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Botanical Medicine Monographs and Sundry

MENISPERMUM CANADENSE.

BY HARRY LEE BARBER, PH.G.

From an Inaugural Essay.

The rhizome examined upon transverse section showed the thickness of the bark to be one-sixteenth the diameter, in some specimens even less. It is formed of two irregular layers, the inner one (liber) being about twice the thickness of the outer covering, and consisting of roundish or lengthened cells of parenchyma, and the elongated bast fibres. The outer layer is entirely parenchyma. The medullary rays are in the shape of an elongated wedge, curved at the pith, and united at the top by a circular zone of polyhedral parenchyma tissue pale brown in color, and separated from the liber by a darker line. The rays are about equal in width to the wood wedges, and are about fourteen in number, but varied from twelve to twenty-six. The pith is about one-fifth the whole diameter, and consists entirely of polyhedral parenchyma. The wood wedges are semicircular on the outer extremity, being capped by a tissue having a semi-lunar form; they consist of ducts and pleurenchyma, and are invariably truncated and tapering towards the centre. The overground stem consists of about one-half pith. The bark is in two layers, structure similar to the rhizome, but the layers proportionately thinner. The wood wedges are oval, being separated by narrow medullary rays, and the cells of the medulla are large and polyhedral.

Analysis.—None of the constituents were soluble in benzin with the exception of a very minute quantity of two yellowish, resinous bodies, one of which was lighter in color, and soluble in ether. No fatty material was dissolved by the action of the benzin.

The ether percolate evaporated left a brownish yellow, soft, resinous mass. This was entirely soluble in alcohol, partially so in water. The residue from tills aqueous solution dissolves entirely in chloroform and benzin, and has all the characteristics of a resin. It is tasteless, inodorous, hard and brittle, brownish in color, and corresponds to the soluble resin of the benzin operation. The aqueous solution responded to the general alkaloidal tests. A tannin (menispermo-tannic acid) was also found in this, giving, with test solution of ferric chloride, a dark

green color.

The ground rhizome was next heated to about 40°C. to expel the ether, and was then percolated with 94 per cent. alcohol. This on evaporation also gave a resinous residue, yellowish brown in color, slightly soluble in ether and partially so in water, a brown resin remaining. Hydrochloric acid was added to this aqueous solution, a yellowish precipitate being thrown down, which was soluble in hot alcohol, and answered all the tests for hydrochlorate of berberine.

On the addition of carbonate of sodium to the mother liquor from the berberine precipitate, a grayish white powder was thrown down, which reacted with various group tests for alkaloids (see "Amer. Jour. Phar.," 1863, p. 302). The precipitate was dissolved in hydrochloric acid, and filtered through animal charcoal. Ammonia was added to the solution, producing a precipitate which on being shaken thoroughly with ether dissolved. This etherial solution was evaporated, the residue being dissolved in water acidulated with HCl, this solution again being precipitated. The above process was repeated several times, in order to attain the highest degree of purity. The alkaloid was at length procured in the form of a whitish, amorphous powder.

The aqueous percolate of the rhizome gave alkaloidal precipitates, and green ones with ferric chloride, showing presence of the tannin before mentioned.

The percolate with diluted hydrochloric acid gave, with ammonia and general group reagents, alkaloidal reactions corresponding to the previous tests, some coloring matter, and a small quantity of pectin.

The ammoniacal percolate gave no evidence of alkaloidal presence, but a large amount of coloring matter was extracted, the color of this percolate being much darker than any of the preceding ones. Nothing important was found in this operation.

The decoction was concentrated. This gave on addition of absolute alcohol, a flocculent precipitate of gummy matter. Test solution of iodine yielded a bluish coloration indicating starch. Test solution of iodo-hydrargyrate of potassium gave here slight evidences of alkaloidal reaction.

On distilling the rhizome with water, a milky-white liquid resulted, separating after long standing, a very minute portion of volatile oil which was colorless, and aromatic, the odor resembling that of oil of erigeron.

Carefully heating the powdered rhizome, without charring, at or near 100°C., the moisture was found to be 3.2 per cent. On incineration it

yielded 7.07 per cent. of ash containing K., Ca., Mg. and Si., with traces of Fe.

The second alkaloid[1] obtained from the rhizome was in the form of a whitish amorphous powder, gradually becoming darker on exposure to the air and light; when first precipitated it was supposed to be either oxyacanthine or menispermine. Solutions of tlie alkaloid were made containing one part in one hundred, in two hundred and fifty, in five hundred, in seven hundred and fifty, and in one thousand parts. These five degrees of strength were taken that the exact limit of precipitation and sensitiveness could be ascertained. The behavior of oxyacanthine is that described by Mr. H. B. Parsons.

	Oxyacanthine.	Menispermine.	Menispine.
Color	White, yell. on expos.	White, yell. on expos.	White, yell. on expos.
Taste	Bitter.	Tasteless, entirely.	Very bitter.
Water	Nearly insoluble.	Insoluble.	1 part in 75.
Alcohol, abs.	Soluble.	1 part in 200.	Very soluble.
Alcohol, com.	1 part in 30.	1 part in 200.	1 part in 6.
Ether	1 part in 125.	1 part in 60.	1 part in 40.
Chloroform	Freely soluble.	1 part in 170.	1 part in 20.
Benzol	Soluble.	1 part in 200.	Insoluble.
Ammonia	Sparingly soluble.	Insoluble.	Insoluble.
Sol. Soda	Moderately soluble.	Insoluble.	Insoluble.
Sol. Soda Carb.	Nearly insoluble.	Insoluble.	Insoluble.

It will be noticed that the alkaloid resembles oxyacanthine in color and influence of air. The bitter taste was distinctly noticeable in a solution of one part in fifteen hundred; it is to be remarked in this connection, that it was not nauseous, but agreeable, like that of gentian.

A marked difference in the solubilities is seen, the alkaloid being five times more soluble in alcohol than oxyacanthine, and over three times in ether. While oxyacanthine is more or less soluble in ammonia, solution of soda, and solution carbonate of sodium, the alkaloid in question is entirely insoluble in all three.

It was also noticed that menispermine was entirely insoluble in and unchanged by hydrochloric acid, but menispine is freely soluble without

1 We propose for this alkaloid the name of *menispine*.—ED.

residue. Other marked differences are that menispermine is perfectly devoid of taste, the other persistently bitter, even in very dilute solutions. Menispermine is insoluble in water, and barely soluble in excess of alcohol and chloroform.

The following experiments prove, in the opinion of the writer, the alkaloid to be distinct from either oxyacanthine or menispermine. The solutions used in this case were in alcohol, 94 per cent., the strengths being one part in two hundred. The reactions of the white alkaloid of Menispermum canadense are identical in both water and alcohol; the table given by the author describing the precipitates obtained from the weaker solutions as being of a paler color, but as being distinctly observable in a $^{1}/_{1000}$ solution, the reactions with potassio-mercuric iodide, phospho-molybdic acid and tannin being faintest. Menispermine was examined at the suggestion of Prof. Maisch, to whom the writer is indebted for the sample used in the experimentation.

	Menispermine.	Oxyacanthine.	Menispine.
Tr. Iodine	Yellow ppt.	Dark brown red ppt.	Dark red ppt.
Iodine in KI	" "	" " "	" "
Potass. Merc. Iod	White "	Yellowish ppt.	Yellowish white ppt.
Ac. phospho-molyb.	" "	Brown ppt. insol. in but dark blue by NH_4OH	Yellow ppt. sol. in NH_4OH with't ch'nge
Potass. cadm. Iod	" "	White ppt.	Grayish ppt.
Acid, picric	Yellow "	Insol. in $HC_2H_3O_2$. Yellowish ppt.	Sol. in $HC_2H_3O_2$. Yellow ppt.
Platinic chloride	" "	Insol. in HCl. Yellowish ppt.	Insol. in HCl. Yellow ppt.
Gold chloride	" "	Insol. in HCl. Orange ppt.	Insol. in HCl. Orange ppt.
Acid, tannic	" "	Brownish ppt., insol. in $HC_2H_3O_2$ and dil. HCl.	Whitish ppt., insol. in $HC_2H_3O_2$ and dil. HCl.
Acid, sulph. conc	Yellow coloration.	Brownish purple, darker on standing.	Brown, fades on standing.
Acid, sulpho-molybdic	Yellowish "	Purple, fades slowly, becomes yellow, then green.	Brown, fades to yellow
Acid, nitric, conc	No change.	Orange red, effervesces color permanent.	Effervesces, yellow, permanent.
Zinc chloride, fused	"	Chocolate brown.	Brownish yellow.

The four last mentioned reagents were applied to the powdered alkaloids.

NOTE ON KAMALA.

BY WILLIAM KIRKBY, PH.C.
Read before the Manchester Pharmaceutical Association.

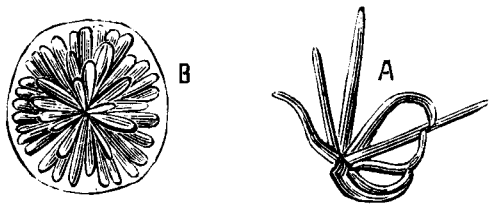
Kamala was not known in Europe as a drug until a very recent period. Before the year 1852 the only account of it is in the writings of Anslie, Roxburgh, Royle and Buchanan. In that year, however, Port-Surgeon Vaughan met with it in the bazaar of Aden under the Arabic name of wars. Specimens obtained by him were forwarded to Mr. Daniel Haubury, together with information concerning the same. The following information collected by him is found in his "Notes on Drugs observed at Aden, Arabia:" "*Wurrus* or *warus* is a red powder used chiefly as a dye. It is the produce of a plant resembling sesame. The plant rises to about 5 feet in height, bearing several separate bunches or clusters of small round seeds, which are covered with a description of flour; this, removed by gentle rubbing, constitutes the dye. Two kinds come into the market. The best comes from the interior, principally from the towns of O Badan and Gebia, and the districts of Yaffaee and Sjibul Rudfan. The second kind, brought by the Somalia of the opposite coast, conies from Hurrer. The second quality is not so much valued, and does not realize the price of the kind which comes from the interior. A considerable quantity of the dye is exported to Bombay, being used at Surat by ladies for dyeing silk a light brown-yellow. The Arabs use it as a dye and as a medicine, internally, for leprosy, and externally, in solution, for freckles and pustules. Much of it finds its way to the Persian Gulf, being known as *asberg*." Dr. Yauglian goes on to say that the best quality sells for 24 rupees the maund, while the African variety sells for only 17 or 18 rupees the maund.

Mr. Hanbury states that he showed the specimens he had received to Mr. Alexander Gibson, of Bombay, who was at that time in London. Mr. Gibson suggested to him that it was obtained from Rottlera tinctoria. He then proceeded to compare the drug with specimens in the museum of the Linnsean Society, and found that Mr. Gibson was correct in his surmise.

Kamala, as found in commerce, is a fine, mobile powder, of a dull red color. Under the microscope it is seen to consist chiefly of translucent, bright red granules mixed with colorless stellate hairs. These hairs give

the drug its dull appearance.

FIG. 1.



B. Gland of genuine kamala. *A*. Stellate hair of the same.

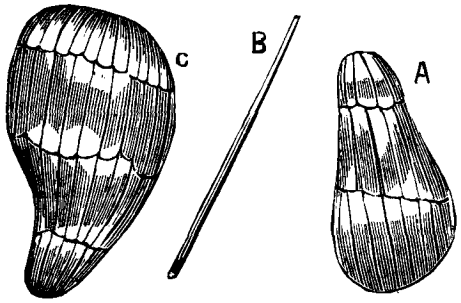
The glands, Fig. 1, B, are spherical, rather irregularly so. Their diameter is from 70 to 120 mkm. (micromillimetres). They are flattened on one side, and are composed of a number of clavate cells enclosed in a pale yellow membrane. The cells are arranged in a radiate manner round a short stalk cell, which is not always visible, occupying the basal side of the gland. From ten to thirty of these cells may be seen on one side; the whole cell, however, contains from twenty to sixty of them. The cells are filled with a red resin, which is soluble in solution of caustic potash, alcohol and ether. On treatment with solution of caustic potash the structure of the gland becomes plainly visible. On appropriate treatment, first with alcohol and afterwards with Schultz's solution of sulphuric acid and iodine, the cells are seen to be composed of cellulose, while the enclosing membrane is seen not to be cellulose.

Professor Flückiger says that he examined authentic specimens from the Calcutta gardens. These were taken from *Mallotus phillipinensis* (*Rottlera tinctoria*), and he found them to agree entirely with the kamala of commerce.

From this it is plainly evident that the source of commercial kamala has been definitely settled.

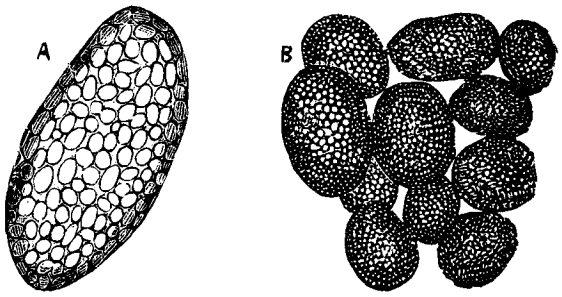
Some years ago Messrs. Allen and Hanbury imported a remarkable kind of this drug from Aden. A full account will be found in "Pharmacographia." Mr. Hanbury forwarded a sample of this to Professor Fliickiger, who submitted it to an exhaustive examination. It differs from the ordinary variety in bulk, in having a dark red or violet color. Microscopically examined, it is at once seen to have quite a distinct structure. Solution of caustic potash dissolves the resin contained by the glands and the general structure is easily seen.

FIG. 2.



A. B. Glands of purple kamala.
B. Simple hair of same.

FIG. 3.



A. New (?) variety of kamala seen dry.
B. The same seen in solution of caustic potash.

The glands are cylindrical, somewhat conical, and are composed, like the other, of resin cells enclosed by a membrane. The arrangement of the cells will be best understood by reference to Fig. 2. The glands are 170 to 200 mkm. long and from 70 to 100 mkm. broad. The hairs mixed with them are simple and long, when compared with the short stellate hairs of the common kind. Professor Flückiger is quite sure the two kinds are not obtained from the same plant.

Dr. Dymock, in his "Vegetable Materia Medica of Western India," says: "'*Wurs*,' or '*wurrus*,' which differs from genuine kamala in being a dark purple color, is the gland of the leaf of a leguminous plant, *Flemingia Gongesta*." He was not able to ascertain if it is collected in India or whether it is imported from Arabia. I have not had the pleasure of seeing Dr. Dymock's book; but it was the note, as above, which appeared in "The Mouth" of a recent number of the "Pharmaceutical Journal," which first attracted my attention to kamala and its sources. Thinking it would be interesting to know if commercial kamala was entirely the produce of *M. phillipinensis*, I obtained samples of the drug from various parts of the country. I find that every one of tlie specimens obtained from dealers is genuine kamala.

Mr. E. M. Holmes, of the Pharmaceutical Society, has been kind enough to let me have samples of the specimens in the Society's museum. The results of my examination are as follows:

Sample marked "490 b," catalogued "Glands, covering fruit of *Rottlera tinctoria*," is genuine kamala.

Sample marked " 490 c" catalogued " Wurrus, first quality," is identical with the purple variety examined by Professor Flückiger and is

presumably the one referred by Dr. Dymock to *Flemingia congesta*.

Sample marked “490 d,” catalogued “Wurrus, second quality.” This is totally different from either of the other two varieties spoken of. I have been unable to find any record of a third kind of this drug. I therefore venture to put before you a short description of this specimen. The glands are from 50 to 170 mkm. long, and from 50 to 100 mkm. broad. When seen with the microscope in a dry state they are translucent and but faintly colored yellow. In form they vary very considerably; in fact, there appears to be no prevailing form. They impart but little color to ether, alcohol or solution of caustic potash. The cells are devoid of any such resin as is seen in the other two kinds. In solution of caustic potash they swell considerably, and their structure is rendered clearly visible. They consist of a mass of cells, composed of cellulose, enclosed by a non-cellulose membrane. The cells are not arranged in any particular manner. The general arrangement is shown, when seen in solution of potash, in Fig. 3, B. The hairs are similar to those found in the purple variety, being quite simple.

On drawing Mr. Holmes's attention to this unknown (?) variety, he informed me that he believed it was the *second* kind mentioned by Dr. Vaughau in his “Notes,” and this sample was probably given by him to Mr. Hanbury, who presented it to the Museum.

I trust that some further information regarding the plants yielding the second and third varieties of “wurrus” will soon be forthcoming.

Looking at the last sort from an economic point of view, it would appear to be worthless as a dye, whatever it may be as a medicine.

In conclusion, I beg to tender my thanks to Mr. Holmes, and to Mr. Elborne who has assisted me in obtaining specimens of the drug. —*Phar. Jour. and Trans.*, May 10, 1884, p. 897.

WARAS.

BY W. T. THISELTON DYEK, C.M.G., F.R.S.

Perhaps I may be allowed to add a few remarks to what is stated about “waras” in Mr. Kirkby's interesting paper in the *Pharmaceutical*

Journal. The note contained in the inclosed copy of the "Kew Report" for 1880, p. 50, is, I believe, the origin of the identification of the plant producing the Aden drug with Flemingia congesta.

The following is the note referred to :

"*Waras*.—A drug known under this name appears to be exported in considerable quantity from Aden. It is used as a substitute for kamala, a well-known Indian product of *Mallotus philippinensis* (*Rottlera tinctoria* Roxb.). Its origin is quite unknown (see Flückiger and Hanbury, 'Pharmacographia' pp. 575, 576). At the suggestion of the former, Captain Hunter, Assistant Resident at Aden, obtained specimens of the plant stated to yield waras in Arabia. He has also sent one to Kew with a note stating that it was gathered 'at an elevation of 6,000 feet on Jebel Dthubarah, 60 miles due north of Aden.' The plant sent was immediately identified with a leguminous species, *Flemingia congesta*, Roxb., having of course no affinity with *Mallotus philippinensis*.

"True kamala consists of the epidermal glands, detached by brushing from the fruits of the *Mallotus*. Alcohol extracts from it a splendid red color. The name 'waras' means saffron, and it may be mentioned in support of the notion that a similar substance is yielded in Arabia by perhaps one or more species of *Flemingia*, that dried specimens belonging to this genus stain paper in the herbarium a bright yellow color when washed over with the alcoholic solution of corrosive sublimate used to protect them from the attacks of insects. *Flemingia rhodocarpa*, Bak., from the Mozambique district has its pods covered with a bright red resinous pubescence.

"In the 'Pharmacographia' (2d ed., p. 372) Flückiger and Hanbury state that *Mallotus philippinensis* grows in Abyssinia and Southern Arabia. In a letter, Professor Flückiger doubts whether he and Mr. Hanbury were not mistaken in regard to this. The evidence of specimens in the Kew herbarium only carries the distribution to the west as far as Scinde. There is nothing improbable in its extending to Arabia, the flora of which is still so imperfectly known."

Professor Flückiger, with whom I had corresponded upon the subject, informed me (July 12, 1881) that though he at first objected to *Flemingia* as the source of "waras" he then thought the statement correct.

As the Kew Museum contained no satisfactory specimens of either African or Arabian "waras," we applied to tlie Resident at Aden to kindly assist us in procuring samples. These reached England in July of last year. In both cases the "waras" itself agreed microscopically with an authentic sample derived from Professor Flückiger, and had the structure figured by Mr. Kirkby. All three also exhibited the characteristic property of turning first bright red, then black, when

carefully heated in small quantity on a glass slip over the flame of a spirit lamp.

The sample of Somali "waras" was mixed with seeds of a dull brown color mottled with black. These were found to agree precisely with the seeds of *Flemingia rhodocarpa*, Bak., from the Mozambique, which, as mentioned in the "Kew Report" (*l. c.*) "has its pods covered with a bright red resinous pubescence." A further scrutiny of the original specimen obtained by Captain Hunter from the neighborhood of Aden, which is in a rather immature state, led Professor Oliver to the conclusion that this also belonged to *Flemingia rhodocarpa*. I believe that the drug is derived from the young pods, and am disposed, therefore, to think that Dr. Dymock is in error in describing it as "the gland of the leaf."

I communicated these further facts to Professor Flückiger, and he wrote to me, October 4, 1883, "I am very much pleased with your statements, and can only say that I most fully agree with your conclusion as to the identity of the Somali "waras" with my original specimen and also that of the seed of *Flemingia rhodocarpa* with those met with in the said drug."

In the new "Official Guide to the Museums of Economic Botany at Kew" (No. 1, p. 45) we accordingly state that "waras . . . consists of the epidermic glands of the young pods of *Flemingia rhodocarpa*, Baker; native of Arabia and East Tropical Africa."

The third variety described by Mr. Kirkby is quite new to me, and I join with him in hoping that some further information about the plant yielding it will soon be forthcoming.

A further most interesting communication on the subject from Major F. M. Hunter, Assistant Resident at Aden, contained a memorandum giving the complete history of the collection of the drug with a further specimen in fruit of the plant producing it, the pods bearing the epidermal glands still undetached. There can be now no sort of doubt that the "waras" plant is really that described by Mr. J. G. Baker, F. R. S., in the "Flora of Tropical Africa," as *Flemingia rhodocarpa*.

But my colleague, Professor Oliver, F. R. S., whose kindness is only equalled by his sagacity, has made the curious discovery that a *Flemingia* apparently confined to South India, *F. Grahamiana*, W. and

A., is not specifically distinguishable from *F. rhodocarpa*; the pods are in fact clothed with tlie same peculiar epidermal glands so characteristic of that species. The “waras” plant is therefore really to be found in India after all.

In creating a new species for the “waras” plant, Mr. J. G. Baker pardonably neglected the comparison of the material he was working upon with specimens of the species occurring in so remote and botanically widely severed an area as the southern part of the Indian peninsula.

I trust that room may be found for Major Hunter's memorandum, which I append in its entirety.

Notes on “waras” collected at Harrar in February and March, 1884.

“In the neighborhood of the city c waras' is not now raised from seed sown artificially, and it is left to nature to propagate the shrub in the surrounding terraced gardens. The plant springs up, among jowari, coffee, etc., in bushes scattered about at intervals of several yards more or less. When sown, as among the Gallas, it is planted before the rains in March. If the soil be fairly good a bush bears in about a year. After the berries [pods] have been plucked the shrub is cut down to within six inches of the ground. It springs up again after rain and bears a second time in about six months, and this process is repeated every second year until the tree dies. Rain destroys the berry [pod] for commercial purposes, it is therefore only gathered in the dry season ending about the middle of March. The bush grows to a maximum height of six feet, and it branches close to the ground. The growth is open and the foliage sparce. Each owner has a few acres of land.

“In the middle of February, 1884, the following processes were observed:

“The leaves [? fruiting shoots] of some plants were plucked and allowed to dry in the sun for three or four days. (The picking is not done carefully and a considerable quantity of the surrounding twigs, etc., is mixed with the berries [pods].) The collected mass was placed on a skin, heaped up to about six or eiglit inches high, and was tapped gently with a short stick about half an inch thick. After some time the pods were denuded of their outer covering of red powder which fell through the mass on to the skin. The upper portion of the heap was then cleared

away and the residual reddish green powder was placed in a flat woven grass dish with a sloping rim of about an inch high. This receptacle was agitated gently and occasionally tapped with the fingers, the result being the subsidence of the red powder and the rising to the surface af the chaffy refuse, which latter was carefully worked aside to the edge of the dish and then removed by hand. This winnowing was continued until little remained but red powder. (No great pains are even taken to eliminate all foreign matter.) A rotl was sold in 1884 for about 13 piasters = 1 rupee 10 as. nearly.

" 'Waras' is sent to Arabia, chiefly to Yemen and Hadhramaut, where it is used as a dye, a cosmetic, and a specific against cold. In order to use it, a small portion of the powder is placed in one palm and moistened with water, the hands are then rubbed smartly together, producing a lather of a bright gamboge color, wich is applied as required."—*Pharm. Jour. and Trans.*, May 17, 1884, p. 917, and May 31, p. 969.

NOTE ON TU-TU (*CORIARIA RUSCIFOLLÆ*.)

BY T. H. HUSTWICK.

The "tu-tu" plant (pronounced "toot" the final vowel in many Maori words being only an aspirate or lip sound is dropped by Europeans) is indigenous to New Zealand. It grows luxuriantly where situation is favorable, and prefers an exposed site on rising ground, with a dry friable soil; its average height, when mature, may be taken at about 5 feet, of a shrubby herbaceous character, and with its spreading branches covering a considerable extent of surface. Surrounded by sombre ferns and withered grasses, the effect of its glossy dark green foliage is very striking.

Tu-tu, though commonly spoken of as a poison, is such only under certain conditions, and even not then to all animals; the horse, goat, and pig being said to be entirely proof against it under all circumstances; while, conditions being favorable, cattle and sheep often fall victims to it. The season of its greatest activity is in spring; then, the wide spreading roots throw up numerous tender, succulent shoots, which are eaten with avidity by sheep fresh from the hills, where dry grasses and ferns have been the rule. Cattle browse on the young leaves, and when coming to them fresh from other pastures, or

exhausted by labor or travel, nearly always with fatal effects. It is said that later in the year the poisonous property is greatly diminished; that even when most virulent its effects are much ameliorated by a previously full stomach, and that the system can become accustomed to it by gradual use. Animals suffering from the effects of this plant are said to be "tooted." Its principal action seems to be on the brain and nervous centres, and produces a condition similar to "staggers." The animal becomes stupid and lethargic, until roused into a fit of mad frenzy by any trivial circumstance, during which it is dangerous for man or beast to be in the way, the frenzy recurring at rapidly decreasing intervals, until death results in a few hours from sheer exhaustion. The only remedy that appears to be used is bleeding from the jugular vein, and that with very poor success, not one in ten lacing benefited, while the exceeding danger attending its use causes it to be practiced only under exceptional circumstances. I am not aware what is the effect of the green herb on man, but singularly enough the "berries" when ripe are grateful and refreshing to the thirsty palate, care being taken to reject the seeds. A common method of utilizing the fruit is by tying a few bunches in a handkerchief and sucking the juice through it. Small birds are very partial to the ripe fruit and no injurious effect on them is apparent; most probably the seeds are voided by them entire. In the early days of the colony, when bullock labor was universal, whole teams were sometimes destroyed or disabled in a single night by this pernicious plant, rendering great care necessary in the choice of a camping place. The immunity enjoyed by the goat in respect of this plant was some years ago made use of on the Flaxbourne sheep run, a large number of these animals being procured for the especial purpose of securing its eradication. That an animal to whom the varied contents of a choice flower garden are a comestible delicacy should be proof against this particular plant is not to be wondered at, but why the plant should be so powerfully toxic as regards other ruminants is a matter for surprise.—*Phar. Jour. and Trans.*, July 12, 1884, p. 22.

INDIA RUBBER AND GUTTA PERCHA CULTIVATION IN CEYLON.

From the Report of the Director of the Royal Botanic Gardens.

India Rubber.[2] *Ceara.*—In Ceylon a planted area of 977 acres is credited to this kind of rubber, but it has not yet appeared among our

2 The import of Caoutchouc into Great Britain during 1882 amounted to nearly 20,000,000 pounds.

exports. Since it has been ascertained that the quality is excellent,[3] cultivators have been endeavoring to discover a means by which the milk can be obtained at a cost sufficiently low to give a return, but without, as yet, encouraging results. The removal of the outer separable bark, as practiced in the experiments referred to in my last report, has been objected to on the ground that the bark formed in its stead is of a different character, very hard and inseparable from the green layer a second time. Instruments have therefore been devised for bleeding without such removal. A knife with two parallel blades, which took out a strip of bark, has been modified into one in which the very sharp cutting edges meet to form a V, the basal angle during use being at the cambium. Another invention avoids all cutting, being a double spur-like wheel with sharp but guarded points which puncture the bark without further injury. The milking (one can scarcely call it tapping) has also been practiced on trees of various ages and at different intervals and seasons. While it is found that the yield of individual trees varies extremely,[4] none of the experimenters is satisfied that the small quantity obtainable by present methods is sufficient to make the cultivation profitable at the existing price of rubber. Mr. Wall, however, who states that hundreds of young trees have been bled daily with the "pricker" for some weeks, and that thus a cooly can collect about half a pound of dry rubber per diem, thinks that, if trees will bear this treatment for two hundred and forty days in the year, the cultivation would be remunerative. It appears evident that milking must be repeated at frequent intervals, and (as often already pointed out) the cultivation be conducted on a large scale. Much of the 35,000 acres in private hands in Ceylon, at present growing nothing but *Lantana* and other weeds, is suitable for this hardy plant, which costs nothing to cultivate, affords a substance of a value which is continually increasing, and awaits only the discovery of a process by which the latter can be cheaply and exhaustively extracted.

Castilloa Rubber.—From a single tree at Pérádeniya a considerable crop of seedlings was raised. The fruits ripened at the end of May; they are little, white, pointed nuts, about half an inch long, covered by a bright orange pulp, and some twenty to thirty are crowded together on the fleshy flattened scaly receptacle, forming collectively what is called a

3 I am informed that as much as 4*s.* a pound has been obtained for Ceylon Ceara rubber.

4 This is to be expected; for it should be recollected that the "milk" in plants is quite distinct from their sap, and is contained in special channels. It has no nutritive function, but, like the alkaloids in cinchona, is rather of the nature of an excretion. Its removal, therefore, per se, inflicts little or no injury on the plant.

compound fruit; about half of the fruits ripen and contain each a single seed. I have already expressed my opinion as to the suitability of this tree for cultivation by a Forest Department as a source of prospective revenue; and as comparatively few of the plants were disposed of to private persons, I made an endeavor to get plantations of this valuable tree formed at Eatna-pura and Kalutara. The plan was sanctioned by the Governor, and I gave the necessary instructions; but after three months' delay it was discovered that the trifling sum necessary could not be provided.

The growth of the largest *Castilloa* tree at Henaratgoda is, at a yard from the ground, $30^{1}/_{4}$ inches, an increase of $4^{1}/_{4}$ inches during the year.

Para Rubber.—Nine trees flowered at Henaratgoda in March, and the fruit ripened in August, About two hundred and sixty seedling plants were raised, many of which have been disposed of to persons desirous to try the culivation. Our largest tree is now 30 inches in circumference, an increase of $4^{1}/_{2}$ inches in the year.

Eighteen plants of another species of Hevea, *H. Spruceana,* were received from Kew in October. This is a native of British Guiana, where it is generally known by its Arawack name “Hatie.” It has been studied in its native forests by Mr. Jenman, who sent us a plant in 1881, which unfortunately died. Dr. Spruce also collected it on the Amazons. It is closely allied to *H. brasiliensis,* and grows under quite similar conditions. The specimen of the rubber sent home by Mr. Jenman for report appears to have been unfortunately mixed with some impurity which prevented its value being accurately ascertained. The plants have been put out mostly at Henaratgoda, and are doing well.

Some seeds of this species were also kindly sent to the garden by the Manager of the Ceylon Company, Limited, in July, but were quite dead. It is useless to attempt to import seeds of this description from any distance, as they lose their vitality in a few days.

Other Rubber Plants.—Landolphia Petersiana, one of the East African rubbers, has flowered during the year, and *L. Kirkii* is now in bud at Henaratgoda. Two plants of *Tabernæmontana crassa* are now doing well. Among seeds received from Mr. L. Wray, of Perak, were some of “Gutta Singret,” which appears from leaf specimens, also sent, to be a species of *Chilocarpus,* another climbing apocynaceous genus. Its

rubber is not of a good quality, and is chiefly used for adulteration. A few plants were raised and are planted at Henaratgoda.

Gutta Percha.—A valuable series of dried herbarium specimens, of wood, and of the commercial products of the various gutta-producing trees of Perak, has been sent by Mr. L. Wray, Jr. (collecting for Sir H. Low), which has enabled me to determine with more certainty the species we possess is a living state. He has also sent me a copy of a report to Sir H. Low on the gutta question, which contains some valuable additional matter to that collected at Kew and published in the report of that institution for 1881, pp. 38-47.

I am now satisfied that the identification of "Gutta Sundek" with *Payena*, (*Ceratephorus*) *Leerii*, on which doubt has been thrown, is correct. Mr. Wray describes the tree as partial to swampy places near the coast, even where the water is salt; the wood is hard and close-grained, and the fruit sweet and eaten by the Malays. There is an inferior variety, with a thinner bark, known by. its longer leaves. Our plants at Henaratgoda have grown quickly; their rate of growth is much more rapid than the species of *Dichopsis*—the largest are over 8 feet high; the tallest at Peradeniya is 6 feet 2 inches.

The young plants of "Gutta Taban putih" grow very slowly. The good dried specimens now sent show this to be distinct from *Dichopsis Gutta*, but I am not able to say to which species of *Dichopsis* they should be referred. This tree is found in the lower hills, 1,800 to 2,500 feet, and not in the plains ; the gutta is a dirty white (whence the name putih = white), coagulates slowly, and does not thoroughly soften even in boiling water. Mr. Wray also distinguishes a small-leaved variety with a longer fruit.

The specimens further confirm our previous knowledge that the best and most frequent sort of gutta percha of commerce, "Gutta Taban merah," is the produce of *Dichopsis Gutta*. Our trees of this are now nine years old, but the tallest is but 9 feet high. According to Mr. Wray, this tree attains 100 to 200 feet in height, with a clean, straight trunk of 4 to 5 feet diameter, flanked at the base with large thin buttresses; the bark is $^1/_3$ to $^1/_2$ an inch thick, brown-red in color, and flakes off; the leaves are much narrower on young plants than old ones, the flowers are white, and the seeds yield an oil, solid at ordinary temperatures, but used for cooking. The gutta is at first white and cream-like, but becomes

pink, and ultimately brownish red ("merah" = red), and this color is strongly imparted to the water in which it is washed. There is a variety of this species affording a paler gutta called "Gutta Taban sutra" ("sutra" = silk), which is found at a higher elevation (500 to 600 feet).

Other sapotaceous trees affording gutta, of which specimens have been sent by Mr. Wray, are "Gutta Taban simpoo," *Dichopsis Maingayi*, Clarke —the product of which is also sold as "gutta putih"—and "gutta garru," *Bassia Mottleyana*, De Vriese, which gives a white hard sort, only used for mixing with other kinds. He also sends examples of the curious substance called "Gutta Jelutoug," used for adulterating gutta percha. It is obtained from a very lofty apocynaceous tree allied to our "Rukattana" (*Alstonia scholaris*)[5] and recently named *Dyera costulata* by Sir J. Hooker.

The yield of the gutta percha trees seems to be very small—less even than the rubber trees. Thus from a tree of *D. Gutta*, thought to be over one hundred years old, and over 100 feet high, Mr. Wray succeeded in extracting, by the ordinary native method, of felling and ringing the trunk and branches, only 2 lbs. 5 ozs. of clean gutta. Of "Gutta Taban putih," a tree 10 inches in diameter, gave 2 lbs. 11 ozs., and one of Payena Leerii, 2 feet 8 inches in circumference, only $6^{1}/_{2}$ ozs. Mr. Wray has satisfied himself that only about $^{1}/_{38}$ part of the gutta percha actually in the bark is extracted by this method, and he believes that by pounding and boiling the bark the whole could be obtained. As the question of the supply of gutta percha is becoming a pressing one, it is to be hoped that experiments on a large scale may confirm this opinion. To quote Sir J. Hooker (Kew Report, 1881, p. 38), "the time cannot be far distant when the natural sources of gutta percha will be definitely used up." In view of this contingency it behoves the governments of those few British colonies—Ceylon being one—in which the trees will grow, to lose no time in establishing plantations, which must in the future become a valuable source of revenue. But in this colony, neither in this case nor in the case of India rubber, can anything be done until a proper forest conservancy is established.—*Phar. Jour. and Trans*, June 28, 1884, p. 1052.

5 This appears to yield a somewhat similar substance at Singapore, called Gutta Pulei.