methods, and that of itself was a great advantage; as only the good specimens were purchased by the commercial agents.

STRENGTH OF SUNN FIBRE.

In the anonymous pamphlet entitled, 'Observations on the Sunn Hemp of Bengal,' 1806, it is stated, that "the Court of Directors having sent orders to Bengal for the cultivation of Sunn with increased attention, tolerable success was attained in most places, but a superiority has certainly been manifested in particular spots, such as Dacca, Luckipore, Chittagong. Hurriall, Malda, Budaul, Rungpore, Radnagore, and Soonamooky"—but Commercolly and Cuttorah are not particularised, though good Sunn was no doubt produced at both places. These places have been mentioned now, to show that the experiments were carried on chiefly in Bengal, though it is by no means proved that the soil and climate of that province are better suited than those of many other parts of India for the production of good fibre. Indeed, there is little doubt that, whether owing to differences of soil and climate, or of preparation, the fibre of the same plant as grown in the West of India is stronger than as grown in Bengal. In the anonymous 'Obs.' it is further stated, that "the culture has not only been attended to by the most scientific men in India, but the means of dressing it so as to preserve the greatest strength to the fibre, &c.; and it is satisfactory to state, that some of the Sunn has exhibited a very considerable proportion of strength beyond the common expectation."

But the above pamphlet is chiefly valuable for giving the results of various "Experiments, made from 1802 to 1806, to ascertain the comparative strength of Sunn with Russian Hemp," made at Messrs. Huddart's rope-manufactory. "But in order to ascertain its comparative merit therewith, it is necessary first to state, that the difference in strength between the best and ordinary Russian Hemp is in the proportion of 5 to 4, sometimes as 6 to 4: that the strength of the best Russian Hemp to the best Sunn bears a proportion as 6 to 4." (p. 5.) "From hence it must be admitted, the Sunn, manufactured in the usual mode for cordage, cannot be put in competition for strength with Russian Hemp;" but when

prepared by Huddart's Warm Register, "the proportion between Sunn so manufactured and the best cordage made in the common mode, when above six-inch, is in favour of the Sunn cordage, progressively as the size is increased." Instances are then given of "a sixteen-inch cable made from Sunn in 1802, laid down as a mooring cable at Gravesend the whole winter; and after various examinations, by cutting off the clinches, upon different ships taking it in as moorings, for five months in succession, it was found so fresh and good, that it went by the last ship that rode by it, to India, as a working cable." (p. 6.) It was also made into canvas and other cloth with success. "This has been manifested in a topsail made for one of the Indiamen, put on board here without any intimation of its difference; and the sail is returned not worse than the other sails of the ship."[1] (p. 7.)

But it must be remembered that these experiments were made with the Sunn which had been grown and carefully prepared under the supervision of the East India Company's commercial agents. A specimen of one of these *Sunns* is still in the India House, marked per *David Scott*, 1802; which, though having the light colour and showing the appearance of ordinary Sunn, is from four to five feet in length, much cleaner, both strong and flexible, and also divisible into fine fibrils. A salvage of it bore 175 lb., when some Sunn sent to the Exhibition of 1851 bore only 150 lb. There is a specimen also of the heckled Sunn, per *Wellesley*, 1802, about three feet long, a bright-looking fibre, but with a good deal of the cellular part still adhering to the fibres. Ordinary Sunn is, moreover, only about three feet in length, rather dirty; fibres entangled and intermixed with portions of the boon, as well as with many short fibres; hence much loss is sustained in heckling, and the men complain of the irritating particles which are given off during this process.

The want of strength is not surprising, for though three days is thought sufficient for the steeping, we learn that the natives, from the press of other work or from indolence, sometimes allow the stems to remain in steep for fifteen days. (*v.* Wisset, p. 195.) It has already been mentioned that Dr.

[1] Its weft only was Sunn, the warp Flax.

Roxburgh, in heckling, found it lost about one third; though the tow is of course of use for some purposes.

But that some good Sunn is also prepared in the present day is evident from the difference in price which it brings in the English market. Mr. Dickson also having passed some of it through his machine; the Sunn has become light-coloured and clean, with the fibres lying parallel to one another, and showing them as well fitted for spinning. Parties who have seen it have pronounced it well worth £35 a ton.

That good Sunn may also be produced in some of the old localities is evident, for Mr. Sconce, when Collector of Chittagong, having grown some Hemp and Flax in this district, as already mentioned at p. 177, grew also some Sunn, which was thus reported on by the Hemp and Flax Committee of the Agri-Horticultural Society, 1843.

"G. *Sample of Sunn* (*Crotalaria juncea*) *or Indian Hemp.*—Quality in every respect superior; clean, strong, of even fibre; would meet with an extensive and ready sale in Europe; it would pay better if not heckled, but merely scutched.

"In addition to the above, your Committee would beg to call the attention of the Society to the memorandum appended to this Report, obligingly furnished by Mr. Deneef."

"G. This is also a good-quality sample; but, like samples B and E (dressed Hemp and dressed Flax), it has been prepared in too expensive a manner to admit of its being profitable. It is much better than my sample of Sunn, and perhaps would fetch £20 per ton in the English market." The sample of true Hemp grown at Chittagong, Mr. Deneef says, would have fetched £18, but if better prepared, £25 per ton.

CULTURE IN MADRAS TERRITORIES.

Dr. Roxburgh, in describing the culture about Rajahmundry, and in the Northern Circars, states that the seed is sown towards the close of the rains, in October or November. A strong clayey soil suits it best, the farmers say. About 120 lb. of seed to the acre is the usual allowance. It requires no further care than being covered with the soil, which is done with the common Hindoo harrow. In February or March soon after the flowers drop, and before the seeds are ripe

(when the Telinga people consider the fibre to be in the greatest perfection), it is pulled up by the roots, like Hemp in Europe; half dried in the sun, then tied up in bundles, and committed to the water, where it is steeped, &c. This plant, he further mentions—and it is the only one—is also cultivated there by some natives to feed their milch cows with during the dry season. It is very nourishing, and causes them to give more milk than most other food. It only bears two or three cuttings; after that, the plants perish. ('Corom. Plants,' v. ii, t. 193.)

Sunn is also cultivated in Rajahmundry as a second crop, on wet lands, with profit to the ryut; and is even exported from that and other Northern districts in some quantity.

Dr. Buchanan, in his 'Journey through Mysore,' mentions that, at Bangalore, Goni is a considerable article of manufacture, and that it is a coarse, but very strong sackcloth, from eighteen to twenty-two cubits in length, and from a half to a quarter of a cubit broad, and that it is made from the *Janupa*, or *Crotalaria juncea*. The *Goni* maker hires from some farmer as much high ground as he thinks will raise a quantity of *Janupa* sufficient to employ his family in manufacturing for the year. The soil may be red or black, but is not manured. The soil is sown broadcast when the rains become heavy. But it is also cultivated on rice-ground in the dry season, with the aid of irrigation. It requires four months to ripen. When cut down it is spread out to the sun and dried. The seed is then beaten out by striking the pods with a stick. The stems are then tied up in large bundles, and preserved in stacks or under sheds. The bundles are taken out as wanted, and put in the water, at which time their bands are cut, and the stems, being opened out, are kept down to the bottom by stones or mud. According to circumstances, they require to be kept in the water from six to eight days. When the bark separates easily from the stems they are taken out of the water, and a man taking them by handfuls beats them on the ground, and occasionally washes them, until they are clean, and at the same time picks out with his hand the remainder of the boon, until nothing except the bark be left. This is then dried, and, being taken up by handfuls, is beaten with a stick to separate and clean the fibres. ('Journ.,' i, p. 226.)

But when at Bhawani Kudal, in the Coimbatore district, he found a great deal of the *Shanapu*. This was grown by the farmers, who, when it is fit for steeping, sell it to the people called Telinga Chitties, who make the Hemp, and work it up into *goni* or sackcloth. There it thrives best on a poor, sandy soil, which, however, is manured any day between the 12th of July and the same day of August. The seed is sown broadcast after rain, and very thick—rather more than two bushels for an acre. The stems are sold by the thousand handfuls. Tall plants sell at two rupees for the thousand handfuls; short ones for a rupee and a half.

But the same plant is also cultivated on fields that have produced a crop of rice, between the 12th of January and the 12th of February. In the following month the field is watered, the seed sown, and covered with the plough. Once a month it requires to be watered, and it takes four months to ripen. This is more valuable than the Hemp cultivated on dry field. An acre requires $4\frac{8}{10}$ bushels of seed, and its produce was in those days worth about £1 2*s*. $10\frac{1}{2}$*d*.

Of these two notices the first is interesting, as showing that the natives of Mysore adopt a practice, that of drying their Sunn stems, which is objected to by those of Bengal. The second showing a separation of the occupations of growing and of preparing the fibre; and this may, perhaps, with a congenial climate, account for the goodness of the fibre of the Western coast.

Dr. Wight states that on the Madras side of India, not only the bark of this species, but of *Crotalaria retusa* is employed as Hemp in the manufacture of cordage and canvas. He further found the Janapa or Sunn plant cultivated at Coimbatore. The stems, cut and dried, were afterwards steeped. This loosens the bark, which is then easily stripped off, and undergoes but little further preparation. He found its fibres were next in strength to the *yerkum* or *mudar*, sustaining 407 lb., when the latter bore 552 lb., and has since observed to the Author that the *Sunn*, grown in the Pass of Poonany, open to both monsoons, is stronger than that grown in the interior.

Dr. Hunter has given the following account of the preparation of such fibres near Madras: "The native process of cleaning plants having bark and woody fibres"—of

which kind are many of the cordage plants—"is very similar to that followed in cleaning fleshy and pulpy plants, viz., by burying in sand or mud at the edge of a tank or in a river, and leaving them to rot. There is this difference, however, that the plants are steeped longer, and are never exposed to the sun to dry, or stacked and covered with matting to be cleaned by dry beating. If this were done, the woody fibre would get hard and brittle, and would again adhere to the other fibre, which being partially rotten would break in the cleaning. To obviate this the rotted plant is taken up in large handfuls, and beaten on flat stones, first at one end and then at the other, in the same way as clothes are washed by the Dhobee; they are next well rubbed and washed to separate the impurities, and are spread out on the ground to dry. We can hardly wonder that most of the string and rope made from fibres prepared in this rude, coarse way, should be dark in colour, possessed of no strength, and of little value. As a general rule, every day's steeping of a fibre takes from its strength and imparts more or less colour. To obviate this, woody plants should be first well beaten with a mallet; then the bark should be separated from the stalk, for it is on the inner part of the bark that the fibres for cordage usually occur. When the bark is brought to a pulpy state, it must be well washed in clean water to remove as much of the sap as possible; for this is the distinctive agent which soon causes putrefaction."

CULTURE IN THE WEST OF INDIA.

On the Bombay side *Sunn* is also extensively cultivated, and attracted some attention at the beginning of this century in the island of Salsette, whence it was called Salsette Hemp, which is probably the same substance now called Brown Hemp. On that side of India, Dr. Roxburgh says, as in some other parts of India, the seed is sown towards the close of the rains, when a stronger soil is said to be required. We have seen that Col. Sykes enumerates the Sunn among the spring crops; that is, among those sown in autumn and reaped in spring. This Bombay Hemp or Sunn has always been highly esteemed. Dr. Roxburgh says it is reckoned particularly good—not

inferior to the best Russian Hemp ('Fl. Ind.,' iii, p. 263); which he conceives is due to the mode of preparation, which we shall immediately notice. But something must also be owing to climate.

So long ago as the year 1802, some fibre was imported by Capt. Isaacke, of the *Skelton Castle*, which was at first considered to be the real Hemp, and called *Malabar Hemp*. Capt. Eastwick, one of the Directors of the East India Company has informed the Author that Major J. D. Watson, also paid great attention at this period to Malabar Hemp. Dr. H. Scott writes of it, that he does not know whether it be the same plant as the *Sunn* of Bengal, but where very great strength is necessary, the substance obtained from it is preferred to the Bengal Sunn, and is very superior to anything of the kind he has seen in the Guzerat. This, he thinks, may depend more on the steeping of the plant and the preparation, than on any difference in the vegetables that produce it; and this opinion was proved to be correct, for Dr. Roxburgh, having obtained some of the seed, found it to be *Crotalaria juncea*.

It was about the time that Dr. Roxburgh was employed in the culture of fibres in Bengal, he learnt that in the island of Salsette, where the best Sunn is said to be prepared, little or no maceration is employed; that the plant while moist is peeled by the hand, and immediately dried, in the open air or under cover, according to the state of the weather. By peeling, the fibres are better kept in their natural state of arrangement, and give support and strength to each other; whereas, by the process of the Bengalese, they get so materially entangled, that a great loss is always sustained. If they are restored to their natural situation by the heckle, there is a loss of nearly one half of the original quantity, which renders the heckled Sunn of Bengal of a high price.

Dr. Roxburgh further says, in 'Fl. Ind.,' p. 283: "Numerous experiments made by me induce a belief that the superiority of the Hemp depends upon the peeling; but it is probable that the climate of the West of India may be more favorable than that of Bengal for the production of a stronger fibre. For no great attention seems to be paid to the culture, according to recent accounts."

More recently, Capt. Thompson, of the firm of Thompson and Co., rope-makers, of Calcutta, in sending three samples of fibre from the Malabar coast, writes: "Allow me also to hand you three specimens of Hemp and rope made of them that I had brought from the west side of India, grown at the places named on the labels (Calicut, Ghote, and the Concan). These have been tested both at the Arsenal and Government Dockyards, and proved perfectly equal to any and all purposes that cordage made of Russian Hemp has hitherto been used for. From the encouraging reports upon this cordage from the heads of both the Naval and Military Departments, there seems no reason to doubt that this Hemp, and others that are being daily discovered, will completely supersede the importation of Europe-made cordage." Capt. Thompson adds, in a note: "This Hemp is no new discovery. I saw it in England, which led me to try it here (*i. e.*, Calcutta). 31st Dec., 1847."

Dr. Gibson, in a Report on the Agriculture and Horticulture of the districts near Bombay, states, that both the *taag* and *umbaree*, or *Crotalaria juncea* and *Hibiscus cannabinus*, are both reaped in the month of November, and both are stored to await the advent and leisure of the warm weather for stripping. The Tag is most usually pulled up, instead of being cut off; as in the latter way it leaves a strong and dangerous stubble. It is in the Deccan, he adds, reckoned a species of cultivation unworthy of a thorough-bred husbandman, and only to be grown by the Ghat people and the wilder tribes. The Wunjaras not unfrequently hire land to grow it on, as it is essential for affording them twine and materials for their gunnies. The seeds are beaten out with a stick, a part is reserved for future sowing, and the overplus is used to feed buffaloes. Its cultivation is more attended to in the Concan and Ghat districts than in the Deccan. It appears to suit any soil, and clears the ground of weeds. Having cultivated the plant to some extent in 1841, he found that it gave a return quite equal, if not superior, to that of the common grains of the country. Its chief expense consists in stripping the fibre. He had tried to separate the fibre by beating, after a slight immersion, but found the interior pith too soft to admit the separation of the fibre by that means. It is first steeped in water for five days

—in running water—and the fibre is afterwards separated by the fingers.

It is used by the natives for articles requiring much strength, as fishing nets, &c. (Agric. and Hortic. Soc. of Western India, 1842.)

Some specimens of the fibre of the *taag*, or *Crotalaria juncea*, having been sent to England to be reported on, were spoken of in the following terms, though the name of the reporter at Hull is not given (1840):

"This sample, No. 2 (*Crotalaria juncea* or *tag*), appears to me of the same quality as the Baltic. I return a part of it, made ready for spinning. You will see the great similarity of the two. My twine-spinner assures me that by taking it sooner, and by using more care in the steeping and exposure, it will be *fully equal to the Baltic.* Surely, by attention, this may be accomplished. It may require Englishmen to direct, and our implements (which are truly simple) to be used—when I have no doubt of the successful result, alike to the grower, the merchant, and our country. Your Hemp is very clean—a material point,—but it wants more beating and dressing; and I think the natives have not proper implements to do it with. You cannot improve in your mode of packing; it is decidedly superior to the Baltic. I do not despair of seeing the produce of the Baltic supplanted by that of India; as the defect appears to me solely to arise in the management of it: it stands too long before it is pulled or cut, or is too much steeped or exposed, to get the fibre to separate from the stalk." (Agric. and Hortic. Soc. of Western India, 1842.)

Wuckoo nar (or fibre), or *Travancore Flax*, as it has been proposed to be called, is another instance of the effects of locality and of climate, combined with variations in the mode of preparation, in making it impossible, from the appearance of fibres, to know the plants producing them. To the Exhibition of 1851, some specimens of strong canvas were sent from Travancore, which have been much approved of by competent judges, from the compactness and strength of the manufacture. On trial, it was found that a piece of this canvas, containing *eleven* threads, was equal in strength to canvas containing *fourteen* threads of Polish rein. Along with the canvas, a few small

heads of the fibre were sent, and labelled *Wuckoo* and *Wucknoo nar*, or fibre, from Travancore. The appearance of this fibre is totally different from any other which comes from India; as it is in the state as if prepared for spinning into thread, and must have been combed or heckled. The fibres are brownish in colour, about 3 to 4 feet in length, clean, and shining, not so fine as Flax, but still resembling some of the coarser kinds. A very competent judge informed the Author that it might be sold for the purposes of Flax, or as a kind of Flax, and was worth £35 a ton. So, some specimens sent to Dundee were valued at the same sum, and it was said could be used for the same purposes as Flax, though rather too dry.

As the Wuckoo nar was so highly thought of, and the Author was unable to form any opinion respecting the plant which produced it, he requested his friend, Dr. Wight, so well acquainted with the Botany of the Peninsula, to ascertain the botanical name of the Wuckoo plant. The more so, as Travancore, with Cochin as a harbour which large ships can enter, is a favorable locality for the export of an article which seems a very desirable object of commerce. Dr. Wight having written to friends in the locality to ascertain this point, was surprised on hearing, as was the Author on being informed, that the Wuckoo plant of Travancore was nothing but the Taag of the Western ghauts, and which further north yields the so well-known Brown Hemp of Bombay. The Author may mention as a curious confirmation of the result obtained, that specimens of the Brown Hemp, passed through Mr. Dickson's machine, are exactly like the fibres of the Wuckoo nar, as sent from Travancore.

The whole subject forms a striking confirmation of the importance of what the Author has frequently endeavoured to impress upon planters and experimentalists, that is, the effects of climate and of physical agents on the products of plants. As these will be found to be quite as important as seed from particular localities, or the adoption of methods of culture which may be suitable to one and not to another locality where it is attempted to introduce them.

Besides Bengal, Madras, and the West of India, Sunn, that is, *Crotalaria juncea*, is also extensively cultivated in North-

West India, for ordinary use. The cultivation may be much increased, and it is probable with considerable addition to the strength and flexibility of the fibre, by the aid of irrigation; and this is easily managed in some, and will be so in most places when the great Ganges Canal is in active operation. It will be found there, as elsewhere, that, as stated by Mr. Deneef as his declared opinion, nothing is wanted but an improved preparation to make it a desirable article for the English market.

Enough has been said respecting the value of common Sunn for most of the ordinary purposes of cordage, and also of the invaluable properties of the fibre of the same plant as grown in the Western ghauts, and where its culture may be indefinitely extended, and easily exported by sea. Though some recent Sunn broke with 150 lb., and some old Sunn bore 170 lb., when Petersburgh broke with 160 lb., the two former may not be able to bear the same degree of twisting as the latter, but see the experiments at pp. 268, 289.

Brown Hemp has, by competent judges, been considered equal to many of the purposes of Petersburgh Hemp; and the Wuckoo nar bore 175 lb. in the same experiments. Dr. Roxburgh made and published a very valuable set of experiments on Sunn, as grown in Bengal. (*v.* Table, p. 268.) In Dr. Wight's recent experiments, the Janapa or Sunn bore 407 lb., and Cotton ropes 346 lb.; but the Ambaree or *Hibiscus cannabinus*, 290 lb., and Coir, 224 lb. The Janapa, or Madras Hemp, as it is called in the markets here, is thus mentioned by Mr. Dickson, as already quoted at p. 133.

"Madras Hemp, valued when imported at £24 per ton, 2 cwt. 3 qrs. 3 lb:

Produced by the machines:

	cwt.	qr.	lb.			
Clean, long fibre, good, valued at £45 per ton	1	1	7½			
Clean tow, valued at £30 per ton .	1	1	9			
Waste	0	0	14½			
				2	3	3

Cost of preparation . 6*s.* 1½*d.*

"This Hemp, when prepared with the Patent Liquid, became soft, white, and so fine when heckled, as to bear the closest comparison with Flax at £80 per ton. It is better than any Russian Flax for fine spinning.

"Bombay Hemp, rough and dark, and valued at £20 per ton :

"This article, being similarly prepared, was considered equal in value with the Madras Hemp."

Though the importation of Sunn for a time diminished, it has again, during the last ten or twelve years, been imported in increasing quantities; and though here it is avowedly used only for ordinary purposes, Mr. J. Kyd, ship-builder, of Kidderpore, near Calcutta, maintained that the Sunn, if properly cured and dressed, would prove equal to Russian Hemp, and even as it was then produced, it was little inferior to it. All that he considered was required to bring this Hemp to a state of perfection, was European superintendence in the growth and manufacture of the material. The natives, moreover, who have many good fibres within their reach, usually make use of Sunn twine, well tanned with the bark of a species of Rhizophora. (*v.* Table of Exports, p. 299.)

The prices of these fibres in the interior, are stated to be from R. 1 8 to Rs. 2 8 per bazar maund; that is, from 3*s.* to 5*s.* for a maund of 84 lb., which is just three fourths of a hundredweight. So, in the Madras territories, it is stated that these fibres may be obtained at 2*s.* a maund in the interior. In Calcutta, Sunn is quoted at about Rs. 5 per maund; and in Bombay at Rs. 4 8 to Rs. 5½ per cwt. in Oct., to Rs. 8 per cwt. in June, but at Rs. 11 in June, 1854.

In the year 1844, when Petersburgh Hemp was selling here for £38 per ton, Indian Brown Hemp was sold for £20, Sunn from £16 to £18, and Jute from £10 to £12.

In Dec., 1854, Bombay Hemp was quoted at £35 to £48, Sunn £27 to £33, Jute £21 to £25, in the same 'Price Current,' when Petersburgh Hemp was selling at £58 to £63.

Comparative Strength between Sunn Cordage, when first made, and three years after, to ascertain the deterioration by Age, and the supposed effects of Tar.

Species of Rope.	Growth of Sunn.	When made.	Where made.	When tried.	Size.	Weight to break. 1803.				Weight to break. 1806.				The average of five trials.
					Inches.	Tons.	cwt.	qrs.	lb.	Tons.	cwt.	qrs.	lb.	per cent.
Hawser-laid Whale-line	Malda	1803	London	1803	$6\frac{1}{2}$	6	0	3	11	5	17	0	0	$2\frac{1}{2}$
Common Yarn	Ditto	Ditto	Ditto	Ditto	4	2	6	3	0	2	2	2	0	11
	Ditto	Ditto	Ditto	Ditto	3	1	14	2	0	1	9	2	0	14
	Ditto	Ditto	Ditto	Ditto	$2\frac{1}{2}$	1	4	1	14	0	19	0	0	20
	Ditto	Ditto	Ditto	Ditto	2	0	17	3	14	0	14	1	0	16

Comparative Strength between Cordage made in the common way, from the best Petersburgh clean and ordinary Hemp, and the Sunn Cordage made by Huddart's Warm Register.

Size.	COMMON MAKE. Best Petersburgh.				COMMON MAKE. Ordinary.				Cuttorah Sunn in 1802.				
Inches.	Tons.	cwt.	qrs.	lb.	Tons.	cwt.	qrs.	lb.	Tons.	cwt.	qrs.	lb.	
8	14	8	1	20	12	4	0	0	15	7	1	24	Warm Registered.
7	12	17	1	8	10	16	3	20	10	18	1	8	
$6\frac{1}{2}$	9	17	0	0	9	10	2	0	8	2	2	0	
5	6	7	1	8	5	17	0	0	5	17	2	8	
$4\frac{1}{2}$	5	19	2	10	4	17	0	0	4	10	1	20	
4	4	13	1	20	3	7	0	0	3	3	1	14	
3	2	15	0	14	2	6	3	7	2	2	2	21	
$2\frac{1}{2}$	1	19	1	14	1	10	0	0	No Warm Registered of these sizes.				
2	1	7	2	14	1	6	0	14					

Comparative Strength of the above best Petersburgh clean Hemp Cordage, in December, 1802, and May, 1806.

8	14	8	1	20	12	19	2	0	The depreciation of strength would be in greater proportion with ordinary Hemp.
7	12	17	1	8	11	13	2	0	
5	6	7	1	8	5	16	0	0	

Jubbulpore Hemp (*Crotalaria tenuifolia,* Roxb.)

Among the cordage sent to the Great Exhibition of 1851, there were some specimens sent by Messrs. Harton and Co., rope-makers, of Calcutta. These appeared to be of excellent quality, and were said to be made of Jubbulpore Hemp. The first notice which we have of this substance is in the 'Proceedings of the Agri-Horticultural Society,' where some Hemp grown in the Jubbulpore Garden from country seed sown at the end of June, 1840, and cut in October, and of canvas woven from the fibre in the School of Industry at Jubbulpore, were presented to the Society by Dr. F. M'Leod, Esq. When Mr. Williams, Superintendent of the above School, and by whom the plant had been grown and the fibre prepared, visited England in the summer of 1853, he presented the Author with a specimen of this fibre. This is long, that is, upwards of five feet in length, of the colour of Petersburgh Hemp, rather roughly prepared, inasmuch as some of the bast is still in the form of narrow ribands, but most of it separated into fine and strong fibres. In the experiments which the Author had made with it, its strength was proved to be at least equal, if not superior, to that of Russian Hemp, inasmuch as when a selvage of Petersburgh Hemp broke with 160 lb., one of Jubbulpore Hemp did not break with less than 190 lb. When examined by experienced brokers and manufacturers, it was considered an excellent substitute for Russian Hemp, and if a little more carefully prepared would leave hardly anything more to be desired, and was valued as worth at from £30 to £35 a ton, that is before any rise took place in the price of fibres.

The plant yielding this fibre having been discovered, we subjoin a description by Dr. Roxburgh, and though some botanists unite it with *Crotalaria juncea,* we keep it separate, until its identity has been determined by experiment. We also add the first notice of this fibre, and of rope made from it.

Crotalaria tenuifolia is a native of Coromandel, which is perennial, ramous, straight, furrowed, hoary. Leaves linear, sericeous underneath. Stipules minute, subulate. Racemes terminal. Legumes sessile, clavate, many-seeded.

In the Botanic Garden (Calcutta) it is perennial, growing to the height of nine feet, with numerous, slender, furrowed, straight branches, which are again more ramous at the top. During the cool season, each twig ends in a long raceme of large, yellow flowers, and the seed ripens in two months.

In the 'Proceedings of the Agri-Horticultural Society' for April, 1851, we find Captain Thompson presenting some dressed samples of the fibre from Jubbulpore, and a piece of rope made of it, part of the rigging made for some ships that were dismantled in the Bay of Bengal the year before, and which has proved equal to any Europe-made rope.

A good account of this fibre and its uses having appeared in the 'Journ. of the Agri-Hortic. Society,' and referring to the plant producing it, we here subjoin extracts from the paper.

At a meeting of the Agricultural and Horticultural Society of India, held on the 12th June, 1852, Messrs. Harton and Co. submitted specimens of the Jubbulpore Hemp fibre in a raw state; as also of fishing lines and tarred rigging made from it. A quantity of this raw material, procured from Jubbulpore by Messrs. Harton and Co. and the late Capt. Thompson about three years ago, was considered so well adapted for cordage purposes, owing to its excellent quality and great strength, that they have been willing to pay a high price for it, to meet the heavy cost entailed by the transport of so bulky an article from Jubbulpore to Calcutta. In consequence of an impression on their part, that the fibre in question was the produce of *Cannabis sativa*—it being so similar in many respects to Russian Hemp—the subject was deemed by the Society deserving of further inquiry.

An application was accordingly made to Mr. Williams, Superintendent of the School of Industry at Jubbulpore, for a small quantity of seed, which was sown immediately on its receipt on the 23d of June, 1852, in the Society's garden. In the course of nine weeks the seedlings had attained the height of $8\frac{1}{2}$ feet, *without branching*—an important point in a fibrous-yielding plant—and commenced flowering in three months from the date of sowing.

Dr. Falconer, to whom a specimen was referred, has pronounced it to be *Crotalaria tenuifolia* of Roxburgh, which Wight and Arnott, and some other botanists, regard as merely a variety of *C. juncea*, the plant affording the well-known "Sunn Hemp" of commerce. But their opinion, it may be observed, is founded on dried specimens. The habit differs very much from that of *C. juncea*.

Messrs. W. H. Harton and Co. have been kind enough to furnish the following memorandum regarding the above fibre:

"This material has been tested several times in the Government Service, both Military and Marine, and some ropes have been found equal to the staple cordage of Europe. A coil of bolt rope, manufactured by us from Jubbulpore Hemp, tested last year in the Marine Department, broke with a strain of 57 cwt. A coil of the same size, taken from one of H.M.'s vessels, was tested shortly after, and broke with a strain of 59 cwt. It may be observed, that the Hemp used in the Naval yards of the British Government, is all selected from the fleet of hemp-laden vessels, before any is permitted to be delivered to private parties. This Jubbulpore Hemp can no doubt be considerably improved, were the preparing process in the hands of Europeans,

manufactured according to the Russian method, instead of being left, as at present, so entirely to the careless and ignorant natives."

The following extract from Mr. Williams's letter, dated Jubbulpore, the 19th Nov., 1852, will close this brief notice of a fibre, which, no doubt, will be better appreciated when its merits become more generally known:

"I am pleased to learn that the seed of the 'Jubbulpore Hemp,' sent down by me in June last, has germinated so well in Calcutta. I can only grow it to advantage here along the ridges of the neighbouring hills (where it attains the height of from six to seven feet); that grown in the plains turning out weak in fibre when made into Hemp. I have lost considerably by sending this Hemp down to Calcutta for sale, having had the misfortune to have had several boats burnt while going down the river; and the steamers decline taking a cargo of it, in consequence of its combustible nature. The native insurance offices at Mirzapore also object to insure it, except at such high rates as to prevent all chance of profit; so that if it could be cultivated along the banks of the river, I have no doubt but that in a few years it would turn out a profitable source of export."

A copy of the official Report on the Experiments made in the Arsenal of Fort William having been subsequently published, is here subjoined.

Report of several kinds of Rope, the manufacture of Messrs. W. H. Harton and Co., of Calcutta, tested in the Arsenal of Fort William, 3d June, 1853.

Kind and quality of Rope.	Size.	Government proof.			Breaking weight.		
	Inches.	cwt.	qr.	lb.	cwt.	qr.	lb.
Oiled Jubbulpore Hemp (*Crotalaria tenuifolia*), Artillery Traces . .	3	36	0	0	43	2	0
Untarred do., superior four-strand, plain laid	3¼	42	0	0	83	0	0
Untarred Dunchee (*Æschynomene cannabina*), do., do. . . .	3½	49	0	0	75	0	0
Pine-apple Fibre, do., do. . .	3¼	42	0	0	57	0	0

(Signed) J. Wilkins,
Officiating Prin. Conductor,
Rear Godowns.

Some of the properties of this fibre may no doubt be due to the peculiar characteristics of the plant; but a good deal is no doubt also due to the soil and climate in which it is grown, and something probably to its having been grown and prepared under Mr. Williams's personal superintendence. This is obvious from the fact, stated by Mr. Williams, that he was only able to grow it on the sides of the hills; that grown in the plains below, he observes, was weaker in the fibre. Mr. Henley having grown some of this plant from the seed sent from

Jubbulpore, has observed to the Author, that, when grown in the lower provinces, although it attains a great height and grows luxuriantly, it is weaker in fibre and the produce smaller in quantity than when grown higher up the country.

The following reports have been made of this fibre by practical men:

"The Jubbulpore Hemp is a very strong article, and would take well if it could be sold cheap enough. A considerable quantity could be sold in Dundee." In another note it is stated to be "of considerable value, and that a good price could be got both for it and for good Sunn, valued at £30 and £35 a ton." Some of it sold, in the summer of 1853, for £27 a ton; when it was said to be worth £30 a ton, if a little better prepared.

DHUNCHEE FIBRE, *Sesbania aculeata* (formerly *Æschynomene cannabina*, Roxb., 'Fl. Ind.,' iii, p. 335, and *Æ. spinulosa*, do., p. 333; *Leguminosæ*).

The natives of Bengal familiarly employ and highly esteem a fibre which is known to them by the name of *Dhunchee*, *Dhunicha*, and *Dhunsha*. It is produced by a plant which Dr. Roxburgh thought was the same as the *Æschynomene cannabina* of König. This was described by Retz, and stated to be a native of the Malabar coast, and that its stems yielded a strong and useful fibre, as a substitute for Hemp. Messrs. Wight and Arnott, in their 'Flora of the Indian Peninsula,' consider it to be identical with *Sesbania cochinchinensis*, which they have from China.

Dr. Roxburgh states that he had not found his plant in a wild state, but that, in various parts of Bengal, it was cultivated for the fibres of its bark, which form a coarse substitute for Hemp. Messrs. Wight and Arnott (l. c.) unite the plant described by Dr. Roxburgh with one which is very common in all parts of India in the rainy season, the *Sesbania aculeata* of Persoon, and which is called Juyunti in Bengal, and *dhundain* in North-West India. It springs up in rice-fields, and other wet cultivation, during the rainy season. These two varieties are thus described by Messrs. Wight and Arnott, under the name of—

Sesbania aculeata, herbaceous, annual, erect, sparingly branched, glabrous; stem and petioles usually sprinkled with minute cartilaginous points; leaves eight to ten times longer than broad; leaflets twenty to forty pairs, linear, obtuse, mucronate; racemes axillary, peduncled, erect, lax, often about half the length of the leaves; few-flowered; flowers pretty large (more than half an inch long), on slender pedicels; corolla about four times the length of the calyx; legumes erect, nearly terete, sharp-pointed.

Dr. Roxburgh gives the following general directions for its culture. The soil is generally low and wet, and not requiring much preparation, as the plant is hardy, growing from six to ten feet, and rapid in growth. This renders it advantageous to cultivate, especially as it is considered a meliorating crop. The time of sowing is when the soil has been moistened by the first showers of April or May. About thirty pounds of seed are allowed to the acre, and less weeding is required than for *Jute*. The crop is ready to cut in September and October, though the fibre does not suffer if left standing till the seed is ripe, in November. The process of steeping and cleaning the fibre is similar to that required for *Sunn*, that is, *Crotalaria juncea*. The general produce of an acre is from one hundred to one thousand pounds of ill-cleaned fibre, the current price somewhat less than that of *Paut*, viz., *Corchorus olitorius* and *capsularis*. The expense of cultivation, including land-rent, is about nine rupees.

This plant, generally cultivated about Calcutta during the rains, grows to the height of from six to ten feet, the fibres are long (six to seven feet), but coarser and more harsh than those of Hemp, unless cut at a very early period. From its great strength it is well calculated for the manufacture of cordage and cables. In Bengal, the fishermen make drag-ropes to their nets of this substance, on account of its strength, and durability in water. Indeed, by the Bengalese it is considered more durable in water than either *Sunn* or *Paut*.

It has been observed to the Author by one gentleman well acquainted with this fibre in India, that he was at a loss to know why the Dhunchee remained so much neglected in this country, as it is really a very excellent fibre for common cord and twine purposes, and certainly very much superior in strength and durability to Jute. It is also a much hardier plant than Jute; the latter, indeed, being rather an uncertain crop, for the production of the fine, long, silky fibre, so much

called for in this country. Another gentleman observed, that thoughr ather wiry it was strong, and chiefly remarkable for its contraction when wetted, so much so, that it would even carry away the mainmast of a ship by mere contraction.

Mr. Deneef, the Belgian farmer, presented samples of the Bengal Hemp, called *Dhuncha*, to the Agri-Horticultural Society, in November, 1840, and stated that they had been dressed after the Belgian mode. A begah, he says, will yield 173 lb. of cleaned fibre, and 92 lb. of seed. A woman can dress about 4 lb. a day. In April, 1851, Captain Thompson presented a dressed sample of the fibre of the *Dhuncha* of Bengal, and a piece of rope made of it. This rope, he stated, had been used in various ways for nearly two years, and from various reports upon it, he thought it likely to come into extensive use. Specimens of the fibre and rope were also sent to the Exhibition of 1851, and we have already given (at p. 292) the result of the trial made with this rope in the Arsenal of Fort William, whence it appears that a three and a half inch rope of Dhunchee broke with not less than 75 cwt., though the Government Proof, required for such rope, was only 49 cwt.

The price of the Dhunchee, in the interior, has long been about R. 1 8 per maund. The following are reports upon this fibre:

"The Dhunchee is very suitable for ropes, and if it will take in tar, is of considerable value. It would probably fetch from £30 to £35 a ton, and after being introduced and known, perhaps £5 more." It was also valued by others at £35 in 1853.

These fibres, in fact all the fibres from the East, would be much more valuable if properly scutched; and if scutching mills were sent out, these fibres could be brought in a greatly improved state to market.

Maljhun, or Maloo Climber, *Bauhinia racemosa* (*Leguminosæ*).

Along the forests of the Sewaliks and the hot valleys of the Himalayas, from the doons of the North-West to the valley of Assam, may be seen a magnificent climber, called *Maljhun* or *Maloo*, with a two-lobed leaf. Of this, the Author observed,

in his 'Himalayan Botany,' p. 184, that *Bauhinia racemosa* hangs in elegant festoons from the tops of lofty trees, which one is at a loss to conceive how, from the distance of its root from the stems, it could ever have ascended; but occasionally a half-killed tree displays the mode of its progress, and indicates the destruction it must have created in the forest.

With the bark of this plant, which, when stripped off, is of a reddish-brown colour, the natives of these mountains make ropes. It was one of those to which Dr. Roxburgh turned his attention, and which has been frequently noticed by travellers in the Himalayas. Capt. Huddleston states that the stems are usually cut in July and August; the outer bark being stripped off, is thrown away, and the inner is used for ropes, as wanted, by being previously soaked in water, and twisted when wet. It is also said to be boiled, and beaten with mallets, which renders it soft and pliable for being twisted into ropes and strings for charpaes. Though the fibre makes very strong ropes, it is not over-durable, and rots if kept constantly in water. Though not collected for sale, it is very abundant all along the foot of the mountains.

Major Swetenham, formerly of the Bengal Engineers, on the 11th of November, 1840, despatched to the late Mr. Thomason some of the fibres of the Maloo creeper, and a specimen of a rope made from it, which he obtained from the valley of the Jumna River within the hills. He describes it as making strong coarse ropes, which he had found to answer well for suspension bridges, though he was unable to say how long they would bear exposure to moisture, for "they had been in use only for two or three years, and iron suspension bridges substituted." Specimens of the fibre, and rope made from it, were sent to the Exhibition of 1851, from Bhagulpore, and called *Patwa* or *Mawal* fibre.

BAUHINIA SCANDENS, similar in properties and uses to the above, is another species of the same genus, of which we find the following notice in the 'Journal of the Agri-Hortic. Society,' vi, p. 185. Specimens of the fibre of *Bauhinia scandens*, and cloth made therefrom, were sent to Major Jenkins by Major Hannay, who mentions that the fibre is used by the Nagas. The plant, Major Jenkins adds, is not uncommon about Gowhatti. It

was recognized by Dr. Falconer, from a few leaves forwarded by Major Jenkins, to belong to *Bauhinia scandens*, a common species in Sillet. Captain Thomson having tested this fibre, reports on it to the following effect:

"The line made from the fibre sent by Major Jenkins, sustained for forty-five minutes, 168 lb., having stretched six inches only in three feet, and therefore is about the same strength with our best *Sunn* Hemp. But, whether from the mode of preparation or the nature of the material, is so harsh and stubborn, and the fibres stick so close together, that the heckles tear it to pieces, and injure its strength."

Dr. Buchanan, in his 'Survey,' mentions both these species as used for many of the same purposes.

Dhak, or Pulas Fibre, *Butea frondosa*, also *B. superba* (*Leguminosæ*).

One of the most generally diffused plants is the *Dhak* or *Pulas*, as it may be found near many villages, forming their tracts of apparently useless because jungle-like land, but which, in fact, is a place of pasturage for their cattle. The Dhak, which is the most usual shrub, yields them firewood, and its bark and roots fibrous matter, which is used as cordage, or beaten to a kind of oakum used for caulking boats. Though such fibre is unimportant as an object of commerce, it is of great use to the natives themselves, for agricultural and domestic purposes, as it is possessed of a good deal of strength. Some Pulas fibre was sent to the Exhibition of 1851, from Beerbhoom.

A ruby-coloured gum, which has been called *Butea kino*, exudes from incisions into the bark, which, though it abounds in astringent matter, Mr. Teil, of Calcutta, has found difficult to apply to the tanning of leather, but its colouring matter is powerful and permanent. In the jungles, where the Dhak is allowed to grow into a small tree, it is highly ornamental from the splendour of its inflorescence, and is further useful from its large flowers, called *teesoo* and *keesoo*, yielding a beautiful dye, which is likely to come into extensive use. This plant is further interesting, as that from which the name of the Pelasgi has been supposed to be derived by Mr. Peacock, in his 'Greece in India.'

PARKINSONIA ACULEATA.—Though this is an American plant, it may, like the Agave, be enumerated among Indian products, because it may now be met with as one of the most common trees in villages and cantonments, flourishing with less care than any other. Some of its fibre, of a beautiful white colour, was sent to the Exhibition of 1851, as a material for paper-making, and which could probably be afforded at a cheap rate, from the cuttings of the shoots of this plant. It, however, has been considered in this country as wanting in strength. It might, nevertheless, be found useful in mixing with other fibrous substances, and beaten up into half-stuff.

BOKHARA CLOVER.—A plant under this name has attracted some notice in Ireland, on account of its fibre. It is the *Melilotus arborea*, and is nearly allied to *M. leucantha*, and therefore not a true Clover. It grows so freely as to yield five or six cuttings in the season of green herbage, from which, it is said, a considerable proportion of strong fibre may be obtained; but the Committee of the Irish Flax Society state, that the trials made in steeping this plant were unsuccessful with them.

EXPORTS OF SUNN AND OTHER HEMP-LIKE FIBRES, ETC., FROM INDIA.

In the beginning of this work, when referring to the great increase which had taken place in the commerce of Indian fibres, a tabular statement was given (p. 9) of the exports of fibrous substances from the three Presidencies. In subsequent pages, the detailed exports of Coir and of Jute have been separately given, and under the head of *Ambaree* or *Hibiscus* fibre, it was stated that the detailed exports of this fibre would be given along with those of Sunn, because the two are not distinguished in the Reports of the Exports from India or in the Imports into this country. Indeed, in the latter, Jute has not hitherto been separated from the others; though it will be so in future reports. In the following table, therefore, the details of the Exports of Indian substitutes for Hemp are given, con-

sisting chiefly of Sunn (Crotalaria); but some Hibiscus, and perhaps a little of Dhunchee, may be included.

Exports.	Hemp. (Sunn.)	Canvas bolts.	Hemp Twine.	Log lines.
From Calcutta—				
To United Kingdom	Mds. 5,641	—	137	—
„ North America	1,885	—	1,593	—
„ Hamburgh	80	—	—	—
„ Mauritius	12	348	490	85
„ New South Wales	17	150	1,097	653
„ Cape of Good Hope	—	15	—	—
„ Guam	—	102	—	—
„ Pegu	—	272	447	69
„ Coast of Coromandel	—	314	1,225	15
„ Coast of Malabar	—	728	2,937	39
„ Penang, Singapore, &c.	—	68	868	437
„ Ceylon	—	—	407	74
„ China	—	—	50	—
Total	Mds. 7,635	1,997	10,301	1,372
Value	Rs. 15,276	12,672	93,284	9,716
From Madras—				Gunny bags (of Sunn?)
To United Kingdom	Cwt. 294	—	—	—
„ Indian French ports	—	—	—	27,750
„ Arabian and Persian Gulfs	75	77	—	—
„ Ceylon	—	—	—	25,000
„ Maldives	—	60	—	
„ Pegu	—	—	—	3,500
„ Bombay	1,709	333	—	—
„ Cape of Good Hope	—	—	—	2,700
„ Travancore	17	—	—	—
Total	Cwt. 2,095	470	—	58,950
Value	Rs. 10,577	3,711	—	6,644
From Bombay—	Hemp and Hemp Rope.			
To United Kingdom	Cwt. 7,851	—	—	—
„ African Coast	16	—	—	—
„ Arabian and Persian Gulfs	2,925	—	—	—
„ Guzerat	500	—	144	—
„ Other Home ports	85	—		—
„ „ Foreign ports	—	—	65	—
Total	Cwt.11,856	—	209	—
Value	Rs. 72,483	—	1,503	—

In a late Minute, published by the Madras Government (19th September, 1854) for the express purpose of directing

attention to the fibrous productions of that Presidency, the exports are given as valued at the following sums, in the respective years from 1847 to 1852, excluding Coir and Coir rope. The year selected in this work, in consequence of the published accounts of the three Presidencies being complete, is that in which the exports were the smallest.

	Hemp.
1847-48 . . .	Rs. 19,819
1848-49 . . .	23,242
1849-50 . . .	23,076
1850-51 . . .	10,577
1851-52 . . .	46,683

Among the Imports of the three Presidencies, we find Cordage and Canvas; but excellent cordage is now made in Calcutta, both by Messrs. Thompson and by Messrs. Harton, as evidenced by the specimens which both sent to the Exhibition of 1851. Some of the canvas also is of excellent quality, as that sent from Travancore (*v.* p. 285).

Bombay, from its insular situation, requires both its Imports (some by sea, others by causeway) and Exports to be noticed. Among the Imports we find Canvas, 9367 bolts,[1] from the United Kingdom, Calcutta, Malabar, and Canara; Gunny bags, 2,729,407, from Calcutta, Malabar, Canara, and Concan. The first are no doubt made of Jute; but the others, probably, of Sunn. Hemp, 57,126 cwt., from Malabar and Canara, Concan, Guzerat, Goa, and the Arabian and Persian Gulfs. This probably includes both *Sunn* and *Ambaree*, or Crotalaria and Hibiscus fibre. Twine, 9738 cwt., from the United Kingdom, Calcutta, and Guzerat; Fishing Nets from the Concan, probably made of Conkanee Hemp; and Grass cloth from China. Of these, we find among the Re-exports, some Hemp, Canvas, Gunnies, and Twine, as well as China-grass cloth.

[1] Europe Canvas is generally preferred in India, though much dearer, that is, Rs. 24 5 6 per bolt of thirty-nine yards each, and country Canvas being only Rs. 16; because the former is so much more durable, and therefore cheaper in the end. But there is no doubt that some of the Indian Canvas is of much better quality than others; and it is desirable to ascertain where the best qualities are made, as well as of Twine and of Cordage; for though much depends upon manufacture, something is due to the fibre, and not a little to the soil and climate where the plant is grown.

Fibrous Plants of different kinds.

Following, as we have done, an arrangement according to the natural families of plants, for the express purpose of bringing together a number of plants which are allied in properties as they are in structure, we shall pass rapidly from the Leguminous plants to the Nettles and their allies, because few of the plants in the intervening families yield fibres which are as yet of commercial importance, though there are some well qualified to become so, from their great strength and fineness, as well as from the abundance in which they may be procured.

In the West Indies, cordage is made of the bark of a species of Mangrove, which is hence called Rope Mangrove. The coasts of the Bay of Bengal and of the Indian islands abound in the Mangrove, which is found also at the mouths of the Indus. Its bark has been used for tanning purposes, for which it is probably more suitable than for cordage.

Among the *Myrtaceæ*, or Myrtle tribe, we have species of Eucalyptus, called, by the colonists of Australia, "stringy bark," and "box-tree," and remarkable for the stringiness of their bark, which is therefore employed for making canvas and cordage by the aborigines, as mentioned by Bennett, in his 'Wanderings,' i, p. 169. In India the stringy bark of a tree called *koombhee* (*Careya arborea*) is employed by the natives of the countries along the foot of the Himalayas as a slow match for their match-lock guns. Among the fibrous barks sent from Assam to the Exhibition of 1851, was one that is named Roxburghia in the Catalogues. This is no doubt a mistake for some plant called after Dr. Roxburgh, probably *Poivrea Roxburghii*, one of the *Combretaceæ*, of which several are remarkable for tough wood as well as bark.

The *Cucurbitaceæ*, again, or the Cucumber and Melon tribe, which are so extensively cultivated in all tropical countries as food for the natives, abound, according to Dr. Hunter, in fibres of great length.

Indeed, many of the plants which are cultivated in fields or gardens would yield fibre in considerable quantities, which would be useful to the paper-maker, instead of being wasted or burnt. Of these we may instance, among the large family

called *Compositæ*, the plant called Jerusalem artichoke, the stems of which abound in fibres. So probably does also the extensively cultivated *Carthamus* or Safflower.

Belonging to this family, we may mention a plant which is remarkable for the under surface of its leaves being covered with a cotton-like tomentum; hence it is called *kupassee*, from *kupas* (a name of cotton). The people in the Himalayas use it as tinder. It is also spun into thread and woven into cloth, of which bags are made. The string, until examined, looks as if formed of fibre. A coarse kind of blanket, called *kurkee*, is said to be made of this substance by the Hill people north of Deyrah. Though curious, this substance is not of much importance.

COROLLIFLORALS (*Corolliflorœ*).

In a previous page (131) we have referred to the distinction between Exogenous plants, as having their floral envelopes composed of several or of a single piece. Having now passed through all the former families of plants, we have arrived at those which have the corol composed of a single piece or petal, into which the stamens are inserted. Hence, by botanists they are called *Corolliflorœ*. The arrangement may be useful, in enabling observers abroad, who are unacquainted with Botany, to ascertain the group to which any plant may belong which they find possessed of fibrous, or of any other useful properties.

Dogbanes (*Apocynaceæ*).

Among the division of plants which we have just noticed, there are comparatively few which are known to be useful for fibrous properties; yet there are some which are most conspicuous for the strength of their fibres. These belong to two families of plants which are so nearly allied to each other, that they were united together by the celebrated Jussieu. Both are remarkable for abounding in milky juice; and some of them in caoutchouc, or some analogous products. Of these, the Apocynaceæ or Dogbanes are composed chiefly of trees and shrubs, of which the Oleander is a conspicuous example. But

some are herbaceous, as in the case of the Vinca, or Periwinkle as it is called, which shows another characteristic, that is, the climbing habit of many of these plants, as well as the toughness of their fibre, as may easily be ascertained by trying to break any of the long, trailing twigs of this plant, so common in gardens and shrubberies. Among these, is a plant called *Nerium piscidium*, by Dr. Roxburgh, 'Fl. Ind.,' ii, p. 7, common in the Khasya or Silhet Mountains, and there called *Echalat*. It there forms an extensive perennial climber. Its bark contains a large quantity of fibre, which the natives use for the same purposes as Hemp. Dr. Roxburgh, in steeping some of the young shoots in a fish-pond, in order to facilitate the removal of the bark and to clean the fibres, found that many, if not all the fishes, were killed. Hence the specific name which he applied. Dr. Wight has formed the plant into a new genus, Echaltum.

It is probable that there are many other fibre-yielding plants in this and the next family among the climbing species.

Asclepiads (*Asclepiadeæ*).

Closely allied to the *Apocynaceæ* is the family of plants which has been named *Asclepiaceæ* and *Asclepiadeæ*, from the genus *Asclepias*, to which most of the species formerly belonged. Among these, there are several remarkable for their fibrous properties, and many more probably remain to be discovered. Though many of this family of plants abound in the hottest and moistest parts of the world, others are also found in the driest and most barren parts of Asia, with a few species extending even to the North of Africa and to the South of Europe, Siberia, North America, and Japan; and southwards, to the Cape of Good Hope and New Holland. The great majority are distinguished by their twining habit; though their flowers are often inconspicuous, their seed-vessels are remarkable for being in pairs, and which, on bursting, display a quantity of thistle-like down attached to each seed, which floats them about as those of thistles and dandelions. This down may no doubt be turned to some useful purposes, and therefore makes the plants abounding in fibre more valuable, as thus yielding a double product; though it is probably only

in dry and barren parts of a country, that it would be desirable to attend to these, instead of to the numerous other fibrous plants which may either be more easily cultivated, or the fibre separated with greater facility.

Syrian Dogbane, *Asclepias syriaca* (*Asclepiadeæ*).

Of the plants of this family, useful both for its down and for its fibrous stem, we may first mention that called Syrian Dogbane, which, although a native of the burning plains of Syria, will grow in colder climes, and is indeed cultivated as far north as Upper Silesia. It is easily propagated either by seed, or by parting the roots. The plants thrive luxuriantly in light soil, but will flourish on any poor land.

The silk-like down which surmounts the seed of this plant, is not more than an inch or two in length; but it has, nevertheless, been usefully applied for articles of dress manufactured of it both in France and in Russia. The fibres of the stem, prepared in the same manner as those of Hemp and Flax, furnish a very long fine thread of a glossy whiteness.

Jetee Fibre, Rajmahl Bowstring Creeper, *Asclepias*, now *Marsdenia tenacissima* (*Asclepiadeæ*).

This comparatively small climbing plant, with greenish-yellow flowers, was found by Dr. Roxburgh's son growing in dry and barren places in the Rajmahl Hills; since then also near Chittagong. Of the fibres of the bark of this plant, the Rajmahl mountaineers make their bowstrings. These are said to last for five years, though in constant use and exposed to all sorts of weather. A drawing and full description of this plant is given by Dr. Roxburgh in his 'Coromandel Plants,' iii, t. 240.

In preparing the fibres of this plant, the Hill people do not put the stems in water, but let them stand in the sun for a day till drier; from the ends, when cut, there exudes a milky juice, which thickens into an elastic substance, like, indeed forming one kind of caoutchouc, acting in the same way in removing black lead marks.

According to Dr. Roxburgh, the fibres of this plant are

not only beautiful in appearance and durable, but the strongest of any he had met with. Some twine made with it bearing 248 and 343 lb. in the dry and wetted states, when Hemp twine bore only 158 and 190 lb. in the same states.

Mr. W. C. Taylor since then met with the same plant near the Palamow coal-mines, having observed his boatmen twisting a substance into thread, which they called *chittee*, of which they made nets, finding it much stronger and more durable than Hemp, and not so liable to rot by being kept in water. Mr. Taylor mentions that the stems are cut into lengths, and then cut down the middle; then dried, and afterwards steeped in water for about an hour or more, which enables the bark to be separated with greater ease; when the fine silky filaments are separated. A $1\frac{1}{2}$-inch rope having been made and sent to Calcutta, was there tested in the Master-Attendant's Office, and found to break with 903 lb., when even Europe rope broke with 1203 lb., and others with greater weights. Its elasticity was considerable, as it stood ninth in strength, but second in elasticity. It was supposed that this might possibly be caused by its being laid up by hand; and it was also observed that the result might have been better, if the yarns had been more easily (evenly?) laid up." But the plant is suited for better purposes than rope-making, besides not being eligible for this purpose, from its comparative rarity and mode of preparation. Mr. Taylor states it might be easily cultivated. (*v.* 'Journ. Agri-Hortic. Soc.,' 1844, p. 221.)

Specimens of the fibre of another species of *Marsdenia*, which has by Dr. Wight been named *M. Roylei*, are stated in the Catalogues to have been sent from Nepal to the Exhibition of 1851. Though the specimens have not been found, we may infer that the fibres of this species are made use of in Nepal.

Orthanthera viminea is another plant of this family well calculated to yield fibre. The Author found it growing at the foot of the Himalayan Mountains, and mentioned it in the following terms in his 'Himalayan Botany,' p. 274. "Another plant of this family, *Orthanthera viminea*, attaining a height of ten feet, is also remarkable for the length and tenacity of its fibres. This grows luxuriantly along the foot of the mountains;

and its long, straight, leafless, slender, and wand-like stems, point it out as seemingly well suited for rope-making."

Other plants of this family, useful for the same purposes, are *Hoya viridiflora*, which yields an excellent fibre, and probably also *Leptadenia spartea*. The fibre of another species of the genus, *L. Jacquemontiana*, was described to the Author, by his late lamented friend Dr. Stocks, as employed in Sindh with *Periploca aphyllum* for making into ropes and bands used for wells, as water does not rot them.

Specimens of the flowers, leaves, immature pods, and stem, of a fibre-yielding plant, were presented by Capt. Hannyington, Political Agent at Purulea in Chota Nagpore, to the Agri-Hortic. Society in 1841.

Capt. H. mentions that this plant is very abundant in the Hills about Purulea, and is also found in the neighbouring plains. It is known to the Coles by the name of *Apoong*. The fibre is said to attain its best condition after the rains. The Secretary mentioned that this plant was introduced into the Botanic Garden from Western India, and is well known to Dr. Wallich, who immediately recognized it as *Holostemma Rheedianum* of Sprengel, the *Ada-Modien* of the Hortus Malabaricus.

But there is no doubt that this family of plants contains many others possessed of useful fibrous properties; but we will conclude with one which is likely to be the most important of all, that is, the *Mudar* or *Yercum*.

Mudar or Yercum Fibre, *Asclepias* now *Calotropis gigantea*, and *C. Hamiltonii* (*Asclepiadeæ*).

Sans., *Arka* and *Akund*; Arab., *Ashur*; Hindee, *Ak*, *Mudar*, and *Muddar*; Madras, *Yercum*, *Tella Jilladdoo*.

In the Southern, as in the Northern parts of India, there is met with in considerable quantities in all uncultivated, and encroaching even on cultivated grounds, a plant with broad, rather fleshy, glaucous-coloured leaves; and which, on being wounded, gives out a milky juice from every part. This is called *Ak* and *Mudar* in Northern, and *Yercum* in Southern India. Its juice, and the powdered bark of its roots, have long been employed as an alterative by the natives of India, in

leprosy and other cutaneous affections, and are no doubt possessed of active properties. Dr. Duncan obtained from it a principle which he called *Mudarine*. In Arabic authors on Materia Medica it is even supposed to have been known to the Greeks. It has long been famous for yielding a kind of Manna, which is called *Sukkur-al-ashur*, and *Ak* or *Mudar ke shukur* (sugar). ('Himal. Bot.,' p. 275.) Lately its milky juice has been collected by making incisions into the plant, and prepared as a substitute for Caoutchouc and Gutta Percha. (*v.* 'Journ. of the Agri-Hortic. Soc. of India,' viii, pp. 107 and 226.) Dr. Riddel calculated that ten average-sized plants will yield as much juice as will make a pound of Gutta-Percha-like substance. This is evaporated in a shallow dish, either in the sun or in the shade; when dry, it may be worked up in hot water with a wooden kneader, as this process removes the acridity of the gum. It becomes immediately flexible in hot water, but is said to become hard in cold water, and is soluble in oil of turpentine, takes impressions, and will no doubt prove a valuable product, either alone or mixed with other substances.

Mr. Moncton, C.S., has proposed making use of the downy substance contained in the follicles of the Mudar; and, indeed, has had paper made of it, as well pure as when mixed with two fifths of the pulp of the Hemp (Sunn?), such as the natives use for making paper. As the glossy and silky, but comparatively short fibre, is difficult to spin, a mixture of one fifth of cotton was made, in order to enable it to be worked. A good wearing cloth, which stands washing and takes a dye, was produced. It is, however, well suited for stuffing pillows or coverlets. Mr. Moncton calculated that its cost would be one rupee a maund. This silky down of the pods is used by the natives on the Madras side in making a soft, cotton-like thread.

The Mudar, Mr. Moncton observes, grows all over India; it seems to thrive on soils that either reject or destroy everything else. It is difficult to conceive anything less productive than dry sand, and yet the Mudar thrives in it. Should its cotton be found useful, the waste lands of India could be covered with it, as it requires no *culture* and no *water*. It comes to maturity in a year, but is perennial; and when once planted

or sown, would require no further care; and where thickly planted, might be made the means of reclaiming poor soils, as the leaves and some of the upper branches rot, while the root and stem remain. Col. Tremenheere, of the Engineers, has suggested that the Mudar should be used as a hedge to protect desert land brought under cultivation from the encroachment of drift sand. This would give a healthful impetus to the cultivation of the plant itself.

We have not entered on these details, in a work on Fibres, on account of the medicinal qualities, or of the down, or of the milky juice of this plant, but because it is one yielding a very excellent fibre. Of this, some beautiful specimens were sent to the Exhibition of 1851, by Dr. Wight, who made experiments upon its great strength. The late Dr. Stocks enumerated it in a list sent some years since to the Author, among the cordage plants of Sindh; and Capt. G. J. Hollings, Deputy-Commissioner of Leia, in the Punjab, has published an account of this fibre being used for fishing nets, and as cordage, at Dehra Ghazee Khan, on the Indus. The species, however, is not the same in all these places. *Calotropis gigantea* is that common in the Southern, and *C. Hamiltonii* in the Northern parts of India, and *C. procera* in Persia; the last extends even to Syria.

The mode of separation of the fibre is tedious, and may for the present oppose some obstacles to the ready supply of this material. Capt. Hollings states that the sticks of the Mudar were cut about twelve or eighteen inches in length; the outer bark was then carefully peeled off, and the fibre picked from the inner part of it. Several threads were then placed side by side, and twisted into a twine by rubbing them between the hands. No water is used (indeed is injurious); everything is done by manipulation. In a subsequent paper, Capt. Hollings observes, that the best plan is to select the straightest branches, which are always the largest; to let them dry for at least twenty-four hours, before any attempt is made to separate the fibre. On the second or third day the sticks are slightly beaten, especially at the joints, which ensures the bark, with the fibre attached, being peeled off without breaking. The workmen then bite through the bark, about the centre of its length; they then hold the tissue of threads in

one hand, and separate the bark with the other. He did not find that any of the ordinary methods of separating fibre were useful; but it is probable that some of the mechanical methods of separating Flax would be effectual with this fibre when in a dry state.

Dr. Wight's specimens, which are those of *C. gigantea*, he describes as being merely stripped off from the stalk, and slightly prepared, to remove the epidermis. He observes, that as it is a most common plant, it may become a valuable article of commerce, if a less costly mode of separating it can be devised, without injuring its quality. The colour, when fresh, is of a greenish-white.

Dr. Wight, from his experiments, considered it the strongest fibre on the Madras side of India, where it is used for fishing lines. It bore 552 lb., when the Janapa or Sunn of Coimbatore bore 404 lb. A small cord, made of the specimens from the Punjab, examined by Capt. Thompson, at Calcutta, bore 3 cwt., "without showing symptoms of distress," and was therefore equal to the best cordage; but it seemed to him still better adapted for the purposes of Flax than of Hemp. Mr. Willis considered the fibre to possess extraordinary merit, which would be valued by spinners for use in their finer fabrics. So, when examined by practical men in this country, it has been pronounced to be well calculated for supplying the place of good Flax, for making prime yarns. One gentleman observed that it twists all up at the end, and therefore could not be heckled. But this is probably owing to the mode of preparation; as the natives are described as twisting it between their hands. It was considered well worth £30, or rather £35 a ton. Capt. Thompson thought, in Calcutta, that it would be valued at from £30 to £40 per ton in England; perhaps more.

Though the Mudar or Yercum fibre, from its fineness, seems well calculated to answer for many of the purposes of Flax; yet, from its strength, it is also well suited to supply the place of Hemp. In the Author's experiments, when Petersburgh Hemp bore 160 lb., and the Brown Hemp of Bombay and Jubbulpore Hemp bore 190 lb., the Yercum also bore 190 lb. Dr. Wight has given the following as the results of his experiments:

Coir	224 lb.
Pooley Mungee (*Hibiscus cannabinus*) .	290 „
Marool (*Sanseviera zeylanica*) . .	316 „
Cotton (*Gossypium herbaceum*) . .	346 „
Cutthalay nar (*Agave americana*) . .	362 „
Janapa (*Crotalaria juncea*), Sunn, hindee .	407 „
Yercum (*Calotropis gigantea*) . .	552 „

In considering the varied useful properties of these plants, we cannot but be struck with the fact, of how wonderfully the Creator of all has furnished every part of the world with plants and animals suited to its diversified soils and climates. So that if the people residing near these barren places would make use of the natural riches within their reach, they have the means, by commercial interchange, of commanding comforts to which they are now strangers; and we might then apply literally the words of the Prophet: "The wilderness and the solitary place shall be glad for them; and the desert shall rejoice, and blossom as the rose." ('Isaiah,' xxxv, 1.)

Aroosha Fibre of Chittagong, *Callicarpa cana* (*Verbenaceæ*).

The family of plants to which the above belongs is not remarkable for any fibrous bark, but it is so from the great diversity of appearance in the plants placed in it, inasmuch as it includes the lowly Vervein and the lofty Teak. The latter conspicuous among plants for the strength and durability of its wood; but its flower is small, and therefore not so much out of place among the Verbenaceæ, because it is by the structure of the flowers and fruit that plants are arranged. Mr. Sconce, when at Chittagong, had some of the fibres of a plant, which he says is there called Aroosha, prepared, first by cutting the stems, which grew three or four feet high, and then steeping. The inner bark was then easily stripped off. This was afterwards heckled, and a portion of the fibre spun into thread, but it does not appear of much value in a country where so many others abound.

Capt. Thompson reports as follows, on the fibre:

"The line I now send you, made from the fibre forwarded from Chittagong, broke at once, without stretching, with only 127 lb.; only the finest

and largest of the material was made into this line. A line of Russian Hemp of the same size with the two herewith sent, will sustain with ease 400 lb.; so that this fibre is much too weak for either sail-cloth or cordage. It however possesses all the free and kindly nature of Flax, and even smells like Flax. It is easily worked, with little or no waste, and I think must have been prepared with vegetable oil."

Naravali Fibre, *Cordia angustifolia* (*Cordiaceæ*).

Dr. Buchanan, in his 'Journey through Mysore,' mentions that ropes are made of the bark of the *Naruvli*, which is the *Cordia angustifolia*, and which he found common near Severndroog. Its fruit is esculent, but tasteless. The plant belongs to the same family as the Sebestens, formerly famous in medicine; but which, when ripe, seems only remarkable for containing much mawkish mucilaginous pulp. It is possible that the bark of some of the species, when young, may yield a useful fibre.

APETALOUS PLANTS.

Having at p. 131 pointed out that as some of the Exogenous families of plants have only a single floral envelope, we need here only note that the following families belong to this subdivision.

Nepal Paper Plant, *Daphne cannabina* (*Thymelææ*).

At the Great Exhibition of 1851, many were much interested about a huge sheet of Nepal paper exhibited by Col. Sykes. This was curious, not only on account of its size, but also on account of the plant from which it was made. This belongs to a genus and family containing plants remarkable for their fibrous bark. Thus the Lace-bark tree (*Daphne Lagetta*, now *Lagetta lintearia*) of the West Indies is "remarkable for the beautiful net-like appearance of its several easily separable layers of bark, whence it has received its English name. As the fibres of other species possess considerable tenacity, they have been employed in making cordage; and the toughness, as well as fineness of the inner bark of

these plants, may be seen in a plant common in our gardens, and used in medicine on account of its acridity, that is, the Mezereon, *Daphne Mezereum* of botanists. It is from the inner bark of one of these plants, the *D. Bholua* (*D. cannabina* of Lourciro, and which is supposed to be identical with the *D. odora* of Thunberg), which is extremely abundant in the Himalayas, that this Nepal paper is made, as from other species in other countries. Another plant of the same, or of an allied genus, as it is called both *Daphne* and *Gnidia eriocephala*, is very common on the ghauts of the West of India, and in the hilly parts of the Southern Mahratta country and of the Dukhun. Several specimens, from various localities, are in Col. Sykes's collection. It is probable that it might be turned to the same use as the Nepal plant.

Of the uses of this plant good accounts have been given by Mr. Hodgson ('Journ. As. Soc.,' i, p. 8, 1832) and Dr. Campbell. The former describes the process as consisting, first, in boiling slips of the inner bark of the paper plant in a ley of wood-ashes for about half an hour, by which time the slips will be quite soft. These are then beaten in a stone mortar with a wooden mallet till they are reduced to a homogeneous pulp. This is then diffused through water, and taken up in sieves and paper frames, as in the ordinary process for making paper by hand. When dry, the sheet of paper is folded up; sometimes it is smoothed and polished by being rubbed on wood with the convex side of a conch shell: but Mr. Hodgson does not explain how the very large sheets of several yards square are made. Though called Nepalese, the paper is not manufactured in Nepal, but in Cis-Himalayan Bhote, in the midst of its immense forests, where there is an abundant supply of the plant, of wood for ashes and for fir[illegible]od, as well as a constant supply of clean water. This pa[illegible] is remarkable for its toughness, as well as its smoothness. Some of it, in the form of bricks of half-stuff, was sent to this country previous to the year 1829. As the quantity sent was not sufficient for a complete experiment, a small portion of it was made into paper by hand. An engraver, to whom it was given for trial, stated that "it affords finer impressions than any English-made paper, and nearly as good as the fine Chinese paper which is employed for what are called India paper proofs." ('Gleanings

in Science,' i, p. 210.) Dr. Campbell describes the paper, as made by the Bhoteahs, "as strong, and durable as leather almost, and quite smooth enough to write on; and for office records, incomparably better than any India paper. It is occasionally poisoned by being washed with preparations of arsenic, in order to prevent the destruction caused by insects. Many of the books in Nepal, written on this paper, are said to be of considerable age, and that the art of making paper seems to have been introduced about 500 years ago from China, and not from India." He states that this paper may easily be procured at Patna, Purneah, and other places in the plains of both Southern and North-Western India.

Celtis orientalis (*Ulmaceæ*).

Capt. Reynolds, who, like several of the other officers in Assam, has paid much attention to the natural products of the province, sent to the Agri-Hortic. Society a specimen of a primitive cloth made by the Garrows from the bark of a tree, whose leaves were enclosed in the parcel. "They make several such cloths of different colours from various barks, and though these manufactures would seem cheap enough, they are not usually at the expense or labour of even such rough clothing for themselves, preferring apparently to go naked; they import at least 100,000 mds. of Cotton, but to my knowledge do not weave a seer for themselves. The Garrows who come to the plains have generally some small ends of cloths; but these are bought from the Bengalees, apparently to attend the *hauts* (fairs) in, not as clothing to protect them from wind and weather."

Dr. Falconer, to whom the specimens were referred, pronounced them to be those of *Celtis orientalis*, a tree which is pretty common all over India, and known under the name of Chakan in Bengal. The cloth is probably called "Yangfung" in Assam: Capt. Reynolds names it "Amfuk." Dr. Buchanan Hamilton says, the under bark of this tree, like that of the West India kind, consisting of numerous reticulated fibres, forms a kind of natural cloth, used by the Garrows for covering their nakedness. ('Lin. Trans.,' xvii, p. 209.) He also describes

it in his report on Assam as a kind of rug worn by the Garrows in the cold weather, and serving them as a blanket by night.

But the specimens of this, as well as some of others, are chiefly interesting as showing the probability of the existence of numerous plants, of which the useful properties still remain unknown—for the fibrous properties of this are not mentioned by Dr. Roxburgh; and of him, it is justly observed in the 'Journ. of the Agri-Hortic. Soc.,' vi, p. 188: "From this circumstance it may be inferred he was not aware of it, as he appears never to have allowed an opportunity to pass of drawing attention to the useful properties of plants described by him, but, on the contrary, to have ever been desirous of rendering his botanical acquirements subservient to the dissemination of useful information in connection with every department of the vegetable kingdom."

Hemp.

Sans., *Bhanga*, *Ganjica*; Hind., *Ganja*; Arab., *Kinnub*; Pers., *Bung*.

Though so many fibres have been mentioned under the name of Hemp, it is only now, as we approach the end of our labours, following an arrangement according to the natural affinities of plants, that we have arrived at the true Hemp plant, the *Cannabis sativa* of botanists. The fibre of which is so generally employed for cordage in Europe, that the value of all other fibres is estimated, not so much from their intrinsic properties, as from their greater or less resemblance to Hemp, and especially to Russian Hemp. There is every reason for believing that the plant is of Eastern origin, while there is no sufficient reason for thinking that the climate of Europe is so peculiarly suited to the production of its fibre, as to exclude those of its native climes. Especially where attention is paid to those where the plant is grown on account of its fibre, and these distinguished from the others where it is cultivated for its resinous and intoxicating secretion. The latter requires exposure to light and air. These are obtained by thin sowing, while the growth of fibre is promoted by shade and moisture, which are procured by thick sowing. But before we proceed

to consider these points, we may first notice the botanical affinities of the plant.

By the celebrated Jussieu, the Hemp and the Hop plants were placed in the same natural family (*Urticeæ*) with the Nettles. In more modern works, they are either continued as a tribe of the same family, under the name of *Cannabineæ*, or these containing only the genera *Cannabis* and *Lupulus* are separated into a distinct family, under the same or a nearly similar name. These two plants are closely connected in properties, as in structure.

The Hop (*Humulus Lupulus*), besides a bitter, secretes a resinous principle: Hop bines abounding in fibre, have often been proposed to be turned to useful account, for cordage or paper, but as yet to little extent.

The Hemp plant likewise secretes a resinous principle in its leaves, on which account these, as well as the *churrus* collected from off the young tops of the stem and flowers, is highly esteemed in all Eastern countries, on account of its exhilarating and intoxicating properties. Hence, among the Arabs the Hemp has a variety of names, as "the increaser of pleasure," "the cementer of friendship," &c. By its name of *Hasheesh* it is often mentioned in the works of travellers in Egypt, Arabia, and Syria; while the name of *Bhang* is not less celebrated in the far East. The Author has treated together of these two plants, in his 'Manual of Materia Medica,' pp. 622—629, 2d ed., from which he extracts the following description of the plant:

The Hemp is a diœcious (occasionally monœcious) annual, from 3 to 10 feet high, according to soil and climate. Root white, fusiform, furnished with fibres. The stem erect; when crowded, simple; but when growing apart, branched even from the bottom, angular, and, like the whole plant, covered with fine but rough pubescence. This stem is hollow within, or only filled with a soft pith. This pith is surrounded by a tender, brittle substance, consisting chiefly of cellular texture, with some woody fibres, which is called the *reed, boon*, and *shove* of the Hemp. Over this we have the thin bark, composed of fibres, extending in a parallel direction all along the stalk. These fibres consist of delicate fibrils, united together by cellular tissue, and all covered by the thin membrane or cuticle.

The leaves are opposite or alternate, on long petioles, scabrous, digitate, composed of from 5 to 7 narrow, lanceolate, sharply serrated leaflets, of which the lower are the smallest, all tapering at the apex into a long entire point. Stipules subulate. *Males* on a separate plant. Flowers in drooping, axillary, or racemose panicles, with subulate bracts. Perianth 5-parted; segments not quite equal, downy. Stamens 5; filaments short; anthers

large, pendulous, 2-celled; cells united by their backs, opening by a longitudinal slit. *Females* in a crowded spike-like raceme, with leafy bracts. The perianth consists of a single, small, spathe-like sepal, which is persistent, acuminate, ventricose at the base, embraces the ovary, and is covered with short brownish glands. Ovary subglobular, 1-celled, with one pendulous ovule. Style short. Stigmas 2, elongated, glandular. Nut ovate, greyish-coloured, smooth, covered by the calycine sepal, bivalved but not dehiscing, and inclosing a single oily seed. Seed pendulous. Testa thin, membranous, marked at the apex with a coloured hilum. Embryo without albumen, doubled upon itself. Radicle elongated, turned towards the hilum, and the apex of the nut separated from the incumbent plano-convex cotyledons by a small quantity of albumen.

The Author having for many years been of opinion that Hemp fibre might be advantageously produced in India in much larger quantities than has ever yet been the case, wrote a report on the subject, in the year 1839, which was sent to India, and published in the 'Trans. of the Agri-Hortic. Soc.,' vol. viii, p. 15. From this he will now make some extracts, and then adduce some of the valuable information which it was the means of eliciting:

"The cultivation of Hemp in India obtained very great attention from the Court of Directors, and instructions were sent to the Governments there to encourage its growth, as well as that of other cordage plants. As the natives of India employ between forty and fifty different kinds of plants for the fibre which they yield, fitted for this purpose in different degrees, the subject of investigation was sufficiently extensive, and received great attention from Dr. Roxburgh."

"On the present occasion I confine myself to the Hemp plant itself (the *Cannabis sativa* of botanists), as being the most valuable of the whole; and because it is in general erroneously supposed that it can only be successfully cultivated in European regions, though there is every reason to believe that it is originally a native of Asia, and even that its Greek and Latin name *Cannabis* is derived from the Arabic *kinnub*. It is well known to be common in Arabia and Persia, as well as in every part of China and of India, and likewise in Egypt and Turkey; but in all these countries it is valued chiefly, if not only, for yielding an intoxicating drug commonly called *bhang*. In European countries, it is on the contrary cultivated only on account of its ligneous fibre, so extensively employed in the manufacture of the strongest ropes, and of coarse but strong kinds of cloth. The wide distribution of this plant throughout Europe and Asia is

remarkable, but easily explained, when we consider that it is an annual, which requires only a few months of summer temperature to bring it to full perfection. The requisites for its successful cultivation, it is, however, necessary to notice, when endeavouring to introduce elsewhere its culture.

"Hemp is cultivated in almost every part of Europe for home consumption, but only in large quantities for export in Russia and Poland, though the finest quality of Hemp comes from Italy. French Hemp is also much esteemed, as well as that grown in both England and Ireland; but for the present purpose it is necessary only to notice the culture of the chief kinds which enter into commerce.

"Hemp is cultivated in almost every province of Russia, but in the largest quantities in the interior, beyond Moscow, as well as nearer Petersburgh, and in the Polish provinces which belong to Russia. The soil must not be over rich nor too sterile, of moderate depth, and friable. The time of sowing varies from the middle of May to the end of June; by some it is recommended not to be sown until the latter end of June, as frosts are very injurious to its growth. The season of reaping is from the end of August to the end of September, and it is therefore between three and four months in a state of vegetation; the male plants being pulled some weeks before the female. The Russian summer, though short, is regular while it lasts, and the temperature sufficiently high to bring it to full perfection.

"That the northern latitudes of Russia are not essential for the successful cultivation of Hemp is, however, evident, from the large quantities which are grown in the southern climate of Italy, both in Bologna and Romagna, and along the banks of the Po, as well as in the neighbourhood of Naples. The Italians have a saying, that 'Hemp may be grown everywhere, but it cannot be produced fit for use, either in heaven or earth, without manure.' The climate of Italy, it is well known, is remarkable for its clearness, regularity, dryness, and warmth, and that irrigation is essentially necessary for much of its agriculture. The Italian Hemp is fine, soft, light-coloured, and strong, as well as long in the staple; and it is important to remark that it brings the highest price in the English market, as, for instance, it sells for 50 shillings per cwt. when

the best Russia sells at 47 shillings for the same quantity.

"If we compare the summer temperature of the northern with these southern situations, we shall not find so great a difference as we might be led to expect by considering only their latitudes, or their mean annual temperatures. Thus Petersburgh and Moscow, in N. latitude 59° 56′ and 56° 45′, have mean summer temperatures of 62° 06′ and 67° 10′ of Fahr., while Milan and Rome, in N. latitude 45° 28′ and 41° 53′, have summer temperatures of 73° 04′ and 75° 20′."

"Without entering into details, it might be inferred as probable, that as Italy grows Rice, and so many other plants of India, so might the latter cultivate a plant like the Hemp, which succeeds so well even so far south as Naples, and which requires only a few months to bring it to perfection; and this even if India did not already possess it. But so far from this being the case, the reverse is the fact; and it is well known that no plant is so commonly cultivated in so many parts of India as the true Hemp plant, which is there called *ganja*, but which differs in no respect from the European plant, though the natives employ it only for the purpose of yielding *bhang*. But cultivated for this purpose, instead of being sown thick, as it ought to be when intended for cordage, it is sown thin by the natives, who afterwards transplant the young plants, and place them at distances of nine or ten feet from each other. The effect of this is to expose them more freely to light, heat, and air, by the agency of which the plant is enabled to perfect its secretions in a more complete manner, and the bhang will consequently be of a more intoxicating nature. The fibrous and woody parts at the same time attain a greater degree of stiffness and solidity, as is found to be the case with timber trees similarly exposed. The Hemp plant, thus grown, will branch much. It may be small in dry situations, and large in rich and moist ones, but in either case its fibres are found, both in Europe and India, to be rougher, stiffer, and more difficultly separated from the woody part than is desirable, but seed is produced in larger quantity and of better quality. This mode of cultivation has, moreover, the disadvantage of being more expensive, from taking up more space than is de-

sirable when the plants are required to yield the best quality of fibre for cordage.

"Plants, when grown in moist situations, in shade, or set thickly together, are well known to run into leaf, shoot up, and to become more lax in texture, while their secretions are imperfectly formed, as is exemplified in the growing of Lettuce, Celery, &c. Hemp and Flax, when cultivated for their fibres, are sown thickly together, and they shoot up into long, wand-like plants, which are much less branched than when freely exposed. Air and light having less free admission, and heat having less influence in evaporating the sap, the effect is to produce a longer fibre, which is at the same time soft and pliable, as well as more easily separated, and in larger quantity on the same space, than when they are set widely apart.

"The natives of India also sow their *Sunn* and *Jute* very thickly together when, for the sake of their fibres, they form the exclusive crop. The effect is to produce a long and flexible fibre, though this is not sufficiently strong to form a good substitute for the true Hemp. This might be cultivated in suitable situations in India, in a manner similar to that adopted in Europe, or like that practised with its substitutes in India. The effect would undoubtedly be to produce a sufficiently long fibre, which would also be softer and more pliable, at the same time that it retained a great portion of its original strength, and probably in as large a quantity as is yielded by the *Sunn* plant. Thus an article might be produced, which, judging from the Italian samples, might enter into competition with the Russian product, and, at all events, afford much more valuable cordage than the several (usually considered) inefficient substitutes which are so extensively cultivated in India, and which, imported into this country, sell only for 15 to 20 shillings per cwt., at the same time that the Russian, Polish, and Italian Hemps are selling for 42 to 50 shillings per cwt.

"The difference in price would appear a sufficient inducement to attempt the culture of the true Hemp in India, especially as there could be no doubt respecting its growth, as it is already so common in every part of that country, and requiring, if anything, only a little modification of its properties. This could be ensured, most probably, by a change in the mode of cultivation. Dr. Roxburgh, as long since as the year 1800,

thought Rohilcund and the neighbouring hills suited to the cultivation of Hemp. I have seen it in great abundance, in a wild state, in the Deyra Doon, and also in the Khadir land of the Saharunpore district, especially along the upper part of the Doab Canal, and where it was chiefly valued for its leaves, being made into *bhang* and *subjee*, and the stems, when dried up, being burnt for firewood.

"There would be little difficulty in cultivating this plant in the low *Khadir* land, where it is wild; nor in converting it into merchantable Hemp. For the natives of the neighbourhood already make use of it, partially for the manufacture of ropes; and the inhabitants of Malabar are said by Dr. H. Scott to employ the Hemp for making their fishing nets.

"The natives of the Himalayas likewise possess the plant, from which though they prepare an intoxicating drug, which they call *churrus*, they likewise value it for its ligneous fibre, from which they prepare a coarse kind of cloth, which they send into the plains for making very durable *grain-sacks*, as well as the strongest ropes (called *sel*), for crossing their rivers.

"This fact, though not generally known, is mentioned by Kirkpatrick in his account of Nepal, and was ascertained by General Hardwick, in his visit to Srinuggur, as well as by myself, when travelling in the Himalayas ('Illust.,' p. 333). I also obtained specimens of the rope and cloth when travelling there, but which I regret I am unable now to find. The plant I have seen in a very luxuriant state at least ten or twelve feet high, in the Himalayas, at elevations of 6000 and 7000 feet, especially in the neighbourhood of buffalo-sheds. In such situations and near villages it could no doubt be easily cultivated to a great extent, and yield a valuable and profitable product.

"The Hemp could likewise be cultivated in the plains at two seasons of the year; that is, during the rainy season, as is now the case, but likewise along with the cold-weather cultivation, which is so similar to that of the summer culture of European countries. But experiments require to be made and specimens procured in order to determine which season is most proper for the culture of this plant in order to yield Hemp of the best quality.

"Hill people might no doubt easily be obtained for preparing

the Hemp according to their own method, and teaching the people in the plains, who are already practised in the art of preparing *Sunn*. It would, however, be desirable to procure, if practicable, the assistance of some European (and such might be found among the soldiery) who had seen and practised the preparation of Hemp in this country. The experiment might be made with little expense, and probably great advantage, from the useful information which would be obtained for the use of cultivators, in the Botanic Garden at Saharunpore, if instructions were given to this effect to Dr. Falconer, Superintendent of that Institution.

"For due attention being paid to the details of this subject, it would be extremely desirable to send out to India specimens, with prices of the different qualities of Hemp found in the markets of this country, so that cultivators in India might know what they had to imitate and rival. It would also be extremely desirable, in order to ascertain the present quality of the Himalayan Hemp, that specimens, in different states of preparation, were sent here, as prepared by the Hill people, together with specimens of the Hempen Rope and Sackcloth of the Himalayas."

Subsequent to the publication of the foregoing report, several papers were sent to the Agri-Horticultural Society of Calcutta, and which are published in vol. viii of their 'Transactions,' and in vol. i of their 'Journal.' These were from Majors Swetenham and Corbett, Captains Kirke and Huddleston, and from the distinguished naturalist, Mr. Hodgson. The substance of the last two we here republish, as containing much of the information on culture contained in the others, while Major Corbett and Capt. Kirke give valuable information respecting the cost and the expense of conveyance to Calcutta; which will be immediately noticed.

Extracts from a Report on Hemp Cultivation, &c., in British Gurhwal, by Captain H. Huddleston, 14th July, 1840.

2. There are two kinds of Hemp, "*Bhang*," indigenous to the Himalayas; —that called "Khur-Bhunga," or Jungle Bhang, growing wild throughout the whole of these Hills in all situations, and attaining a very considerable height during the season of the periodical rains, is of no use whatever, for the very insignificant quantity of "churrus" (the inspissated juice of the leaves obtained from the plant by rubbing between the hands) does not remunerate even the poorest class for the trouble bestowed upon it, and as

it does not yield a fibre that can be turned to any use, I need not of course make any further remarks regarding it.

3. The real Hemp, or cultivated kind, is grown chiefly on high lands, and principally on the northern faces of the mountains, in well prepared and abundantly manured soils close to villages, or in recently cleared lands by burning the primeval forests, the soil of which, from the accumulated decomposed vegetable matter of years, is rich enough to ensure the superior growth of the plant and an abundant crop without any manure for one season. No irrigation is ever resorted to, and very little is produced under an elevation of 3000 feet, the heat of the valleys being detrimental to its quality, and the plant appears to flourish best at elevations of from between 4000 to 7000 feet.

The middling district situated between the "Pindur" to the north and the "Nyar" or "Samee" rivers to the south, and centrically with regard to the province of Kumaon and Gurhwal, may be termed the chief Hemp-producing districts of British Gurhwal. The fields nearest to villages, as being the easiest for manuring, and the culturable wastes with a rich soil of accumulated rotten vegetation, or recently cleared forest lands, being those in which the Hemp plant is alone cultivated to advantage with respect to its quality.

4. The culture of "Bhang" or Hemp, as practised in this district, is as follows: After the ground has been well cleared and prepared, the seed is sown, towards the end of May, or early in June, at the rate of 20 or 25 *pathas*, equal to about 26 or 33 seers (from 52 lb. to 66 lb. avoirdupois) per beesee, which latter is the common denomination now used in Gurhwal, and very near equal to an English acre. During the early growth of the plant the ground is kept free from all weeds, and the young plants are thinned, leaving a few inches between each, and until the crop has attained a good height, the ground is kept clean from all rank vegetation—after which it attains to the height of twelve and fourteen feet, and is cut in September and November.

5. Of this cultivated Bhang there are two kinds, the plant called *Goolanga* or *Goolbhanga* which produces seed (the female), and the one which only flowers, but has no seed; and this latter is called "Phoolbhang" (the male), from which the best sort of Hemp is prepared; the plants being cut a month or six weeks earlier, and producing a stronger and superior fibre to the other. On the stalks being cut green, they are dried for several days in the sun, by being piled against the walls of the terraced fields until they become quite brown. The plants have the seed extracted by rubbing between the hands, which produces the "Churrus," and this is scraped off and made into rolls for sale. The leaves also are pounded, from which "Ganjah" and "Subzee" are manufactured in small quantities. When the stalks are sufficiently dry they are tied up into bundles, and steeped for fifteen or sixteen days (eight days, Swetenham) in tanks or running streams, being kept under water by pressure—on being taken out they are beaten with wooden mallets, and dried again in the sun, when the fibre is stripped off from the thickest end of the stalk, and after being again beaten, this fibre is made up into twists for sale and manufactured into sackcloth for wear, bags, and ropes.

6. The total money return from the produce of the cultivation of the Hemp plant would be considerable, if there were any demand for exportation, though the average return even now is amply remunerating to the grower, and were it not from the well-known dislike which the Hill people have to extra labour, it would be more extensively cultivated than it is. The limited cultivation at present, however, supplies the wants of the population for sackcloth, bags, and ropes, nearly the whole of which, in considerable quantities, is consumed in the district—the lower classes of the Gurhwal population dressing themselves in the cloth manufactured from the Hemp, and this still encourages the cultivation in a great measure. The average return per beesee (or English acre) may be stated as follows:—three seers (6 lb.) of churrus, value

Rs. 6 (or twelve shillings); four maunds (or 320 lb.) of Hemp, value Rs. 8 (sixteen shillings); and about thirty to thirty-five seers (60 to 70 lb.) of seed, yielding about five seers (10 lb.) of oil, value R. 1 (two shillings). Giving a total of Rs. 15 per beesee.

7. The seed sells generally at 20 *pathas* per rupee, or from twenty-seven to thirty seers (as this wooden measure varies in different places), and the seed being light, I have found that the average weight of each patha is about one seer and five chittacks. The Hemp sells at 2 rupees a maund amongst themselves, and the Dooms (or lowest class of the agricultural community) are the chief cultivators of the plant.

8. When Dr. Rutherford held a contract for the supply of Hemp to the Honorable Company, and also made extensive purchases of it with other staple articles of produce of the Hills on his own account, the cultivation of Hemp was very considerable indeed in this district; and in case of any demand being again created, immense tracts would no doubt be sown with it, provided the same plan of advances to cultivators were adopted.

9. The plan adopted by Dr. Rutherford appears to have been thus: advances through his agents to the landed proprietors and individual cultivators were made during the early part of the year, stipulating for the Hemp being delivered at their own doors at 4 rupees a maund, and the carriage during the cold season to the marts of Kotedwarra in Gurhwal, and Chilkeea in Kumaon at the foot of the Hills (where Goomashtas or agents were ready to receive the Hemp), being defrayed extra—which did not, I imagine, on an average exceed a rupee a maund—so that the raw material was and is capable of being delivered at those marts for 5 rupees a maund; and as only a few miles further of land carriage would be required to ship the Hemp into boats on the Ganges or Ram Gunga for transit to Calcutta, this would not, I should think, double the cost of it.

Hemp Cultivation in Nepaul: by H. B. Hodgson, Esq.

Mr. Hodgson states, that the cultivation is peculiar to the Northern districts of Nepaul, but only, as he suspects, because the tribes inhabiting them are less scrupulous than the people of the great valley, and other Central and Southern tracts; for, at least in the valley, the plant flourishes greatly, if properly tended, as Mr. Hodgson has proved in his own garden; and the spring crops of the valley are almost choked with *spontaneous* growth of Hemp, which, however, being uncultivated, is stunted and virtueless. The Northern districts (popularly called Cachar) are nevertheless the prime seats of culture, and there alone is the plant manufactured into rope or cloth; though the edible extracts are sometimes prepared nearer to and around Katmandhoo.

The season of sowing Bhang seed in Nepaul is from Chyett to Bysack (March to April).

Damp soils, comprising black earth, are fittest for this crop. Before ploughing the field, sufficient manure is to be sprinkled over it, then completing the work of the plough, the seeds are to be sprinkled, and having broken the clods into dust, the field is to be made even.

At seven or eight days after sowing the seeds the plants come up, but their rapidity of growth and their size and strength depend on the abundance of the rains or artificial watering. If the plants be very thick, they must be thinned, so as to stand three inches distance from each other. They flower and fruit in Sawun (July); and at the beginning of Bhadoon (August) are in their full growth; but while yet succulent and in flower, they are to be cut, with exception of some seed plants, which are not to be reaped till October. It is the bark of the young but full-grown or Sawun

plants, which is soft, that is used for making Bhangela. That of the old or October plants is hard and not suitable for manufacture.

After the plants have been cut off at the ground, they must be placed in the sun for eight or ten days, or until they be dried sufficiently. They must then be steeped in water for three days, and on the fourth day the plants must be taken out of the water and peeled. The peelings are to be washed and put in the sun; and when quite dried, they are ready for manipulation. They are then to be torn into thin threads with the nails of the hands; next twisted with a spinning-wheel (Tikuli), and when the threads are thus prepared, they are to be boiled with ashes of wood and water in a pot, for four hours, and to be washed again for the purpose of whitening. This is the way of preparing Bhangela thread, out of which blankets are woven.

One mana (half a kucha seer) of seed is sufficient for a ropini of land (one fifth of Badshahi bigah), which produces ten or twelve loads of bhang. Hemp grows equally well on slopes or flats, and near the tops as well as on the sides of the mountains, if not too low. But a moist rich soil is indispensable. The plant attains to a height of eight to ten feet, and should be cut when the flower is falling and the seed forming.

Before proceeding to consider the prospect of obtaining merchantable Hemp from the heights of the Himalayas, we may notice what is practicable in regard to—

Hemp Culture in the Plains of India.—Though the production of Hemp in the Himalayas, and in the low lands at their foot, is chiefly contemplated, that of its culture in the plains may also be mentioned. This was attempted by Dr. Roxburgh, and though probably in the least favorable situation in India, yet with some success; as he observes:

"In many parts of Bengal, particularly where the land is so low as to remain humid through the dry season, Hemp thrives luxuriantly during the cold season; at Soonamooky it did well on a sandy soil, manured with dung from stables. Prolonged immersion much injures the quality of the Hemp, the rainy season is therefore preferable for the cultivation and maceration of the plant, and we must content ourselves with one crop in the year, for it is a very false, though prevailing notion, that the fertile fields of Asia produce at least two crops annually. The burning heats of Asia, while they last, are as unfavorable for vegetation as the frosts of winter are in Europe." And in Wisset it is stated:

"A native, who had an opportunity of observing the mode of cultivating and preparing the Hemp raised by Mr. Douglas, at Rishera, has offered to the Board of Trade to contract with them for supplying a very considerable quantity, I believe 500 maunds (about 17 tons), of properly dressed Hemp next

season, at the rate of ten sicca rupees per maund (this is equal to 300 sicca rupees, or, at 2*s*. 6*d*. = £35 per ton, and at 2*s*. = £30 per ton)."

The next important notice which we have respecting the culture of Hemp in the plains of India, is from Mr. Deneef, already mentioned at p. 174, &c., and of and from whom we have the following communication:

Sample of Hemp grown and manufactured in Bengal, after the manner pursued in Belgium. Presented by Mr. H. Woollaston, on behalf of Mr. G. Deneef, Belgian farmer.

Calcutta, Oe. 8, 7630, 1840.

Monsieur Spry, Secrétaire de la Societé d'Agriculture et d'Horticulture du Bengale,

J'ai l'honneur de vous envoyer par l'entremise de Monsieur Woollaston, membre de votre Société, un échantillon de chanvre, qui me semble mériter beaucoup d'attention, il me parait aussi avantageux que le chanvre de Russie et de Manille qui se vendent à Londres £22 à £27 le tonneau. La manufacture en est tres simple et n'exige aucun instrument; elle est faite en Belgique par des vieillards et des enfants. Aucun ouvrage ne saurait être plus convenable pour les bras inactifs des familles pauvres de cette contrée, il n'est nullement fatigant et se fait par assis; de plus, chaque livre de chanvre, procure au teilleur 3 lb. de matière a brûler.

La préparation du sol ne demande pas de grands soins ni par conséquent de grandes dépenses; sa végétation est superbe, la plante n'occupe le sol que pendant 80 jours (du commencement de Juin, à la fin d'Août). J'en ai a peu prés 4 beegas, qui me donneront environ 1000 lb. de fibres, que je prepare en ce moment; et que je me propose d'envoyer le plutôt possible, pour échantillon, à la Société expérimentale du Lin a Londres, et aprés en avoir reçu une reponse, concernant sa valeur reélle; je m'empresserai de vous envoyer un rapport exact sur la mode de sa culture.

Il serait étonnant que l'Inde, qui a tant de moyens en terrain et en hommes, ne pourrait pas concourir avec la Russie, qui est obligée de payer £2 0 0 par tonneau pour frais d'exportation au gouvernement Russe meme, et 6*s*. per tonneau au passage du Sond, et ne pourrait réclamer sa part, des millions d'espèces, que la mère patrie est obligée de payer annuellement à la Russie sa puissante rivale.

J'ai l'honneur de vous saluer avec la plus parfaite considération,

Votre trés devoué serviteur,

G. Deneef, Belgian Farmer.

The Hemp produced by so little labour and care, and which only occupied the ground for eighty days from the beginning of June to the end of August, according to Mr. Deneef, was pronounced good by the members of the Flax and Hemp Committee; by Mr. Fergusson, as "uncommonly strong, and if it can be produced cheaply and abundantly, it is likely to be a most important article." Mr. Hodgkinson, who doubted of its being the true Hemp—though without sufficient grounds—

pronounced "the article as superior, be it what it may, and deserving of the first attention."

With respect to the interchange of seed, or to the kind which is most desirable, we have the following fact, though it is probable that some of the Himalayan seed would answer equally well:

"A few fresh stalks of Hemp raised from Russian seed received last year from Dr. Royle, and corresponding specimens of the indigenous Hemp plant of Bengal. *Presented by Mr. Deneef.* The superiority of the former in texture was very apparent."

In treating of both Flax and Sunn, mention was made of Mr. Sconce's experiments with both of these plants at Chittagong, in the year 1843. He at the same time grew some Hemp from country seed (*ganza*) sown in November. Of the fibre, the Hemp and Flax Committee reported: The Fibre is exceedingly strong and clean, but the admixture of Tow spoils the appearance and deteriorates the quality; while of the dressed Hemp it was said, that some of the fibres were strong, others weak, and as only partially heckled. These defects, being those of management, might easily be remedied.

From the far Southern we proceed to the North-Western provinces; here the late Mr. Bell, of Agra, on hearing of the above experiments in Bengal, writes, that there "can be no difficulty in the cultivation of the *bhang* or *ganja*, which is now sown only for the intoxicating drug the natives obtain from it; but the vigour the plant shows, and the height it reaches when thus sown, much scattered to admit of its throwing out its branches, satisfied me that, sown more densely, it would at least run the height of Sunn, and this I suppose sufficient for the desired length of fibre in the Hemp."

There is no doubt that the Hemp plant will grow to a great height even in the plains of India. The Author received a letter from his friend, Capt., now Sir Proby Cautley, dated from Saharunpore (10th Aug., 1840), stating that the Hemp was in cultivation in the Botanic Garden, and looking as fine as any that he had ever seen, nearly twelve feet high, with a natural healthy look of dark green. Dr. Falconer, however, afterwards reported that the Hemp fibre did not retain the strength or

flexibility which characterise it in the Himalayas. But the Author has been informed that they are able to use some of the Hemp growing spontaneously along the upper part of the Himalayan base, for the general purposes of cordage. The Hemp growing in the Goruckpore district at the foot of the Hills, is considered of good quality, and some is being sent to this country on purpose to have its properties tested. It is probable that Mr. Williams might succeed in the cultivation of Hemp in the soil and climate of Jubbulpore.

Quality and Cost of Himalayan Hemp.—From the account which has been given above, by local officers, of the cultivation, and the other testimony which we have respecting the plant, there is no doubt that the Ganja of the Himalayas is the true Hemp plant of Europe (the *Cannabis sativa* of botanists). As the plant has ceased to be as extensively cultivated as formerly chiefly from the want of any external demand, there would seem to be no difficulty in again increasing the culture, and to a still greater extent, if this requisite for all culture was again restored. The only questions which remain to be determined are the quality of the Hemp and the cost at which it could be conveyed to Indian ports, where, if not required for export to Europe, it could be beneficially employed for naval and other purposes. This would be preferable to their continuing, as in some places is still the case, to import Hemp and Tow from Europe, when India produces at least as good, if not a superior article, and at a cheaper rate. This is evident from the following abstract of the information on the subject.

"In the Himalayas the Hemp grows wild, and is, moreover, carefully cultivated, both on account of its exhilarating secretions, and its strong and flexible fibre. With the properties of this the Hillmen are well acquainted, as they make with it both twine and rope, and a coarse cloth (*bhangela*) with which they clothe themselves, as well as make sacks and bags. Their hempen wrappers they wear much as a Highlander does his plaid, fixing it in front with a wooden skewer, instead of a brooch. A traveller in the Himalayas, some years since, described the natives as applying Hemp 'extensively to purposes of a domestic nature, such as hanging their supernumerary female children, administering rope's-end to their wives, penning up cattle, and making a sort of netted, or knitted, or knotted shoes, to which a sole of untanned leather is sometimes, but by no means generally, affixed.'

"The culture seems to be very well understood in most parts, though the best methods are not always practised either of planting, or of picking, or of preparing their Hemp. All along the Himalayas—that is in Nepaul, in Kemaon, in Gurhwal, and up to the newly acquired hills of the Punjab, at

elevations of from 3000 and 4000 to 7000 feet—Hemp is cultivated by the Hillmen, though chiefly for their own use, the plants growing to eight or ten, some say twelve or fourteen, feet in height. They sow about the month of May, carefully prepare, and usually manure the ground, weed and thin the plants to within three or four inches, and cut the male plants, '*phoolbhanga*, which flowers, but has no seed,' a month or six weeks before the female plant, '*goolanga*, or *goolbhanga*, which has seed,' the latter being harvested about the end of September. The stems, when cut down, are dried in the sun, and then steeped in water for three or more days. Beaten with wooden mallets, the fibre is then stripped off, and again beaten. In some places it is said to be boiled with wood ashes—that is, potash,—and sometimes bleached before being spun into thread. The stalks are made into torches. The culture is described to be the most profitable of any, as the *churrus* and *ganja*, different forms of *bhang*, are said of themselves to pay the expenses of culture. The Hemp they sell among themselves for Rs. 2 a maund—that is, 4s. for about 82 lb. The seed is even roasted and eaten, or expressed for its oil, and the oilcake given to their cattle. The culture is not much extended, for it is more laborious than they like, and there is said to be a prejudice among the Brahmins and Rajpoots against the cultivation of this plant, which is therefore confined to the Doom class. But there is no doubt that the culture could be immensely extended if the inducements of price were greater."

There being no doubt of this being the genuine Hemp plant, the next point to ascertain is the quality of the fibre which the Hillmen produce with their own unaided efforts. On this point the information is most satisfactory. Mr. Hodgkinson, a Calcutta merchant, who was well acquainted with this staple, and had personal knowledge of the produce on the Continent, pronounced some Hemp sent from the Deyra Doon to be "equal in colour, cleanness, length, and strength to the best Russian."

Mr. Deneef, a Belgian farmer, sent to India by the Flax Experiment Company, said: "Ces échantillons sont de vrai *Cannabis sativa*, pareil à celui du nord de l'Europe. J'ai été enchanté de voir une si charmante vegetation de cette plante produite dans l'Inde; mais cet article n'est pas preparé comme on le desire dans les marchés Anglais; d'abord chanvre mâle et chanvre femelle ont été coupés ensemble, et ensuite dressés dans l'etat humide d'apres la methode des Indiens. S'il était dressé à la manière des Européens du nord, qui consiste à tirer le chanvre mâle, cinq semaines avant celui qui produit la sémence, à ne rouir que bien peu chaque genre séparément, la chanvre mâle ne pouvant pas séjourner dans l'eau aussi longtemps que l'autre; ensuite à ne le dresser que quand il est bien sec et lorsque les fibres se separent aisément; il formerat une belle matière première pour les cordages solides. Au contraire, dressé et rincé dans l'eau il perd'une certaine graisse qui lui est naturelle, et qui est cause que la poix s'imbibe plus facilement avec lui, ce qui le rend fort contre la pluie et la chaleur, et fait en même temps bénéfice du manufacturier, qui sait si bien distinguer la différence de la préparation."[1] ('Journ. Agric. Soc. of India,' i, p. 46.)

Some specimens of Hemp from the Himalayas recently tried in this country have been found to bear a greater weight and strain than the best Petersburgh Hemp. Some of it is also very fine and soft, more like Flax than Hemp.

There is little doubt, therefore, of the good quality of this Hemp, even without any improvement from European instruction. It is a not less important point to ascertain the price at which it could be brought to this

[1] In preparing Hemp for the European market, care should be taken not to twist or tie the ends together, but having laid the fibres parallel to each other, simply to tie them together near the thicker end, so as to form *heads*, as seen in Petersburgh Hemp.

country. In the 'Journal of the Agri-Horticultural Society of India, (vol. i, p. 45), may be observed a memorandum by the late Lord Auckland, when Governor-General of India, in which it is stated:

Prime cost of Hemp at Deyra, Rs. 54 per ton . . .	£5	8	0
Carriage to Calcutta (about 1000 miles), Rs. 24 per ton .	2	8	0
Total cost and charges of Hemp at Calcutta . .	£7	16	0
Prime cost of Hemp seed at Deyra, Rs. 36 per ton . . .	3	12	0
Carriage to Calcutta, Rs. 24 per ton	2	8	0
	£6	0	0

Though the above are deduced from the rates at which the natives sell Hemp and Hemp seed among themselves, large quantities could not be obtained at the above prices, for the natives would not extend their crop, or take much trouble in preparing it for market, unless some greater inducements were held out to them. Others, therefore, have calculated that the price of the Hemp might be doubled to the natives, and that one rupee more should be given for their bringing it down to the foot of the hills, whence it could be readily conveyed to the Ganges, either from Kemaon or Gurhwal, or from Sirmore to the Jumna, and from the Kangra Hills to the Sutlej. Therefore Capt. Kirke calculated the cost of 500 maunds of Hemp from Deyra Doon, a valley within the Himalayas, to be about Rs. 2500; carriage on bullocks to the Ganges (but carts have been much introduced since then), Rs. 125; a 600 maund boat from Sookertal, Rs. 130; together Rs. 2755; this, with the addition of ten per cent. for contingencies, making the total cost to Calcutta, Rs. 3030 for 500 maunds of Hemp, or for something more than seventeen tons, or about £17 14*s.* a ton in Calcutta.

Capt. Kirke's memorandum further states that 22½ feet of the fine sail-cloth which he forwarded could be bought for 9½ annas; 22½ feet of the coarse sackcloth for six annas; 20 seers of the rough Hemp for one rupee; and 29 seers of the Hemp seed for one rupee.

Major Corbett gives three calculations of the cost of Hemp from the district of Kemaon to Calcutta, all expenses included:

From Kotedwarra, 37 tons, £661—	£17	17	per ton.
,, Chilkeea	13	15	,,
,, Sunea	13	4	,,

He also sent some Hemp cloth or canvas made in the Hills, which was 7¼ yards long, and 22½ inches wide, of which the price was one rupee.

The above facts being sufficiently favorable, both respecting the quality and the cost of the Himalayan Hemp, and the Author having been informed by good practical judges that the best plan to make the peculiar qualities of any of these Indian fibres known to manufacturers here would be to have a few tons of each sent into the market for two or three years, he was induced to recommend that this should be done with the Himalayan Hemp.

"As it is quite practicable to give an impulse to the growth of Hemp in the Himalayas, and as the price is so moderate and

the quality so good, I believe it might be established as a regular article of export from India, or, at all events, of consumption in the dockyards of that country. I would therefore suggest that the local officers of the districts of Kemaon, Deyra Doon, Sirmore, and Kote Kangra (more properly Kooloo), should be authorised to purchase certain quantities of the Hemp (say from 5 to 10 tons), and send it down to Calcutta, for transmission to and sale in the markets of this country, taking care that while they give sufficient encouragement to the cultivators, they do not so far increase the cost, either by raising the price or by enhancing the expense, as to interfere with its subsequent profitable sale by merchants. It is probable that the Himalayan Hemp would sell here for £35 a ton."

The Author has lately received a letter from Dr. Jameson, dated 6th Nov., 1854, referring to this fibre, and also to the order which had been sent by the Court of Directors to India for the purchase of some of this Himalayan Hemp, in order to make it known in the markets here. He states that the Civil Authorities had "issued orders to purchase ten tons of the Hemp grown in Gurhwal and Kemaon, which they were procuring at the rate of from Rs. 4 to Rs. 6 per maund, or £10 16*s.* to £16 4*s.* per ton. Carriage to Calcutta will cost about £5, and to England, with other incidental charges, say £10 per ton[1] more, which will bring the article up to £25 16*s.* to £31 4*s.* Of course, when it is exported on a larger scale the price of carriage will be greatly decreased." "This country possesses immense advantage in abundance of land, &c., and the Calcutta and Bombay merchants could always have their Hemp to ship in December." With regard to the quality of the Hemp he observes: "Moreover, the Hemp grown in our mountains and in the Doons (valleys) is far superior in strength to the Russian samples of Russian Hemp which have been sent by the Court of Directors. On showing these to the Puharee (Hill) growers of Hemp, they declared that were they to produce such an inferior article it would scarcely find a sale." The specimens were obtained from one of the most respectable houses in London, and bought for their own use. They were sent for the purpose of showing how the Hemp of commerce comes into market, instead of being twisted, tied, or platted, as is much of the fibre from

[1] Mr. Heuley (*v.* p. 86) estimates all such charges at £7 a ton.

India. But if the Himalayan Hemp generally resembles that which has been referred to as from Kangra, no Russian Hemp will come near it in point of strength.

The essentially good qualities of the Hemp grown in the Himalayas, consisting in the strength, divisibility, fineness, and softness of the fibres of much of what is grown there, will make it, when known, very desirable for many purposes. That grown at the lower elevations is also possessed of considerable strength, as proved from the experiments made on a 2-inch rope in the Master-Attendant's office at Calcutta. The results given in the accompanying table (p. 332) are a portion of an extensive series of experiments, undertaken in the year 1840, in compliance with the orders of the Marine Board, dated 7th October, 1839.

The samples of Deyra and Arracan Hemp were forwarded for experiment from the Agri-Horticultural Society, and were laid up in a 2-inch rope, in November 1841, but the experiments were interrupted by the death of the Master-Attendant, and these samples were not submitted for trial till the 18th of December, 1844, so that the rope was three years old. At the same time, the small samples of *jetee* (*v.* p. 304) were tried.

It will be seen from the abstract, that amongst the thirteen samples of the 2-inch rope, the Deyrah Hemp stands the fifth in strength and the twelfth in elasticity. ('Journ. Agri-Hortic. Soc.,' iii, p. 227.) Further details are given in other tables, at pp. 224-25 of the Journal.

But Hemp of far greater strength is produced in these, which are probably the native hills of the plant. Mr. Williams, of Jubbulpore, gave to the Author, in the year 1853, a sample of Hemp, which he stated had been forwarded to him by D. F. Macleod, Esq., as the produce of Kote Kangra, in the Sikh Himalayas. This the Author has, in his Lecture and Experiments, as well as in communications with various individuals, called Kote Kangra Hemp. It is the fibre which is mentioned (at p. 133) as not breaking with a weight of 400 lb., when China-grass from Assam broke with 320 lb., and Petersburgh Hemp with only 160 lb. It has, moreover, appeared to all the practical men who have since then examined it, as the strongest fibre with which they were acquainted.

Abstract of Report of Proof of Moorgahvi, Arracan, Deyra, and Jetee Rope, compared with Europe, Manilla, New Zealand, Sunn, and Coir Rope, in the order of Strength and Elasticity.

No. of Sample.	STRENGTH.				ELASTICITY.			
	2-inch Rope.		1½-inch Rope.		2-inch Rope.		1½-inch Rope.	
	Names.	Weight at which broken.	Names.	Weight at which broken.	Names.	Length stretched before breaking.	Names.	Length stretched before breaking.
		lb.		lb.		Inches.		Inches.
1	Manilla, (white,) .	2731	New Zealand . .	2231	Sunn, (white,) . .	17½	Coir, (plain,) . .	32
2	Sunn, (ditto,) . .	2679	Europe, (1839,) . .	1967	Ditto, (tarred,) . .	13⅝	Jeetee . . .	15
3	Europe, (Pat,) . .	2655	Ditto, (Pat,) . .	1743	Manilla, (tarred,) .	13½	Sunn, (white,) . .	13½
4	New Zealand . .	2591	Sunn, (tarred,) . .	1703	Moorgahvi, (white,) .	13	Manilla, (white,) .	13
5	Deyrah	2519	Ditto, (white,) . .	1607	Manilla, (white,) .	11½	Sunn, (tarred,) . .	11½
6	Europe, (1839,) . .	2463	Manilla, (tarred) .	1463	Europe, (1839,) . .	10⅔	Europe, (Pat,) . .	10¼
7	Sunn, (tarred,) . .	2239	Ditto, (white,) . .	1431	New Zealand . .	10½	Moorgahvi, (tarred,)	10
8	Arracan . . .	2231	Europe, (twice laid,)	1214	Europe, (Pat,) . .	10⅓	Ditto, (white,) . .	9½
9	Manilla, (tarred,) .	1712	Jeetee	903	Moorgahvi, (tarred,)	9½	Europe, (1839,) . .	9½
10	Europe, (twice laid,)	1351	Moorgahvi, (white) .	875	Arracan . . .	9	Manilla, (tarred,) .	9
11	Ditto, ditto . .	1295	Europe, (twice laid) .	871	Europe, (twice laid,)	8⅔	New Zealand . .	8
12	Moorgahvi, (white,)	1175	Coir, (plain,) . . .	823	Deyrah	7½	Europe, (twice laid,)	6½
13	Ditto, (tarred,) . .	1063	Moorgahvi, (tarred,)	711	Europe, (twice laid,)	7	Ditto, ditto . . .	6

Master-Attendant's Office,
30th Dec., 1844.

A. B. CLAPPERTON,
1st Assist. to the Master-Attendant.

Dr. Jameson, in the above letter, observes, with regard to the so-called Kote Kangra Hemp, that he himself had brought it to Mr. Macleod's notice, and that it was not produced in the Kangra district, but in Kooloo and Lahoul, which are a little farther in the interior.

Before concluding, we have to detail the method of cultivating and preparing Hemp in Europe, in order to contrast them with the practice of the East, and for the information of those who may wish to cultivate it in this country. We are indebted for the directions to some of the most approved writers on the subject, and have contrasted them with those of Mr. Rowlandson in his paper in vol. x of the 'Journ. of the Royal Agricultural Society.'

CULTURE AND PREPARATION OF HEMP IN EUROPE.

Hemp being one of the few plants cultivated in Europe, which has the male and female flowers in different plants, affords some anomalies in its culture, especially that of having two harvests in the same crop. In some older works the male is frequently named the female plant, and *vice versa*.

Soil.—The soil in which Hemp thrives, is a deep, rich, moist soil, five or six inches deep; besides the alluvial, where sand and clay are intimately mixed, and having the above characteristics, also the friable loams, which contain much vegetable matter. All should contain a fair portion of sand, as this keeps the soil open and light for the roots to spread in. Hemp thrives well in Holland and Lincolnshire. Stiff, cold clays are unsuitable, for even if the plant should grow well, it is not easy to pull it, "for when strong clay becomes saturated with rain, the soil runs together, and on drying sets as hard as a pavement." If the soil be over-rich, the plant grows too luxuriantly, and produces a coarse but strong fibre. But Hemp is sometimes sown in such soils to meliorate them for the cereals, which would otherwise run too much to straw. But as many soils are too poor, they require to be raised to a suitable state by the addition of manure; and with this, it is said that Hemp may be grown in the same soil for many years. When a fine quality of fibre is required, of course, only the most suitable soil should be selected, or that in which the growth of the plant is neither excessive nor stunted. In Italy, Hemp is sown in their best lands, which are rich and strong loams, and made fine and friable. In Romagna, where the best Hemp is produced, they say it may be grown anywhere with manure. In the Himalayas, the Author has seen the Hemp growing most luxuriantly in the neighbourhood of bullock-sheds, and producing fibre of great strength. In India, spots near the habitations of natives are the best adapted for the growth of Hemp; but in these they generally grow Tobacco. At Soonamooky it grew luxuriantly in sand, which was manured with stable-dung. Hence, Hemp grown in the plains will be dearer than the other fibres.

Culture and Manure.—But the richness of the soil, and the quantity of manure required, must vary, not only according to the nature of the soil and its re-

quirements, but also to the warmth of the soil and the nature of the climate. Warm, moist ones require less than cold, whether dry or moist climates. In England, Mr. Rowlandson says, the generality of soil will require a dressing of ten tons of well-rotted farm-yard dung per acre, ploughed and harrowed in early in April. He quotes an extensive grower, who says twenty-five tons of well-rotted, mixed stable and feeding-shed manure, should be applied per acre. The land should, of course, be in the first instance well ploughed and properly drained; also, well harrowed and rolled, to get the top-soil into good tilth; and weeds, as horse-mint, or twitch, destroyed. The manure must be carefully and evenly spread, and the plough follow close to the spreader.

Seed.—Of seed, that from Holland is the most esteemed, ripens soon, yields abundant crops, and of a fine quality; but well-grown English seed is also of good quality. Indian seed, from external appearance, appears fine; but may not be so well suited in the first crop for fibre; but the Himalayan seed, both from its appearance and the nature of its produce, is probably inferior to none, and perhaps only requires interchanging with different districts. The seed should be of a bright, grey colour, and plump; and must not have undergone heating in any way, and therefore the taste, when bitten, should be sweet, and not bitter or acrid.

The quantity of seed may vary from two to two and a half, others say to three bushels an acre. The last, if a fine fibre is required for weaving into cloth. But the larger quantity cannot be sown on very rich soils. The thicker it is on suitable land, the finer it will grow. The fresh-ploughed land should be sown very evenly, care being taken to scare away birds. The best time for sowing, in England, is from the 1st to the 15th of May; but it is sown even in June, as frosts are apt to injure the young plant; but late-sown plants are apt to grow thin and weak.

After-culture.—Hemp seed is sown both broadcast and in drills. When grown on account, chiefly, of the seed, it is sown thin. Sinclair says, by sowing Hemp in drills, a coarser and stronger bark or fibre, fit for cordage, will be produced, and a less quantity of seed is required than by sowing it broadcast. This latter mode is to be preferred, when Hemp is wanted for textile purposes. The stems rise slender and fine, according to their proximity; but they require to be weeded or hoed out to within a foot of each other, and may require a second hoeing, to destroy weeds; but in general the Hemp will, itself, smother all weeds, except in the spaces between drills. During its season of rapid growth, the plant necessarily requires moisture, and therefore, in some countries, irrigation is practised.

Pulling.—As already observed, Hemp has usually two harvests; but when grown on account of the fibre only, it may be pulled when in flower, and no distinction made between the male and female plants. But as it is usually desirable to get both the seed and the fibre of both plants, the male plants, or *white Hemp*, are pulled as soon as they have shed their pollen, usually about thirteen weeks after they have been sown. They may then be easily recognised by their leaves becoming yellow, and the stem of a whitish colour, and the flowers faded. Each plant is pulled up singly by the root, care being taken not to break or cramp the stem in the hand. The ripeness of the female plant is known not only by many of the same signs as those of the male, but also by the seeds beginning to turn of a grey colour, being firm inside, and some of the capsules to open. This is generally about Michaelmas in England. When the seed has become perfectly ripe, the bark is apt to become woody and coarse, and to separate with difficulty. But the seed which is required for sowing, ought to be taken from plants allowed enough of room to spread and then to fully ripen their seed.

Drying.—When the plants are pulled, it is recommended to hold the root

end upppermost, and with a wooden sword dress off the flowers and leaves, as they assist in manuring the land. They are then bound in small bundles with bands at each end, of such a size that you can grasp with both hands, or sometimes into bundles of twelve handfuls each, and arranged along the borders of the field. If not done before, with a fork knock and shake off the soil from the roots, and scrape off the undergrowth of leaves. It is then set up like wheat in shocks, for a week or so. The stalks which form each handful should be as nearly as possible of an equal length, and the roots in particular should be placed as even as possible. If the crop is kept till spring, it is tied in larger bundles, and stacked and thatched.

Gathering Seed.—When the female Hemp is gathered, it is allowed to stand eight or ten days in the air, to allow the seed to dry and ripen; the tops being covered with undergrowth, to keep off the birds. After which, they cut off the heads, or gently beat out or thrash them to get out the seed, on a cloth. Care must be taken in conveying the bundles of seeded stems, as by passing a rope round the bundles and under the heads, and dragging the rope over the shoulder. The seed which remains after this operation, is got out by combing the heads on the teeth of a ripple; but the seed is inferior to that which first falls out, and is unfit for sowing. The female plant is generally stacked during the winter, and not steeped till the spring.

Drying.—When the Hemp has been pulled, it ought, according to some authorities, to be dried in the sun for one or two days, but Du Hamel observes, that it is a matter of doubt whether the plant should be dried before it is steeped; so Mills, in his 'Husbandry,' like the natives of India with their Sunn (*v.* p. 274), thinks that this drying appears needless trouble. So Marcandier directs, that when the Hemp is perfectly ripe, it must be put into the water as soon as it is pulled out of the ground; and Sinclair says, that Hemp should be watered as soon as possible. In this state, it is said to require only four days, but, when it has been dried, eight days of steeping. The time must, moreover, depend a good deal on the temperature of the water.

Steeping.—The steeping of Hemp, called *Water-retting*, is a very important part of its preparation, and is to be distinguished from another method, which is called *Dew-retting*. The steeping places are often only ditches, three or four feet deep, varying in breadth and length, dug for the purpose on the margins of rivers. The bundles of Hemp are laid at the bottom of the water, and covered with straw, and sometimes with sods, and loaded with pieces of wood and large stones to keep them down. The object, as in the case of Flax, is by a slight degree of fermentation to enable the epidermis, or outer skin, to separate readily from the bark, and this from the boon or reed. This is readily ascertained, by taking out one of the steeped stems and holding it by the root end, and drawing the thumb-nail up the stem to the top. If the fibre slip up the stem, it is a proof that it has been sufficiently retted.

Du Hamel, having steeped Hemp in different sorts of water, observes, that the fibres steeped in putrid standing water were softer than those which had been steeped in running water. But in water which does not run, the fibres contract a disagreeable colour: they are, however, notwithstanding this, easily bleached; it is desirable, however, to make a small stream of water pass through the steeping place.

Du Hamel, referring to the common opinion, that Hemp intended for fine cloths should be retted more than that for coarse cloths, and that for making of ropes should be steeped least of all, observes, that though there may be some truth in this, it is in vain to hope greatly to improve, by this process, fibres which are naturally coarse. A fine fibre cannot be obtained without

the concurrence of soil, of seasons, and of climate, the mode of sowing and of culture, and the degree of ripeness.

Drying after Watering.—When the Hemp is sufficiently retted, it is taken carefully out of the water, and then carried to a field of aftermath or any other grass (hence called *grassing*) that is clean and free from cattle. Here it is spread out very evenly, and will probably require to lie there for three weeks or more, in order to bleach, and the fibre to become free; during which time it must be carefully turned over, with light long poles, every three or four days. Mr. Rowlandson says it is sufficiently bleached when pink spots appear on the stem. It is sometimes dried along a wall, or on rocky ground, and sometimes artificially, in ovens and kilns. When dry, the Hemp is tied up in bundles again, and carried to the barn or rick.

Peeling and Breaking.—When the Hemp is sufficiently dried, the next process is either to *peel* it, by taking one stalk after the other, breaking the reed, and slipping off the bark. The process is simple but tedious, and will give occupation to those who are without any. But it comes off in ribbons, which do not heckle so well as Hemp that has been broken, and they are apt to retain some of the thick parts next the root, hence the saying, that this mode is better for the seller than the buyer.

The term of breaking or braking Hemp, applies rather to the boon or reed than to the fibre, for this only bends under the hand of the dresser, and does not break. The operation is performed either by beating the Hemp, which is a laborious and tedious work, or by the break, which may be moved either by hand or by a spring or treddle attached to the upper jaw of the break, or by fluted rollers, worked by horse-, wind-, or water-, and now sometimes by steam-power. When Hemp has undergone the process of breaking, it is ready, like Flax, for the process of scutching, in which scutching mills are now used, as in the case of Flax. By rubbing, beetling, and striking the Hemp with reiterated blows, the longitudinal fibres are separated from one another, and in proportion to the greater or less degree of that separation the Hemp becomes more or less fine, elastic, and soft to the touch. (Du Hamel.)

Dew-retting (p. 199), Mr. Rowlandson says (l. c., p. 180) will produce the most valuable white Hemp. The stems, after being pulled, are allowed to stand in the stooks for two or three days; they are then spread out on land where the grass is plentiful, and may require to be there for six weeks, and to be frequently turned. The process will be completed when the pink spots appear, as before noticed, which must be carefully looked for, when it will be ready to gather and tie up in bundles, to form stooks, in order to dry; the fibre will not sustain any damage before the pink spots appear. *Snow-retting* is practised in Russia and Sweden. After the first fall, they spread the Hemp (which has been dried in the sun or otherwise) on the snow, and leave it there to be covered with other falls of snow, until spring, when it is usually found to be sufficiently retted. (Wisset, p. 194.) In Livonia they steep their Hemp in a manner which is a medium between still and running water, in a series of basins, one above the other, but as has already been observed, the French, for whom this information was originally obtained, do not avail themselves of it. (*v.* l. c., p. 204.)

In addition to the ordinary methods of preparation of Hemp, we may briefly refer to others, most of which, however, have in improved forms been already noticed under the head of Flax.

The Abbé Brulles recommended the use of soap in the pro-

portion of one part to forty-eight of water, at a temperature of about 200° F., and the water to be about forty times the weight of the Hemp. Du Hamel tried boiling the Hemp stems in water, but he did not find that the peeling was facilitated. Marcandier recommended a second watering, and also the use of a warm alkaline ley. (l. c., pp. 243 and 245.)

But as we have seen the use of hot water successfully applied to Flax in recent times, and soap has been used in several processes, and in a very ingenious manner in one which we omitted to notice,—that in which a little acid is afterwards added, so that decomposition takes place, in consequence of the acid uniting with the alkaline base, when the oil which is set free assists in softening the fibre.

In the article on Sunn we have already referred (p. 276) to a peculiar method of drying, to which the Livonians are said to ascribe the good or bad quality of their Hemp. The stems are first set up to *drain,* and then spread out for a day to *dry;* after which they are made up in heaps, and covered over with straw, or other similar material of any kind, to make them *sweat.* When they have sweated *enough,* they are laid again in small heaps, so that the air may dry them in the shade by blowing through them; after which they are next effectually dried by fire, kiln, or oven, and immediately put under the breakers whilst yet hot. It is probable that this method, when skilfully practised, must produce some of the same effects in Hemp as in some other vegetable substances. Mr. Frushard observes, with regard to the natives of India: "The reason why their tobacco falls so much to dust, is owing to its not being *sweated* enough. When properly *sweated,* as they manage it in America, it becomes tough like a bladder; and toughness and suppleness are the qualities wanted in Hemp." (Wisset, p. 223.)

Besides these, we have also the dry method of separating Hemp in some places, as related by Mr. Durno, who was the British Consul at Memel, and who states that in the southern parts of Poland, steeping is not practised at all, on the supposition that the harle is thereby weakened, and the colour darkened. Instead of steeping, they there *dry the stalks in the sun.* But the dressing is more laborious, and consequently more expensive. (Wisset, p. 177.) Mr. Dickson, as in the case

of Flax, has succeeded admirably in separating Hemp fibre by passing dried stems from Italy under the rollers of his machine (*v.* p. 224), and the Author has no doubt that the method may be successfully practised with several fibres for many purposes.

Crop and Profit.—Mr. Rowlandson says the best land for obtaining fibre of the strongest description is a fat loam, not too heavy with clay, and a portion of sand intermixed. On such land, succeeding a crop of beans, Hemp will grow six or seven feet high, and bean-stalks in such make good manure for Hemp. He adds: "I have known 9 quarters of beans per acre after Hemp, weighing 21 stone per sack. Hemp after beans will produce 30 stone more per acre, of the strongest and heaviest fibre, than by any other mode of culture; the weight of fibre in ordinary culture and circumstances will produce 60 to 70 stone per acre." A good crop of Hemp after beans will produce 28 to 30 bushels of seed per acre; in the ordinary way, 20 to 22 bushels per acre. But only particular circumstances or prices render Hemp a desirable culture in England; for, in general, it cannot be considered a productive crop—though it may bring 5*s.* per stone, and good seed 5*s.* per bushel,—as it requires much manure, and "Hemp land will grow other crops of equal or superior value at a less cost." But other countries, such as parts of India and the Himalayas, which prefer any exportable product like Flax or Hemp, will be glad to cultivate both, if they get any reasonable encouragement. The co-operation of a purely manufacturing establishment might facilitate and give advantages to the production of Hemp, as to that of Flax.

IMPORTS, ETC., OF HEMP FROM INDIA.

It is not impossible therefore that as India now supplies England with the cheapest of fibrous materials, Jute, that the country will also be able to supply the strongest and best, that is, Himalayan Hemp. The greater distance which this has to travel, but chiefly by the Ganges River, may be easily paid for by its greater value. We also believe that as Mr. Deneef succeeded in growing some good Hemp even in the plains of Bengal in the rainy season, so others will be able to do so

in other parts of India. The expenses of transit from distant parts will, no doubt, be diminished when larger quantities are operated upon and the arrangements are made by mercantile men. All such transactions in the Hills would be facilitated if it were found possible to make the road from the Kemaon Hills into the plains practicable for light carts, as this has been done with the Sikh hills to some extent, but these are there less precipitous. That there is nothing chimerical in the expectation of greatly increased quantities of fibre being imported, even from so distant a country as India, is evident from what has already taken place. If this has been possible with the cheaper it cannot be impracticable with the better. Though the information is not very certain, we find from the published reports that Hemp was exported from India to the following extent:

HEMP IMPORTED FROM INDIA, AND SOLD IN ENGLAND.

	Cwt.		Cwt.
1803 . .	4820	1807 . .	4738
1804 . .	8335	1808 . .	4023
1805 . .	3399	1809 . .	1543
1806 . .	6421	1810 . .	2555

In 1850-51, Imported into Bombay, of *Ganza* (Hemp-herb), 514 cwt. from Concan; and Exported to the United Kingdom 15,896 lb.=Rs. 5796.

How greatly and rapidly the increase of fibrous materials has gone on within the last few years from India is evident from the following table of the imports from Russia and the British territories in India, from 1847 to 1851; while in the year 1831, 506,803 cwt. were imported from Russia, and only 9472 cwt. from the East Indies.

Quantities of Hemp Imported into the United Kingdom from—

	1847	1848	1849	1850	1851
Russia . .	544,844	540,207	641,548	614,535	672,342
Br. Ter. in East Indies	185,788	258,239	360,362	399,345	590,923

As soon as Hemp is brought down in the spring, or in the course of the summer, it is selected and made up into bundles by sworn selectors (*brackers*), who are said to act with impartiality and exactness; and tickets are affixed to every bundle as selected, &c.

Hemp at Petersburgh is assorted into clean Hemp, or firsts; outshot Hemp, or seconds; half-cleaned Hemp, or thirds; and Hemp Codilla. Riga Hemp is distinguished as rein (or clean), outshot, and pass Hemp.

Particular care is taken to ship Hemp and Flax in fine, dry weather. If either get wet, they are apt to heat, and to be totally spoiled. For this reason every vessel taking in Hemp and Flax is furnished with mats to prevent their getting damp.

A bundle of clean Hemp weighs from 56 to 65 poods; ditto outshot, 48 to 55 poods; ditto half-clean, 40 to 55 ditto. (1 pood=36 lb. avoirdupois.) 63 poods are about equal to an English ton; the fixed charges on which in Petersburgh amount to 45 roub. 32 cop.; also commission and stamps, and on import into London, about £10 5*s.* 8*d.*, freight included; when the price is £40 a ton. (*v.* M'Culloch, from Mr. Borrison on the Commerce of Petersburgh.)

With regard to prices, those of Hemp will of course vary at different times, like those of all other products. It is usually highest in the summer months, and lowest in September.

In December, 1833, Petersburgh clean Hemp was 25*s.* to 26*s.*; Riga Rein at 29*s.* per cwt.

In the year 1840, Italian Hemp was at 50*s.* the cwt.; Polish Rein, 48*s.*; Petersburgh clean, 47*s.*; clean for cordage, 46*s.*; Polish Pass Hemp, 46*s.*; Petersburgh half-clean, 42*s.*

In the year 1844, the price of Petersburgh Hemp was 38*s.* per cwt., or £38 per ton.

At the end of 1854, Petersburgh clean, £60 10*s.* to £63; outshot, £59 to £61; half-clean, £57 10*s.*; Riga Rein, £61 to £64; do. outshot, £58 to £63. But we cannot do better than conclude with an extract from the 'Commercial Circular' of the Messrs. Lindsay.

"As regards Hemp, the rates for this article advanced in the early months of the year, and obtained their highest point in March, when £75 per ton was paid for clean. They then gradually fell to £58 to £60—about its present value—it having become apparent that supplies to a much larger extent than were anticipated would be received *viâ* Memel, &c. The future range of prices will, of course, necessarily depend on the action of our Government as respects Prussian neutrality. It, however, must not be lost sight of that the variety and extent of substitutes in the course of introduction will, under any circumstances, for some time to come diminish the consumption of Russian Hemp."

Bread-fruit Tribe (*Artocarpeæ*).

Though in general appearance no plants seem to differ more than the Mulberry and Bread-fruit trees from the Nettles, yet if we examine the actual flowers of all these plants, we shall find that the resemblances are much greater than the differences. Hence Jussieu united them together into the natural family of Urticeæ; but as some are distinguished by their milky juice, and flowers aggregated into heads, these have been separated from the others under the name of Artocarpeæ.

Among these we find the Bread-fruit, Fig, and Mulberry, genera of extensive distribution, numerous in species, growing to a great size, and many of them of the greatest utility to mankind: though we have only to notice them with reference to their fibrous properties. These are probably much more important than is generally supposed; if we look to them as sources of material for paper-making, since the bark of some of the species is already applied to this purpose in some countries.

Thus the Bread-fruit tree (*Artocarpus ineisa*), so famous for affording the chief article of food to the inhabitants of the South Sea Islands, and for which an expedition was sent by George III, under the celebrated Bligh, to introduce it into the West Indies, has bark which is also useful to the people from its fibrous qualities: for being stripped and then beaten and prepared, it makes a kind of cloth, with which the South Sea Islanders clothe themselves. At Taiti, clothing made of it, and worn chiefly by the common people, was more common than that made with the Paper Mulberry, though inferior to it in softness and whiteness.

Some of the Indian species of Artocarpus, as the *Jak* tree, *Kantal*, or *A. integrifolius*, and the *Dephal* or *A. Lakoocha*, and others, are probably possessed of similar properties; they are very abundant, grow to a great size, and are frequently cut down on account of their wood.

There were sent to the Exhibition of 1851, bark and bark *cloth*, which may all be produced by species of Artocarpus, as one of them is said to be bark of the

Trap tree, a species of *Artocarpus*, which furnishes the Gutta used as birdlime. The fibre of the bark is used for fishing lines, cordage, and nets at Singapore.

Chowat Kurnat, similar to the above, from Baram River.

Glam tree bark, from Borneo, furnishes a paper-like bark much used in caulking the seams of vessels.

Kumut or bark cloth worn by the Kayans when mourning for the dead—River Baram.

The Paper Mulberry, formerly Morus, now *Broussonetia papyrifera*, is a tree of this family which has long been famous for its fibrous bark, as this is made into a kind of cloth as well as into paper. It is a native of the isles of the Southern Ocean, as well as of China and of Japan. In Taiti, or Otaheite,

and other islands, they make cloth of its bark; and it is said that the finest and whitest cloth and mantles worn by the principal people at Otaheite and in the Sandwich Islands is made of the bark of this tree, and this when dyed red takes a good colour. It is called *Kaili* on the west coast of Celebes. Some of the cloth made of its bark was sent to the Exhibition of 1851.

The manufacture of paper from this bark was long since accurately described by Kæmpfer, as seen by him in Japan, where they are said to cultivate this plant much as osiers are cultivated in Europe; the young shoots being cut down in December, after the leaves have fallen. These are then cut into good long pieces, and are boiled until the separation of the bark displays the naked wood, from which it is then easily separable with the aid of a longitudinal incision.

In order to make paper, the dried bark is soaked for a few hours in water, after which the outer cuticle and the internal green layer are scraped off. The stronger and firmer pieces are separated from the youngest shoots, which are of inferior quality. The selected bark is boiled in a ley of wood-ashes till the fibres can be separated by a touch of the finger. The pulp so produced is then agitated in water till it resembles tufts of tow. If not sufficiently washed the paper will be coarse, but strong; if too much boiled it will be weaker, but white. It is then beaten on a table, with batons of hard wood, into a pulp. Mucilage obtained from boiled rice, or from a plant called *oreni*, is added to the pulp. These three are stirred with a clean reed till reduced into a homogeneous liquor, and when of a due consistence are ready for conversion into sheets of paper. This process is interesting, from its resemblance to that adopted with the Nepal Paper plant, showing the probable introduction of the art from China.

Specimens of Paper Mulberry cloth, or rather paper used for the purposes of cloth, and made from the bark of the Paper Mulberry, as well as paper made from the same bark, were sent to the Exhibition of 1851 from Singapore.

The fibrous properties of the foregoing plant are interesting not only on its own account but also because it is allied to the Mulberries, a genus (*Morus*) numerous in species, and abounding in individuals, many of which are cultivated on account

of their fruit, but still more for their leaves as food for the silk-worm. It is probable that most of the species of the genus Morus have bark of a sufficiently fibrous nature. But few, if any, seem to be turned to useful account. Yet the bark of the White Mulberry seems from very early times to have been made into paper in China; for Marco Polo informs us that "the Grand Khan causes the bark to be stripped from those Mulberry trees, the leaves of which are used for feeding silk-worms, and takes from it that thin rind which lies between the coarse bark and the wood of the tree. This being steeped, and afterwards pounded in a mortar until reduced to a pulp, is made into paper, resembling that which is made from cotton." This fact directs attention to the bush cultivation of the Mulberry in Bengal, for feeding silk-worms. This culture consists in planting cuttings of the Mulberry, which, as they grow, are cut down about four times in the year, in order to produce young leaves for the successive broods of silk-worms. The countless number of shoots which are thus thrown away, or used as fuel, would probably, under the agency of the dhenkee, yield good half-stuff for the paper-maker. Mr. Henley, indeed, informs us that, before leaving India, he had produced very satisfactory specimens of half-stuff from the bark of these rejected stems. The bark separates when the cut stems are steeped in water, and when pounded up, the greater part of the mucilaginous matter passes off, leaving a mass, having much of the good qualities of linen rag half-stuff.

The genus *Ficus*, celebrated for one of the species yielding the Fig, one of the most early cultivated of fruits, and another the Caoutchouc of Assam, while the Bur and the Peepul are, in India, two of the most highly esteemed of trees, is also a genus numerous in species which abound in all parts of India. It is probable that the bark of some of the species, like that of the Mulberry, may be converted into half-stuff, as Mr. Ostandje states that the bark of one of the species is used for paper-making in the Island of Ceylon.

A stately forest tree, called Chandul, which has been placed here and called *Lepurandra saccadora*, is indigenous on the West side of India, as in the ravines at Kandalla and in the jungles near Coorg, where people manufacture sacks from the bark by a very simple process. A branch is cut, corresponding

to the length and diameter of the sack wanted. It is soaked a little, and then beaten with clubs until the inner bark separates from the wood. This done, the sack formed of the bark is turned inside out and pulled down, until the wood is sawed off, with the exception of a small piece left to form the bottom of the sack, and which is carefully left untouched. These sacks are in general use among the villagers for carrying rice, and are sold for about six annas each.

Nettles (*Urticaceæ*).

In treating of Hemp, it was stated that it belonged to the natural family of the Nettles, or *Urticeæ*. These are widely diffused throughout both tropical and temperate climates, though they generally occur where there is considerable moisture either of soil or of climate. Though small and herbaceous in Europe, they grow to a gigantic size in the hot moist parts of Asia, and extend from its warm tropical islands, all along the Malayan Peninsula, to the foot of the Himalayas, and along which, and in its valleys, they flourish, even near to the banks of the Sutlej. Species are also found around the Neilgherries, and along the Malabar coast to the Concan. Though the flowers of all are inconspicuous, some of the species (as *Urtica pulcherrima*) are remarkable for the beauty of their foliage; one of them (*U. tuberosa*) is distinguished by its tuberous rootstock, which is eaten by some of the natives of India, either in its raw or cooked state. Every one, however, knows that the great characteristic of the Nettles is their sting. Some of the Indian species are remarkable, even among Nettles, for this quality; as, for instance, *U. crenulata* and *U. heterophylla*, the latter "a most ferocious-looking plant." Many of the Nettles formerly placed in the genus *Urtica* have been removed to the genus *Boehmeria*, which includes what are sometimes called stingless Nettles. But many of each have long been famous for the tenacity of their fibre.

Thus, of the European species, thread and cloth, as also paper, have been made from the fibre of the common Nettle (*Urtica dioica*). So, of the Siberian species, *U. cannabina*,

thread and cord is made for the use especially of fishermen. In the Society Islands, also, cord is made with the fibres of *U. argentea;* and in Japan, the bark of the species called *U. Japonica,* is employed in making lines, cordage, and cloth.

China-grass, Rheea, or Ramee Fibre (*Urticaceæ*).

China, *Chû* or *Tchou Ma;* Japan, *Tsjo, Karao;* Sumatra, *Caloee;* Malay, *Ramee;* in Bonoa, *Inan;* on East Celebes, *Gambe;* Rungpore, *Kunkhoora* and *Kunchoora;* Assam, *Rheea;* in Shaw, *Pan.*

The species which is most famous among these Nettles for its fibre is that called *Urtica nivea,* but now *Boehmeria nivea.* Kæmpfer, in his 'Amœnitates Exot.,' gives *Mao, Tsjo, Karao,* as the Japan names of the plant; and Thunberg says of it, copying from him: "Cortex pro funibus conficiendis, et filis validis ad texturas, expetitur;" and "E seminibus oleum causticum exprimitur."

Though we have now abundance of information on the subject, in place of the hints we formerly had, it is only within the last few years that Sir W. Hooker has published, in the 'Kew Journ. of Botany,' vol. i, p. 25, and vol. iii, p. 313, that he has obtained satisfactory information, through Sir George Staunton and Dr. Wallich, that the so-called China-grass is the fibre of this *Urtica nivea* of Linnæus, the *Boehmeria nivea* of Gaudichaud.

Though the beautiful fabric known as China-grass cloth has long been known, its fibre has only in comparatively recent times attracted much attention, and the plant producing it was long unknown. When imported, however, into this country, it sold for 60 to 80, and even for £120 a ton. It can be, at most times, had at Ningpo for about 6 dollars a picul of 133 pounds. The above high prices following every demand, have prevented this fibre from coming into general use for our manufactures. But a small black, almost invisible spot, which occasionally occurs on the fibre has also prevented its use for fine purposes.

Though the plant was not known botanically, full descriptions of the mode of preparing the fibre are given in Chinese works. One of these accounts was translated and transferred to the 'Journ. of the Hortic. Soc. of London,' in vol. iv, part iv, under the head of the Cultivation and Preparation of

the *Tchou Ma*, or Chinese Flax; and this we propose republishing, for reasons which will be obvious.

By this account we learn that the plant is cultivated with considerable care; that it may be obtained from seeds, but more quickly by parting the roots, as it throws up numerous shoots; that these may be cut down, and that fresh ones will spring up, so that three several crops are obtained in the season. Great care is also taken in the scraping, peeling, steeping, and bleaching of the fibre. We also learn that the first crop yields strong and coarse fibres, and the second and third crops, delicate fibres for the finer fabrics.

This China-grass fibre has of late years attracted considerable attention, and no less than three Prize Medals were given at the Exhibition of 1851, for the finely prepared specimens of this fibre. These looked like fine white silk or asbestos, some dyed of different colours, and some woven into cloth. The Jury Report of Class IV thus mentions them:

"The process of Messrs. L. W. Wright and Co., for the preparation of China-grass, &c., for which a patent was obtained in 1849, consists, essentially, in a very ingenious arrangement for boiling the stems in an alkaline solution, after they have previously been steeped for twenty-four hours in water of a temperature of 90°. The fibre is then thoroughly washed with pure water, and finally subjected to the action of a current of high-pressure steam till nearly dry. A very beautiful series of specimens, illustrating the preparation of this fibre, the various stages of the process, the bleaching of it, and the uses to which it may be applied, both alone and in conjunction with other fibrous materials in the formation of mixed fabrics, is shown by Messrs. Wright.

"Very beautiful samples of China-grass fibre are likewise shown by Messrs. Hives and Atkinson.

"Equally fine specimens are exhibited by Messrs. Marshall and Co., of Leeds.

"For all these samples, the Jury have awarded Prize Medals."

Caloee or Ramee (*Urtica tenacissima*, Roxb.)

Dr. Roxburgh, when making his experiments on Fibres at the beginning of this century, took much pains with one of a

species of Urtica, which he named *U. tenacissima*, because he considered it one of the strongest fibres he had ever met with. He first became acquainted with it in consequence of four plants having been sent to him by Mr. Ewer from Bencoolen, in Sumatra. He afterwards wrote that "some thousand plants have been reared from these four, so readily does it grow and multiply;" in fact, that "it may be grown from cuttings as readily as the willow." He further describes it as thriving anywhere, but most luxuriantly in shade, where there is much moisture. In four months it attains the height of eight or ten feet, when its shoots flower and can be cut down. Other shoots then spring up, which are also soon fit to be cut; and so on successively for almost any period. If left alone, the plant will in a short time produce a complete jungle. He, however, experienced considerable difficulty in separating the fibre. The Malays, he learned, merely steep the shoots in water for ten or twelve days, peel off the bark, and dry it in the sun.

Besides its strength, he considered that the beauty, fineness, and softness of the fibre, are also greatly in its favour. In Sumatra it is called *Caloee;* but the Malays call it *Ramee*, and use the fibre for sewing thread, for twine, and for making fishing nets. Marsden states, that the shoots are cut down, dried, and beaten, after which the rind is stripped off; but Dr. Roxburgh did not find this method to succeed with him. He was afterwards informed by a friend at Canton that the grass cloth of China was made from the fibres of this plant.

In the year 1810 three bales of this Caloee fibre were sent to the India House, having been produced in the Botanic Garden at Calcutta. In December, 1811, one of these bales was sent to Messrs. Sharpe, then of Mark Lane. On the 4th Feb., 1812, they reported, that having brought the Caloee fibre to the state of Hemp for the use of cordage, a thread was spun, of the size of those spun in the King's Rope-yards, which bore 252 lb., whereas the weight required to be borne in his Majesty's yards by Russian Hemp of the same size is only 82 lb.

Other bales were subsequently received on several occasions, and in 1815 one was sent to Dr. Taylor, of the Society of Arts. The Society voted one of their medals to Capt. J. Cotton, of the East India Company, for his efforts in introducing this fibre into this country.

A bale of this fibre having been given to Mr. Lee, the inventor of the machine mentioned at p. 221, he observed that the fibre appeared to have been peeled off the plant while it was in a green state, and that this rendered it of less value. He conceived that it would be more easily cleaned if the plants were taken dry, without water-steeping or dew-retting. But when cleaned the fibre is strong, soft, and fine, and of more value than the best Russian Hemp.

Two more bales were sent in December, 1814, to the Court of Directors by Dr. F. Buchanan, who had succeeded Dr. Roxburgh, with a letter, dated 16th December, 1814, from which the following is an extract: "I beg leave to mention that the Caloee plant is by no means a new species of Urtica, as Dr. Roxburgh supposed. It is the *Urtica nivea* of Willdenow and the *Ramium majus* of Rumphius."[1] ('Flora Amboin.,' v, t. 79, fig. 1.) "The plant under the name of Kankora has from time immemorial been cultivated in the Dinagpur and Rongypur districts of Bengal, and its fibres are used for a few purposes that require great strength with little thickness, but the expense of cleaning the fibrous part has always prevented it from coming into general use." He therefore proposed discontinuing the cultivation. But if we refer to Roxburgh's 'Flora Indica,' iii, p. 591, then, certainly, in manuscript, we find that he was quite aware of his plant being identical with that of Rumphius, though it appeared to him to differ from the description of the *U. nivea* of Willdenow.

We observe that it was considered at that time that Indian fibres could never be introduced into this country, as the freight could not be calculated on at less than £12 per ton, of fifty cubic feet. Now about 30,000 tons weight are imported.

The Court, in a dispatch dated 8th May, 1816, in sending out some of Lee's machines (p. 222), and referring to this plant, observed: "The Caloee is a plant that appears to be com-

[1] Rumphius observes, respecting the separation of the fibre, that it is more easily effected when the stem is in a dry state: "Caulium cortex tenuis est, inque fila findi potest præsertim in siccata planta;" and, again, "Caules autem isti sponte siccari debent tum facile separatur ipsorum cortex, qui in fila commode findi potest." "Alii adultos sumunt viridis herbæ caules, ipsorumque deglubunt exteriorem viridem, et succosum, corticem ad interiorem album librum qui ligno incumbit, quum in tenuissima findunt fila." (l. c., p. 214.) He further says, "It is diligently cultivated in all places inhabited by the Orang Badjos."

paratively in its infancy as to cultivation, but being a perennial the expense attending other fibrous plants is not incurred; and if this process, instead of scraping and peeling, will furnish its fibre clear of its mucilaginous coat, you may rejoice in the acquisition of the invention: for we have found the fibre stronger than Russian Hemp of the best description; and by some further improvements of this person's invention it has been brought to a thread, preferable to the best material in Europe for Brussels lace."

So that at that time one of the most important applications of this fibre was well known.

Rheea of Assam; *Kunkhoora* of Rungpore. (*Urtica tenncessimi.*)

The above very valuable plant was for some time lost sight of. But attention having been directed, by Major Jenkins and the officers employed with him in Assam, to the fibrous plants of that valley, Major Hannay and Capt. Dalton were induced to cultivate a small portion of land with this fibre; and the former having prepared ten bales of a fibre which he called Rheea fibre, and five bales of another called Bon Rheea, and eleven of these having been sent to the Court of Directors of the East India Company, were referred to the Author to report upon. This he did to the following effect:

"The Rheea fibre forwarded by the Government of Bengal as the produce of Assam in order that its properties and value may be correctly ascertained in this country, appears to me likely to prove one of the most valuable products of India, for in strength it far exceeds the best Hemp, and in fineness it rivals superior kinds of Flax. Its culture is well known to the natives of Assam as well as of the districts of Rungpore, of Dinagepore, also in Burma, Siam, and of other Eastern countries and islands. It can now be produced and sold with profit at as cheap a rate as Russian Hemp.[1] If any machine could be invented for facilitating the separation of the fibre from the woody part of the stalks, the Rheea would speedily undersell all other fibres, as from four to five crops of fibre can be obtained from the same plants within the year.

[1] This is probably at present incorrect, from the Author misunderstanding a passage in Major Hannay's report. (*v.* p. 352.)

" The Rheea fibre, though a new import from Assam, is well known under another name, being identical with the highly valued article of commerce, known by the name of China-grass, the Chu-Mâ of the Chinese, and from which the famed Grass cloth of China is manufactured. The proof is very complete of the identity of the plants from which these two differently named fibres are obtained. One of the educated Chinese introduced into Upper Assam on the establishment of the Tea Manufactory in that valley, recognised the *Rheea* as identical with the *Chû Mâ* of his own country.[1] The Rheea of Assam had been ascertained by botanists to be the same plant as the *Urtica tenacissima* of Dr. Roxburgh, who half a century ago was informed by a friend at Canton that the plant which he had obtained as the *Caloee* of Sumatra, and to which he had given the above botanical name, was that from which the Chinese grass cloth was made. Lately, Dr. Macgowan, settled at Ningpo, sent specimens of the Chû Mâ to Calcutta. These Dr. Falconer found to be the same plant as the *Boehmeria nivea* of botanists, described under the name of *Urtica tenacissima* by Roxburgh. He says: 'The specimens from China correspond exactly with those grown in the Botanic Garden, with which I have compared them.' (May 5, 1849.) Sir W. Hooker has also identified these two plants as being identical, and has described the former as yielding what is called *China-grass*. Further, manufacturers in this country have found the two fibres to be the same for all practical purposes."

Mr. Sangster, who has paid much attention to this fibre, writes, that " our engineer, who prepared all our China-grass, is satisfied that your samples are equal to the best sorts from China." So Mr. Marshall, of Leeds, who is the largest consumer of China grass in this country, is satisfied that the Assam is the same for all practical purposes, as will afterwards clearly appear.

" The identity of the Rheea fibre with China-grass, or the

[1] " I went this morning to the old Chinese Doctor of Medicine here, with a good grass cloth handkerchief in my hand; and on seeing which he immediately said it was the *Hengchung Hapo* of China, and identical with the *Rheea* of the Doms of Upper Assam, the stuff being whitened by bleaching. I can trust to what this old man says, as he is an intelligent man and a great reader; his acount was corroborated by another intelligent Chinese, formerly one of the Government head tea-makers." (Major Hannay.)

Chû Mâ, and consequently its value having been proved, it is important to find that it is a plant very widely diffused in the East. Dr. M'Gowan writes from Ningpo ('Agri-Hortic. Soc.,' vi, p. 241), that 'the Chû Mâ is found at the base of hills from Cochin China to the Yellow River, and from Chusan to the farthest west that researches can for the present extend.' We find that it is known in Celebes and Borneo, cultivated in Java and Sumatra, and many other of the islands of the East, where it seems to be known chiefly by the names *Rami* and *Caloee*. It is known in Siam and at Singapore; the string made of it is called *tali rami*, and the fishing nets manufactured with it are conspicuous for their elegance and strength. Col. Burney, in 1836, obtained it from Pivela and Youkyouk, in the Shan province of Ava, where it is called *Pan*, and where Mr. Landers afterwards found it. Plants sent by the Colonel to Moulmein and to Tavoy succeeded well, but required much water. It has long been known as cultivated by fishermen in the Bengal districts of Rungpore and of Dinagepore, where it is called *Kunkhoora*. Col. Jenkins first sent it from Cochin in 1836; and it is found in different parts of Assam, where it is called *Rheea*, and from whence specimens have frequently been sent to the Agri-Hortic. Society of Calcutta, and whose 'Journal,' vols. iii to viii, contain numerous notices respecting it.

"In Assam, Rungpore, and Dinagepore, this plant seems to be very generally cultivated, though only in small quantities, by the Dooms or fishermen, near their huts. The climate of Assam, and of these districts, being moist, is very suitable to the plant. Manure is useful, moisture essential for quick growth, as well as shade and protection from storms to allow it to grow to the height of eight feet, from which a six-feet fibre may be extracted. Hence it is most common in the districts along the foot of hills. It is grown from the separated roots, and may be cut down several times, so that four or five crops may easily be obtained during the year, and the aggregate produce of an acre of ground be about twelve maunds. The different crops vary in strength and fineness. All the officers of the district state that the culture is perfectly understood, and though cultivated only in small quantities by the fishermen for their own use, it is susceptible of easy and rapid extension, if

the cultivators had any inducement to grow it. The expense seems to be about five rupees a maund; for Major Hannay, referring to the fact of £20 a ton having been offered for any quantity in Calcutta, observes that, as 'it costs at least five rupees per maund, you will see that it can scarce be sent to Calcutta at the price offered.' He says, also, that if any cheaper method of separation from the stalk could be discovered it would undersell all other fibres."

From the mode of expression adopted as above by Major Hannay, the Author was led to think that the whole expense for the production of the fibre was five rupees a maund. But in another place he says, the expenses of cultivation are ten rupees a maund. Capt. Jenkins ('Journ. Agri-Hort. Soc.,' viii, p. 379) also says, the present cost is ten rupees a maund; but as the plant can be grown with the least possible trouble, and the preparation of the Flax from it is a very facile process, he states, that "there is no doubt the Flax can be grown at half this price." The dearness is no doubt owing partly to only small quantities being produced for the use of the fishermen, who do not for their purposes require very large quantities. Mr. Henley, in a letter in the 'Journ. Agri-Hort. Society,' says, that "it must necessarily be a much more expensive article than either Sunn or Jute, inasmuch as a labourer can prepare one and a half to two maunds of Jute per day's work, whilst of the *Kunchoora* he cannot manufacture more than as many seers." It is evident that some improved method of separation is the most essential requisite.

"Various attempts have been made to make this fibre more generally known, and to bring it into demand as an article of commerce." (The early experiments have already been mentioned.) "It has frequently been sent by Col. Jenkins, and the officers employed in Assam, to the Agri-Horticultural Society of Calcutta. Mr. Henley, and others, have sent small quantities to the markets of this country, but without attracting much attention, or selling it at remunerating prices. Samples were sent by Major Hannay, Capt. Reynolds, Baboos Deena Nath, and Lokenath, to the Exhibition of 1851, when honorable mention was made of their exertions.

"A Prize Medal was, however, awarded for some beautifully white and silky looking fibre sent by the Singapore Com-

mittee, from M. Weber, of Java, as the produce of a plant which he called *Boehmeria candicans*, and also *Linum usitatissimum* on the same label. The former is probably only another name for our plant, as it is said to be the *Rami* or *Ramee* of the Malays. The plant is cultivated by the Dutch in Java, and its fibre has been introduced into Holland, and gold medals awarded to Messrs. Meerburg, of Leyden, for specimens of sail-cloth, ropes, cables, &c., and also for some finer kinds of cloth and table-cloths. The plant producing this fibre was called *Boehmeria candicans*, and also *B. utilis* by Professor Blume, but it is probably only a variety of *B. nivea*, or perhaps a nearly allied species.

"Major Hannay, who has long paid attention to this fibre, and to whom much praise is due, was induced to grow, and prepare the present samples together with some grown by Capt. Dalton (six bales of Dom Rheea and five of Bon Rheea), in consequence of applications from this country by merchants, who, however, did not offer a sum (£20 a ton at Calcutta) which would pay for the expenses of culture and preparation.

"Since the samples arrived in this country, I have endeavoured to make the fibre known, and its value appreciated. Specimens of both the Rheea and the Wild Rheea were sent to the Society of Arts, and an account of them published in their 'Journal' for the 9th of December, 1853. Specimens were also sent to Mr. Marshall, of Leeds; likewise to the Commercial Association of Manchester, to Belfast, to Paris, and to the Chamber of Commerce at Dundee. Its fibres have been shown to, and specimens given to numerous individuals well acquainted with such subjects.

"The letter of Mr. Marshall is most satisfactory, as he is himself a spinner of the finest yarns, and the largest if not the only consumer of China-grass:"

Dear Sir,—We have examined the samples you sent to us, and I now give you the result.

No. 1. Cultivated Rheea.—This is evidently just the same fibre we are using, imported from China, under the name of China-grass. It is not so fine in quality as the best descriptions we obtain from China, which are still longer than this sample, and of a green colour. We should class it with the middle or coarse quality, and estimate its value, delivered in England, at £48 to £50 per ton. It appears to be clean and regular in colour, and free from dead fibres, which are often a great detriment; and would be an useful quality of fibre, of which we could take a regular supply.

No. 2. Rheea fibre, sent to the Exhibition of 1851.—The same as No. 1, but coarser in quality.

No. 3. Fibre from Java.—We think this is the Rheea fibre prepared, but can hardly judge from so small a sample: it seems to be a good, clean fibre, and worth further inquiry.

No. 4. Wild Rheea fibre.—Very coarse; only fit for rope-making.

I hope this report will be satisfactory to you. It would certainly be an important advantage to us, as consumers of China-grass or Rheea fibre, to be able to obtain a supply from Assam. If it could be supplied at lower rates than those I have mentioned, that would, of course, much encourage the consumption of it in this country. I have stated what we consider the *full* value at present in our market here. At present there is not much consumed in England, but a good supply from a nearer market than China might enlarge the demand.

I am, sir, very truly,

Leeds; *Dec.* 10, 1853. J. G. MARSHALL.

Major Hannay, in one of his papers to the Agri-Horticultural Society of Calcutta, mentions that some specimens of his Rheea fibre having been sent direct to Leeds were valued at £50 a ton. Mr. Sangster, of the firm of Wright and Co., to whom one of the Prize Medals was awarded, has no doubt of the identity of the Assam produce with that of China, and therefore of its being of equal value. Mr. Dickson, who has had much experience with different fibres and the finer kinds of Flax, pronounced it to be a splendid fibre. Mr. Norrie, of Dundee, who has also examined many of these Indian fibres, finds it a very superior article, which can be brought to different qualities of fineness to suit the market it is sent to. It can be prepared to a quality suitable for the Dundee market, and also to a much finer quality, suitable for the markets requiring it finer; but says it must be kept soft and silky, which no mere mechanical means will do. These are very different opinions from one given a few years ago by a practical man, who stated that it might answer for carpet warps. Within the last year many have applied to the Author for information respecting this fibre, and how it could be obtained. One house in Belfast applied, through the Secretary of the Commercial Association of Manchester, for fifty tons of the fibre, and one gentleman, who has long paid attention to China-grass, and has carefully examined the Rheea fibre of Assam, addressed a letter to the Court of Directors of the East India Company, stating that he wished to obtain it to the extent of fifty tons monthly for a Continental house.

"*The Rheea Fibres for Rope-making.*—Though I have no doubt

that, when the peculiarities of the Rheea fibre, or China-grass, are more generally known, its excellent qualities will be fully appreciated, and it will come into more general use as a rival to the finer kinds of Flax; yet at present there are, I believe, but few spinners who thoroughly understand its management or have machinery to do it justice. It is not likely therefore to realise its full value in the market at present. Hence it was desirable to have its strength tested as a substitute for Hemp, as it might not all be required to supply the place of Flax. Mr. W. Cotton has been good enough to have a bale of Rheea fibre, and also one of the Wild Rheea, twisted into five-inch rope, and prepared by the warm register in Messrs. Huddart's rope-manufactory at Limehouse; the strength of each was carefully tried and compared with similar rope made of Russian Hemp. I am happy to state that the experiments which I this day (16th Jan., 1854) witnessed were most satisfactory, neither rope breaking until the Rheea fibre bore above nine tons weight, and the Wild Rheea, within a few pounds, nearly as much. The results of the experiments are stated in the accompanying memorandum, with which I have been favoured by Messrs. Huddart. (*v.* p. 373.)

"*Bon Rheea or Jungle Rheea.*—Though it is to be hoped that the Rheea fibre will prove too valuable to be only employed for rope-making, the Wild Rheea, on the contrary, is well calculated, and is indeed sent, for this purpose. No information has been sent respecting the plant yielding it, but it is no doubt one of the Nettle tribe, and from being called Bon or Jungle Rheea, it has been inferred that it is the Rheea in a wild state. But though we have no proof of this, it is satisfactory to find that Major Hannay describes it as 'uncultivated, but very common in all parts of the province:' and again, 'common in most of our forests; by proper management, any quantity of young shoots can be obtained, and as the divided roots afford numerous shoots, and the plant can be propagated by slips as well as by seed, its cultivation for its fibre might be carried on with facility.' He further says, 'it is cultivated largely by the Hill tribes on the west of Yeunan, and by the Singpoos and Dhoanncas of our own north-eastern frontier, to a small extent only for a coarse cloth, but chiefly for nets.' It is recognised by the Nepaulese as the Leepeeah of Nepal. Capt.

A. Thompson, of the firm of Thompson and Co., rope-makers, of Calcutta, says of it, that it is all that can be desired for either canvas or lines, and only requires to be known to be generally used for that purpose."

"Having ascertained in the most satisfactory manner that the fibres in question are possessed of the requisite degree of strength, and the Rheea fibre of fineness in addition, the next point to determine is how to make their good qualities so known in the market, that the fibres may not be condemned as new things and of no value. I am informed by the best judges, that, having taken the best means to determine the real value of the articles, they must next be sent into the market for three or four years in sufficient quantities to attract the notice of the best manufacturers; and for this purpose I am told that from ten to twenty tons annually would be sufficient: others say twice a year, but this in the case of India would be needlessly troublesome. The time, however, is extremely favorable for such an experiment, from the high price of Russian Hemp, which I am told will not come down to its ordinary price for two years, if the supply of money from this country is stopped for even this season."

"The next difficulty is to induce the natives of the districts containing these valuable fibres to extend their ordinary cultivation of the Rheea or of the Hemp, or to collect the Wild Rheea in increased quantities, and to prepare them all as carefully as possible for the English market. The officiating Commissioner of Revenue in Assam recommends that, as the culture of the Rheea fibre is sufficiently well understood, 'the best way to encourage its extension would be to secure to the ryots a sure market at remunerating prices.' Capt. Dalton, Collector of Debrooghur, states, 'that the best method would be for Government to offer a premium of so much a ton on all that is produced for three or four years.' Both recommendations might be united in one, if the officers who take so zealous an interest in the improvement of their districts were authorised to purchase (unless they find individuals willing to do so) from ten to twenty tons of these fibres in their respective districts, taking care that they were as carefully and cleanly prepared as possible, and as closely resembling as possible the specimens of Petersburgh Hemp which Mr. W. Cotton has been good enough

to send for transmission to India. The improved appearance of the Rheea fibre sent by Major Hannay is owing to specimens sent out to him by Mr. W. Sangster. I would include in this direction for the Rheea fibre also the districts of Rungpore and of Dinagepore, where the same fibre is cultivated under the name of Kunkhoora, and where labour is more abundant than in Assam."

TRANSMISSION OF RHEEA FIBRE FROM ASSAM.

In conformity to the orders of the Court of Directors, directions were sent by the Governor-General of India with printed copies of the papers to the Commissioners in Assam and Rajeshaye, and to Singapore.

Colonel Jenkins, in his reply, dated 2d August, 1854, reports that Capt. Dalton, Collector of Luckimpore, did not expect to be able to obtain more than two or three tons, as the cultivation of the Rheea is at present confined to a few villages of fishermen, and that Major Hannay some time since abandoned the experimental cultivation which he had commenced, on account of the low prices then offered, which would not pay the cultivators.

But it is stated—"As the large introduction of this article amongst our articles of commerce is likely to be a matter of great importance, I would beg to recommend that Government should buy up any quantity, up to ten tons, procurable each season for the next three years." This has been sanctioned by the Indian Government.

Capt. Dalton writes: "The lowest price at which it is likely to be procurable is six annas a seer, or about £12 sterling a ton. When it is more extensively cultivated, and the best method of preparation thoroughly understood, so that, as in the reeling of silk, women and children may be employed as well as men, it ought not to cost more than four annas a seer, or £28 a ton." He continues:

"The process described in Dr. Royle's paper, quoting from Major Hannay, is that commonly used by the natives of the province. Major Hannay practised a different method, which he calls the Indo-Chinese, which is not only the most cleansing, but also the cheapest." (*v.* p. 363.)

Major Hannay, besides describing this method as below, states that he had been requested to forward to England some of the Rheea as stripped from the stalk, and without any further scraping or cleaning. But he is of opinion that if the Rheea is not immediately deprived of its gummy and mucilaginous matter, it would most probably rot before reaching England. (This, however, would only be the case if it were not perfectly dry, and this may be difficult to effect in a moist climate like that of Assam.) "A cleaning factory established in the Rheea-growing districts, and capital employed to encourage the ryots to cultivate, would be the most likely means to cheapen the article in the market and increase its subsequent consumption." Ten bales of the Dom Rheea had, however, been sent off to this country.

Dr. Oxley, in reply to the requisition for some of the fibre from Singapore, writes (19th July, 1854) that the *Ramee* is indigenous all over the Malayan Archipelago; it grows freely at Singapore, but is not cultivated or planted to any extent, and therefore it could not be obtained in any quantity, though it is used by the Malays as twine, their common name for which is "*tali ramee*." They make their fishing lines of it, and prefer their own lines to any of European manufacture. The refuse in preparing the fibre is admirably adapted for making paper, and is used for this purpose in Java. As this fibre is remarkable for fineness, flexibility, and strength, it seems well worthy of cultivation, especially if any cheaper method of cleaning can be devised, as it is an object of attention in Java, whence it is imported into Holland, and various goods made of it, as we have already stated, by the Messrs. Meerburg, at Leyden.

The Ramee, that is, the *Rheea* of Assam, yielding four or five cuttings in the year, amounting to about twelve maunds of valuable fibre, must, therefore, be well worth cultivation in many localities from Assam to Arracan, also in Pegu, and down to Singapore, and perhaps also on the Malabar Coast. We therefore republish modes of cultivation and of preparation. The first, from Chinese works, is very similar to the directions from similar sources given by Dr. M'Gowan, of Ningpo (*v.* 'Journ. Agri-Hortic. Soc.,' vol. vi, p. 209); while the second is that which Major Hannay so successfully practises in Assam.

CHINESE CULTIVATION.—THE TCHOU MA, OR CHINESE FLAX (URTICA NIVEA).

Translated from the Chinese, by M. Stanislas Julien, and retranslated from the French.

[The following extract possesses much interest, in addition to what it derives from its Chinese origin, in consequence of its being not impossible that attempts may be made to introduce the cultivation of Tchou-ma into Great Britain. Its delicate fibre forms the Flax from which the finest of the Chinese linen fabrics are manufactured.]

Amongst the products of Chinese industry which were exhibited a few years ago in the Rue St. Laurent, were some pieces of a fine silky tissue, called by the Chinese *hia-pou* or summer cloth, and made of the fibres of the plant called by botanists *Urtica nivea.* Some seeds of this plant were sent from Canton in 1843, by M. Hébert, but they never arrived; and I was at that time told that they would probably not grow in our climate. I am sorry that I was not then able to translate the papers which I now lay before the public. After reading the following account of the cultivation of the plant in question, it will be readily seen, by those who are competent judges of the matter, that the supposed want of success was owing to nothing but ignorance of the care and delicate treatment which are necessary for the culture of the plant now before us. The way in which its valuable threads are peeled, steeped, and bleached, is, as will be seen, described by the Chinese authors, with a precision and minuteness amply sufficient to enable any person to pursue this new branch of industry in our own country. Until a new supply of seeds is received from China, roots or young plants of the *Urtica nivea* may be obtained from the Garden of Plants, and be propagated in the way mentioned below; and thus may a substance be given to our manufacturers, which will, in their hands, be made into a tissue as soft as silk, and as fine as, but stronger and tougher than the best French cambric.

Cultivation of the Tchou-ma (*Urtica nivea*).

('Imperial Treatise of Chinese Agriculture,' lib. lxxviii, fol. 3.)

For the purpose of sowing the *tchou-ma* in the third or fourth month, a light sandy soil is preferred. The seeds are sown in a garden, or where there is no garden, in a piece of ground near a river or a well. The ground is dug once or twice, then beds one foot broad, and four feet long are made; and after that the earth is again dug. The ground is then pressed down, either with the foot or the back of a spade. When it is a little firm, its surface is raked smooth. The next night the beds are watered, and on the following morning the earth is loosened with a small-toothed rake, and then again levelled.

After that half a *ching* (four pints and a half) of moist earth and a *ho* (one pint) of seeds are taken and well mixed together. One *ho* of seeds is enough for six or seven beds. After having sown the seeds it is not necessary that they should be covered with earth; indeed, if that were done, they would not germinate.

The next thing to be done is to procure four sticks, sharp at one end, and to place them in the ground in a slanting position, two on one side of the bed and two on the opposite side; they are for the purpose of supporting a sort of little roof two or three feet high, and covered with a thin mat.

In the fifth or sixth month, when the rays of the sun are powerful, this

light mat is covered with a thick layer of straw. If this precaution were not adopted, the young plants would be destroyed by the heat.

Before the seed begins to germinate, or when the young leaves first appear, the beds must not be watered. By means of a broom dipped in water the roof of matting is wetted so as to keep the ground underneath moist. At night the roof is removed in order that the young plants may catch the dew.

As soon as the first leaves have appeared, if parasitical plants appear they must be immediately pulled up. When the plant is an inch or two high, the roof may be laid aside. If the earth is rather dry, it must be slightly moistened to the depth of about three inches.

A stiffer soil is now chosen and thrown into beds, to which the young plants are to be transferred. The following night the first beds, in which the young plants are, are to be watered, the next morning the new beds are to be watered also. The young plants are then dug up with a spade, care being taken to keep a small ball of earth round their roots, and are pricked out at a distance of four inches the one from the other. The ground is often hoed.

At the end of three or five days the earth must be watered, and again at the end of ten days, fifteen days, and twenty days.

After the tenth month the plants must be covered with a foot of fresh horse, ass, or cow dung.

(Extract from the General Treatise on Agriculture, intituled ' Nong-tching-tsiouen-chou.)

When the *tchou-ma* is cultivated for the first time it is raised from seed. The roots of the seedling plants give of themselves new shoots. At the end of a few years the roots cross each other and intertwine, when the stems must be separated and replanted.

At the present day it is very common in the countries of 'An-king and Kien-ning, to disentangle the roots with a knife, and to replant them. Those who cannot procure seeds follow the plan adopted for obtaining young mulberry trees from layers.

This plan is a very quick one.

In those countries, however, where there are no roots of the *tchou-ma*, and where it is not easy to procure them from other places, the seed is had recourse to.

As soon as the young plants are a few inches high they are watered with a mixture of equal quantities of water and liquid manure. Immediately after the stems are cut the ground must be watered, and this ought to be done at night or on a cloudy day; for if the plants were watered in the sunshine, they would rust. Great care must be taken not to make use of pig's dung.

The *tchou-ma* may be planted every month; but it is necessary that *the ground be moist*.

Transplantation and Propagation of the Tchou-ma.

('Imperial Treatise on Agriculture,' lib. lxxviii, fol. 5.)

When the tufts of the *Tchou-ma* are strong enough the earth around is dug, and new stocks are detached and transplanted elsewhere. The principal stock then grows more vigorously. At the end of four or five years, the old stock becoming excessively strong, they are divided and replanted in other beds.

Some persons are satisfied with bending the long stems down and obtaining layers in the ordinary way.

When a bed becomes too crowded, another must be formed, and then another and another. In this way the plants may be propagated to any extent.

A stiff soil that has been well worked in autumn is chosen and manured with fine muck. In the following spring the plants are transplanted. The best time for carrying on this operation is when vegetation commences; the next best is when the new shoots appear; and the worst is when the stems have attained a considerable size.

The new plants are placed a foot and a half from each other, and when they have been well surrounded with earth they are watered.

In summer as well as in autumn advantage must be taken of the time when the earth has just been moistened by rain. The offsets can be transplanted to places near at hand; but it is essential to have a ball of earth around each plant.

To propagate the *tchou-ma*, proportions of its roots two or three inches long are detached by a knife, and are placed by twos and threes in little trenches that are about a foot and a half from each other. The roots are then surrounded with good earth and watered; the watering is renewed three or five days afterwards. When the new stems have attained a certain height, the earth must be often hoed.

If the earth is dry it must be watered. If the plants have to be carried to a distance, their roots ought to be surrounded by the soil in which they have been growing, well enveloped in leaves of the reed. They are placed, in addition to this, in a mat folded so as to exclude them from air and light. They may then be carried without danger to a distance of many hundred miles.

The first year, when the plants are a foot high, they are gathered; they are gathered again in the second year. The fibres of the cut stems are fit for spinning.

In the tenth month of every year, before cutting the offsets which pass beyond the roots, the earth is covered with a thick layer of cow or horse dung. In the second month the manure is raked off, in order to allow the new plants to come up freely. At the end of three years the roots become excessively strong. If part of the plants which come up in close tufts were not removed, the others would be smothered.

Gathering the Tchou-ma.

The *tchou-ma* may be gathered three times a year. When the stems are cut, the little shoots springing from the rootstock should be about half an inch high. As soon as the large stems are cut, the suckers spring up with more vigour, and soon furnish a second crop. If the young shoots be too long, the large stems ought not to be cut; but the ground shoots would not become vigorous, and would be prejudicial to the development of the larger stems.

The first crop is got in towards the commencement of the fifth month; the second in the middle of the sixth, or at the beginning of the seventh month; and the third and last in the middle of the eighth or the beginning of the ninth month. The stems of the second crop grow much faster than the others, and are by far the best.

After the crop, the stocks of *tchou-ma* are covered with manure and immediately watered.

Peeling the Fibres of the Tchou-ma.

When the stems are all got in they are split longitudinally with knives of iron or of bamboo. The bark is first removed; then the lower layer (which is white, and covered with a shrivelled pellicle which comes off by itself) is scraped off with a knife. The interior fibres are then seen; they are to be removed and softened in boiling water. If the *tchou-ma* be peeled in winter, the stems must be previously steeped in tepid water in order that they may be the more easily split.

The first layer of *tchou-ma* is coarse and hard, and is only good for making common materials; the second is a little more supple and fine; the third, which is the best, is used for making extremely fine light articles.

Steeping and Bleaching the Tchou-ma.

The stems are tied up in little sheaves and placed on the roof of a house, in order that they may be moistened by the dew at night, and dried again by the sun in the day.

In the course of from five to seven days they become perfectly white. If the weather be cloudy or rainy the stems are placed under cover in a current of air. If they are wetted by the rain they immediately turn black.

Another author says, after peeling the fibres they are tied in skeins, arranged in a circle, and steeped for a night in a pan of water; they are then spun on a wheel. This done, they are again steeped in water containing the ashes of burnt mulberry wood.

Having taken them from the pans they are divided into packets of 5 oz. weight each; the packets are placed for a night in a tub of a mixture consisting of a cup of pure water and an equal quantity of powdered chalk to each packet.

The next day the chalk is got rid of, and the fibres are boiled in water containing straw ashes, by which process they become white and supple. Being now dried in the sun they are again boiled in pure water; they are then stirred about in more water, which finishes the cleansing process, and lastly they are dried in the sun.

This done, the fibres are joined end to end on the wheel so as to make long threads, which form the warp and the woof, and are manufactured into stuff in the usual way.

Another author says, after having spun the fibres of *tchou-ma*, they are boiled in lime water, and when cool, carefully washed in pure water. Then by means of a bamboo sieve, placed on the surface of the water, they are spread out in equal layers in order that they may be as it were half wetted below, and half dried above. As night approaches, they are taken out, strained and dried: the same process is repeated the next and following days, until the threads are perfectly white. They are then, but not before, fit for being made up.

According to another process, the *tchou-ma* is first soaked, then spun and made up, instead of being soaked after the spinning.

Other persons again take the fresh fibres, expose them at night to the dew, and in the day to the sun; then spin and weave, bleaching last of all.

Others, lastly, following those who employ the plant *Ko*, cut the stems, soften the fibres in the steam of boiling water, then weave, and do not bleach at all. Fibres thus prepared give a material that is more supple and fibrous.

Mode of gathering the best seeds of Tchou-ma.

When seeds of *tchou-ma* are wanted for the purpose of sowing, those which are found on the main shoots are to be preferred. In the ninth month, after the period *choang-kiang* (after the 2d of October), the seeds are collected and dried in the sun; they are then mixed with damp sand, and put in a bamboo basket, carefully covered with straw. This precaution is needed, for if the seeds are frozen they will not grow. The seeds of the lateral shoots are not fit for sowing. Before sowing, the seeds are thrown into water, and those that sink are used, while the others are of no use.

The seeds are sown before the first half of the first month. The best seeds are those which are spotted black. After they are sown they are covered with ashes. If they are sown thick the plants coming from them will be weak

and sickly; they will be strong and healthy, on the contrary, if the seeds are thinly sown. As soon as the leaves appear the plants are watered with liquid manure. In the seventh month the seeds are collected, put on canvas, and hung in a strong current of air; this aids and hastens germination. ('Journal of the Horticultural Society of London,' vol. iv, part iv.)

INDO-CHINESE METHOD *for preparing the Rheea Fibre, as practised in Upper Assam. By Major Hannay.*

To cut the Rheea.—The Rheea is fit for cutting when the stems become of a brown colour for about six inches upwards from the root.

Hold the top of the stalk in the left hand, and with the right hand strip off the leaves by passing it quickly down to the root, and cut off with a sharp knife, taking care to be above the hairy network of the roots, as these should be covered up with manure immediately to ensure another crop quickly; lop off the tender top to the stalk, and make the reeds up into bundles of 200 or 250, if the stripping process is not to be carried on in the field or garden, but it is best to strip off the bark and fibre on the spot, as the burnt ashes of the stem afford a good dressing for the roots along with dry cow dung.

To strip off the Bark and Fibre.—The operator holds the stalk in both hands nearly in the middle, and pressing the forefinger and thumb of both hands firmly, gives it a peculiar twist, the inner pith is broken through; and then passing the fingers of his right and left hand rapidly, alternately, towards each end, the bark and fibre is completely separated from the stalk, in two strands.

Making up into Bundles.—The strands of bark and fibre are now made up into bundles of convenient size, tied at the smaller end with a shred of fibre, and put into clean water for a few hours, which I think deprives the plant of its tannin or colouring matter, the water becoming quite red in a short time.

Cleaning Process.—The cleaning process is as follows:

The bundles are put on a hook fastened in a post, by means of the tie at the smaller end, at a convenient height for the operator, who takes each strand separately of the larger end in his left hand, passes the thumb of his right hand quickly along the inner side, by which operation the outer bark is completely separated from the fibre, and the riband of fibre is then thoroughly cleaned by two or three scrapings with a small knife. This completes the operation, with some loss, however, say one fifth, and if quickly dried in the sun it might at once be made up for exportation; but the appearance of the fibre is much improved by exposure (immediately after cleaning) on the grass to a night's heavy dew, in September or October, or a shower of rain during the rainy season. After drying, the colour improves, and there is no risk from mildew on the voyage homewards.

OTHER SPECIES OF URTICA AND BOEHMERIA (*Urticeæ*).

BON RHEEA, Wild or Jungle Rheea, Boehmeriæ species.

In the preceding observations, the *Bon* or *Bun Rheea,* that is, Jungle Rheea, is so called as if it were the Dom Rheea or China Nettle in a wild state. Of this there is no proof, but considerable probability that it is a distinct species, possessed of many of the same properties as the Ramee or Rheea Nettle.

Indeed, Major Hannay, who has chiefly brought it into notice, says of Bon or Jungle Rheea (*Boehmeriæ* species) that it is a jungle plant, common in the Assam forests, and thriving best in the vicinity of water or of running streams. When unmolested it grows to a tree, but, by proper management, any quantity of young shoots can be obtained; and as the divided roots afford numerous shoots, the plant can be propagated by slips as well as by the seed. Its cultivation for its fibre might be carried on as with the Willow in Europe.

By the Chinese in Assam it is said to be exported into Southern from Northern China. It is cultivated largely by the Hill tribes, north-west of Yeunan, and by the Singpoos and Dhoanneas of our own north-eastern frontier, to a small extent only for a coarse cloth, but chiefly for nets. The Nepaulese recognise it as the *Leepeeah* of Nepaul. ('Journ. Agri-Hortic. Soc.,' vii, p. 222.)

This fibre, in the state in which it has been sent, is well adapted for rope-making. It is about five feet in length, brown in colour, strong, and flexible. Capt. W. Thompson, of the house of Messrs. Thompson, rope-makers, of Calcutta, says of it: "It is all that can be desired either for canvas or lines, and only requires to be known to be generally used for such purposes." It was the kind which was made into a five-inch rope by Messrs. Huddart (p. 373,) along with the Dom Rheea or China-grass,and broke with a weight of about nine tons, or precisely 21,025 lb. Since then, it has been made up into ropes of various sizes, which have been carefully tested, and found in every case greatly to exceed in tenacity those made of Russian Hemp of the same size, as shown in the Table at p. 374. It has also been made up into lines and cords, some of them almost fine enough for fishing lines: in all which it displays its fitness for all such purposes, from the union of strength and flexibility. There is no doubt that it would command a market as soon as its good qualities become known. It would be desirable to ascertain whether, by pressing it between grooved rollers, or something of that kind, it could not be sent in a still cleaner state, and command a still higher price. It was valued at £35 a ton.

MESAKHEE FIBRE, Boehmeriæ species (*Urticeæ*).

Another fibre is enumerated by Major Hannay ('Journ. Agri-Hortic. Soc.,' vii, p. 217), which he says is called *Mesakhee*, and is an *Urtica*, but not a stinging one. It is a shrubby tree, probably a species of *Boehmeria*, and is very abundant. Its young branches, which are tender and red-coloured, as well as its leaves, are edible. Only a small quantity was at first sent, but afterwards three maunds of the fibre, to Messrs. Gouger and Co., to ascertain the value of the fibre in the Home market. Capt. Thompson says of it, in a report to the Agri-Horticultural Society: "I forward a log-line made of the fibre of the *red Mesakhee* plant, as also the remainder of the fibre itself. I find the strength of it quite equal to Russia Hemp, but for want of being properly harvested, the fibres cling so close together that great loss of material takes place in hackling it. I think it well adapted for cordage, and if brought into general use ought to bring as much as Petersburgh Hemp." ('Journ. Agri-Hortic. Soc.,' viii, p. 90.)

Major Hannay says: "The Murrees and others might be induced to bring the fibre for sale; but as the value of this Nettle in the market has not been ascertained, I have only offered at the rate of Rs. 5 per maund, which, however, on account of the slow method of manipulation, has not been considered remunerative." (l. c., p. 89.)

Of Major Hannay's Nos. 6, 7, and 8, the first, which is the foregoing, he says is called *Mesakhee* or *Mejingah*, the other *Mesakhee*. No. 6 has but little fibre and very rough stem. No. 7 has much the same habits as Bon Rheea, and can be cultivated like it. Its fibre is also of the same character, but white, strong, and durable. It is used for the same purposes.

Capt. Dalton, in a letter, dated 20th July, 1854, referring to what the Author had said respecting the Wild or Bon Rheea, writes: "As he alludes to the batch sent through this office by Major Hannay in 1853, he must refer to the 'Mesakhee,' of which large quantities are procurable, growing wild in Upper Muttock and elsewhere in the district. The instructions regarding the specimen of Petersburg Hemp sent out as a sample are more applicable to this fibre than to the Bon Rheea.

I propose to take measures for collecting as much of it as I can get prepared. The cost will be from three to four annas a seer. This might be accompanied by samples of the *Bon Rheea, Bon Surat,* and other fibres, all prepared to resemble the Petersburgh Hemp. If for these wild fibres we had a good market, the frontier tribes, Singphoos, &c., who understand how to prepare them, might be induced to assist in supplying them." The specimens which the Author had referred to in the above communication were sent under the name of Bon Rheea from India. The two plants, *Bon Rheea* and *Mesakhee,* may be identical or nearly allied species, but this cannot be ascertained without authentic Botanical specimens. Major Hannay distinguishes the two kinds—the *Bon Rheea* being his No. 2, and *Mesakhee* No. 6—in his paper in the 'Journ. Agri-Hortic. Soc.,' vii, p. 215.

Chor Putta, or Surat, *Urtica crenulata* (*Urticeæ*).

This plant is a native of the hills and valleys on the east of Bengal. Dr. Roxburgh obtained it first near Luckipore. It has since been found near the Pundua Hills. Major Hannay enumerates it among the fibrous plants of Assam. It has an erect shrubby stem, with oblong acute leaves, having the margins crenulate or slightly dentate, both sides alike the bark armed with acute burning hairs. The sting produces great pain, extending to the armpit; abates after two or three days, but does not disappear entirely for nine days. Major Hannay says of this and another, which he enumerates as Nos. 3 and 4, and calls gigantic stinging Nettles, that they afford a quantity of fine white fibre, but apparently of no great strength, and, by report, not very lasting. Some of the Hill tribes use the fibre for fabricating coarse cloths.

Horoo Surat of Assam, or Neilgherry Nettle, *Urtica heterophylla* (*Urticeæ*).

The *Horoo Surat* of Assam, said to be the *Urtica heterophylla* of Dr. Roxburgh, is the most widely diffused of the large Indian Nettles, inasmuch as it is found in the Southern Concan,

on the Malabar coast, and specimens of fibre of what was called *Neilgherry Nettle*, produced by *Urtica heterophylla*, were sent by Dr. Wight to the Exhibition of 1851. It is also found in Burmah and in Assam; and along the foot of the hills extends to the Deyra Doon. It may be seen even in the northern valleys of the Himalayas. It is an annual, with erect angular stems, marked with small white specks, in which are inserted stiff, most acute bristles. The leaves are long, petioled, caudate at the base, variously lobed, and towards the top of the plant almost palmate; all are grossly serrate, armed with the same bristles as the stem and branches, from four to eight inches long and nearly as broad. Dr. Roxburgh says of it, that it is the most ferocious-looking plant he has seen, and it acts up to its appearance: the least touch of any part producing most acute pain, but fortunately of short duration. The bark abounds in fine, white, glossy, silk-like, strong fibre. Major Hannay says of it, that it is the *Horoo Surat* of the Assamese, and known to the Bhotecas as the *Serpah* or *Herpah*,—that the fibre is extensively used by them in the manufacture of cloth. It was recognized by the Chinese as the *Theng Mah*, and said to be prized for the softness of its fibre, as well as for its strength. As the seeds are quick of vegetation, the cultivation of this plant can be carried to any extent.

The fibre of this Nettle, sent from the Neilgherries, is very long, soft, white, and silky, and has been much admired by many of the best judges of fibres. The specimens were sent by Dr. Wight, and prepared in a rude way by boiling by the Todawars of the Neilgherry Mountains. Dr. Wight says of it, that "it produces a beautifully fine and soft flax-like fibre, which the Todawars use as a thread material, and if well prepared fitted to compete with Flax for the manufacture of even very fine textile fabrics."

This fibre could of course be equally well prepared in a multitude of other places, some near, others distant from the sea. Mr. Marshall did not consider it well suited for his purpose. At Dundee, it was thought a very good fibre, but rather dry. Mr. Dickson, who has passed it through his machine and liquid, has rendered it like a beautiful, soft, silky kind of Flax, and calls it a wonderful fibre, of which the tow would be useful for mixing with wool, as has been done with the China-grass, and

the fibre used for the finest purposes. If this should be proved to be the case on trial, it might no doubt be produced abundantly, and, with some improved process of separation, very cheaply, at easily accessible places on the Western Coast of the Indian Peninsula.

Pooah Fibre, *Boehmeria frutescens* (*Urticeæ*).

Dr. Campbell, Superintendent of Darjeeling, addressed a letter to the Agri-Hortic. Soc., forwarding a new description of Wild Hemp from Eastern Nipal and Sikkim, on behalf of Sergeant Crutcher, who used the fibre in his craft of sewing leather.

"*Description of the Plant.*—The plant from which the Hemp is made is called 'Pooah' by the Parbuttias; 'Kienki' by the Lepchas; and 'Yenki' by the Limboos. It grows to the height of six or eight feet, and varies in the thickness of the stem from the size of a quill to that of the thumb. The leaf is serrated, of a dark green colour above, silvery white below, not hairy or stinging; and has a reddish pedicle of about three inches long. The seed forms in small currant-like clusters along the top of the plant, and on alternate sides about an inch apart. Two small leaves spring from the stem at the centre of and above each cluster of seed.

"*Habitat.*—The 'Pooah' is not cultivated, but grows wild and abundantly in the valleys throughout the mountains of Eastern Nipal and Sikkim, at the foot of the Hills skirting the Tarai to the elevation of 1000 or 1200 feet; and within the mountains up to 3000 feet. It is considered a hill plant, and not suited to the plains or found in them. It does not grow in the forest, but is chiefly found in open clear places, and in some situations overruns the abandoned fields of the Hill people within the elevations which suit it. It sheds its leaves in the winter, throws them out in April and May, and flowers and seeds in August and September. The exact period altering of necessity with the elevation.

"*When used.*—It is cut down for use when the seed is formed; this is the case with the common Flax, in Europe. At this time the bark is most easily removed and the produce

is best. After the seed is ripe it is not fit for use, at least it is deteriorated.

"*How prepared.*—As soon as the plant is cut, the bark or skin is removed. This is very easily done. It is then dried in the sun for a few days; when quite dry it is boiled with wood-ashes for four or five hours; when cold, it is beaten with a mallet on a flat stone until it becomes rather pulpy, and all the woody portion of the bark has disappeared; then it is well washed in pure spring water and spread out to dry. After exposure for a day or two to a bright sun it is ready for use. When the finest description of fibre is wanted, the stuff after being boiled and beaten, is daubed over with wet clay, and spread out to dry. When thoroughly dry the clay is rubbed and beaten out; the fibre is then ready for spinning into thread, which is done with the common distaff.

"*Uses.*—The 'Pooah' is principally used for fishing nets, for which it is admirably adapted on account of its great strength of fibre and its extraordinary power of long resisting the effects of water. It is also used for making game-bags, twine, and ropes. It is considered well adapted for making cloth, but is not much used in this way."

Dr. Falconer recognized the "Pooah" as the "*Boehmeria frutescens* of Botanists, common at lower elevations on the Himalayas from Gurhwal to the Sikkim hills (Ganges to Burrampooter). In the outer hills of Gurhwal and Kumaon it is called 'Poee,' and the tough fibre is used there for making nets. In Darjeeling, *B. frutescens* goes by a similar name, 'Pooah,' and the fibre is used for similar purposes. It was first described by Thunberg, who distinguishes it from the textile species, *Boehmeria* (or *Urtica*) *nivea*, which grows there in abundance."

Capt. Thompson, to whom the specimens of Pooah fibre were sent, says of it, that, "when properly dressed, it is quite equal to the best Europe Flax, and will produce better sailcloth than any other substance I have seen in India. I observe, from Dr. Campbell's communication, that mud is used in the preparation, which clogs it too much, &c. My superintendent, Mr. W. Rownee, who understands the nature of these substances, tells me, that if potash were used in the preparation (which is invariably done with Russian Hemp and Flax) instead

of clay or mud, that the colour would be improved, the substance rendered easy to dress, and not liable to so much waste in manufacturing." Sergeant Crutcher thought that the fibre might be supplied for four rupees a maund, when large quantities were prepared. Capt. Thompson thought that it would be worth twelve rupees a maund in Calcutta.

Other Himalayan Nettles.

Major Swetenham, when writing respecting the Maloo Creeper (*v.* p. 296), mentions the large Nettle of Gurhwal—which he says is considered by the natives as superior to Bhang, or the true Hemp—thus: "There is another plant that grows in the interior of the Hills from which stronger ropes even than the Hemp are said to be made—I allude to the large Nettle plant. I have seen this growing to the height of fourteen or fifteen feet; the Hill people in preparing ropes from this plant, steep it for *three* days *only*, and then strip off the fibre; this is done in a contrary method to the Hemp stripping, *i. e.*, the top of the Nettle is broken off, and the fibre pulled down from the thin end."

Capt. Huddleston, in his paper on the Hemp of the Himalayas, mentions also other fibres. Among these—"The larger Nettle called *Jurkundaloo*, *Kundaloo*, and *Kubra*, grows chiefly in the northern parts of the district, in great quantities; it also grows in the middle ones; and from its fibres the natives make rope for tying up their cattle and snow-sandals. One bundle will produce about a seer of fibre, but it is not collected for sale. The plant grows about eight or nine feet high, and the stalks are about the size of a finger in thickness. It is cut in the cold season, and the stalks are soaked a few days in water before the fibre is stripped off from the thick end like Hemp." ('Trans. Agri-Hortic. Soc.,' viii, p. 275.)

Dr. Campbell also mentions the gigantic stinging Nettle of the Nipal and Sikkim Hills, as made into Hemp and used in making the cloth called "Bangra." The preparation is the same as the "Pooah." The Bangra is harder and stiffer than the "Pooah," and not adapted to making cordage and nets.

Mr. C. Gubbins, C.S., when at Simla, forwarded some specimens of fibrous material produced by a species of Urtica growing about and below Simla, used by the natives of those parts for making string. The process, which he describes as employed for separating this fibre, is interesting from its simplicity. The plant is cut in October, and dried in the sun; when brittle it is beaten, and the fibres separate easily. He observes: "Seeing it stated that there was considerable labour required in cleaning the fibre, I made particular inquiries on this head; and as far as I can learn, there is no greater trouble in cleaning the fibre of the Urtica when merely dried, than is experienced with the Hemp of the Hills which is not rotted in water." Hence the separation would seem to be effected entirely by the dry process and mechanical means.

Capt. Rainey, when Assist. Pol. Agent at Subathoo, sent a net formed from the fibre of a Stinging Nettle, which grows in the same locality as that described by Mr. Gubbins, as he says:

"1st. The Nettles from which this sample was wove, grew in the low valleys adjacent to the Hill Station of Simla in the Himalaya Mountains.

"2d. The vegetable abounds in all the ravines and valleys of those mountains, and forms one of the most rank weeds of these places, during the rainy months.

"3d. In August and September, when it is in perfection, it can be obtained in any quantity, running from five to six and seven feet in height.

"4th. As far as I have been able to ascertain, it is chiefly in demand, if not at present wholly so, for fishing nets; in consequence of the virtue ascribed to the cord wove from it, of gaining increased strength by constant immersion in water, and resisting decay from that element longer than any other description of cords.

"5th. The weed is known throughout the lower and centre ranges of the Himalayas by the names Babar, or Allow, or Bichoo; the last evidently consequent on its stinging property, being the common designation of the scorpion.

"6th. The following is the preparation to which the article is subjected by the natives of the place; but, I doubt not, much of the process might be omitted or simplified—

"1st. Being cut in August or September, the weed is exposed for *one* night in the open air.

"2d. The stalk is then stripped of leaves and dried in the sun.

"3d. When well dried it is deposited in an earthen pot which contains water mixed with ashes (the refuse remains of any wood fire), and boiled for four and twenty hours.

"4th. The stalk thus boiled is then taken to a stream and well washed.

"5th. The Hemp is then brought home, and being sprinkled with flour (otta) (of the grain called Koda), it is again dried in the sun, and afterwards spun at any time into cord for nets of every description."

As no distinctive characters are given of these Nettles, it is impossible to determine the respective species. In Gurhwal and near Simla, *Urtica virulenta* and *U. heterophylla* are common as stinging Nettles, as well as some others; while of species of Boehmeria, the *B. frutescens, macrostachya, Goglado, salicifolia*, are found, and all probably abound in fibre, though a few only have been as yet ascertained to do so, as has been mentioned in the preceding pages.

STRENGTH OF THE RHEEA OR NETTLE FIBRES.

With regard to the strength of these Nettle fibres, it has already been stated that Dr. Roxburgh found the Rami or Caloee bore 240 lb., when Hemp bore 158 lb., and Sunn 150 lb., *v.* Table, p. 268. Messrs. Sharpe, in 1815, found a cord bore 252 lb., when Russian Hemp was only required to bear 82 lb. So in our experiments with these fibres in an untwisted state (already quoted at p. 131), Petersburgh Hemp bore only 160 lb., when China-grass bore 250 lb., the Rheea 320 lb., and the Wild Rheea 343 lb. Mr. Henley had previously found the Kunkhoora or Rheea to bear about three times the weight of Russian Hemp. Capt. Thompson also thought it about three times as strong; and though rather too wiry, he considered it would make excellent cordage, as well as canvas. But though this is too valuable to be applied to such purposes, we have in the Wild Rheea equal strength with greater flexibility, and all that is required, as is apparent from the following ab-

stract of the experiments made at Messrs. Huddart's, referred to at p. 355.

Experiments on Strength of Rope made from samples of Fibre of the growth of India, received from Dr. Royle, at Messrs. Huddart's Rope-manufactory, Limehouse, Feb. 13, 1854.

Description of Hemp.	Size of Rope.	Number of Yarns per strand.	Total number of Yarns in Rope.	Strength of Rope in pounds.	Strength of Rope per inch, circumf. squared.	Size of Rope at breaking.	Tar absorbed.	Amount of stretching.
	Inc.							
Wild Rheea, 1st expt. .	$4\frac{7}{8}$	44	132	19,032	*844	$4\frac{3}{8}$	1-7th	1 in 16
Ditto, 2d expt. . .	$4\frac{7}{8}$	44	132	21,025	*894	$4\frac{3}{8}$	1-7th	1 in 16
Rheea Fibre . . .	$4\frac{7}{8}$	44	132	20,488	*910	$4\frac{3}{8}$	1-9th	1 in 16

So Messrs. Morgan, having made some rope for Mr. Sangster with the Rheea sent him by Major Hannay from Assam, found it to be at least 50 per cent. better than similar rope made of Russian Hemp. This is conspicuous also in the following experiments. The excellence of the fibre for lines and fine cordage is particularly observable in the fine thread called *Talli Rami* from Singapore, as likewise in the delicate nets, some of which seem fine enough for lace instead of for catching fish. The fitness of the Wild Rheea, from its strength, flexibility, and durability, is seen in the various kinds of line and cord which the Author has had made of it in this country, as well for fishing lines, as bowstrings, clewlines for hammocks, &c., in order to show its fitness for all and every purpose to which fibrous substances require to be applied.

A subsequent report was made on the strength of these fibres, when twisted into cords and rope of different sizes.

"In continuation of the experiments which I made on the strength of some Indian fibres in their untwisted state, I beg leave to subjoin an account of some others that I thought it desirable to have made on some of these fibres after they had been twisted into twine, cord, and rope, of different kinds, by a regular rope-maker. This I have had done in order to obviate the objections which are made against new articles by ignorance or prejudice, or from the opposition of interested parties.

"These cords and ropes having been subjected to a fresh set of experiments, and compared with others made of Russian

Hemp and of as nearly as possible the same size, I am happy to report that in every instance the Wild Rheea has proved stronger than Russian Hemp, and in the case of the two-inch rope the Indian fibre bore 1000 lb. more than the Russian. The cultivated Rheea, which is equally strong, will, I hope, be applied to better purposes than rope-making; but it is important that the Wild Rheea is proved by these experiments to be fit for every purpose for which strong fibre is required, either in Europe or in India."

A few experiments were also made with rope made of other Indian fibres.

"Plantain and Pine-apple fibres, though less strong, are capable of bearing considerable weights, and might be used for many ordinary purposes. But the fibre of the Agave, commonly called American Aloe, is capable of bearing a great strain, and the plants have the peculiarity of being able to flourish in a dry soil and climate, such as that of the Deccan and of Mysore. The Dhunchee fibre of Bengal, which is hardly known in this country, appears to be as strong as Russian Hemp, and is, I understand, as easily cultivated and as cheap as Jute. The results which have been obtained will be incorporated in my forthcoming account of Indian fibres."

	lb.
Wuckoo Fibre small Cord . . . . . broke at	86
Petersburgh Hemp Cord	170
Wild Rheea Cord, same size as Russian	190
Rheea Fibre Cord, one thread larger	230
Pound line of Wild Rheea	510
Six-thread Cord of *Petersburgh Hemp*	505
Six-thread Ratline of Rheea, tarred	525
Six-thread do. of Wild Rheea, do.	530
Nine-thread do. of Wild Rheea, do.	860
Twelve-thread do. of Wild Rheea, do.	1120
One-inch Rope of Wild Rheea	1350
One-and-half-inch Rope of Wild Rheea, tarred	1900
One-and-half-inch Rope of Wild Rheea, do.	1900
Two-inch Cord of *Russia Hemp*	1800
Two-inch Rope of Rheea Fibre, tarred	2800
Twelve-thread Rope of Plantain, made in India	864
Twelve-thread do. of Pine-apple, do.	924
Two-inch Cord of *Russia Hemp*	1800
Two-inch Rope of Dhunchee fibre, made in India . . .	1850
Two-inch Rope of Agave, usually called Aloe, do. . . .	1900

For the sake of comparison we reprint the experiments made with the untwisted selvages of some of the same fibres, and of which the specimens were very carefully prepared by George Aston, and their strength tried in the office of the Military Stores.

Petersburgh Clean Hemp	broke with	160 lb.
A fibre from Travancore, called Wukka	„	175
Yercum fibre	„	190
Jubbulpore Hemp	„	190
China grass, from China	„	250
Rheea fibre or China grass, from Assam	„	3 0
Wild Rheea, also from Assam	„	343

Hemp from Kote Kangra, in the Himalayas, bore 400 lb. without breaking.

The other tables, in which the strength of various Indian fibres is given, as tested by different experimentalists, are to be seen, of Pine-apple fibre at p. 41; of Agave, &c., p. 49; of Moorva, p. 56; of Plantain, p. 88; of different fibres, pp. 268, 269; of Sunn, pp. 277, 289; Jubbulpore Hemp and Dhunchee fibre, p. 292; of Mudar, p. 310; of Himalayan Hemp, p. 331; and of other fibres, p. 332; of Rheea and other Nettles, pp. 347, 355, 364, 372.

We have thus carried our investigation of fibre-yielding plants from Grasses in the Endogens to Nettles among the Exogens. We have found that in following an arrangement according to the Botanical affinities of plants, we have obtained some important practical results. Inasmuch, as we have seen different plants with their products, possessed of the same properties, grouped together in the same natural families; and have been led to infer how appropriately we may search among these very groups, for other fibrous plants in whatever country we may be in, though none exceed India in such natural riches.

We may congratulate our readers that the arrangement has brought us to conclude with a family like that of the Nettles, of which so many of the species are conspicuous for fibrous properties, each consisting of numerous individuals widely distributed, and which are easily cultivated. They appear useless only because so few take the trouble, or, we should rather say, enjoy the pleasure of reading the wide-spread book of Nature. When some of the improved methods of separating fibre are successfully applied to such plants as the Rheea and Wild Rheea,

the benefits to India and the world will be incalculable. For they are exceeded by none in fineness, excel all others in strength, and may be fitly compared to the trunk of the elephant, which can pick up a needle or root up a tree.

CONCLUDING OBSERVATIONS.

The Author having endeavoured to carry out what he stated to be his opinion in his Lecture before the Society of Arts, finds he cannot do better than conclude as he did then:

"The foregoing enumeration will, I hope, be considered sufficiently extended to prove that India possesses a number of plants, many of them valuable as articles of food, or for other properties, and which are capable of yielding very excellent kinds of fibre, useful either for Paper-making, for Textile fabrics, or for Cordage. They vary in fineness and in strength, as is required for the various wants of the arts and manufactures of civilised life. It would be easy to extend the list (as has been done in this work) with the names of many other plants which are already employed by the natives of India, or which have been subjected to experiment by Europeans. But it will, perhaps, be better to recapitulate the most important of the subjects which I have brought before your notice. Neglecting the Grasses, which, however, are not to be forgotten, if we want a cheap material for paper-making—and this is far from an unimportant object, considering the constantly increasing demands and the rising prices, of the raw material required for this indispensable requisite of civilised life. That paper so made will not be devoid of many useful properties I feel well assured, from the pleasure I have myself experienced in writing these notes on paper made from straw. But it is among the white-fibred plants, such as the Moorva, the Aloe, and the Agave, also in the Pine-apple, and, above all, in the Plantain, that we have boundless supplies of material, not only for paper-making, but for the finest as well as the coarsest textile fabrics, and for cordage which may rival Manilla Hemp, or the American Agave, which bridges over broad rivers. The oakum of these plants may be converted into paper; and that made from the Plantain is remarkable as well for fineness as for

toughness. The fibres may be woven into fabrics of different qualities; and though they may not be well fitted for making knots, they may yet be twisted into ropes which are capable of bearing considerable strains, and possess the advantage in their white colour, of not being likely to deceive the purchaser by a semblance to Hemp. So if we require a fibre which shall unite with strength the property of being almost indestructible under water, we have only to employ the black horsehair-like fibres of the Ejoo or Sago Palm, which has also all the lightness of the Coir of the Cocoa-nut.[1]

"Among the Malvaceous and Leguminous plants, or those among which the Brown Hemp, the Dhunchee, and Sunn of India are found, with the Jute among the Linden tribe, we have a variety of cheap products, because the plants can be grown with ease, and their fibres separated with facility. The supply may, moreover, be indefinitely and rapidly expanded, because they form a part of the ordinary culture. Though these do not possess all the strength, they have the colour of Hemp, which I am told is an advantage; and they are admirably adapted for many coarse fabrics, as well as for cordage for ordinary purposes. Many of them also are edible, like the Okhro of the West Indies and the Ram turai of India; and, therefore, we may, as in the case of the Plantain, be multiplying the supply of food for the body, at the same time that we are increasing the means for diffusing information for the mind."

[Though numerous attempts have been made to produce merchantable Flax in India and without much success, chiefly from inattention to physical desiderata, I believe there is at present a very favorable prospect of getting some good Flax

[1] Since the articles on Moorva, Pine-apple, Manilla Hemp, and Plantain were written, the Author has received specimens from Bombay, from Dr. Gibson, of cord made from the first, under his direction, who states that the plant is abundant on that side of India, and yields one of their strongest fibres. Dr. Oxley, at Singapore, writes that thousands of acres of Pine-apple plant cover the adjacent islands; so that the supply might be considered inexhaustible, of a fibre remarkable as well for fineness as for strength; and also, that the *Musa textilis* of Manilla grows freely there, and would thrive well in the low lands, if these were drained. Dr. Hunter, of Madras, has stated that Plantain fibre has begun to be exported from the West or Malabar coast of India. Indeed, several of the fibres mentioned in the above Lecture and in this work have been imported during the year into this country; or have been sent as specimens, from new sources.

from the North-Western provinces, from whence the successful example may spread to other parts. As Jute has come to be an important article of commerce for textile purposes, so I believe that several other fibres might become so, as they have also the characteristic of fineness with the property of being spun, and that much more easily than either the Plantain or Pine-apple fibre, employed for textile purposes by the islanders of the great Indian Ocean.]

"But, if we require fibres possessed of all, or even more than the strength of Russian or of Polish Hemp, we shall find this a property, not only of the Hemp of the Himalayas, but of the various Nettles which clothe the foot of these mountains, from Assam to the Sutlej; and if we pay a price proportioned to the quality of the article, I have no fears but that the supply will increase in proportion to the demand. If we want them still cheaper than they can at present be furnished, we have only to supply the cultivators with some simple machinery, by which the fibre may be separated more easily than by the present primitive methods. In that case I feel assured that the Rheea fibre will not only undersell every other fibre, but, in point of strength, take a position which will be second to none of those which are at present imported. India is in many respects so well suited to the growth of fibres, that the supply not only of this, but of many others, may easily become more abundant than from any other country.

"In addition to affording such facilities, I hope the day is not distant when something will be done to encourage, instead of depressing the efforts of planters and colonists when they send a new thing to market. Because some account of the properties and value of the article as suited to different purposes would be more encouraging than a statement that it is of 'no value' because 'unknown in the market.' While the fact very often is that the substance is well known in many markets, though not in the one to which it has unfortunately been sent. I feel confident that the Collections of Raw Products which are being established will have considerable effects; but they should be multiplied so as to extend to every large commercial town, or at least to the principal sea-ports; and as in the city, time is counted by minutes, I would have one in the very heart of the city. But to be fully useful such Collections

should be connected with Societies interested in the investigation of such subjects, and publishing Journals where the learning, the science, and the practical applications connected with each subject should be published. I could almost hope that the time is come (or very nearly so) in which knowledge of Natural Subjects should be considered a part of General Education, and that what is called the study of Geography be connected with a general knowledge of the Soils, the Climates, the Plants, and the Animals of the different regions of the globe, and not be confined, as it often is, to boundaries, to the height of mountains, the length of rivers, and to a bare enumeration of places. Some of the improved views now entertained on such subjects must be ascribed to the discovery that so many made of their own ignorance at the Great Exhibition of 1851, which in this, as in so many points, will continue to be, as it has already been, of immense benefit both to producers and consumers in all parts of the world."

Finally, the Author may say, that if there is any truth in the information which he has brought together, or in the inferences which he has drawn, there need be no want of, but an abundant supply of cheap and effective materials for Paper-making, and our textile manufactures from the vegetable kingdom need not be confined to Flax and to Cotton. While with regard to cordage, neither our Royal nor our Mercantile Marine need restrict themselves to European sources of supply. So if, for fishing nets, track-ropes, and mine-ropes, we require the utmost degree of strength in the smallest amount of space, the requisites are to be found in some of these Oriental fibres, as, for example, in the Rheeas of Assam, the Rami of the Malays, or the Chû Ma of China. These produce fibres of different degrees of fineness, according as they are taken from the later or the earlier crops; so, while the one may rival the softest Flax in fineness, the other may exceed the Russian, or any other except Himalayan Hemp, in strength.

APPENDIX.

A.

An Account of the Total Quantities of Flax and Hemp respectively IMPORTED *into the* UNITED KINGDOM *in each Year, from* 1801 *to* 1853, *both inclusive; distinguishing the Quantities received from the Russian Empire from those received from all other parts.*

YEARS.	FLAX AND TOW, OR CODILLA OF HEMP AND FLAX.			HEMP DRESSED.		
	From Russia.	From other parts.	From all parts.	From Russia.	From other parts.	From all parts.
	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
1801	188,106	85,613	273,719	682,175	67,171	749,346
1802	215,086	67,528	282,614	445,759	61,634	507,393
1803	215,201	76,431	291,632	686,777	70,912	757,689
1804	261,814	90,786	352,600	716,013	23,124	739,137
1805	369,871	101,877	471,748	615,771	15,932	631,703
1806	306,119	52,793	358,912	742,382	5,691	748,073
1807	378,362	44,414	422,776	751,828	25,869	777,697
1808	136,481	80,311	216,792	240,146	22,294	262,440
1809	395,217	134,868	530,085	796,076	59,765	855,841
1810	476,100	38,383	514,483	844,308	116,302	960,610
1811	224,037	10,734	234,771	452,588	16,296	468,884
1812	356,267	6,329	362,596	733,991	129,632	863,623
1813	The Records of the year 1813 were destroyed by fire.					
1814	389,948	110,585	500,533	526,488	42,235	568,723
1815	233,423	92,453	325,876	722,692	30,094	752,786
1816	150,321	62,350	212,671	369,177	6,280	375,457
1817	294,456	120,300	414,756	458,531	16,758	475,289
1818	286,603	141,045	427,648	659,431	24,777	684,208
1819	335,491	74,290	409,781	485,006	7,788	492,794
1820	315,481	66,907	382,388	415,813	10,350	426,163
1821	365,087	133,466	498,553	253,425	2,372	255,797
1822	419,860	190,246	610,106	583,761	32,694	616,455
1823	297,845	256,093	553,938	653,161	13,980	667,141
1824	448,894	293,637	742,531	557,365	14,571	571,936
1825	666,279	388,954	1,055,233	578,647	16,443	595,090
1826	527,905	160,717	688,622	465,088	24,242	489,330
1827	669,937	237,142	907,079	524,868	48,525	573,393
1828	643,153	233,036	876,189	454,303	49,817	504,120
1829	683,956	238,084	922,040	327,379	47,553	374,932
1830	703,582	240,514	944,096	461,099	45,671	506,770
1831	623,257	313,154	936,411	506,803	24,017	530,820
1832	667,868	314,648	982,516	492,355	101,209	593,564
1833	776,856	352,777	1,129,633	469,960	57,499	527,459
1834	562,816	248,906	811,722	583,841	89,970	673,811
1835	438,483	302,331	740,814	610,519	77,040	687,559
1836	1,037,021	492,095	1,529,116	556,458	29,574	586,032
1837	682,025	318,840	1,000,865	591,675	181,946	773,621
1838	1,089,559	536,718	1,626,277	580,999	149,377	730,376
1839	705,708	517,993	1,223,701	781,462	214,231	995,693
1840	870,401	382,839	1,253,240	599,078	84,990	684,068
1841	969,455	377,388	1,346,843	542,764	109,401	652,165
1842	844,725	301,034	1,145,759	415,565	170,340	585,905
1843	1,089,386	347,764	1,437,150	463,061	272,682	735,743
1844	1,112,024	471,470	1,583,494	655,954	257,279	913,233
1845	859,627	558,696	1,418,323	603,286	328,564	931,850
1846	740,396	406,696	1,147,092	620,656	262,238	882,894
1847	681,167	370,922	1,052,089	542,857	268,708	811,565
1848	1,085,732	377,929	1,463,661	536,400	309,371	845,771
1849	1,352,334	454,339	1,806,673	636,938	424,955	1,061,893
1850	1,240,766	582,152	1,822,918	600,992	447,643	1,048,635
1851	818,676	375,508	1,194,184	664,580	628,831	1,293,411
1852	949,907	458,807	1,408,714	537,132	531,024	1,068,156
1853	1,294,827	607,650	1,902,477	806,396	412,374	1,218,770

B.

MATERIALS FOR PAPER-MAKING.

The deficient supply of and an increasing price for, the materials for making paper, with the prospect of a still greater consumption, having for some time excited the attention of manufacturers and of the public, the Author has, like others, been requested to state what probable sources of supply were open to the manufacturer.

In histories of the manufacture of paper, the Chinese are generally acknowledged to have been the first to have made paper from pulp. The Egyptian paper, or Papyrus, was made by gumming slices of vegetable tissue together under pressure. So what is called Rice paper consists only of thin slices of cellular tissue of a little-known plant. The Arabs are supposed to have learnt the art in the eighth century from the Chinese, but much more probably from the Hindoos, as they translated many of their works and adopted much of their science. (*v.* the Author's 'Essay on the Antiquity of Hindoo Medicine.') The Arabs are further said to have introduced the art of paper-making into Spain in the ninth or tenth century. Paper was first made at Nuremburg in the year 1390, but in England not till the year 1450.

There is no doubt that the manufacture of paper from pulp has been known in China from very early times: it is said for at least 2000 years. They employ a vast variety of fibrous substances for this manufacture, and apply paper to a variety of uses little thought of in other countries. They make up an infinite variety of kinds, from the coarse, heavy, half-inch-thick touch-paper, for retaining a slow, enduring fire, to the beautiful so-called India paper suited for our finest proof engravings. In the tea-chests there is a lavish use of many thicknesses of paper. If a hut or boat is leaky over-head, the bed is protected by a large sheet of oiled paper. If a shopkeeper wants to tie up a parcel, he seizes a strip of tough paper, and by rolling it on his thigh at once converts it into a strong pack-thread. Even patches on a torn sail are at times made of tough paper,

as we have been informed by an intelligent visitor to that country. It is the cheapest of materials in daily use, and the manufacturers are very numerous. They make it of Rice straw, of young Bamboos, of different fibres, and of the bark of the Paper Mulberry. Showing that the inventors of the art make use chiefly of unwoven fibres, though they also employ refuse cloth and silk, &c.

So India, though hardly ever mentioned in histories of the art, is a country where considerable quantities of paper are made, though not generally of a good quality; their thick ink does not so much require this. There are small manufactories of it in most parts of the country, and to a considerable extent at such places as Ahmedabad, Lucnow, &c. As we have seen in the foregoing pages, a great variety of fibres, such as Jute, Sunn, Ambaree, Moorva, and old sacks and fishing nets are also employed, though in general the natives prefer the Sunn fibre. The Himalayan process with the inner bark of the Paper plant very much resembles that of the Chinese with the Paper Mulberry. It is probable therefore that the art was introduced from that country into the Himalayas, and not from India. Into which it was probably carried at a very early period, and from thence learnt by the Arabs; who would hardly else have used Cotton, an Indian product. The Hindoos themselves, as I am informed by Professor Wilson, still used, about the beginning of the Christian era, or as late as the age of the Dramas, the inner bark of the *Bhurja* or Birch (*Betula Bhojputtur*) for writing on. In Southern regions the leaves of the Palmira and of the Talipat are well known to have been long used, as they still are, for writing on with a style. But the manufacture of paper from pulp has long been established in India, and before the Arabs began to make translations from the Sanscrit, at the same time that they did so from Greek writers.

Dr. Buchanan, in his survey of the lower provinces of the Bengal Presidency, has given an account of the manufacture of paper from Pat or Jute (*Corchorus olitorius*) at Dinagepore, and in Behar, &c., from Sunn (*Crotalaria juncea*). It is also so made in other parts of the country, as well as from Hibiscus fibre. And there can be no difficulty in doing so with the numerous fibrous materials which India produces in such vast variety, and which we have already mentioned in so much detail.

It is objected that pulp from unwoven fibres does not draw through the present machinery so well as that made from rags. A modification of machinery would remedy this. But it is probable that if the half-stuff were made from the clean bark without first separating the fibres, these might probably be so entangled as to answer some of the effects of the weaving. As rags have to be collected, cut, cleaned, and bleached, the Author cannot but think that the primitive method of using the bark of suitable plants and trees will afford both a cheap and an effectual substitute. Besides which the supply of rags must come short of the increasing demands of the world for paper.

Bengal and the east coast of the Bay of Bengal, as well as the Malabar or west coast of India, are the places where the growth of suitable materials, from the warmth and moisture of the climate, is most abundant, and the conveyance by sea is at the same time most easy. In Arracan the price of Bast, even made into rope, is one rupee per maund. (*v.* p. 238.)

As the greatest natural riches would be of little value unless they could be made available at reasonable rates, the Author consulted Mr. Henley, who is practically well acquainted with the usages of the people and the rates at which their services may be obtained. He has favoured the Author with letters on the subject, and has also published a paper in the 'Journal of the Society of Arts' for 1854, p. 486. He there observes: "It is to India we must look for extensive and cheap supplies, for it is there alone we find the necessary conditions of very low-priced and intelligent labour, with an abundance of elementary suitable materials; and that as articles of small price are particularly sensitive of charges, such as of freight, &c., it is only by large operations that an average of low charges can be accomplished."

Suitable materials being abundant, he proposes that it should be reduced to the state of half-stuff by the aid of the Dhenkee, already mentioned at p. 86, as an instrument to be found in almost every house in Bengal, being used for husking rice, the preparation of tobacco, of drugs, dye-stuffs, and brick-dust.

The charges to London, including freight, insurance, exchange, dock, and in fact all commercial charges, he estimates at £7 per ton weight. It is necessary to specify the ton weight, as the ton for freight would be only 16 cwt. The cost of

half-stuff, as already quoted at p. 86, of different qualities, would be about £4 4*s.* and £7; as contracts could be made at the rate of Rs. 1 8, or 3*s.*, to Rs. 2 8, or 5*s.*, per maund of 82 lb., deliverable at any central depôt within a radius of twenty miles. The expenses of agency, conveyance, &c., in India, about £2 2*s.*, and of freight to London, and other expenses, about £7; so that the lower quality might be imported here for £13 4*s.*, and the better quality, equal to linen rags, for £16 5*s.*

"It would be necessary to have recourse to the usual Indian system of making cash advances to contractors ere a pound of the goods had any existence. Such, however, is the universal system of the country. The natives, it must be admitted, are wonderfully faithful on the whole in adhering to their bargains."

"The method proposes to avail itself at once of their own simple arts; it brings the question as nearly as possible to the state of a domestic industry, ever the most economical in such countries; it reduces to the lowest point the charge of collecting from extensive districts the various elementary matters which might present themselves."

Dr. L. Playfair, in a communication on this subject, observes, that the price mentioned in the Treasury letter, of 2*d.* to 2½*d.* per lb. for a partially prepared pulp, is by most makers considered to be too high, and that materials should be looked for at the price of 1*d.* to 1½*d.* per lb. for roughly prepared pulp; but if bleached, or in as far an advanced state with regard to colour and texture as cotton or linen rag, then 2½*d.* to 4*d.* per lb. might be obtained. "The quantity of any promising material sent home for experiment should not be less than half a ton in weight," though in some cases a cwt. will give satisfactory results.

To serve as points of comparison we may here insert a notice of the ordinary and the increased prices of rags from the 'Journal of the Society of Arts.'

A.	26*s.*	32*s.* to 34*s.* per cwt.
B.	16*s.*	20*s.* „
C.	11*s.* 6*d.*	15*s.* „
D.	7*s.*	10*s.* „

Bleaching salts, alkali, alum, hide pieces for size, are other articles required; and all have increased in price.

Of the quantity of material that is required, we may form

some idea from the fact that 177,633,009 lb. weight of paper were produced in 1853 in Great Britain.

C.

The Author having been requested to give his opinion respecting an increased supply of Materials for Paper-making, did so in the Report which is subjoined to the following—

Copy of Correspondence between the Departments of the Treasury and Board of Trade, in regard to the increasing Scarcity of the Materials for the Fabrication of Paper.

(Printed by order of the House of Commons.)

Treasury Chambers, February 13, 1854.

Sir,—I am commanded by the Lords Commissioners of Her Majesty's Treasury to acquaint you that it has been represented to their Lordships that great and increasing scarcity has been felt of late in obtaining supplies of the raw material of paper, consisting not only of rags, but also largely of the refuse of cotton- and flax-mills. It is stated that within the last ten years the prices of these articles have greatly advanced, that rags can be imported from only a few parts of Europe, and that as there is no regular and open market for rags and the other materials used in the manufacture of paper, increased demand and high price do not call forth increased supply, as in other articles of commerce from abroad.

With a view to diminish the inconvenience thus felt, it has been suggested to my Lords, that Her Majesty's Consuls abroad might be instructed to obtain information, and procure samples of vegetable fibre in their respective localities, applicable to the manufacture of paper. In doing this, it would have to be borne in mind that the great essential of such an article must be its cheapness, to cover the high freights now prevailing, and which, it may be anticipated, will prevail for some time. As regards the nature of the articles, my Lords are informed, that with the exception of jute canvas and gunny bagging, every description of vegetable fibre is now capable of being bleached, and is available for fine papers. Fibrous reeds and rushes, the inner bark of many trees, and several kinds of vegetable fibre in warm or tropical countries, are substances likely to be of service, especially where they could be imported

as dunnage among the cargo, or in compressed bales, but quantity and steadiness of supply are essential. As regards price, my Lords understand that if the article could be laid down so as to cost from 2*d.* to 2½*d.* per lb. when purified and bleached, without reckoning the cost of preparation, it would be sufficiently low to answer the purpose in view.

My Lords request that you will bring this subject under the consideration of the Lords of the Committee of Privy Council for Trade, and move their Lordships, if they concur in the expediency of the inquiry here suggested, to communicate on the subject with the Foreign Office, in order that the necessary circular instructions may be issued to Her Majesty's Consuls abroad, to carry out the objects adverted to.

I am, &c.,

James Booth, Esq., &c. (Signed) JAMES WILSON.

Board of Trade, April 19, 1854.

Sir,—I am directed by the Lords of the Committee of Privy Council for Trade to forward to you a copy of a communication received from the Lords of Her Majesty's Treasury, and to request that the Commissioners for the Affairs of India may bring it under the notice of the Chairman and Directors of the Honorable East India Company, with a view to obtaining the opinion of Dr. Forbes Royle, the officer in charge of the scientific correspondence relating to the vegetable productions of India.

I have, &c.,

Sir T. N. Redington, &c. (Signed) J. EMERSON TENNENT.

India Board, May 15, 1854.

Sir,—In reply to your letter of the 19th ult., enclosing a letter addressed to the Board of Trade by the Treasury respecting the procuration of raw material for the manufacture of paper, I am directed by the Commissioners for the Affairs of India to transmit to you a report by Dr. Royle, received from the East India House upon this subject, in compliance with the object expressed in your letter.

I have, &c.,

Sir J. E. Tennent, &c. (Signed) T. N. REDINGTON.

Memorandum on Materials for the manufacture of Paper procurable from India.

In reply to the reference from the Lords of the Committee of Privy Council for Trade, requiring my opinion respecting increased supplies of raw material for Paper-making, I beg to be allowed to observe that it is a subject on which I have of late been frequently consulted, and have communicated much of the following information.[1]

Paper, it is well known, is in Europe made chiefly from linen or cotton rags, but also from the refuse and sweepings of cotton- and flax-mills, as also of the coverings of our cotton bales and of worn-out ropes. But paper is also made from the stems and leaves of many grasses, as from rice straw, and from the bamboo by the Chinese, and of late from common straw in this country, and even from wood shavings. The fibrous part of many Lily- and Aloe-leaved plants have been converted into excellent paper in India, where the fibres of Tiliaceous, Malvaceous, and Leguminous plants are employed for the same purpose: as in the Himalayas, one of the Lace-bark tribe (p. 310) is similarly employed, and in China one of the Mulberry tribe, and the Nettle in Holland. I mention these various sources, because plants belonging to the same families as the above abound in India and other warm countries, and are capable of yielding a very abundant and never-failing supply of sufficiently cheap and very excellent material for paper-making of all kinds. Some may be used without any further process of bleaching, but all are capable of having any colour they may possess destroyed by chemical means. I would not except the jute canvas or gunny bagging, because I have seen specimens of jute of a beautiful silky white, both plain and manufactured into fabrics for furniture, &c., &c., as shown by the late Colonel Calvert at the East India House.

As the Chinese make paper of rice straw, and of the young shoots of the bamboo, while the Hindoos make ropes of different grasses (such as *Saccharum Munja* and *S. Sara*) strong enough for their Persian wheels as well as for towing lines, it is evident that these and probably many others contain a suffi-

[1] Some of it was published about the same time in the 'Gardener's Chronicle.'

ciency of fibrous material for paper-making (p. 30). The cultivated Cereals cannot well be turned to much account, for their straw forms the chief food for cattle; but as the country abounds with grass jungles, which are in the autumn of every year burnt down in order that the young blades may spring up and afford pasturage for cattle, it is evident that there are many situations where a sufficiency might be cut down before it has become perfectly dried up, and converted into half-stuff for paper-makers [as might also the refuse of the Sugar-cane].

Of the Sedges (p. 33) also some are, in India, employed for making ropes, as the Bhabhur or *Eriophorum cannabinum*, for making rope bridges for crossing some of the hill torrents. The Papyrus we know was used by the Egyptians for making their paper, but this was by cutting the material into thin slices and making these adhere together under pressure. But others of the genus, as the *Cyperus tegetum*, is used in India for mat-making. As these plants as well as Rushes grow together in large quantities, it would be quite possible in many places to turn them to profitable account.

Many parts of the world abound in the Lily- and Aloe-leaved plants which have been alluded to above, and of which the leaves contain much easily separable fibrous materials. These belong to the genera Agave, Aloe, Yucca, Sanseviera, Bromelia, and others, all of which abound in white-coloured fibres, applicable to various useful purposes, and of which the tow might be used for paper-making, and considerable supplies obtained. Paper used to be made from the Sanseviera in Trichinopoly, and some has been made at Madras, of the unbleached Agave alone, and also mixed with old gunny bags. (pp. 37, 41, 51, 57.) [Recently, also, from the leaf of the Pandanus, p. 35.]

[The Arrow-root (p. 60) and Ginger tribes (p. 61), containing such plants as those yielding the fecula called Arrow-root, Tous les Mois, Tikkur, &c., and Ginger, Turmeric, Cardamoms, &c., all have annual stems and leaves, which are the refuse of the present culture, and might yield an abundant supply of half-stuff.]

Among cultivated plants there is probably nothing so well calculated to yield a large supply of material fit for making paper of almost every quality as the Plantain (*Musa paradisiaca*) (*v.* p. 61), so extensively cultivated in all tropical countries on

account of its fruit, and of which the fibre-yielding stems are applied to no useful purpose. The plant, as every one acquainted with tropical countries knows, is common near the poorest huts and in the largest gardens, and is considered to yield by far the largest quantity of nutritious matter. Its fruit in many places supplying the place of bread, and in composition and nutritious value approaching most nearly to the potato, may, if produced in too large a quantity, be preserved in the same way as figs, or the meal may be separated, as it resembles rice most nearly in composition. Each rootstock throws up from six to eight stems, each of which must be yearly cut down, and will yield from three to four pounds of the fibre fit for textile fabrics, for rope-making, or for the manufacture of paper. As the fruit already pays the expenses of the culture, this fibre could be afforded at a cheap rate, as from the nature of the plant, consisting almost only of water and fibre, the latter might easily be separated. One planter calculates that it could be afforded for £9 13*s*. 4*d*. per ton. Some very useful and tough kinds of paper have been made in India from the fibres of the Plantain, and some of finer quality from the same material both in France and in this country.[1]

All the plants which have been already mentioned are devoid of true bark, and are called Endogenous in structure. Simple pressure between rollers, and washing, would appear to be sufficient for the separation of the fibres of most of them. But the following families of plants are all possessed of true bark which requires to be stripped off, usually after the stems have been steeped in water, before their respective fibres can be separated from the rest of the vegetable matter.

The Flax plant (p. 133) abounds in fibre, but this is too valuable to be converted into paper. India, however, grows immense quantities of the plant, on account of its seed (linseed) which is both consumed in the country and exported in enormous quantities. But nowhere is the fibre turned to any account. This is no doubt owing to the climate not favouring the formation of soft and flexible fibre; but the short fibre which is formed, and might be easily separated, would be valu-

[1] Specimens of these and of the other Papers made in India, were sent with the original communication, and were afterwards shown at some Scientific Meetings.

able for paper-making, and might add to the agriculturists' profits without much additional outlay.

So some Malvaceous (p. 253) plants are cultivated on account of their fruits being used as articles of diet, as Okhro (p. 259) (*Hibiscus esculentus*), in the West Indies and in the United States. The *Ram-turai* of India is closely allied to it, and is cultivated for the same purpose. Both plants abound in fine flexible fibre, which is not, but might be easily separated, and afford a considerable supply, especially if the cultivation was extended in the neighbourhood of towns. Paper is made from a species of *Hibiscus* in Japan, and *H. Sabdariffa* is cultivated in India on account of its jelly-yielding calices. Numerous other species of Hibiscus, of Sida, and of other genera of this family, abound in warm climates; several are cultivated in different countries, as *Hibiscus cannabinus* in India, and *Sida titiæfolia* in China: more might be so. They grow quickly, and to a large size, and abound in fibrous material of a fine, soft, flexible quality: on which account they might be cultivated with profit, and the tow be useful to the paper-maker. (p. 200.) [The stems of Cotton plants would also yield a supply.]

The Tiliaceæ (p. 232) are likewise remarkable for the abundance and fine quality of fibre which many of them contain. *Tilia europea* produces the enormous quantities of bast exported from Russia. *Corchorus olitorius* and *C. capsularis*, the leaves of both of which are used as a vegetable, yield the large supply of Jute (p. 239) imported into this country, as well as the gunny cloth and bags exported even to America. Several species of Grewia yield edible fruit, on which account they are cultivated. Others abound in the jungles, and most would yield a valuable fibre, as some of them already do, for commercial purposes. [The Indian Basts, p. 239, are cheap, and abound in fibre.]

Some of the Leguminosæ also abound in valuable fibre. *Crotalaria juncea* yields the common *Sunn* of India. *Sesbania aculeata* or *cannabina* yields the *Dhanchi* of Bengal; while *Bauhinia racemosa* is used for making rope bridges in the Himalayas. The fibre of *Parkinsonia aculeata* was sent to the Exhibition in 1851, expressly as being fitted for paper-making: though colourless, it wants strength. (pp. 270—298.) [Some paper is made from gunny bags in India.]

Several plants produce large quantities of a silky cotton-like substance, not applied to any use, such as the Silk Cotton tree (p. 264), the Mudar of India (p. 306), several species of Saccharum (p. 32), &c., which might be collected where labour is cheap, and would no doubt be well fitted for conversion into pulp for paper. [So also the Dogbanes and Asclepiads, pp. 302-3.]

[The Nepal Paper plant (*Daphne cannabina*) has been mentioned above, and is treated of at p. 311.]

Among the Nettle, the Mulberry, and Bread-fruit tribes of plants (p. 340), there are many which seem well calculated to yield material for paper-making. The Chinese we know employ the inner bark of *Morus*, now *Broussonetia papyrifera* (p. 341). This, no doubt, produces some of the Chinese paper, which is remarkable for toughness. I believe that the refuse cuttings of the bush cultivation of the Mulberry in Bengal (p. 343) might be turned to profitable account. The barks of many stinging (*Urtica*), and of stingless (*Boehmeria*) Nettles (p. 344), abound in fibres remarkable for strength; the tow of these might be converted into paper-stuff if not required for mixing with wool (p. 358) [as might also the bark cloths, p. 342].

The weeds of tropical countries which grow in such luxuriance, and among which are species of Sida (p. 262), of Grewia, of Corchorus, of Triumfetta (p. 233), and of many other genera, might all yield an abundance of fibrous material, if the refuse of the above cultivated plants were found not to be sufficient. Some simple machinery for separating the fibre would greatly facilitate operations, while the expenses of freight might be diminished by compression, or, as suggested, by packing the material as dunnage. The cheapness of labour, as of everything else in many of these countries, would enable material for paper-making to be brought here in great abundance and at a sufficiently cheap rate, if ordinary pains were taken by the consumers in Europe, to encourage the planter or colonists of a distant region.

I have, &c.,

(Signed) J. Forbes Royle.

East India House, May 3, 1854.

INDEX.

PRINTED BY J. E. ADLARD, BARTHOLOMEW CLOSE.

ERRATA.

Page 32, line 38, *for* "Mr. Burns," *read* "Mr. Barns;" so also in pp. 33 and 144.
„ 33, „ 29, *for* "Cyperacæ," *read* "Cyperaceæ."
„ 254, „ 17, *for* "Numajee," *read* "Munjee."
„ 341, „ 9, *for* "ineisa," *read* "incisa."
„ 343, „ 37, *for* "saccadora," *read* "saccidora."
„ 345, „ 8, *for* "Shon," *read* "Shan."
„ 349, „ 12, *for* "tencessime," *read* "tenacissima."
„ 375, „ 4, *after* "Military Stores," *add* "the strength of the large ropes was tried at the Rope-works of Messrs. Mathews, in Bermondsey."

WORKS OF DR. FORBES ROYLE.

THE FIBROUS PLANTS OF INDIA,

Fitted for Cordage, Clothing, and Paper;

With an account of the Cultivation and Preparation of Flax, Hemp, and their Substitutes.

By J. FORBES ROYLE, M.D., F.R.S.,

Formerly Superintendent of the Hon. East India Company's Botanic Garden at Saharunpore, Professor of Materia Medica and Therapeutics in King's College, London, &c., &c.

8vo, price 12*s.*, cloth,

ON THE

CULTURE AND COMMERCE OF COTTON IN INDIA

AND ELSEWHERE,

With an account of the Experiments made by the Hon. East India Company.

By J. FORBES ROYLE, M.D.

1 vol., 8vo, with plates, price 18*s.*, cloth,

"The work is divided into three parts. The first treats of the imports of Cotton into Great Britain—the origin and progress of the Cotton culture in America—culture of Cotton in India—nature and present condition of India Cotton—exports and imports of India Cotton—measures adopted to improve Cotton in India—opinion of spinners, &c. The second part treats of the early history of Cotton—structure of the fibre of Cotton—the commercial varieties of Cotton—genus and species of Cotton, &c., &c. The third part discusses the experimental culture of Cotton in India, and gives a variety of official documents relating to various territories of the Indian empire. The book gives a complete historical summary of the history of Cotton, and induces the hope that Cotton growing in India may by and by render us less dependent on American produce than we have yet been. Dr. Royle has inserted a very curious and elaborate map at the commencement of his volume, illustrative of the prices and supplies of Cotton, from 1806 till 1849. It ought to be studied by commercial men and by our legislators."—*Glasgow Examiner.*

THE PRODUCTIVE RESOURCES OF INDIA.

By J FORBES ROYLE, M D.

Royal 8vo, price 14*s.*, cloth,

"Dr. Royle has brought a large store of knowledge, accumulated from local observation, practical experience, and scientific study, to bear upon the subject, which he has elucidated with much ability."—*Times*

"We hail Mr. Royle's work (which we recommend to the attentive perusal of all those who desire to inform themselves on the many important topics of which it treats) as the harbinger of a better order of things."—*Edinburgh Review.*

"Dr. Royle's 'Essay on the Productive Resources of India' supplies a valuable commentary upon the petition of the East India Company on this subject, and the inquiries of the committees."—*Asiatic Journal.*

"We recommend this book to the notice of the naturalist, the statesman, and the philanthropist."—*Athenæum.*

"A most important and valuable work."—*United Service Gazette.*

MANUAL

OF

MATERIA MEDICA AND THERAPEUTICS.

By J. FORBES ROYLE, M.D.

Fcp. 8vo, price 12*s.* 6*d.*,

AN ESSAY ON MEDICAL EDUCATION.

By J. FORBES ROYLE, M D.

Price 2*s.*,

THE ANTIQUITY OF HINDOO MEDICINE.

By J. FORBES ROYLE, M.D.

8vo, 6*s.* 6*d.*, cloth,

"This work of Dr. Royle's exhibits considerable research in ground hitherto almost untrodden, and opens entirely new views on the origin and progress of Medicine during the early ages. It is also particularly acceptable for the accuracy of its details on the geographical distribution of some of our most valuable drugs. We recommend Dr. Royle's learned, yet unpretending, volume, to the notice of all interested in the study of the history of Medicine and the Materia Medica."—*British and Foreign Medical Review.*

"This very curious volume has been already so fully noticed in the different literary and medical journals, that we have only the agreeable duty of recommending it to the notice of our general and medical readers."—*Edinburgh New Philosophical Journal.*

"A work of immense research and erudition."—*Medico-Chirurgical Review.*

ILLUSTRATIONS OF THE

BOTANY AND OTHER BRANCHES

OF THE

NATURAL HISTORY OF THE HIMALAYAN MOUNTAINS,

AND OF

The Flora of Cashmere.

By J. FORBES ROYLE, M.D.

2 vols., impl. 4to, with one hundred coloured plates, published at £11 11*s.*, reduced to £5 5*s.*, cloth, lettered,

"It is not too much to say of this very remarkable work, that it is indispensable to all who would acquire a knowledge of the vegetation, climate, and soil of the north of India."—*Athenæum.*

"This work unquestionably contains a greater amount of valuable practical information upon useful matters than any work yet written upon the foreign possessions of any other European power."—*Dr. Lindley in Botanical Register.*

"This most learned, elaborate, and truly useful work, must sooner or later find its way into all good libraries, public or private, not only in Britain, but in every country."—*Loudon's Gardener's Magazine.*

"We feel justified in pronouncing this to be by far the most valuable practical work which has yet been published with reference to the vegetable resources of the British territories in Asia, and the most calculated to show how the vegetable kingdom is capable of extending our revenues in the most valuable part of our Colonial possessions."—*Asiatic Journal.*

"No one who would be acquainted either with the ornamental, the cultural, or the medical qualities of the Indian Flora, can dispense with the possession of Dr. Royle's highly valuable labours."—*Journal of the Asiatic Society of Bengal.*

"A more valuable contribution has rarely been made to the science of Natural History, than by the splendid work of Mr. J. Forbes Royle."—*Times*

"Replete with varied and important facts and inferences, no one can peruse this work without advantage and great satisfaction. The plates are very beautifully executed and coloured."—*London Medical Gazette.*

"We highly recommend this publication to our readers, containing, as it does, not only an ample store of information respecting the natural productions of the Himalayas, but also the best general view of the physical features of those magnificent mountains."—*London and Edinburgh Philosophical Magazine and Journal of Science.*

"The text is rich in original details, as well as in elaborate scientific researches; and everything bearing on the Materia Medica, whether as acknowledged in the schools, or as existing only in the written dispensatories of the natives of the country, is studiously noticed."—*British and Foreign Medical Review.*

February 1855.

A CATALOGUE

OF

NEW AND STANDARD WORKS,

PUBLISHED BY

SMITH, ELDER AND CO.,

65, CORNHILL, LONDON.

Works in the Press.

I.

MILITARY FORCES AND INSTITUTIONS OF GREAT BRITAIN. Their Constitution, Administration, and Government, Military and Civil. By H. BYERLEY THOMSON, Esq., Barrister-at-Law, Author of "The Laws of War Affecting Commerce and Shipping." 8vo. Price 15*s*. cloth. (*Now ready.*)

II.

THE FIBROUS PLANTS OF INDIA FITTED FOR CORDAGE, CLOTHING, AND PAPER. By DR. J. FORBES ROYLE. 8vo. Price 12*s*. cloth. (*Now ready.*)

III.

GRACE LEE. By JULIA KAVANAGH, Author of "Women of Christianity," "Nathalie," "Daisy Burns," &c. Three Volumes, post 8vo. (*Now ready.*)

IV.

THORNEY HALL: A Story of an Old Family. By HOLME LEE, Author of "Maude Talbot." Small post 8vo, price 6*s*. (*Now ready.*)

V.

SERMONS. By the late Rev. FRED. W. ROBERTSON, A.M., Incumbent of Trinity Chapel, Brighton. Post 8vo. (*Just ready.*)

VI.

TRAVELS AND ADVENTURES IN ASSAM. By CAPT. JOHN BUTLER. One Volume 8vo, with Plates. (*Just ready.*)

VII.

PHYSICAL GEOGRAPHY OF THE HIMALAYA. By CAPT. RICHARD STRACHEY, Bengal Engineers. 8vo, with Numerous Illustrations.

New Works.

VII.

THE LAWS OF WAR. AFFECTING COMMERCE AND SHIPPING. By H. BYERLEY THOMSON, Esq., B.A., Barrister at Law. Second Edition, greatly enlarged. 8vo. Price 4*s.* 6*d.*, boards.

"Mr. Thomson treats of the immediate effects of war; of enemies and hostile property; of prizes and privateers; of licenses, ransom, recapture, and salvage; of neutrality, contraband of war, blockade, right of search, armed neutralities, &c., &c. Such books as this are essentially necessary to tell us what the laws of nations were, and what they are likely to become; and merchants will find Mr. Thomson's book a great help. It is a well-timed and appropriate publication."—*Economist.*

VIII.

A MANUAL OF PRACTICAL THERAPEUTICS; Considered chiefly with reference to Articles of the Materia Medica. By EDWARD JOHN WARING, M.R.C.S., H.E.I.C.S. One thick Volume, Foolscap 8vo. (755 pp.) Price 12*s.* 6*d.* cloth.

"Mr. Waring's Manual presents in a concise form the information which the medical man requires in order to guide him in prescribing the most suitable remedies; and it will, we think, obtain favour with the medical public, for the extent and usefulness of its information, as well as from its filling a gap which has been felt by many."—*Lancet.*

"A very useful work, giving, as briefly as possible, the opinions of the standard English writers, on the Therapeutic employment of each article of the 'Materia Medica.'"—*Medico-Chirurgical Review.*

IX.

MODERN GERMAN MUSIC. By HENRY F. CHORLEY, Esq. Two Volumes, post 8vo. Price 21*s.*

"Mr. Chorley is a tourist with a purpose; he travels as a pilgrim to the shrines and dwelling places of the art which he loves, and on which he here expatiates. He takes with him a power of appreciating all that is noble in art and worthy in the artist: but his Hero is Mendelssohn, with whom he lived on terms of intimate knowledge."—*Athenæum.*

X.

DOINE; or, the National Songs and Legends of Roumania. Translated from the Originals, with an Introduction, and Specimens of the Music. By E. C. GRENVILLE MURRAY, Esq. One Volume, crown 8vo. Price 7*s.* 6*d.* cloth, or 9*s.* cloth gilt.

"The Doine are national songs of Roumania, which have been collected in Wallachia, and are now offered to the public in an elegant English dress. They are extremely pretty and characteristic; and no one can glance at them without feeling a deep interest in a people who can feel so tenderly and nobly. The volume is tastefully executed."—*Athenæum.*

XI.

POEMS: By WILLIAM BELL SCOTT. Fcap. 8vo, with Three Plates. Price 5*s.* cloth.

"Mr. Scott has poetical feeling, keen observation, deep thought, and a command of language."—*Spectator.*

"Poems by a Painter, stamped with the impress of a masculine and vigorous intellect."—*Guardian.*

New Works.

XII.

BALDER. A Poem. By the Author of "The Roman." Second Edition, with Preface by the Author. One Volume, crown 8vo, price 7*s.* 6*d.* cloth.

"Balder is the type of intellect enwrapt in itself, and losing sight of all other things either in earth or heaven; he is aspiration without labour, philosophy without faith. We can believe the book to be written as a warning of the terrible issues to which ungoverned ambition and a selfish pride can conduct the most brilliant qualities which are merely intellectual. Genius is unmistakeably present in every page of this strange book."—*Fraser's Magazine.*

XIII.

THE INSURRECTION IN CHINA. By Dr. YVAN and M. CALLERY. With a Supplementary Account of the Most Recent Events. By John Oxenford. *Third Edition, Enlarged.* Post 8vo, with Chinese Map and Portrait, 7*s.* 6*d.*, cloth.

"A curious book, giving a lucid account of the origin and progress of the civil war now raging in China, bringing it down to the present day."—*Blackwood's Magazine.*

"The book can scarcely fail to find a curious and interested public."—*Athenæum.*

"An interesting publication, full of curious and valuable matter."—*Examiner.*

XIV.

THE CROSS AND THE DRAGON; or, The Fortunes of Christianity in China; with notices of the Secret Societies of the Chinese. By J. Kesson. One Volume, post 8vo, price 6*s.* cloth.

"A painstaking and conscientious book."—*Spectator.*

"A very readable outline of the subject."—*Athenæum.*

XV.

MEMORANDUMS MADE IN IRELAND. By Sir John Forbes, M.D., Author of "The Physician's Holiday." Two Vols., Post 8vo, with Illustrations, price 1*l.* 1*s.* cloth.

"The book is excellent, and, like all the writings of its author, points to a good purpose. It is honest, thoughtful, liberal, and kindly. By readers of all grades Dr. Forbes's volumes will be read with pleasure."—*Examiner.*

"A complete handbook of the sister island."—*New Quarterly Review.*

XVI.

JUVENILE DELINQUENCY. Two Essays which obtained the Prizes offered by Lady Noel Byron. By Micaiah Hill and C. F. Cornwallis. One Volume, post 8vo, price 6*s.* cloth.

"This volume is the best existing manual of the subject. The first Essay may be said to compass the whole round of the subject, with its statistics presenting a manual of the standing facts and arguments. The other is remarkable for a vigorous portraiture of the general causes of juvenile delinquency; and it has a novelty and force which throw a new light upon the subject."—*Spectator.*

Works of Mr. Ruskin.

I.

LECTURES ON ARCHITECTURE AND PAINTING. With 15 Plates. Crown 8vo, price 8*s.* 6*d.* cloth.

"Mr. Ruskin's Lectures are eloquent, graphic, and impassioned; exposing and ridiculing some of the vices of our present system of building, and exciting his hearers by strong motives of duty and pleasure to attend to architecture. His style is terse, vigorous, and sparkling, and his book is both animated and attractive."—*Economist.*

"We conceive it to be impossible that any intelligent persons could listen to the lectures, however they might differ from the judgments asserted and from the general propositions laid down, without an elevating influence and an aroused enthusiasm."—*Spectator.*

II.

THE STONES OF VENICE. Now complete, in Three Volumes imperial 8vo, with 53 Steel Plates, and numerous Woodcuts. Price 5*l.* 15*s.* 6*d.* cloth.

Each Volume may be had separately, viz.—

VOL. I.—THE FOUNDATIONS, with 21 Plates. Price 2*l.* 2*s.*
VOL. II.—THE SEA STORIES, with 20 Plates. Price 2*l.* 2*s.*
VOL. III.—THE FALL, with 12 Plates. Price 1*l.* 11*s.* 6*d.*

"This book is one which, perhaps, no other man could have written, and one for which the world ought to be and will be thankful. It is in the highest degree eloquent, acute, stimulating to thought, and fertile in suggestion. It shows a power of practical criticism which, when fixed on a definite object, nothing absurd or evil can withstand; and a power of appreciation which has restored treasures of beauty to mankind. It will, we are convinced, elevate taste and intellect, raise the tone of moral feeling, kindle benevolence towards men, and increase the love and fear of God."—*Times.*

"The 'Stones of Venice' is the production of an earnest, religious, progressive, and informed mind. The author of this essay on architecture has condensed into it a poetic apprehension, the fruit of awe of God and delight in nature; a knowledge, love, and just estimate of art; a holding fast to fact and repudiation of hearsay; an historic breadth, and a fearless challenge of existing social problems; whose union we know not where to find paralleled."—*Spectator.*

III.

EXAMPLES OF THE ARCHITECTURE OF VENICE, Selected and Drawn to Measurement from the Edifices, In Parts of Folio Imperial size, each containing Five Plates, and a short Explanatory Text, price 1*l.* 1*s.* each. Parts One to Three are Published. Fifty India Proofs only are taken on Atlas Folio, price 2*l.* 2*s.* each Part.

IV.

ON THE NATURE OF GOTHIC ARCHITECTURE, AND THE TRUE FUNCTIONS OF THE WORKMAN IN ART. (Reprinted from Chapter 6, Vol. 2, of "The Stones of Venice.") Price 6*d.* stitched.

Works of Mr. Ruskin.

V.

MODERN PAINTERS. Imperial 8vo. Vol. I. *Fifth Edition*, 18*s.* cloth. Vol. II. *Third Edition*, 10*s.* 6*d.* cloth.

"Mr. Ruskin's work will send the painter more than ever to the study of nature; will train men who have always been delighted spectators of nature, to be also attentive observers. Our critics will learn to admire, and mere admirers will learn how to criticise: thus a public will be educated."—*Blackwood's Magazine.*

"A very extraordinary and delightful book, full of truth and goodness, of power and beauty."—*North British Review.*

"One of the most remarkable works on art which has appeared in our time."—*Edinburgh Review.*

*** The Third Volume is in preparation.

VI.

THE SEVEN LAMPS OF ARCHITECTURE. With Fourteen Etchings by the Author. Imp. 8vo, 1*l.* 1*s.* cloth.

"By the 'Seven Lamps of Architecture,' we understand Mr. Ruskin to mean the seven fundamental and cardinal laws, the observance of and obedience to which are indispensable to the architect who would deserve the name. The politician, the moralist, the divine, will find in it ample store of instructive matter, as well as the artist."—*Examiner.*

VII.

THE OPENING OF THE CRYSTAL PALACE: Considered in some of its relations to the Prospects of Art. 8vo. Price 1*s.* sewed.

"An earnest and eloquent appeal for the preservation of the ancient monuments of Gothic architecture."—*English Churchman.*

VIII.

PRE-RAPHAELITISM. 8vo., 2*s.* sewed.

"We wish that this pamphlet might be largely read by our art-patrons, and studied by our art-critics. There is much to be collected from it which is very important to remember."—*Guardian.*

IX.

THE KING OF THE GOLDEN RIVER; OR, THE BLACK BROTHERS. With 22 Illustrations by RICHARD DOYLE. 2*s.* 6*d.*

"This little fairy tale is by a master hand. The story has a charming moral, and the writing is so excellent, that it would be hard to say which it will give most pleasure to, the very wise man or the very simple child."—*Examiner.*

X.

NOTES ON THE CONSTRUCTION OF SHEEP-FOLDS. 8vo., 1*s.*

Works of Mr. Thackeray.

I.

THE ROSE AND THE RING; Or, the History of Prince Giglio and Prince Bulbo. By Mr. M. A. TITMARSH. With 58 Cuts drawn by the Author. 3rd Edit. Price 5*s*.

"Let all seekers after the wittiest and most wonderful extravagance—all lovers of uncompromising holiday fun, rejoice over the Christmas book furnished this year by Mr. Thackeray. It is a most humorous and pleasant little book, and illustrated by the author with a profusion of comical pictures, which nobody could have done so well."—*Examiner*.

"We have not met with so good a Fairy Tale since Mr. Ruskin's; that was seriously, this is comically, poetical, with no lack of quiet satire. It is a most sensible piece of nonsense—a thoroughly light-hearted and lively Christmas book for boys and girls, old and young."—*Athenæum*.

"A book of broad fun, with here and there sly strokes of satire. The wisdom that breathes from its pages is the wisdom that sounds in a hearty laugh."—*Spectator*.

II.

LECTURES ON THE ENGLISH HUMOURISTS OF THE 18TH CENTURY. By W. M. THACKERAY, Esq., Author of "Vanity Fair," "The Newcomes," &c. Second Edition. Crown 8vo, price 10*s*. 6*d*., cloth.

"To those who attended the lectures, the book will be a pleasant reminiscence, to others an exciting novelty. The style—clear, idiomatic, forcible, familiar, but never slovenly; the searching strokes of sarcasm or irony; the occasional flashes of generous scorn; the touches of pathos, pity, and tenderness; the morality tempered but never weakened by experience and sympathy; the felicitous phrases, the striking anecdotes, the passages of wise, practical reflection; all these lose much less than we could have expected from the absence of the voice, manner, and look of the lecturer."—*Spectator*.

"What fine things the lectures contain! What eloquent and subtle sayings, what wise and earnest writing! How delightful are their turns of humour; with what a touching effect, in the graver passages, the genuine feeling of the man comes out; and how vividly the thoughts are *painted*, as it were, in graphic and characteristic words."—*Examiner*

III.

ESMOND. By W. M. THACKERAY, Esq. Second Edition, 3 Vols., crown 8vo, reduced to 15*s*. cloth.

"Mr. Thackeray has selected for his hero a very noble type of the cavalier softening into the man of the eighteenth century, and for his heroine one of the sweetest women that ever breathed from canvas or from book, since Raffaelle painted and Shakepeare wrote. The style is manly, clear, terse, and vigorous, reflecting every mood—pathetic, grave, or sarcastic—of the writer."—*Spectator*.

"In quiet richness, 'Esmond' mainly resembles the old writers; as it does also in weight of thought, sincerity of purpose, and poetry of the heart and brain."—*Fraser's Magazine*.

IV.

THE KICKLEBURYS ON THE RHINE. By Mr. M. A. TITMARSH. With 15 Cuts. Third Edition. Price 5*s*. plain, and 7*s*. 6*d*. coloured.

A PORTRAIT OF W. M. THACKERAY, Esq. Engraved by Francis Holl, from a Drawing by Samuel Laurence. India Proofs, 2*l*. 2*s*.; Prints, 1*l*. 1*s*.

Works of Currer Bell.

I.

VILLETTE. By CURRER BELL, Author of "Jane Eyre," "Shirley," &c. In Three Volumes, post 8vo, reduced to 15*s*. cloth.

"This book would have made Currer Bell famous had she not been already. It retrieves all the ground she lost in 'Shirley,' and it will engage a wider circle of readers than 'Jane Eyre,' for it has all the best qualities of that remarkable book. There is throughout a charm of freshness which is infinitely delightful: freshness in observation, freshness in feeling, freshness in expression."—*Literary Gazette.*

"This novel amply sustains the fame of the author of 'Jane Eyre' and 'Shirley' as an original and powerful writer. 'Villette' is a most admirably written novel, everywhere original, everywhere shrewd, and at heart everywhere kindly."—*Examiner.*

"The tale is one of the affections, and remarkable as a picture of manners. A burning heart glows throughout it, and one brilliantly distinct character keeps it alive."—*Athenæum.*

II.

SHIRLEY; a Tale. By CURRER BELL. A new Edition. Crown 8vo, 6*s*. cloth.

"The peculiar power which was so greatly admired in 'Jane Eyre' is not absent from this book. It possesses deep interest, and an irresistible grasp of reality. There is a vividness and distinctness of conception in it quite marvellous. The power of graphic delineation and expression is intense. There are scenes which, for strength and delicacy of emotion, are not transcended in the range of English fiction."—*Examiner.*

"'Shirley' is an admirable book; genuine English in the independence and uprightness of the tone of thought, in the purity of heart and feeling which pervade it, in the masculine vigour of its conception of character."—*Morning Chronicle.*

"'Shirley' is very clever. The faculty of graphic description, strong imagination, fervid and masculine diction, analytic skill, all are visible. Gems of rare thought and glorious passion shine here and there throughout the volumes."—*Times.*

III.

JANE EYRE: an Autobiography. By CURRER BELL. Fourth Edition. Crown 8vo, 6*s*. cloth.

"'Jane Eyre' is a remarkable production. Freshness and originality, truth and passion, singular felicity in the description of natural scenery, and in the analyzation of human thought, enable this tale to stand boldly out from the mass, and to assume its own place in the bright field of romantic literature. We could not but be struck with the raciness and ability of the work, by the independent sway of a thoroughly original and unworn pen, by the masculine current of noble thoughts, and the unflinching dissection of the dark yet truthful character."—*Times.*

IV.

WUTHERING HEIGHTS and AGNES GREY. By ELLIS and ACTON BELL. With a Selection of their Literary Remains, and a Biographical Notice of both Authors, by CURRER BELL. Crown 8vo, 6*s*. cloth.

V.

POEMS. By CURRER, ELLIS, and ACTON BELL. 4*s*. cloth.

Mr. Gwynne's Fictions.

I.

NANETTE AND HER LOVERS. By Talbot Gwynne, Author of "The School for Fathers," "Silas Barnstarke," &c. One Vol. crown 8vo, reduced to 5s. cloth.

"We do not remember to have met with so perfect a work of literary art as 'Nanette' for many a long day; or one in which every character is so thoroughly worked out in so short a space, and the interest concentrated with so much effect and truthfulness."—*Britannia.*

"It would be difficult to suppose a more pleasing sketch, or a more interesting heroine than Nanette."—*Sun.*

"In Nanette's simple faith, affectionate nature, and honest, earnest conduct, there is a very striking and pleasing delineation of character."—*Literary Gazette.*

II.

THE LIFE AND DEATH OF SILAS BARNSTARKE. By Talbot Gwynne. One Volume, crown 8vo., reduced to 5s. cloth.

"The gradual growth of the sin of covetousness, its temporary disturbance by the admixture of a softer passion, and the pangs of remorse, are portrayed with high dramatic effect, resembling in some scenes the gigantic majesty of ancient Tragedy."—*John Bull.*

"A story possessing an interest so tenacious that no one who commences it will easily leave the perusal unfinished."—*Standard.*

"A book of high aim and unquestionable power."—*Examiner.*

III.

THE SCHOOL FOR FATHERS; An Old English Story. By T. Gwynne. Crown 8vo. Reduced to 5s. cloth.

"The pleasantest tale we have read for many a day. It is a story of the *Tatler* and *Spectator* days, and is very fitly associated with that time of good English literature by its manly feeling, direct, unaffected manner of writing, and nicely managed, well-turned narrative. The descriptions are excellent; some of the country painting is as fresh as a landscape by Constable, or an idyl by Alfred Tennyson."—*Examiner.*

"'The School for Fathers' is at once highly amusing and deeply interesting—full of that genuine humour which is half pathos—and written with a freshness of feeling and raciness of style which entitle it to be called a tale in the *Vicar of Wakefield* school."—*Britannia.*

IV.

THE SCHOOL FOR DREAMERS. By T. Gwynne. Crown 8vo. Reduced to 5s. cloth.

"The master-limner of the follies of mankind, the author of 'The School for Fathers,' has produced another tale abounding with traits of exquisite humour and sallies of sparkling wit."—*John Bull.*

"A story which inculcates a sound and sensible moral in a manner equally delightful and effective."—*Morning Post.*

"A powerfully and skilfully written book, intended to show the mischief and danger of following imagination instead of judgment in the practical business of life."—*Literary Gazette.*

New Fictions.

I.

COUNTERPARTS; OR, THE CROSS OF LOVE. By the Author of "Charles Auchester." Three Volumes, post 8vo. Reduced to 15s. cloth.

"'Two forms that differ, in order to correspond;' this is the true sense of the word '*Counterpart.*' This text of Coleridge introduces us to the work,—foretelling its depth of purpose and grandeur of design. The feelings of the heart, the acknowledged subject of romance, are here analysed as well as chronicled."—*Sun.*

"There are, in this novel, animated and clever conversations, sparkling descriptions, and a general appreciation of the beautiful in nature and art—especially the sea and music."—*Globe.*

"We can promise the reader an abundantly pleasing and intellectual repast. The incidents of the story are numerous and remarkable, and some of them are distinguished by a rare originality."—*Morning Advertiser.*

"'Counterparts' is superior to 'Charles Auchester' in style and matter."—*Literary Gazette.*

II.

MAUDE TALBOT. By Holme Lee. Three Volumes, post 8vo. Reduced to 15s. cloth.

"A well-wrought and really admirable work of fiction, of a solid and very thoughtful kind. Great skill is shown in the development of character; the persons of the tale are very distinct and real."—*Examiner.*

'Maude Talbot' must take rank as a superior novel; and it will excite and reward attention."—*Athenæum.*

III.

AMBROSE: THE SCULPTOR. An Autobiography of Artist-Life. By Mrs. Robert Cartwright, Author of "Christabelle," &c. Two Vols., Post 8vo.

"This novel is written in a very earnest spirit, and its matter is interesting."—*Examiner.*

"There are well-conceived characters and striking incidents in Mrs. Cartwright's tale."—*Literary Gazette.*

"An impassioned novel."—*Athenæum.*

IV.

THE HEIR OF VALLIS. By William Mathews, Esq. Three Volumes, post 8vo.

"The 'Heir of Vallis' must win for itself an exalted niche among the novels of the year. The writing is clear and forcible, the characters are worked out with power and distinctness, and the plot is elaborated without detracting from its effect."—*Britannia.*

V.

AVILLION, AND OTHER TALES. By the Author of "Olive," "The Head of the Family," &c. Three Volumes, post 8vo.

"'Avillion' is a beautiful and fanciful story; and the rest make agreeable reading. There is not one of them unquickened by true feeling, exquisite taste, and a pure and vivid imagination."—*Examiner.*

"These volumes form altogether as pleasant and fanciful a miscellany as has often been given to the public in these latter days."—*Athenæum.*

Works of Mr. Leigh Hunt.

I.

THE AUTOBIOGRAPHY OF LEIGH HUNT: with Reminiscences of Friends and Contemporaries. 3 vols. post 8vo, 15*s.* cloth.

"These volumes contain a personal recollection of the literature and politics, as well as some of the most remarkable literary men and politicians, of the last fifty years."—*Spectator.*

II.

MEN, WOMEN, AND BOOKS. 2 vols. post 8vo, with Portrait, 10*s.* cloth.

"A book for a parlour-window, for a summer's eve, for a warm fireside, for a half-hour's leisure, for a whole day's luxury; in any and every possible shape a charming companion."—*Westminster Review.*

III.

IMAGINATION AND FANCY. 5*s.* cloth.

"The very essence of the sunniest qualities of the English poets."—*Atlas.*

IV.

WIT AND HUMOUR. 5*s.* cloth.

"A book at once exhilarating and suggestive."—*Athenæum.*

V.

A JAR OF HONEY FROM MOUNT HYBLA. 5*s.*

VI.

TABLE TALK. 3*s.* 6*d.* cloth.

"Precisely the book we would take as a companion on the green lane walk."—*Globe.*

Miss Kavanagh's Female Biographies.

I.

WOMEN OF CHRISTIANITY, EXEMPLARY FOR PIETY AND CHARITY. By Julia Kavanagh. Post 8vo, with Portraits. Price 12*s.* in embossed cloth, gilt edges.

"A more noble and dignified tribute to the virtues of her sex we can scarcely imagine than this work, to which the gifted authoress has brought talents of no ordinary range, and, more than all, a spirit of eminent piety."—*Church of England Quarterly Review.*

II.

WOMAN IN FRANCE DURING THE 18th CENTURY. By Julia Kavanagh. 2 vols. post 8vo, with Eight Portraits. 12*s.* in embossed cloth.

"Miss Kavanagh has undertaken a delicate task, and she has performed it on the whole with discretion and judgment. Her volumes may lie on any drawing-room table without scandal, and may be read by all but her youngest countrywomen without risk."—*Quarterly Review.*

Oriental.

I.

BOYD'S TURKISH INTERPRETER: a Grammar of the Turkish Language. 8vo. Price 12*s*.

II.

CRAWFURD'S GRAMMAR AND DICTIONARY OF THE MALAY LANGUAGE. 2 vols. 8vo, 36*s*. cloth.

III.

BAILLIE'S LAND TAX OF INDIA, According to the Moohummudan Law. 8vo, price 6*s*. cloth.

IV.

IRVING'S THEORY AND PRACTICE OF CASTE. Post 8vo, price 5*s*. cloth.

V.

DR. ROYLE ON THE CULTURE AND COMMERCE OF COTTON IN INDIA. 8vo, 18*s*. cloth.

VI.

KELAART'S PRODROMUS FAUNÆ ZEYLANICÆ. 8vo. Price 10*s*. 6*d*. cloth.

VII.

GINGELL'S CEREMONIAL USAGES OF THE CHINESE. Imperial 8vo, price 10*s*. 6*d*. cloth.

VIII.

SMYTH'S HISTORY OF THE REIGNING FAMILY OF LAHORE. With Portraits. 8vo. Price 12*s*.

IX.

BOMBAY GOVERNMENT RECORDS.

No. 1.—ON THE SUPPLY OF WATER TO BOMBAY. With Maps and Plans. Price 9*s*.
No. 2.—REPORT OF THE SOUTHERN DISTRICT OF THE SURAT COLLECTORATE. Price 6*d*.
No. 3.—ON THE SETTLEMENT OF FORAS LANDS IN BOMBAY. With Maps. Price 4*s*.
No. 4.—REPORT ON THE COLLECTORATE OF SHOLAPORE, and Statistical Report of Cambay. Price 1*s*.

Miscellaneous.

I.

DOUBLEDAY'S TRUE LAW OF POPULATION. Third Edition, 8vo, 10*s*. cloth.

II.

SWAINSON'S ACCOUNT OF AUCKLAND, NEW ZEALAND. Post 8vo, with a View and Coloured Map, 6*s*. cloth.

III.

McCANN'S TWO THOUSAND MILES' RIDE THROUGH THE ARGENTINE PROVINCES, &c. 2 vols. post 8vo, with Illustrations. Price 24s. cloth.

IV.

LAURIE'S SECOND BURMESE WAR. A NARRATIVE OF THE OPERATIONS AT RANGOON. Post 8vo, with Map, Plans, and Views. Price 10*s*. 6*d*. cloth.

V.

LAURIE'S PEGU: A Narrative of the Concluding Operations of the Second Burmese War. One thick Volume, post. 8vo, with numerous Plans and Views. Price 14*s*. cloth.

VI.

TRAITS OF AMERICAN INDIAN LIFE. By a FUR TRADER. Post 8vo, price 7*s*. cloth.

VII.

ROWCROFT'S TALES OF THE COLONIES; OR, THE ADVENTURES OF AN EMIGRANT. Fifth Edition. 6*s*. cloth.

VIII.

DALLAS'S POETICS: AN ESSAY ON POETRY. Crown 8vo. Price 9*s*. cloth.

IX.

GOETHE'S CONVERSATIONS WITH ECKERMANN. Translated by JOHN OXENFORD. 2 vols. post 8vo, 10*s*. cloth.

Religious, and Educational.

STEINMETZ'S NOVITIATE; OR, THE JESUIT IN TRAINING: being a Year among the English Jesuits. *Third Edition*, post 8vo, 5*s*. cloth.

"This is a remarkable book. It describes with a welcome minuteness, the daily nightly, hourly occupations of the Jesuit Novitiates of Stonyhurst, their religious exercises and manners, in private and together; and depicts with considerable acuteness and power, the conflicts of an intelligent, susceptible, honest-purposed spirit, while passing through such a process."—*British Quarterly Review.*

A CONVERTED ATHEIST'S TESTIMONY TO THE TRUTH OF CHRISTIANITY. *Fourth Edition*, fcap. 8vo, 3*s*. cloth.

"A very interesting account of the experience of an intelligent and sincere mind on the subject of religion. We can honestly recommend the book to the notice of our readers."—*Eclectic Review.*

EVANS' (REV. R. W.) RECTORY OF VALEHEAD. *Fourteenth Edition*, 3*s*. cloth.

MORISON'S RELIGIOUS HISTORY OF MAN. *Second Edition*. Fcap. 3*s*. cloth.

ELEMENTARY WORKS on SOCIAL ECONOMY. Uniform in fcap. 8vo, half-bound.

I.—OUTLINES OF SOCIAL ECONOMY. 1*s*. 6*d*.
II.—PROGRESSIVE LESSONS IN SOCIAL SCIENCE. 1*s*. 6*d*.
III.—INTRODUCTION TO THE SOCIAL SCIENCES. 2*s*.
IV.—QUESTIONS AND ANSWERS ON THE ARRANGEMENTS AND RELATIONS OF SOCIAL LIFE. 2*s*. 6*d*.
V.—OUTLINES OF THE UNDERSTANDING. 2*s*.
VI.—WHAT AM I? WHERE AM I? WHAT OUGHT I TO DO? &c. 1*s*. sewed.

"The author of these various manuals of the social sciences has the art of stating clearly the abstruse points of political economy and metaphysics, and making them level to every understanding."—*Economist.*

PARENTS' CABINET OF AMUSEMENT AND INSTRUCTION. In volumes, each complete in itself, 2*s*. 6*d*.

LITTLE STORIES FROM THE PARLOUR PRINTING PRESS. By the Author of the "Parents' Cabinet." 2*s*. cloth.

Works of Practical Information.

I.

LEVI'S COMMERCIAL LAW OF THE WORLD. 2 Vols. Royal 4to. Price 6*l.* cloth.

II.

THE BRITISH OFFICER; HIS POSITION, DUTIES, EMOLUMENTS, AND PRIVILEGES. By J. H. STOCQUELER. 8vo, 15*s.* cloth extra.

III.

HUGHES'S DUTIES OF JUDGE ADVOCATES. Post 8vo, 7*s.*, cloth.

IV.

SIR JOHN HERSCHEL'S ASTRONOMICAL OBSERVATIONS MADE AT THE CAPE OF GOOD HOPE. 4to. with Plates. Price 4*l.* 4*s.*, cloth.

V.

DARWIN'S GEOLOGICAL OBSERVATIONS ON CORAL REEFS, VOLCANIC ISLANDS, AND ON SOUTH AMERICA. 8vo, with Maps, Plates, and Woodcuts, 10*s.* 6*d.* cloth.

VI.

PIDDINGTON'S SAILOR'S HORN-BOOK OF STORMS. Second Edition, 8vo, 10*s.* 6*d.*, with Charts and Storm-Cards.

VII.

PIDDINGTON'S CONVERSATIONS ABOUT HURRICANES, FOR THE USE OF PLAIN SAILORS. 8vo, 7*s.* With Storm-Cards.

VIII

GREEN'S BRITISH MERCHANTS' ASSISTANT.

CONTAINING:—

PART I.—TABLES OF SIMPLE INTEREST at 3, 3½, 4, 4½, and 5 per cent.
PART II.—TABLES OF INTEREST ON EXCHEQUER BILLS, at from 1¼*d.*, to 3½*d.* per cent. per diem.
PART III.—TABLES OF ENGLISH AND FOREIGN STOCK, BROKERAGE, COMMISSION, FREIGHT, INSURANCE, &c.

Roy. 8vo, 1*l.* 11*s.* 6*d.*, cloth. (Each part may be had separately).

LONDON: PRINTED BY STEWART AND MURRAY, OLD BAILEY.