, yet, as it grows in Purí and there seems to be a fair trade in the roots between that district and the Madras Presidency, where they are extensively used in dyeing, the information received from Purí is here entered.

There is apparently considerable confusion as to the scientific name of the plant which produces the "chay-root" of Southern India. Balfour says in one place: "Chay-root is the root of *Morinda citrifolia*;" in another, "chay-root is the root of a small biennial weed, the *Oldenlandia umbellata*, Linn." Elsewhere he states that the roots of *Morinda umbellata*, Linn., are sometimes used instead of chay-root in dyeing cotton *red*; but under *Morinda umbellata* he states that the roots of this plant yield a *yellow* dye. The same confusion appears also from the remarks in Mr. Liotard's Memorandum. Most authorities, however, make chay-root the root of the *Hedyotis umbellata*, Lamk., which is the same as the *Oldenlandia umbellata*, Linn., and the information detailed below agrees with this.

Growth.

This plant, the root of which is known as "Indian madder" or "chay-root," is reported to grow wild in the Purí district in sandy soil near the sea. "The dye is not extracted in the Purí district, but the roots are exported in their rough state to the south, to various places in the Madras Presidency. The cost of collection is about Rs. 3 per seer. The right to collect the surbuli in Sátpárá is farmed by Government for Rs. 8 in alternate years."

As stated above, the surbuli root does not seem to be used for dyeing purposes at all in Bengal, although extensively used in the Madras Presidency. An account of its use in the Madras Presidency has been received from the Collector of Ganjam. In that district surbuli is said to be scarcely used at all for dyeing, but it is extensively used in Sigadam and Bazipet in the Vizagapatam district, and also in the Godavery and Kistna districts.

"Both old and new white cloths are dyed with chay-root, but in old cloths the resulting colour is not so good as in new, for the freshness of the colour depends much on the texture of the fabric."

Methods of dyeing.

The following descriptions of the process employed, differing slightly in detail, are given from Ganjam:—

To dye a piece of cloth for a woman's garment 16 cubits long, make a mixture of 1½ seers *ginjelly oil*, 8 tolas of *alum*, 3 seers clear water, and 2 seers of pulverised *chay-root*, and wash in this the cloth thrice, on three successive days, drying it in the sun after each washing. On the fourth day wash the cloth again in clear water and dry in the shade. Then

SURBULL.

boil the cloth for two hours in a bath of one viss of pulverised chay-root and 20 seers water, and then dry in the sun: the next day wash the cloth in clear water and again dry in the sun. Then again wash the cloth in water containing the alkaline ashes used by washermen (called *chakali, kamum, and kharum*), and again dry in the sun: then wash in clear water and dry in the sun. Then boil the cloth for two hours in a bath of 4 seers pulverised chay-root and 15 seers water, and dry in the sun. The next day wash the cloth in clear water and dry.

1½lb of *ginjelly oil* is well mixed with as much *karem* water (*i.e.*, the wood-ashes water employed by washermen) as is required and a little cowdung in a pot, and the cloth dipped in this. The cloth is hung up to dry in the morning sun. It is then subsequently dipped twice a day for six days in karem water alone. It is to be dipped merely, not steeped, as steeping would damage it. On the seventh day it is well kneaded in the karem water, washed well in a tank, and dried in the sun. 2lb of well-dried *chay-root* are then pulverised, divided into two equal portions, and each put in water, the quantity of which varies according to the depth of colour required. A little *alum* is added to each solution. The cloth is then boiled in each portion in turn, and is then washed well and dried in the sun. (This is the process as described by the balajis of Berhampore. It is not stated how much cloth these proportions of the ingredients will dye.)

(Nos. 13029, 13120, 13121, cotton, all dark red, have been dyed in one or other of these two ways, but it is not stated which method has been followed in each case.)

MANJISTHA.

11. Rubia cordifolia, *Linn.*—Nat. Ord. RUBIACEÆ.

Manjistha, मञ्जिष्ठा, منجيٹھا, मनकीठा.
Manjeet.
Majetti or Mejatti (?) (Assam).
Moojeetee or Monadista (Jalpáigurí).
Ryhoi (Khasia and Jynteah Hills).

The information collected regarding Indian madder or manjeet is exceedingly fragmentary, and it is impossible now to take measures to supplement it. Specimens of the stems and root of the plant have been received from Dárjíling, Jalpáigurí, Maidah, Cuttack, and from several districts of Assam, viz. Nowgong, Lakimpur, and the Khasia and Jynteah Hills, and references to its use as a dye-stuff are made in the reports from Bánkurá, Húglí, Midnapur, Maldah, Bhágalpur, and Mánbhúm; but in most of these cases it is not stated whether the plant grows in the district in question or is imported from elsewhere for use as a dye-stuff. The only definite information as to the growth of the plant comes from Dárjíling and Nowgong. In the Dárjíling district it is described as a small climber, common all over the Dárjíling hills at elevations varying from 3,000 to 7,000 feet, but most abundant between 5,000 and 6,000 feet. It is found either creeping along the ground or climbing the trunks of trees in long festoons. From Nowgong we are informed that the creeper majetti grows on the hills bordering the Assam valley, whence it is brought down for sale to the valleys by the Bhutias, Mishmis, Nágás, and other hill tribes. The plant seems also to grow in the hilly districts of Cuttack, Chutiá Nágpur, and Bhágalpur. There is no mention of any *cultivation* of the plant, although it seems to have been once cultivated in the

Growth and cultivation.

Dárjíling district, to judge from the following remark of the Deputy Commissioner :—" It used to be extensively cultivated in Dárjíling many years ago, and was exported pretty considerably ; but the trade in it has been dying out, and now, except a petty traffic at the hâts, it is not sought after." Dr. Schlich states that the annual outturn in the Dárjíling district is about 200 maunds (1876) : the Collector of Maldah states that about 6 maunds of the dye-stuff are prepared annually in his district for local use. MANJISTHA.

The prices of the manjeet wood in the various districts are as follows :—

Bánkurá	...	... Rs. 9 to 10 per maund.
Húglí	...	... Rs. 10 to 12 per maund (imported from Calcutta as a drug, not as a dye).
Dárjíling	...	... Rs. 3 to 3-8 per maund.
Maldah	...	... Rs. 65 per maund.
Cuttack	...	... As. 4 per seer of 105 tolas (*i.e.*, about Rs. 7-8 per maund).

The prices in Bánkurá, Húglí, and Cuttack are fairly consistent, but the price in Dárjíling is very much below what obtains elsewhere, whilst the price as given by the Collector of Maldah is more than five times the highest price in any other district from which we have returns. But the Maldah returns, as already frequently pointed out, are uniformly carelessly compiled and totally untrustworthy, unless we can assume that in that particular district a state of things obtains which is totally distinct from what is found in any other part of India.

Exports and imports.

There is a slight export trade from India in madder or manjeet (including probably *Oldenlandia umbellata*) and also a considerable import of foreign madder. Madder is free of duty on the export: imported madder was subject to a duty of 7½ per cent previous to August 5th, 1875, afterwards diminished to 5 per cent up to March 9th, 1882, after which it was altogether removed. The statistics of these exports and imports are here given.

Exports of Madder or Manjeet.

Year.	India.		Sindh.		Madras.		Bengal.		Countries to which exported.	Quantity.	Value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.			
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.		Cwt.	Rs.
1875-76	101	1,968	5	55	96	1,913	.....	.....	Ceylon	96	1,913
									Mekran and Sonmiáni	5	55
1876-77	657	5,791	8	137	41	949	608	4,705	United Kingdom	600	4,585
									Ceylon	49	1,069
									Mekran and Sonmiáni	8	137
1877-78	51	862	33	505	11	263	7	94	United Kingdom	5	70
									Ceylon	13	287
									Mekran and Sonmiáni	33	505
1878-79	335	2,090	34	423	6	129	295	1,547	United Kingdom	295	1,547
									Other countries	40	543
1879-80	136	1,175	6	83	2	32	128	1,060	United States	128	1,060
									Other countries	8	115
1880-81	250	3,311	2	40	6	120	242	3,151	United States	242	3,151
									Other countries	8	160
1881-82	310	3,841	.....	.....	9	151	301	3,690	United Kingdom	135	1,506
									United States	166	2,184
									Ceylon	9	151

Imports of Madder or Manjeet.

Year.	India.		Bombay.		Sindh.		Madras.		Bengal.		Countries whence imported.	Quantity.	Value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.			
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.		Cwt.	Rs.
1875-76	8,418	1,04,455	6,498	85,182	1,768	17,483	152	1,790	.....	.....	Aden	270	3,145
											Arabia...	763	9,270
											Ceylon	152	1,790
											Persia	7,233	90,250
1876-77	7,723	1,01,163	7,433	97,343	279	3,666	11	154	.....	.....	Aden	758	10,445
											Arabia...	659	8,335
											Persia	6,293	82,207
											Other countries	13	176
1877-78	3,736	47,113	3,604	45,724	131	1,380	1	9	.....	.....	Aden	850	10,869
											Arabia	175	2,242
											Ceylon	1	9
											Persia	2,710	33,993
1878-79	6,033	74,567	5,814	71,677	191	2,410	28	480	.....	.....	Aden	523	7,360
											Persia	5,409	65,940
											Other countries	101	1,267
1879-80	3,298	38,548	3,151	36,732	122	1,383	24	433	.....	.....	United Kingdom	98	1,332
											Aden	467	5,456
											Arabia	160	1,655
											Persia	2,501	29,033
											Other countries	72	1,072
1880-81... ...	8,353	95,736	8,006	91,321	334	3,653	13	257	.....	.....	Aden	904	10,686
											Arabia...	483	5,950
											Persia	6,703	75,858
											Turkey in Asia	218	2,612
											Other countries	45	630
1881-82	6,241	92,445	7,479	83,717	754	8,621	5	68	3	39	Aden	932	10,511
											Arabia	306	3,515
											Ceylon	5	68
											Persia	6,998	78,351

MANJISTHA.

Preparation of the dye and methods of dyeing.—In Bengal it would seem that the dye of manjeet is extracted mainly from the stem and only occasionally from the root, as is the case in the North-West Provinces and elsewhere in India. It would seem to result that the manjeet of Bengal is rather the *Rubia Munjista* of Roxburgh than the *Rubia cordifolia*. Roxburgh states that the roots, stem, and larger branches of the *Rubia Munjista* are used for dyeing red,* and that the stem is preferred to the root.† This species of Roxburgh is, however, reduced to *Rubia cordifolia* in Hooker's "Flora of British India."

Dye obtained from stem.

To prepare the dye, the wood of the manjeet is first dried, then crushed and pounded, and then generally boiled with water, but sometimes merely left to steep for two or three hours in cold water. The dye solution obtained is of a deep red, and is used generally to dye coarse cotton fabrics or the thread which is to be woven into such fabrics.

Extraction of dye.

Alum seems to be universally employed as a mordant except in Assam, where, as will be seen below, a process is adopted different from that in use in Bengal. The following report from Cuttack gives in detail the method of dyeing with manjeet there employed:—

Alum as mordant.

> Bruise the *manjistha* and boil with water: on cooling, strain, and mix the tincture with a little *alum*. Steep the cloth in this, squeeze it well, and then take it out and dry it. Repeat this three or four times, until the required colour is attained. To dye 60 yards of cloth a yard wide in this way requires 1½ seers of manjistha and 1 chittack of alum. (Cuttack.)

The following account has been received from Midnapur, into which district madder is imported:—

> Madder is cut into very small chips, which are carefully washed and then boiled in water for 6 hours: the water has then become *red*. The silk or cloth to be dyed red is boiled for 10 minutes in water made alkaline by the addition of some ash, generally that of *burnt plantain leaves*, and is then steeped in a solution of *alum* in water and then drenched several times in the red dye, above obtained.

In Midnapur it is stated that a *red* dye, used chiefly in dyeing pillow or quilt cases, is obtained from boiling madder with *lime*.

In the Darjíling district no mordant seems to be used. Dr. Schlich says:—"To prepare the dye the plant is well dried, then pounded and boiled. As a rule, specially amongst the Lepchas, it is mixed with lac. The cloth to be dyed is then steeped in it." Elsewhere, however, it is stated that *harra* and *bahera* (myrabolans) are used as mordants in dyeing with manjeet, the articles to be dyed being steeped in a solution obtained by pounding and boiling these before using the manjeet.

In the Maldah district *tari* or *tori*, described as the "astringent legumes of a shrub found wild in the jungles of Gour" (*vide* p. 141), is mixed occasionally with manjistha and alum to produce a red dye. In combination with iron dross (jhama) this mixture of manjistha, alum, and tori produces a purple, called *begunia*, after the

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* Roxburgh's *Flora Indica*, Carey's edition, I, 375.

† Balfour's Cyclopædia of India, *Rubia cordifolia*.

begun, a native vegetable of a deep purple colour. The method is as follows :— MANJISTHA.

6 seers of *iron dross* (jhama) are placed in a vessel, into which is poured the liquor resulting from boiling 4 seers of rice-water (kanji) with ½ seer of parched Indian corn (makai). Water is added and the vessel is left out in the sun daily until its contents acquire a sweetish taste, which takes place in about 15 days. In another vessel 1 seer of powdered *manjistha* wood is boiled in 9 seers of water, and the dye is ready when the water has been boiled down to one-third of its original quantity. In this 1 chittack of *alum* is boiled before its use. In a third vessel *tori* water is prepared by boiling the fruit of the tori plant (commonly called in the district *chamarlati*) in water. The material to be dyed is first wetted in the tori water, which acts as a mordant, and then dried in the sun. It is then dipped in the manjistha dye and afterwards in the decoction first mentioned, upon which it becomes purple. (Maldah.)

Manjistha is also used in the Darjíling district to produce a *maroon* colour by adding a little *indigo* to the liquor in which the manjistha wood has been boiled.

Majetti-dyeing in Assam.

The method of dyeing with majetti followed in Assam, generally to dye thread to be afterwards woven into cloth, is described as follows :—

The dye itself is made by cutting a few dried sticks of *majetti* into pieces and steeping them in cold water for some hours : a red infusion results. The thread or cloth to be dyed is first boiled in water containing the pounded bark of the jam-tree (jamon), *Eugenia Jambolana*, and afterwards dried in the sun. It is then steeped in the majetti dye, to which is added a mixture* of *goat's milk*, *lime*, and *kolkhar* (a potash extracted from plantain ashes) in equal quantity : afterwards the whole is boiled gently for about 15 minutes. The cloth or thread is then removed and dried in the shade.

The only mention of the use of manjistha with other dyes is from Jalpáiguri, in which district it is used as an auxiliary in dyeing endi thread red with lac to heighten the colour. The process is described under lac (p. 56). A specimen of cotton yarn dyed a light purple by titaphapur (*Polygonum sp.?*) and manjistha has been received from Darjíling, but no particulars are given. (No. **10693**.) From Bhágalpur mention is made of a combination of manjeet with bakam (*Cæsalpinia sappan*) to produce a permanent red, but no details are given.

12. Lac-dye. LAC-DYE.

Lac, lahi, laha, laksha, লাহা, লাক্ষা, ସଲ, ସଲି.
La (Sudris of Singbhúm).
En (Kols of Singbhúm).
Rung or rungia.
Jhuri (Dacca).

Cultivation.

The information obtained in the course of the enquiry upon which this report is based includes very little in addition to that supplied in Mr. J. E. O'Conor's pamphlet on "Lac: production, manufacture, and trade" (Calcutta, 1876). It appears to be formed spontaneously in the jungles of most parts of Bengal to a greater or less extent; the only districts in which any extensive cultivation takes place being apparently Bánkurá, Bírbhúm,

* The quantity of this mixture is given as "a tola or two in weight;" but as neither the weights of the other ingredients nor the quantity of cloth is stated, this is useless.

LAC-DYE.

Murshidábád, Lohárdagá, Mánbhúm, and Singbhúm. But such cultivation is carried on mainly on account of the shell-lac, and not of the lac-dye, which is now apparently unmarketable, having been almost completely superseded by cochineal and aniline dyes.

The trees on which lac is cultivated in Bengal are—

Schleichera triguga, *Willd.* (koosum).
Butea frondosa, *Roxb.* (palás).
Ficus religiosa, *Linn.* (pipal, aswat, or asood, pakur).
Zizyphus Jujuba, *Lamk.* (bor or baer, kool): Maldah, Lohárdagá, Bankurá.
? (nakur): Maldah.

Trees on which reared.

The first two trees (koosum and palás) are those most generally used for the purpose, and are said to produce the best lac: the pipal is also largely used, and in Bírbhúm it is apparently the tree on which the principal lac cultivation is carried on: the bor, baer, or kool tree is only mentioned in the returns from Maldah, Lohárdagá, and Bankurá as one of many trees used for lac production in these districts: the nakur is only mentioned from Maldah.

Seasons of 'sowing' and 'gathering.'

There are generally two crops in the year: the insects are placed on the trees at various periods from October to February, and cover the branches with the resinous incrustation in about 5 or 6 months, the crop being collected at various times from April to July. As soon as the first crop is collected, insects are again put on the trees, and the second crop is ready for gathering from October to January. The time of 'sowing' and 'gathering' seems to vary with the nature of the tree on which the lac is reared. Thus, we are informed from Mánbhúm that on the koosum tree the first sowing takes place in February, the first reaping in May, the second reaping in October or November. On the palás tree, however, the first sowing takes place in November, and reaping in April and October. In some districts fresh twigs containing the insect are tied on to the trees after the first reaping, to ensure a plentiful second crop; in others, *e.g.*, Singbhúm, portions are left ungathered on the trees, and these give rise to the second crop, without any further grafting. In this case the second crop is said to be scarcely worth the trouble of collecting. The Collector of Maldah states that in his district the sowing may be carried on at any period of the year, but that from the middle of September to the middle of November, and from the middle of January to the middle of March, are the best periods for the purpose. This is inconsistent with the information from other districts. Owing to the peculiar nature of lac cultivation, it is impossible to obtain any accurate idea of the area devoted to the purpose or of the cost and profits of cultivation. No district officer has even attempted to estimate the area covered by the trees on which the lac insect is reared; and the estimates sent up of the cost and profits of cultivation are in all cases advanced with much hesitation. The following table condenses all the information received on this head, and also contains the estimate of the annual produce of each district.

Statistics.

	Average annual produce for the 5 years preceding 1875.	Cost of cultivating, gathering, &c.	Yield of stick-lac per 100 trees.	Selling price of stick-lac.	Profits.	Price of lac-dye.
Bardwán	.....	.....	.....	.....	.....	Rs. 20 to 50 per maund.
Bánkurá	1,000 to 1,500 mds. (dye).	Rs. 25 per 100 trees	25 maunds per 100 trees.	Rs. 10 per maund ...	Rs. 225 per 100 trees	Rs. 16 to 20 per maund.
Birbhúm	About 1,500 mds. (dye).	.....	.....	.....	.....	Under Rs. 20 per maund.
Midnapur	.....	.....	.....	.....	.....	Rs. 30 per maund.
Húglí	.....	.....	.....	.....	.....	Rs. 30 to 32 per maund.
Murshidábád	2,000 to 4,000 maunds (stick-lac ?).	Rs. 10 per tree	.....	.....	Rs. 40 per tree	Rs. 5 to 12 per maund (stick-lac ?).
Maldah	.....	.....	.....	.....	.....	Rs. 120 per maund (Rs. 12 ?).
Dacca	150 mds. (dye).	.....	.....	.....	.....	.....
Monghyr	.....	.....	.....	.....	.....	Rs. 80 per md. (?)
Santál Parganás	.....	.....	.....	.....	.....	Rs. 10 per md. (?)
Cuttack	.....	.....	.....	Re. 1-4 per seer of 105 tolas.	.....	.....
Lohárdagá	.....	.....	.....	.....	.....	Rs. 12 to 40 per maund.
Manbhúm	1,60,000 maunds (shell-lac, stick-lac ?).	Rs. 3 for palás lac per maund Rs. 4 for koosum lac „	.....	Rs. 13 per maund, palás lac. Rs. 20 per maund, koosum lac.	Rs. 10 per maund, palás lac ... Rs. 16 per maund, koosum lac.	Unsaleable.
Singbhúm	.....	.....	.....	{ Rs. 15 per maund (rangia lac). Rs. 20 per maund (koosum lac). }	.....	.....

LAC-DYE.

Cost and profits, &c.

These figures are too scanty to allow of any analysis, but in so far as they admit of mutual comparison they display the inconsistencies usual in such returns. For example, the only two districts in which an estimate of the cost and profits of lac cultivation per tree is made are Bánkurá and Murshidábád. In Bánkurá the cost per tree is Rs. 4, in Murshidábád Rs. 10: in Bánkurá the profits per tree Rs. 2-4, in Murshidábád Rs. 40—a difference sufficient to prevent any reliance being placed on the accuracy of either estimate. The returns are rendered still less valuable by the fact that many of the district officers have confused 'stick-lac,' 'lac-dye,' and 'shell-lac' together, so that it is impossible to tell in many cases which is meant. Thus the Deputy Commissioner of Mánbhúm reports that 1,60,000 maunds of *shell-lac* are produced annually in his district; but as in one place he gives the price of his shell-lac as Rs. 13 per maund for palás and Rs. 20 per maund for koosum, and these are the same as the prices previously given for the raw product from the trees, it is obvious that 'shell-lac' is a mistake for 'stick-lac.' The Collector of Murshidábád states in one column that the quantity of *dye* annually produced is from 2,000 to 4,000 maunds; but as in the next column he reports that the greater portion (of the dye produced) is used locally for the manufacture of 'choories,' it is obvious that he is thinking of stick-lac and not of the lac-dye. The data are insufficient to give any general idea of the cost and profits of cultivation per tree. The yield per tree depends of course on the size of the tree, and varies greatly for the same tree in different seasons. The Ranchi Lac Company state that the yield for the same tree varies with the seasons from a few seers to several maunds. After the 'seed' is placed on the trees the sole remaining cost to the cultivator is apparently merely the expense of watching them to prevent the theft of the stick-lac when approaching maturity.

The returns would seem to show that at the time of this compilation—

The cost of cultivation varied from Re. 1 to Rs. 4 per maund of stick-lac produced;

The selling price of stick-lac varied from Rs. 10 to Rs. 20 per maund;

The profits of cultivation varied from Rs. 9 to Rs. 16 per maund of stick-lac produced.

Lac-dye was in many districts unsaleable; in others its selling price varied from Rs. 12 to Rs. 40 per maund. Its selling price is now (1883) from Re. 1 to Rs. 10 per maund.

Trade between districts.

The greatest lac-producing districts are apparently the districts of the Chutiá Nágpur Division, especially Mánbhúm and Singbhúm, which export large quantities of stick-lac to Calcutta and to the neighbouring districts of Midnapur, Bánkurá, and Bardwán, also to Mirzapur in the North-West Provinces. Thus all the stick-lac used at the factories at Sonámukhí in the Bardwán district is imported from Chutiá Nágpur; and from 8,000 to 9,000 maunds of

stick-lac are imported from Chutiá Nágpur into the Bánkurá district. All other districts in which stick-lac is produced in any considerable quantity forward the greater portion to Mirzapur and Calcutta, some of it, however, finding its way from Calcutta to districts of Bengal where little stick-lac is cultivated. As regards the quantities of stick-lac, shell-lac, and lac-dye which find their way to Calcutta from the different districts, no information of any value has been received.

Preparation of the dye and processes of dyeing.—The following are the methods employed by the native dyers of Bengal for preparing the dye from the crude stick-lac. These may be divided into three stages: (1) the separation of the resin from the wood round which it forms an incrustation; (2) the separation of the dye contained in this (lac-dye) from the resin (seed-lac); (3) the formation of the dye into solid cakes.

Separation of resin from wood.

The first of these objects is obtained by pounding the stick-lac between stones, or grinding it in some way: the resin separates readily from the twigs, which are removed.

Extraction of dye from the resin.

The contained dye is then separated from the resin by pounding the resin into a finer powder and leaving it to soak in pots or troughs of water for periods varying from 6 to 24 hours. Generally after the first trituration the powdered resin is left to soak by itself, but sometimes it is rubbed continually under the water to ensure the complete separation of the dye from the resin, and fresh water is added at intervals. When the dye and the resin are completely separated, the thick liquid containing the dye is strained off through a piece of coarse cloth, leaving the resin (shell-lac) behind.

Formation of dye into cakes.

In order to obtain the dye in the form of solid cakes, the liquid thus obtained is simply left to settle in vats, at the bottom of which a thick sediment forms. Sometimes a little *lime-water* or *quicklime* is added to quicken the formation of this sediment; sometimes a series of vats, generally three, one above the other, are employed. The liquid is first run into the upper vat, where a sediment is soon formed; the liquid remaining is then run into the second vat, where another sediment forms more slowly; the liquid from this is then run into the lower vat, where the precipitation of all that remains of the lac-dye is ensured by adding a small quantity of *lime-water*. (Bírbhúm, Mánbhúm.)

The thick sediment thus obtained is then placed in wooden boxes and pressed into the form of cakes. The wooden boxes are sometimes lined with cloth to absorb part of the moisture. The cakes are then dried by exposure to the air and cut into the required size. These cakes constitute the lac-dye of commerce. In some places the dye is made into small balls instead of cakes. (Lohárdagá.)

The information received as to the processes of dyeing with lac adopted by the native dyers of Bengal is very scanty, and scarcely admits

LAC-DYE.

of being presented as a connected account. Lac-dye is used chiefly to dye woollen and silk materials and leather.

Dyeing.

Where the cakes of lac-dye prepared as above are employed, they are first washed and pounded and then generally boiled in water for about an hour to give the dye a sufficient consistence, *alum* and an *alkali* (generally potash) being added, apparently to heighten the colour. (Midnapur.) In some districts alum is not employed, the dye being merely boiled with *saji* or wood ashes. (Lohárdagá.) In Bánkurá the brightening of the colour is apparently effected by boiling the dye with *lime juice*. In other districts no auxiliary of any kind is employed, the dye being prepared by merely steeping the pounded lac in hot water and then straining through a cloth. (Jalpáigúrí.) Bark of *thanthelang* (*Acacia Intsia?*), which is said to be acid, is sometimes employed in Jalpáigurí to heighten the colour. (No. **12252**, silk.) The liquid obtained as above is sometimes allowed to rest, so that impurities may subside to the bottom; the upper part is then poured off and boiled again. (Midnapur.)

Preparation of dye from crude stick-lac.

Frequently the dye when required is prepared directly from the crude stick-lac, and not from the cakes of dye. In Maldah the Collector reports that for this purpose the stick-lac is ground, and then left to soak in water for about six hours (or a whole night) in an earthen vessel, about 12 seers of water being used for about 10 seers of the powdered stick-lac. The quantity of water is given as 2 maunds in another account. The lac powder is then squeezed and rubbed with the hand and 4 or 5 tolas of *sajimati* are thrown in whilst this is going on, and the whole is sometimes well mixed together by rubbing with the feet. It is then strained, and the liquid placed in another earthen vessel and boiled: afterwards 15 tolas of the strained powder of the bark of the lodh-tree (*Symplocos racemosa*) are mixed gradually with it, and it is left to stand for a day. The scum and froth are then skimmed off, and the liquid is strained through a cloth and is ready for use. The liquid dye thus obtained is called *bol*. Sometimes this liquid is further mixed with hot tamarind-water, prepared by mixing 2½ or 3 seers of *tamarind* with 1 maund water. The proportions given are sufficient to dye 15 yards of silk, which is simply steeped in the liquid, boiled, and then dried. (No. **4492**, silk.) The silk-dyers of Bishnupur, in the Bánkurá district, employ a similar process for preparing the dye directly from the stick-lac, the only differences being that the ground stick-lac is left to soak in water for a day, and that, instead of sajimati, alum or a solution of potash is employed. There is no mention of lodh-bark, the dye being ready for use after the boiling.

Fermentation induced by flour-paste.

In the Meetapore Jail, Patná, where lac is used for dyeing woollen yarns, the following method of preparing the dye-liquid is adopted:—The cake of lac is washed clean, broken into small pieces, and then rubbed well with a small quantity of water in a large gumlah. Water is then added in large quantity to dissolve all the lac, and *flour-paste*, in the proportion of 12 chittacks to 1 seer of the lac-cake, is then added to the liquid and the whole left in the sun for four days, apparently to induce fermentation. It will be found, on reference to Mr. Liotard's

Memorandum, that this addition of flour-paste with a view to fermentation is generally adopted throughout the whole of India where woollen materials are to be dyed with lac. No mention of it, however, is made in any of the reports from the Bengal districts except that referred to above. The methods of preparing the dye-infusion above detailed seem to be used indifferently, no matter what material—silk, wool, or sometimes cotton—is to be dyed, unless special mention is made of the material.

Cleaning of materials.

The woollen and silk materials seem to be generally submitted to a preliminary cleaning and preparation for the dye before being dipped in it. The Superintendent of the Meetapore Jail, Patna, reports that woollen yarns are prepared for the dye as follows: 1 seer of the yarn is steeped in *sajimati* for about 2 hours, then washed in clear water and dried in the sun. When perfectly dry it is again washed in a solution of ½ chittack of *lime* in water, and then dried again in the sun. It is then ready for the dye. Silk to be dyed with lac is previously boiled for about 10 minutes in an alkaline solution, obtained generally by soaking the *ashes of burnt plantain leaves* in water, and then steeped in a solution of *alum* in water. (Midnapur.)

The silk or woollen materials are simply steeped in the dye-infusion prepared as above for a longer or shorter period, or sometimes boiled with it, as in the process adopted in Maldah explained above. In some cases the material is after a time withdrawn from the dye and dried, and then again soaked in freshly prepared dye. In Jalpáigurí endi thread is soaked in the dye for six hours, then withdrawn and dried, and then again soaked for six hours in freshly prepared dye.

In the Meetapore Jail, Patna, the woollen yarn is allowed to remain in the dye-infusion for ten days, being turned every day. After the tenth day the yarn is taken out and washed and boiled for six hours in a solution of 2 chittacks (?) of *lodh-bark* and ½ chittack (?) of *huldi* in 1½ gallons of water. This apparently acts as a mordant, and when the yarn is dried in the sun it has acquired a permanent red colour. (Nos. **12855** and **12856**.) The following account is given of the method adopted by the Meches of the Darjíling Terai in dyeing silk thread red:—"The thread is first mixed with a plant called *amlia* (p. 151); these are boiled together for some time. The thread is then dried and coloured with lac-dye, and next mixed with the leaves of a plant called bhauri (*Symplocos theæfolia*), and again boiled. When dried, it is of a deep red."

The following specimens of woollen materials dyed with lac, mostly from the Bardwán Division, are in the Economic Museum:—

Nos.	**3440, 4651,**	Bírbhúm, dyed with	quality No. 1;
„	**3441, 4652,**	ditto	„ 2;
„	**3442, 4653,**	ditto	„ 3;

Nos. **2012**, Bírbhúm; **2028**, Cossipore; **7730**, Bánkurá; **8108**, Bardwán; **2007**, Assam.

No. **12941** is a specimen of tusser thread dyed with lac from Hoshiarpur, Panjab.

LAC-DYE. Lac-dye seems to be rarely employed in combination with other dyes to produce compound colours. A specimen of silk dyed a brownish purple by *indigo* and *lac* was received from the Rájsháhí Division, but no details of the process adopted were given. In Jalpáigurí endi thread dyed with lac as above without the aid of any auxiliary has its colour heightened by boiling it for one or two hours in a mixture of monadista (*Rubia cordifolia*) and bark of lotka (*Baccaurea sapida ?*, p. 138) pounded in water.

Used as a cosmetic. Lac-dye seems to be employed in various parts of Bengal by native women as a cosmetic for dyeing the soles of the feet and the palms of the hand or tips of the fingers, taking the place of mehndi or henna (*Lawsonia alba*), which is almost universally employed for that purpose. To prepare this cosmetic, pieces of stick-lac are bruised in water, and cakes made either of cotton (Murshidábád) or of the similar floss covering the seeds of the mudar (*Calotropis gigantea*) are steeped in the water, so that the fibres may attract the dye. (Lohárdagá.) These are the cakes used as cosmetics, either by wetting them and rubbing them on the hands and feet, or else by soaking them in water and applying the water to the skin. These cakes are called *alta*. (Murshidábád.)

European capital. As regards European capital invested in the manufacture of lac-dye at the time when this report was compiled, mention was made in the Collectors' reports of the following factories:—One in the Bírbhúm district, that of Messrs. Farquharson and Campbell, of Ilambázár, in which very little capital was invested in the preparation of the dye, the principal business being indigo; several factories at Sonámukhí, in the Budbud sub-division of the Bardwán district; the factory of the Ránchí Lac Company at Ránchí, in the Lohárdagá district; and two factories at Dacca. In these, however, as well as in the larger factories at Calcutta, less and less attention was being given to the preparation of the dye, as it was ceasing to be remunerative owing to the fact that cochineal was rapidly taking its place in Europe and aniline dyes in this country. The reports of the Collectors were nearly unanimous in stating that wherever aniline dyes were known to the natives, they were rapidly superseding lac-dye. The fall in the selling price of lac-dye from about Rs. 80 per maund to about Rs. 16 in the three or four years preceding 1876 is attributed to the simultaneous introduction of these cheaper mineral dyes. This has destroyed the local demand for lac-dye; the foreign demand has also been greatly diminished by the successful competition of cochineal. Lac-dye was formerly much used in dyeing the scarlet tunics of the British army, hunting coats, &c. Cochineal has almost entirely superseded it for the former purpose. It does not seem, however, to give an equally lasting colour. Lac-dye does not readily discolour with perspiration, whereas cochineal does.

Decline of lac-dye industry.

Exports. The decline in the importance of lac-dye, both absolutely and relatively to shell-lac, &c., which Mr. O'Conor's tables show had been going on rapidly during the ten years 1866–76, has been continued since, as is seen from

the following tables. A duty of 4 per cent was levied on exports of lac-dye up to 27th November, 1874, from which date it has been free of duty. Shell-lac, button-lac, stick-lac, and other sorts of lac were subject to a duty of 4 per cent on export up to the 14th July, 1877, when the duty on shell-lac was reduced to Re. 1-8 per cwt., on button-lac to Re. 1-4 per cwt., and the duty on stick-lac and other sorts of lac was altogether removed. The duty on exports of shell-lac and button-lac was removed on 25th February, 1880. On imported lac of all sorts a duty of 7½ per cent was levied up to 5th August, 1875, when it was lowered to 5 per cent, and removed altogether on 14th July, 1877. The first table, compiled from the Annual Accounts of the Trade and Navigation of British India, is meant to bring down the information contained in Mr. O'Conor's pamphlet to the present date.

LAC-DYE.

Exports of Lac from 1876-77 *to* 1881-82.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Year.	Different kinds.	Bengal.		Bombay.		Madras.		British Burmah.		Sindh.		Total from India.		Countries to which exported.	Quantities exported to the various countries, and value thereof.	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.			
		Cwt.	Rs.	Cwt	Rs.	Cwt	Rs.	Cwt.	Rs.	Cwt	Rs.	Cwt.	Rs.		Cwt.	Rs.
1876-77 ...	Dye	19,051	3,78,556	...	...	...	...	...	...	...	.....	19,051	3,78,556	United Kingdom ...	14,367 ...	2,92,816
														France	117 ...	1,872
														Italy	20 ...	500
														United States ...	4,547 ...	83,368
														Total ...	19,051 ...	3,78,556
	Shell	89,829	42,17,238	48	3,120	2	139	...	...	...	.....	89,879	42,20,497	United Kingdom ...	64,113 ...	29,93,550
														Austria	1,327 ...	74,687
														France	4,379 ...	1,76,037
														Italy	2,712 ...	1,00,147
														Egypt...	106 ...	4,051
														United States ...	16,024 ...	8,17,044
														Arabia	21 ...	1,355
														China—Hong-Kong	289 ...	13,618
														Java	44 ...	1,798
														Straits Settlements	239 ...	10,683
														Australia	615 ...	26,847
														Other countries ...	10 ...	680
														Total ...	89,879 ...	42,20,497
	Stick	349	9,104	...	...	1	35	105	3,659	...	.....	455	12,798	United Kingdom ...	203 ...	6,445
														France	103 ...	1,410
														United States ...	45 ...	1,284
														Straits Se tlements	105 ...	3,659
														Total ...	455 ...	12,798

1876-77—(*contd.*)	Other sorts ...	19,326	7,57,847	1	45	...	6	...	...	...	15	19,327	7,57,913	United Kingdom ...	18,516	...	7,22,938
														Austria	153	...	7,805
														Italy	121	...	4,521
														United States ...	532	...	22,400
														Other countries ...	5	...	249
														Total ...	19,327	...	7,57,913
	Dye	9,569	2,90,074	...	...	...	...	...	...	1	13	9,570	2,90,087	United Kingdom ...	7,292	...	2,34,041
														France	476	...	19,610
														United States ...	1,781	...	35,723
														Other countries ...	21	...	713
														Total ...	9,570	...	2,90,087
	Shell	78,754	28,43,527	121	7,005	...	20	...	...	...	.....	78,875	28,50,532	United Kingdom ...	56,758	...	20,48,569
														Austria	1,531	...	50,880
														France	7,149	...	2,27,251
														Italy	1,921	...	56,537
														United States ...	10,903	...	4,46,518
														Arabia	23	...	1,308
														China—Hong-Kong	96	...	3,016
														Straits Settlements	146	...	4,631
1877-78 ...														Australia	341	...	11,353
														Other countries ...	7	...	489
														Total ...	78,875	...	28,50,552
	Stick	18	288	21	769	...	...	1,354	14,750	...	.....	1,393	15,807	United Kingdom ...	1,102	...	10,150
														France	18	...	288
														Persia	21	...	769
														Straits Settlements	252	...	4,600
														Total ...	1,393	...	15,807
	Button ...	9,051	2,75,585	56	2,786	...	...	...	...	...	.....	9,107	2,78,371	United Kingdom ...	8,266	...	2,43,107
														Austria	65	...	3,341
														France	471	...	16,176
														Italy	5	...	165
														United States ...	300	...	10,582
														Total ...	9,107	...	2,78,371

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Year.	Different kinds.	Bengal.		Bombay.		Madras.		British Burmah.		Sindh.		Total from India.		Countries to which exported.	Quantities exported to the various countries, and value thereof.	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.			
		Cwt.	Rs.	Cwt	Rs.	Cwt	Rs.	Cwt.	Rs.	Cwt	Rs.	Cwt.	Rs.		Cwt.	Rs.
1877-78—(*contd.*)	Other sorts ...	5,699	1,85,648	...	...	...	...	...	...	1	16	5,700	1,85,664	United Kingdom ...	5,250 ...	1,69,945
														Mekran and Sonmiáni.	1 ...	16
														Austria	86 ...	3,103
														France	304 ...	9,748
														United States ...	51 ...	2,500
														Other countries ...	8 ...	352
														Total ...	5,700 ...	1,85,664
	Dye	8,256	1,95,182	...	...	...	...	...	...	5	103	8,261	1,95,285	United Kingdom ...	7,638 ...	1,89,950
														United States ...	568 ...	4,760
														Other countries ...	55 ...	575
														Total ...	8,261 ...	1,95,285
1878-79 ...	Shell	64,402	22,21,966	96	2,877	...	...	...	...	...	.....	64,498	22,24,843	United Kingdom ...	38,264 ...	13,02,025
														Austria	2,348 ...	70,791
														France	4,912 ...	1,46,628
														Italy	571 ...	15,543
														United States ...	17,541 ...	6,59,704
														China—Hong-Kong	242 ...	8,449
														Straits Settlements	211 ...	6,942
														Australia	378 ...	13,784
														Other countries ...	31 ...	977
														Total ...	64,498 ...	23,24,843
	Stick	361	7,070	28	342	119	2,122	881	9,070	...	.....	1,409	18,604	United Kingdom ...	651 ...	10,986
														Straits Settlements	668 ...	6,509
														Other countries ...	90 ...	1,109
														Total ...	1,409 ...	18,604

1878-79—(*contd.*)	Button ...	17,114	5,46,061	...	...	...	...	...	...	...	.....	17,114	5,46,061	United Kingdom ...			15,399	...	4,86,983
														Austria			34	...	1,178
														France			517	...	17,078
														United States ...			1,164	...	40,823
															Total	...	17,114	...	5,46,061
	Other sorts ...	141	2,364	...	...	...	...	...	...	...	.....	141	2,364	United Kingdom ...			141	...	2,364
															Total	...	141	...	2,364
1879-80 ...	Dye	13,609	2,24,271	...	...	...	...	...	...	181	2,297	13,790	2,26,568	United Kingdom ...			9,613	...	1,84,342
														United States ...			4,171	...	42,138
														Other countries ...			6	...	88
															Total	...	13,790	...	2,26,568
	Shell	49,521	30,40,841	19	1,005	...	9	...	...	...	.....	49,540	30,41,855	United Kingdom ...			29,503	...	19,18,223
														Austria			535	...	13,786
														France			2,691	...	1,00,140
														Italy			468	...	15,203
														United States ...			15,761	...	9,60,184
														China—Hong-Kong			93	...	3,969
														Straits Settlements			149	...	7,495
														Australia			213	...	15,993
														Other countries ...			38	...	1,362
															Total	...	49,540	...	30,41,855
	Stick	103	4,531	6	120	27	480	425	8,381	507	5,113	1,068	18,625	United Kingdom ...			606	...	9,426
														Straits Settlements			425	...	8,381
														Other countries ...			37	...	818
															Total	...	1,068	...	18,625
	Button ...	6,435	4,24,253	84	1,533	...	...	...	...	...	.....	6,469	4,25,786	United Kingdom ...			4,956	...	3,62,213
														France			322	...	9,786
														United States ...			1,182	...	53,468
														Other countries ...			9	...	319
															Total	...	6,469	...	4,25,786
	Other sorts ...	181	2,125	...	...	...	...	...	...	...	.....	181	2,125	United Kingdom ...			181	...	2,125
															Total	...	181	...	2,125

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Year.	Different kinds.	Bengal.		Bombay.		Madras.		British Burmah.		Sindh.		Total from India.		Countries to which exported.	Quantities exported to the various countries, and value thereof.	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.			
		Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.		Cwt.	Rs.
1880-81	Dye	5,836	1,24,939	...	...	...	12	.....	.....	468	5,250	6,304	1,30,201	United Kingdom ...	6,018 ...	1,27,694
														United States ...	286 ...	2,495
														Ceylon	....	12
														Total ...	6,304 ...	1,30,201
	Shell	60,809	43,14,198	33	2,069	...	.....	.....	.....	...	.....	60,842	43,16,267	United Kingdom ...	27,622 ...	17,57,720
														Austria	1,163 ...	76,584
														France	3,743 ...	2,43,712
														Italy	663 ...	43,776
														United States ...	27,145 ...	21,59,917
														China—Hong-Kong	136 ...	9,575
														Straits Settlements	204 ...	14,245
														Australia	150 ...	9,669
														Other countries ...	16 ...	1,069
														Total ...	60,842 ...	43,16,267
	Stick	105	2,850	...	5	33	1,896	244	7,483	958	10,465	1,340	22,689	United Kingdom ...	1,117 ...	15,465
														France	50 ...	1,500
														Eastern Coast of Africa—Zanzibar.	....	5
														Straits Settlements	173 ...	5,719
														Total ...	1,340 ...	22,689
	Button ...	19,752	13,08,052	8	520	...	...	...	...	...	.....	19,760	13,08,572	United Kingdom ...	16,542 ...	10,84,758
														Austria	197 ...	14,451
														France	924 ...	64,235
														United States ...	2,097 ...	1,45,128
														Total ...	19,760 ...	13,08,572

1880-81— (*contd.*)	Other sorts ...	145	5,460	1	13	...	...	...	...	...	.....	146	5,473	United Kingdom ...		145 ... 5,460
														Arabia		1 ... 13
															Total ...	146 ... 5,473
	Dye	4,252	75,612	...	...	...	...	...	...	780	16,346	5,032	91,958	United Kingdom ...		4,742 ... 86,952
														United States ...		290 ... 4,998
														Mekran and Sonmiáni.		 8
															Total ...	5,032 ... 91,958
	Shell	86,413	55,47,339	77	5,074	...	...	...	...	...	.....	86,490	55,52,413	United Kingdom ...		49,478 ... 29,96,428
														Austria		3,485 ... 2,04,321
														France		5,022 ... 2,94,500
														Italy		2,352 ... 1,39,883
														United States ...		24,660 ... 18,23,035
														Arabia		34 ... 2,381
														China—Hong-Kong		726 ... 46,304
														,, Treaty Ports		5 ... 300
														Straits Settlements		294 ... 19,035
														Australia		446 ... 25,693
														Other countries ...		8 ... 533
															Total ...	86,490 ... 55,52,413
1881-82 ...	Stick	61	759	...	...	...	...	120	2,865	320	7,140	501	10,764	United Kingdom ...		375 ... 7,590
														Straits Settlements		120 ... 2,865
														Other countries ...		6 ... 309
															Total ...	501 ... 10,764
	Button ...	25,336	15,31,918	...	...	1	27	...	...	...	.....	25,337	15,31,945	United Kingdom ...		21,939 ... 13,15,033
														Austria		429 ... 23,311
														France		249 ... 17,390
														Italy		54 ... 3,000
														United States ...		2,629 ... 1,71,194
														Sumatra		1 ... 27
														Australia		36 ... 1,990
															Total ...	25,337 ... 15,31,945
	Other sorts ...	143	5,383	...	...	...	...	6	60	92	2,760	241	8,203	United Kingdom ...		199 ... 6,256
														United States ...		21 ... 1,437
														Other countries ...		21 ... 510
															Total ...	241 ... 8,203

Imports of Lac.

Year.		India.		Bengal.		Bombay.		Madras.		British Burmah.		Countries whence imported.	Quantity.	Value.
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.			
		Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.		Cwt.	Rs.
1875-76 ...	Lac-dye ...	17	430	.....	.....	.....	.....	17	430	.....	.....	Straits Settlements	17	430
	Shell-lac ...	2	125	.....	.....	2	125	.....	.....	.....	.....	China—Hong-Kong	2	125
	Stick-lac ...	4,298	1,73,932	670	30,551	1,714	71,513	1,912	71,812	2	56	Ditto ditto	26	778
												Straits Settlements	4,272	1,73,154
	Other sorts ...	3,790	1,73,779	3,756	1,73,308	1	64	26	260	7	147	Ditto ditto	3,781	1,73,547
												Other Countries	9	232
1876-77 ...	Shell-lac ...	2	182	.....	.....	.....	.....	2	182	.....	.....	Ceylon	2	182
	Stick-lac ...	2,283	58,410	885	16,420	430	12,143	968	29,847	.....	.....	United Kingdom	346	3,459
												Straits Settlements	1,937	54,951
	Other kinds ...	.....	12	.....	.....	.....	.....	.....	12	.....	.....	Ceylon	.....	12
1877-78 ...	Shell-lac ...	2	98	2	98	.....	.....	.....	.....	.....	.....	United Kingdom	2	98
	Stick-lac ...	2,196	55,457	56	2,233	1,785	42,901	355	10,323	.....	.....	Straits Settlements	2,196	55,457
	Other kinds ...	3	55	.....	.....	3	55	.....	.....	.....	.....	Persia	3	55
1878-79 ...	Shell-lac ...	62	310	.....	.....	.....	.....	62	310	.....	.....	Straits Settlements	62	310
	Stick-lac ...	560	13,630	.....	.....	501	12,167	59	1,463	.....	.....	Ditto ditto	560	13,630
	Other kinds ...	3	55	.....	.....	.....	.....	3	55	.....	.....	Ceylon	3	55
1879-80 ...	Stick-lac ...	391	18,451	281	13,956	.....	.....	77	4,145	33	350	Straits Settlements	391	18,451
	Other kinds ...	.....	3	.....	.....	.....	.....	.....	3	.....	.....	United Kingdom	.....	3
1880-81 ...	Stick-lac ...	2,317	97,449	41	1,236	848	29,525	1,379	64,268	49	2,420	Straits Settlements	2,317	97,449
1881-82 ...	Shell-lac ...	1	120	.....	.....	.....	.....	1	120	.....	.....	United Kingdom	1	120
	Stick-lac ...	1,096	38,549	13	476	912	31,603	170	6,440	1	30	China—Hong-Kong	23	770
												Straits Settlements	1,074	37,779
	Other kinds ...	.....	7	.....	.....	.....	.....	.....	7	.....	.....	United Kingdom	.....	7

The total exports, then, of the various products of lac are as follows:—

Years.	Shell-lac.		Stick-lac.		Button-lac.		Other forms.		Lac-dye.	
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.
1876-77 ...	89,879	42,20,497	455	12,798	.....	.....	19,327 (Button-lac included.)	7,57,913	19,051	3,78,556
1877-78 ...	78,875	28,50,552	1,393	15,807	9,107	2,78,371	5,700	1,85,664	9,570	2,90,087
1878-79 ...	64,498	22,24,843	1,409	18,604	17,114	5,46,061	141	2,364	8,261	1,95,285
1879-80 ...	49,540	30,41,855	1,063	18,625	6,469	4,25,786	181	2,125	13,790	2,26,568
1880-81 ...	60,842	43,16,267	1,340	22,689	19,760	13,08,572	146	5,473	6,304	1,30,201
1881-82 ...	86,490	55,52,413	501	10,764	25,337	15,31,945	241	8,203	5,032	91,958

The exports of lac-dye from the year 1871-72 to the year 1881-82 are as follows:—

Year.	Cwt.	Value.	Average value per cwt.
		Rs.	Rs.
1871-72	17,463	7,81,189	45
1872-73	10,427	4,68,655	45
1873-74	9,907	4,45,612	45
1874-75	8,385	3,76,340	45
1875-76	10,668	2,65,723	25
1876-77	19,051	3,78,556	20
1877-78	9,570	2,90,087	30
1878-79	8,261	1,95,285	24
1879-80	13,790	2,26,568	16
1880-81	6,304	1,30,201	21
1881-82	5,032	91,958	18

Decline in importance of lac-dye.

It will thus be seen that there has been a steady decline in the quantity exported since 1871-72, except during the years 1876-77 and 1879-80, when for some exceptional reason the export was abnormally high.* During the years 1867-68 to 1870-71 the average value of exported lac was a little under Rs. 45 per cwt. This was fixed as the tariff valuation in 1871, and obtained till 1875, when the duty was removed from lac-dye. During the years 1871-75 the great decline in the importance of lac-dye had occurred, and since the duty was removed the value of the exported lac-dye has fallen to Rs. 18 per cwt., as compared with Rs. 45 per cwt. in the years 1867–71. The trade in lac-dye has in fact become of no importance. In illustration we may quote the following passages from the Resolutions by the Government of Bengal on the Administration Report from the Chutiá Nagpur and Bardwán Divisions for 1881-82:—"The lac-dye industry in the

* Messrs. W. Haworth and Co., of whom enquiries were made as to the cause of these abnormally high exports, replied as follows:—"There was an unusual demand, brought about by some unsatisfactory results in the use of aniline dyes. Prod ıction was in consequence much stimulated for the time, and became far in excess of the requirements of the trade: stocks became heavy, and the article has since remained a drug in the market." (1883)

LAC-DYE. Lohárdagá district is said to be declining, and the Deputy Commissioner reports that the Ránchí Lac Company have for some months been running the dye off into the fields. It does not pay the cost of manufacture, having been completely supplanted in the market by aniline dyes." (*Calcutta Gazette*, 1882, p. 971.) "The supersession of lac-dye by English dyes is rapidly diminishing the importance of the lac industry of Bánkurá and Birbhúm." (*Calcutta Gazette*, 1882, p. 1085.)

The following plants are also said to yield a *red* dye; but the information received is so slight as to be scarcely worth reproduction. However, such as it is it is here entered:—

AMULTAS. **13. Cassia Fistula**, *Linn.* (Cathartocarpus Fistula, *Pers.*)—Nat. Ord. LEGUMINOSÆ.

Amultas.

The bark of this tree is said to be used to produce a *red* dye in Lohárdagá. "Boil the bark, and to each 2 chittacks add 2 tolas of *alum*: a *light red* is obtained. If the bark (fruit rind?) of pomegranate be added, a *deep red* results." (*Vide* Tans, p. 155.)

MADAR. **14. Erythrina indica**, *Lamk.*—Nat. Ord. LEGUMINOSÆ.

Pálté Mádár, পালতে মাদার।

This tree is mentioned in the report from Húglí as producing a *red* dye. "The tree grows abundantly in the district. The flowers are collected about the end of February, and when dried and boiled in water yield a *red* dye."

JABA. **15. Hibiscus Rosa-sinensis**, *Linn.*—Nat. Ord. MALVACEÆ.

Jabá, জবা।

It is mentioned from Húglí that a *red* dye is obtained by children from the flower, which is used in colouring paper. If the flowers are rubbed on paper, they give it at first a reddish colour, turning immediately into a pretty purple or lilac: the addition of a little lime juice or other acid turns this at once into a bright red. Balfour states that the flowers of this plant are employed in some parts of India in obtaining a black colour, but there is no mention of such use in Bengal.

RANG **16. Peristrophe tinctoria**, *N.E.*—Nat. Ord. ACANTHACEÆ.

Ráng, রাং।

Detailed information regarding the cultivation, growth, and use in dyeing of this plant has been received from Midnapur, in which district it seems to give rise to an industry of some importance in connection with the manufacture of "masland" mats. No mention of it is, however, made in the returns from any other district. A

specimen of the growing plant was forwarded from Midnapur, and was identified by Dr. King as *Peristrophe tinctoria*. RANG.

Cultivation.

From the account given by the Collector of Midnapur it appears that this plant is cultivated in the jurisdictions of thanas Sabang, Patáspur, Náráyangarh, Pánchkurá, and Raghunáthpur by the classes of people called Vaishnávs, Báitís, Suktís, and Kaibarttas. The plant is propagated either by cuttings or from seed, but the former method is preferred, as the growth is quicker. The ground is dug up with a *kodáli* in Kártik (October–November), and again in the month of Jaishtha (May–June) (?) next following, when it is also manured with mud. In the month of Ashár (June–July), when the ground has been sufficiently moistened by the rain, the cuttings are planted; they begin to grow in about 10 or 12 days. The ground is afterwards dug up with a *kodáli* once a month, and weeds are carefully removed. The plants grow to a height of about two cubits, and flower in Kártik (October–November), in which month their twigs and the matted extremities of the branches (জট) are lopped off, to be used in dyeing the sticks for "masland" mats. The twigs are cut into small chips, and are then broken into thin pieces by means of a *dhenki;* they are then dried in the shade and stored in gunny-bags till required. Sometimes a portion of the roots is taken and pounded with the twigs. The same plant serves for two or three years. The area under cultivation of ráng is estimated at 1,000 bighas (in a previous letter it is given as 2,000 acres), and about 10,000 maunds of the dye-stuff are prepared annually. It sells at Rs. 15 per maund.

Masland mats.

Ráng is used exclusively in dyeing the sticks from which "masland" mats are manufactured. The sticks are made into convenient bundles, and pounded ráng is placed about the parts to be dyed, which are separated from the rest by palm-leaf knots at both ends. One seer of pounded ráng is then mixed with 20 seers of water, and the whole boiled. The part of the bundle to be dyed is dipped in this and boiled in it for three hours; then removed and dried. It has acquired a *red* colour. Although exclusively used for this purpose, a piece of cloth dyed with ráng by way of experiment has been forwarded from Midnapur, the process adopted being that described on page 128, with the substitution of ráng for babla bark. (No. **11245**, cotton, dull *red*.)

17. **Pterocarpus santalinus**, *Linn.*—Nat. Ord. LEGUMINOSÆ. RAKTA CHANDAN.

Rakta chandan, রক্তচন্দন।

This tree does not apparently grow in Bengal, but its wood (red sandal-wood) is imported from the Madras Presidency by way of Calcutta, and the colouring matter which it yields is used "to mark idols and the forehead in ceremonies. It is sold in the bazar at four annas per seer." (Húglí.) There is no further mention of it in the returns from the various districts, so that it is probably not used at all in Bengal as a dye, or only very sparingly.

RAKTA CHANDAN.

The following mineral substance may here be mentioned as being occasionally employed in giving a red colour to fabrics :—

GERIMATI.

18. Red ochre or red earth.

Gerimati or geroomati, গেরি মাটি।

This earth, the impure sesquioxide of iron, is to a slight extent used in dyeing fabrics. Mendicants and ascetics colour their clothes with an infusion of geri. (Húgli.) In Lohárdagá, where it is obtained in the parganá Korambe, it is apparently used when mixed with water in dyeing *red* and *brownish red*. Its general use, however, is in making pigments for house-painting.

Its price in Cuttack is two annas per seer of 105 tolas.

CHAPTER II.

Dye-stuffs giving Yellow Dyes.

1. Artocarpus integrifolia.
2. Bixa Orellana.
3. Butea frondosa.
4. Cedrela Toona.
5. Curcuma longa.
6. Curcuma Zedoaria.
7. Curcuma Zerumbet.
8. Symplocos racemosa.
9. Symplocos theæfolia.
10. Symplocos spicata (?)
11. Symplocos phyllocalyx.

12. Berberis nepalensis.
13. Crocus sativus.
14. Lawsonia alba.
15. Michelia Champaca.
16. Plecospermum spinosum.

17. Binee huldi.
18. Gach huldi.
19. Samlick.

20. Yellow ochre.

21. Peori or peri rung.

1. Artocarpus integrifolia, *Linn.*—Nat. Ord. URTICACEÆ. KANTHAL.

Kanthal, কাঁঠাল.

Information regarding the use of this plant, the well-known jack-fruit tree, has been received from Midnapur, Chittagong, Rájsháhí, and Maldah. The Magistrate of Chittagong reports that it is cultivated all over his district. "A pit is dug and filled with cowdung, and in this the jack-seed is inserted in June and July." The cost of cultivation is nil, whilst the profits vary from As. 4 to Rs. 2 per tree, realised by the sale of the fruit. The Collector of Midnapur states that each jack-fruit realises about 6 pie in his district.

Both the *fruit* and the *wood* are used as dyes in Bengal. From Mr. Liotard's Memorandum it would seem that a dye is extracted in Oudh from the *bark*: and Balfour mentions that a yellow dye is obtained from the *roots* in Sumatra; but the bark and roots are not used for this purpose in Bengal. The only information regarding the use of the *fruit* for dyeing is from Midnapur, where it is stated that "the juice of small green jack-fruit boiled with aich root and lime produces a *red* dye, which is used in dyeing cloth and jute, the latter for tying bomb (বম)," (p. 38).

Fruit used in dyeing.

The *wood*, reduced to sawdust, seems to be more frequently used in dyeing fabrics, generally silks, *yellow*, either alone or in conjunction with *alum*.

Wood used in dyeing.

The jack-wood, stripped of bark and pith, is powdered and boiled, and gives a semi-permanent *yellow*. (Chittagong.)

1¼ seers of sawdust of jack-wood are boiled in 30 seers of water till 12 seers remain. When this has cooled, the thread to be dyed is twice dipped in it, wrung out, and dried: it acquires a *yellow* colour. (No. 4495, yellowish brown, silk.) (Rájsháhí.)

To produce *yellow*, *kanthal* wood and *alum* are employed. (Maldah.)

KANTHAL.

The thread or stuff to be dyed is first prepared by washing in hot water with *fuller's earth*, drying, and dipping in a solution of *alum*, and again drying. 1¼ seers of sawdust and peelings of jack-wood are then boiled in 30 seers of water till 10 seers remain. When it has cooled, the thread or cloth is steeped in it for two hours, then slightly wrung out and dried, and then steeped again for two hours. It is then again dried, and washed with cold water and dried again. The colour is a not very permanent yellow. (No. 11247 yellow, silk.) (Rájsháhí.)

In Maldah a green dye is prepared from *kanthal* wood and *indigo* (p. 126).

LATKAN.

2. Bixa Orellana, *Linn.*—Nat. Ord. BIXINEÆ.

Latkan, or natkan, লটকন (Western and Central districts and Orissa)

Bilatti huldi, بلايتي هلدي, বিলাতী হলদী, ବେଲାତୀ ହଳଦୀ (Bhágalpur, Orissa, Dacca, Chittagong).

Rungphul or rungphur (Chutiá Nágpur).

Goolbas (Cuttack).

Jolandhur (Assam).

Powassi (Mughs of Chittagong).

This plant seems to be found to a small extent in most parts of the province, either growing in the jungles or cultivated in gardens or homesteads. The only district from which definite information has been received as to the extent to which it is cultivated is Midnapur. Here the seed is said to be sown when the rains have well set in, and after five years the plant is mature, and bears fruit in the months of October and November. The approximate area covered by the trees under cultivation is given as 500 acres in Midnapur. From Chittagong it is reported that the nuts of "bilatti huldi" are ripe in April or May. "The capsules are oblong, bristled pods, somewhat resembling those of a chestnut, at first dark green in the East Indian plant, or red in the West Indian plant, but as they ripen changing to a dark brown. On bursting open they display a red pulp, in which are contained from 30 to 40 irregularly-formed seeds, somewhat resembling raisin-stones." The pulpy covering round the seeds gives the dye known in commerce as arnotto, arnatto, or rocou.

Growth and cultivation.

The prices given are—

Midnapur	...	...	Rs. 50 per maund.
Monghyr	...	...	„ 2-8 „

but it does not appear whether these are the prices of the capsules or of the seeds themselves; but probably the latter. It is needless to discuss the great discrepancy between these prices. In Mr. Liotard's Memorandum the only price mentioned is 8 to 12lb per rupee (Bangalore), which would be from Rs. 7 to Rs. 10 per maund.

Prices.

The Collector of Midnapur states that the importation of magenta into his district was quite doing away with the cultivation of latkan—

a statement which, as the colours produced by latkan and magenta are quite different, requires explanation. LATKAN.

Preparation of dye and processes of dyeing.—The following account from Ure's Dictionary may here be given of the preparation of the dye from the American plant :—

"As soon as the pods arrive at maturity, they are gathered, divested of their husks, and bruised. Their pulpy substance, which seems to be the only part which constitutes the dye, is then put into a cistern, with just enough water to cover it, and in this situation it remains for seven or eight days, or until the liquor begins to ferment, which, however, may require as many weeks, according to circumstances. It is then strongly agitated with wooden paddles or beaters, to promote the separation of the pulp from the seeds. This operation is continued until these have no longer any of the colouring matter adhering to them. It is then passed through a sieve, and afterwards boiled, the colouring matter being thrown to the surface in the form of scum, or otherwise allowed to subside. In either case it is boiled in coppers till reduced to a paste, when it is made into cakes and dried.

"Instead of this long and painful labour, which occasions diseases by the putrefaction induced, and which affords a spoiled product, Leblond proposed simply to wash the seeds of the bixa till they are entirely deprived of their colour, which lies wholly on their surface ; to precipitate the colour by means of vinegar or lemon juice, and to boil it up in the ordinary manner, or to drain it in bags, as is practised with indigo.

"The experiments which Vanquelin made on the seeds of the bixa, imported by Leblond, confirmed the efficacy of the process which he proposed ; and the dyers ascertained that the arnatto obtained in this manner was worth at least four times more than that of commerce ; that, moreover, it was more easily employed ; that it required less solvent ; that it gave less trouble in the copper, and furnished a purer colour.

"Arnatto dissolves better and more readily in alcohol than in water, when it is introduced into the yellow varnishes for communicating an orange tint.

"The decoction of arnatto in water has a strong peculiar odour and a disagreeable taste. Its colour is yellowish red, and it remains a little turbid. An alkaline solution renders its orange-yellow clearer and more agreeable, while a small quantity of a whitish substance is separated from it, which remains suspended in the liquid. If arnatto be boiled in water along with an alkali, it dissolves much better than when alone, and the liquid has an orange hue.

"The acids form with this liquor an orange-coloured precipitate, soluble in alkalis, which communicate to it a deep orange colour. The supernatant liquor retains only a pale yellow hue.

"When arnatto is used as a dye, it is always mixed with alkali, which facilitates its solution and gives it a colour inclining less to red. The arnatto is cut in pieces and boiled for some instants in a copper with its own weight of crude pearl-ashes, provided the shade wanted does not require less alkali. The cloths may be afterwards dyed in this bath, either by these ingredients alone or by adding others to modify the colour; but arnatto is seldom used for woollen, because the colours which it gives are too fugitive, and may be obtained by more permanent dyes. Hellot employed it to dye a stuff prepared with alum and tartar, but the colour acquired had little permanence. It is almost solely used for silks.

"To make an orange hue, which contains more red than the aurora, it is requisite, after dyeing with arnatto, to redden the silks with vinegar, alum, or lemon juice. The acid, by saturating the alkali employed for dissolving the arnatto, destroys the shade of yellow that the alkali had given and restores it to its natural colour, which inclines a good deal to red."

It would thus appear that arnotto is only sparingly soluble in water, the solution being *yellowish red.* Arnotto is quite insoluble in acids, which, on being added to the decoction of arnotto in water, precipitate the colouring matter as an *orange* deposit. The addition of

LATKAN. an alkali, either to the decoction of arnotto in water or to the precipitate formed with acids, dissolves it almost completely, but takes away the red colour, leaving it almost *yellow*. Substances dyed in this alkaline solution can be rendered *orange* or *yellowish red* in colour by steeping them in an acid solution, which neutralises the alkali and restores the red shade. The alkali employed is generally crude pearl-ashes, whilst the acid substance is vinegar, alum, or lemon juice.

Dyeing in Bengal.

In Bengal native dyers use this dye, obtained generally directly from the seeds when required, in dyeing silk and cotton. But apparently a solution of the dye in water alone is invariably employed, no mention of an alkaline solution being made in any of the returns. The dye is obtained from the seeds either by boiling with water or by merely pounding in water. (Lohárdagá.) In Chittagong the seeds are steeped in water, which is afterwards drained off and allowed to evaporate, leaving a deposit, which is formed into cakes and kept for use. When required, a cake is dissolved in hot water. As far as can be inferred from the imperfect returns received, the cloth is generally dyed by merely steeping in the infusion of the seeds without the aid of any auxiliary at all. All the colours produced from latkan are fleeting. The following account has been received from Húglí :—

> "The seeds of latkan are put in a vessel of water. The dyers have no definite idea as to the proper proportion of water to be used, but generally the proportion of water to seeds seems to be about 24: 1 in weight. The seeds are allowed to remain in the water for 3 or 4 hours, after which they have become soft and elastic. They are then boiled in the same water at a moderate heat until about ¼th of the water is evaporated. The decoction is then removed from the fire and a small quantity of *alum*, *milk*, and *cocoanut water* is mixed with it: it is then filtered. The cloth to be dyed is first well saturated with water, with the view of securing uniformity of colour, and steeped in the dye solution for about an hour. It is then removed and dried in the shade, never in the sun. The colour thus obtained is "kacha," and fades completely after 7 or 8 washings; but if the cloth be kept carefully and not used, it will retain its colour for about a year, remaining quite bright for about four months." (No. 11168, cotton.)

In Lohárdagá an alkali is employed as an auxiliary, but not to dissolve the dye, as it is stated that the cloth, after being steeped in the liquor resulting from pounding the seeds in water, is subsequently boiled with *wood ashes*.

In Maldah acids are employed to redden the colour, as the Collector reports that the "dye-stuff gives a yellow colour to silks and cottons. A red colour is obtained in combination with *alum*, *lemon juice*, *and water*."

Latkan with other dyes.

Latkan does not seem to be much used with other dye-stuffs. An *orange* dye is mentioned as being made in Purí by mixing *sajimati*, *palas*, *latkan*, *alum*, and water (*vide* p. 74). This is stated to be very fleeting. There are in the Economic Museum two specimens of yarn dyed a very beautiful orange (Nos. 12181, cotton, and 12182, silk) by a combination of latkan with kamláguri (*Mallotus philippinensis*).

The *bark* of latkan is employed as a mordant in Kuch Behar in dyeing with dáruharidrá (*Morinda tinctoria*, p. 35).

3. Butea frondosa, *Roxb.*—Nat. Ord. Leguminosæ.

Palás, parás, পলাশ, پلاس, પલાસ.
Tesu (flowers), (Orissa and Chutiá Nágpur).
Kes (Mánbhúm).

This tree, sometimes called the "bastard teak," grows abundantly on the plains all over Bengal. It flowers at various periods from February to May, after the age of 7 or 8 years. The dye is extracted from the dried flower-petals: it is not, however, of any importance as an article of trade, and is rarely sold in the bazars. The prices given are—

Patná	... Rs. 3	per maund.
Monghyr	... „ 2-8	„
Cuttack	... „ 30-8	„ (Re. 1 per seer of 105 tolas).
Mánbhúm	... As. 4 to Re. 1	per maund.

Prices and trade.

The price given from Cuttack is obviously inaccurate. The other prices agree fairly well with those given in Mr. Liotard's Memorandum for the rest of India. The dye-stuff seems to be exported to a certain extent from the various districts to Calcutta; and from Chutiá Nágpur, where immense quantities of the flower are gathered, a considerable portion is exported to the North-West Provinces. About 1,200 maunds of the flower are said to have been gathered in the Palámau sub-division of Lohárdagá during the five years preceding 1875.

Extraction of dye.

Processes of dyeing.—The dye-stuff simply consists of the *petals* of the plant, sometimes apparently not even dried. The dye is extracted either by merely steeping them in water or by boiling in water: sometimes by simply pressing the flowers with the hands until the juice exudes, or by steeping in water and pressing at the same time.

The cloth to be dyed is sometimes merely steeped in this solution, without the use of any auxiliary at all, obtaining a fleeting orange colour (Palámau, Patna). The process as described from Patna is as follows:—

> A given quantity of the dye is mixed thoroughly with twice as much (in weight or volume?) water: half the quantity of water is then evaporated, and the remainder allowed to cool. It is then strained and the cloth dipped in it. A deeper shade is obtained by repeated immersions. (Patna, No. 11208, cotton.)

Or *alum* is employed, either by first impregnating the cloth with a solution of alum before dipping it in the dye solution (Sáran), or by adding it to the dye solution before dipping in the cloth (Chutiá Nágpur, Lohárdagá) as explained in the following process:—

> Petals dried in the shade and boiled in water in the proportion of 1 seer of flowers to 4 seers of water, until 2 seers remain. 4 tolas of *alum* are next added. The cloth is steeped in this solution and then dried in the shade.

Sometimes *lime* is used as well as *alum*, and this is said to darken the colour (Chittagong, Mánbhúm, Dinájpur), (Nos. 11365, 11553,

PALAS. 11554, 11555, cotton, from Mánbhúm). This method is employed in the Chittagong Division for dyeing paper toys. The method adopted in Dinájpur is described as follows:—

> The flowers are freed from the calyx and pistils and dried in the sun: they are then thoroughly washed and cleaned. 1 seer of the cleaned flowers is then rubbed in 1½ seers of water for a time, and the liquid is then separated from the flowers. 2 tolas of slaked *lime* and a small quantity of *alum* are added to this liquid. The cloth is then steeped in the mixture, worked about in it, then removed and dried in the shade. (No. 13784, cotton).

Or an alkali, generally *sajimati*, is employed with the alum. (Maldah, Sáran: No. 11217, Sáran, cotton.) This also darkens the colour, producing an *orange red*. This is in accordance with Roxburgh's experiments (Flora Indica, Clarke's reprint, p. 540), who found that the dye-stuff with alum gave a beautiful bright yellow, which is changed to a deep reddish orange by the addition of an alkali. In the latter two cases the alum and lime, or alum and alkali, are added to the dye liquid before dipping in the cloth.

Parás with other dyes.

The only other dye-stuffs that are mentioned as being used with parás are hari (*Terminalia Chebula*), latkan (seed-pods of *Bixa Orellana*), and lodh (*Symplocos racemosa*). Hari is said to be sometimes mixed with the dye solution, as it makes the resulting colour less fleeting (Palámau). In Purí we are told that "an orange dye of a fleeting character is made by mixing *sajimati*, *palás*, *latkan*, *alum*, and water." The following detailed account of the methods employed in dyeing woollen yarns yellow has been received from the Meetapore Jail, Patna:—

> 1 seer of woollen yarn is steeped in *sajimati* water for about two hours and then washed. 6 chittacks of *parás* flowers are put in a gumlah along with 10 seers of water for three days: 2 chittacks of *lodh* are then added, and the whole boiled thoroughly in a gurrah for about an hour and a half. The yarn is then put in this solution, and the whole boiled again for three or four hours. The yarn is then taken out and steeped in *sajimati* water, prepared from 2 chittacks of sajimati and 5 seers of water. It is then removed and washed well in clean water and dried in the sun. The dye resulting is a pucka *yellow*, called *jurda* (जरदा). (No. 12852.)
>
> If the yarn after being boiled in the dye solution is washed in clean water and dried, without being steeped in the sajimati water, the colour called *badámi* (बदामी) is obtained, which is also pucka. (No. 12853.)

From Bhágalpur mention is made of a combination of palás with *indigo*, but no details are given.

TOON. 4. Cedrela Toona, *Roxb.*—Nat. Ord. MELIACEÆ.

Toon.

Growth and cultivation.

Information regarding this tree, and that very meagre, has only been received from the Patná, Bhágalpur, and Chutiá Nágpur Divisions, although it seems to be found sparingly in most parts of Bengal. It is cultivated to a certain extent, and is also found as a jungle product. Its value arises mainly from its wood, "which is made into furniture of all kinds, and is much admired for its close grain and beautiful colour, resembling mahogany, to which it is deemed equivalent." The fruit and bark are also of use for

medicinal purposes, the bark being powerfully astringent. A yellow dye is extracted from the white fragrant *flowers*, which appear in March and April (Lohárdagá), but is apparently very little used, and the tree does not seem to be anywhere cultivated for the sake of the dye. A red (?) dye is also extracted from the *seed* (Palámau).

The flowers and seeds are scarcely a marketable commodity, but the following prices are given :—

		Rs.	A.	P.	
Sáran and Darbhangah (flowers)	...	3	6	0	per maund.
Monghyr („)	...	10	0	0	„
Palámau (Lohárdagá) (seed ?)	...	8	10	0	„

Prices and trade.

It is stated that in Palámau 120 maunds were produced during the five years preceding 1875. This must mean 120 maunds of flowers, as it is subsequently stated that 50 or 60 maunds of seed are exported annually, "chiefly to Behar markets—Gayá, Dáudnagar, Patná, and Sásserám." But there is great confusion in this statement, and it is impossible to tell in each instance whether seeds or flowers, or both, are meant.

Extraction of dye.

The dye is extracted generally from the flowers or from the calyx alone (Chutiá Nágpur sub-division of Lohárdagá), or from the seed (Palámau); but it seems to be very sparingly used, generally by the poorer classes of people, and not by professional dyers. The flowers, or the calyces alone, are simply boiled in water to extract the dye. The proportions are given from Chutiá Nágpur (Lohárdagá) and from Patná, but differ widely. From the former we are told that 1 seer of flowers is put in 15 seers of water and the whole boiled till 5 seers only remain; from the latter, that "to the flowers twice as much water (in weight or volume ?) is added and the whole boiled till half the liquid remains: the solution is then strained." When the seeds are employed they are simply pounded and boiled in water (Palámau).

The cloth to be dyed is merely steeped in the solution so obtained, and no auxiliary of any kind is employed. The resulting colour is a very fleeting *yellow*. (No. **6669**, Muzaffarpur: No. **7545**, Darbhangah; No. **11210**, Patna : all cotton.)

Mr. Buck states in his report that the dye extracted from the seed is *red;* but no reference to this is contained in any of the returns received.

Toon with other dyes.

In Sáran and Darbhangah the toon dye is rarely employed separately, but is mixed with *turmeric* to produce a deep yellow dye called *basanti* (No. **6680**, cotton, Darbhangah). The *basanti* of Cawnpur is made in the same way with the addition of lime and acidulated water (*vide* Mr. Buck's Report, page 29). It is probable that these two latter ingredients are also used in Sáran and Darbhangah, but have been omitted from the statement by inadvertence.

In Chutiá Nágpur (Lohárdagá), cloth previously dyed yellow with toon flowers as above is dyed *red* by steeping it in a solution obtained by adding water to a paste made by grinding together *pán leaves, kuth, supári, and chúná*, as if for eating (p. 132).

HULDI. **5. Curcuma longa,** *Linn.*—Nat. Ord. SCITAMINEÆ.

Huldi, ہلدی, হলুদী.
Haridrá, হরিদ্রা.
Halud, হলুদ, (Bardwán Division).

This valuable plant is cultivated everywhere in Bengal, but mostly for use as a condiment, although it is extensively employed in dyeing. It is generally grown in gardens or homesteads for home consumption. As it is usually grown with other crops, it is difficult to estimate the precise area under cultivation of turmeric. The following estimates have, however, been received :—

Midnapur ...	...	...	16,000 acres.
Húglí ...	...	...	1,000 bighas.
24-Parganás	...	...	500 ,,
Rájsháhi ...	...	8,000 to	10,000 ,,
Monghyr ...	...	...	10,000 acres.

Growth and cultivation.

In Bardwán the cultivation of turmeric is said to be "extremely limited;" in the Rájsháhi Division it is said to be grown in all the districts; in the Chittagong Division it is "cultivated everywhere;" in the Patná Division it is cultivated "to a very limited extent;" in Bhágalpur it is grown "everywhere in small quantities in the neighbourhood of the villages;" in Monghyr it is grown "in large quantities in the western parts of the Begu Saráí sub-division;" in Orissa it is grown "everywhere in abundance;" and in Chutiá Nágpur (Lohárdága) "the area cultivated is small, as the cultivation is confined to Koeries and others who follow a similar method of cultivation."

The account given in Roxburgh's "Flora Indica" of the cultivation of turmeric may here be reproduced:—"The ground must be rich, friable, and so high as not to be overflowed during the rainy season, such as the Bengalees about Calcutta call *danga*. It is often planted on land where sugarcane grew the preceding year, and is deemed a meliorating crop. The soil must be well ploughed and cleared of weeds, &c. It is then raised in April and May, according as the rains begin to fall, into ridges nine or ten inches high and eighteen or twenty broad, with intervening trenches nine or ten inches broad. The cuttings or sets, viz. small portions of the fresh root, are planted on the tops of the ridges at about eighteen inches or two feet asunder. One acre requires about from nine hundred such sets, and yields in December and January about two thousand pounds weight of the fresh root."

Judging from Mr. Buck's Report and Mr. Liotard's Memorandum, Roxburgh's description would seem to apply pretty accurately to the cultivation of turmeric in all parts of India. It is referred to by the Collector of Monghyr as giving an accurate account of the method of cultivation adopted in his district; but the accounts received from other districts differ considerably as to the seasons of sowing and of digging up the rhizomes. According to this account the cuttings or sets, small portions

Seasons of planting and digging up.

of the fresh root-stock from which the plant is reared, are planted in April or May, when the rains begin to fall, and the yield is dug up in December or January following. But the following are the seasons of planting and of digging up the rhizomes in the districts named: —

Midnapur	... April-May.	February-March.
Húglí	... February-March.	October-November.
24-Parganás	... May.	February.
Rájsháhí	... March-April.	March-April.
Chittagong	... April-May.	
Sáran and Darbhangah	... June.	March.
Bhágalpur	... August	December or earlier.
Monghyr	... April-May.	December-January.
Lohárdagá (Chutiá Nágpur)	June-July.	

So that, if these accounts be correct, the season of planting varies from February to July, and of digging-up from October to April.

To supplement Roxburgh's account of the cultivation, the following extracts from the district reports may be given. In 24-Parganás turmeric is planted "in shady places on high lands well ploughed and manured." In Midnapur "the ground is several times dug up with a *kodáli* (native spade) and properly watered before inserting the cuttings, and this process of turning up the soil and watering is afterwards repeated whenever the ground becomes hard and dry." In Chutiá Nágpur (Lohárdagá) "the soil is well dug to a depth of one foot, and well manured with old manure and ashes before the cuttings are inserted." In Sáran and Darbhangah "the soil is weeded twice after the planting, but no irrigation is necessary." After being dug up the rhizomes are boiled in water and dried in the sun to form the turmeric ordinarily sold in the Indian bazar. From Húglí we are informed that the "raw rhizomes are boiled with cowdung, peeled, washed, and dried before they are fit for use. This reduces them to half their weight."

The following table embodies all the information received regarding cost and profits of cultivation, &c. In it the figures in italics are not contained in the original returns, but are calculated from the other columns.

Districts.	Approximate area under cultivation.	Estimated cost of cultivation per bigha or per acre.	Average annual yield of rhizomes for dyeing purposes.	Yield per bigha or per acre.	Price per maund.	Total sum realised per bigha or per acre.	Profit per bigha or per acre.
Bardwan Division.							
Midnapur	16,000 acres	.....	.....	.....	Rs. 10.		
Húgli	1,000 bighas	Rs. 6-8 per bigha ...	.....	From 8 to 10 maunds of raw turmeric or about 4 to 5 maunds of prepared turmeric per bigha.	Rs. 6 to 7 per maund prepared turmeric.	*About Rs. 29 per bigha*	Rs. 20 per bigha.
Presidency Division.							
24-Parganás	500 bighas	Rs. 10 per bigha ...	6 maunds of dye, the whole being absorbed locally.*	5½ *maunds per bigah*	Rs. 3 to 4 ...	.....	„ 10 „ „
Rajshahi and Kuch Behar Division.		Rs.					
Rájsháhí	8,000 to 10,000 bighas, or 4 to 5 square miles.	12 maunds rhizomes for seed ... ... 72 Rent per bigha ... 3 Labour of weeding and cleaning ... 3 Total per bigha ... 78	.....	About 18 maunds per bigha.	Rs. 6 per md.	18 maunds at Rs. 6 per maund = Rs. 108.	„ 30 „ „
Chittagong Division.							
Chittagong	.....	Cost nothing ...	.....	.....	Sold at 1 anna per seer, or when the turmeric is dried at 2 to 3 annas per seer.	.....	1½ pies per plant.
Patna Division.							
Sáran and Darbhangah ...	.....	Rs. 40 per acre ...	.....	25 maunds of dry root per acre.	Rs. 4 per md.	25 maunds at Rs. 4 per maund = Rs. 100.	Rs. 60 per acre.
Bhagalpur Division.							
Bhágalpur	.....	Rs. 15 per standard bigha.	.....	12 maunds per bigha...	Rs. 4 per md.	12 maunds at Rs. 4 per maund = Rs. 48.	„ 33 „ „
Monghyr	10,000 acres	Rs. 10 per bigha ...	Few maunds only.*	2 *to* 6 *maunds per bigha.*	4 seers per rupee.	.....	Rs. 10 to Rs. 50 per bigha.
Orissa Division.							
Cuttack	.....	.....	.....	.....	Common turmeric at 1½ anna per seer of 105 tolas. Cnarparia huldi at 2½ annas per seer of 105 tolas.	.....	
Chutia Nagpur Division.							
Lohárdagá (Chutiá Nágpur sub-division).	.....	.....	.....	15 maunds per bigha...	3 to 4 seers per rupee.		

* The meaning of this is probably that only a few maunds of the produce were used in dyeing.

Cost of cultivation.

It will be seen that the cost of cultivation, omitting Rájsháhí, varies from Rs. 6-8 per bigha (Húglí) to Rs. 15 per bigha (Bhágalpur). In Rájsháhí the cost is put down at Rs. 78 per bigha, more than five times the highest cost elsewhere. Details are, however, given, showing how this high cost is calculated; and the principal item is the price of 12 maunds of "seed-cuttings" at Rs. 6 per maund, giving Rs. 72 under this head. No details as to how the cost is calculated are given from the other districts. It is probable that the expense of the rhizomes required for planting is omitted from these other estimates, and that what is required for planting is set aside from the crop of the year, and its price not taken into account in estimating the sum realised We may observe that in the estimate given in Mr. Buck's Report of the cost in the Cawnpore district no mention is made of the price of the rhizomes for cuttings; the cost is given at Rs. 19 per bigha ($\frac{1}{7}$ acre), or about Rs. 11 for a bigha reckoned as $\frac{1}{3}$rd acre. This agrees with the cost given above, except for Rájsháhí. In the reports from Oudh, in Mr. Liotard's Memorandum, the cost is given as varying from Rs. 5 to Rs. 26 per acre, which is considerably less than in Bengal. In Chittagong the cost is given as nothing, the cultivator tilling the ground and attending to the plant himself.

Yield.

The yield per bigha is variously given as from 8 maunds (Húglí) to 18 maunds (Rájsháhí). But these figures cannot be compared together, as it is doubtful in many cases whether the yield of fresh rhizomes is meant or the yield of prepared turmeric after boiling and drying. From Húglí it is stated that the yield is from 8 to 10 maunds of raw rhizomes, which, after being prepared for the market, lose half their weight. This would lead us to infer that the larger figures given are the yield of raw rhizomes, whilst the smaller are probably the yield of prepared turmeric. If we adopt this explanation, the yield of raw turmeric would seem to vary from 8 to 17 maunds per bighs, and of prepared turmeric from 4 to 9 maunds per bigha. In order to make the figures from Monghyr mutually consistent, it would be necessary that the yield per bigha should be from 2 to 6 maunds (prepared turmeric ?), and similarly the yield in the 24-Parganás must be about 6 maunds per bigha (prepared turmeric ?). According to Roxburgh's account quoted above, the yield is about 2,000lb of fresh rhizomes per acre, or a little over 8 maunds per bigha, which is under the average of the above. Mr. Buck states that in the Cawnpore district the yield is about $2\frac{1}{3}$ maunds of dried turmeric for a bigha reckoned as $\frac{1}{3}$rd acre. In Oudh Mr. Liotard's figures would seem to show that the yield varies from 4 to 11 maunds per bigha (prepared or raw ?).

Selling price.

The selling price is given as varying from Rs. 2-8 per maund (Chittagong) to Rs. 10 per maund (Midnapur and Monghyr). Here again comparison is impossible, as it is in many cases doubtful whether it is the price of the prepared turmeric or of the raw rhizomes as dug up that is meant, both being apparently sold. From the Chittagong returns it would seem that the prepared turmeric fetches more than twice that realised for the raw turmeric. It seems probable, then, that the lower prices given

HALDI. (Rs. 2-8 to Rs. 4 per maund) are for the raw turmeric, and the higher prices (Rs. 6 to Rs. 13 per maund) for the prepared turmeric. Mr. Buck gives Rs. 9 per maund as the price of the dried turmeric, which is fairly consistent with this. In Oudh the price is given as from Rs. 10 to Rs. 14. Obviously this must be the dried turmeric.

The profit is given from Rs. 10 per bigha (24-Parganás) to Rs. 50 per bigha (Monghyr). In Chittagong it is given at 1½ pies per plant. Taking Roxburgh's statement that 900 plants are grown on an acre, or 300 on the standard bigha, this would give a profit of about Rs. 2-6 per bigha—considerably less than elsewhere. Mr. Buck gives the profit in the Cawnpore district as Rs. 17 per $\frac{1}{7}$th acre, which would give Rs. 10 per bigha of $\frac{1}{3}$rd acre. The Oudh returns would seem to show a profit of from Rs. 2 to Rs. 21 per acre—considerably less than the above.

We may notice that, except in the Rájsháhí estimates, the root-stock required as "seed" for the subsequent year's crop is not deducted from the yield per acre, but the profits are calculated as if the whole yield were sold, whilst no account is apparently taken, in estimating the cost of the crop, of the cost of root-stock for "seed," which in this case would have to be bought. The same remark applies to the Cawnpore returns in Mr. Buck's Report. We may note also that the only return of the quantity of root-stock required for the sets is from Rájsháhí, where it is stated to be 12 maunds per bigha. In the Cawnpore returns it is given as 250lb per acre, or a little over 1 maund per standard bigha. It is probable that the 12 maunds per bigha is far too high an estimate.

Exports. The following table gives the exports of turmeric from Indian ports for the years from 1876-77 to 1881-82. Turmeric is free of duty on the export. From the tables it will be seen that the export trade in turmeric is rapidly declining, the quantity exported in 1881-82 being less than half that exported in 1878-79, whilst the value per cwt. also has similarly declined.

Exports of Turmeric from 1876-77 *to* 1881-82.

Year.	India.		Bengal.		Bombay.		Sindh.		Madras.		British Burmah.		Countries to which exported.	Quantity.	Value.
	Quantity.	Value.	Quantity.	Value.	Quantity	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.			
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.		Cwt.	Rs.
1876-77 ...	123,824	10,50,050	95,232	8,24,161	11,087	1,04,031	197	1,957	17,199	1,18,856	109	1,045	United Kingdom ...	71,418	5,75,578
													Austria	137	1,022
													France	11,475	98,030
													Italy	2,277	21,817
													Turkey in Europe ...	193	1,937
													Cape of Good Hope ...	221	2,012
													Eastern Coast of Africa	722	7,657
													Egypt	307	3,045
													Mauritius	1,796	21,260
													South America ...	421	3,443
													United States	19,006	1,78,196
													Aden	1,818	17,814
													Arabia	3,276	28,478
													Ceylon	4,629	31,490
													Mekran and Sonmiáni	184	1,615
													Persia	3,493	33,911
													Straits Settlements ...	1,008	7,907
													Turkey in Asia ...	1,339	13,939
													Other countries ...	103	899
1877-78 ...	147,228	12,40,189	121,366	10,07,807	9,232	89,990	39	422	16,249	1,39,011	342	2,959	United Kingdom ...	78,727	6,41,988
													Austria	1,184	10,515
													France	24,452	2,01,836
													Italy	3,111	22,338
													Eastern Coast of Africa	539	5,438
													Egypt	359	3,106
													Mauritius	4,518	46,172
													South America ...	270	2,150
													United States	16,930	1,55,104
													Aden	1,694	16,534
													Arabia	2,570	24,963
													Ceylon	5,900	44,667
													Mekran and Sonmiáni	149	1,528
													Persia	3,297	32,935
													Straits Settlements ...	1,402	11,994
													Turkey in Asia ...	1,788	16,469
													Other countries ...	298	2,460

(81)

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NOTE.

Exports of Turmeric from 1876-77 to 1881-82—concluded.

Year.	India.		Bengal.		Bombay.		Sindh.		Madras.		British Burmah.		Countries to which exported.	Quantity.	Value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.			
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.		Cwt.	Rs.
1878-79 ...	166,734	12,28,520	137,928	9,80,178	15,613	1,45,555	88	483	13,155	95,805	.....	.....	United Kingdom ...	115,018	8,35,608
													Austria	351	2,340
													France	13,745	99,286
													Cape of Good Hope ...	233	1,572
													Eastern Coast of Africa, Mozambique ...	88	388
													Eastern Zanzibar ...	511	5,037
													Egypt	1,508	11,061
													Mauritius	1,655	13,457
													South America ...	258	1,644
													United States	15,001	1,08,548
													Aden	1,658	15,709
													Arabia	4,548	40,172
													Ceylon	2,455	24,208
													Mekran and Sonmiani	135	1,212
													Persia	4,924	43,775
													Straits Settlements ...	1,089	7,084
													Turkey in Asia ...	3,364	21,988
													Other countries ...	485	3,435
1879-80 ...	130,427	8,23,387	99,009	5,90,419	17,320	1,48,206	26	271	13,893	83,102	169	1,201	United Kingdom ...	81,186	4,97,451
													France	9,081	53,740
													Cape of Good Hope ...	178	1,088
													Eastern Coast of Africa Mozambique	98	533
													Eastern Zanzibar ...	479	3,880
													Egypt	991	7,041
													Mauritius	1,911	13,603
													South America ...	257	1,913
													United States	18,866	1,18,422
													Aden	1,869	14,811
													Arabia	2,000	15,712
													Ceylon	4,012	21,755
													Mekran and Sonmiani	210	1,809
													Persia	6,113	40,558
													Straits Settlements ...	1,116	5,905
													Turkey in Asia ...	2,296	19,584
													Other countries ...	361	2,528

1880-81 ...	98,193	5,11,278	68,535	3,18,834	13,364	1,00,608	39	346	16,205	91,490	.....	.....	.....	2,24,543
													United Kingdom ...	46,605
													France	26,303
													Italy	883
													Eastern Coast of Africa, Mozambique	130
													Eastern Zanzibar ...	703
													Egypt	784
													Mauritius	1,094
													Natal	194
													Réunion	211
													United States	5,063
													Aden	3,091
													Arabia	3,539
													Ceylon	4,005
													Japan	331
													Persia	4,329
													Straits Settlements ...	460
													Turkey in Asia ...	735
													Other countries ...	729
1881-82 ...	70,783	3,66,047	48,733	2,18,398	11,544	93,154	31	272	9,994	55,004	481	2,219		1,06,138
													United Kingdom ...	24,117
													France	14,595
													Italy	649
													Cape of Good Hope ...	230
													Eastern Coast of Africa, Mozambique... ...	80
													Eastern Zanzibar ...	589
													Egypt	490
													Mauritius	3,118
													Natal	153
													United States	9,696
													Aden	1,693
													Arabia	2,810
													Ceylon	5,123
													China, Hong Kong ... Treaty Ports ...	1,273
													Mekran and Soumiani ...	144
													Persia	133
													Straits Settlements ...	2,103
													Turkey in Asia ...	1,543
													Other countries ...	1,792
														387

														1,06,138
														63,397
														3,015
														1,196
														687
														4,688
														3,670
														17,715
														1,089
														47,173
														13,060
														22,435
														25,434
														10,285
														1,188
														1,060
														17,951
														2,716
														14,694
														1,991

HULDI.

There is a very slight import of turmeric, the figures of which may here be given. Imported turmeric was subject up to 5th August, 1875, to a duty of 7½ per cent, then lowered to 5 per cent, and removed altogether after the 9th March, 1882.

Imports of Turmeric from 1876-77 *to* 1881-82.

Year.	India.		Bombay.		Madras.		Sindh.		Bengal.		British Burmah.		Countries whence imported.	Quantity.	Value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.			
	lb	Rs.	lb	Rs.	lb	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.		lb	Rs.
1876-77 ...	211	15	65	6	146	9	.....	.....	.....	.....	.....	.....	Mauritius	65	6
													Ceylon	146	9
	Cwt.		Cwt.		Cwt.									Cwt.	
1877-78 ...	67	1,669	.....	.....	67	1,668	.....	1	.....	.....	.....	.....	Straits Settlements ...	67	1,663
													Other countries ...	.....	6
1878-79 ...	33	330	.....	.....	1	10	.....	.....	9	56	23	264	Straits Settlements ...	23	264
													Other countries ...	10	66
1879-80 ...	2	26	.....	.....	.....	3	1	15	1	8	.....	.....	Turkey in Asia ...	1	15
													Other countries ...	1	11
1880-81 ...	15	68	.....	.....	2	22	.....	.....	13	46	.....	.....	Mauritius	7	22
													South America... ...	6	24
													Ceylon	2	23
1881-82 ...	27	133	25	125	2	8	.....	.....	.....	.....	.....	.....	Mauritius	2	8
													Arabia	25	125

Extraction of dye and processes of dyeing.—Turmeric itself yields a yellow dye of a fleeting character, but it is principally used as an auxiliary to other dye-stuffs. From Húglí it is reported that "formerly on festive occasions an infusion of turmeric was used in dyeing garments, but magenta has now taken its place. At present turmeric is used as a dye for colouring country-made paper." It is used only by the lower classes for dyeing their garments for weddings or other festive occasions, for which permanency of colour is not requisite. The rhizomes are simply soaked and pounded in water to extract the dye. (Nos. **4646, 6682,** and **7547,** cotton.)

Sometimes *alum* is added to the infusion, which apparently tends to make the yellow purer, destroying any shade of red. The following description of the process has been received from Chutiá Nágpur (Lohárdagá) :—

> 1 seer of huldi is steeped for 24 hours in 1 seer of sour milk; the outer covering of the root is then removed, and the root pounded up with ¼ seer milk; water is then added, and the whole strained through a cloth; to this solution 2 tolas *alum* are added; the cloth to be dyed is steeped in this, and, on removal, is dried in the shade. The colour is a pure *yellow*.

The Collector of Maldah gives the following formula for producing yellow—*turmeric, alum,* and *rice-water*. A process of dyeing yellow with *gach huldi, turmeric, jooree,* and *alum,* employed in Chittagong, will be found described on p. 91.

Or an *acid,* such as the juice of the lime or lemon, is sometimes added, as in the following account of another process adopted in Chutiá Nágpur (Lohárdagá) :—

> 1 seer of huldi is pounded up with water, then strained, and ¼ seer of any acid, such as *lime juice, sour milk,* &c., is added. The cloth is steeped in this, and, on removal, dried in the shade. This gives a darker shade of *yellow*.

The native dyers of Calcutta produce a brilliant yellow, called *basanti rang,* by a mixture of *turmeric, sajimati,* and *lemon* or *lime juice*. Here the acid is apparently used to correct the red tint produced always where an alkali acts on turmeric. (No. **12180,** silk yarn.)

Here also we may describe a process adopted in Monghyr for dyeing *yellow* :—

2½	seers of	mahooah	bark	(*Bassia latifolia*),
2½	,,	mango	,,	(*Mangifera indica*),
1¼	,,	pomegranate	,,	(*Punica Granatum*),
1¼	,,	kuchnar	,,	(*Bauhinia variegata*),

> are pounded up and mixed well with 5 seers of water. The liquid is then strained and boiled until it forms a thick paste, to which, while hot, 10 chittacks of powdered *huldi,* 1½ seers of *sajimati,* and 5 chittacks of *alum* are added. Let this drain through a coarse cloth, and then make up into balls or cakes. These cakes are called *pili rung*. This process gives 1¼ seers of pili rung.
>
> To dye 1 square yard of cloth with *pili rung,* dissolve ⅓rd chittack of *pili* in 4 chittacks or ½lb of hot water; in this soak the cloth well. It acquires a dark brown colour. Dip it then into *lime juice* and water, when it immediately changes into a bright *yellow*. (No. **11063,** cotton.)

HULDI.

Harra (*Terminalia Chebula*) is sometimes used as an auxiliary in dyeing yellow with turmeric, as in the following account from the Meetapore Jail, Patna:—

> 1 seer of woollen yarn is steeped in *sajimati* water for about 2 hours, then washed. Then 4 chittacks of *huldi* and 3 chittacks *harra* are placed in a gumlah with 5 seers of water, and the yarn is steeped in the liquor for 12 hours. The yarn is then removed and dried in the shade. The result is the yellow called *pumba*, which loses its colour if exposed to the sun and cannot stand washing. If the resulting colour has a reddish tinge, this is rectified by washing it in *alum* water, which brings it out a bright yellow. (No. 12854 ?)

The Tehsildar of Terai gives the following account of the method employed by the Meches in the Darjíling Terai for dyeing silk thread yellow:—

> The silk thread is boiled with *turmeric* powder; it is then mixed with the powdered bark of *gumbengfong* (p. 90), a tree growing in the jungles. The thread is then dried in the sun, and afterwards mixed with the bark of another tree, called *khoidai* (*Symplocos racemosa* ?), and boiled.

Turmeric with indigo.

The principal compound colour in the production of which turmeric is employed is *green* in combination with *indigo*. The dye-stuffs are either all mixed together and the cloth dipped in the compound solution, or the cloth is first dyed with indigo and then dipped in a solution of huldi. The former process is reported from Chutiá Nágpur (Lohárdagá):—

> If to the water employed in the two processes above mentioned for dyeing yellow with turmeric a little *alum* and *indigo* be added, a green colour called *dhani* is obtained.

Examples of the second process are given from Midnapur and Darjíling as follows:—

> *Turmeric* and *alum* are dissolved in water, and the thread or cloth of silk or cotton previously dyed with *indigo* is drenched in this solution and dyed green. (Midnapur).
>
> The leaves of the plant called "singen" by the Bhutiahs (*Symplocos lucida ?*) are ground and boiled in water with the thread to be coloured. The cloth or yarn is then dried, soaked in water with *indigo*, and kept for 5 or 6 days. It is then again boiled with *huldi* in water. (No. 13799, cotton.)

Turmeric with other dyes.

The process adopted in the Meetapore Jail, Patna, for dyeing the shades of green known as *harasabuj* and *dhani* will be found detailed under indigo (p. 126). The following additional specimens dyed green with indigo and turmeric are in the Economic Museum, but the processes are not given:—

No. 4491, indigo and turmeric, silk (Maldah).

Nos. 12188, silk yarn, and 12189, cotton yarn, indigo, turmeric, and lime juice (Calcutta native dyers).

A combination of *indigo*, *huldi*, and *singrahar* (*Nyctanthes Arbor-tristis*) is mentioned as being in use in Bhágalpur, but no details are given.

Huldi is also used as an auxiliary in dyeing with lac (Meetapore Jail, Patna, p. 55); in dyeing red with ál, *Morinda tinctoria* (Monghyr, Saran, Darbángah, p. 33); in dyeing with safflower, *Carthamus tinctorius* (p. 17); and in dyeing with toon, *Cedrela Toona* (p. 75). Men-

tion is made from Bhágalpur of a combination of huldi with singrahar (*Nyctanthes Arbor-tristis*), but no details are given, nor is the colour stated. HULDI.

6. Curcuma Zedoaria, *Roxb.*—Nat. Ord. SCITAMINEÆ. BUNHULDI.

Palua or bunhuldi, পালুয়া, বনহলুদ, পাল, or বনহলুদ.

Information regarding this species of *Curcuma*, the wild turmeric, has been received from Balasor alone. It is said to grow wild everywhere in this district. It is not used properly as a dye, but only in the preparation of the ábir powder (*vide* p. 4).

For further information regarding this plant, we may refer to Roxburgh's Flora Indica, Clarke's reprint, pp. 8-9.

7. Curcuma Zerumbet, *Linn.*—Nat. Ord. SCITAMINEÆ. SHATI.

Shatí, শটী.
Kuchoor.

Information regarding this species of *Curcuma* has been received from Maimansinh alone (*vide* Roxburgh's Flora Indica, pp. 7-8). In this district it is said not to be cultivated, but to grow spontaneously on high waste lands and at the side of roads. "The parganás of Husainpur and Husainsháhí and the Madhupur forest are famous for the growth of the plants and also for the preparation of the ábir powder (আবির) from it." Like the *Curcuma Zedoaria* above mentioned, the root-stock is not properly used as a dye, but in the preparation of the ábir powder used in the *holi* festival. The description of the preparation of this powder in the Maimansinh district is as follows:—

> "The *shatí* is washed and pounded in a dhenki (ঢেঁকী). The powder is then put into an earthen vessel full of water and allowed to rot. The water is afterwards poured off and the powder is dried. It is then mixed with the juice extracted from bakam-wood. This turns it red, and it is called ábir or holi powder. Shatí is gathered for this purpose in the month of Pous (December–January)."

The roots of kuchoor are mentioned as being employed in Lohárdagá as an auxiliary in dyeing with kamalágundi (*Mallotus philippinensis*, p. 19).

8. Symplocos racemosa, *Roxb.*—Nat. Ord. STYRACEÆ. LODH.

Lodh, লোধ, লোধ্র.
Lodhra (Mánbhúm).
Nidhu, নিধু, লোধ্র (Balasor).
* Pathani lodhoo, পাথানি লোধ্র (Cuttack).
Khoidai, kaidai (Darjíling).

This tree is nowhere cultivated, but is found here and there wild in the jungles. It is specially mentioned as growing wild on the Garjáts and other hill ranges in Orissa. The only other districts in which it is mentioned as a jungle product are the Santál Parganás and Midnapur. Balfour says "it is a native of Bardwán and Midnapur in Bengal." The bark is said to be used in Cuttack for medicinal purposes as an astringent.

* This is the name given in the report from Cuttack to the "bark of an unknown tree obtained from Garjáts, used for obtaining a red dye with lac, alum, and turmeric." As it is probably either lodh or some allied species of *Symplocos*, it is entered here.

LODH.

Both *bark* and *leaves* are used in dyeing. The prices of the bark given are—

				As.
Midnapur	...	...	...	4 per seer.
Balasor	...	...	...	5 „

In Cuttack "it is sold roughly by the basket." There is a slight trade in lodh bark; it is said to be exported largely from Mánbhúm to Rániganj and Assensol, and to Calcutta from the Santál Parganás. Into the Bhágalpur district it is imported from the North-West.

Dye from bark.

The lodh bark by itself yields a *yellow* dye, which is extracted by steeping it in hot water. But this seems to be rarely, if ever, employed. The only district in which mention is made of lodh being used as a dye by itself is Balasor, in which "the bark is boiled in water for eight hours and cotton cloth is steeped in this infusion for half an hour." (No. **11346**, cotton.) From Chutiá Nágpur (Lohárdagá) we are told that a *red* dye is prepared by boiling lodh bark with *sajimati*, this dye being used in printing red on a white ground.

Lodh bark with other dyes.

Lodh bark is used chiefly as an auxiliary with other dyes, as it appears to act as a mordant. The dyes as an auxiliary to which it is chiefly employed are ál or áich (*Morinda tinctoria*), lac, bakam (*Cæsalpinia Sappan*), and parás (*Butea frondosa*). It is employed as an auxiliary with aich or achchu in Lohárdagá, Monghyr, and Balasor (see under *Morinda tinctoria*, pp. 33, 35, 36); with lac in Maldah (Nos. **4492**, silk; **11343**, cotton), (see under lac, p. 54); with bakam in Balasor (No. **11347**, cotton), (p. 3); and with parás in Patná (Nos. **12852**, **12853**, woollen yarns) (p. 74). From Cuttack it is stated to be used for obtaining a *red* dye with lac, alum, and turmeric, but no details are given. It is also employed by the Meches of the Darjíling Terai along with *turmeric* and *gumbengfong* in dyeing silk yellow (p. 90). Lodh-bark is also used in the preparation of *ábir* powder, as described in detail on p. 4.

Lodh leaves.

The *leaves* of the lodh tree are also employed along with *Morinda tinctoria* in the Chutiá Nágpur sub-division of Lohárdagá (*vide* p. 33).

Roxburgh gives the following details of a process of dyeing *red* with ál and munjeet adopted by the dyers of Calcutta:—

> For three yards of cloth take lodh bark, burra hur (*Myrabolana Chebula*, Mat. Med. *Terminalia Chebula*, Roxb.), of each 1 chittack, or 2 ounces, pound and rub them with water on a stone; mix them up with water and steep the cloth in it; then dry it. Take 1 chittack of alum, dissolve it in water, and boil it: put the cloth into this solution, and let it boil for an hour; then wash and dry it. Then take ál, viz. *Morinda tinctoria*, Roxb., one chittack, dhawra flowers, *Grislea tomentosa*, Roxb., one chittack, munjeet, *Rubia Munjeet*, Roxb., half a seer, nearly a pound, separately, mix them with lukewarm water, and let it boil. Then put in the cloth and let it remain boiling for forty minutes.

BHAURI.

9. Symplocos theæfolia, *Ham.* (S. lucida, *Wall.*)— Nat. Ord. STYRACEÆ.

Bhauri.

This plant seems to be found wild in the northern districts of the Rájsháhí Division, from which alone information regarding it has

been received. Mr. Gamble, in his "Trees, Shrubs, and Large Climbers of the Dárjíling District," gives its vernacular names as *kharani* and *chashing*, but in most of the information received the plant is called *bhauri*, and a growing specimen forwarded from Dinájpur has been identified by Dr. King as *Symplocos lucida*. Mr. Gamble gives *bhauri* as the Bengali name for *Bradleia lanceolaria*, Roxb. BHAURI.

Its *leaves* are used in these districts as an auxiliary in dyeing with dáruharidrá (*Morinda tinctoria*) and lac. The processes are described in full under these dye-stuffs, and need not be repeated here (*vide* pp. 34, 35, 55).

Singen or Soongen (Darjiling). SINGEN.

In the report from the Rájsháhí Division the *leaves* of a tree called "soongen," found on the hills or in the valleys at the foot of the hills, are said to yield a *yellow* dye, which is extracted by bruising the leaves in a mortar and then boiling them.

Two specimens of cotton yarn (Nos. **13799, 13800**), dyed *green* and *blue* respectively by a mixture of "singen" leaves and indigo (pp. 124, 126), have been received from Dárjíling. The processes are described under indigo. This is probably the same as "soongen." In the letter conveying these specimens singen is said to be *Symplocos lucida*. In Mr. Gamble's "Trees, &c., of Dárjíling," however, the Bhootia name of *Symplocos racemosa* is given as *singen*, so that it is doubtful which of these two species of *Symplocos* this singen is.

Four specimens of woollen yarn dyed various colours with singen, probably combined with other dyes, have also been received, but no information accompanied them. (Nos. **10692**, green: **10694**, red: **10695**, yellow: **10696**, yellowish red.)

10. Symplocos phyllocalyx, *Clarke*.—Nat. Ord. STYRACEÆ. CHANDAN.

Chandan.

Found on the Dárjíling hills above 8,000 feet elevation. A colour is extracted by the Nepalese from the bright *red* wood by grinding it on a stone, and is used to make their caste-marks on the forehead. (Dr. Schlich.) (*Vide* Hooker's Himalayan Journal, vol. II, p. 41.)

11. Symplocos spicata, *Roxb.* ?—Nat. Ord. STYRACEÆ. GYONG.

Gyong.

"A small tree, found above 3,000 feet in the Himalayas, and also in Eastern Bengal. The leaves are dried, pounded, mixed with the fruit of a plant called *kanda* (p. 152), which is also pounded, and the article to be dyed steeped in the infusion; a *yellow* colour is thus obtained." (Dr. Schlich.)

CHATRI. **12. Berberis nepalensis,** *Spreng.*—Nat. Ord. BERBERIDEÆ.

Chatri (Gamble).

"A small tree of the upper hills, very common around Dárjíling. A dye is occasionally extracted from the *yellow* wood by the Bhootias." (Dr. Schlich.)

SAFFRON. **13. Crocus sativus,** *Linn.*—Nat. Ord. IRIDACEÆ.

Saffron, জাফরান্.

Mentioned as being sold in the Húglí bazars in small quantities as a condiment, and as yielding a yellow colour. It is not stated, however, whether it is used at all as a dye.

MEHNDI. **14. Lawsonia alba,** *Lamk.* (Lawsonia inermis, *Roxb.*)—Nat. Ord. LYTHRACEÆ.

Mehndi (মেহদি), henna.

The information received regarding henna is so scant as to be barely worth reproducing. It is a shrub stated to be sometimes grown as a fence to gardens. It seems to be rarely used as a dye, except for the purpose of staining the fingers, feet, or nails of native women a bright orange colour. This use of henna is almost universal throughout India, especially amongst Mahommedan ladies. For this purpose the freshly plucked leaves of the plant are made into a paste by pounding them with catechu or lime. It is also used for dyeing the beard or hair. The only district in which it is reported to be used for dyeing fabrics is Purí, the Collector of which reports: "Mehndi is sometimes used for dyeing cloths, but their colours are very fleeting."

CHUMPA. **15. Michelia Champaca,** *Linn.*—Nat. Ord. MAGNOLIACEÆ.

Chumpa.

The flowers on being boiled in water yield a *yellow* dye. (Lohárdagá.)

GUMBENGFONG. **16. Plecospermum spinosum,** *Trecul.* (Batis spinosa, *Roxb.*)—Nat. Ord. URTICACEÆ.

Gumbengfong.

Found in the hills or valleys at the foot of the hills in the Dárjíling district, used by the Meches of the Terai in colouring silks *yellow*: "They first mix *turmeric* powder with the thread and boil them together; then powdered bark of *gumbengfong* is mixed with the thread, which is then dried in the sun and again mixed with the bark of a tree called khoidai (*Symplocos racemosa*) and boiled" (*vide* Gamble's "Manual of Indian Timbers," p. 327). Some of the specimens forwarded from Dárjíling as "gumbengfong" are, however, not *Plecospermum spinosum*, but belong to the genus *Morinda*.

The following dye-stuffs are also mentioned as giving yellow dyes, but the scientific names of the plants are not known.

17. Binee huldi.

BINEE HULDI.

"Cultivated at Cox's Bazar and Ramoo to a very small extent for dyeing purposes. The juice (of roots?) gives a non-permanent *yellow* colour." (Chittagong.) This may be the same as bunhuldi, *Curcuma Zedoaria*, p. 87.

18. Gach huldi.

GACH HULDI.

Saininua (Mughs).

Information regarding this plant has been received from Chittagong, into which district the *bark* is imported from Koladyne, in Arracan.

It may be used as a dye by itself, as described in the following account:—

"The bark should be scraped so as to clean it. It is then broken up and steeped in water for nearly 2 hours, then crushed in a rice-husking machine, after which the dye is squeezed out of it. The cloth to be dyed is steeped in the dye three times, and dried in the shade after each steeping." (No. 13114, cotton, yellow.)

Or it may be used along with *turmeric* and *jooree* (p. 152), as follows:—

"The plant is stripped of its outer *bark* and soaked for one night in water, and then it is pounded in water and the liquid drawn off. Common *turmeric* and *alum* and some *cocoanut* or *cicamum oil* are added to this liquid, and then a solution of *jooree*, an imported dye-stuff, is mixed with it. In this the silk or thread to be dyed is placed and the whole boiled, when the thread or silk acquires a semi-permanent *yellow* colour."

19. Samlick.

SAMLICK.

Bark of a tree found chiefly in the hills or valleys at the foot of the hills in the Dárjíling district, especially on the banks of the Teesta and Runjeet rivers. *Yellow* dye extracted by boiling the bark, principally used by the Meches at the foot of the hills. The specimen forwarded appears to be the stem of a species of *Morinda*.

The following mineral dye may here be mentioned:—

20. Yellow ochre.

RAMRAJ.

Rámraj, رام رج, राम रज, kaimati, haldimati.

This, the hydrated sequi-oxide of iron, is generally used in making yellow pigments for house-painting, and by bairágis to rub on their bodies. In Lohárdagá, where it is procured from the parganá Biru, it is used for giving *yellow* and salmon-coloured dyes by mixing it with water. Its price in Cuttack is given as 2 annas per seer of 105 tolas.

The following account has been received from Monghyr of a yellow dye of animal origin :—

PEORI RUNG.

21. Peori or peri rung.

This is a substance used as a dye in the Monghyr district. It is made from the *urine* of cows fed on mango leaves and water alone. The cows so fed seldom live more than two years, and those cow-keepers who trade in this dye are despised as cow-destroyers. The urine is boiled to give the peori as a bright yellow deposit. It sells at Rs. 4 per seer,* and is said to fetch Rs. 8 in Calcutta, and to be exported to Europe. The trade seems to be profitable, as one or two traders in peori have paid income-tax on the profits. The peori is dissolved in hot water and the cloth dipped in it. One and a half chittacks of peori will dye one yard of cloth a good *yellow*. (No. 11170, cotton.)

It is, however, stated that this dye is rarely used for fabrics, as they smell of cow's urine. It is used generally to colour doors, railings, &c.

* In another letter the price is given as 16 seers for a rupee, which is probably an error.

CHAPTER III.

Dye-stuffs giving Blue Dyes.

1. Indigofera tinctoria.
2. Reyong.

1. Indigofera tinctoria, *Linn.*—Nat. Ord. LEGUMINOSÆ. INDIGO.

Neel or nil, नील, نيل.
Kalma (Chittagong).
Ryomn or Rum* (Dárjíling).
Rom (Nowgong).

Growth and cultivation.

This most important of dye-producing plants, giving origin to one of the principal industries of Bengal, is cultivated almost everywhere throughout the province. The uncultivated plant is, no doubt, also widely distributed, although the only districts in the reports from which mention is made of the wild plant are Palámau in Lohárdagá, in which the indigo plant, *jungli nil*, is said to grow wild all over the district, and Purí, in which district it is said to grow wild in the Khurdhá sub-division, "in extensive patches during the rainy season, thriving even in rough, rocky soils, where nothing else will grow." This wild plant in Purí is said, however, to be *Indigofera aspalathoides*, Vahl., or *Indigofera enneaphylla*, Linn. The estimated areas under cultivation of indigo are those given in the *Statistical Reporter* for April, 1877, the statistics in which seem to have been mainly taken from the same letters as those upon which this report is based. It may be as well, however, to repeat them here, especially as there are several inaccuracies in the account referred to.

Bardwán Division—

Bánkurá	...	...	12,000	bighas.
Bírbhúm	...	...	15,000	,,
Bardwán	...	...	49,500	,, (principally in the sub-divisions of Kálná, Bud-bud, and Jehánábád).
Húglí	...	...	1,500	bighas.
Midnapur	...	...	30,000	acres. (20,000 in *Statistical Reporter*.)

* It seems doubtful whether this is *Indigofera tinctoria* or not. Mr. Gamble gives *ryŏm* as the Lepcha name of *Marsdenia tinctoria*. Two specimens of thread (Nos. 13799 and 13800) dyed with *ryomn* were, however, forwarded from Dárjíling, and in the letter of despatch it was stated that this was the common indigo. It may, however, be the same as the *reyong* mentioned in p. 126.

INDIGO.

Presidency Division—	
Jessor	103,222 bighas.
Nadiyá*	190,000 „
Murshidábád	130,000 „ (21,643 acres in *S. R.*)
24-Parganás	5,850 bighas.
Rájsháhí and Kuch Behar Division—	
Rájsháhí†	42,000 bighas.
Rangpur	13,000 acres. (10,000 acres in *S. R.*)
Maldah	55,000 bighas. (10,000 acres in *S. R.*)
Dacca Division—	
Farídpur	4,500 bighas. (Previously given as 10,500 bighas.)
Chittagong Division—	
Chittagong	51 acres? (45 acres in Patiá, 6 acres in Teknáf.)
Patná Division—	
Champáran	60,000 acres.
Gayá	781 „
Patná	1,875 „ (1,062 acres in *S. R.*)
Sáran	50,740 acres.
Sháháhád	9,320 „
Muzaffarpur	65,000 „
Darbhangah	50,000 „ (55,000 to 60,000 acres in *S. R.*)
Bhágalpur Division—	
Monghyr	15,000 acres. (12,000 European, 3,000 native.)
Purniah	70,000 acres(in *S. R.*, from 60,000 to 70,000).
Santál Parganás	19,000 bighas.
Chutiá Nágpur Division—	
Mánbhúm	3,000 acres.

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* In a subsequent return the following estimate was given—

	Bighas.
Kushtiá sub-division	40,000
Sadr ditto	33,000
Bangáon ditto	30,000
Ránághát ditto	13,000
Mehrpur ditto	43,430
Chuádángá ditto	47,000
Total for Nadiyá ...	203,430

† In the Administration Report for 1877-78 the areas under cultivation in the Rájsháhí Division are given as—

	Acres.
Rájsháhí	16,800
Pabná	4,224
Rangpur	13,300

The methods of cultivating indigo are essentially the same all over Bengal, and may be described as follows.

Cultivation.

In nearly all districts there are two sowings of indigo annually—one after the cessation of the annual rains, in October or November, and the other in the early part of the year, varying in different districts and years from February to April, generally immediately after the first spring shower of rain. The autumn sowing, called katika (Rájsháhí) or khutkee (Purniah), is generally confined to the alluvial lands along the river-banks left by the receding waters when the rains cease. The spring sowings are on higher lands lying beyond the reach of the periodical inundations. In some districts portions of these higher lands are also sown with indigo in the autumn, whilst the soil is still thoroughly moist after the rains. This is the case in Nadiyá and Jessor. In the case of alluvial lands no previous ploughing or preparing of the soil is required: the seed is simply sown broadcast from day to day as the receding inundations expose continually fresh alluvial deposits. But for all other lands intended for indigo-sowing, whether in autumn or spring, the soil requires careful ploughing and harrowing beforehand. This is especially the case for the spring sowings, for which much more care is required than for the autumn sowings, which are generally less productive. The amount of ploughing and harrowing required for the spring sowing varies of course in different districts according to the nature of the soil. Thus in Bardwán the land is said to be ploughed twice or thrice and harrowed; in Rájsháhí the inland and higher lands require three or four ploughings after the first showers for the March sowings; in Rangpur seven or eight ploughings and as many harrowings, besides two or three drillings, are requisite; in Purniah "some of the higher grounds require twelve ploughings, the lower only six, whilst land from which a toree crop has been taken only requires four." In some districts this preparation of the soil takes place after the fall of the first spring showers, as in Rájsháhí; but in others the preparation of the soil is going on all through the cold weather. Thus in Maldah indigo lands not sown in October are ploughed in December and January, and again ploughed after the first rain in February, just before the seed is sown: in the Patná Division the ploughing in preparation for the ensuing spring sowing takes place in October and November, immediately after the rains have ceased: in Faridpur the ploughing for the spring crop takes place in October, November, and December.

The soil is sometimes manured before the sowing, sometimes whilst the plant is growing. The seed, generally sown broadcast, is sometimes harrowed into the soil. In Monghyr, whilst on low lands the seed is, as elsewhere, sown broadcast, on the higher lands it is sown in drills. In the Chittagong Hill Tracts it is also sown in drills, as appears from the account below; and the Collector of Faridpur reports that in his district "the seed is sown in straight furrows about a foot apart from each other." The indigo sown in the autumn grows but slowly during the cold weather, but rapidly after the first fall of rain. Both crops require careful weeding. The soil is sometimes harrowed to root out grass and weeds whilst the plant is

growing. Weeding is in some places done with the *kodál* (hoe) and in others with the *pusni* (spade) (Purniah). The autumn sowings are weeded from February to May; the spring sowings when the plant is from 3 or 4 inches (Maldah) to a foot high (24-Parganás). The plants from both the autumn and spring sowings are cut during the rainy season, at periods varying from the end of June to the end of August. Generally the crop sown in the preceding autumn is first cut as the rivers begin to encroach on the alluvium, but sometimes both are cut at the same time (Nadiyá). In the case of the indigo on alluvial lands, it is frequently necessary to cut it before it has attained maturity owing to the rising of the rivers. In some districts there are two or even three cuttings. In Rangpur, where there is apparently no autumn sowing, the spring-sown crop is cut twice during the same harvest. In the Patná Division also the spring crop is cut first in July and a second time in September; these cuttings being called "murhun" and "khunti" respectively. In Monghyr both crops are cut first in June or July, and "they are cut a second and third time in favourable seasons of alternate sunshine and showers up to the commencement of the cold season." In this district the autumn-sown crop, after its first cutting in June or July, is allowed to spring up again and bear seed. In all cases the subsequent cuttings are very inferior to the first.

In the 24-Parganás, Rangpur, Faridpur, Chittagong Hill Tracts, and the Patná Division there seems to be no autumn sowing. In Maldah there are apparently three times of sowing and three distinct crops: (1) the October sowing, called *chittan* or *chittany* sowing; (2) the February sowing, called *brishti butul*; (3) the April sowing, at the commencement of the rains, after the land has been ploughed and prepared, called *apta butul*.

Sown sometimes with other crops.

Generally indigo is sown by itself, but in the Rájsháhí district the Collector says that on the higher lands sown with indigo after ploughing in October "oats and kalai may be sown on the same ground." In Mánbhúm indigo is usually sown with other crops at both sowings, such as wheat and mustard in October and teel in April and May. In the Chittagong Hill Tracts, also, indigo is sown by the hillmen along with various other crops, as stated in the following account of the cultivation of indigenous indigo communicated by the Commissioner of the Chittagong Division:—

"Indigenous indigo-seeds are planted by the hillmen, along with their other crops, in Baisákh, *i.e.*, April and May, every year. The leaves are gathered in Ashár or Srában, *i.e.*, July or August, following. The method of cultivation does not differ from that followed for their other crops: it is known as *júm* cultivation, and may be described as follows:—

"A piece of jungle is cut in January or February and left to dry until the middle of April. About that time, when the jungle is thoroughly dry, it is set fire to, and after the first fall of rain the clearance is sown by dibbling seeds of various kinds into holes made with the point of a *dao*. Paddy, cotton, gourds, indigo, and other seeds are thus sown." (*Vide* Hunter's Statistical Account of Bengal, vol. VI, pp. 72-74.)

The Assistant Commissioner of Palámau says:—"Wild indigo grows all over the district, and the dyers collect the seed from the

wild plant and sow a small quantity on the village irrigation embankments as soon as the rain falls. The cultivation costs them nothing, as they merely scratch up the ground, for which they pay no rent, and throw in the seed. They thus get a sufficient quantity of the dye to last them for a few months in the year."

Cultivation in Purniah.

The following account of the cultivation of indigo in Purniah is given in full, as containing more careful details than the reports received from other districts:—

"Sowing in some places begins in October in high alluvial deposits, where the seed is often sown broadcast without any ploughing. This is called *khutkee*.

"In most factories, however, no land can be sown till February, when the Maghat or Magh sowing is made on land from which the maghat toree, or red mustard crop, has been reaped, and other high land which retains its moisture. In the end of February the lower lands, and in March the higher *dearah* or *chur* lands, are subjected to inundation, and in April the lower *chur* lands are sown. Sometimes the planter waits for rain till he sows, and sometimes sows on the plan called *harrara* (هریرا), that is, the land is ploughed and harrowed and the seed sown broadcast and allowed to lie and wait for rain.

"In some parts of the district very high land is not sown till the end of April (Baisákh). Up-country seed is used for the October and February sowing, and *daisi*, or seed grown in or near this district, for the later sowings.

"The higher lands require more cultivation than the lower; some grounds require twelve ploughings (boro chas), the lower only six chas; land from which a toree crop has been taken only requires four chas.

"Ploughing costs the ryots about one rupee per eight chas, and weeding, which commences in April, costs in the south of the district about eight annas per bigha, and is done with the kodál. In the north, however, it is a more expensive and troublesome task, and is done with the pusni or spade.

"The later crop is generally sown by the ryots in the south, of their own free will, without any advance, and is sold by them in open market. This is called *fasil* cultivation.

"The manufacture begins in June, and is generally finished by the middle of August, but in good seasons goes on till September."

Soils best suited for indigo cultivation.

It will be seen from the above account that the lands most used for indigo cultivation are low soils and sandy churs in the neighbourhood of rivers, owing to their being periodically enriched by the alluvial deposits left by the retiring waters. But the crop grown on high loamy lands seems to be generally of a superior quality, although requiring much more careful cultivation.

System of cultivation in Purniah.

It is unnecessary here to explain the different systems of cultivation adopted in the various districts of Bengal and the relations between the ryots and the planters, as information on this head may be obtained elsewhere. We give, however, the account received from Purniah, as the system adopted in this district seems to differ considerably from that usual elsewhere:—

"The system of indigo planting and manufacture followed in this district is as follows.

"In October the ryots attend at the factory, and are paid up all that may be due to them for indigo delivered during the preceding season, and take advances for the ensuing season. The sum advanced and the terms of the contract vary in different parts of the district. The planters in the south advance Rs. 3

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per bigha, and make the contract only for one year ; in the north Rs. 2 or Re. 1 per bigha is only advanced, and a contract is sometimes made for as long a term as ten years.

(1) The contract generally binds the ryot to cultivate a certain quantity of land exclusively for the factory.
(2) Not to sell his plant to another factory.
(3) To get the land ready in proper time for sowing.
(4) To sow it when ready.
(5) To weed at the proper time with the aid of the factory.
(6) To cut the plant when required.
(7) To deliver a certain quantity, generally eight, sometimes seven or nine bundles, measured with a " 6-hath " chain, per rupee.
(8) The factory is bound to take any seed at Rs. 5 per maund, and to make good any loss the ryot may suffer from wilful negligence by the factory servants.
(9) The planter in most cases engages to pay for carriage, either by cart or boat, to the factories.

"There is no doubt that the cultivation of indigo in the district pays the ryot during the months much of the sowing and cutting goes on : no other crop can be sown or cut. Much of it is sown on land from which other crops have been cut, and on another land rice can be sown after the indigo is cut. On some low chur lands nothing but indigo can be grown ; and, lastly, if the ryot is fairly paid by measurement for his crop, indigo pays better than anything else.

"Besides the village cultivation, every factory gives employment to a large number of men (as many as 200 in a large concern) permanently as peons, blacksmiths, carpenters, thatchers, gardeners, ploughmen, and ordinary coolies.

"All classes of ryots cultivate indigo ; some cultivate as much as 100 bighas, some as little as a quarter of a bigha. The planters assist their ryots in many ways by giving them bullocks and ploughs and by advancing money, for which they take no interest as long as indigo is grown for them."

Cost and profits.

As regards the cost and profits of cultivation, the average yield per bigha, and so on, the following table embodies all the information received in the course of this enquiry.

Districts.	Approximate area under cultivation.	Estimated cost of cultivation per bigha, or per acre, or per maund.	Average annual yield for the five years preceding 1876.	Yield per bigha or per acre.	Average price of dye.	Profit per bigha, or per acre, or per maund.	Remarks.
Bardwan Division.							
Bánkurá	12,000 bighas...	Rs. 3 per bigha ...	300 maunds ...	1 *seer per bigha* ...	From Rs. 225 to Rs. 250 per maund. (Later estimate, Rs. 170 to Rs. 285 per maund.)	Re. 1 to Re. 1-8 per bigha.	
Bardwán	49,500 ,, ...	Rs. 2-8 ,, ...	1,640 ...	1·33 *seers per bigha*	Rs. 100 to Rs. 250 per maund.	Rs. 2 per bigha.	
Birbhúm	15,000 ,, ...	.....	About 500 ,, ...	1·33 *seers* ,,	Rs. 200 per maund in Calcutta market.		
Midnapur	30,000 acres ...	.....	1,300 ,, ...	1·73 *seers per acre, or* ·58 *seers per bigha.*	Rs. 200 per maund ,,		
Húglí	1,500 bighas	Rs. 3-2 per bigha ...	188 ,, ...	40 to 50 bundles per bigha at 8 to 10 bundles per rupee. 5 *seers per bigha.*	Rs. 125 to Rs. 290 a maund	.....	The Collector of Húglí remarks:—"The rent payable for each bigha of indigo land varies from Rs. 2-8 to Rs. 3, so that the profit to the cultivator, exclusive of the wages of labour, is *nil*; but the cultivation of indigo, like clover cultivation in England, replenishes the lost powers of the soil, and the ryots have ample time to grow a second crop on the same land."
Presidency Division.							
Jessor	103,222 ,, ...	Rs. 7 or Rs. 8 per bigha	4,500 ,, ...	1·74 *seers per bigha*	Rs. 240 per maund ...	Rs. 5 or Rs. 6 per bigha.	
Nadiyá	190,000* ,, ...	Rs. 5 to Rs. 7 ,,	7,740 ,, ...	1·63 *seers per bigha*	Rs. 150 to Rs. 350 per maund.	Frequently the bare outlay is not returned, while in other years the profit may reach 50 or 60 per cent.	
Murshidábád	130,000 ,, ...	Rs. 5 per bigha ...	5,000 ,, ...	1·54 *seers per bigha*	.....	50 per cent = Rs. 2-8 per bigha.	
24-Parganás	5,850 ,, ...	Rs. 5 per bigha, including ground-rent.	200 maunds in 1875 (?)	1·36 *seers per bigha*	Rs. 100 to Rs. 350 per maund.	The ryot is barely remunerated for his labour.	

* *See* foot-note, p. 94.

Districts.	Approximate area under cultivation.	Estimated cost of cultivation per bigha, or per acre, or per maund.	Average annual yield for the five years preceding 1876.	Yield per bigha or per acre.	Average price of dye.	Profit per bigha, or per acre, or per maund.	Remarks.
Rajshahi and Kuch Behar Division.							
Rájsháhi	42,000 bighas	For 1 maund of indigo:— Rs. 2½ maunds of seed 15; Rent for 20 bighas 21; Cost of preparing land and dressing crop ... ... 40; Cost of manufacture ... ... 20; Establishment, &c., about ... ... 29; Total ... 125	2,000 maunds ...	12 bundles or about 2 seers per bigha, or 1 maund in 20 bighas. 1·9 *seers per bigha.*	Rs. 200 to Rs. 250 per maund in Calcutta.	About Rs. 125 per maund in good seasons.	
Rangpur	13,000 acres ...	Rs. 150 to Rs. 175 per maund.	2,500 ,, ...	7·69 *seers per acre*= 2·56 *seers per bigha*	Rs. 200 to Rs. 225 per maund.	About Rs. 50 per maund.	
Maldah	55,000 bighas	Rs. 105 per maund ...	2,000 ,, ...	20 maunds per bigha. (!) 1·45 *maunds per bigha.*	Rs. 210 per maund ...	100 per cent.	
Dacca Division.							
Faridpur	4,500 ,, ...	Rs. 4 per bigha ...	200 ,, ...	About 2 seers per bigha, valued at Rs. 6. 1½ *seers per bigha*	Rs. 3 per seer ...	Rs. 2 per bigha.	
	(10,500 ,, ...	Rs. 4 ...	1,300 ,, ...	Rs. 6 per bigha ...	Rs. 200 per maund ...	Rs. 2 ,,)	

CHITTAGONG DIVISION.							
Chittagong Hill Tracts	.....	.....	500 ,, ...	.....	.....	.....	
Chittagong—							
Patiá	45 acres ...	Rs. 50 per acre ...	60 ,, ...	1 *maund* 7 *seers per acre.*	Rs. 3 per seer ...	In Patiá, Rs. 25 per acre.	
Teknáf	6 ,, ...	Rs. 17 ,, ...				In Teknáf, Rs 5 per acre.	
PATNA DIVISION.							
Champáran	60,000 ,, ...	Rs. 30 ,, ...	12,000 ...	8 *seers per acre*...	Rs. 200 per maund ... (Rs. 250 per maund previously.)	Rs. 6 per acre.	
Gayá	781 , ...	About Rs. 10-8 per acre.	200 ,, ...	10·24 *seers per acre*	Rs. 240 per maund ...	Rs. 2-8 per acre.	
		(Rs. 16 per acre ...	.....	.....	Rs. 78 ,, ...	Rs. 4 ,,)	
Patná	1,875 ,, ...	Rs. 10-10 per acre ...	200 ,, ...	4·27 *seers per acre*	.....	.....	
Sáran	50,740 ,, ...	Rs. 29-13 per acre ...	10,148 ,, ...	8 *seers per acre*...	Rs. 200 per maund... ...	Rs. 31 per acre.	
	(50,000 ,, ...	,, 7 ,, ...	10,000 ,, ...	.....	,, 250 ,, ...	,, 40 ,,)	
Shahábád	9,320 ,, ...	,, 23-14 ,, ...	4,140 ,, ...	17·77 *seers per acre*	Rs. 152 to Rs. 274 per maund.	.....	"The accounts for the whole district of Shahábád show a loss (1875) of Rs. 10,000."
	(11,000 ,, ...	,, 27-4	7,000 ,, ...	.....	Rs. 120 per maund ...	Rs. 13-10 per acre.)	
Tirhut (Muzaffarpur)	65,000 ,, ...	,, 33-14 per acre ...	13,100 ,, ...	8·06 *seers per acre*	,, 200 ,, ...	,, 5-8 per acre.	
	(60,000 ,, ...	,, 37-8 ,, ...	15,000 ,, ...	.....	.....	,, 12-8 ,,)	
Darbhangah	50,000 ,, ...	,, 30 ,, ...	12,500 ,, ...	10 *seers per acre*...	Rs. 200 per maund... ...	,, 20 ,,	
.....	.....	(,, 30 ,, ...	8,500 ,, ...	.....	,, 250 ,, ...	,, 15 ,,)	

Districts.	Approximate area under cultivation.	Estimated cost of cultivation per bigha, or per acre, or per maund.	Average annual yield for the five years preceding 1876.	Yield per bigha or per acre.	Average price of dye.	Profit per bigha, or per acre, or per maund.	Remarks.
Bhagalpur Division.							
Bhágalpur	.....	Rs. 6-14 to Rs. 10 per acre.	2,500 maunds from European factories only.	12 to 20 acres required for a maund of dye. 84 *seers per bigha*	.....	.....	
Monghyr	15,000 acres ...	.....	About 3,500 to 4,000 maunds.	3½ *seers per bigha.*	Rs. 4 per seer	.....	
Purniah*	70,000 „ ...	Rs. 3 per bigha ...	In 1873 ... 7,345 Mds. „ 1874 ... 2,203 „ 1875 ... 7,750 In 3 years... 7,298 maunds in factory maunds of 74lb 10 oz.	32 bundles, or 3½ seers, valued at Rs. 20-11 per bigha.* 3·29 *seers per acre.*	Rs. 219 per factory maund	Rs. 17-11 per bigha.	
Santál Parganás ...	19,000 bighas	Rs. 3 per bigha or Rs. 150 per maund.	500 maunds ...	1·06 *seers per bigha.*	Rs. 150 to Rs. 280 per maund.	Average profit Rs. 50 per maund if the season is favourable, otherwise a total loss.	
Chutia Nagpur Division.							
Mánbhúm	3,000 acres ...	.....	150 „ ...	2 seers per acre ...	Rs. 240 to Rs. 280 per maund.	Not exceeding Rs. 9 per acre.	
Orissa Division.							
Puri	.....	.....	.....	.....	Rs. 3 per seer of 105 tolas.	.....	

* The returns from Purniah are exceptionally perplexing. The Collector arrives at the area, 70,000 acres, by taking an average of the yield for the two years 1873-74 and assuming 4 *seers per acre* as the average produce. In the next paragraph, in estimating the cost and profits *per bigha*, he says that the average yield is 32 bundles or 3½ *seers per bigha*. This cannot mean the standard bigha of ⅓rd acre; nor can it be the local bigha, which in Purniah varies from village to village, having all values from [illegible] acre up to more than 1½ acres.

We shall discuss these statistics for the different Divisions separately. INDIGO.

Bardwán Division.—The cost of cultivation is only given for the three districts Bánkurá, Bardwán, and Húglí, and ranges apparently from Rs. 2-8 to Rs. 3-2 per bigha. The profits to the cultivator are given for the same districts as Re. 1 to Re. 1-8 for Bánkurá, Rs. 2 for Bardwán, and no profit at all in Húglí. The figures given for Húglí would, however, show a profit similar to that for the other districts. Taking the outturn as 45 bundles per bigha, selling at 9 bundles a rupee, we get a total of Rs. 5 realised per bigha, which gives a profit of Re. 1-14. Except in the case of Húglí, no figures are given of the average yield per bigha; but in the table we have inserted in italics the average yield per bigha, calculated from the figures in columns 1 and 3. These are—

Bánkurá	...	...	... 1	seer per	bigha.
Bardwán	...	...	... 1·33	„	„
Bírbhúm	...	...	... 1·33	„	„
Midnapur	...	...	... ·58	„	„
Húglí	...	...	... 5	„	„

or an average of 1·85 seers per bigha.

These figures throw considerable doubt on the Midnapur and Húglí returns. Apparently indigo cultivation is about five times as productive in the Húglí district as elsewhere in the Division, whilst on the other hand we are told that the profit to the cultivator is *nil*. The price given for the dye in the 5th column is the price which the indigo from the various districts fetches in Calcutta, whither nearly the whole of it is sent. This price varies from Rs. 100 to Rs. 290 per maund, according to the season and the quality.

Presidency Division.—The cost of cultivation here varies from Rs. 5 to Rs. 8 per bigha. In this estimate the ground-rent is apparently included. The profits to the cultivator vary from nothing to Rs. 6. We are told both from 24-Parganás and Nadiyá that in some years the sum realised from the sale of the proceeds barely covers the outlay, whilst in more favourable seasons the profit may be 50 or 60 per cent on the outlay (Nadiyá). Calculating from columns 1 and 3 the average yield per bigha, we get—

Jessor	...	...	... 1·74	seers per	bigha.
Nadiyá	...	...	... 1·63	„	„
Murshidábád	...	...	... 1·54	„	„
24-Parganás	...	...	... 1·36	„	„

or an average of 1·57 seers per bigha.

This gradual fall in productiveness seems to lead to a corresponding fall in the profits in column 6. The price obtained for indigo from this Division in the Calcutta market, whither it is all sent, varies from Rs. 100 to Rs. 350 per maund.

The following passages may here be quoted from a letter from the Commissioner of the Presidency Division, dated 25th October, 1876, in answer to a request from Government that the figures in the first return should be revised:—

"*The 24-Parganás.*—The Collector of the 24-Parganás reports that in the Basírhát sub-division there is only one indigo factory, with an average area

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under cultivation of 872 bighas during the past three years, and that the average outturn during the same period was 18 maunds, or at the rate of one maund to about 48½ bighas. The outturn varied very greatly from year to year. In 1873, 1,000 bighas produced 28 maunds, while, in 1875, 778 bighas produced only 8 maunds.

"In Satkhirah an area of about 100 bighas is under indigo cultivation, producing on an average 4 maunds—an outturn sufficiently corresponding with that which Mr. Cotton regards as normal.

"In Báráset sub-division Mr. Agabeg this year has 3,800 bighas under indigo, being an increase of 1,000 bighas on last year's area. Up to June an outturn of about 250 maunds was expected, or at the rate of one maund to a little over 15 bighas. But the subsequent wind and heavy rains have greatly damaged the crop, and no more than 72 maunds are now expected, or at the rate of one maund to 53 bighas.

"The total area under indigo cultivation in the district of the 24-Parganás, as shown in the statement previously submitted, does not correspond with the area given in this letter. The figures for Basírhát show an increase of 372 bighas, and the figures for Báráset differ from those reported before; but the Collector assures me that the present figures can be relied upon as correct.

"*Nadiyá.*—The Collector of Nadiyá reports that the quantity of land under indigo cultivation is estimated as follows:—

		Bighas.
In the Kushtiá sub-division		40,000
„ Sadr „		30,000
„ Bangáon „		30,000
„ Ránághát „		13,000
„ Mehrpur „		43,430
„ Chuádángá „		47,000
Total ...		203,430

"The Collector believes that these figures are not far from the truth, and he states that they include not much guess work.

"He observes that the fact seems to be that 20 bighas of land to one maund of indigo appears to be too low an estimate as to area for this district, as the statements which he has received with regard to individual factories show results varying from about one maund to 15 bighas to one maund to 50 bighas of cultivation, and even more in exceptional cases. The average can therefore hardly be taken to be more than one maund to 30 bighas.

"The original estimate of 190,000 bighas, which has been shown in the statement previously submitted, is in the opinion of the Collector not very wrong, but he doubts if the estimate of 7,740 maunds of outturn is not rather high; but he has no means of obtaining more accurate results.

"*Jessor.*—The Collector of Jessor reports that the most reliable information as to the cultivation of indigo in Jessor is given in Baboo Ram Shunker Sen's work, which gives the area and outturn in 1872 at 1,03,223 bighas and 4,678 maunds. The article in the *Reporter* gives the outturn in 1872, 1874, and 1875 at 4,788, 5,124, and 3,650 maunds. The area under cultivation has not altered materially during the last three years. The average yield in European factories is about 2 seers 2 chittacks to a bigha, which is a little over a maund to 20 bighas, but the inferior cultivation in native factories reduces the general average.

"*Murshidábád.*—The Collector of Murshidábád reports that the estimates formerly given by Mr. Wavell as regards indigo area and outturn were made on very rough approximations, or rather broad guesses. There was a more reliable return in his office, which gives the area under indigo at 21,643 acres, or 64,929 bighas. Taking the outturn of dye at 12lb per acre, this would give 3,246 maunds of indigo for the district—a figure which tallies well with Messrs. Moran's return for 1875 (*Statistical Reporter*), wherein the outturn is stated at 3,150 maunds."

Rájsháhi Division.—In this Division the manufacturers of indigo themselves apparently rent the land, so that the cost of manufacturing the indigo from the plant is included in the returns, which are thus not immediately comparable with those from the preceding two Divisions, in which the cultivator of indigo sells the plant to the manufacturer (*vide* Hunter's Statistical Account of Bengal, vol. VIII, page 72). The cost of cultivating the plant and manufacturing the dye from it amounts to from Rs. 105 to Rs. 175 per maund of dye produced. Reducing this to bighas by means of the figures given in columns 3 and 4, we get these results:— INDIGO.

Rájsháhí	...	...	Rs. 6-4 per bigha.
Rangpur	...	...	„ 9-8 to Rs. 11-4 per bigha.
Maldah	...	...	„ 3-12 per bigha.

The profits amount to from Rs. 50 to Rs. 125 per maund of indigo produced, or—

Rájsháhí	...	...	Rs. 6-4 per bigha.
Rangpur	...	...	„ 3-4 „
Maldah	...	...	„ 3-12 „

The cost of production is thus seen to be considerably higher than in the previous two Divisions; but this includes the additional cost of manufacturing the dye from the plant, which, judging from the details from Rájsháhí, is about $\frac{1}{8}$th of the whole cost.

Calculating from columns 1 and 3 the average yield per bigha, we get—

Rájsháhí	...	...	...	1·9 seers per bigha.
Rangpur	...	...	...	2·56 „
Maldah	...	...	...	1·45 „

or an average of 1·97 seers per bigha.

The Collector of Maldah, consistently inaccurate in his returns on all dye-stuffs, states that the yield per bigha is 20 maunds. His own figures, however, would make it 1·45 seers, which is more consistent with probability and with other returns than the extraordinary yield of 20 maunds per bigha. Indigo cultivation would thus seem to be much more productive in Rangpur than in the other two districts; but if these returns are trustworthy it is much more costly, and consequently the profit is smaller. But the returns themselves are probably too loosely compiled to warrant this or any other inference. The greater productiveness in Rangpur is probably explained by the fact that in this district there are two crops from the same ground (p. 96). The price which the manufactured indigo fetches is given as from Rs. 200 to Rs. 250 per maund.

Patná Division.—The returns from the different districts in this Division exhibit the most extraordinary inconsistencies. In the first returns from the Division, which are entered in brackets below the final returns, the discrepancies were so great as to lead the Government of Bengal to request that the district officers should be called upon for fresh returns. The figures entered in the table are these revised statistics.

The cost of cultivation according to these revised statistics varies from Rs. 10-8 per acre in Gayá to Rs. 33-14 per acre in Muzaffarpur. As the bare figures alone are given, it is impossible to tell the principle the different district officers have adopted in calculating the cost of cultivation, and the great discrepancy between the cost as given for

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Patná and Gayá and that for the others may be due to the district officers having understood the words "cost of cultivation" in different senses.

The profits of cultivation vary from Rs. 2-8 per acre in Gayá to Rs. 31 per acre in Sáran. Here, again, the differences are possibly due to the methods of calculation adopted by the Collectors. In the returns from Sáran the total profit on the 50,740 acres cultivated is given at Rs. 20,29,600, which would give a profit of Rs. 40 per acre, and not Rs. 31, as stated separately.

Calculating as before the yield per acre from columns 1 and 3, we get—

Champáran	...	8	seers per acre,	or 2·67	per standard bigha.
Gayá	...	10·24	„	or 3·41	„
Patná	...	4·27	„	or 1·42	„
Sáran	...	8	„	or 2·67	„
Sháhábád	...	17·77	„	or 5·92	„
Muzaffarpur	...	8·06	„	or 2·69	„
Darbhangah	...	10	„	or 3·34	„

Taking the average we get 9·48 seers per acre, or 3·16 seers per bigha. The figures previously advanced would give—

Champáran	...	...	8	seers per acre.
Gayá	...	...	10·24	„
Patná	...	...	4·27	„
Sáran	...	...	8	„
Sháhábád	...	...	25·45	„
Muzaffarpur	...	...	10	„
Darbhangah	...	...	6·8	„

giving an average of 10·39 seers per acre, or 3·46 seers per bigha.

These figures would seem to show that indigo cultivation is about twice as productive in the Patná Division as elsewhere in Bengal. In the district of Patná itself the produce, 1·42 seers per bigha, agrees fairly well with the average of other Divisions; but for all other districts the yield is notably in excess of that elsewhere. This may possibly mean that the soil of this Division is peculiarly adapted for indigo cultivation, or else that a more careful method of cultivation is here adopted; but it is probably mainly due to the fact that in this Division there are two crops obtained from the same ground (p. 96).

The price obtained for the indigo from this Division in the Calcutta market, whither it is all exported, is given as from Rs. 152 to Rs. 274 per maund.

The following extracts from the letter of the Commissioner of the Patná Division, dated 23rd September, 1876, forwarding the revised statistics, may be here given to illustrate the difficulty of obtaining trustworthy statistics on such a question as the costs and profits of indigo manufacture:—

"The figures now furnished by the Collectors differ widely from those previously returned. According to the previous figures, the average yield of indigo per acre in Muzaffarpur and Darbhangah was 10 and 7 seers respectively, while the present returns fix the produce at 8 seers in Muzaffarpur and 10 seers in Darbhangah. This difference is the more remarkable as the soil of Muzuffarpur is infinitely superior to that of Darbhangah.

"The Collectors of Patná and Sháhábád have furnished no figures to show how the calculation is based; but it is clear that there has been a misunderstanding as to how the average profit per acre should be calculated. The difference is probably due to the method of calculation adopted by the Collectors.

"Mr. Worsley (Muzaffarpur) has taken into account not only all the charges incidental to cultivation and manufacture, but also the interest on the outlay

borrowed. The Champáran and Gayá figures are evidently based on the same principle. The estimate for Darbhangah includes only the charges of cultivation and manufacture, but not the interest, and Sáran has excluded all items of expenditure. But notwithstanding this explanation the estimates differ widely.

"In submitting a reply to the Government resolution I would ask—

"Are the figures to include all expenditure? Factories, in estimating their expenditure, include everything,—rent, salaries of managers, interest on block, interest on outlay, &c.—or simply the cost of ordinary cultivation?

"The information required would appear to include all expenditure. If so, it is difficult to give the information accurately, as some factories are carried on with borrowed, some with private, capital. Some factories pay heavy premiums on leases, and the loss on realisations of rent is carried against the profits. Some factories have their own milkiyuts, *i.e.*, landed property, and pay no rent for zerat cultivation, nor do they include any rent account in calculating their profits.

"The bigha of indigo varies: there is the bigha of 1,471 square yards, 7,225 square yards, and 6,400 square yards. Taking the 6½ hâth luggee as the measure for the ordinary size of the indigo bigha, and including all expenses, the average cost of cultivation may be put down at Rs. 30 per bigha, and the produce at 5 seers per bigha. This reduced to acreage would give Rs. 34-6 as the cost per acre of 4,840 square yards, and the produce at 9½ seers per acre.

"The seasons differ so, and the circumstances of soil, rainfall, blight, destruction by inundation so vary, that even here there is an uncertainty in calculating the produce, which, in ordinary seasons, or from ordinary land, varies from 5 to 8 seers per bigha; 5 in the northern and 8 in the southern factories.

"With regard to the price of indigo, all the districts in North Behar have valued it at about Rs. 200 a maund. Some factories sell better than others. In favourable years indigo has sold for over Rs. 300 a maund, but a safe calculation is to place it at Rs. 200, for washings and bachra indigo help to lower the average. It is said that planters of late years are disinclined to give written information on many points connected with their manufacture, and it is difficult to get at the figures of outturn."

Bhágalpur Division.—The cost of cultivation is given here as from Rs. 3 to Rs. 10 per bigha. The profits are given for two districts only,—Rs. 16-11 per bigha in Purniah, and Rs. 50 per maund in the Santal Parganás in favourable seasons. The returns from the Santál Parganás are obviously inaccurate. In the second column the cost of cultivation is put down as "Rs. 3 per bigha or Rs. 150 per maund," which would make the produce of 50 bighas equal to a maund. Columns 1 and 3, however, give the produce of 38 bighas as a maund. The profit, given as Rs. 50 per maund, would therefore be either Re. 1 per bigha or Re. 1-5 per bigha, according as we take the former or latter of these estimates. The yield per bigha calculated from columns 1 and 3, or stated in the return, is as follows:—

Bhágalpur	...	...	...	·84	seers per bigha.
Monghyr	...	...	...	3·33	„ „
Purniah	...	...	...	1·09	„ „
Santál Parganás	...	...	...	1·06	„ „

or an average of 1·58 seers per bigha.

It will thus be seen that in Monghyr the yield per bigha is very nearly the same as the average for the Patná Division, which, as shown above, is twice as great as the average for other Divisions of Bengal; and here again this is probably due to the fact that there are two or more crops obtained from the same ground (p. 96). The yield in Bhágalpur is considerably less than the average.

The price obtained for the indigo from this Division seems to vary from Rs. 160 to Rs. 280 per maund.

Dacca Division.—In this the only returns are from the Faridpur district. The cost is given as Rs. 4 per bigha, the profit Rs. 2 per bigha. The average outturn of dye calculated from columns 1 and 3

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Chutia Nágpur Division.—Here the only returns are from Mánbhúm. The profit is said not to exceed Rs. 9 per acre, and to be in favourable seasons 50 per cent on the outturn, which would make the cost of cultivation also about Rs. 9 per acre. The yield would seem to be about 2 seers per acre, or ⅔ seers per bigha: the price obtained from Rs. 240 to Rs. 260 per maund.

Chittagong Division.—In the two sub-divisions of Patiá and Teknáf the cost of production is given as Rs. 50 per acre and Rs. 17 per acre respectively; the profit in the former case is Rs. 25, in the latter Rs. 5, per acre. The discrepancy may be due to the fact that in Patiá indigo is cultivated in the plains after thorough ploughing; in Teknáf on the hills with possibly much less care, so as to cost less, but bring in consequently a less return. The yield would seem to be about 1 maund 7 seers per acre, or about 16 seers per bigha. This is so much in excess of what is the case elsewhere as to throw discredit on the figures.

This indigo is apparently all sold locally at Rs. 3 per seer, or Rs. 120 per maund.

That these figures are inaccurate is easily seen thus. From the figures given in columns 1, 2, 5, and 6 we can easily calculate what must be the total produce of the two districts to make them consistent. It will be found that the produce of Patiá must be about 28 maunds 5 seers only, and of Teknáf 1 maund 4 seers, or a total produce of 29 maunds 9 seers. But the produce is given as 60 maunds.

Orissa Division.—The only figure given here is the price of locally manufactured indigo in Puri, viz. Rs. 3 per seer of 105 tolas, which will give about Rs. 91 per maund.

European capital employed. As to the question of European capital employed in the indigo manufacture, the following table gives the figures forwarded by the Collectors on this head, together with the number of European and native factories at the time when these statistics were collected. This table is of course incomplete, merely containing the figures available :—

Districts.	European capital invested.	Number of Factories.	
		European.	Native.
Bardwán Division—			
Bánkurá	About Rs. 75,000	.....	.....
Bardwán	About ½ of the whole	.....	.....
Birbhúm	About Rs. 60,000	1	.....
Midnapur	About Rs. 80,000	.....	.....
Presidency Division—			
Jessor	Nearly 85 per cent of the quantity produced in this district is the property of European planters.	.....	.....
Nadiyá	About Rs. 14,45,000	.....	.....
24-Parganás	About Rs. 70,000 by Mr. Agabeg and Rs. 1,300 by Mr. Drummond.	.....	.....

Districts.	European capital invested.	Number of Factories.	
		European.	Native.
Rájsháhí and Kuch Behar Division—			
Rájsháhí...	.....	14*	1
Patná Division†—			
Champáran	.....	12	.....
Gayá	.....	2	2
Patná	.....	1	2
Sáran	.....	33	36
Muzaffarpur	.....	19	9
Darbhangah	.....	15	.....
Bhágalpur Division—			
Bhágalpur‡	About Rs. 3,30,000	15	6
Monghyr	,, 5,00,000	10	7
Purniah	Probably £100,000	34 (with 31 out-works).	3
Santál Parganás	About Rs. 1,30,000	.....	.....
Chutiá Nágpur Division—			
Mánbhúm	About Rs. 30,000	.....	.....

* In the Administration Report of the Rájsháhí Division for 1878-79 it is stated that the number of factories was then nine, six being European and three native.

† For the Patná Division the figures are exclusive of out-works.

‡ The Collector of Bhágalpur gives the following detailed statement regarding the indigo concerns in his district:—

	Name of concern.	Average cultivation in acres.	Average outlay.	Average outturn in	Remarks.	
			Rs.	Mds.		
Soopool.	Bhaptiahe ...	118	1,220	17		
	Rajpore ...	2,488	10,000	40		
	Peepra ...	1,341	5,500	40		
	Murwalla ...	287	2,500	25	Native.	
	Enamputti ...	709	8,000	60	.....	Out-factory at Sunrábí.
	Bongong ...	6,370	44,600	280	.....	Out-factories at Baijnáthpur and Sour.
	Bhuttaneah ...	4,875	16,000	120	.....	Out-factory at Chándipur.
	Dulgaon ...	3,716	11,000	120	Native.	
	Bissenpore ...					
	Lutchmeepore	850	8,000	2,000	Seed only	Out-factories at Thesseah, new Kutta Hoolas.
Mudhpoora.	Patterghat ...	625	10,000	120	.....	Out-factory at Bellari.
	Singhessur ...	350	18,000	180		
	Toolsia ...	2,875	1,00,000	650		
	Lohur ...	1,437	12,000	100		
	Sohonia ...	1,250	.....	40	Native ...	Out-factory at Sonebursa. No regular outlay. Ryots cultivate as ordered, getting certain deductions in rent.
	Gungledey ...	2,275	1,20,000	600	.....	Out-factories at Pirpointi, Sahebgunge, Ekdarra, Pealapur, Azmah, Miranpur,§ Bhowánipur,§ and Náthpur.§
	Barari ...	6,486	52,000	245	Native ...	Out-factories at Coigong, Ghaga, Agerpur, and Patti Belwar.
	Khungerpore...	2,625	34,200	179	.....	Out-factories at Azimnagar, Tárápur, Dumráon, and Mahtah.
	Luteepore ...	6,056	81,201	529	.....	Out-factories at Charun, Nárainpur (now head-quarters), Choisah, Nurduh, and Kashnagar.
	Sooltangunge...	500	10,000	75	Native ...	Bariárpur, Surbela, and Muskepur.
	Ghogah ...	A hundred acres or so, on the decline; a few maunds only manufactured at a small expense.			Native ...	Out-factory at Patterghát.

Those marked § were closed this year (1876).

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The difficulty of obtaining satisfactory information under these heads, and the degree of reliance to be placed on these figures, may be gathered from the following extracts from the letters of Collectors:—

"As regards the extent to which European capital is employed in the production and manufacture of indigo, I addressed all the European planters on this subject; but I regret to say, with two exceptions, no notice has been taken of my letters. From the two replies received, and taking the average outturn of indigo from European factories in the district as 2,500 maunds, which I believe to be a very approximate average, I calculate that Rs. 2,50,000 are expended in its production and Rs. 80,000 in its manufacture, making a total of Rs. 3,30,000." (Bhágalpur, 1875.)

"It is difficult to state what amount of European capital is employed in this industry: probably £100,000 is annually employed by the various factories, but there are no figures showing what capital is invested in buildings, machinery, and zemindaries. There are 34 head factories with 31 out-works, of which only three are owned and managed by natives. It is probable, however, that many factories are largely mortgaged and worked on money advanced by native bankers and others, but on this point no accurate figures exist. Natives have of late taken to this mode of investment." (Purniah, 1876.)

"There is only one small factory, Baniádih, situated at parganá Jupla, the property of Mr. James Mylne of Baniádih, that is now working; and though I believe Mr. Mylne, who is laying out capital in extending his estate in that parganá, and in creating extensive irrigation works both for the benefit of his own estate and the surrounding country, hopes eventually to raise his produce to 300 maunds, he does not now get more than 30 maunds at the outside, and probably the capital actually employed in producing that amount is not more than Rs. 3,000 at the outside. In fact, I am told that the indigo stands him Rs. 90 per maund." (Palámau, 1875.)

"As regards the fixed capital, or that which is sunk in buildings, landed property (milkiyut), zurpeshgi leases, and quasi-permanent loans, the proportions may perhaps be five-sixths the European and one-sixth the native. The native factories are for the most part small, and inferior in all respects to European factories.

"The circulating capital, or that which is actually expended in the annual production of indigo, is ordinarily advanced year by year by Calcutta agents at interest of 18 per cent. As a rule the value of a factory is determined by (*a*) its average outturn of indigo, (*b*) its extent of milkiyut, (*c*) its amount of money invested in zurpeshgi leases and loans, and (*d*) its liabilities. Irrespectively of items (*b*), (*c*), and (*d*), which are of course subject to variation, the broad rule is that the value of a factory is calculated at Rs. 20,000 per each 100 maunds of its average annual produce, *e.g.*, if the average outturn of a factory be 1,000 maunds, the price of the factory will be Rs. 20,000 × 10 = Rs. 2,00,000. Assuming, therefore, that the average outturn of indigo in this district is 13,100 maunds annually, the value of fixed capital quoad (*a*) will be Rs. 26,20,000. I have no sufficient data for valuing (*b*), (*c*), and (*d*), but I believe that Mr. Studd is the only planter who can afford to give loans on a very large scale. In one of his factories (Serayah) it is currently reported that there are 6 lakhs of rupees outstanding as loans, If, however, a rough conjecture may be of any use, I should not put the total amount of fixed capital invested in indigo higher than 50 lakhs.

"Taking the annual outlay at Rs. 30 per bigha, the total amount of circulating capital will be 22½ lakhs. The aggregate quantity therefore of both kinds of capital invested in indigo will be 72½ lakhs." (Muzaffarpur, 1876.)

"On the question of the extent to which European or native capital is interested in working these factories, no precise answer can be furnished.

"It is scarcely possible for Government to get precise information on the point. It could only be furnished by the indigo-planters, by their Calcutta agents and brokers, and to some extent by local native bankers. None of these willingly supply definite information on the point. This being the case, the matter becomes one of conjecture. I should say, however, that the total annual outlay, including interest on money invested in plant, &c., is about Rs. 15,00,000 in this district. A large proportion of this money is supplied by native bankers; but what proportion the sum so supplied bears to the total, or to the amount of European capital invested, it is not possible for me to state with precision.

"As far, however, as I, on the small quantity of reliable information I possess on the subject, can form an opinion, I believe that European capital does not supply so much of the annual outlay on indigo factories as popular European belief on the subject would lead one to suppose. I have a strong suspicion that if we knew the amounts annually advanced to indigo-planters by native bankers, we should be surprised how largely the industry rests on native capital." (Darbhangah, 1876.)

"My own calculation is that the annual outturn of the Patná Division is 40,000 maunds, which, at Rs. 200 per maund, represents the value of Rs. 80,00,000. This is the produce of 174,587 acres. The actual cost of outturn is then Rs. 60,00,000 (bearing a profit of Rs. 20,00,000). Annually three-quarters to a million sterling is employed in this industry in the four districts of Champáran, Muzaffarpur, Darbhangah, and Sáran. Of this amount such concerns as those of Messrs. Moran & Co., Messrs. Hill & Co., Messrs. Finch and Studd, the Agra Bank, and Messrs. Baring Brothers, work with English capital.

"The second class concerns work with native capital. The third class work on the pernicious system of wholly carrying on their concerns with the rents they realise from the tenants. I should hazard the opinion that native capital bears the proportion of one-third to two-thirds European. The Chuprah factories are almost wholly carried on by native capital." (Commissioner, Patna Division, 1876.)

Messrs. W. Moran & Co. have kindly supplied the following list of all European factories in Bengal (including Benares and the Doab) at the time of issuing this Report (1883). The figures annexed are the outturns of each factory in factory maunds during the crop season 1881-82. The list includes, in addition to European factories, such native factories as are known and have known marks: these are marked (N). The districts named are indigo districts, which are not altogether the same as the geographical districts of the same name.

List of European Indigo Factories and of Native Factories of known marks in Lower Bengal, Behar, Benares, and the Doab.

LOWER BENGAL.

	Mds.
Jessore, 13—	
Hazrapore	609
Joradah	545
Muddenderry	85
Nohatta	394
Chowlia	209
Sindooree	492
Bizoolee	154
Goldar	166
Caragoda	100
Shapore	22
Baboocolly	81
Beneepore (N)	27
Nyssindpore (N)	41
Kishnaghur, 14—	
Katcheekatta	105
Katlee	182
Moisgunge	352
Neechindipore	287
Ramnaghur	143
Shikarpore	473
Sonadah (N)	55
Narainpore (N)	46
Notipatta (N)	96
Dogatchee (N)	32
Doleemallow (N)	102
Simultolla (N)	51
Sreeharrygunge (N)	177
Buggoolah (N)	67
Midnapore, 4—	
Bogree	371
Bahadurpore	137

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	Mds.
Junglimahal	352
Sildah	248
Bardwán, 3—	
Bancoora	167
Cossipore (N)	100
Kissenpore (N)	57
Maldah, 1—	
Muttrapore	352
Moorshedabad, 12—	
Akrigunge	494
Boromasia	57
Cantacobra	278
Furridpore	164
Cuddamsaur	25
Doudpore (N)	58
Bogwanpore (N)	57
Aurungabad (N)	110
Sabdulpore (N)	191
Patkabarry	877
Rampoora	17
Turtipore	249
Rajshahye and Pubna, 7—	
Rajahpore	434
Manjeepara	32
Syllidah (N)	141
Luckee Coondee (N)	23
Damoodeea (N)	40
Mozumpore	99
Bur Furridpore	6
Bhagulpore, 16—	
Burraree (N)	304
Colgong	418
Kunjunpore	130
Lutteepore	293
Sugrampore	251
Fyzallygunge (N)	210
Kurbeenah	13
Putterghat	47
Gogah	66
Selimpore	65
Bowsee	94
Rajpore	40
Singhessur	71
Sultangunge (N)	50
Agurpore	34
Gobagurrah	6
Purneah, 20—	
Bowgong	80
Gondwarrah	1,220
Kolassee	364
Munshye	418
Mynanugger	312
Inampore	42
Juggernathpore...	147
Delowree (N)	40
Sahrah, &c.	242
Gocoolnugger	57
Kajah	147
Kagaha	108
Sursee	74
Patilwa	16
Neolgunge	85
Peergunge	48
Forbesabad	68
Symree	19
Latowna	19
Mathore	54

BEHAR.

	Mds.
Monghyr, 5—	
Bogwanpore	802
Munjoul	2,241
Begoo Serai	185
Bassownee	4
Kujrah (N)	50
Tirhoot, 57—	
Anarh	108
Amooah, &c.	279
Belsund	805
Rajkund	205
Begum{Serai	341
Burgong	113
Bungaon	204
Bhicanpore	822
Japaha	377
Battowlea	219
Rewarree	121
Bhukrowly (N)	20
Nowadah (N)	57
Contai	838
Ragai	594
Mooteepore	1,046
Chupraon	128
Chitwarrah	683
Dooriah	963
Kurnoul	1,024
Doolhye	950
Surryah	950
Dowlutpore	1,243
Keonta	1,379
Doudpore	790
Dhurrumpore	287
Doomrah	150
Hattowree	500
Bughownie	87
Hattee Oostee	200
Hursingpur	1,119
Jeetwarpore	1,406
Jaintpore	1,164
Khan Mirzapore	299
Kumtoul	275
Kurhurree	255
Khopee	74
Tewarrah	210
Mohwal (N)	192
Nurarh	119
Ottur	831
Husnah	108
Joynugger (N)	58
Pundoul	1,268
Poopree	419
Purreree	182
Paharpore (N)	201
Peruckpore	272
Shahpore	438
Shahpore Oondee	967
Singeeah	407
Sewdaspur	43
Sydpore Roonee	290
Aberampore (N)	90
Hossainpore (N)	97
Captaingunge	291
Thurmah	242
Chumparun, 10—	
Barrah, &c.	6,674
Mooteehary, &c.	2,534
Lall Serryah	1,608

	Mds.
Lowurreah	179
Moorlah	1,116
Pursah	692
Peepra	1,543
Raugepore	1,394
Tatareah	755
Rai Burwah	251
Chuprah, 35 —	
Arroah, &c.	1,533
Balla	78
Suffiabad	127
Bansghat	340
Bhamoo	120
Burhowlea	352
Burhoga	1,159
Gaighat (N)	31
Gopalapore	217
Ghurkha (N)	67
Hurpore (N)	258
Hurpore Nurhum (N)	49
Jogahpore, &c.	644
Jatepore	255
Karingah (N)	163
Mahomedpore (N)	268
Nowadah	231
Nugwah	201
Oorma	108
Pertabpore, &c.	1,634
Rajahputty	410
Ramcolla	635
Rampore, &c.	355
Ramghur (N)	12
Seetulpore (N)	210
Suddowah	1,577
Zamanpore (N)	18
Hadjeepore (N)	29
Chitowlee (N)	23
Husrajpore (N)	73
Kehunia	123
Munrowlee (N)	20
Mohurrumpore	135
Sreenuggur (N)	80
Hotta (N)	11

BENARES PROVINCES.

	Mds.
Patna, Shahabad, &c., 13—	
Bulleah	127
Bulleah, F & A	65
Guhmur	109
Bhojepore	19
Shapore	133
Chynepore	51
Mussye	43
Jugdispore	243
Dheree	186
Tillaree	153
Busdewah	10
Barownda	29
Ghazeepore, &c., 10—	
Bugiedand	101
Kookreepore	96
Mahawa	57
Kuthout (N)	181
Passeepore (N)	61
Shamsabad	40
Kajha	24
Patkowly	56
Maharajgunge (N)	49
Kainwar	21
Gorruckpore, 7—	
Bubnowly	1,452
Belwar	159
Beoree	78
Lehra	304
Netour	260
Rajdhani (N)	11
Ramghur	8
Benares, 3—	
Beylah	302
Camareah	600
Cutchooa	134
Juanpore, 10—	
Ahmedpore	81
Bowalpore	257
Colinjurah (N)	270
Noorpore	61
Pussewah	541
Deochandpore	80
Rampore	92
Bubcha (N)	54
Buckrabad (N)	61
Buttowrah	25
Allahabad, 3—	
Allumchund (N)	524
Koorsund	52
Behar	420

DOAB, 15.

	Mds.
Bellah	860
Bholee	1,021
Bilsee	676
Cosma	838
Hatrass	25
Mewnah	519
Futtehgurh	279
Oudhurunpur	66
Mypalpore	17
Mussooree	514
Oomerghur	151
Rahr	445
Awa	562
Churcher's	75
Khoodna	50

Messrs. W. Moran & Co. add:—"There are a large number of small native factories in Lower Bengal, more particularly in Jessor, Nuddea, and Rungpore, of which we do not keep any records. In the Benares Division there are also many, more especially in Azimghur and Juanpore. The greater portion of the cultivation in the Doab is entirely native. The following figures for last year's (1881-82) outturn show pretty well the proportion of European to native-made

INDIGO.

indigo. In European we include all the factories owned or worked by natives which are marked (N) in the preceding list, and in the native outturn we include only such native lots as we keep no record of yearly :—

	Mds.
Lower Bengal—	
European	16,000
Native	2,000
Behar—	
European	59,000
Benares—	
European	8,000
Native	6,000
Doab—	
European	6,000
Native	53,000 "

State of the indigo industry.

The information supplied as to whether indigo cultivation was declining or increasing at the time referred to (1876) is very scanty, and not of any very definite value. In Behar it is reported that " the cultivation of indigo has largely increased of late years in Tirhut ; " in Champáran " the cultivation of indigo is increasing, but not very rapidly ; " in Gayá " it is rather on the decrease, as many factories have found it a losing speculation ; " in Sáran " it had increased rapidly until latterly, when bad seasons have caused a decrease ; " in Darbhangah " less cultivation than formerly : the northern factories have failed, and Anár, Hathowri, Nowadah, and Motipur factories have less cultivation than formerly." A further report from Sáran, dated 20th September, 1876, however, says " the cultivation of indigo seems to be on the increase (though the profits returned seem to be smaller), as appears from the subjoined statement :—

Year.	Principal concerns.	Out-works.	Total.
1860	17	8	25
1865	26	12	38
1873	30	25	55
1876	52	17	69

So that at this time the cultivation of indigo was on the increase in Muzaffarpur, Champáran, Sáran, and on the decrease in Gayá and Darbhangah. In the Bhágalpur Division the Collector of Monghyr reports that " it is decreasing, though not to any noticeable extent, and the native factories are not on the increase " (1877). These vague statements, if they mean anything at all, can only mean that indigo cultivation was in a stationary condition, on the whole, in Behar, showing no marked tendency either to increase or decrease. The only other Division from which information has been received on this subject is Dacca. The Collector of Farídpur reports (1877) that " there is not now cultivated more than a fiftieth part of the land sown with indigo fifteen years ago, when the district was dotted with factories and the Europeans and natives vied with each other in carrying on the speculation. The crop is unpopular, and said to be less paying to the

ryot than ordinary grain or other food-crops. European capital has within the last few years almost ceased to be employed in the cultivation of indigo." The Collector of Bákarganj also reports that "indigo was formerly cultivated in Bákarganj on a small scale, but the cultivation has now ceased." In this Division, then, it is clear that the cultivation of indigo has declined very considerably. From the Bardwán Division the Collector of Húglí reports (1876) that "at one time the whole district was studded with indigo factories, the property of Europeans. All these factories have now changed hands, and no European capital is now employed in this manufacture in the district. The majority of the factories have been closed, and stand as relics of a former age. Only a few factories are now worked by natives by way of experiment." In the Rájsháhí Division the Collector of Rangpur reports (1876):—"There were two European factories here, one at Borobári and the other at Kisorganj. They have both been sold to two native zemindars, and are now in a dilapidated condition, and not properly worked for want of funds. There are at present no European indigo factories in the district." These statements would seem to point to a general decline in indigo manufacture, which at the time of compiling these figures had not affected Behar. INDIGO.

The following table, compiled from Messrs. W. Moran & Co.'s annual circulars, gives the total outturn of indigo from the various districts of Bengal and the North-West Provinces from 1873-74 to 1880-81, and the estimate for 1881-82.

		1873-74.	1874-75.	1875-76.	1876-77.	1877-78.	1878-79.	1879-80.	1880-81.	Estimate, 1881-82.
		Mds.	Mds.	Mds.	Mds.	Mds.	Mds.	Mds.	Mds.	Mds.
DACCA DIVISION ...	Dacca, Faridpur, &c.	270	.....	.....	.....	.....	.....	.....	.....	.....
	Faridpur	.....	313	342	.....	.....	.....	.....	.....	.....
PRESIDENCY „ ...	Jessor	5,124	3,407	3,056	3,177	4,243	2,065	3,823	2,812	2,820
	Nadiyá	5,171	3,740	3,933	3,077	2,273	2,540	3,076	2,343	2,100
	Murshidábád	3,003	3,286	3,522	4,000	2,000	2,550	4,785	2,695	2,600
BARDWAN „ ...	Bardwán and Bánkurá	1,513	.....	.....	.....	.....	.....	.....	.....	.....
	Bardwán	.....	1,020	542	1,019	532	357	483	134	170
	Midnapur	1,430	1,437	1,342	887	681	1,438	972	819	1,050
RAJSHAHI „ ...	Maldah and Pábná	774	.....	.....	.....	.....	.....	.....	.....	.....
	Maldah	.....	1,228	1,117	889	330	133	468	469	300
	Rájsháhi and Bográ	1,899	.....	.....	.....	.....	.....	.....	.....	.....
	Rájsháhi and Pábná	.....	1,360	985	1,429	441	890	1,259	753	600
BHAGALPUR „ ...	Purniah	2,203	7,190	2,915	5,004	2,700	2,312	3,820	3,924	3,760
	Bhágalpur	2,537	3,510	2,497	3,494	1,908	1,333	3,470	2,319	1,900
	Monghyr	721	.....	.....	.....	.....	.....	.....	.....	.....
	Rangpur and Native	5,214	4,069	3,057	3,326	1,394	917	1,834	1,237	1,000
	Total from Lower Bengal ...	29,859	30,560	23,308	26,302	16,502	14,535	23,490	17,425	16,300
BEHAR	Tirhut	7,930	.....	.....	37,020	15,591	14,280	29,245	27,987	26,500
	Tirhut and Monghyr	.....	35,898	19,775	.....	.....	.....	.....	.....	.....
	Monghyr	.....	.....	.....	4,162	1,082	1,940	3,910	3,203	3,200
	Champáran	7,158	18,338	12,571	21,576	9,959	7,544	19,685	14,492	11,800
	Chapra (Sáran)	3,312	14,530	9,664	19,493	8,225	4,623	13,550	12,380	16,200
	Total from Behar ...	18,400	68,766	42,010	82,251	34,857	28,387	66,390	58,062	57,700
	Total from Lower Bengal and Behar ...	48,259	99,326	65,318	1,08,553	51,359	42,922	89,880	75,487	74,000
N.-W. PROVINCES ...	Benáres ... ... European ...	10,604	7,343	9,911	7,103	9,390	5,406	6,534	7,427	8,000
	Benáres ... ... Native ...				5,288	8,166	3,290	4,296	7,057	7,000
	Doab ... ... European ...	20,414	21,133	27,631	5,473	6,461	2,725	5,390	5,895	7,000
	Doab ... ... Native ...				28,732	37,825	18,785	30,100	39,539	47,000
	Total N.-W. Provinces ...	31,018	28,476	37,542	46,596	61,842	30,206	46,320	59,918	69,000
	GRAND TOTAL ...	79,277	1,27,802	1,02,860	1,55,149	1,13,201	73,128	1,36,200	1,35,405	1,43,000

In this table all native-made indigo, from whatever part of Bengal, is classed with that from Rangpur, as the whole of the indigo from Rangpur is of native manufacture. Under the heading "Benáres," indigo from Patná, Sháhábad, Arrah, Ghazipur, and Azimgurh is included. It will be noticed, too, that Monghyr, although in the Bhágalpur Division, is classed with Tirhut, as the Monghyr factories are mostly under the management of Tirhut planters, and the indigo has the Tirhut marks. INDIGO.

Making use of this table to supplement the statistics from which the above inferences were drawn, we see that indigo cultivation is apparently now quite extinct in the Dacca Division. In the Presidency Division there has been a gradual decline; still more so in the Bardwán Division, the outturn being now only about half of the yield ten years ago. This decline is, however, confined to the Bardwán and Bánkurá districts, the yield from Midnapur having remained fairly constant. In the Rájsháhí Division also there has been a steady falling off in the yield: the indigo industry has apparently almost died out in Pábná and Bográ, whilst it has declined considerably in Rájsháhí, Maldah, and Rangpur. In Behar, however (*i.e.*, Bhágalpur and Patná Divisions), there has been a very large increase in the yield of indigo, more especially in Tirhut and the districts north of the Ganges. The yield from the North-West Provinces has also rapidly increased, owing mainly to the great extension of irrigation works in the Doab, which has given an immense stimulus to the native indigo industry. The tremendous yield of indigo in 1876-77, the greatest on record, was mainly due to the great yield from Behar.

The following tables give particulars of the exports and imports of indigo from India during the years from 1875-76 to 1881-82. Previously to 5th August, 1875, indigo was subject on export to a duty of Rs. 3 per maund: from that date the duty became Rs. 3 per maund on manufactured indigo and Rs. 3 per ton on indigo leaves, green or dry: from the 25th February, 1880, the duty was altogether removed. Imported indigo was subject to a duty of 7½ per cent up to 5th August, 1875, afterwards lowered to 5 per cent, and altogether removed on 9th March, 1882.

Exports.

Exports of Indigo.

Year.	India.		Bengal.		Bombay.		Sindh.		Madras.		Countries to which exported.	Quantity.	Value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.			
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.		Cwt.	Rs.
1875-76 ...	110,392	2,87,50,625	84,228	2,35,25,774	2,066	3,42,038	1,541	1,96,178	22,557	46,87,635	United Kingdom ...	72,494	1,83,32,652
											Austria	6,411	20,05,784
											France	16,970	51,30,189
											Italy	1,118	3,29,330
											Malta	128	37,772
											Russia	1,016	3,37,959
											Egypt	577	1,68,471
											United States	4,089	9,14,414
											Arabia	198	23,093
											China—Hong-Kong ...	5	1,426
											Mekran and Sonmiáni	34	2,866
											Persia	3,981	7,23,829
											Turkey in Asia... ...	3,364	8,51,395
											Other countries ...	7	1,445
1876-77 ...	100,384	2,96,27,355	69,379	2,35,66,023	2,102	3,22,628	1,034	1,38,810	27,869	56,00,394	United Kingdom ...	61,141	1,76,92,242
											Austria	5,813	21,05,648
											France	12,259	43,78,320
											Italy	1,220	4,49,074
											Malta	231	60,467
											Russia	59	19,725
											Turkey in Europe ...	48	10,326
											Eastern Coast of Africa	11	1,705
											Egypt	7,506	17,23,762
											United States	6,157	17,65,058
											Arabia	319	38,785
											Ceylon	3	356
											China—Hong-Kong ...	134	55,965
											Mekran and Sonmiáni	44	3,889
											Persia	2,961	5,94,926
											Turkey in Asia... ...	2,478	7,28,567
1877-78 ...	120,605	3,49,43,340	99,402	3,04,37,068	2,243	3,42,583	2,061	2,60,360	16,899	39,03,429	United Kingdom ...	51,641	1,49,43,687
											Austria	6,618	21,55,166
											France	29,999	99,80,147
											Italy	1,392	4,69,622
											Malta	3	1,115
											Turkey in Europe ...	7	1,949
											Egypt	12,417	30,35,773
											United States	9,832	24,03,586
											Aden	3	375
											Arabia	328	45,541
											Ceylon	5	1,273
											Mekran and Sonmiáni	30	2,545
											Persia	4,152	6,99,959
											Turkey in Asia... ...	4,178	11,52,602

1878-79	...	105,051	2,96,04,625	74,747	2,30,88,814	2,229	3,45,583	1,964	2,50,762	26,111	59,19,466	United Kingdom ...	52,552	1,40,19,024
												Austria	7,125	22,14,922
												France	15,004	50,02,735
												Greece	20	6,691
												Italy	837	3,05,071
												Malta	38	9,296
												Turkey in Europe ...	35	6,718
												Cape of Good Hope ...	10	3,500
												Egypt	8,637	20,04,949
												United States	10,773	29,78,472
												Arabia	332	47,184
												Mekran and Sonmiáni	26	1,777
												Persia	4,354	7,46,559
												Turkey in Asia	4,710	11,88,152
												Australia	593	1,68,960
												Other countries ...	5	673
1879-80	...	100,923	2,94,72,265	47,928	1,88,04,499	5,331	8,12,788	3,765	4,21,451	43,899	94,33,527	United Kingdom ...	56,783	1,49,00,854
												Austria	4,932	20,59,075
												France	10,309	40,11,824
												Holland	102	36,000
												Italy	380	1,44,569
												Malta	84	19,687
												Egypt	9,248	22,51,417
												United States	13,406	46,37,375
												Arabia	54	7,332
												Persia	4,116	7,19,732
												Turkey in Asia	1,481	4,82,271
												Other countries ...	26	3,129
1880-81	...	116,870	3,57,15,814	88,111	2,88,45,753	1,954	4,15,981	1,510	2,18,810	25,296	62,35,270	United Kingdom ...	60,092	1,88,68,636
												Austria	9,337	30,75,624
												France	13,944	47,25,761
												Greece	67	25,698
												Italy	1,656	5,25,837
												Malta	129	30,847
												Russia	155	52,068
												Turkey in Europe ...	12	2,500
												Cape of Good Hope ...	11	2,554
												Eastern Coast of Africa, Zanzibar.	12	2,840
												Egypt	15,590	39,96,878
												United States	10,074	30,11,939
												Aden	19	4,635
												Arabia	290	51,045
												Persia	3,024	5,63,616
												Turkey in Asia... ...	2,457	7,72,372
												Australia...	6	2,240
												Other countries ...	5	734

Year.	India.		Bengal.		Bombay.		Sindh.		Madras.		Countries to which exported.	Quantity.	Value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.			
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.		Cwt.	Rs.
1881-82 ...	150,363	4,50,90,802	91,898	3,15,12,595	4,507	8,53,312	2,870	4,46,537	51,088	1,22,78,358	United Kingdom ...	81,504	2,41,52,216
											Austria	11,066	38,20,403
											France	15,047	51,46,287
											Greece	94	35,000
											Italy	1,717	5,95,026
											Malta	177	40,337
											Russia	93	36,100
											Turkey in Europe ...	80	20,270
											Eastern Coast of Africa, Zanzibar.	18	3,218
											Egypt	10,896	25,63,469
											United States	19,935	64,11,665
											Arabia	307	51,224
											Japan	6	1,406
											Mekran and Sonmiáni	10	1,265
											Persia	5,510	10,52,176
											Turkey in Asia... ...	3,896	11,59,686
											Other countries ...	7	1,054

Imports of Indigo.

Year.	India.		Bombay.		Madras.		British Burmah.		Bengal.		Sindh.		Countries whence imported.	Quantity.	Value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.			
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.		Cwt.	Rs.
1875-76 ...	751	7,687	4	475	.....	41	747	7,171	.....	.....	.....	.....	Straits Settlements ...	747	7,171
													Other countries ...	4	516
1876-77 ...	1,327	15,567	2	121	.....	.....	1,325	15,446	.....	.....	.....	.....	Arabia	2	121
													Straits Settlements ...	1,325	15,446
1877-78 ...	2,249	22,455	3	1,019	1	94	2,243	21,175	2	467	.....	.....	United Kingdom ...	3	1,060
													Straits Settlements ...	2,243	21,175
													Other countries ...	3	220
1878-79 ...	2,045	41,630	.....	.....	79	20,870	1,961	19,501	5	1,259	.....	.....	United Kingdom ...	81	21,481
													Straits Settlements ...	1,964	20,117
													Other countries ...	.....	33
1879-80 ...	1,755	21,293	16	2,087	18	2,096	1,717	16,564	.....	221	4	325	United Kingdom ...	18	2,261
													Mauritius	13	1,969
													Straits Settlements ...	1,717	16,564
													Other countries ...	8	499
1880-81 ...	1,968	32,018	9	1,626	66	10,675	1,893	19,456	.....	261	.....	.....	United Kingdom ...	66	10,956
													Arabia	9	1,570
													Straits Settlements ...	1,893	19,493
													Persia	9	1,413
1881-82 ...	2,238	25,265	15	2,341	1	50	2,222	22,741	.....	133	.....	.....	Straits Settlements ...	2,222	22,741
													Other countries ...	7	1,111

Preparation of the dye from the plant.—Full accounts of the methods of extracting the dye from the indigo plant, and the rationale of these methods, will be found in Ure's Dictionary of Arts and Manufactures, in Watts's Dictionary of Chemistry, Balfour's Cyclopædia, and elsewhere. The process being well known, it is needless to repeat it here. We shall confine ourselves to noticing the more primitive methods adopted by the natives of the country, and any local peculiarities in the manufacture reported from the various districts.

Native methods.

The Assistant Commissioner of Palámau reports that the native dyers of his district "soak the plants in a nad, or large open earthen vessel. The water is beaten up, and then put on the fire in chatties to boil. When this has been done sufficiently, the dye is strained through country cloth." In this manner the dyers (rungrez) of the district, who themselves grow the plant on the village irrigation embankments from seed gathered from the wild plants, obtain a sufficient quantity to last them for a few months in the year. Although the whole process is "clumsy and primitive," it will be seen that these native dyers follow the successive stages adopted in large factories. The four stages—steeping, beating, boiling, straining—are all distinct, although all carried out in the rudest possible manner.

Use of lime.

The Magistrate of Chittagong gives the following account of the manufacture of indigo for local use in his district:—"The plant on being gathered is allowed to rot in water and then removed. The water is then mixed with *lime*, and the liquid allowed to stand for about 12 hours. At the end of this time a deposit is found at the bottom of the vessel, which is dried and kept in the form of cakes." In the Chittagong Hill Tracts the method employed by the hillmen is as follows:—"About 5 or 6 seers of the indigo leaves are placed in a pot with 2 or 3 seers of water and allowed to rot for three or four days: the leaves are then crushed with the hand. When pulped, the rubbish is thrown away and the liquid is mixed with 2 chittacks of slaked *lime*. The dye then curdles, and is taken out of the pots and dried. The yield is ¼ seer to every 5 or 6 seers of leaves." Here, apparently, the precipitation of the dye is brought about by adding lime instead of "beating." In former days weak lime-water was generally added to the liquid in the beating vat after the completion of the beating to hasten the precipitation of the dye, but this is now discontinued in all European factories. According to Ure, "in order to hasten the precipitation, lime-water is occasionally added to the fermented liquor in the process of beating; but those who manufacture the superior qualities of indigo avoid the use of lime, as it has a tendency to make the indigo hard and red." From Mr. Buck's Report it would seem that this rude method employed in the Chittagong district is also used in the North-West Provinces for the preparation of small quantities of dye for domestic purposes.

The accounts of the processes adopted in the various European factories only differ from the account given in Balfour and Ure in details, such as the duration of each stage of the manufacture, the number of men employed, &c. The dimensions of the vats are given

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as 18 feet square by 4 feet deep in the 24-Parganás. The duration of the first stage of the manufacture—the steeping—is given as 12 to 14 hours (Patná); 10 to 18 hours according to the state of the weather, a shorter time being sufficient in fine and hot weather (24-Parganás); 15 to 20 hours (Dacca); 10 to 12 hours if of the February sowing, 15 to 20 hours if of the later sowings (Purniah). The duration of the second stage—the beating—is variously given as from 2 to 5 hours. The paddles or wooden oars employed for beating are called *pharwas* ঢ়্যাওয়া (Purniah). In many factories the beating is effected by machinery.

Very few improvements upon the method of indigo manufacture have apparently been effected. Various proposals have been made for shortening the successive stages. Nitre is sometimes added to the liquid in the steeping vat to hasten the fermentation; and it has been proposed to add a mixture of caustic potash and nitre to the beating vat in order to hasten the oxidising process. But neither of these improvements can be considered established, and the process of indigo manufacture is virtually what it has been from the beginning of the century.

Methods of dyeing with indigo.—We need only concern ourselves here with the methods of dyeing with indigo adopted by native dyers. But it may be as well to preface this with a general account of the nature of indigo-dyeing.

Methods of dyeing in Europe.

The blue principle in indigo, called indigo-blue or indigotin, is completely insoluble in water or other ordinary solvents, the only known real solvent for it being anhydrous acetic acid mixed with a little sulphuric acid. By various deoxidising substances, however, indigo-blue becomes converted into indigo-white, (indigogene), which dissolves readily in alkaline liquids and lime-water, forming a colourless or slightly yellow solution. If the fabric to be dyed be immersed in this colourless solution, it imbibes the soluble indigo-white, and on being taken out and exposed to the air the indigo-white upon and within the fibre rapidly takes up oxygen from the atmosphere and becomes again converted into insoluble indigo-blue, forming a permanent dye. In no other case is such a method of dyeing applicable, "no mordant being required, and there being no combination of the colour formed within the stuff, the dye-drug in its natural hue being fixed within the fibre." Indigo thus gives a *substantive* colour.

European "vats."

The differences between the various processes of dyeing with indigo merely depend on the different methods adopted to deoxidise the insoluble indigo-blue so as to convert it into soluble indigo-white. These give rise to different indigo "vats." The deoxidisation may be effected by mixing with the indigo-blue various substances of energetic deoxidising properties, or else by fermentation. Instances of the former are the "copperas vat," in which ferrous sulphate and slaked lime being mixed with the indigo, the lime liberates ferrous oxide, which deoxidises the indigo-blue, and the resulting indigo-white then dissolves in the excess of lime; the "urine-vat," in which urine deoxidises the indigo-blue and dissolves the resulting indigo-white by

means of its ammonia; the "hydrosulphite of soda vat," in which hydrosulphite of soda is the deoxidising agent, and the indigo-white is dissolved by an alkali. Instances of the latter are the "woad vat," in which the fermentation of the woad deoxidises the indigo-blue, this fermentation being set up by the sugar, starch, extractive matter, &c., of the *madder* and *bran*, with which it is mixed, and kept in check by lime, which also serves to dissolve the resulting indigo-white; the "bran and molasses" vat, in which the fermentation of the bran causes the deoxidisation, this fermentation being again kept in check by lime. In Europe the "copperas vat" is that invariably employed in dyeing cotton goods, and is also used for linen and silk goods; the "urine vat" is employed for woollen and linen goods; the "woad" and "bran and molasses" vats generally for woollen goods.

Dyeing in India.

In India, according to Mr. Buck, the deoxidisation "is generally brought about by fermentation. This is excited by the addition of certain alkaline substances together with some saccharine matter, and occasionally by raising the temperature" (*vide* Dyes and Tans of the North-West Provinces, page 9).

The method described by Mr. Buck as generally adopted in India is followed more or less closely in dyeing woollen-yarns in the Meetapore Jail, Patna, as follows:—

The yarn is first washed in *sajimati* water and then rinsed out. The dye-solution is prepared by mixing the following ingredients:—

1 seer best European indigo.
3½ seers sajimati.
1¼ seers chunam.
1 seer gur or molasses.
10 gurrahs water.

The solution is stirred three or four times a day for three or four days. In the cold season a fire must be kept up near the solution so as to keep it at a summer temperature. The yarn is then dipped in the solution and allowed to dry. This is repeated until the required depth of colour is obtained, after which the yarn is dried in the sun, and well washed when dry. The depth of colour obtained depends on the number of dippings and the duration of each: thus—

(i) *Leelá*, the darkest blue, obtained by many dippings and of long duration (Mr. Buck gives *four* dippings). (No. 12847.)
(ii) *Asmáni*, sky-blue: dippings quicker and less frequent (Mr. Buck gives *one* dipping). (No. 12848.)
(iii) *Kowriállah*, lighter than above: fewer dippings, and of shorter duration still. (No. 12849.)

In all cases the result is a pucca or fast colour.

The only other district in which gur (গুড়) or molasses is reported to be employed is Dinájpur, the Collector of which gives the following formula for dyeing *blue*:—

10 seers *indigo*, 6 chittacks of *dáruharidrá*, 4 seers of *gur*.

The colour thus produced would probably be purple rather than blue, as dáruharidrá itself is a red dye.

In all other districts in which indigo is used for dyeing various shades of blue, the method employed seems to differ considerably from

INDIGO.

that set forth above, and no other mention is made of the use of gur or molasses along with alkaline matters to promote fermentation.

The following method is employed in the Dárjíling district for dyeing cotton yarn blue :—

Singen (*Symplocos lucida*) is ground and boiled in water with the yarn. The yarn is then dried, and boiled with *indigo* (ryomn or rum) in the refuse water left on washing sheep's wool. This dirty water is supposed to aid in dissolving the indigo, and also to act as a dye-stuff by itself. (No. 13800.)

The following method is employed in the Rájsháhí district for dyeing thread dark blue :—

The thread is first washed with *sajimati* and dried. Then 4 chittacks of kolee *chuna* (shell-lime), ½ seer of patta *sajimati*, 4 chittacks of *aoosh* wood (*Morinda tinctoria*), 2 seers of cold water, are mixed together and allowed to stand for two or three hours. The solution is decanted, so as to separate it from the deposit, and 2 chittacks of *indigo* are rubbed down in it, and the whole is then put in a jar in which a little old indigo-dye remains : 4 chittacks *lime* and 2 chittacks of *aoosh* wood are again added to this solution. The thread is then twice dipped in this solution and dried. It is again twice dipped and dried on the following day, when it acquires a permanent dark blue colour. A small portion of the dye is always kept as a soft leaven or ferment to mix with new dyes.

The process of dyeing blue with *indigo*, *achhu*, *lodh*, and *khár-páni* adopted in Balasor will be found described under *Morinda tinctoria*, p. 36. (No. 4016, cotton.)

The Collector of Maldah gives the following formula for dyeing blue with indigo :—

Indigo, *chakunda* seeds (*Cassia Tora*), *plantain ashes*, and water.

The Commissioner of the Chittagong Division gives the following account of the process of indigo-dyeing adopted by the hillmen :—

¼ seer of the indigo-dye, prepared as described above, is mixed with ¼ seer of the seeds called *ichi-bichi* (p. 154), ½ seer of the ashes obtained by burning dried wood of *phulgach* (p. 156), and 1 seer of water. The mixture is left alone for 4 or 5 days, until the *ichi-bichi* rots, when the seeds are crushed and blended with the mixture. The dye thus prepared is used for colouring thread to be afterwards woven into cloth by the hill women. The thread is saturated with the dye 3 or 4 times and dried. If the colour required be a darker blue, the thread is afterwards soaked for 2 or 3 days in the black liquid obtained by boiling about ¼ seer of the green bark of the *kalagap* tree (p. 154) in 1 seer of water.

The following more complete account of the same process, differing slightly in details, was subsequently received from the same Division :—

The thread or linen is prepared for dyeing by boiling it in water sufficiently to remove any grease or dirt that adheres to it. It is then rinsed in cold water and dried.

Ashes of burnt phulgach wood are then thoroughly dissolved in water and allowed to settle. The alkaline solution so obtained is then decanted. The seeds of *ichi* are fried in a pan until they acquire a brown tint. Then a mixture is made of 1 part *indigo* (kalma), phulgach ash solution 8 parts, fried seeds of *ichi* 1 part, in an earthen pot. This mixture is exposed to the sun continually for 10 to 15 days or more, being stirred with a piece of stick 3 or 4 times every day. At night-time the pot is

kept covered. A sort of fermentation goes on, and the dye solution is ready when the bubbles rising to the surface have the desired blue tint.

The prepared thread or linen is then soaked in this liquid and dried by exposure to the sun. This is repeated several times till the colour is sufficiently deep, and the thread or linen is then washed in clean water. (No. 13580, cotton.)

If a dark black-blue tint be required, a solution is obtained by boiling coarsely powdered *kalagap* bark in water, into which the thread or linen, coloured blue as above, is soaked and dried by exposure to the sun several times until the desired depth of colour is obtained.

In place of the phulgach ash mentioned above, the *ashes* of the *mustard plant*, *kalai bamboo*, *mirtinga bamboo*, or *imlitgach* (p. 156) are occasionally employed.

Dyeing with indigo in this fashion is only carried on during the month of April.

The following additional specimens of fabrics dyed blue with indigo are in the Economic Museum, but the processes adopted have not been given:—

No. 4494, silk, Rájsháhí and Kuch Behar Division.
Nos. 10689, 10690, woollen yarn, Dárjíling, dyed with ryomn.
No. 10691, cotton, Dárjíling.
No. 12190, cotton yarn, Calcutta native dyers.
No. 12191, silk yarn, Calcutta native dyers.

Combinations with other dyes.

The only compound colours produced by combining indigo with other dyes of which mention is made in the letters from which this report is compiled are black, purple, green, and maroon.

(i) *Black* (more probably blue-black).—Indigo, protosulphate of iron, and haritaki (fruit of *Terminalia Chebula*).

12 chittacks of *haritaki* are boiled in 30 seers of water till only 10 seers are left, and then cooled. The thread, first washed in *sajimati* and dried, is saturated in this solution and dried again. 2 chittacks of *sulphate of iron* and two tolas weight of *indigo* dye solution, prepared as above with chuna, sajimati, and aoosh wood, are mixed together. The thread is then soaked in this mixture twice and dried. (Rájsháhí.) (*Cf.* Mr. Buck's Report, p. 10. Here, however, the two dyes, indigo and sulphate of iron, are mixed together, instead of being kept separate.)

(ii) *Purple.*—Indigo, with aich, bakam, lac, safflower, or madder.

Indigo, *sajimati*, *lime*, and chips of *aich* root are taken in equal proportion and steeped in water for four days in a covered pot. Fermentation takes place during this time, and froth collects at the top of the water. The froth is removed, and yarn or cloth, silk or cotton, previously dyed red either with *madder*, *lac*, *kusum*, or *aich* (pp. 48, 54, 55, 16, 38), is steeped in the liquid two or three times, and acquires a purple colour. (Midnapur.)

Bakam, *indigo*, and *alum* give a bright purple. (Nos. 12185, silk thread, and 12186, cotton thread, dyed by Calcutta native dyers: process not stated.)

Indigo and *bakam* are pounded together and boiled. (Bhágalpur.)

Indigo and *lac* give a bright purple. (No. 4493, Rájsháhí and Kuch Behar Division, silk: process not given.)

Indigo and *kusum* give a purple dye. (Bhágalpur.)

(iii) *Green* of various shades.—Indigo and turmeric or kantal-wood.

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Turmeric and *alum* are dissolved in water, and thread or cloth of silk or cotton dyed with *indigo* is saturated with the solution and becomes green. (Midnapur.)

If to the water employed in the two processes mentioned on p. 85 for obtaining a yellow dye from *turmeric* a little *alum* and *indigo* be added, a green colour called *dhâni* is obtained. (Lohárdagá.)

Turmeric and *indigo*, or *kantal-wood* (wood of the jack-tree, *Artocarpus integrifolia*) and *indigo*, give green. (Maldah, No. 4491, silk.)

Leaves of the plant called *singen* by the Bhutiahs (*Symplocos lucida ?*) are ground and boiled in water with the yarn (cotton) to be coloured. The yarn is then dried, and soaked in water with *indigo*, and kept about five or six days. It is then boiled with *huldi* in water, and acquires a green colour. (Darjíling, No. 13799, cotton.)

The following account of the methods adopted for dyeing woollen yarns various shades of green, all kucha, has been received from the Meetapore Jail, Patna:—

The yarn is first dyed with indigo as explained above. It is then dried in the sun and washed. A solution is made of 2 to 3 chittacks *huldi* and 1½ gurrahs of *peworree water*, the yellow extract of safflower, and the yarn is then steeped in this for four hours in summer and two days in winter. It is then wrung out and dried in the shade. The colour resulting is *hárá* or *hárásábuj*, the different shades of which depend on the darker or lighter tint produced by the indigo dyeing. (No. 12850.) The shade of green called *dhâni* is obtained by washing out the yarn in *alum* water. (No. 12851.)

Specimens of silk and cotton thread, dyed green by *indigo*, *turmeric*, and *lemon* or *lime-juice* by a Calcutta native dyer, have been received, but details of the process are not given. (Nos. 12188, silk, and 12189 cotton.)

(iv) *Maroon.*—Indigo and madder.

The Deputy Commissioner of Dárjíling reports that a good *maroon* colour is obtained by boiling *madder* with a little indigo (p. 49).

Combinations of indigo with singrahar (*Nyctanthes Arbor-tristis*), with palás (*Butea frondosa*), and with huldi (*Curcuma longa*) and singrahar, are mentioned as being used in the Bhágalpur district, but no details are given, nor are the colours stated.

REYONG.

2. Reyong.

"A climber of the Teesta and Ranjeet valleys. with bluish *leares*. The latter are dried, ground up, and the article to be dyed steeped in the infusion. The colour obtained varies from blue to black, generally very much like indigo." (Dr. Schlich.)

This may be *Marsdenia tinctoria*, the Lepcha name of which Mr. Gamble gives as ryôm, or perhaps *Strobilanthes flaccidifolius*, Nees, which is called "room" in Assam, and yields a blue dye resembling indigo (*vide* footnote, p. 93).

CHAPTER IV.

Dye-stuffs giving Brown or Black, and Green Dyes.

Brown or Black.	*Green.*
1. Acacia arabica.	1. Baccaurea sapida.
2. Acacia Farnesiana.	2. Hedyotis capitellata.
3. Acacia Catechu.	3. Mangifera indica.
4. Adhatoda Vasica.	4. Tagetes patula.
5. Areca Catechu.	
6. Bassia latifolia.	
7. Bauhinia variegata.	
8. Ceriops Roxburghiana.	
9. Diospyros Embryopteris.	
10. Diospyros melanoxylon.	
11. Erythrina sp. (?)	
12. Eugenia Jambolana.	
13. Ficus religiosa.	
14. Ficus glomerata.	
15. Mimusops Elengi.	
16. Piper Chaba.	
17. Semecarpus Anacardium.	
18. Shorea robusta.	
19. Strychnos Nux Vomica.	
20. Hirakosh.	

1. **Acacia arabica,** *Willd.* (Mimosa arabica, *Roxb.*)—Nat. Ord. LEGUMINOSÆ. BABUL.

Bábul or bábur, বাবুল, ببول, ببور.
Báblá, বাবলা (Bardwán).

Growth and cultivation.

This tree grows wild plentifully all over Bengal, and seems to be cultivated to a certain extent in some districts for its bark, which is extensively employed in tanning, and only very slightly as a dye. The only district in which it is definitely mentioned as being cultivated is Midnapur, where the Collector estimates the area under babla cultivation at 8,000 acres, and remarks:—"Much care is not required for its cultivation. The ground is dug up here and there with a kodáli, and the seeds sown in these spots in June or July. No further care is necessary. The seeds germinate in ten days or so, and the plants bear fruit in three or four years. They grow to the height of a moderate-sized

BABUL. tree. The fruit ripens in February or March. The pods are called 'terry.'" In Purniah "the babul tree is grown extensively all over the district," and in several other districts (Húglí, Dacca, Murshidábád) it is mentioned as growing wild.

Babul bark is only to a very slight extent a marketable article. The following prices are given:—

Midnapur	...	...	... Rs. 2-8	per maund.
Húglí	...	...	... 4 As. to 6 As.	„ „

Use in dyeing. The *bark* of this plant, whilst in extensive use as a tan (p. 157), is very rarely employed in dyeing in Bengal, and very little information has been received regarding the method of employing it for this purpose. The dye is extracted by simply steeping or boiling in water. The following detailed account is given by the Collector of Midnapur:—

> For dyeing a yard of cloth a pound of the bark of *babla* is cut or broken into very small chips, and is boiled in about 5lb of water until about 3lb of water remain. The solution is then allowed to cool. A pice weight of *alum* (about ¼ oz.) is then pounded and mixed with the solution. The cloth to be dyed is washed in pure water, and the moisture well wrung out of it. It is then steeped in the above solution, and is afterwards put to dry in the shade. This steeping and drying is repeated two or three times. (No. 11505, cotton, dark brown.)

The Collector of Midnapur also states that if instead of babla bark alone the barks of babla and keund (*Diospyros melanoxylon*) be mixed together and treated as above, a *black* dye is obtained, which is used in blackening pillow and quilt cases (No. **11567**, cotton). He also says:—"The barks of *arjun* (p. 151), *garan* (p. 133), *babla*, boiled together in water, yield a reddish dye, in which pillow and quilt cases are washed several times, and then daubed with mire (কাদা) and dried in the sun. They are then washed, and found to be of a black colour."

From Dacca we are informed that "bark of babul, mixed with a *salt of iron*, gives a moderately permanent inky dye."

The *legumes* of babur are used in dyeing black and violet in the Meetapore Jail, Patná, as described on p. 138.

In Monghyr the *gum* of babul is employed in dyeing with ál (*Morinda tinctoria*, p. 33).

GOOHIA BABUR. 2. **Acacia Farnesiana**, *Willd.* (Mimosa Farnesiana, *Roxb.*)—Nat. Ord. LEGUMINOSÆ.

Goohia babur.

This tree, which is also known as babul, is mentioned from Dacca as growing wild in that district. "The *bark* mixed with a salt of iron gives an inky dye, moderately permanent." The bark is also used in tanning in the districts of Dacca and Faridpur (p. 158).

The *legumes* of goohia babur are used in dyeing black and violet in the Meetapore Jail, Patná, as described on p. 138.

3. **Acacia Catechu**, *Willd.* (Mimosa Catechu, *Roxb.*)—Nat. Ord. LEGUMINOSÆ. KUTH.

Khair, খয়র, ખેર, ચેર (Rájsháhí, Bhágalpur, Chutiá Nágpur).
Pápri khair, পাপড়ি খয়র (Rájsháhí).
Kuth.

Information regarding this plant has only been received from the Bhágalpur, Chutiá Nágpur, and Rájsháhí Divisions. Dr. Schlich, Conservator of Forests, remarks of it:—"This tree is found in large numbers in Chutiá Nágpur, at the foot of the Himalayas, and probably in other parts of Bengal." From Bhágalpur it is reported that "the tree grows in the jungles of the Supul sub-division and also in Bánká." From Purniah it is stated to be grown in the north of the district. The only district of Chutiá Nágpur in which it is expressly mentioned as growing in the jungles is Hazáribágh. It is stated also to be found in the Rájsháhí district.

Growth.

The information received regarding the price of catechu or kuth, the astringent extract made from the wood of this plant, is as follows:—

Hazáribágh	...	...	...	Rs. 5 to 7 per maund.
Chutiá Nágpur, sub-division of Lohárdagá			...	„ 12-8 „ „

These figures scarcely agree with the remark of Dr. Schlich that "it is sold in the bazars of Chutiá Nágpur at Rs. 2-8 per maund."

It is reported from Hazáribágh that "about 1,000 maunds of catechu are produced annually in this district, the whole of which is exported, chiefly to Calcutta, where it sells at from Rs. 8 to Rs. 12 per maund." The Collector of Bhágalpur states that although the plant grows in several parts of his district as above, the "kuth" used in the district is mostly imported; whilst the Collector of Purniah mentions an importation of kuth into his district from Nepal.

Trade.

The following tables give the exports and imports of kuth and gambier from 1875-76 to 1881-82. Gambier is the similar astringent extract from the leaves of *Uncaria Gambier*, imported from the Straits Settlements and Ceylon, which is often confounded with cutch. Cutch and gambier are free of duty on export. Up to 5th August, 1875, imported cutch or gambier was subject to a duty of 7½ per cent, reduced to 5 per cent from that date, and removed altogether from the 9th March, 1882. The imports are nearly altogether gambier, which is imported for making *pán*. None of this is re-exported except a small quantity to Mauritius, &c., for the *pán* of the Hindoo coolies there. So that there is scarcely any gambier in the "cutch and gambier" exported. But the cutch exported from Bengal is not produced in Bengal. Nearly the whole of it is brought from British Burmah to be re-shipped to the United States, as there is little direct communication between British Burmah and the States.

Exports of Cutch and Gambier.

Year.	India.		Bengal.		Bombay.		Madras.		British Burmah.		Countries to which exported.	Quantity.	Value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.			
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.		Cwt.	Rs.
1875-76 ...	192,683	16,64,545	76,285	7,20,247	8	235	284	4,233	116,106	9,39,830	United Kingdom ...	105,188	8,52,862
											France	1,930	18,800
											Italy	1,427	13,697
											Mauritius	87	1,700
											United States	66,390	6,25,656
											Ceylon	5,241	49,286
											Straits Settlements ...	12,387	1,01,998
											Other countries ...	33	526
1876-77 ...	264,933	25,07,515	85,751	9,53,631	28	714	1,179	18,932	177,975	15,34,238	United Kingdom ...	161,492	14,12,599
											France	1,225	14,550
											Italy	273	2,738
											Mauritius	5,800	44,470
											United States	78,239	8,60,007
											Ceylon	2,918	25,813
											Straits Settlements ...	14,813	1,25,299
											Other countries ...	173	2,039
1877-78 ...	195,320	18,27,563	71,513	7,78,821	41	938	1,634	29,485	122,132	10,18,319	United Kingdom ...	98,870	8,47,983
											France	4,102	46,379
											Italy	3,518	35,304
											United States ...	58,133	6,37,186
											Ceylon	1,879	32,479
											Straits Settlements ...	23,748	2,27,153
											Other countries ...	70	1,080
1878-79 ...	217,194	18,79,265	50,107	5,35,252	36	737	1,589	25,310	165,462	13,17,966	United Kingdom ...	126,352	10,25,666
											France	5,395	54,824
											Egypt	1,267	12,605
											United States... ...	35,986	3,91,788
											Ceylon	2,001	29,981
											Straits Settlements ...	46,026	3,62,199
											Other countries ...	167	2,202
1879-80 ...	232,123	28,13,994	67,757	9,08,389	31	756	45	703	154,290	19,04,146	United Kingdom ...	102,770	13,17,574
											France	508	6,414
											Spain	1,000	12,000
											Egypt	8,017	1,16,574
											United States	62,761	8,48,198
											Ceylon	114	1,558
											Straits Settlements ...	46,907	5,10,714
											Other countries ...	46	963

1880-81 ...	316,077	42,22,527	99,155	14,76,618	124	2,135	120	2,820	216,678	27,40,754	United Kingdom ...	146,654	19,40,280
											France	627	10,062
											Italy	1,727	26,348
											Malta	1,658	23,763
											Egypt	22,653	3,31,329
											United States	97,829	14,49,234
											Ceylon	561	8,813
											Persia	106	1,697
											Straits Settlements ...	44,224	4,30,264
											Other countries ...	38	737
1881-82 ...	198,897	25,30,840	57,747	8,48,286	5	182	132	2,557	141,013	16,79,815	United Kingdom ...	120,912	14,71,420
											France	1,991	31,061
											Italy	145	2,150
											Egypt	18,467	2,46,197
											United States	48,580	6,90,714
											Ceylon	977	18,536
											Straits Settlements ...	7,629	68,044
											Australia	100	1,451
											Other countries ...	96	1,267

Imports of Cutch and Gambier.

Year.	India.		Bengal.		Bombay.		Sindh.		Madras.		British Burmah.		Countries whence imported.	Quantity.	Value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.			
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.		Cwt.	Rs.
1875-76 ...	10,474	1,60,039	8,872	1,41,820	1,562	17,771	.....	.....	40	448	.....	.....	Straits Settlements ...	10,473	1,60,033
													Ceylon	1	6
1876-77 ...	13,535	1,72,182	11,921	1,49,756	1,611	22,191	.....	.....	23	235	.....	.....	Straits Settlements ...	13,521	1,71,808
													Other countries ...	34	374
1877-78 ...	17,953	2,37,660	15,989	2,13,450	1,940	23,947	.....	.....	21	231	3	32	Straits Settlements ...	17,948	2,37,593
													Other countries ...	5	67
1878-79 ...	16,779	2,12,079	14,908	1,91,837	1,850	20,016	.....	.....	20	211	1	15	Straits Settlements ...	16,778	2,12,055
													Other countries ...	1	24
1879-80 ...	11,998	1,65,958	11,428	1,59,099	551	6,618	.....	.....	17	218	2	23	Straits Settlements ...	11,983	1,65,777
													Other countries ...	15	181
1880-81 ...	19,621	2,49,366	17,666	2,25,798	1,869	22,393	20	260	63	881	3	35	Straits Settlements ...	19,569	2,48,679
													Other countries ...	52	687
1881-82 ...	17,762	2,38,324	16,259	2,19,164	1,448	18,424	.....	.....	54	728	1	8	China—Hong-Kong ...	108	2,273
													Straits Settlements ...	17,624	2,35,641
													Other countries ...	30	410

KUTH.

Details as regards the method of manufacturing the catechu or kuth from the wood of this tree will be found in Mr. Liotard's Memorandum and elsewhere. No particulars of the methods of manufacture employed in Bengal have been received.

Use in dyeing.

The catechu, or astringent extract thus prepared from the heart-wood, is occasionally, but very rarely, employed for dyeing purposes. The following account of its use as a dye is given from Hazáribágh:—

> The catechu or kuth is steeped in cold water for about 12 hours. The solution is then strained to get rid of impurities; *lime-water* is then well mixed with this solution, which is then placed in the sun, when it assumes a *dull red* colour. The cloth to be dyed is steeped in this liquid, and on removal is dried in the shade. This process of steeping and drying is repeated three times. For 20 yards of cloth 1 seer of catechu, about 2 gallons of water, and a bottle of lime-water, are required.

From the Chutiá Nágpur sub-division of Lohárdagá we are told that "the kuth is dissolved in water to which *alum* is added, and cloth steeped in this is dyed a *dull red*." It is, however, stated that the "kuth" employed is the extract of the *bark*, but this must be a mistake. From Bhágalpur we are informed that *kuth*, *sajimati*, and *singrahar* (*Nyctanthes Arbor-tristis*) are used to give a dye, as also *kuth* and *kasis* (protosulphate of iron), but no details are given, nor are the colours stated.

Pán prepared as if for chewing, consisting of leaves of *Piper Betle*, kuth, areca-nut, and lime, is used in Lohárdagá with toon flowers (*Cedrela Toona*) in dyeing red (p. 75), whilst the spittle resulting from chewing *pán* is used as a subsidiary in dyeing with dáruharidrá (*Morinda tinctoria*) in Dinájpur (p. 35).

Wood used in dyeing.

Apparently the *wood* of the *Acacia Catechu* is sometimes directly used as a dye-stuff instead of the extracted "kuth." This is the case in Palámau, whence it is reported that "a dirty *brown-red* dye is occasionally extracted from the wood cut up into chips and boiled. It is, however, only used for staining wood, such as door-frames."

ASURO.

4. Adhatoda Vasica, *Nees.*—Nat. Ord. ACANTHACEÆ.

Asuro.

"Found in many parts of Bengal: is said to yield a *black* dye, which the hillmen extract from the *leaves* and *fruit* by soaking them in water." (Dr. Schlich.)

(Mr. Gamble gives *asuru* as the Paharia name of *Tabernæmontana coronaria*, Willd., and *asura* as that of *Cyclostemon subsessile*, Kurz.)

SUPARI.

5. Areca Catechu, *Linn.*—Nat. Ord. PALMÆ.

Supári, সুপারি।

The *nut* of this plant, the well-known betel-nut palm, yields an inferior kind of catechu. It is reported from Rájsháhí to be used for a *coffee-brown* dye, but no particulars are given.

The betel-nut is a principal ingredient in *pán*, which is used in dyeing red with toon (*Cedrela Toona*) in Lohárdagá (p. 75): the spittle resulting from chewing pan is used as a subsidiary in dyeing with dáruharidrá (*Morinda tinctoria*) in Dinajpur (p. 35). SUPARI.

6. **Bassia latifolia**, *Roxb.*—Nat. Ord. SAPOTACEÆ. MAHOOA.

Mahooa, mahwa, mohwa.

The *bark* of this tree, under the name *mahooa*, is mentioned as one of the ingredients employed in Lohárdagá in making a pucca black, see p. 144: also in Monghyr it is used in preparing *pili rung*, p. 85.

7. **Bauhinia variegata**, *Linn.*—Nat. Ord. LEGUMINOSÆ. KUCHNAR.

Kuchnar.

The *bark* of this tree, under the name *kuchnar*, is mentioned as one of the ingredients used in Lohárdagá in preparing a pucca black (see p. 144). It is also mentioned as one of the ingredients used in Monghyr in preparing *pili rung* (see p. 85).

8. **Ceriops Roxburghiana**, *Arnott.* (Rhizophora decandra, *Roxb.*)— Nat. Ord. RHIZOPHOREÆ. GARAN.

Garán, গরান।

Grahani, গ্রহনী, or giráni, গিরানি, গেড়া, গিওয়া (Balasor).

This plant grows abundantly in the Sundarbans, whence its bark, in extensive use as a tan (p. 158), finds its way in considerable quantity into other parts of Bengal. It is also mentioned as growing in the jungles in Midnapur, and as "growing in the jungles of the seashore" in Balasor. The prices given for the bark are—

Midnapur	...	...	...	Rs. 5 per seer.
Balasor	...	...	...	Anna 1 „

Dr. Schlich writes:—"An almost unlimited amount of garán bark is avilable in the Sundarbans. The bark of mature garán trees, which yields a greater proportionate amount of colouring matter than that of younger trees, sells in the Jessor district for Re. 1 per maund, that of the smaller trees running at various places from As. 12 down to As. 4 per maund. The cost of the labour of cutting off the bark chiefly accounts for the price charged." It is needless to draw attention to the tremendous discrepancies in these prices.

The Collector of Balasor writes:—"Grahani has a large local consumption, and is very cheap. Boatmen go to the jungles and gather as much as they require: they sell it at about one seer for one anna."

The *bark* of garán is but little used in dyeing. It is used in Midnapur along with the barks of arjun (*Terminalia Arjuna*) and babla (*Acacia arabica*) in obtaining a *black* dye (p. 128). From Balasor it is reported that "the solution obtained by boiling down the bark of *grahani* with a small quantity of *teel-seed oil*, besides being used

GARAN. as a tan, is employed to stain ropes a rusty dark-brown colour, and to stain cloths worn by boatmen. It is only used with native cloths, and preserves them from the effects of water. It is said to greatly strengthen ropes which have been soaked in it."

GAB. **9. Diospyros Embryopteris**, *Pers.* (D. glutinosa, *Roxb.*)—Nat. Ord. EBENACEÆ.

Gab, গাব।
Mokod (Midnapur).
Makoorkend (Mánbhúm).
Kenduguti (Assam).

Growth. The only information regarding the growth of this plant is from Húglí and Mánbhúm. In Húglí "the tree grows wild, and is also planted by fishermen on the borders of their homesteads": in Mánbhúm "gab is a jungle plant, not very plentiful, but can be found if required. It ripens in October and November."

The selling price of the gab fruit is given as from Re. 1 to Rs. 2 per maund in Mánbhúm.

'Gabing' boats and nets. The Collector of Húglí remarks:—"The gab fruit, when fresh, yields a gum with which boats and nets are coloured. This gum imparts a *brown* colour, dark inclining to red, to the object to which it is applied, and also protects the timber or fibre from the action of water. It is more prized for this latter quality than as a colouring matter." From Rájsháhí it is also reported that "an infusion of the unripe gab fruits is used for steeping fishing nets, and the astringent viscous mucus of the fruit is used everywhere for painting the bottoms of boats."

Use in dyeing. Gab *fruit* is but sparingly used for the *brown* dye which it yields. The fruit is simply pounded and boiled, and the cloth steeped in the liquid, no auxiliary being employed. (Mánbhúm, No. 11364, cotton, dark brown.) The following more detailed account has been received from Húglí:—

> In order to produce the best dye, the gab fruit must neither be very raw nor very ripe. It is broken into small pieces and steeped for about two hours in about twice as much water by weight. The gab is then removed, and again steeped for two days in the same quantity of water. The fruit is then removed and thrown away, and the two extracts thus obtained are mixed together. About ¼ of this mixture is then taken and heated to nearly boiling point, and then poured into the remainder of the extract, so as to heat the whole moderately. The cloth to be dyed is steeped in this for a few minutes, then removed and dried in the air. This process of steeping and drying is repeated three times, and the cloth has than acquired a permanent *brown* colour. About 400 gab fruits are required to dye 60 yards of cloth a yard wide.

In Dacca gab is used in dyeing *black* in conjunction with haritaki (*Terminalia Chebula*) and *hirakosh* (protosulphate of iron). The ingredients may either be mixed together and boiled in water and the

cloth steeped in this compound solution, or the cloth may be first impregnated with a decoction of haritaki and afterwards steeped in a solution prepared from gab and hirakosh. Instead of the gab fruit, the juice alone, extracted by pounding the fruit, may be employed. These two processes are described as follows :— GAB.

The gabs are dried for some days before they are used. They are then cut into pieces and pounded. The juice so obtained is mixed with *haritaki* and *hirakosh* and boiled in water. In this liquid the cloth to be dyed is steeped and acquires a dense *black* colour. To dye a piece of cloth one yard square 2½ chittacks of gab juice, 1½ chittacks haritaki, 5 annas weight hirakosh, and 2½ powas of water, are required. (No. 11248, cotton, dense black.)

½ powa of pounded dry *haritaki* is mixed with ½ seer by measure of water and boiled down till 1½ powas remain: it is then filtered, and the fabric to be dyed is steeped in the liquid and then dried. A decoction of gab is prepared by mixing ½ powa of dry well pounded gab with ½ seer by measure of water and boiling down till 1½ powas remain. A little *green vitriol* (protosulphate of iron) is dissolved in the filtered liquid, and the fabric prepared as above is well soaked in this. On drying, it has acquired a *dense black* colour. To dye a piece of cloth 60 yards by one yard, 5 or 6 seers of haritaki, 9 or 10 seers of dry gab, and ½ seer of green vitriol, are required. (Dacca.)

10. Diospyros melanoxylon, *Roxb.*—Nat. Ord. Ebenaceæ. KEUND.

Keund, কেঁউদ।

The *bark* of this plant is used in conjunction with that of babla (*Acacia arabica*) in dyeing black in Midnapur (*vide* p. 128). The price of this bark is given as annas 4 per seer.

In the despatching letter this plant was first stated to be *Costus speciosus*, but a specimen of the leaves subsequently sent was identified by Dr. King as *Diospyros melanoxylon*. Another specimen of the bark used in the above process of dyeing seems, however, to be a *Terminalia*. (Dr. Watt).

11. Erythrina sp. (?).—Nat. Ord. Leguminosæ. MADAR.

Mádár, মাদার।

Bark of mádár is given in a list of dye-stuffs produced and used in Midnapur, and a specimen of cotton cloth (No. 11180) dyed a light brown with it has been received. In the list the scientific name of the plant is put down as *Erythrina fulgens*, but there is no such species of *Erythrina*. The method employed is that described on p. 128, with the substitution of mádár bark for that of babla.

12. Eugenia Jambolana, *Lamk.*—Nat. Ord. Myrtaceæ. JAMOON.

Jamoon, jam.

The *bark* of this tree, under the name *jamoon*, is mentioned as one of the ingredients used in Lohárdagá in preparing a pucca *black* (see p. 144). Also used in dyeing with manjeet (*Rubia cordifolia*) in Assam (see p. 49).

ASHATHA.

13. Ficus religiosa, *Linn.*—Nat. Ord. URTICACEÆ.

Ashatha, অশ্বত্থ।
Asud.
Bur (Lohárdagá).

The *bark* of this tree is mentioned as being used as a dye-stuff in Midnapur;* its selling price is given as Rs. 2-8 per maund. The method employed is that described under *babla* (p. 128), the bark of *ashatha* being substituted for babla bark. The resulting colour is a light *brown*. (No. **11178**, cotton.)

The bark of this tree (bur) is also mentioned as being used along with many other barks in preparing a pucca *black* in Lohárdagá (p. 144).

GOOLUR.

14. Ficus glomerata, *Willd.*—Nat. Ord. URTICACEÆ.

Goolur.

The *bark* of this tree, under the name *goolur*, is also mentioned as one of the ingredients used in Lohárdagá in preparing a pucca *black*, see p. 144.

BAKUL.

15. Mimusops Elengi, *Linn.*—Nat. Ord. SAPOTACEÆ.

Bakul, বকুল।

This plant is only mentioned in the reports from Bírbhúm and Midnapur, as a jungle product the *bark* of which is to some extent used as a dye. The price of the bark is given as 1 anna per seer in Midnapur.

From Bírbhúm we are merely told that the "dye is extracted by boiling or steeping the bark in water."

In Midnapur the bark of bakul is used either by itself or in combination with the bark of ashna (*Terminalia tomentosa*). In either case the process is similar to that described on p. 128, with the substitution of bakul bark, or a mixture of bakul and ashna barks, for those of babla and keund. (No. **11181**, cotton, bakul alone, light brown; No. **11569**, cotton, ashna and bakul, reddish brown.)

CHAIKATH.

16. Piper Chaba (*W. Hunter, Asiatic Researches, IX*, 391)—Nat. Ord. PIPERACEÆ.

Chaikath (wood and roots).

The *wood* and *roots* of this plant are used in Balasor for dyeing. Chaikath by itself gives apparently a pale *brown* (No. **11344**, cotton). Combined in equal proportions with *bakam* (p. 3), it gives a *brownish red* (Nos. **11345** and **12967**, cotton). The specimens referred to were dyed by steeping for half an hour in an infusion prepared by boiling the dye-stuffs for eight hours.

* A specimen of the leaves of the ashatha whose bark is employed in the above process of dyeing was identified by Dr. King as *Pterocarpus Marsupium*, Roxb.: but this was probably forwarded by some mistake, as all the other specimens are *Ficus religiosa*.

17. **Semecarpus Anacardium**, *Linn.*—Nat. Ord. ANACARDIACEÆ. BHALIA.

Bhalia or bhelwah.

This tree, the fruit of which forms the common "marking-nut" is only mentioned as a dye-stuff in the returns from Balasor, Cuttack, and Hazáribágh. In Balasor "it grows in the hill jungles, and its seed is ripe in November and December." (*Cf.* Roxburgh, p. 268, where the seed is said to be ripe in January and February.) In Cuttack "it is produced everywhere, especially in the Gurjats."

The prices of the nuts are given as Rs. 2-8 per maund in Balasor, where it is said to be procurable in only moderate quantities, and Re. 1 per maund in Cuttack (the seer here being 105 tolas), where it is said to be abundant.

The only particulars of its use as a dye come from Balasor and Hazáribágh. The *fruit* is used either alone or with *alum*. The details given are as follows:—

Two jars are put on a brick fire, one over the other; the upper one contains the *bhalia* fruit and has a hole in the bottom. The heat causes a black resinous juice to exude from the bhalia, which runs into the lower jar. The cloth may either be dyed in this black liquid alone, or *oil* may be mixed with the liquid before the cloth is dipped in it. The cloth is then well washed out with water. *Lime-water* must be poured on the cloth to cause it to dry speedily. (Balasor.) (No. 11197, cotton, bhalia and oil, greyish black; and No. 11198, cotton, bhalia alone, greyish black.)

For each square yard of cloth take ¼th seer of *bhelwah* fruit and leave it to soak in ½ seer of water for 3 days. Then strain through a coarse cloth. The material to be dyed is washed well in water, and when half dry is washed again in water in which 1 tola of *alum* has been dissolved. When half dry the cloth is dipped in the dye solution obtained as above and worked well about in it till the required depth of colour is obtained. It is then removed and dried in the sun. When perfectly dry it is washed frequently in fresh water to get rid of the smell of the dye-stuff. (Hazáribágh, No. 11231, cotton, dark grey.)

18. **Shorea robusta**, *Gaertn.*—Nat. Ord. DIPTEROCARPEÆ. SÁL.

Sál.

The *bark* of this well-known forest tree is occasionally used for dyeing purposes. It is only mentioned in this connection from the Chutiá Nágpur sub-division of Lohárdagá, in which the bark of sál is said to yield both *red* and *black* dyes, but no particulars of the processes employed are given, except its use to give a black dye in conjunction with the barks of several other trees, as described under aoula (*Phyllanthus Emblica*, p. 144).

19. **Strychnos Nux-vomica**, *Linn.*—Nat. Ord. LOGANIACEÆ. KUCHLA.

Kuchla or kochla, কুচলা, কোচলা.

The only district in which this is mentioned as a dye-producing plant is Balasor. In the report from this district the plant is said to grow in abundance in the Gurjats jungles, and its *seeds* are used both

KUCHLA.

as a dye-stuff and for medicinal purposes. A kind of oil is also extracted from them, which is exported to Calcutta in considerable quantities. The export of kuchla seed by sea during the five years preceding 1875 is given as 13,568 maunds, valued at Rs. 26,942. In a subsequent report the price is given as Re. 1-4 per maund, but it is doubtful whether this is meant for the price of the seed or of the oil thence extracted.

Three specimens of cotton cloth dyed with kuchla seed have been forwarded from Balasor, the methods of dyeing employed being thus described:—

Mix 31 tolas of *kuchla* seed with 7 tolas of *chunam* and boil the whole well in water for 12 hours: steep the cloth in this infusion for ¼ hour. (No. 11194—very pale *brown*.)

Mix 31 tolas of *kuchla* seed with 7 tolas of *hirakosh* (protosulphate of iron) and 7 tolas of *chunam*, and then treat as in first process. (No. 11195—darker *brown*.)

Mix 31 tolas of *kuchla* seed with 7 tolas of *hirakosh*, and then treat as above. (No. 11196—dirty *brownish black*.)

The following mineral, of extensive use in dyeing, may here be mentioned:—

HIRAKOSH.

20. Protosulphate of iron, or green vitriol.

Hírákosh, हीराकस.

Kasis, كسيس, कसीस.

This mineral is extensively employed in dyeing in Bengal. It is principally employed in producing various shades of *black* with *Terminalia Chebula* (harra), *Phyllanthus Emblica* (aola), and other myrabolans, as described under those dye-stuffs. It is also employed in dyeing black with gab (*Diospyros Embryopteris*, p. 134), and in dyeing brown with kuchla (*Strychnos Nux-vomica*) as above.

It is also used to produce a black or blackish grey with *tairi* pods (*Cæsalpinia Sappan*, p. 3) by a process thus described:—

Pound ½ chittack of *tairi* and put it in a seer of cold water. After 2 or 3 hours rub it well with the palms of both hands. In the same way pound and put in cold water a small bit of *kasis*. Mix the two solutions together and dip the cloth in the resulting liquid. To dye 60 yards of cloth one yard wide 1 seer of tairi and 2 chittacks of kasis are required. (Monghyr, No. 11173, cotton, blackish grey.)

In the Meetapore Jail, Patna, the processes of dyeing woollen yarns black and violet are thus described:—

The woollen yarn is washed in sajimati and dried in the sun. It is then placed in a gurrah with 4 chittacks of *babur* (legumes of *Acacia arabica*), 2 chittacks of *kasis* (protosulphate of iron), and ¼ seer of *goohia babur* (legumes of *Acacia Farnesiana*), and water, and then boiled for 5 hours. The liquid is allowed to cool, when the yarn is removed and washed well with water. The colour is a pucca *black*. (No. 12857.)

For *khutmuly* colour the process is the same as that adopted for dyeing red with lac (see p. 55), except that the yarn is boiled in a solution of *babur* 4lb, *kasis* ½lb, *goohia babur* 8lb, instead of with lodh and huldi. This is a pucca colour. (No. 12858.)

Hirakosh is also used in Midnapur to produce a *yellow* dye by mixing with *lime*. With this dye napkins (গামছা) are coloured. HIRAKOSH.

From Bhágalpur, combinations of *kasis* with the bark of the mango (*Mangifera indica*), with the fruit of tair (*Carissa Carandas*), with singrahar (*Nyctanthes Arbor-tristis*), and with kuth (*Acacia Catechu*), are mentioned as dyes, but no details are given, nor are the colours stated.

The following four dye-stuffs are said to give *green* dyes:—

1. **Baccaurea sapida**, *Müll. Arg.* (Pierardia sapida, *Roxb.*)—Nat. Ord. EUPHORBIACEÆ. LUTCO.

Lutco.
Kalabogati (Paharia); Sumbling-kúng (Lepcha).

"A tree found in Eastern Bengal, and to some extent in the lower hills of the Himalayas. The Lepchas extract a *green* dye from the *leaves*." (Dr. Schlich.)

Gamble states that the *leaves* are used in Northern Bengal and Assam in dyeing (*Manual of Indian Timbers*, p. 355), and that the "*bark* is used by the Lepchas as a mordant in dyeing with manjeet or lac." (*Trees, Shrubs, &c., of Dárjíling*, p. 69). An instance of its use in dyeing with lac will be found described on p. 56.

2. **Hedyotis capitellata**, *Wall.*—Nat. Ord. RUBIACEÆ. BAKRELARA.

Bakrelara (Paharia); Kalhenyok (Lepcha).

"A small climber, common in the Dárjíling Terai and lower hills up to 6,000 feet elevation: yields a *green* dye. The Lepchas grind up the green *leaves* and steep the article to be dyed in the infusion." (Dr. Schlich.)

Mr. Gamble (*Trees, Shrubs, &c., of Dárjíling*, p. 48) says:—"The Paharias also use it, mixed with leaves of *Luculia gratissima*, as a blue dye. It seems to be used more as a mordant than as a regular dye."

3. **Mangifera indica**, *Linn.*—Nat. Ord. ANACARDIACEÆ. AM.

Am, আম, গাছ, আম।
Ambra.

The *bark* of this well-known tree is here and there used in dyeing. Particulars as to its growth and cultivation may be found elsewhere. The Magistrate of Chittagong alone gives particulars. He says—"It is cultivated all over the district. A pit is dug and filled with cowdung, in which the seed is sown in June and July. The cultivation costs nothing, and the profit arising from the sale of the fruit is from As. 4 to Rs. 3 per tree."

The use of the bark of the mango tree in dyeing is only mentioned in the reports from Chittagong, Bhágalpur, Monghyr, and the Chutiá Nágpur sub-division of Lohárdagá. The Magistrate of Chittagong states that "the juice of the bark is obtained by simple beating: it is mixed with *lime*, and a fleeting *green* dye is obtainep."

[illegible] From Bhagalpur it is stated that "the bark is used in dyeing," and a combination of mango bark with *kasis* (protosulphate of iron), is mentioned, but no details are given, nor is the colour stated. In Mongyr it is one of the ingredients used in preparing *pila rang*, from which a bright yellow is obtained (p. 65). In Lohárdagá it is used along with the leaves of several other trees in obtaining a permanent black (*vide* under *Phyllanthus Emblica*, p. 144).

[illegible] 4. **Tagetes patula**, *Linn.*—Nat. Ord. Compositæ.

Genus. [illegible]

The *flowers* of this plant are used in Lohárdagá to give a dull green dye. "The flowers are first freed from the calyx, &c., the petals alone being retained. These are dried in the shade. To 1 seer of dried flowers 5 seers of water are added, and the whole boiled till 2 seers remain: 5 tolas of *alum* are then added. The cloth is steeped in this solution and then dried in the shade: the colour resulting is a *dull green*."

CHAPTER V.

Dye-stuffs used as Mordants or Auxiliaries.

1. Acacia Intsia.
2. Cæsalpinia sp.
3. Carissa Carandas.
4. Cassia Tora.
5. Cinnamomum Tamala.
6. Cordia Myxa.
7. Fagopyrum esculentum.
8. Nardostachys Jatamansi.
9. Phyllanthus Emblica.
10. Punica Granatum.
11. Sarcochlamys pulcherrima.
12. Terminalia Chebula.
13. Terminalia belerica.
14. Terminalia Arjuna.
15. Terminalia tomentosa.
16. Terminalia citrina.
17. Wedelia calendulacea.
18. Woodfordia floribunda.

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19. Amlia.
20. Bambi.
21. Ichi.
22. Jooree.
23. Kalagap.
24. Kanda.
25. Kharula.
26. Porashi.
27. Sood.

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28. Alum.

Amaranthus spinosus.
Guizotia oleifera.
Musa sapientum.
Vitex Negundo.
Achan.
Chakaiphang.
Bambusa Tulda.
Kalai.
Akorjya.
Phulgach.
Imlitgach.

Albizzia Lebbek.
Heritiera Fomes.
Vigna Catiang.
Goolung.
Guloncho.
Kuj or kajri.
Kheeta.

Many of the dye-stuffs mentioned in the preceding chapters are more frequently employed as mordants or auxiliaries in dyeing with other substances than for the colour which they themselves yield. In this chapter we give an account of those dye-stuffs which, employed as mordants or auxiliaries, are rarely, if ever, used as dyes by themselves.

1. **Acacia Intsia**, *Willd.* (Acacia cæsia, *W. and A.*)—Nat. Ord. Leguminosæ. THANTHELANG.

Thanthelang.

The *bark* and *leaves* of this plant are used in the Jalpáigurí district in dyeing with dáruharidrá (*Morinda tinctoria*) and lac (pp. 35, 54). A seedling was forwarded from Jalpáigurí, and was identified by Dr. King as probably *Acacia cæsia*; "but it is impossible to say absolutely, as the seedlings of many allied species are indistinguishable." The leaves are said to contain an acid whose action adds brightness to the colour. If this plant is not procurable, other acids are employed.

THANTHELANG. The leaves are said to be of no use after they have dried. The process followed in dyeing with dáruharidrá is thus described.—

> The wood of *dáruharidrá* is cut into pieces and boiled in water with endi thread. The thread is then dried and boiled in water with the leaves of *thanthelang*. It is again dried, and again boiled in water with *dáruharidrá*. It is then kept wet (with the dáruharidrá solution?) for 6 hours, after which it is dried in the sun and has acquired a *yellow* colour.

The process adopted with lac is not described. It is stated, however, that the colour obtained is not fast. A specimen of endi thread dyed red with lac and thanthelang has been received. (No. **12252.**)

TARL

2. Cæsalpinia sp.—Nat. Ord. Leguminosæ.

Tari, tori, tiree.
Chámárlatí, চামারলতী.

The *legumes* of a plant called tari, tori, or chamarlati in Maldah and Santál Parganás, and tiree in Chittagong, are mentioned as being used in these districts both in dyeing and tanning. From Santál Parganás the tari pods are said to be derived from a "thorny shrub with leaves very much like the babul, but the thorns are like those of a rose tree, and not long spikes, like those of the babul. It grows very plentifully in the Daman, and forms an article of export trade." In Maldah it is described as "a shrub wild in the jungles of Gour." From Chittagong it is described as a "prickly creeper." In Monghyr and other places the bakam tree is called "tairi;" but the descriptions quoted show that these pods are not those of the *Cæsalpinia Sappan*, but probably of another species of *Cæsalpinia*.

These pods are used in Maldah as a mordant in dyeing with manjistha (see p. 48) and in dyeing with bakam (p. 3).

In Chittagong *tiree* pods are used in giving a *black* dye with myrabolans (see pp. 144, 150, 151), and also in tanning (*vide* under Tans).

In the Santál Parganás they are used in tanning, and also "in preparing ink and medicinally, and the native ladies use them in blackening their gums."

KURANJA.

3. Carissa Carandas, *Linn.*—Nat. Ord. Apocynaceæ.

Kuranja or tair, كرنجا, करञ्जा, टेर, ٹیر

The *fruit* of this plant is mentioned as being used in dyeing in Bhágalpur, in which district the plant grows. No particulars are given; it is merely mentioned as being used in dyeing with *kasis* (protosulphate of iron), with *sajimati*, and also with *bakam* and *alum*, but the resulting colours are not stated.

CHAKUNDA.

4. Cassia Tora, *Linn.*—Nat. Ord. Leguminosæ.

Chákundá, চাকুন্দা.

The *seed* of this plant is mentioned as being used in dyeing with indigo in Maldah (p. 124). There is no further mention of its use in dyeing.

5. **Cinnamomum Tamala**, *Nees* (Laurus Cassia, *Roxb.*)—Nat. Ord LAURACEÆ. TAJ.

Taj (bark).

The *bark* of this plant, known as *taj*, is used in Lohárdagá as an auxiliary in dyeing with kamalágundi (*Mallotus philippinensis*, p. 19).

6. **Cordia Myxa**, *Linn.*—Nat. Ord. BORAGINEÆ. BOHARI.

Bohari.

The green *leaves* of this plant are mentioned as being used in dyeing with hardi (*Morinda tinctoria*) in Dárjilíng (see p. 35). There is no other mention of their use in dyeing.

7. **Fagopyrum esculentum**, *Mœnch.* (Polygonum Fagopyrum, *Linn.*).—Nat. Ord. POLYGONACEÆ. TITAPHAPUR.

Titaphapur.

A specimen of woollen yarn dyed a light purple by *titaphapur* (buckwheat) and *manjistha* has been received from Dárjíling, but no particulars are given, p. 49. (No. **10693.**) A specimen of the plant forwarded was identified by Mr. Brace as *Fagopyrum esculentum*.

8. **Nardostachys Jatamansi**, *DC.*—Nat. Ord. VALERIANEÆ. JATAMANSI.

Jatámansi.

The *root-stock* of this plant is used in Lohárdagá as an auxiliary in dyeing with kamalágundi (*Mallotus philippinensis*, p. 19).

9. **Phyllanthus Emblica**, *Linn.*—Nat. Ord. EUPHORBIACEÆ. AMLA.

Amla or anla, আমলা, আমলা (Behar, Rájsháhi, Chutiá Nágpur).
Aunlah or yeonlah (Balasor and Hazáribágh).
Awulah, aoula, or aola (Lohárdagá, Cuttack).
Amlaki (Bardwán, Chittagong, Orissa).

This tree seems to be found in most parts of Bengal, although definite reference to it is made in the returns from only a few districts. In Chittagong "it grows in the hills;" it is mentioned as being found in the jungles in Bhágalpur and the Santál Párganás; "it grows in the hill jungles" in Balasor; it is found plentifully in Cuttack, Palámau, and Mánbhum.

The *fruit*, *bark*, and *leaves* of this tree are used in dyeing and tanning. The nuts ripen and are gathered from November to January, whilst the bark is cut as required at any time of the year.

The prices given for the nuts are—

Chittagong	...	...	Rs. 5 per maund.
Balasor	...	...	„ 4 „ „
Cuttack	...	...	„ 2 „ „ (1 anna per seer of 105 tolas.)
Chutiá Nágpur (Lohárdága)	...		„ 5 „ „ (Bark, leaves, or fruit?)

AMLA.

Dr. Schlich, Conservator of Forests, states that "the fruit is estimated to be worth Rs. 2 per maund," which is considerably less than the average of the prices just given. In a report from the Bengal Forest Department, referred to in Mr. Liotard's Memorandum, page 20, the prices given are As. 4 per maund in Kurseong and Rs. 2 to Rs. 2-8 in Chittagong.

The fruit of this tree is included, under the general name "myrabolans," with those of the various species of *Terminalia* hereafter considered, being known as "Emblic myrabolans," and is used pretty much as the other varieties of myrabolans, viz. *Terminalia Chebula* and *Terminalia belerica*, in dyeing and tanning. The dye from the fruit is a *blackish grey*, and is extracted by crushing and boiling the fruit in hot water.

It is also employed to give a *blackish grey* dye with the protosulphate of iron, as described in the following account from Cuttack:—

> Prepare an infusion of the fruit of *aola*: steep the material to be dyed in this for some time, then wring out the cloth and dry it. Add to the infusion of aola a small quantity of *hirakosh* (protosulphate of iron), and again steep the cloth in the infusion. Wring out and dry it. Then wash the cloth in water, to which *limes* or *tamarinds* have been added, and afterwards again dry it. To dye 60 yards of cloth 1 yard wide, 5 or 6 seers of aola, 1¼ seers of hirakosh, and 400 limes are required. (Cuttack, No. 11955, cotton, blackish grey.)

The fruit is also employed instead of either of the other two varieties of myrabolans in Chittagong to give a *black* dye along with *tiree* pods, as described under *Terminalia Chebula* and *Terminalia belerica*, *q. v.*

The use of the *bark* for dyeing purposes is only mentioned from the Chutiá Nagpur sub-division of Lohárdagá, as follows:—

> Take 2 chittack of the barks of aoula, am (*Mangifera indica*), bur (*Ficus religiosa*), mahooa (*Bassia latifolia*), jamoon (*Eugenia Jambolana*), sál (*Shorea robusta*), kuchnar (*Bauhinia variegata*), and goolur (*Ficus glomerata*), all reduced to powder, and boil the mixture in 4 seers of water till 2 seers remain. Filter and steep the cloth in the liquid several times and dry in the shade. Keep the cloth afterwards in contact with clay for three days, and then wash it well. The result is a pucca *black*.

From the same district the "bark, leaves, and fruit" are said to be used to produce both *black and purple* dyes, but no further particulars are given.

ANAR.

10. Punica Granatum, *Linn.*—Nat. Ord. LYTHRACEÆ.

Anar.

No particulars have been received as to the growth of this plant. The *fruit-rind* is but rarely employed in dyeing in Bengal. The only mention of its use as a dye by itself is from Sáran, as follows:—

> Anar-ka-chilka, or broken pieces of the pomegranate bark (fruit-rind ?), are boiled in hot water for half an hour or more, and the infusion is then strained and is ready for use. Cloths steeped in it acquire a *yellow* colour. (No. 6718, cotton, yellow; No. 11218, cotton, light brown.)

In this description the *bark* is said to be used, but the specimen forwarded as *anar-ka-chilka* is the *fruit-rind* and not the bark. ANAR.

The fruit-rind is used in Hazáribágh as an auxiliary in dyeing with bahera (*Terminalia belerica*), as described on p. 151.

In the two following cases the *bark* is said to be used. This may, as in the case above mentioned, be a mistake for *fruit-rind*; but, as no specimens were forwarded, it is impossible to say.

The *bark* of pomegranate is used as an auxiliary in dyeing with amultas (*Cassia Fistula*, p. 66) in Chutiá Nágpur (Lohárdagá), as follows:—

> If the bark of amultas (*Cassia Fistula*) be boiled, and *alum* be added in the proportion of 2 tolas alum to 2 chittacks amultas, a light red dye is obtained. If to this the bark (fruit-rind?) of pomegranate be added, a *deep red* results.

Pomegranate bark is also one of many ingredients used in Monghyr to produce a bright yellow. (No. **11063.**) (*Vide* p. 85.)

11. **Sarcochlamys pulcherrima**, *Gaudich.*—Nat. Ord. URTICACEÆ. DAGGAL.

Daggal.

The *leaves* of daggal are used in the Garo Hills in dyeing with chengrung! (*Morinda angustifolia*, p. 39). In Mr. Liotard's Memorandum, pp. 127, viii, the leaves and twigs of *dagal* or *dogal* are said to be used in Assam in dyeing brown with the bark of *Albizzia odoratissima*. Its scientific name is there given as *Sarcochlamys pulcherrima*, and this is assumed to be the same.

12. **Terminalia Chebula**, *Retz.*—Nat. Ord. COMBRETACEÆ. HARRA.

Harra or hurree, হরড়া, হরড় (Orissa, Chutiá Nágpur, Behar).
Harítaki, হরীতকী, or hartaki, হরতকী (Western, Central, and Eastern districts, Orissa, Chutiá Nágpur).
Harida (Cuttack).
Kasan (Jalpáigurí).
Silikha (Assam).

From Hazáribágh and the Chutiá Nágpur sub-division of Lohárdagá we are told that the *unripe* fruit is called *jeongi harra*, and the *ripe* fruit simply *harra;* whilst from Palámau the Assistant Commissioner reports that "when the fruit ripens prematurely and falls, it is called *chotki* (or small) *harra:* when it attains its full size and ripens on the tree and is picked, it is called *burki* (or large) *harra.*"

Growth.

According to a report from the Bengal Forest Department quoted in Mr. Liotard's Memorandum, the tree "is common only in Palámau and Hazáribágh. Trees are also not uncommon in the Kurseong and Teesta divisions, and a few are found in Jalpáigurí and Buxa." But the information before us would seem to show that it is found in greater or less quantity all over Bengal. It is mentioned as being found in the jungles in Midnapur, Rájsháhí, Sántál Parganás, and Mánbhúm. In Chittagong "the trees grow wild on the hills." In Monghyr "it is found

in some quantity in the Kharakpore hills." In Balasor "it grows wild in the hill territories to the west of the district." In Cuttack "it grows everywhere in abundance." In Palámau "it is one of the commonest jungle trees." It seems, however, to be nowhere cultivated, the nuts being collected from trees growing spontaneously in the jungle. These are ripe for gathering at various times from November to January.

HARRA. The following are the prices given for the dried fruit (myrabolans) in various districts:—

	Rs.	A.		
Midnapur	2	8	per maund.	
Rájsháhi	3	0	„	
Chittagong	5	0	„	
Monghyr	2	8	„	
Cuttack ... about	2	0	„	(1 anna per seer of 105 tolas).
Chutiá Nágpur (Lohárdagá)	5	0	„	(jeonghi harra).
	1	4	„	(harra).
Palámau	3	8 to Rs. 5	per maund.	

In the report from the Bengal Forest Department, quoted above, the prices are given as annas 10-8 per maund in Palámau, annas 4 per maund in Kurseong, and in Chittagong Rs. 2-8 per maund, which differ considerably from the above figures.

Trade. From many of the districts the myrabolans are exported to Calcutta, more especially from Orissa. The quantity exported by sea from the Balasor district to Calcutta during the five years preceding 1875 is estimated at 804 maunds, valued at Rs. 1,359. From Palámau there seems to be a considerable export to Benáres and Behar. The total produce of this district during the five years preceding 1875 is given as 5,000 maunds, of which from 2,000 to 3,000 are said to have been exported to those markets.

The following tables give the exports and imports of myrabolans from the year 1875-76. In this name are included the fruit of *Phyllanthus Emblica*, *Terminalia belerica*, and other species of *Terminalia* in addition to *Terminalia Chebula*. Myrabolans are free from duty on export. Up to 5th August, 1875, imported myrabolans were subject to a duty of 7½ per cent, then reduced to 5 per cent, and removed altogether from the 9th March, 1882.

Year.	India.		Bengal.		Bombay.		Madras.		Sindh.		Countries to which exported.	Quantity.	Value.
	Quantity.	Value.	Quantity.	Value	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.			
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.		Cwt.	Rs.
1875-76 ...	286,350	10,64,013	12,525	40,908	153,910	6,57,665	119,915	3,65,440	.....	.....	United Kingdom	283,297	10,51,952
											Austria	264	1,296
											Italy	300	1,256
											Straits Settlements ...	2,171	8,052
											Other countries	318	1,457
1876-77 ...	361,217	13,58,225	25,786	75,417	150,172	6,97,886	185,259	5,84,922	.....	.....	United Kingdom	359,193	13,50,001
											France	615	2,630
											Straits Settlements ...	1,031	2,813
											Other countries	388	1,781
1877-78 ...	537,055	23,05,265	108,682	3,75,027	168,886	9,04,758	259,487	10,25,480	.....	.....	United Kingdom	533,287	22,84,966
											Italy	1,013	3,626
											United States	2,484	15,344
											Other countries	271	1,329
1878-79 ...	541,346	23,45,740	26,659	1,01,981	165,329	8,83,924	349,354	13,59,810	4	25	United Kingdom	526,607	22,94,923
											France	653	2,330
											United States	12,961	43,684
											China—Hong-Kong ...	151	604
											,, Treaty Ports ...	402	1,615
											Other countries	572	2,584
1879-80 ...	354,977	15,80,818	27,565	83,859	271,289	12,99,297	56,114	197,571	9	91	United Kingdom	342,397	15,26,806
											Holland	949	2,847
											United States	5,129	15,671
											China—Hong-Kong ...	114	316
											,, Treaty Ports ...	5,625	31,666
											Straits Settlements ...	295	1,376
											Other countries	468	2,136
1880-81 ...	315,628	12,37,067	12,269	35,565	196,567	8,64,968	106,792	3,36,654	.....	.....	United Kingdom	308,781	12,12,761
											France	2,750	10,988
											Germany	331	1,389
											United States	2,897	8,690
											Other countries	869	3,259
1881-82 ...	391,566	14,44,925	7,560	19,777	241,775	10,12,320	142,014	4,11,960	217	868	United Kingdom	386,182	14,24,948
											Germany	1,239	4,955
											China—Hong-Kong ...	1,069	2,911
											,, Treaty Ports ...	784	3,138
											Australia	1,966	7,616
											Other countries	326	1,357

Imports of Myrabolans.

Year.	India		Madras.		Bombay.		British Burmah.		Countries whence imported.	Quantity.	Value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.			
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.		Cwt.	Rs.
1875-76 ...	1,381	5,828	1,381	5,828	.....	.....	.....	.....	United Kingdom	.....	2
									Ceylon	1,381	5,826
1876-77 ...	1,223	4,381	1,223	4,381	.....	.....	.....	.....	Ceylon	1,223	4,381
1877-78 ...	747	4,342	746	4,336	1	6	.....	.....	Ceylon	746	4,336
									Straits Settlements	1	6
1878-79 ...	3,068	12,038	3,068	12,038	.....	.....	.....	.....	Ceylon	3,068	12,038
1879-80 ...	251	905	200	620	.....	.....	31	285	Ceylon	200	620
									Straits Settlements	31	285
1880-81 ...	473	1,038	468	1,019	5	19	.....	.....	Ceylon	473	1,038
1881-82 ...	1,940	7,496	1,874	7,181	66	315	.....	.....	Ceylon	1,940	7,496

Harra is occasionally, but very rarely, used as a dye by itself.

Use in dyeing.

The rind of the fruit is pounded and steeped in water, and the cloth simply dipped in this infusion, acquiring a *dirty grey* colour.

Balfour says:—"The *fruit* and *galls* are used by dyers and harness-makers. With alum they give a durable *yellow*, with ferruginous mud an excellent *black*, and they make useful ink." This apparently sufficiently describes its use in Bengal as a dye, as from many districts the only information received on this head consists in quoting the above passage from Balfour's Cyclopædia.

Both the *fruit* and the *galls* found on the leaves are mentioned as being employed with alum to give a good permanent *yellow*.

But the most extensive use to which harra is put as a dye is in the production of various shades of black in combination with some salt of iron, generally the protosulphate called in the vernacular *kasis* or *hirakosh*. The property which tannin or tannic acid possesses of producing a black precipitate with salts of iron is that upon which the preparation of ordinary ink depends; and harra is extensively employed in Bengal for that purpose. The same property is taken advantage of to make a *black* dye. The process is described as follows:—

The *burki* (or large) *harra* is preferred for dyeing purposes. The fruit is pounded and the stone or kernel extracted. This is then boiled in chatties. After cooling, the cloth to be dyed is soaked in the liquid, and afterwards in a solution of *kasis* (protosulphate of iron) in water. The colour of the harra solution itself is a dirty green, which the sulphate of iron turns *black*. The density of the black depends on the strength of the solution of protosulphate of iron. (Palámau.)

Both the unripe fruit (*jeonghi harra*) and the ripe fruit (*harra*) yield a black dye with *protosulphate of iron*, but the unripe fruit is preferred. (Chutiá Nágpur sub-division of Lohárdagá.)

Prepare an infusion of *harra* and steep in it the cloth to be dyed, and boil the whole. Then withdraw the cloth, and after it has cooled scatter over it *iron dust* or filings, and press this well in until the cloth becomes *black*. Then boil it again for a short time, and on cooling wash it in cold water and allow it to dry. For a piece of cloth 1 seer in weight 6 chittacks of best harra, 4 chittacks of iron dust, and a quantity of water sufficient for the complete immersion of the cloth, are required. (No. 11550, cotton, Cuttack.)

(Nos. 12187, 12193, silk yarn, and 12192, cotton yarn, have also been dyed with *haritoki* and *iron filings* by a Calcutta native dyer.)

Sometimes *goor* or molasses is employed in addition to harra and protosulphate of iron:—

Cotton is dyed black by boiling it in a solution of *iron*, *goor*, and powdered *haritoki*. (Maldah.)

In Rájsháhí a little *indigo* is added to the protosulphate of iron to deepen the resulting black:—

12 chittacks of *haritoki* are boiled in 30 seers of water till 10 seers remain, and then the solution is allowed to cool. The prepared (?) thread is saturated with this solution and dried. 2 chittacks of *sulphate* of *iron* and 2 tolas weight of *indigo* dye are then mixed together, and the thread soaked twice in this and dried. (Rájsháhí.)

HARRA.

In Dacca a deep black is obtained by using *gab*, the dried fruit of *Diospyros Embryopteris*, in combination with harra and protosulphate of iron, as described under gab, p. 135. In Chutiá Nágpur (Lohárdagá) a dark neutral tint, called *kakraiza*, is obtained from harra, protosulphate of iron, and safflower (*Carthamus tinctorius*, p. 17).

In Chittagong haritoki and *tiree* pods (Cæsalpinia sp. ?) are used to produce a *black* dye—

> The fruit of *haritoki* is steeped in water for 7 days along with some pods called *tiree* (p. 142), which are obtained from a prickly creeper of that name in the jungles here, and the whole is boiled. A semi-permanent *black* dye is obtained. (Chittagong.)

Harra and the protosulphate of iron, with or without goor, are also used to produce a *khaki* or iron-grey colour, although it is not quite clear in what the process differs from that employed to produce *black* as above :—

> Cotton is dyed a *khaki* colour by boiling it in a solution of *iron, goor*, and powdered *haritoki* three or four times. (If boiled only once, the resulting colour is black as above ?) (Maldah.)

> Khaki or earth dye is prepared from *harra* and *kasis* (protosulphate of iron), by boiling the ingredients together. (Monghyr.)

Harra is also employed as a mordant, or accessory to concentrate the colour, with safflower (*Carthamus tinctorius*, p. 16), ál (*Morinda tinctoria*, p. 33), manjeet (*Rubia cordifolia*, p. 48), huldi (*Curcuma longa*, p. 86), and tesu (*Butea frondosa*, p. 74).

BAHARA.

13. Terminalia belerica, *Roxb.*—Nat. Ord. COMBRETACEÆ.

Bahará, bahera, or baharra, বহড়া, বাহাড়া, ବାହାଡ଼ା, [illegible], बहड़ा.

Growth.

According to the statement quoted under *Terminalia Chebula* from Mr. Liotard's Memorandum, this species of *Terminalia* is common in almost all the Bengal forests, much more so than *Terminalia Chebula*. This statement is, however, not borne out by the information received, as it is only mentioned in the returns from one or two districts. It is mentioned as "growing wild in the hills" in the Chittagong Division: it is mentioned also as a jungle product in Bhágalpur, Santál Parganás, and Mánbhúm. In the Orissa Division it is said to be produced everywhere in abundance in Cuttack, and to grow wild in the hill territories to the west of the Balasor district. The *fruit* of this species seems to yield an inferior kind of myrabolan. The nuts are ripe for gathering at various times from November to January. In the returns it is frequently confounded with *Terminalia Chebula*, and from some places the same price is given for both, though this is most likely a mistake. The prices given are—

Chittagong	... Rs. 5	per maund	(same price as *T. Chebula*.)
Cuttack ...	about Rs. 2	„ „	(ditto ditto.)
Chutiá Nágpur	... Re. 1-4	„ „	(same price as the inferior kind of harra).
Mánbhúm ...	Re. 1 to Rs. 2	„ „	

In the report from the Bengal Forest Department above referred to, the prices given are Re. 1 per maund in Chittagong and As. 3 per maund in the Terai.

BAHARA.

In Chittagong "the entire produce is absorbed locally:" from the Santál Parganás most is exported to Calcutta: from Cuttack it is exported to Calcutta and other places: from Balasor also exported to Calcutta, the export by sea during the five years preceding 1875 being estimated at 12,491 maunds, valued at Rs. 12,794: from Mánbhúm it is said to be exported into the Bánkurá district.

Bahera is used as a dye-stuff in the same way as harra. It is used as a dye by itself by pounding the nut and steeping it in hot water. The specimen of cotton cloth, No. **11349**, in the Economic Museum from the Balasor district was coloured by "steeping it for half an hour in an infusion prepared by boiling the nut of bahera for eight hours." The resulting colour is a snuffy *yellow* or *brown*.

In the Chutiá Nágpur sub-division of Lohárdagá the nut is boiled with *sajimati*, and yields a similar *brown* or *snuff* colour.

Bahera is also employed, like harra, to obtain a *black* with proto-sulphate of iron.

It is also sometimes substituted for *harra* in Chittagong in the process described above for obtaining a *black* dye with *tiree* pods.

The following detailed description of the method employed in Hazáribágh to dye with bahera has been received from that district:—

> For each square yard of cloth take ¼ seer of *bahera* nuts. Extract and throw away the stones, and break the rind into as small pieces as possible. Put these into a seer of water along with a tola weight of *pomegranate rind*. Leave the whole to stand for one night. Then boil the infusion, allowing it to boil over three times. Then allow it to cool, and strain through a coarse cloth. Wash the cloth to be dyed well in water. When half dry, wash again in water, in which a tola of *alum* has been previously dissolved. Then dip the cloth in the dye solution, working it about well so as to make the colour uniform. When the colour is deep enough, dry the cloth in the sun, and afterwards wash frequently in clear water so as to get rid of the smell of the dye. The resulting colour is a snuffy yellow. (Hazáribágh, No. **11232**, cotton.)

The bahera nuts are also used as mordants instead of harra in dyeing with madder or manjeet (*vide* p. 48).

ARJUN.

14. Terminalia Arjuna, *Bedd.*—Nat. Ord. COMBRETACEÆ.

Arjun, অর্জুন.

The only information regarding the use of this tree for dyeing purposes comes from Midnapur, in which district *Terminalia Arjuna* is found in the jungles. A specimen of cotton cloth dyed a light brown with arjun *bark* has been received from this district, the method employed being the same as that described on p. 128 with the substitution of bark of arjun for that of babla. (No. **11179**.)

The bark is also employed in preparing a *black* dye, along with garán (*Ceriops Roxburghiana*) and babla (*Acacia arabica*), as described under babla (*vide* p. 128).

The price of the bark is given as 3 annas per seer.

ASAN.

15. Terminalia tomentosa, *Bedd.*—Nat. Ord. COMBRETACEÆ.

Asan, ashna, অসন, আশন.

This tree is mentioned as a jungle product in the returns from

ASAN. Midnapur, Bánkurá, Balasor, Cuttack, Santál Parganás, and the several districts of Chutiá Nágpur. In Balasor it is mentioned as being found wild along with various other dye-producing trees in the hill territories to the west of the district. From the latter district the bark is said to be exported to Calcutta.

The *bark* of asan is used occasionally, but very rarely, as a dye-stuff. The bark is broken up and boiled in water to extract the dye. The resulting colour is *brown* or *buff*. The specimen No. **11348** in the Economic Museum from Balasor was dyed by steeping the cotton cloth for half an hour in an infusion prepared by boiling the bark of asan for 8 hours.

The bark of ashna is used in the Midnapur district to produce a reddish dye, along with the bark of bakul (*Mimusops Elengi*), which is used in colouring gunny-bags. The method employed is similar to that described on p. 128, with the substitution of a mixture of the barks of ashna and bakul for those of keund and babla. (No. **11569**, cotton, brownish red.)

A mixture of the barks of asan and porashi (p. 154) is said to produce a very good red dye in favour with tanners. The red leather-shoes worn by the common people owe their colour to this dye. (Mánbhúm.)

HARRA. 16. Terminalia citrina, *Roxb.*—Nat. Ord. COMBRETACEÆ.

Harra.

The fruit of this tree, resembling that of *Terminalia Chebula*, is, no doubt, frequently confounded with it, but the only special mention of its use is as a mordant in dyeing with ál in Monghyr. (See p. 33.)

KESRAJ. 17. Wedelia calendulacea, *Less.* (Verbesina calendulacea, *Roxb.*)—Nat. Ord. COMPOSITÆ.

Kesraj.

"The root of this plant is pounded, and gives a *black* dye with salts of iron." (Lohárdagá.)

DHAO. 18. Woodfordia floribunda, *Salisb.* (Grislea tomentosa, *Roxb.*)—Nat. Ord. LYTHRACEÆ.

Dawai, dhawayi, dawa, dhowa, dhao.
Dhadki.
Dhan, dhainti, धातकी।

This plant, which is very little used as a dye, grows wild in the jungles in most parts of Bengal, being in several districts of Chutiá Nágpur the commonest of the jungle plants. It is nowhere cultivated, as it grows wild in more than sufficient quantity to meet the very limited uses to which its parts are put as a dye (flowers), a tan (flowers and leaves), and for the preparation of a cooling drink. The plant flowers at various periods from February to April. The flowers are picked and dried in these months, and, in districts where the leaves are used as a tan, these are gathered and dried in the autumn.

The plant being everywhere a jungle product, the cost of production is merely that of the labour of collecting the flowers. DHAO.

No particulars of the produce of any district have been received except from Palámau in Lohárdagá, the Assistant Commissioner of which states that the Garhwa mahajans estimate the annual produce in the sub-division at 200 maunds of the dried flower, about 100 maunds of which is exported to Gayá, Patná, and Benáres.

The price of the dried flowers is given as—

Palámau, from Rs. 3-8 to Rs. 4 per maund.
Mánbhúm, „ As. 4 to Re. 1 „ „
Húglí, Rs. 5 per maund.
Cuttack, one anna per seer of 105 tolas, equivalent to less than Rs. 2 per maund.

The discrepancy between these prices, especially for neighbouring districts like Mánbhúm and Palámau, may possibly be explained by the following extract from a letter from the District Superintendent of Police, Mánbhúm, dated August, 1877:—"The season for collecting dhadki is over, and but small stocks are kept. Such as is exported is despatched in April and May, and very little is retained for home consumption. Any quantity might be procured at extremely low prices in the season, which is January and February." It is probable, then, that the lower prices given above apply to the period of the year when the dhadki flower has just been collected; the higher prices, to periods when there is scarcely any to be had.

This plant seems to be rarely used as a dye by itself, less rarely as a subsidiary in dyeing with ál (*Morinda tinctoria*), under which the process is described (p. 33). In Palámau in Lohárdagá, where it seems to grow most plentifully, it is stated not to be used as a dye, but as a cooling drink, the method of preparing which is not given. From this district there is a large export to Gayá, Patná, and Benáres, probably for use as a subsidiary in dyeing with ál, although the Assistant Commissioner of Palámau states that it is exported to these places not for use as a dye. The leaves and flowers seem to be pretty widely used as a tan (p. 161).

Where used as a dye by itself, the *flowers* are either boiled in water or else steeped for a considerable time in cold (? Mánbhúm) or hot water. To the solution thus prepared *alum* (or *lime* and *alum*) is added as a mordant, and the material to be dyed is immersed in this solution several times until a pink colour of the required depth is obtained.

The scientific names of the following are unknown:—

19. Amlia, আমলিয়া.

AMLIA.

Found wild in the jungles of the Dárjíling Terai, used by the Meches in dyeing silk thread red (p. 55). "The thread is first mixed with amlia (leaves?), and these are boiled together for some time. The thread is then dried and coloured with lac-dye, and then mixed with the leaves of *bhauri* (*Symplocos theæfolia*) and again boiled. When dry, it is a deep *red*." Specimens of stem, leaves, and seeds

AMLIA. have been forwarded, but these have not been found sufficient for identification. Dr. Watt says it is probably either a species of *Hibiscus* or of *Abutilon*.

BAMBI. ## 20. Bambi.

The *leaves* of this plant are used in the Garo Hills in dyeing with chengrung (*Morinda angustifolia*, p. 39).

ICHI. ## 21. Ichi (Chukma) or ichki (Bengali).

A tree found in the Chittagong Hill Tracts, the seeds of which (ichi-bichi or ichki-bichi) are used in dyeing with indigo (see p. 124). From the specimen of seed forwarded, it would seem to be probably a *Cassia* (Dr. Watt.)

JOOREE. ## 22. Jooree.

An imported dye-stuff used in Chittagong in dyeing with *gach-huldi* (p. 91). It may be *lac*, which is called in the Eastern districts *jhuri*, but the colour does not seem to suit this supposition. Dr. Watt suggests that this is probably *Jasminum humile*, a native name of which is *jauri*, and which gives a good yellow die.

KALAGAP. ## 23. Kalagap.

A tree found in the Chittagong Hill Tracts, the *bark* of which is used in dyeing with indigo (see pp. 124, 125). A reference to it will be found in Lewin's "Hill Tracts of Chittagong," pp. 119, 122.

KANDA. ## 24. Kanda?

The *fruit* of this plant is mentioned by Dr. Schlich as being used in dyeing yellow with gyong (*Symplocos spicata?* p. 89).

KHARULA. ## 25. Kharula.

The *bark* of this tree is used in Chittagong in dyeing with rung-gach (pp. 40, 41).

PORASHI. ## 26. Porashi.

The *bark* of porashi gives a dye, obtained by boiling it in water, but the colour is not stated (Mánbhúm.) "An admixture of the barks of porashi and asan (*Terminalia tomentosa*, p. 152) produces a very good *red* dye, in favour with tanners. The red leather shoes worn by the people owe their colour to this dye." This cannot be parás (*Butea frondosa*), as parás is mentioned separately in the same list. It may, however, be *Thespesia populnea*, of which *parash* is given by Mr. Gamble as one of the vernacular names.

SOOD. ## 27. Sood.

The *bark* of this tree is used in the Santál Parganás in dyeing with ál, p. 35.

We may mention here—

28. Alum. ALUM.

Phitkiri or phitkárí, ফিটকারী।

This, the double sulplate of aluminium and potassium, is of almost universal use in dyeing operations, as will be seen in the preceding pages, but no special information regarding it has been received.

Alkalis and acids—The *alkalis* required in dyeing are supplied in Bengal generally either from sajimati (সাজিমাটী), an impure mixture of the carbonates of soda and potash, or from the ashes of various plants. Those specially mentioned are as follows :— SAJIMATI.

Amaranthus spinosus, *Willd.*—Nat. Ord. AMARANTACEÆ. KANTANATE.

Kántánaté.

The ashes of the burnt wood of this plant are used in Cuttack in dyeing with kamlágundi (*Mallotus philippinensis*), *vide* p. 19. There is no other mention of its use in dyeing.

Guizotia oleifera, *DC.* (Verbesina sativa, *Roxb*).—Nat. Ord. COMPOSITÆ. SIRGOOJA.

Sirgooja.

Ashes of sirgooja used in Lohardagá in preparing thread for dyeing with chyli (*Morinda tinctoria*, p. 31).

Musa sapientum, *Willd.*—Nat. Ord. MUSACEÆ. PLANTAIN.

The ashes of the leaves, bark, or fruit-rind of the plantain are universally employed in many dyeing processes in Bengal.

Vitex Negundo, *Linn.*—Nat. Ord. VERBENACEÆ. NISHINDA.

Nishinda.

Ashes of the leaves used in dyeing with kamalágundi in Bírbhúm (p. 19.)

Achan. ACHAN.

Ashes of burnt wood of this plant used in dyeing with achhu in Tipperah, p. 35.

Chakaiphang. CHAKAIPHANG.

Ashes of roots of this plant used in dyeing with achhu in Tipperah (p. 35).

The ashes of various species of bamboo, known as *mritinga* (*Bambusa Tulda*, Roxb.), *kalai*, and *akorjya*, respectively, and of the *mustard plant*, are used in Chittagong in dyeing with rung-gach and indigo (pp. 40, 125); also the ashes of *phulgach* and of the young shoots of *imlitgach*. *Akorjya* is obviously the same as *aworja*, mentioned in

Lewin's "Hill Tracts of Chittagong," p. 130, where also the *kalai* bamboo is mentioned. Of these and other kinds of bamboo mentioned by Lewin, Gamble remarks that their species has not yet been definitely settled (*Manual of Indian Timbers*, p. 431). *Phulgach* is the *fool* of Lewin, p. 122, the ashes of which he states are used in dyeing with *kalagap* (p. 154). *Imlitgach* may probably be *Tamarindus indica*.

ACIDS. The *acids* employed in dyeing in Bengal are generally those prepared from the fruits of the lime or lemon, or of the tamarind. The leaves of thanthelang (*Acacia Intsia*) are also said to be used on account of an acid contained in them (p. 141).

Of the following dye-stuffs mention is made in the returns, or else specimens have been received, but no particulars as to their use in dyeing are given :—

CHAMAI. **Albizzia Lebbek**, *Benth.*—Nat. Ord. LEGUMINOSÆ.

Chamái, চমাই, chámai, চামই, or chámárkasá, চামারকশা.

The *bark* of this plant is mentioned as a dye-stuff found in the jungles of Midnapur, and selling at 2 annas per seer. No further information is given. Gamble gives *chamar kas* as the Panjáb name of *Phyllanthus nepalensis*, but Dr. Watt identified the bark and fruit sent up as *Albizzia Lebbek*.

SUNDAREE. **Heritiera Fomes**, *Buch.*—Nat. Ord. STERCULIACEÆ.

Sundaree, সুদঁরি.

A specimen of the *bark* has been forwarded from Nadiyá as a dye-stuff, but without any particulars.

SHIM. **Vigna Catiang**, *Endl.*—Nat. Ord. LEGUMINOSÆ.

Shim or chim, শিম, ছিম.

The *leaves* of the ordinary bean of the country are mentioned in a list of dye-stuffs used in the Rájsháhí Division, and a specimen of these leaves has also been forwarded as a dye-stuff from Jalpáigurí ; but in neither case are any particulars given.

GOOLUNG. **Goolung.**

The *bark* of this is mentioned as being used as a dye-stuff in the Santál Parganás. The dye is extracted by steeping it in hot water, but the colour is not stated. The bark is said to be exported to Calcutta.

GULONCHO. **Guloncho.**

A specimen of the *bark* of this has been received as a dye-stuff from the Presidency Division, but no particulars are given. Gamble gives *gulancha* as the Bengali name of *Tinospora cordifolia*, Miers; but Dr. Watt thinks the specimen sent is probably a species of *Vitis*.

KUJ. **Kuj or kajri.**

The *bark* is mentioned in a list of dye-stuffs in use in Mánbhúm. A specimen of bark forwarded seems to be a *Morinda* (Dr. Watt).

KHEETA. **Kheeta.**

The *fruit* is mentioned in a list of dye-stuffs in use in Mánbhúm. Gamble gives *keeta* as the Kol name of *Phœnix acaulis*, Roxb.

CHAPTER VI.

Tans and Tanning in Bengal.

In the circular letter from the Government of Bengal to the Commissioners of the various Divisions, instituting the enquiries upon which this report is based, it was requested that "such information as may be available on the subject of tans of Indian production may also be furnished." The information received from the various districts in accordance with these instructions is, however, exceedingly fragmentary and incomplete, and it is impossible now to take steps to supplement it without unduly delaying this Report, already sadly behind time for the reasons explained in the Preface. This fragmentary information is therefore here entered; but it must be understood that it does not profess to be a complete account of the methods of tanning and dyeing leather practised by the moochis and chamars of Bengal, nor anything more than a collection of the fragmentary statements contained in the letters from which this report is compiled. We shall first give a list of all the substances mentioned as being employed in tanning operations, and then a general account of the methods of tanning and dyeing leather, as far as can be gathered from the returns.

A.—List of Tans and Tanning Agents, employed in Tanning and Colouring Hides and Skins by the Native Tanners of Bengal.

Most of these are also used in dyeing fabrics, and a detailed account of their growth, cultivation, &c., will be found in the preceding part of this volume. It must be understood that the substances mentioned below are not all tans proper, *i.e.*, substances containing tannin or tannic acid, which, by combining with the gelatin of the skins, converts them into leather. Some are used in the process of tanning for other purposes.

1. Acacia arabica, *Willd.* (*p.* 127).—Nat. Ord. Leguminosæ.

The *bark* of this tree is extensively used as a tan everywhere in Bengal, being here, as in the rest of India, generally the cheapest and most effective tanning agent.

The *legumes* of babul are less frequently employed (Midnapur, Rájsháhí, Santál Parganás), and the *leaves* more rarely still (Midnapur).

The methods of preparing the tanning solution from these will be found described in the second section of this chapter.

Leather tanned with babul is of a *buff* colour.

2. Acacia Catechu, *Willd.* (*p.* 129).—Nat. Ord. Leguminosæ.

Kuth, the astringent extract of the wood of this tree, is used occasionally as a tanning agent (Purniah).

The *bark* of this tree is also used as a tan (Bhágalpur, Gayá).

3. **Acacia Farnesiana**, *Willd.* (*p.* 128)—Nat. Ord. Leguminosæ.

Bark employed as a tan in Dacca and Faridpur.

4. **Bassia latifolia**, *Roxb.* (*p.* 133).—Nat. Ord. Sapotaceæ.

The *bark* of mohwa used as a tan in Bardwán; *leaves* in Dinapur. Mahoria leaves are used in Shahabad; mahora leaves in Muzaffarpur. These are probably the same.

5. **Bixa Orellana**, *Linn.* (*p.* 70).—Nat. Ord. Bixineæ.

Rungphul is mentioned in a list of tans used in Mánbhúm, but it is not stated what part of the plant is used: probably the *fruit*.

6. **Cæsalpinia digyna**, *Rottl.*—Nat. Ord. Leguminosæ.

Kunti.

Only mentioned from Cuttack, where the *legumes* are used as a tan. In the letter from Cuttack this is said to be a species of *Acacia*, but the pod forwarded seems to be *Cæsalpinia digyna*.

7. **Cæsalpinia sp.** (*p.* 142).—Nat. Ord. Leguminosæ.

Legumes used in Santál Parganás (tari), Maldah (lati), and in Chittagong (tiree).

8. **Carissa Carandas**, *Linn.* (*p.* 142).—Nat. Ord. Apocyneæ.

Fruit of kuranja or tair used in Bhágalpur.

9. **Cassia alata**, *Linn.*— Nat. Ord. Leguminosæ.

Specimens of soonari *bark* used in tanning in Cuttack sent as *Cassia Fistula* proved on examination to be *Cassia alata* (Dr. Watt.)

10. **Cassia Fistula**, *Linn.* (*p.* 66).—Nat. Ord. Leguminosæ.

Bark used in Dacca, Faridpur (sonali bark), and in Cuttack (soonari bark).

11. **Ceriops Roxburghiana**, *Arnott.* (*p.* 133).—Nat. Ord. Rhizophoreæ.

Garán, grahani, giráni.

Bark used in Balasor, Dacca, Faridpur, Maimansinh, Rájsháhí, Murshidábád. In the latter two districts "garran" is said to be a species of *Acacia*, but it is probably *Ceriops Roxburghiana*, the Bengali name of which is "garán." The Collector of Murshidábád reports that "garran" bark is generally preferred to "babul" bark for tanning

purposes on account of its cheapness. The *pods* of garán said to be used in Rájsháhí.

Dr. Schlich writes:—"An almost unlimited amount of garán bark is available in the Sundarbans. The bark of mature garán trees, which yields a greater proportionate amount of colouring matter than that of younger trees, sells in the Jessor district for Re. 1 per maund; that of the smaller trees running at various prices, from annas 12 to annas 4 per maund. The cost of the labour in cutting off the bark chiefly accounts for the price charged."

From Balasor we are informed that "the tan from grahani is prepared by boiling down the bark with a small quantity of *teel-seed oil*. It is used to stain ropes a rusty dark-brown colour, and to stain cloths worn by boatmen. It is said to greatly strengthen ropes which have been soaked in it, and is the ordinary tan used by curriers, babul bark not being used here."

12. **Citrus medica**, *Linn.* (Citrus acida, *Roxb*).—Nat. Ord. Rutaceæ.

Kaguji.

Leaves of lime used in tanning in Mánbhúm.

13. **Diospyros Embryopteris**, *Pers.* (*p.* 134).—Nat. Ord. Ebenaceæ.

Fruit used in Lohárdagá (Chutiá Nágpur).

14. **Diospyros melanoxylon**, *Roxb.* (*p.* 135)—Nat. Ord. Ebenaceæ.

Kend.

Fruit used in Lohárdagá (Chutiá Nágpur).

15. **Erythrina** sp. (*p.* 135).—Nat. Ord. Leguminosæ.

Madar, মাদার।

The *bark* of this is used in conjunction with that of deuch (p. 161) in dyeing skins yellow (Midnapur).

16. **Eugenia Jambolana**, *Lamk.* (*p.* 135).—Nat. Ord. Myrtaceæ.

Bark of jám used in Midnapur along with barks of bakul and garán in dyeing skins red.

17. **Ficus religiosa**, *Linn.* (*p.* 136).—Nat. Ord. Urticaceæ.

Bark of ashatha used in Bánkurá.

18 **Lagerstrœmia parviflora**, *Roxb.*—Nat. Ord. LYTHRACEÆ.

Bark of sidha* used along with bark of ashna in dyeing skins black. (Midnapur.)

19. **Loranthus longiflorus**, *Desr.*—Nat. Ord. LORANTHACEÆ.

Bándá.

The *wood* of this plant is used in Bhágalpur and the Santál Parganás. It is a parasite of the mango tree, very common in those districts, with handsome scarlet flowers. The mode of preparing the wood for use in tanning is described in the second section of this chapter.

20. **Mallotus philippinensis**, *Müll. Arg.* (*p.* 18).—Nat. Ord. EUPHORBIACEÆ.

The *leaves* of kamlá are used in Mánbhúm.

21. **Mangifera indica**, *Linn.* (*p.* 139).—Nat. Ord. ANACARDIACEÆ.

Bark is used in Bánkurá and in the Dacca district. "The mango bark is used in the same manner and to about the same extent as babul bark." (Dacca.)

22. **Mimusops Elengi**, *Linn.* (*p.* 136).—Nat. Ord. SAPOTACEÆ.

Bark of bakul used as a tan in Bánkurá. In Midnapur it is used in dyeing skins red in combination with the barks of garán and jám.

23. **Phyllanthus Emblica**, *Linn.* (*p.* 143).—Nat. Ord. EUPHORBIACEÆ.

The *fruit* used in Bhágalpur, Lohárdagá, Mánbhúm. *Leaves* in Bírbhúm, Midnapur, Santál Parganás, Lohárdagá. *Bark* in Mánbhúm.

24. **Shorea robusta**, *Gærtn.* (*p.* 137).—Nat. Ord. DIPTEROCARPEÆ.

Bark of sál used in Bánkurá, Midnapur, Santál Parganás, Mánbhúm, Lohárdagá.

25. **Symplocos racemosa**, *Roxb.* (*p.* 87)—Nat. Ord. STYRACEÆ.

Lodh-*bark* used in Balasor.

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* This is the only mention of "sidha" in these returns. The scientific name is not given, but as I find Mr. Gamble mentions that the bark of *Lagerstrœmia parviflora* is used for tanning, and gives the Bengali name as "sida," I have assumed these to be the same.

26. **Terminalia Arjuna**, *Bedd.* (*p.* 151).—Nat. Ord. COMBRETACEÆ.

Bark used in Bánkurá, Midnapur, Mánbhúm.

27. **Terminalia belerica**, *Roxb.* (*p.* 150).—Nat. Ord. COMBRETACEÆ.

Fruit (Bhágalpur, Lohárdagá).
Leaves (Bírbhúm).

28. **Terminalia Chebula**, *Retz.* (*p.* 145).—Nat. Ord. COMBRETACEÆ.

Fruit used nearly everywhere.

29. **Terminalia tomentosa**, *Bedd.* (*p.* 151).—Nat. Ord. COMBRETACEÆ.

Bark used nearly everywhere.

30. **Woodfordia floribunda**, *Salisb.* (*p.* 152)—Nat. Ord. LYTHRACEÆ.

Leaves (Purniah, Santál Parganás, Lohárdagá).
Flowers (Lohárdagá).

The following tans are also mentioned, but the scientific names of the plants yielding them are unknown :—

31. Bunda.

Leaves used in Muzaffarpur. This may be *Loranthus longiflorus*, the native name of which is "banda."

32. Chuni.

Bark (Mánbhúm).

33. Deuch.

The *barks* of deuch and mádár (*Erythrina sp*). boiled in water give a yellow dye to skins (Midnapur).

34. Gatheyas or gátiyá, গাইয়া ।

The *bark* is used in Chittagong in tanning leather, to which it also gives a *red* colour. It is probably a *Terminalia* (Dr. Watt).

35. Khawa.

Bark (Palámau).

36. Porashi. (*p.* 154).

Barks of porashi and asur produce a very good red dye, in favour with tanners; and the red leather shoes worn by the people owe their colour to this dye (Mánbhúm).

Gallnuts are also employed (Balasor, Húglí). In the latter district they are said to be the only tan used. But it is probable that these are not really gallnuts, but myrabolans, which are frequently mistaken for, and called, gallnuts.

The mineral substances employed as auxiliaries in the processes of tanning and dyeing leather are salt (generally the coarse kind, called *khari nimak*), lime, alum, sal-ammoniac (nisadal), protosulphate of iron (hirakosh), blue vitriol (sulphate of copper), sulphate of sodium (kheri noon). Rice-gruel (kanja) and pigeon's dung are also used. The processes in which these are employed will be described in the next section.

B.—General Account of the Methods of Tanning and Dyeing Leather as practised in Bengal.

Tanning, tawing, shamoying.

The skins of animals in their natural state are liable to be destroyed by putrefaction, and are readily affected by various influences which render them unsuitable for use in that condition. By various chemical and mechanical means, however, they may be prepared so as to be capable of resisting these influences and acquire various new and valuable properties. The processes adopted have for their object to prevent the skins from putrefying, to make them supple and pliable, to render them impervious to, and unalterable by water, and to increase their strength and durability. Skins so prepared become leather, and this is brought about by three processes:—

(1) **Tanning**, in which the *gelatin*, of which the hide or skin principally consists, is made to combine with an astringent principle called *tannin*, or tannic acid, contained more or less plentifully in various vegetable products, so as to form *tanno-gelatin*, the essential basis of leather.

(2) **Tawing**, in which the leather is prepared by the action of certain mineral substances, generally alum, on the hides or skins.

(3) **Shamoying**, in which the leather is prepared by causing oils or fatty substances to combine with the skins.

These two last processes, generally used only for fine or thin skins, do not seem to be employed at all in Bengal.

In order to make the native processes of tanning intelligible, we shall give a brief sketch of the various stages in the process of tanning as generally adopted in European tanneries, and append to the account of each step the accounts of the corresponding native processes contained in the returns.

Softening.

The first process is the bringing of the skins or hides into a soft, flaccid condition suitable for working. This is effected by soaking in water, sometimes rubbing or beating them at the same time, for a shorter or longer period according to the condition in which the hide is received. Spent lime-water is sometimes used instead of water, whilst for dry hides and dry salted hides brine has to be employed.

The skins are first softened with water. (Dinapur.)

The skin is first placed in pure water for 24 or 30 hours to soften. (Santál Parganás.)

Liming, sweating, unhairing, fleshing.

The next process has for its object the removal of the hair and scarf-skin on the outer or grain side of the skin (unhairing), and of the flesh and fatty matter adhering to the inner side of the skin (fleshing). This is generally effected by placing the skins or hides in a vat containing milk of lime, in which they are moved about frequently to loosen the hair and scarf-skin (liming). It is sometimes effected by laying them in a heap for a short time and then suspending them on poles in a close room heated by a smouldering fire: a slight putrefaction takes place, which loosens the epidermis and renders the hair easily removable (sweating). This latter method does not seem to be practised in Bengal. The hair being thus loosened, the skin is then stretched over a beam, and with a working knife the hair and scarf-skin are shaved and scraped off. The skin is then turned on the beam with its inner or flesh side outwards, and the flesh and fatty matters are similarly removed with a fleshing-knife. During the above process of "liming," the lime not only loosens the hair and scarf-skin, but also causes the "corium" or true skin to swell up, and become porous and more permeable to the tanning solution in the subsequent stages (plumping). The lime also combines with the fatty matter of the inner or flesh side to form calcareous soap, thus neutralising the fat, which would otherwise interfere with the action of the tannin.

The skin, when removed, is rubbed on its inside surface with *lime*, and kept for 10 or 15 days in a solution of lime and water. It is then stripped of the hair by the hand, washed in clear water, and the inside scraped clean with a sharp knife (cher), about one foot long by two inches broad. (Maldah.)

The skins are steeped in a solution of *lime* for a fortnight, then taken out, and the hair cleaned off with a two-edged blade. (Bardwán.)

Skin is freed from hair by the application of *quick-lime*. (Húglí.)

Skin thoroughly smeared with wet *quick-lime* and kept for a week or so in a closed vat full of water. Hair and particles of fat or muscle are then scraped off. (Murshidábád.)

Skins are cleaned by treating with *lime*. (Cuttack.)

Skins, after being softened as above, are removed from the water and given a coating of *shell-lime* on the *inner* side, and rolled up and left in that state till morning, when they are placed in a bath of shell-lime and water until the hair is removed. This takes from 5 to 15 days, according to the freshness of the skin and strength of the bath. The hair from a new skin is burnt off more rapidly than from an old one. From

the lime bath the skin is taken and washed in clean water, and then left to soak for the night in clean water. Next morning it is taken out and scraped clean with a *kurpi*. (Santál Parganás.)

Skins, either fresh or softened with water, are rubbed over with a mixture of *lime*, *i.e.*, lime mixed with water and reduced to the consistency of cream, and then steeped in a trough containing a solution of lime, till the hair becomes loose and removable. For each buffalo hide 4 seers of lime are dissolved in water just sufficient to cover the hide; for each bullock or cow hide, $2\frac{1}{2}$ seers of lime are dissolved as above; and for each calf, sheep, or goat skin, $\frac{3}{4}$ seer of lime. The hair of a buffalo, bullock, or cow hide takes 15 days to become loose so as to be easily detached by rubbing; the skins of smaller animals take only half the time. The hair being removed, the skins are next steeped in fresh water for 24 hours. Any portion of flesh still adhering is scratched off by stretching the skins over a plank. (Dinapur.)

Puring, plumping.

The next stage is intended to remove the lime thoroughly and still further to distend the pores and cause the fibres to swell, so as to make the skin more susceptible to the tannin (raising or plumping). This is done in a variety of ways, depending on the nature of the skin and the kind of leather into which it is desired to convert it. Skins for morocco and thin leathers are first pured or bated in a preparation of dog's dung, then washed and put into a drench of bran and water, heated to about 185°F. Calves' skins, sealskins, &c., after being well washed in water, are immersed in water containing pigeon's dung, dog's dung, or other such matters, in which they remain about ten or twelve days, and are then "worked" with a concave tool on both sides on a convex beam. For some kinds of leather the "puring" and "plumping" are effected by immersing the skins in weak acid solutions, either stale tan liquor or weak solutions of sulphuric acid.

In most of the returns received from the various districts of Bengal no mention is made of any process of "puring" or "plumping," and it would seem that the tanning proper is begun immediately after the "fleshing," without any attempt being made to get rid of the injurious lime or to further distend the pores of the skin so as to prepare them to be more readily acted upon by the tanning materials.

Hides, after being limed and fleshed as above, are then soaked in *kanji or rice-gruel* for three or four days, and afterwards exposed to the sun to dry. (Bardwán.)

The skins, after being fleshed as above, are steeped in water for three days, the water being changed every day, and are then soaked in a solution of *pigeon's dung*. One seer of pigeon's dung is dissolved in water just sufficient for steeping four large skins, either buffalo or bullock. In this solution the hides are soaked for 24 hours, after which they are washed and squeezed out so as to free them from water. (Dinapur.)

Colouring.

The tanning proper now begins. The hides are first suspended over poles laid across the mouths of pits containing spent tanning liquors. These "oozes" contain very little tannin, but a certain amount of gallic and acetic acids have been developed in them, and they are strong in the colouring matters extracted from the tanning materials. The acids neutralise any remaining trace of lime, and still further "plump" the skins, whilst the weak solution of tannin begins the gradual conversion of the skin

into leather. The hides are moved forward from one pit to another, the strength of the tanning infusion gradually increasing. This stage is called "colouring," as the hide is dyed or coloured on its surface, and occupies about a week. The next stage is called "handling."

Handling.

The "handling" pits are a series of pits containing tanning infusions of increasing strength, in which the hides are spread out horizontally and "handled" once a day, or more frequently if necessary,—that is to say, are drawn out of the pit with a tanner's hook, piled on the side to drain, and then returned to the pit, the hides previously at the top of the pit being now placed at the bottom. As the hides pass from one pit to the next, the strength of the tanning infusion increases, whilst frequent "handling" becomes less necessary. "Handling" occupies about six weeks. The next stage is called "laying away." In this the hides are placed in

Laying away.

pits called "layers" or "lay-aways," in which thin layers of the tanning bark or mixture are placed between the hides laid horizontally, and the pit is filled up with an infusion of the tanning material. In about a month the bark is spent; the pits are then cleared out, and charged with fresh bark and infusion as before, the hides previously at the top being now placed at the bottom. This process of renewing the tan is repeated three or four times, when the tanning is complete. The hides are then removed and hung up in a shed to dry. During this process they are compressed with a steel tool and are rolled with a brass roller. On drying they are ready for the market. The whole process of tanning may occupy more than a year for the best qualities of sole leather. For morocco and thin leathers the skins are, as above, first treated with a spent tanning infusion. They are then sewn up in bags in pairs with the grain or outer side outwards, and fresh tanning infusion is poured into this bag. This infusion, aided by pressure, penetrates the pores of the skin and completely tans it. The skins are then ripped open and thrown into vats containing fresh tanning liquor, which tans those portions untouched by the liquor in the bags.

The fruit of *Terminalia Chebula* (haritaki) and the leaves of *Phyllanthus Emblica* (amlaki) and of *Terminalia belerica* (baharâ) are used as tans in this district. (Birbhûm.)

The skins, after being soaked in *kanji* and dried in the sun as above, are rubbed with a preparation of babul bark (*Acacia arabica*) and mohwa bark (*Bassia latifolia*). (Bârdwân.)

The barks of asan (*Terminalia tomentosa*), sal (*Shorea robusta*), arjun (*Terminalia Arjuna*), bakul (*Mimusops Elengi*), ashotto (*Ficus religiosa*), babla (*Acacia arabica*), and mango (*Mangifera indica*), make good tans by being boiled with water singly or together. (Bânkurâ.)

The following combinations are employed as tans in the district of Midnapur:—

The bark of sal (*Shorea robusta*) or arjun *Terminalia Arjuna*), and the leaves of amlaki (*Phyllanthus Emblica*) pounded together and steeped in water.

The bark of arjun and the bark, leaves, and fruit of babla (*Acacia arabica*) similarly prepared with water.

Haritaki *(Terminalia Chebula)* and the leaves of *amlaki* similarly prepared with water.

Haritaki and the bark of *babla* similarly prepared.

The bark of *babla* and *arjun* similarly prepared.

There are two methods of tanning employed in this district. One is called "tanga kas" (*i.e.*, tanning by hanging) and the other "duba kas" (*i.e.*, tanning by dipping). In the first mode the hide divested of hair is sewn up with the tanning preparation in it and hung up in that state for seven or eight days. After this period it is taken down, laid open, dried in the sun, and then dyed. In the second mode the hide divested of hair, as before, is kept steeped in a tanning preparation for seven or eight days also, at the end of which it is taken out and manipulated as before. (Midnapur.)

After the skin is freed from the hair as above, it is boiled in an infusion of *gallnuts*, the only tan used in this district. (Húglí.)

After the skin is fleshed as above, it is placed in an infusion of pounded garán (*Ceriops Roxburghiana*) and myrabolans (*Terminalia Chebula*). In this it is kept for a period varying from one to four weeks, and is then taken out, sprinkled with *rice-water* and *salt*, and left to dry in the sun. In parts of the district the bark of the *babul* is used instead of garán bark, but the latter is generally preferred on account of its cheapness. (Murshidábád: No. 5020, reddish brown.)

There is little tanning done here. Skins are simply cured and sent away. The few moochis tan their own leather, and the materials they use are the fruit of haritaki (*Terminalia Chebula*), the pods of the babul (*Acacia arabica*), and a bark which they call garron (*Ceriops Roxburghiana*) and the pods. (Rájsháhí.)

After the skins are fleshed as above, 8℔ of the dried fruit called lati (*Cæsalpinia sp.*) is pounded in a mortar and mixed with water. The skin is kept in this mixture for four or five days, rubbed while wet with ½℔ *kheri noon* (sulphate of soda), and then dried. (Maldah).

Bark of *gatheyas* (p. 161) is pounded and soaked in water. Into this the hide, cleared of hair, is thrown, and kept soaking in it for four or five days. This process is repeated three or four times, and gives a *red* leather. If a similar process be followed with tiree pods (*Cæsalpinia sp.*), the leather obtained is a *greyish white*. (Chittagong.)

After being soaked in the solution of pigeon's dung as above, the skins are steeped in a solution of mohwa (*Bassia latifolia*) leaves, prepared by steeping the leaves in water for three or four days. This solution is renewed every three days, and the soaking is continued for 15 days. The skins are next put into a masonry vat, which is filled with a solution of the bark of the babul tree (*Acacia arabica*), prepared by steeping babul bark in water for three or four days. A layer of babul bark finely cut is also placed between every two skins. This process goes on for eight months in the case of buffalo, bullock, or cow hides; four months for calf, sheep, or goat skins. The solution in the vat is changed every second month. The skins are then taken out, washed well with water, and rubbed with cocoanut husk. After this they are rubbed over with a piece of flat brass to drive out any remaining water. They are then hung up and partially dried in a room, and lastly greased with a mixture of cow and hog's lard in equal proportions, then dried for two or three days, when they are ready for use. (Dinapur.)

After the processes described above, a bath is prepared from the pod of *babul*. If the seed is green, it is boiled; if it is dry, it is crushed and thrown into cold water. In this bath the hide is allowed to remain three days: it is then taken out and the water wrung from it. A similar bath is then prepared from the tari (*Cæsalpinia sp.*), and the hide is placed in it for a further period of three days. If tari is not at hand, a second of babul is substituted. When taken from this bath the hide is cleaned of the sediment of babul and tari and sewn up into the form of a bag, and hung up under a tripod. The bruised wood of a parasite of the mango tree (*Loranthus longiflorus*) is then placed inside, and the skin is filled with water. It is allowed to remain in this state for a couple

of days. After this the skin is taken down and one side or the other—it is perfectly immaterial which—rubbed with *khari* salt and then dried, when it is ready for use.

During the flowering and fruiting season of the mango the preparation of the parasite of the mango-tree is omitted, but the skins are not then so soft as when it is used. The parasite is prepared in this way. The leaves are stripped from it, and the sticks laid together on a hide or mat and bruised by two or three persons beating them with the musal or gamal (the iron-rimmed wooden pestle used for pounding grain in an ookley). (Eastern parts of Santál Parganás).

The hide is first rubbed with lime and so cleaned; then dry amla leaves (*Phyllanthus Emblica*) are pounded and put with the hide to steep in water, where it remains for four days. It is then taken out and made into a bag, which is filled with water and asan (*Terminalia tomentosa*) or sal (*Shorea robusta*) bark, and so kept for four or five days. The hide is then considered tanned. (Deoghur, Santál Parganás.)

The hide, after being left in lime for 15 or 20 days, is then taken out and the lime removed. The hide is then left to soak in water, in which the leaves of the amla (*Phyllanthus Emblica*) and the dhaoa (*Woodfordia floribunda*) and the fruit of the hurra (*Terminalia Chebula*) have been placed. It is then ready for use. (Santál Parganás.)

Skins, after being treated with lime and cleaned, are soaked in the astringent solution prepared by pounding the bark of soonari (*Cassia Fistula*) bark of asan (*Terminalia tomentosa*) and pods of kunti (*Cæsalpinia digyna*) and soaking in water for 24 hours. The process of soaking is repeated three times. (Cuttack.)

The tans used here are asan (*Terminalia tomentosa*), lodh (*Symplocos racemosa*), grahani (*Ceriops Roxburghiana*), and gallnuts (probably *myrabolans*). Grahani is the ordinary tan used by curriers. It has a large local consumption, and is very cheap. The tan is prepared by boiling down the bark with a small quantity of *teel-seed oil.*

(Balasor: No. 11532, cow hide, reddish brown.
„ 11533, buffalo „ dark brown.
„ 11534, sambar „ light „
„ 11535, goat skin, dark „
„ 11536, sheep „ bright red.
„ 11537, calf „ pale brown.
„ 11538, deer „ „ „)

The tans used here are three, viz. the barks of the *khawa* (p. 161) and *asan* trees, and the leaves of the *awula* (*Phyllanthus Emblica*) tree. The two last are the best. The barks or dried leaves, as the case may be, are boiled, and the solution poured into the skin, suspended by its four corners, so as to form a bag. The liquor, as it soaks through, falls into a vessel below; and when the whole has soaked through, it is again poured into the skin, and this operation is repeated till the skin is sufficiently tanned. (Palámau.)

Tans used by the chamars are haritaki (*Terminalia Chebula*), the leaf of the amla (*Phyllanthus Emblica*), and the bark of the asan (*Terminalia tomentosa*) tree. The leaves and bark are smashed up together and mixed with the haritaki after it has been boiled. (Mánbhúm: Nos. 9063, 9064).

The bark of the garán (*Ceriops Roxburghiana*) is stripped off when fresh and green, and hung up in the shade to dry to a certain extent. If dried in the sun the result is not such a good colour; and if dried too much, more labour and time are required in extracting the colour. In dry hot weather this takes about four days. When dried sufficiently the bark is beaten up fine with a pestle and mortar and put with the hide to be coloured into an earthen or other vessel in the shade. For the preparation of a single bullock's hide from 6 to 7 seers of garán with two

gharas of water are required. In this it is left to soak for three days and nights, the hide being hand-rubbed and turned about inside the vessel for about half an hour each morning and evening. At the end of this time the whole of the water and colouring matter is cleared out of the vessel and fresh powdered bark and water to the same amount as before put in with the hide, which, being treated as before, will be thoroughly dyed at the end of a second period of three days and nights. The skin is then smoothed out with the hands, dried partially in the sun, and when still damp brought into the shade to finish drying. The result of this process is the ordinary reddish brown coloured leather of which common native shoes are made.

By mixing a preparation of the fruit of the haritaki (Bengali), hurra (Hindi), (*Terminalia Chebula*), prepared, as described below, in the proportion of 1½ of garán to 2 of haritaki, the leather is dyed a yellowish almond colour. The preparation of the haritaki is as follows:—First soak the fruit in cold water for about six hours, then throw out the water and fill up with fresh. Then boil for about an hour until the fruit becomes soft, then throw out the boiling water, and wash the fruit in cold water to take off all impurities: after which it is reduced to fine powder with the pestle and mortar and mixed in the proportions above noted with powdered garán bark. The process of colouring the hide is the same as for garán bark above. (Dr. Schlich.)

Dyeing leather.—The information received on this head is very meagre, and scarcely worth reproduction. Leather dyed by most of the above processes has acquired the ordinary *buff* or *brown* colour, unless the colour is specially mentioned. The following information has been received regarding the substances used for dyeing leather various colours, but no details are given of the methods employed. Nor is it clear in many cases whether the skin is first tanned as above and the preparations mentioned below then applied to dye it, or these materials themselves tan and dye the skin at the same time. The latter, however, would seem to be generally the case.

Red.

Bark of garán.—Skin is dyed red by being kept steeped for eight days in water in which the bark of garán (*Ceriops Roxburghiana*) is soaking. The bark is sometimes boiled in water, and the skin kept steeped in this. (Midnapur).

Leather tanned as described above by bark of garán has acquired a *reddish brown* colour. Of this the common native shoes are made. (Dr. Schlich).

Barks of bakul, garán, and jám.—Another mode of dyeing skin red is to steep it in water in which the barks of bakul (*Mimusops Elengi*), garán, and jám (*Eugenia Jambolana*) have been soaked. (Midnapur.)

Barks of porashi and asun.—A mixture of the barks of porashi (p. 154) and asun (*Terminalia tomentosa*) produces a very good red dye in favour with tanners. The red leather shoes worn by the people owe their colour to this dye. (Mánbhúm.)

Bark of gatheyas.—Leather tanned with the bark of gatheyas (p. 161), as described above, is *red.* (Chittagong.)

Lac.—Lac is mentioned from several districts as being used in dyeing leather, but no particulars are given.

Yellow.

Barks of deuch and madar.—Skins are dyed yellow by steeping in water boiled with the barks of deuch (p. 161) and madar (p. 159). (Midnapur.)

Leather tanned with garán and haritaki, as described on p. 168, has acquired a *yellowish almond* colour. (Dr. Schlich.)

Black.

Barks of sidha and ashna.—Skins are dyed black by steeping in a preparation of water and the barks of sidha (*Lagerstræmia parviflora*) and ashna (*Terminalia tomentosa*). (Midnapur.)

Haritaki and blue vitriol.—Another mode is to steep the skin in a preparation made of haritaki and blue vitriol. (Midnapur.)

Haritaki and ferruginous mud.—Haritaki, with ferruginous mud, gives a good black, used by harness-makers. (Húglí.)

Green.

Nisadal (*chloride of ammonia*) *and copper.*—Green for dyeing skins is obtained by steeping nisadal (chloride of ammonia) in a copper pot. (Midnapur.)

Purple.

Hirakosh.—Skins are dyed purple by first dyeing them red, as above, and then steeping in water mixed with hirakosh (protosulphate of iron). (Midnapur.)

White.

Salt and alum.—To make skins white, rub them, after tanning, with a preparation of *salt* and *alum*. (Midnapur.)

The leather obtained by tanning with tiree-pods, p. 166, is a *greyish white*. (Chittagong.)

APPENDIX A.

List of Indian Vegetable Dyes, of which particulars are given in Mr. Liotard's Memorandum and this Report, arranged according to Natural Orders.

This list does not profess to be a complete list of Indian vegetable dyes, but only of those identified dyes of which particulars have been obtained in the course of the enquiry of which Mr. Liotard's Memorandum and the preceding Report are the result. In it are included only those plants which supply real dyes or mordants, but not those which are merely used in dyeing processes on account of the acids contained in their fruit or leaves, or the alkalis in their ashes. Astringents employed in tanning leather, but not in dyeing fabrics, are omitted, as also are vegetable oils used in dyeing. A complete list of Indian dyes, mordants, &c., will be found in Dr. G. Watt's forthcoming "Dictionary of Indian Economic Products."

Scientific Name.	Part of plant used.	Colour produced, &c.	Page in Mr. Liotard's Memorandum.	Page in this Report.
RANUNCULACEÆ.				
1. Delphinium saniculæfolium, *Boiss.*	Flowers and flower-stalks.	Sulphur-yellow	4, 61, 89, 94, 135, 138, iv, vi	
MAGNOLIACEÆ.				
2. Michelia Champaca, *Linn.*	Flowers ...	Yellow ...	.....	90
ANONACEÆ.				
3. Anona squamosa, *Linn.*	Fruit (?) ...	Auxiliary ...	65, 75	
MENISPERMACEÆ.				
4. Coscinium fenestratum, *Colebr.*	Root and stem	Yellow ...	i, vi	
BERBERIDEÆ.				
5. Berberis aristata, *DC.* (B. tinctoria, *Lesch.*)	Root: also bark and wood of stem.	Yellow ...	77	
6. Berberis nepalensis, *Spreng.*	Wood ...	Yellow ...	.....	90
BIXINEÆ.				
7. Bixa Orellana, *Linn.*	Pulpy covering of seeds, or seeds themselves.	Orange ...	2, 64, 65, 80, 81, 91, 95, 125	20, 31, 35, 70-72, 74, 158
	Bark ...	Mordant ...		

Scientific Name.	Part of plant used.	Colour produced, &c.	Page in Mr. Liotard's Memorandum.	Page in this Report.
LEGUMINOSÆ.				
32. Acacia arabica, *Willd.* (Mimosa arabica, *Roxb.*)	Bark ... Legumes ...	Brown. Black, and as a mordant.	116, 127, 129, 130, i .	32, 33, 127-8, 133, 135, 136, 138, 151, 152, 157, 165, 168
33. Acacia Catechu, *Willd.* (Mimosa Catechu, *Roxb.*)	Astringent extract prepared from the heart-wood, or the wood itself.	Brown-red, and as a mordant.	2, 8, 9, 126, 127, 128	35, 42, 75, 129-32, 139, 157
34. Acacia Farnesiana, *Willd.* (Mimosa Farnesiana, *Roxb.*)	Bark ... Legumes ...	Black with iron salts. Mordant.	.....	128, 138, 158
35. Acacia Intsia, *Willd.* (A. cæsia, *W. & A.*)	Bark and leaves.	Auxiliary in dyeing with lac and *Morinda tinctoria*.	.....	32, 35, 54, 141-2, 156
36. Acacia rugata, *Ham.*	Leaves ...	In dyeing green with turmeric.	121	
37. Acacia Suma, *Kurz*	Astringent extract prepared from the heart-wood.	Mordant ...	8, 9	
38. Acacia Sundra, *DC.*	Ditto ...	Mordant ...	9	
39. Albizzia odoratissima, *Benth.*	Bark ...	Madder-brown with the pounded leaves and twigs of *dogal* (*Sarcochlamys pulcherrima*).	127, viii	145
40. Bauhinia tomentosa, *Linn.*	Bark ...	Ash-colour (*khaki*) with other barks.	130	
41. Bauhinia variegata, *Linn.*	Bark ...	Black, and as a mordant.	.....	85, 133, 144
42. Butea frondosa, *Roxb.*	Petals ...	Yellow.	76, 77-80, 90, 91, 92, 93, 95, 96, 112, 125, 126, 127, 130, 134, 135, 138	50, 73-74, 88, 126, 150, 154
	Bark ...	Brown with other barks.		

Scientific Name.	Part of plant used.	Colour produced, &c.	Page in Mr. Liotard's Memorandum.	Page in this Report.
LEGUMINOSÆ— *concluded.*				
43. Butea superba, *Roxb.*	Flowers ...	Yellow ...	78	
44. Cæsalpinia Sappan, *Linn.*	Wood ...	Red.	24-26, 61, 64, 65, 67, 69, 70, 75, 120, 128, 130, 131, 134, 135, 139, iii	1-4, 17, 49, 88, 125, 136, 138, 142
	Legumes ...	Black with iron salts.		
45. Cæsalpinia sp. (?) ...	Legumes ...	Black with iron salts, and as a mordant.	.....	3, 48, 49, 142, 150, 151, 158, 166, 169
46. Cassia auriculata, *Linn.*	Flowers ...	Yellow.	73, 112, 113, 116, ii, vi	
	Bark and root.	Red: bark also as a mordant.		
	Seed ...	As an auxiliary in dyeing with indigo.		
47. Cassia Fistula, *Linn.* (Cathartocarpus Fistula, *Pers.*)	Bark ...	Red ...	vii	66, 145, 158, 167
48. Cassia Tora, *Linn.*...	Seed ...	Yellow, and as an auxiliary in dyeing with indigo.	113, 114, ii, iii, vi	124, 142
49. Erythrina indica, *Lamk.*	Flowers ...	Red ...	.....	66
50. Erythrina sp. ...	Bark ...	Brown ...	.....	135, 159, 161, 169
*51. Glycyrrhiza glabra, *Linn.*	Root ...	Auxiliary in madder-printing.	133, iv	
52. Indigofera tinctoria, *Linn.*	Leaves and stem.	Blue ...	2, 4, 6, 13, 48, 65, 67, 96-111, 112, 114, 127, 128, 133, 134, 135, 136, 137, 138	3, 16, 17, 36, 38, 42, 43, 49, 56, 70, 74, 86, 89, 93-126, 149, 154
53. Pterocarpus santalinus, *Linn.*	Wood, root ...	Red ...	60, 61, 69	67

* Imported.

Scientific Name.	Part of plant used.	Colour produced, &c.	Page in Mr. Liotard's Memorandum.	Page in this Report.
RHIZOPHOREÆ.				
54. Ceriops Roxburghiana, *Arnott.* (Rhizophora decandra, *Roxb.*)	Bark ...	Red, or black with other barks.	.....	128, 133-4, 151, 158-9 160, 166, 167, 168, 169
55. Kandelia Rheedii, *W. & A.*	Bark ...	Red ...	74	
COMBRETACEÆ.				
56. Terminalia Arjuna, *Bedd.*	Bark ...	Dirty-brown...	63, 71, 90, vi	128, 133, 151, 161, 165, 166
57. Terminalia belerica, *Roxb.*	Fruit ...	Brown, and as a mordant.	13, 15, 16, 20, 21, 22, 66, 132	48, 144, 146, 150-1, 161, 165
58. Terminalia Catappa, *Linn.*	Bark and leaves.	Black, and as a mordant.	15, 16	
59. Terminalia Chebula, *Retz.*	Fruit, galls, bark.	Mordants: fruit and galls give also a yellow dye.	5, 13, 15, 17-22, 25, 66, 67, 68, 69, 70, 71, 73, 89, 128, 129, 130, 131, 134, 137, iv	16, 31, 33, 48, 74, 86, 88, 125, 134, 135, 138, 144, 145-50, 152, 161, 162, 165, 166, 167, 168, 169
60. Terminalia citrina, *Roxb.*	Bark ... Fruit ...	Black, and as a mordant. Yellow, pale green.	94, 116, 124	33, 152
61. Terminalia paniculata, *Roth.*	Fruit ...	Mordant ...	15, 22	
62. Terminalia tomentosa, *Bedd.*	Fruit ... Bark ...	Mordant. Brown, or black with iron salts.	15, 20, 22, 63, ii	136, 151-2, 154, 160, 161, 162, 165, 167, 168, 169
MYRTACEÆ.				
63. Eugenia Jambolana, *Lamk.*	Bark ...	Black with other barks, and as a mordant.	105, 108, 128, 130, viii	49, 135, 144, 159, 160, 168
64. Eugenia sp.	Bark ...	Black with other barks, and as a mordant.	116, viii	
65. Psidium Guyava, *Linn.*	Bark ...	Black with other barks.	116, 128	

Scientific Name.	Part of plant used.	Colour produced, &c.	Page in Mr. Liotard's Memorandum.	Page in this Report.
MELASTOMACEÆ.				
66. Memecylon edule, *Roxb.* (M. tinctorium, *Koen.*)	Leaves ...	Yellow ...	ii	
LYTHRACEÆ.				
67. Lagerstrœmia parviflora, *Roxb.*	Leaves ...	Mordant ...	71, 124	160, 169
68. Lawsonia alba, *Lamk.* (L. inermis, *Roxb.*)	Leaves ...	Reddish brown	47, 48, 66, 131, iii	56, 90
69. Punica Granatum, *Linn.*	Fruit rind ...	Greenish-brown, and as a mordant.	4, 11-13, 76, 92, 93, 126, 127, 128, 129, 134, 135, 138, viii	66, 85, 144-5, 151
	Flowers ...	Light red, or black with iron salts.		
	Bark ...	Mordant and blackish-grey with iron salts.		
	Seed ...	Mordant.		
70. Woodfordia floribunda, *Salisb.* (Grislea tomentosa, *Roxb.*)	Petals ...	Red, and as a subsidiary in dyeing with ál, &c.	46, 67, 68, 69, 70, 130, 133, 134, 136, 137	32, 33, 34, 152-3, 161, 167
	Leaves and twigs.	Yellow, (*nauti*).		
CUCURBITACEÆ.				
71. Citrullus vulgaris, *Schrad.*	Fruit and galls.	Black ...	116	
DATISCACEÆ.				
72. Datisca cannabina, *Linn.*	Root ...	Yellow ...	90, 94, 96, 121, 124, vi	
RUBIACEÆ.				
73. Hedyotis capitellata, *Wall.*	Leaves ...	Green, and as a mordant.	.....	139
74. Morinda angustifolia, *Roxb.*	Root (especially root-bark) and wood.	Red	6, 49, 74	38-9, 145, 154

Scientific Name.	Part of plant used.	Colour produced, &c.	Page in Mr. Liotard's Memorandum.	Page in this Report.
RUBIACEÆ—*concld.*				
75. Morinda citrifolia, *Linn.*	Root (especially root-bark) and wood.	Red	49-53, 66, 73	20, 33, 36-8, 43
VAR. *M. bracteata*, sp. *Roxb.*	Wood ... / Root-bark...	Yellow ... / Red ...	49	38, 39
76. Morinda persicæfolia, *Ham.* (Morinda lanceolata, *Wall.*)	Root (especially root-bark).	Red or yellow	74	39
77. Morinda tinctoria, *Roxb.*	Root or root-bark: twigs and bark of stem: juice of leaves.	Red and yellow.	4, 46, 49-53, 66, 67, 68, 69, 70, 71, 72, 130, 134, 135, 139, 140	20-36, 37, 38, 72, 86, 88, 89, 123, 124, 125, 128, 132, 133, 141, 142, 143, 150, 152, 153, 154, 155
FORMA *exserta*,* M. exserta, *Roxb.*	Root or root-bark.	Red and yellow.	49, 51	33, 39
78. Morinda umbellata, *Linn.*	Root	Red	49, 54	43
79. Morinda sp. ? (rung-gach).	Root	Red	.....	39-41, 154
80. Oldenlandia umbellata, *Linn.* (Hedyotis umbellata, *Lamk.*)	Root	Red	i, ii	43-4, 45
81. Randia dumetorum, *Lamk.*	Fruit... ...	Auxiliary in calico-printing.	iv	
82. Rubia cordifolia, *Linn.*	Stem, root ...	Red ...	2, 54, 55, 69, 70, 72, 76, 89, 95, 131, 134, 135, 136, 138, 139, viii	44-9, 59, 88, 125, 126, 135, 142, 143, 150
VALERIANEÆ.				
83. Nardostachys Jatamansi, *DC.*	Rhizome ...	Auxiliary in dyeing with kamalágundi (*Mallotus philippinensis*).	.....	19, 143

* *Vide* Hooker's Flora of British India, vol. III, p. 156.

Scientific Name.	Part of plant used.	Colour produced, &c.	Page in Mr. Liotard's Memorandum.	Page in this Report.
COMPOSITÆ.				
84. Carthamus tinctorius, *Linn.*	Flowers ...	Yellow and red.	26-32, 57, 61, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 92, 95, 125, 126, 127, 128, 139	3, 4-18, 42, 86, 125, 126, 150
85. Tagetes erecta, *Linn.*	Flowers or petals.	Yellow ...	92, ii, v	
86. Tagetes patula, *Linn.*	Flowers ...	Yellow, dull green.	ii	140
87. Wedelia calendulacea, *Less.* (Verbesina calendulacea; *Roxb.*)	Root	Black with salts of iron.	.....	152
SAPOTACEÆ.				
88. Bassia latifolia, *Roxb.*	Bark... ...	Black, and as a mordant.	.....	85, 133, 144, 158, 165, 166
89. Mimusops Elengi, *Linn.*	Bark... ...	Brown ...	.....	136, 152, 159, 160, 165, 168
EBENACEÆ.				
90. Diospyros Embryopteris, *Pers.* (D. glutinosa, *Koen.*)	Fruit... ...	Brown ...	.....	134-135, 138, 150, 159
91. Diospyros melanoxylon, *Roxb.*	Bark... ...	Black ...	.....	128, 135, 136, 152, 159
92. Diospyros mollis (?)	Fruit... ...	Black ...	viii	
93. Diospyros sp. (tai)...	Fruit... ...	Purple (?) ...	120	
STYRACEÆ.				
94. Symplocos cratægoides, *Ham.* (S. paniculata, *Wall.*)	Leaves ... Bark ...	Mordant ... Yellow ...	88	
95. Symplocos grandiflora, *Wall.*	Leaves ...	Mordant ...	74, 88, 95, 122, 125	
96. Symplocos phyllocalyx, *Clarke.*	Wood ...	Red ...	.....	89

Scientific Name.	Part of plant used.	Colour produced, &c.	Page in Mr. Liotard's Memorandum.	Page in this Report.
STYRACEÆ—*concld.*				
97. Symplocos racemosa, *Roxb.*	Leaves ...	Yellow, and as a mordant.	62, 63, 71, 80, 88, 90, 127, 130, 133, 138	3, 4, 31, 33, 34, 35, 36, 54, 55, 74, 86, 87-8, 89, 90, 124, 160
	Bark ...	Yellow, and as a mordant.		
	Wood (?) ...	Mordant.		
98. Symplocos spicata, *Roxb.*	Leaves ...	Yellow ...	.....	89, 154
99. Symplocos theæfolia, *Ham.* (S. lucida, *Wall.*)	Leaves ...	Yellow, and as a mordant.	.....	31, 34, 35, 55, 86, 88-89, 124, 126, 153
OLEACEÆ.				
100. Jasminum grandiflorum, *Linn.*	Flowers ...	Auxiliary in dyeing with âl.	73	
101. Nyctanthes Arbor-tristis, *Linn.*	Flowers (corolla-tube).	Orange ...	58-60, 68, 92, 93, 95, 126, 125, 128, ii	17, 41-3, 86, 87, 126, 132, 139
APOCYNACEÆ.				
102. Carissa Carandas, *Linn.*	Fruit ...	(?)	.....	139, 142, 158
103. Wrightia tinctoria, *Br.*	Leaves ...	Blue ...	96	
ASCLEPIADEÆ.				
104. Marsdenia tinctoria, *Br.*	Leaves ...	Blue ...	109	126
LOGANIACEÆ.				
105. Strychnos Nux-vomica, *Linn.*	Seed ...	Brown ...	.....	137-8
BORAGINEÆ.				
106. Cordia Myxa, *Linn.*	Leaves ...	Mordant ...	.....	32, 35, 143
SOLANEÆ.				
107. Datura alba, *Nees*	Seed ...	Mordant ...	75	

Scientific Name.	Part of plant used.	Colour produced, &c.	Page in Mr. Liotard's Memorandum.	Page in this Report.
ACANTHACEÆ.				
108. Adhatoda Vasica, *Nees.* (Justicia Adhatoda, *Linn.*)	Leaves ...	Yellow ...	94, 135, ii, vi	132
	Leaves and fruit ...	Black ...		
109. Peristrophe tinctoria, *Nees.*	Twigs and root	Red ...	.....	66-7
110. Strobilanthes flaccidifolius, *Nees* (Ruellia indigotica, *Balfour*).	Leaves ...	Blue ...	109	126
Strobilanthes flaccidus = Strobilanthes flaccidifolius (?) (*Vide* Gamble's Manual of Indian Timbers, p. 280.)	Leaves and twigs.	Red (?) ...	74, 114, 122	
	Leaves ...	Blue ...		
VERBENACEÆ.				
111. Gmelina arborea, *Roxb.*	Bark ...	Mordant ...	65, 75	
CHENOPODEÆ.				
112. Chenopodium album, *Linn.*	Leaves and twigs.	Auxiliary in indigo-dyeing.	112	
POLYGONACEÆ.				
113. Fagopyrum esculentum, *Mœnch.* (Polygonum Fagopyrum, *Linn.*)	Stem... ...	Auxiliary in dyeing with *Rubia cordifolia.*	.....	49, 143
114. Rheum Emodi, *Wall.*	Root... ...	Yellow ...	89, 90, 95, 96, 121, 124, vi	
LAURACEÆ.				
115. Cinnamomum Tamala, *Nees.* (Laurus Cassia, *Roxb.*)	Leaves, bark	Subsidiary ...	iii	19, 143
EUPHORBIACEÆ.				
116. Agyneia coccinea, *Buch.*	Bark... ...	Red	75	
117. Baccaurea sapida, *Müll. Arg.* (Pierardia sapida, *Roxb.*)	Bark ...	Mordant ...	74, viii	56, 139
	Leaves ...	Green ...		

Scientific Name.	Part of plant used.	Colour produced, &c.	Page in Mr. Liotard's Memorandum.	Page in this Report.
EUPHORBIACEÆ—*concluded.*				
118. Jatropha Curcas, *Linn.*	Juice of stem	Black ...	viii	
119. Jatropha glandulifera, *Roxb.*	Leaves ...	Green ...	ii	
120. Mallotus philippinensis, *Müll. Arg.* (Rottlera tinctoria, *Roxb.*)	Powder round the seed. Root ...	Orange ... Red	4, 56-58, 89, 90, 91, 92, 125	16, 18-20, 72, 87, 143, 155, 160
121. Phyllanthus Emblica, *Linn.* (Emblica officinalis, *Gærtn.*)	Leaves, bark Fruit ...	Mordant. Blackish, and as a mordant.	20, i, ii, iii, v, vii	137, 138, 140, 143-4, 146, 160, 165, 167
CUPULIFERÆ.				
122. Quercus sp. ...	Gall-nuts ...	Greyish, and as a mordant.	128, 129, ii, viii	
URTICACEÆ.				
123. Artocarpus integrifolia, *Linn.*	Bark, wood, root. Fruit ...	Yellow. Auxiliary in dyeing with aich.	91, 92, v, ix	38, 69-70, 125, 126
124. Ficus glomerata, *Willd.*	Bark ...	Black with other barks.	.....	136, 144
125. Ficus mysorensis, *Roth.*	Bark ...	Dirty brown	viii	
126. Ficus religiosa, *Linn.*	Bark ... Root ...	Brown, and as a mordant. Pale pink ...	v, viii	50, 136, 144, 159, 165
127. Plecospermum spinosum, *Trecul.* (Batis spinosa, *Roxb.*)	Bark, wood ...	Yellow ...	.....	86, 88, 90
128. Sarcochlamys pulcherrima, *Gaudich.*	Leaves and twigs.	Madder-brown with the bark of *Albizzia odoratissima.*	127, viii	39, 145

Scientific Name.	Part of plant used.	Colour produced, &c.	Page in Mr. Liotard's Memorandum.	Page in this Report.
PIPERACEÆ.				
129. Piper Betle, *Linn.*	"Leaves used at Kánauj for colouring the border of a kind of chintz made there, called *fard pukhta.*"	? ...	iii	35, 75, 132
130. Piper Chaba, *W. Hunter, Asiat., Res.*, IX, 391.	Wood and roots.	Brown ...	.....	3, 136
CASUARINÆ.				
131. Casuarina equisetifolia, *Forst.* (C. muricata, *Roxb.*)	Bark ... Nut-juice ...	Mordant ... Black ...	10, 114	
CONIFERÆ.				
132. Cupressus sempervirens, *Linn.*	Fruit ...	Black with salts of iron.	117, v	
PALMÆ.				
133. Areca Catechu, *Linn.*	Astringent extract from nut.	Coffee-brown, and as a mordant.	8	35, 75, 132-33
134. Cocos nucifera, *Linn.*	Fruit-rind ...	Dirty-brown (*khaki.*)	vii	
SCITAMINEÆ.				
135. Alpinia Galanga, *Swz.*	Wood ...	Auxiliary in calico-printing.	iv	
136. Curcuma longa, *Linn.*	Rhizomes ...	Yellow, and as an auxiliary with other dyes.	4, 6, 13, 29, 57, 61, 63, 67, 69, 72, 83-87, 92, 93, 94, 95, 96, 125, 126, 127, 128, 129, 131, 133, 134, 136, 137, 138, i, ii	3, 17, 19, 20, 31, 33, 42, 43, 55, 76-87, 88, 90, 125, 126, 150

Scientific Name.	Part of plant used.	Colour produced, &c.	Page in Mr. Leonard's Enumeration.	Page in this Report.
SCITAMINEÆ—contd.				
127. Curcuma *Zedoaria*. *Rosc.* (C. *aromatica*, *Salisb.*)	Rhizomes ...	Dirty yellow, and in preparing sair powder.	vii	4, 87, 91
128. Curcuma *Zerumbet*. *Roxb.*	Rhizomes ..	In preparing sair powder, and as an auxiliary in dyeing with *Morinda* (*M. tinctoria*.)	iii	4, 19, 87
LILIACEÆ.				
129. Aloe indica. *Royle* (*A. perfoliata*. *Roxb.*)	? —	Black —	116	
IRIDACEÆ.				
130. Crocus sativus. *Linn.*	Flowers ...	Yellow —	94, 95, 96, 130, iv, vi.	90

* Imported.

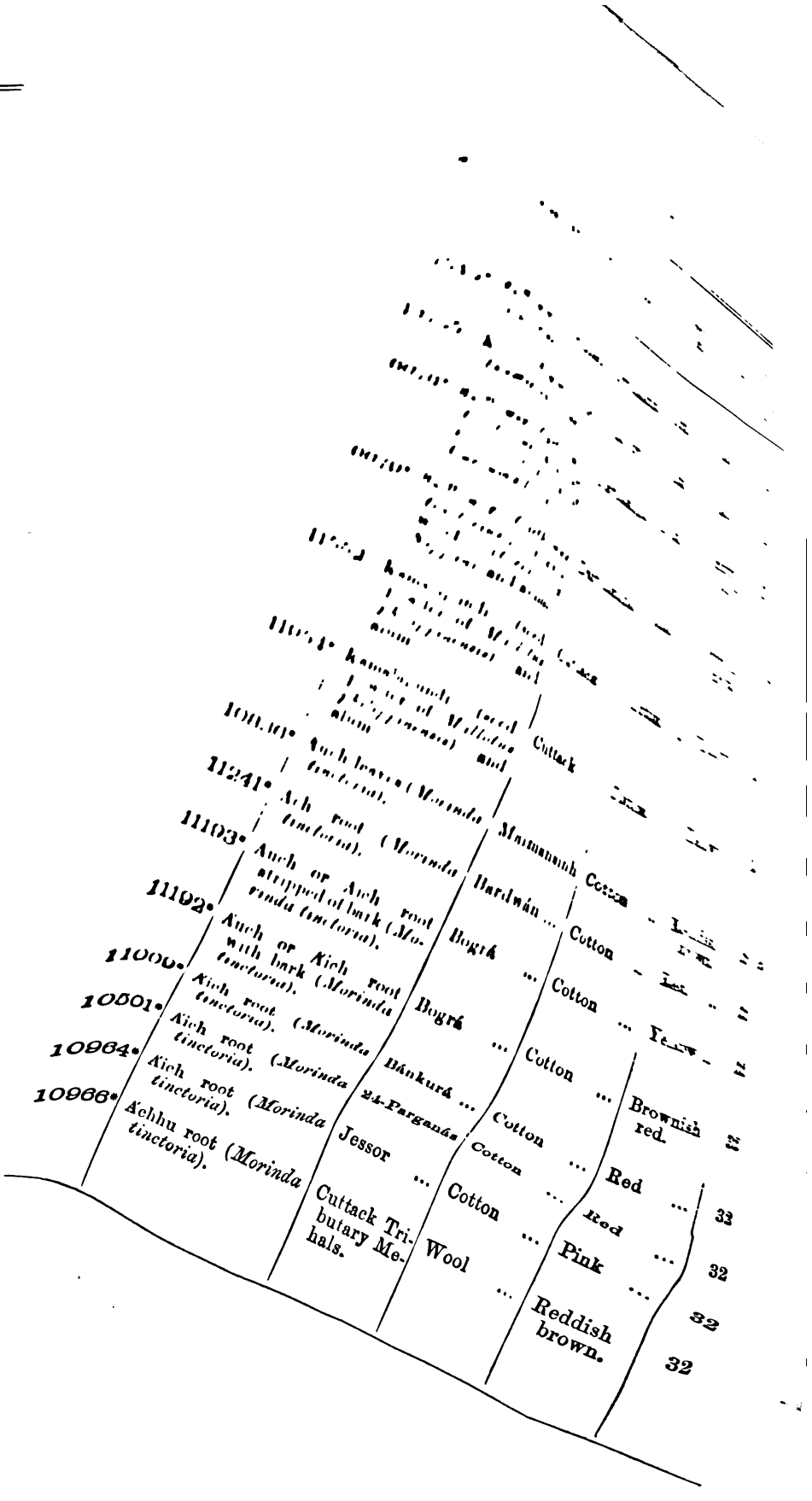
APPENDIX B.

List of specimens of fabrics, dyed by processes explained in the preceding pages, in the Bengal Economic Museum, Calcutta.

DUPLICATES of the specimens marked thus (*) formed the collection of 108 samples of fabrics dyed with Bengal dyes forwarded by Mr. Locke to the Secretary of State for India in 1878.

As many of these colours are not permanent, and the specimens have been in the Museum for many years, it is impossible in some cases to find out what the original colour was. These are marked with a query (?).

Museum Nos.	INGREDIENTS OF DYE.	Whence received.	Nature of fabric.	Colour.	Page where process of dyeing is described.
12183*	Bakam wood (*Cæsalpinia Sappan*).	Calcutta ...	Silk yarn...	Red ...	3
12184*	Bakam wood (*Cæsalpinia Sappan*).	Calcutta ...	Cotton yarn	Red (?) ...	3
12968	Bakam wood (*Cæsalpinia Sappan*).	Balasor ...	Cotton ...	Red (?) ...	3
11173*	Tairi (legumes of *Cæsalpinia Sappan*) and hirakosh (protosulphate of iron).	Monghyr...	Cotton ...	Blackish grey.	3, 138
11345*	Bakam wood (*Cæsalpinia Sappan*) and chaikatha (wood and roots of *Piper Chaba*).	Balasor ...	Cotton ...	Brownish red (?)	3, 136
12967	Bakam wood (*Cæsalpinia Sappan*) and chaikatha (wood and roots of *Piper Chaba*).	Balasor ...	Cotton ...	Brownish red.	3, 136
11347*	Bakam wood (*Cæsalpinia Sappan*) and lodh bark (*Symplocos racemosa*).	Balasor ...	Cotton ...	Brownish purple.	3, 88
6670	Safflower (*Carthamus tinctorius*).	Muzaffarpur	Cotton ...	Red ...	16
6671	Safflower (*Carthamus tinctorius*).	Muzaffarpur	Cotton ...	Red ...	16
6677*	Safflower (*Carthamus tinctorius*).	Darbhangah	Cotton ...	Red ...	16



Museum Nos.	Ingredients of Dye.	Whence received.	Nature of fabric.	Colour.	Page where process of dyeing is described.
11557*	Achhu root-bark (*Morinda tinctoria*).	Cuttack Tributary Mehals.	Cotton ...	Reddish brown.	32
10968*	Ach root-bark (*Morinda tinctoria*).	Singbhúm...	Cotton ...	Red ...	33
10969*	Ach root (*Morinda tinctoria*).	Singbhúm...	Cotton ...	Purplish red.	33
10848*	Al root (*Morinda tinctoria*), dhao flowers (*Woodfordia floribunda*), harra (fruit of *Terminalia citrina*), &c.	Monghyr ...	Cotton ...	Red ...	33
10849*	Al root (*Morinda tinctoria*), dhao flowers (*Woodfordia floribunda*), harra (fruit of *Terminalia citrina*), &c.	Monghyr ...	Cotton ...	Red ...	33
11216*	Al root (*Morinda tinctoria*), lodh bark (*Symplocos racemosa*), turmeric (rhizomes of *Curcuma longa*), alum, and myrabolans (fruit of *Terminalia Chebula*).	Sáran ...	Cotton ...	Red ...	33
10489*	Al root (*Morinda tinctoria*).	Patná ...	Cotton ...	Red ...	33
10490*	Al root (*Morinda tinctoria*), myrabolans (fruit of *Terminalia Chebula*), and alum.	Patná ...	Cotton ...	Yellow ...	33
6672*	Al root (*Morinda tinctoria*), myrabolans (fruit of *Terminalia Chebula*), and alum.	Muzaffarpur	Cotton ...	Red ...	33
10962*	Al root (*Morinda tinctoria*), myrabolans (fruit of *Terminali Chebula*), and alum.	Muzaffarpur	Cotton ...	Red ...	33

Museum Nos.	Ingredients of Dye.	Whence received.	Nature of fabric.	Colour.	Page where process of dyeing is described.
7548*	Safflower (*Carthamus tinctorius*).	Darbhangah	Cotton ...	Red ...	16
13785	Kusum flowers (*Carthamus tinctorius*).	Dinájpur ...	Cotton ...	Red ...	16
6678*	Safflower (*Carthamus tinctorius*) and turmeric (rhizomes of *Curcuma longa*).	Darbhangah	Cotton ...	Saffron yellow.	17
6679*	Safflower (*Carthamus tinctorius*), bakam wood (*Cæsalpinia Sappan*), and alum.	Darbhangah	Cotton ...	Purplish brown.	3, 17
11552	Kamalágundi (seed-powder of *Mallotus philippinensis*) and alum.	Cuttack ...	Cotton ...	Yellow (?)	19
11954*	Kamalágundi (seed-powder of *Mallotus philippinensis*) and alum.	Cuttack ...	Cotton ...	Yellow (?)	19
10836*	Áuch leaves (*Morinda tinctoria*).	Maimansinh	Cotton ...	Reddish brown.	26, 36
11241*	Ách root (*Morinda tinctoria*).	Bardwán ...	Cotton ...	Red ...	32
11193*	Áuch or Áich root stripped of bark (*Morinda tinctoria*).	Bográ ...	Cotton ...	Yellow ...	32
11192*	Áuch or Áich root with bark (*Morinda tinctoria*).	Bográ ...	Cotton ...	Brownish red.	32
11009*	Áich root (*Morinda tinctoria*).	Bánkurá ...	Cotton ...	Red ...	32
10501*	Áich root (*Morinda tinctoria*).	24-Parganás	Cotton ...	Red ...	32
10964*	Áich root (*Morinda tinctoria*).	Jessor ...	Cotton ...	Pink ...	32
10966*	Áchhu root (*Morinda tinctoria*).	Cuttack Tributary Mehals.	Wool ...	Reddish brown.	32

Museum Nos.	Ingredients of Dye.	Whence received.	Nature of fabric.	Colour.	Page where process of dyeing is described.
11557*	Achhu root-bark (*Morinda tinctoria*).	Cuttack Tributary Mehals.	Cotton ...	Reddish brown.	32
10968*	Ach root-bark (*Morinda tinctoria*).	Singbhúm...	Cotton ...	Red ...	33
10969*	Ach root (*Morinda tinctoria*).	Singbhúm...	Cotton ...	Purplish red.	33
10848*	Al root (*Morinda tinctoria*), dhao flowers (*Woodfordia floribunda*), harra (fruit of *Terminalia citrina*), &c.	Monghyr ...	Cotton ...	Red ...	33
10849*	Al root (*Morinda tinctoria*), dhao flowers (*Woodfordia floribunda*), harra (fruit of *Terminalia citrina*), &c.	Monghyr ...	Cotton ...	Red ...	33
11216*	Al root (*Morinda tinctoria*), lodh bark (*Symplocos racemosa*), turmeric (rhizomes of *Curcuma longa*), alum, and myrabolans (fruit of *Terminalia Chebula*).	Sáran ...	Cotton ...	Red ...	33
10489*	Al root (*Morinda tinctoria*).	Patná ...	Cotton ...	Red ...	33
10490*	Al root (*Morinda tinctoria*), myrabolans (fruit of *Terminalia Chebula*), and alum.	Patná ...	Cotton ...	Yellow ...	33
6672*	Al root (*Morinda tinctoria*), myrabolans (fruit of *Terminalia Chebula*), and alum.	Muzaffarpur	Cotton ...	Red ...	33
10962*	Al root (*Morinda tinctoria*), myrabolans (fruit of *Terminali Chebula*), and alum.	Muzaffarpur	Cotton ...	Red ...	33

Museum Nos.	Ingredients of Dye.	Whence received.	Nature of fabric.	Colour.	Page where process of dyeing is described.
11052*	Ál root-bark (*Morinda tinctoria*), dhao flowers (*Woodfordia floribunda*), and myrabolans (fruit of *Terminalia Chebula*).	Darbhangah	Cotton ...	Red ...	34
1097*	Aich root (*Morinda tinctoria*) and alum.	Bírbbúm ...	Cotton ...	Red ...	34
4655*	Ach root (*Morinda tinctoria*) and alum.	Bírbhúm ...	Woollen yarn	Red ...	34
3517*	Ach root (*Morinda tinctoria*) and alum.	Bírbhúm ...	Woollen yarn	Red ...	34
11335*	Dáruharidrá root (*Morinda tinctoria*) and bhauri leaves (*Symplocos theæfolia*).	Dinájpur ...	Cotton ...	Brownish red.	34
11576*	Dáruharidrá root (*Morinda tinctoria*) and bhauri leaves (*Symplocos theæfolia*).	Dinájpur ...	Cotton ...	Red ...	34
11166*	Dáruharidrá root (*Morinda tinctoria*) and bhauri leaves (*Symplocos theæfolia*).	Dinájpur ...	Cotton ...	Yellow (?)	34
11340*	Dáruharidrá root (*Morinda tinctoria*) and bhauri leaves (*Symplocos theæfolia*).	Dinájpur ...	Cotton ...	Red ...	34
11243*	Malancha or ál root (*Morinda tinctoria*) and lodh bark (*Symplocos racemosa*).	Bákarganj	Cotton ...	Red ...	35
12776	Dáruharidrá root-bark (*Morinda tinctoria*) and latkan bark (*Bixa Orellana*).	Kuch Behar	Cotton ...	Brownish pink.	35
12777	Dáruharidrá root-bark (*Morinda tinctoria*) and bhauri leaves (*Symplocos theæfolia*).	Kuch Behar	Cotton ...	Red ...	35

Museum Nos.	Ingredients of Dye.	Whence received.	Nature of fabric.	Colour.	Page where process of dyeing is described.
12778	Dáruharidrá root-bark (*Morinda tinctoria*) and bhauri leaves (*Symplocos theæfolia*).	Kuch Behar	Woollen yarn	Red ...	35
11202*	Áchhu root (*Morinda tinctoria*) and ashes of plants.	Tipperah ...	Cotton ...	Red ...	35
11203*	Áchhu root (*Morinda tinctoria*) and ashes of plants.	Tipperah ...	Cotton ...	Red (?)...	35
4017*	Áchhu root (*Morinda tinctoria*), lodh bark (*Symplocos racemosa*), khárpáni, and castor oil.	Balasor ...	Cotton yarn	Red ...	36
4018	Áchhu root (*Morinda tinctoria*), lodh bark (*Symplocos racemosa*), khárpáni, and castor oil.	Balasor ...	Cotton ...	Pink ...	36
10491	Áuch root (*Morinda tinctoria*).	Mánbhúm...	Cotton ...	Red ...	36
10806*	Ách root (*Morinda tinctoria*).	Mánbhúm...	Cotton ...	Red (?)...	36
10787*	Ách root (*Morinda tinctoria*).	Midnapur	Cotton ...	Red ...	36
10833*	Áchhu root (*Morinda tinctoria*).	Balasor ...	Cotton ...	Red ...	36
11061*	Áchhu root (*Morinda tinctoria*).	Puri ...	Woollen yarn	Red ...	36
12444	Chenung root (*Morinda angustifolia*).	Garo Hills	Cotton yarn	Red ...	39
11239*	Rung-gach root (*Morinda sp.*) and kharula bark.	Chittagong	Cotton ...	Red ...	40
13581	Rung-gach root (*Morinda sp.*) and ashes of plants.	Chittagong Hill Tracts.	Cotton ...	Red ...	41
6681*	Shinghar flowers (*Nyctanthes Arbor-tristis*).	Darbhangah	Cotton ...	Orange...	42

Museum Nos.	Ingredients of Dye.	Whence received.	Nature of fabric.	Colour.	Page where process of dyeing is described.
6668	Shinghar flowers (*Nyctanthes Arbor-tristis*).	Muzaffarpur	Cotton ...	Orange...	42
7546*	Singrahar flowers (*Nyctanthes Arbor-tristis*).	Darbhangah	Cotton ...	Orange...	42
11209*	Harsinghar flowers (*Nyctanthes Arbor-tristis*).	Patná ...	Cotton ...	Orange...	42
13786	Shinghar flowers (*Nyctanthes Arbor-tristis*) and alum.	Dinájpur ...	Cotton ...	Orange...	42
13029	Surbuli root (*Oldenlandia umbellata*), ginjelly oil, and alum.	Ganjam, Madras Presidency.	Cotton ...	Red ...	44
13120	Surbuli root (*Oldenlandia umbellata*), ginjelly oil, and alum.	Tekkali in Ganjam.	Cotton ...	Red ...	44
13121	Surbuli root (*Oldenlandia umbellata*), ginjelly oil, and alum.	Chicacole in Ganjam.	Cotton ...	Red ...	44
10693	Manjistha twigs (*Rubia cordifolia*) and titaphapur (*Fagopyrum esculentum*).	Dárjíling.	Cotton yarn	Light purple.	49, 143
12252	Lac-dye and thanthelang bark (*Acacia Intsia*).	Jalpáigurí	Silk ...	Red ...	54, 142
4492*	Lac-dye, lodh-bark (*Symplocos racemosa*), and sajimati.	Maldah ...	Silk ...	Red ...	54, 88
11343*	Lac-dye, lodh-bark (*Symplocos racemosa*), and sajimati.	Maldah ...	Cotton ...	Red ...	54, 88
12855	Lac-dye, flour paste, lodh-bark (*Symplocos racemosa*), and huldi (rhizomes of *Curcuma longa*).	Patná Jail	Woollen yarn	Red ...	55

Museum Nos.	Ingredients of Dye.	Whence received.	Nature of fabric.	Colour.	Page where process of dyeing is described.
12856	Lac-dye, flour paste, lodh-bark (*Symplocos racemosa*), and huldi (rhizomes of *Curcuma longa*).	Patná Jail	Woollen yarn	Red ...	55
3440	Lac-dye, quality No. 1	Bírbhúm ...	Wool ...	Red ...	55
4651	Lac-dye, quality No. 1	Bírbhúm ...	Wool ...	Red ...	55
3441	Lac-dye, quality No. 2	Bírbhúm ...	Wool ...	Red ...	55
4652	Lac-dye, quality No. 2	Bírbhúm ...	Wool ...	Red ...	55
3442	Lac-dye, quality No. 3	Bírbhúm ...	Wool ...	Red ...	55
4653	Lac-dye, quality No. 3	Bírbhúm ...	Wool ...	Red ...	55
2012	Lac-dye ...	Bírbhúm ...	Wool ...	Red ...	55
2028	Lac-dye ...	Cossipore ...	Wool ...	Red ...	55
7730	Lac-dye ...	Bánkurá ...	Wool ...	Red ...	55
8108	Lac-dye ...	Bardwán ...	Wool ...	Red ...	55
2007	Lac-dye ...	Assam ...	Wool ...	Red ...	55
12941	Lac-dye ...	Hoshiarpur	Silk yarn...	Red ...	55
11245*	Ráng twigs (*Peristrophe tinctoria*).	Midnapur	Cotton ...	Red ...	67
4495*	Kántál-wood sawdust (*Artocarpus integrifolia*).	Rájsháhí ...	Silk ...	Yellowish brown.	69
11247*	Jack-wood sawdust (*Artocarpus integrifolia*), fuller's earth, and alum.	Rájsháhí ...	Silk ...	Yellow ...	70
11168*	Latkan seeds (*Bixa Orellana*) and alum.	Húglí ...	Cotton ...	Yellowish red (?)	72
12181*	Latkan seed-pulp (*Bixa Orellana*) and kamaláguri (seed-powder of *Mallotus philippinensis*).	Calcutta ...	Cotton yarn	Orange ...	20, 72
12182*	Latkan seed-pulp (*Bixa Orellana*) and kamaláguri (seed-powder of *Mallotus philippinensis*).	Calcutta ...	Silk yarn ...	Orange ...	20, 72

Museum Nos.	Ingredients of Dye.	Whence received.	Nature of fabric.	Colour.	Page where process of dyeing is described.
11208*	Parás flowers (*Butea frondosa*).	Patná ...	Cotton ...	Orange ...	73
11365*	Palás or kes flowers (*Butea frondosa*), alum, and lime.	Mánbhúm	Cotton ...	Orange ...	73
11553*	Kes or parás flowers (*Butea frondosa*), alum, and lime.	Mánbhúm	Cotton ...	Orange ...	73
11554*	Kes or parás flowers (*Butea frondosa*), alum, and lime.	Mánbhúm	Cotton ...	Orange ...	74
11555*	Kes or parás flowers (*Butea frondosa*), alum, and lime.	Mánbhúm	Cotton ...	Orange ...	74
13784	Palás flowers (*Butea frondosa*), lime, and alum.	Dinájpur ...	Cotton ...	Orange ...	74
11217*	Tesu flowers (*Butea frondosa*), alum, and sajimati.	Sáran ...	Cotton ...	Orange-red.	74
12852	Parás flowers (*Butea frondosa*), lodh-bark (*Symplocos racemosa*), and sajimati.	Patná Jail...	Woollen yarn	Yellow (*jurdá*).	74
12853	Parás flowers (*Butea frondosa*), lodh-bark (*Symplocos racemosa*), and sajimati.	Patná Jail...	Woollen yarn	Yellow (*badámi*).	74
6669	Toon flowers (*Cedrela Toona*).	Muzaffarpur	Cotton ...	Yellow ...	75
7545*	Toon flowers (*Cedrela Toona*).	Darbhangah	Cotton ...	Yellow...	75
11210*	Toon flowers (*Cedrela Toona*).	Patná ...	Cotton ...	Yellow...	75
6680*	Toon flowers (*Cedrela Toona*) and turmeric (rhizomes of *Curcuma longa*).	Darbhangah	Cotton ...	Yellow...	75
4646	Turmeric (rhizomes of *Curcuma longa*).	Bánkurá ...	Silk ...	Yellow ...	85

Museum Nos.	Ingredients of Dye.	Whence received.	Nature of fabric.	Colour.	Page where process of dyeing is described.
6682*	Turmeric (rhizomes of *Curcuma longa*).	Darbhangah	Cotton ...	Yellow...	85
7547*	Turmeric (rhizomes of *Curcuma longa*).	Darbhangah	Cotton ...	Yellow ...	85
12180*	Turmeric (rhizomes of *Curcuma longa*), sajimati, and lemon juice.	Calcutta ...	Silk-yarn ...	Yellow (*basanti*).	85
11063*	Pili rung and lime-juice, pili rung being prepared from mahooa bark (*Bassia latifolia*), mango bark (*Mangifera indica*), pomegranate bark (*Punica Granatum*), kuchnar bark (*Bauhinia variegata*), turmeric (rhizomes of *Curcuma longa*), sajimati, and alum.	Monghyr ...	Cotton ...	Yellow ...	85
12854	Huldi (rhizomes of *Curcuma longa*), harra (fruit of *Terminalia Chebula*), and alum.	Patná Jail...	Woollen yarn	Yellow (*pumba*).	86
11346*	Lodh bark (*Symplocos racemosa*).	Balasor ...	Cotton ...	Pale brown(?)	88
10692	Singen (*Symplocos theæfolia ?*).	Dárjíling ...	Woollen yarn	Green ...	89
10694	Singen (*Symplocos theæfolia ?*).	Dárjíling ...	Woollen yarn	Red ...	89
10695	Singen (*Symplocos theæfolia ?*).	Dárjíling ...	Woollen yarn	Yellow ...	89
10696	Singen (*Symplocos theæfolia ?*).	Dárjíling ...	Woollen yarn	Yellowish red.	89
13114	Gach huldi bark ...	Chittagong	Cotton ...	Yellow ...	91
11170*	Piori (prepared from cow's urine).	Monghyr ...	Cotton ...	Yellow ...	92
12847	Indigo (*Indigofera tinctoria*), sajimati, chuna, and gur.	Patná Jail	Woollen yarn	Blue (*leelá*).	123

Museum Nos.	Ingredients of Dye.	Whence received.	Nature of fabric.	Colour.	Page where process of dyeing is described.
12848	Indigo (*Indigofera tinctoria*), sajimati, chuna, and gur.	Patná Jail	Woollen yarn	Sky blue (*asmáni*).	123
12849	Indigo (*Indigofera tinctoria*), sajimati, chuna, and gur.	Patná Jail	Woollen yarn	Light blue (*kowridl-lak*).	123
13800	Indigo (*Indigofera tinctoria*) and singen (*Symplocos theæfolia?*)	Dárjíling ...	Cotton yarn	Blue ...	89, 124
4016	Indigo (*Indigofera tinctoria*), áchhu root (*Morinda tinctoria*), lodh-bark (*Symplocos racemosa*), and khár-páni.	Balasor ...	Cotton ...	Blue ...	36, 124
13580	Indigo or kalma (*Indigofera tinctoria*), ichi seeds, and ashes of plants.	Chittagong Hill Tracts.	Cotton ...	Blue ...	125
4494*	Indigo (*Indigofera tinctoria*).	Rájsháhí and Kuch Behar Division.	Silk ...	Blue ...	125
10689*	Ryomn (*Indigofera tinctoria?*).	Dárjíling ...	Woollen yarn	Blue ...	125
10690*	Ryomn (*Indigofera tinctoria?*).	Dárjíling ...	Woollen yarn	Blue ...	125
10691*	Indigo (*Indigofera tinctoria*).	Dárjíling ...	Cotton yarn	Blue ...	125
12190*	Indigo (*Indigofera tinctoria*).	Calcutta ...	Cotton yarn	Blue ...	125
12191*	Indigo (*Indigofera tinctoria.*)	Calcutta ...	Silk yarn ...	Blue ...	125
12185*	Indigo (*Indigofera tinctoria*), bakam wood (*Cæsalpinia Sappan*), and alum.	Calcutta ...	Silk yarn ...	Purple ...	3, 125
11286*	Indigo (*Indigofera tinctoria*), bakam wood (*Cæsalpinia Sappan*), and alum.	Calcutta ...	Cotton yarn	Purple ...	3, 125
4493*	Indigo (*Indigofera tinctoria*) and lac-dye.	Rájsháhí and Kuch Behar Division.	Silk ...	Purple ...	125

Museum Nos.	Ingredients of Dye.	Whence received.	Nature of fabric.	Colour.	Page where process of dyeing is described.
4491*	Indigo (*Indigofera tinctoria*) and turmeric (rhizomes of *Curcuma longa*).	Maldah ...	Silk	Green ...	86, 126
13799	Indigo (*Indigofera tinctoria*), singen leaves (*Symplocos theæfolia*), and huldi (rhizomes of *Curcuma longa*).	Dárjíling...	Cotton ...	Green ...	86, 89, 126
12850	Indigo (*Indigofera tinctoria*), sajimati, chuna, gur, huldi (rhizomes of *Curcuma longa*), and peworree water (yellow extract from flowers of *Carthamus tinctorius*).	Patná Jail	Woollen yarn	Dark green (*hárá*).	126
12851	Indigo (*Indigofera tinctoria*), sajimati, chuna, gur, huldi (rhizomes of *Curcuma longa*), peworree water (yellow extract from flowers of *Carthamus tinctorius*), and alum.	Patná Jail	Woollen yarn	Light green (*dháni.*)	126
12188*	Indigo (*Indigofera tinctoria*), turmeric (rhizomes of *Curcuma longa*), and lemon or lime juice.	Calcutta ...	Silk yarn...	Green ...	86, 126
12189*	Indigo (*Indigofera tinctoria*), turmeric (rhizomes of *Curcuma longa*), and lemon or lime juice.	Calcutta ...	Cotton yarn	Green (?)	86, 126
11505*	Báblá bark (*Acacia arabica*) and alum.	Midnapur	Cotton ...	Brown ...	128
11567*	Báblá bark (*Acacia arabica*), keund bark (*Diospyros melanoxylon*), and alum.	Midnapur	Cotton ...	Black ...	128
11364*	Makurkend or gáb fruit (*Diospyros Embryopteris*).	Mánbhúm	Cotton ...	Brown ...	134

Museum Nos.	Ingredients of Dye.	Whence received.	Nature of fabric.	Colour.	Page where process of dyeing is described.
11248*	Gáb fruit (*Diospyros Embryopteris*), haritoki (fruit of *Terminalia Chebula*), and hirakosh (protosulphate of iron).	Dacca Division.	Cotton ...	Black ...	135
11180*	Mádár chhal (bark of *Erythrina sp.*) and alum.	Midnapur	Cotton ...	Light brown.	135
11178*	Asud chhal (bark of *Ficus religiosa*) and alum.	Midnapur	Cotton ...	Brown ...	136
11181*	Bakul chhal (bark of *Mimusops Elengi*) and alum.	Midnapur	Cotton ...	Light brown.	136
11569*	Bakul bark (*Mimusops Elengi*), ashna bark (*Terminalia tomentosa*), and alum.	Midnapur	Cotton ...	Brownish red.	136, 152
11344*	Chaikatha (wood and roots of *Piper Chaba*).	Balasor ...	Cotton ...	Pale brown.	136
11197*	Bhalia fruit (*Semecarpus Anacardium*) with oil.	Balasor ...	Cotton ...	Greyish black.	137
11198*	Bhalia fruit (*Semecarpus Anacardium*).	Balasor ...	Cotton ...	Greyish black.	137
11231*	Bhelwah fruit (*Semecarpus Anacardium*) and alum.	Hazáribágh	Cotton ...	Dark grey	137
11194*	Kuchla seed (*Strychnos Nux-vomica*) and lime.	Balasor ...	Cotton ...	Pale brown.	138
11195*	Kuchla seed (*Strychnos Nux-vomica*), hirakosh (protosulphate of iron), and lime.	Balasor ...	Cotton ...	Dark brown.	138
11196*	Kuchla seed (*Strychnos Nux-vomica*), and hirakosh (protosulphate of iron).	Balasor ...	Cotton ...	Brownish black.	138

Museum Nos.	Ingredients of Dye.	Whence received.	Nature of fabric.	Colour.	Page where process of dyeing is described.
12857	Kasis (protosulphate of iron), bábur pods (*Acacia arabica*), and goohia bábur pods (*Acacia Farnesiana*).	Patná Jail	Woollen yarn	Black ...	138
12858	Lac-dye, flour-paste, kasis (protosulphate of iron), bábur pods (*Acacia arabica*), and goohia bábur pods (*Acacia Farnesiana*).	Patná Jail	Woollen yarn	Violet (*khutmuly*)	138
11955*	Aola fruit (*Phyllanthus Emblica*), hirakosh (protosulphate of iron), and lime juice.	Cuttack ...	Cotton ...	Blackish grey.	144
6718	Anar-ka-chilka (fruit-rind of *Punica Granatum*.)	Sáran ...	Cotton ...	Yellow ...	144
11218*	Anar-ka-chilka (fruit-rind of *Punica Granatum*).	Sáran ...	Cotton ...	Light brown ?	144
11550*	Harra (fruit of *Terminalia Chebula*) and iron filings.	Cuttack ...	Cotton ...	Black ...	149
12187*	Haritoki (fruit of *Terminalia Chebula*) and iron filings.	Calcutta ...	Silk yarn ...	?	149
12192*	Haritoki (fruit of *Terminalia Chebula*) and iron filings.	Calcutta ...	Cotton yarn	Black ...	149
12193*	Haritoki (fruit of *Terminalia Chebula*) and iron filings.	Calcutta ...	Silk yarn ...	Black ...	149
11349*	Country gallnuts (fruit of *Terminalia belerica*).	Balasor ...	Cotton ...	Snuffy brown.	151
11232*	Bahera fruit (*Terminalia belerica*), fruit-rind of pomegranate (*Punica Granatum*), and alum.	Hazáribágh	Cotton ...	Yellow ...	151
11179*	Arjun chhal (bark of *Terminalia Arjuna*) and alum.	Midnapur	Cotton ...	Brown (?)	151
11348*	Asan bark (*Terminalia tomentosa*).	Balasor ...	Cotton ...	Brown or buff.	152

APPENDIX

Table showing the Districts from which Specimens of the

Vernacular and Scientific Names.	Puri.	Cuttack.	Cuttack T. Mehals.	Balasor.	Midnapur.	Hugli.	Bardwan.	Bankura.	Birbhum.	24-Parganas.	Jessor.	Nadiya.	Murshidabad.	Chittagong.	Chittagong Hill Tracts.	Noakhali.	Bakarganj.	Faridpur.	Dacca.	Tipperah.
Al, ách, áich, &c., *Morinda tinctoria*, Roxb., *and M. citrifolia*, Linn. (root, root-bark, stem, leaves).	*	*	...	*	*	*	*	*	*	*	*	*	*	...	...	...	*	...	...	*
Amla, aola, ámlaki, &c., *Phyllanthus Emblica*, Linn. (fruit and leaves).	...	*	...	*	...	...	...	...	...	*	...	...	...	*	...	...	...	...	...	...
Amliá (stem, leaves, and seed.)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Anar, *Punica Granatum*, Linn. (fruit-rind).	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Arjun, *Terminalia Arjuna*, Bedd. (bark).	...	...	...	...	*	...	*	*	...	...	...	...	...	...	...	...	...	...	...	...
Asan or ashna, *Terminalia tomentosa*, Bedd. (bark).	...	*	...	*	*	...	*	*	...	...	...	...	...	...	...	...	...	...	...	...
Asud, ashatha, bur, &c., *Ficus religiosa*, Linn. (bark, leaves).	...	...	...	...	*	...	...	*	...	...	...	...	...	...	...	...	...	...	...	...
Báblá, bábul, &c., *Acacia arabica*, Willd. (bark, pods).	...	...	...	...	*	*	...	*	...	...	...	*	*	...	...	...	...	...	...	...
Bahará, bahera, &c., *Terminalia belerica*, Roxb. (fruit).	...	*	...	*	...	...	...	...	...	*	...	...	...	*	...	...	...	...	..	...
Bakam, tairi. *Cæsalpinia Sappan*, Linn. (wood, pods).	...	*	...	*	...	...	...	*	...	*	*	*	*	...	...	...	...	...	*	...
Bakul, *Mimusops Elengi*, Linn. (bark).	...	...	...	...	*	...	...	*	...	...	...	...	...	...	...	...	...	...	...	...
Banhaldi or palua, *Curcuma Zedoaria*, Roxb. (rhizomes).	...	...	...	*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Banhardi, dáruharidrá, *Morinda angustifolia*, Roxb. (root-bark, leaves).	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bhalia, bhelwah, *Semecarpus Anacardium*, Linn. (fruit).	...	*	...	*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bhauri, *Symplocos theæfolia*, Ham. (leaves).	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Chaikatha, *Piper Chaba*, W. Hunter, (wood, roots).	...	...	...	*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Chakai-phang (root) *	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*
Chákundá, *Cassia Tora*, Linn. (seeds).	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Chamái or chámárkasá, *Albizzia Lebbek*, Benth. (bark, fruit).	...	...	...	...	*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

* This table is based upon one drawn

C.

*Dye-Stuffs mentioned in the preceding pages have been received.**

Hill Tipperah.	Maimansinh.	Pabna.	Rajshahi.	Bogra.	Maldah.	Dinajpur.	Rangpur.	Santal Parganas.	Bhagalpur.	Monghyr.	Purniah.	Gaya.	Patna.	Shahabad.	Saran.	Champaran.	Muzaffarpur.	Darbhangah.	Chutia Nagpur T. Mehals.	Lohardaga.	Hazaribagh.	Manbhum.	Singbhum.	Jalpaiguri.	Kuch Behar T. Mehals.	Darjiling.
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up by Mr. Locke in 1877.

Vernacular and Scientific Names.	Puri.	Cuttack.	Cuttack T. Mehals.	Balasor.	Midnapur.	Hugli.	Bardwan.	Bankura.	Birbhum.	24-Parganas.	Jessor.	Nadiya.	Murshidabad.	Chittagong.	Chittagong Hill Tracts.	Noakhali.	Bakarganj.	Faridpur.	Dacca.	Tipperah.
Dalhuldi, *Morinda persicæfolia*, Ham. (root-bark.)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dawai, dhaiki, &c., *Woodfordia floribunda*, Salisb. (flowers).	...	...	...	...	...	...	...	...	...	*	...	...	...	...	...	...	...	...	...	...
Gab, makurkend, &c., *Diospyros Embryopteris*, Pers. (fruit).	...	...	...	...	*	*	...	...	...	...	...	...	...	...	...	...	...	...	*	...
Gach huldi	...	...	...	...	...	...	...	...	...	...	...	...	...	*	...	...	...	...	...	...
[illegible], [illegible] *Roxburghiana*, Arnott (wood, bark).	...	...	...	*	...	...	...	...	...	...	...	...	*	...	...	...	...	...	...	...
[illegible]	...	...	...	...	...	...	...	...	...	...	...	...	...	*	...	...	...	...	...	...
Geru mati, &c., red ochre ...	*	*	...	...	*	...	...	...	*	...	...	...	*	...	...	...	...	...	*	*
Guia babul, *Acacia Farnesiana*, Willd. (pod).	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
[illegible], *Plecospermum spinosum*, Trecul (wood, [illegible] stem).	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Harra, haritaki, &c., *Terminalia Chebula*, Retz. (fruit.)	...	*	...	*	*	...	...	...	...	*	*	...	*	*	...	*	...	...	...	...
Henna, mehndi, *Lawsonia alba*, Lamk. (leaves).	...	...	...	...	...	*	...	...	...	*	...	...	...	...	...	...	...	...	...	...
Hirakash (protosulphate of iron.)	...	*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Huldi, harrida, &c., *Curcuma longa*, Linn. (rhizomes.)	...	*	...	...	*	*	...	...	...	...	...	*	*	*	...	...	...	...	...	...
[illegible]	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*	...	...	...	...	...
[illegible], *Indigofera tinctoria*, Linn. (leaves, leaves with the extract therefrom).	*	*	...	...	*	...	*	*	...	*	...	*	*	*	*	...	...	...	*	...
[illegible] (seeds)	...	...	...	...	...	...	...	...	...	...	...	...	...	*	*	...	...	...	...	...
[illegible], *Citrus medica*, Linn. (leaves).	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
[illegible] (bark)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

	Hill Tipperah.
	Maimansinh.
	Pabna.
	Rajshahi.
	Bogra.
	Maldah.
	Dinajpur.
	Rangpur.
	Santal Parganas.
	Bhagalpur.
	Monghyr.
	Purniah.
	Gaya.
	Patna.
	Shahabad.
	Saran.
	Champaran.
	Muzaffarpur.
	Darbhangah.
	Chutia Nagpur T. Mehals.
	Lohardaga.
	Hazaribagh.
	Manbhum.
	Singbhum.
	Jalpaiguri.
	Kuch Behar T. Mehals.
	Darjiling.

Vernacular and Scientific Names.	Puri.	Cuttack.	Cuttack T. Mehals.	Balasor.	Midnapur.	Hugli.	Bardwan.	Bankura.	Birbhum.	24-Parganas.	Jessor.	Nadiya.	Murshidabad.	Chittagong.	Chittagong Hill Tracts.	Noakhali.	Bakarganj.	Faridpur.	Dacca.	Tipperah.
Kalagap (bark)	...	...	...	...	...	...	...	...	...	...	...	...	...	..	*	...	...	...	...	...
Kalai bamboo ash	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*	...	...	...	...	...
Kamalá, *Mallotus philippinensis*, Müll. Arg. (Seed-powder, fruit).	*	*	...	...	*	...	...	*	*	...	...	...	*	...	...	...	...	...	...	...
Kántánaté and kántánaté-kher, *Amaranthus spinosus*, Willd. (Stems, leaves, ash).	...	*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Kánthál, *Artocarpus integrifolia*, Linn. (bark, wood).	...	...	...	...	*	...	...	...	...	...	...	...	...	*	...	...	...	...	...	...
Keund, *Diospyros melanoxylon*, Roxb. (bark).	...	...	...	...	*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Kuchla, kochla, *Strychnos Nux-vomica*, Linn. (seeds).	...	...	...	*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Kunti, *Cæsalpinia digyna*, Rottl. (pod).	...	*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Kusum, *Carthamus tinctorius*, Linn. (flowers).	...	*	...	...	*	...	...	*	...	*	*	*	*	*	...	...	...	*	*	*
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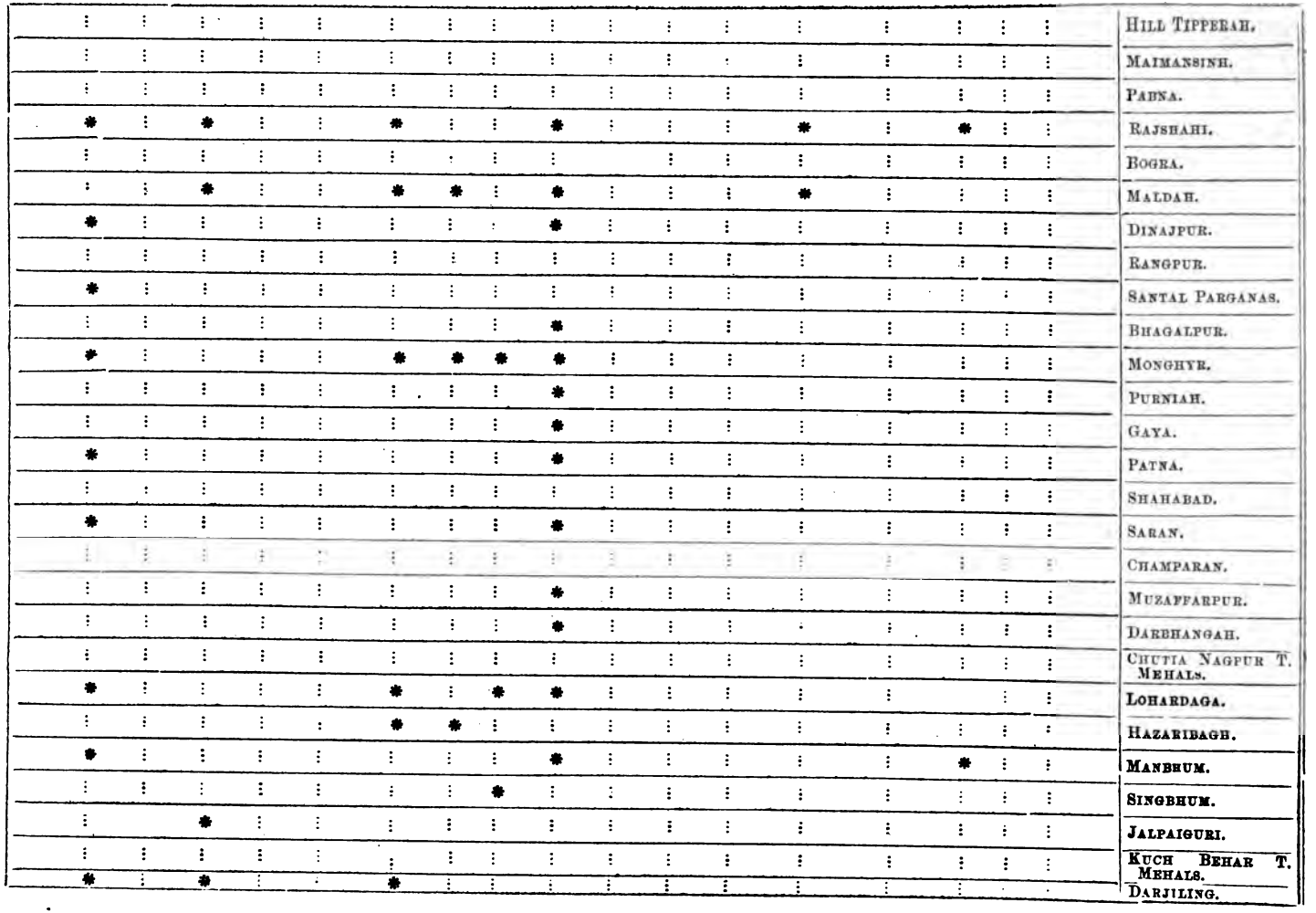
...lás, kes, &c., *Butea frondosa*, Roxb. (flowers).	...	*	...	...	...	...	...	...	...	...	...	...	...	*	...	...	...	...	..	...


Hill Tipperah.
Maimansinh.
Pabna.
Rajshahi.
Bogra.
Maldah.
Dinajpur.
Rangpur.
Santal Parganas.
Bhagalpur.
Monghyr.
Purniah.
Gaya.
Patna.
Shahabad.
Saran.
Champaran.
Muzaffarpur.
Darbhangah.
Chutia Nagpur T. Mehals.
Lohardaga.
Hazaribagh.
Manbhum.
Singbhum.
Jalpaiguri.
Kuch Behar T. Mehals.
Darjiling.

VERNACULAR AND SCIENTIFIC NAMES.	PURI.	CUTTACK.	CUTTACK T. MEHALS.	BALASOR.	MIDNAPUR.	HUGLI.	BARDWAN.	BANKURA.	BIRBHUM.	24-PARGANAS.	JESSOR.	NADIYA.	MURSHIDABAD.	CHITTAGONG.	CHITTAGONG HILL TRACTS.	NOAKHALI.	BAKARGANJ.	FARIDPUR.	DACCA.	TIPPERAH.
Peori, preparation from cow's urine.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Phulgach and phulgach ash	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*	...	...	...	...	...
Pili rung (p. 85)	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...
Rámraj, kaimáti, &c., yellow ochre.	*	*	...	...	*	..	...	*	...	...	...	*	...	...	...	...	...	...	...	...
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Samlick, (stem)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Shim, *Vigna Catiang*, Endl. (leaves).	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Singen, *Symplocos theæfolia*, Ham. (?), (leaves).	...	...	....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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Tari, tiree, chámárlati, &c., pods of various species of *Cæsalpinia*.	...	...	...	...	...	...	...	...	...	...	...	...	...	*	...	...	...	...	...	...
Thanthelang, *Acacia Intsia*, Willd. (bark, leaves).	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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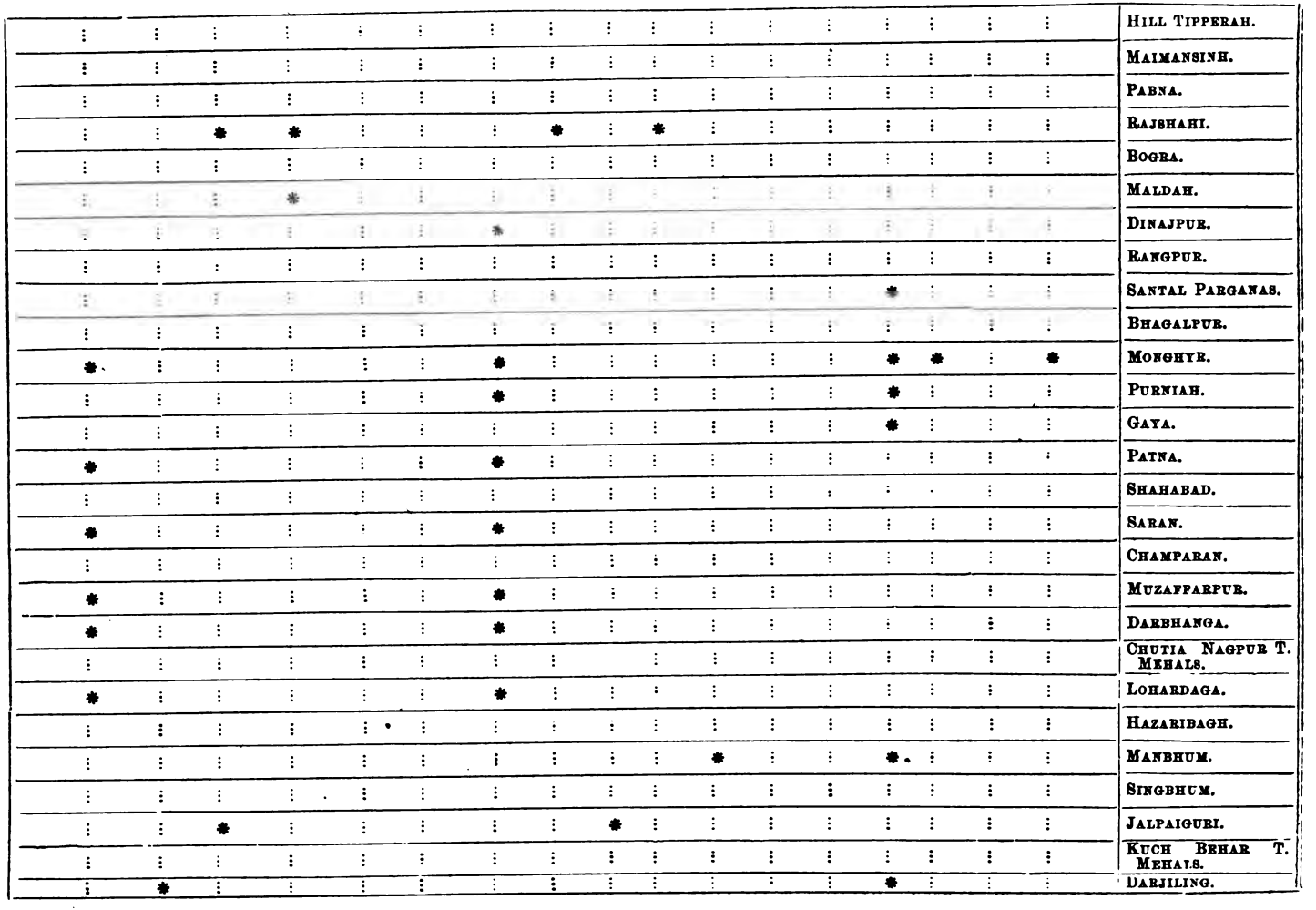
Hill Tipperah.
Maimansinh.
Pabna.
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Jalpaiguri.
Kuch Behar T. Mehals.
Darjiling.

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