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Scientific Papers

by

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1. An Examination of the Leaves of *Gymnem*
Sylvestre.
2. *Naregamia Alata*, The Goanese Specacuan.
3. The Mineral Concretion of the Teak Tree.
4. The optical method of Analysis for quinine
sulphate.
5. The Phenomenon of Decepcitation in
Organic substances.
6. Waras, its Composition and Relation
to Kamala.
7. Bark of *Michelia Nilagrica*.
8. Bark of *Rhamnus Nigra*.
9. Leaves of *Adhatoda Vasica*, Nees.
10. The Glorodendrons and their che-
-mical constituents.
11. Proximate Analysis of *Farifraga ligulata*.
12. Some Drugs of British Yikkin.
13. Laurel Nut oil.
14. *Gymnemic Acid*.
15. *Podophyllum Emodi*.
16. *Musambra*, a Variety of East Indian Aloe.
17. *Balsamodendron Berryi*.

3-

AN EXAMINATION OF THE LEAVES.

OF

GYMNEMA SYLVESTRE*

BY

DAVID HOOPER, F.C.S.

Gymnema sylvestre (R. Br.) is an asclepiadaceous plant growing in the Deccan peninsula, from Concan to Travancore; it is also met with in Assam, and on the Coromandel coast, and is distributed in the continent of Africa. It is a stout woody climber, with long slender branches.

The leaves are opposite, entire, from $1\frac{1}{2}$ to 3 inches long and from 1 to 2 inches broad, elliptic or obovate, acute or cuspidate, rarely cordate at the base, membranous, thinly pubescent on both sides, the upper surface of a darker green than the lower. *Gymnema sylvestre* is mentioned in the non-official list in the Pharmacopoea of India (1868), and in Dr. Dymock's "Materia Medica of Western India." The powdered root has for a long time been known among the Hindus as a remedy for snake-bites, in such cases it is applied locally to the part affected and also taken internally in the form of a decoction. But the most curious circumstance connected with this plant was first noticed by Mr. Edgworth, who discovered that by chewing some of the leaves it destroyed the power of the tongue to appreciate the taste of sugar; he found that powdered sugar, taken immediately after masticating some of the leaves, tasted like so much sand in his mouth, and this effect lasted for twenty-four hours. Dr. Dymock reviewing this property, said he was unable entirely to confirm this statement, his experience was, that sugar taken into the mouth after chewing the fresh plant had a saltish taste, but was still easily recognizable.

Some authentic leaves were procured by Mr. Lawson from Guindy Park Madras, who placed them at my disposal for chemical examination. They had a bitterish astringent and slightly acid taste. After chewing one or two leaves it was proved undoubtedly that sugar had no taste immediately afterwards, the saltish taste experienced by others was due

* A paper read at a meeting of the Nilgiri Natural History Society, Ootacamund, March 7th 1887.

to an insufficiency of the leaf being used. Sugar in combination with other compounds in dietetic articles is plainly destroyed as to its taste after using these leaves. In ginger bread, for instance, the pungency of the ginger is alone detected, the rest is tasteless meal; in a sweet orange the taste of the sugar is so suppressed and that of the citric acid consequently developed that in eating it resembles a lime in sourness. Among the several kinds of foods, drugs and beverages which affect the palate *Gymnema* does not pretend to render them all tasteless, it does not affect pungent and saline things, astringents and acids. It is limited to apparently two diverse substances sweets and bitters. It has been noted that sugar taken after the leaf tastes like sand, so I have found that sulphate of quinine taken after a good dose of the leaf tastes like so much chalk. I am not going to propose its use in the administration of nauseous drugs, until the medical properties of the *Gymnema* have been more studied, otherwise the quantity of the vehicle taken may prove to counteract the effect of the medicines. The experience of several friends as well as my own is that the effect does not last for twenty-four hours as stated, but for only one or two hours, after that time the tongue resumes its appreciation of all that is sweet or bitter.

The powdered leaves were submitted to the action of various solvents and by this means it was ascertained, that the peculiar property of *Gymnema* leaves was dissolved out by alcohol, and, as it occurred in the aqueous extract of the residue, it was therefore soluble in water. As benzine and ether took from the leaves certain principles of the same appearance and weight, it was conceived that nothing would be gained by using both solvents; the preliminary extraction was therefore made with ether rectified from water and spirit. The ether extract consisted of chlorophyll and two resins separated by their solubility in alcohol. The resin insoluble in spirit formed the larger portion, it was soluble in chloroform, bisulphide of carbon and benzine. It was elastic and tenacious, decomposed by warming with nitric acid, the product being precipitated with water; only partially saponified with caustic potash. Sulphuric acid dissolved it in the cold giving a green solution. It seemed to consist principally of a neutral resin. The resin soluble in spirit was readily saponified with soda and gave a permanent bluish green colour with sulphuric acid; like the former resin it was of an acrid nature, and left a tingling sensation in the throat.

The alcoholic solution of the leaves was almost entirely soluble in water, in fact, by treating the leaves separately by alcohol and water 36.37 per cent. organic matter was extracted, by treating the drug with water alone 36 per cent was removed. By direct experiment it was found that in the former extract

0.47 per cent was an acrid resin similar to those found in the ether extract. The aqueous solution of the substances soluble in alcohol had a decidedly acid reaction, it gave no colouration with ferric chloride, showing absence of tannin. It was deepened in colour with alkalies, but gave a bulky precipitate with sulphuric, nitric, hydrochloric and acetic acid. It reduced Fehling's solution on boiling, and gave a cloudiness with Nessler, a precipitate with lead acetate, but none with tannin or picric acid. The precipitate caused by sulphuric acid was collected on a filter and washed till it ceased to give a cloudiness with barium chloride. It yielded a greenish powder, insoluble in water, but soluble in alcohol, ether, benzine and chloroform. With potash, soda and ammonia it afforded fine red solutions with orange-coloured froth, but they were both precipitated on the addition of the mineral acids. It dissolved in concentrated sulphuric and nitric acids with intense red colour, but in both mixtures it was destroyed and precipitated by water. It fused at about 60° C. into a blackish brittle mass. Heated in a test tube it gave off fumes of creosote, but no crystals were obtained in a subliming apparatus. Gently ignited it burnt with a bright flame, leaving no ash. It was thrown down as a bulky grey mass by acetate of lead, the lead salt decomposed by sulphuretted hydrogen in water left the substance in the reddish evaporated filtrate from the lead sulphide. The body just described has the characteristics of an organic acid related in some particulars to chrysophanic acid, but having some distinctly peculiar reactions and possessing the antisaccharine property ascribed to the leaves, I propose to call it *Gymnemic acid*.

Gymnemic acid forms more than six per cent. of the constituents of *Gymnema* leaves in combination with a base which has not been isolated. Another organic acid was present in the lead acetate precipitate which was identified as tartaric acid. The filtrate from the insoluble lead compounds was treated with sulphuretted hydrogen gas, and the clear liquor after evaporation was examined for sugar. Glucose was detected in some quantity by its immediate and abundant reduction of Fehling's solution, the sugar examined in a polariscope had a left handed rotation.

Chloroform agitated with an alkaline solution of the leaf left a crystalline residue of a brownish colour, it had a bitter taste, and acted as a sialagogue. With the ordinary alkaloidal reagents it afforded coloured precipitates, but was a neutral principle. Its further examination together with that of *Gymnemic acid* are reserved for further investigation.

The leaves after being exhausted with ether and then alcohol were treated with water. The gum was detected and estimated in the usual manner. A carbohydrate, optically inactive, and after boiling with acid, reducing Fehling's solution was found in this extract.

Diluted soda removed a brownish liquid which consisted of albuminous matters only partially soluble in alcohol and acetic acid. These were not weighed but calculated by difference.

A solution of one per cent. hydrochloric acid was employed to remove the oxalate of calcium. A microscopical examination of the powdered leaves showed a fair sprinkling of the conglomerate crystals or raphides so well known to exist in *Rhubarb*. The dilution of the acid menstruum rendered this process very tedious, so a stronger acid was used and the marc washed with it until ammonia produced no cloudiness. The collected liquors were allowed to deposit, the sediment was then collected on a filter, dried and weighed; then incinerated and weighed again. The calcium carbonate was calculated into oxalate, and the difference between this and the first weighing was reckoned as pararabin. No oxalic acid was found in a free state.

The ash of *Gymnema sylvestre* is very high, a fact in accordance with the amount of lime salts it contains. Gentle ignition of the air-dried leaves left as much as 11.65 per cent., and about one half of this was calcium carbonate. One hundred parts contained.

15.41 soluble in water.

78.71 soluble in acid.

5.88 sand and siliceous residue.

The cellulose was estimated by steeping the leaves in sulphuric acid of specific gravity 1.50 for 30 hours, washing, drying, burning and deducting the ash; this result did not differ materially from the weight of the totally exhausted powder treated with chlorine water.

The following is a tabulated analysis of the powdered and sun dried leaves:—

Ether extract (chlorophyll & resins) ...	5.51
Alcoholic extract (gymnemic acid, tartaric acid, glucose, neutral bitter principle, resin &c.) ...	19.50
Aqueous extract (gum 1.45 per cent., glucose, carbohydrate and extractive) ...	16.87
Alkaline extract, by difference (albuminous and coloring matters) ...	8.15
Acid solution { calcium oxalate ...	7.64
{ pararabin ...	2.74
Ash (balance of) ...	5.69
Cellulose ...	27.86
Moisture ...	6.04

100.00

NAREGAMIA ALATA, THE GOANESE IPECACUANHA*

BY DAVID HOOPER, F.C.S.

Dr. Dymock, in his 'Vegetable Materia Medica of Western India,' describes *Naregamia alata*, W. and A., of the natural order of Meliaceae, as the country ipecacuanha of the Portuguese at Goa, and states that it is the best indigenous emetic he has met with in that part of India. As the drug seems to be devoid of history it was probably unknown in the sixteenth century, when the intelligent and observant Dr. Garcia d'Orta was for thirty years physician to the Viceroy's Court and the hospital at Goa. In confirmation of the recent introduction of naregamia, its use does not appear to have extended far beyond its habitat. The plant grows from the Concan southwards by the Malabar coast to Travancore, preferring the slopes of the Western Ghats. By the natives in these regions it is used as an emetic, and as a remedy for bile, rheumatism and indigestion, usually in the form of a decoction or infusion. The sample that I have examined was kindly procured for me by Mr. Ferguson, of Calicut; it was collected some nine or ten miles from the town, where it has a reputation in cases of fever, and grows in some abundance.

Vernacular.—Kapur bhendi, pit-wel, tinpana (Marathi), trifolio (Goa), nelanaringu, nelakanugida (Canarese).

Botanical Characters.—The naregamia plant (of which there is only one known species in India) is a small glabrous or shining undershrub, not more than a foot in height, with several slender, woody, erect or decumbent stems, with few branches. The leaves are from one to four inches long, and trifoliate. Leaflets, sessile, cuneate-obovate, entire or obtusely lobed, terminal leaflet rather larger than the lateral ones and about the length of the common winged-petiole. Peduncles axillary, solitary, one-flowered. The flowers are about one inch long and quite white. Styles yellow. Capsules triangular and three-valved.

* Reprinted from the "Pharmaceutical Journal," October 15th 1887.

It is a very attractive plant in the flowering season, which extends from the middle of April to the middle of June.

Description.—The drug consists of the root with the slender stems attached to it, the leaves having been stripped off. The root stock is contorted and warty and with the roots is pale brown in colour; the mealy suberous layer may easily be removed by rubbing. The stems are of a dirty-green, with the bark more firmly adherent. A transverse section of the root exhibits a brown outer layer of bark with a light-coloured interior, and a yellowish wood. If the section be touched with a drop of iodine solution a blue ring will appear in the bark, showing the presence of starch in the librous portion. On account of the hard wood the drug is very difficult to powder in a hand mortar. The activity of the drug resides in the cortical portion, but as this forms one-third, and the woody material two-thirds of the whole, it differs from the true *ipocacuanha*. The powder is light brown; it has a peculiar aromatic and pungent odour, and a slightly bitter and nauseous taste.

Chemical Composition.—Powdered *naregamia* was treated both consecutively and independently with the following solvents:—Ether, alcohol, water, diluted acid and diluted alkali. The ether extract contained an *alkaloid*, an *oxidizable fixed oil* and a *wax*.

The alkaloid was separated by agitating the extract with diluted sulphuric acid, and the clear colourless solution at once afforded precipitates by the usual reagents. The alkaloid was left as an amorphous, slightly coloured residue of a brittle consistence, on the gentle evaporation of its ethereal solution. It formed crystalline salts with sulphuric, nitric and hydrochloric acids, but gave no satisfactory colour reactions when mixed with the concentrated acids. It was precipitated from its solutions by tannin, potassio-mercuric iodide, phosphomolybdate of soda, and iodine. It differs from emetine in readily forming acicular crystals with acids, and by not giving any colour with chlorinated lime and acetic acid; and it differs from the principal cinchona alkaloids in its optical inactivity. Having such definite peculiarities in its proper-

ties and reactions, I propose to call this alkaloid after the generic name of the plant, *naregamine*.

The fixed oil was soluble in strong spirit, soluble also in dilute caustic soda, with a brown and red fluorescent solution. The wax was insoluble in spirit, it was coloured brown and afterwards black by sulphuric acid.

The alcoholic extract consisted mainly of *sugar* with some little resinous matter. No tannic substances were detected, but a body precipitable by neutral plumbic acetate, related to an organic acid.

The aqueous extract evaporated to a small bulk, and treated with two volumes of alcohol, gave a precipitate of *gum*. The filtrate from this, evaporated and treated with four volumes of alcohol, caused a precipitate which after standing some hours separated out into large colourless rhombic prisms. A crystalline alkaloidal substance soluble in water, insoluble in strong spirit, having an acid reaction, containing nitrogen, and occurring in this extract, shows that it is allied to, if not identical with *asparagin*.

Among the less important constituents of *naregamia* are *albuminous*, *pectinous* and *colouring* matters, *starch*, *cellulose*, *woody fibre* and *ash*. The starch is in minute rounded granules of about the same size as rice. The ash is of a reddish colour, and contained 10 per cent. insoluble in hydrochloric acid.

The following table will show in what amount the various principles occur:

Ether extract	...	...	2.93
Alcoholic extract	...	...	5.40
Aqueous extract	...	...	7.00
Albuminous matter, etc.	...	...	7.61
Starch and cellulose	...	...	17.66
Woody fibre	...	...	44.77
Ash	...	...	5.52
Moisture	...	...	9.11

100.00

Medical Properties.—About 1 ounce of the powdered *naregamia* was sent to Surgeon-General Bidie, who undertook to have some experiments made on its therapeutic action in the Monegar Choultry Hospital, Madras. I have been favoured by Dr. Bidie with the medical report, which

contains the following information:—"The powder was tried in two cases of dysentery. The first patient had a very severe attack of the disease, and had recovered from a similar attack only a month before, and was in consequence in a very weak and emaciated state. After three doses, all traces of blood in his motion disappeared. The drug was administered in doses of 20 grains, preceded by 15 minims of tincture of opium. The second patient also recovered rapidly, but the disease was not so severe as in the first case. As an emetic its effects were exactly similar to the official drug, 20 grains acting as an effectual emetic in an adult. It was also tried in small doses as an expectorant in catarrhal affections with good results, and was effectual in the treatment of children suffering from bronchitis."

The results of these experiments confirm Dr. Dymock's experience of the emetic property of naregamia, and Dr. Bidie intends to have more extended trials made with it in dysentery and other complaints.

Pharmacy of Naregamia.—The "vinum" being a recognized preparation of the true ipecacuanha, a vinum naregamia was made by using sherry containing 15.16 per cent. absolute alcohol by weight, 2.4 per cent. solids, and traces of tannin. The finished product, however, could not be recommended as a suitable preparation, for the following reasons:—1. The wine deposited after standing a few days. 2. Large doses were taken, much in excess of the official wine, without producing an emetic effect. 3. Naregamine is precipitated by tannin, which is frequently found in sherries. 4. Naregamine was detected with facility in the residual marc. If a liquid preparation is required, I should suggest a tincture made with the powdered drug and rectified spirit of the strength of 2½ ounces to 1 pint. The alcohol dissolves out the alkaloid and most of the fatty constituents, and the tincture exhibits the activity of the root. Powdered naregamia is the form in which it will chiefly be used; it is conveniently carried about, and is simple in its administration.

Ootacamund, India.

THE MINERAL CONCRETION OF THE TEAK TREE.

BY DAVID HOOPER.

At the last meeting of the Nilgiri Natural History Society Mr. Lawson showed a specimen of a whitish mineral substance found in a teak tree growing in the Government Plantation at Nilambur. This peculiar secretion is not altogether unknown to officers in the Forest Department, and its composition has on more than one occasion been investigated by chemists.

In 1870 the fact of calcareous masses occurring in timber was brought to the notice of the Asiatic Society of Bengal by Mr. R. V. Stoney who stated (*vide* P.A.S.B. May 1870 p. 135) that many trees in Orissa had pieces of limestone or calcareous tufa in their fissures, but principally Asan (*Terminalia tomentosa*, W and A) Swarm (*Zizyphus rugosa*, Lam.) Sissu (*Dalbergia sissu*, Roxb) and Abuus (*Diospyros melanoxylon*, Roxb.)

In 1880 Mr. V. Ball in making a geological survey in the Central Provinces met with this concretion, and thus alludes to it in his "Jungle Life in India." "Some white marks on the cut stumps of an Asan tree caught my eye, and these on examination proved to be sections or laminae of calcareous matter which alternated with the ordinary rings of woody growth. The rocks about were gneisses and schists, and I could discover nothing in the soil to account for the peculiarity. In some cases irregularly shaped pieces seven inches long by two inches thick were met in the trunks at a height of about six feet from the ground. By the natives the lime is burnt and used for chewing with *pan*. On examination it was found there was no structure in these masses which would justify a conclusion that they had been formed by insects. Some included portions of decayed wood seemed to be cemented together by the lime."

Major General Morgan, late Deputy Conservator of Forests, Madras, speaks of it in the following terms in his "Forestry of Southern India." "It is a curious fact that in the Wynad, though there is no free lime in the soil, yet Teak (*Tectona grandis*) and Blackwood (*Dalbergia latifolia*), if wounded near the ground contrive to absorb large quantities of lime. It may be seen encrusting the tree on the surface as far as four feet in height, from three inches to a foot in width, and two or three inches in thickness. The lime is so hard that it destroys circular saws, and the Carumburs use it for chewing with betel."

Abel in 1854 thus described it. "The wood of teak, which grows in the South of India and other tropical countries, frequently exhibits cracks and cavities of considerable extent lined with a white crystalline deposit consisting chiefly of hydrocalcic orthophosphate, Ca H PO_4 , H_2O , with about 11.4 per cent. ammonio-magnesium phosphate." (Chem. Soc. Qu. J. xv. 91.)

This white deposit in the wood of teak has also been examined by Thoms, who found it to consist of monocalcic orthophosphate Ca H PO_4 . (Landw. Versuchs. St. xxii. 68; xxiii. 413.) More recently still Professor Judd has found in teak a specimen of crystalline apatite, a well known mineral containing a large proportion of calcium phosphate.

"The formation of this deposit indicates that the wood itself must contain a considerable quantity of phosphoric acid, and the analysis shows this is really the case as the ash of teak wood is composed as follows:—

CaO	MgO	FeO	K ₂ O	Na ₂ O	SiO ₂	SO ₃	P ₂ O ₅	CO ₂	Cl
31.35	9.74	0.80	1.47	0.04	24.98	2.22	29.69	0.01	0.01

The percentage of carbon and hydrogen are higher than in most woods, and this together with the richness in calcium phosphate and silica may perhaps account for the great hardness of teak." Watts' Dict. Chemistry, 3rd Sup. p. 1894.

The sample from Nilambūr was in the form of a rounded flattened cake about ten inches in diameter and two or three inches in thickness; dirty white in color, with a rough gritty surface. A sample was made for analysis by breaking off portions from different parts of the cake and reducing the whole to a fine powder. The powder examined under the microscope was mainly in an amorphous condition similar to prepared chalk, with a dark colored gummy matter, and a small quantity of crystalline quartz sand. The following is the composition :—

Calcium carbonate	...	...	70.05
Tricalcic orthophosphate	...	...	2.89
Quartz sand	...	...	9.76
Organic matter	...	...	14.30
Moisture	...	...	3.00
			100.00

The analysis shows that the principal compound is calcium carbonate, and the concretion approaches nearer the chalk or limestone formation than that of the apatite or phosphatic found by other investigators. An examination of deposits from other trees might show greater differences than these, but it seems enough has been done to prove that the calcium element forms the base.

The sand, probably blown up as dust and made to adhere by the organic matter, is a mechanical ingredient. The deposit contained no salts of sodium or calcium soluble in water, nor any ammoniacal compounds; this would stand to reason, as the heavy rains to which this district is subjected would scarcely leave anything soluble on the trees.

A sample of the soil from the Teak Plantations, the same as that in which the Ipecacuanha is being cultivated, has also been examined. It is a light reddish brown sandy loam with quartz. In a dry state it contains 79 per cent. of silica and silicates, about 5 per cent. of organic matter, the same of iron oxide and alumina, and .217 per cent. lime as oxide.

The scanty amount of lime present in the soil, and the large amount found in the tree, show what an enormous quantity must have been taken up by the sap. I have shown elsewhere that a full sized cinchona tree contains about 10 ounces of lime (as slaked lime), not concentrated by abnormal development in one place, but distributed in all its parts. A teak tree from its size and ash contents would have a much larger supply than a cinchona, and yet, it seems, is able to excrete it in some abundance. In what manner this takes place is not easy to determine. The calcium enters the plant in a soluble form as sulphate. The calcium unites with oxalic and other acids and is precipitated, while the sulphuric acid parts with its sulphur to form organic compounds. A wound in the tree is liable to render these processes abnormal by causing the vegetable acids to ferment by exposure to the air and to yield carbonic acid as one of the products, and this meeting with the calcium in the ascending sap exuding from the wound might convert it into an insoluble calcium carbonate which would harden in the cavity of the tree and form the deposit.

A paper read at a meeting of the Nilgiri Natural History Society, Ootacamund, November 7th 1887.

The optical method of Analysis
For quinine sulphate

By David Hooper, F.C.S.

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The estimation of quinine by means of the polariscope has been discussed both favourably and adversely by some prominent Chemists, familiar with bark analysis. Although it has been regarded as an expeditious and accurate method by some ^{who} uphold its use, it seems to be unsatisfactory in indicating large quantities of an alleged impurity (Cinchonidine) in commercial samples of sulphate of quinine, which have had the reputation of being almost absolutely pure. The publication of these unexpected disclosures was made in the Nieuw Tijdschrift voor de Pharmacie in Nederland, as stated in this Journal for March 13, 1886, and it was remarked at the time that it might be expected to lead to further inquiry

inquiry into the value of the method of analysis by which the results were arrived at.

It is with the intention of elucidating some points in this subject, that I am anxious to contribute my experience as to the working of the optical method, having had numerous opportunities extending over a period of two years.

D^r. A. C. Oudemans was the first to experiment in this direction, by determining the specific rotatory power of the cinchona alkaloids and their salts, he was able to arrive at formulæ by which the amount of them could be determined in mixtures of them. D^r. O. Hesse has proposed an assay of quinine based on the use of the anhydrous sulphate, and its rotatory power. D^r. W. F. Koppe-schaar has brought a mass of evidence together to advocate the plan

plan of polarizing the double tartrates of quinine and cinchonidine. Mr. R. A. Davies has found the optical process very useful in determining the effect of recrystallization upon certain samples of sulphate of quinine. While D^r. de Vrij has, from the ^{very} first, used the polariscope in his quinological researches, and given it so much publicity in his interesting "Studies" that he has thoroughly identified himself with the process. All these gentlemen have given their testimony more or less in its favour, and they show that some reliance may be placed on the analysis of quinine sulphate by polarizing.

As to the salt employed in optical experiments, I am greatly in favour of the tartrate rather than the sulphate. The efflorescent character of sulphate of quinine and the varying amount of water of crystallization are fatal objections to its use. From 5 to 18 per cent. of water has been found in

ordinary

ordinary samples. Left in an open vessel the salt is constantly changing weight according to the conditions of the atmosphere. I have found that on taking samples from the same bottle on two different occasions in the morning, the water had increased from 13 to 15 per cent. Dr. Hesse in his assay uses the absolutely dry salt; to obtain this is an operation which must be undertaken with great precautions, as moisture is absorbed so readily. From this cause, it is possible to introduce into the experiment, at this early stage, an error, which no amount of accuracy in the after proceedings could rectify. If the weight is not certain at the commencement, then the mean of any number of readings of the polariscope will be worthless. The tartrates, on the other hand, are more constant in
the

the proportion of combined water. ¹⁹ They lose their hygroscopic moisture at 30° to 40° C. and do not increase or diminish in weight in climatic changes. I have frequently proved this by placing weighed amounts under cover for twelve to twenty hours, when it was found that the alteration, if any, was insignificant.

I will now draw attention to the intrinsic value of the optical method in estimating sulphate of quinine, and will notice a simple experiment by which it may be made to prove its own accuracy. I will grant that a careful analysis made by polarizing the tartrate from a certain sample of the sulphate and subsequent calculations give results which stand in need of confirmation. Another sample may be taken, and keeping the optical method in view, let it be divided into two parts by the agency of water. Dr. Paul's modification of Kerner's test is well adapted for this purpose. The sample is heated with a

a quantity of water insufficient to dissolve it; it is then left to cool and filtered. By this fractional crystallization two parts are obtained: the original sulphate, if containing any cinchonidine, will leave on the filter a purer salt, while the mother liquor will be a saturated solution of quinine sulphate. The recrystallized quinine is dried, weighed and converted into tartrate. The mother liquor is slightly concentrated, and also treated with alkaline tartrate. These two tartrates when dried are polarized, and it will be observed that the former salt invariably gives a higher rotation than the latter, affording evidence of the actual state of affairs brought about by recrystallizing. On adding together the amounts of quinine sulphate and cinchonidine sulphate, determined in each fraction, they will be found to correspond with the quantities of these two salts found by

by polarizing the tartrates obtained from the original sample.

I have employed the above method in testing three samples of sulphate of quinine, which differed considerably in their composition and purity.

The first sample had been manufactured experimentally in this country, and the presence in it of cinchonidine was so marked, that it was detected with ease by the other method of the Pharmacopœia of 1867. It yielded 93.22 per cent of tartrate, which gave the molecular rotation, $[\alpha]_D = -180^\circ.0$; by calculating the double tartrate into the respective sulphates, it was found that 67.79 parts of sulphate of quinine, and 40.77 parts of sulphate of cinchonidine made 108.56 parts total, therefore the sample under examination was composed as follows:—

Sulphate of quinine	62.45
" " cinchonidine	37.55
	<hr/> 100.00

Four grams of the original sample were fractionated by means of boiling water,

water. The recrystallized salt, when converted into tartrate, gave the rotation $[\alpha]_D = -191^\circ.66$, and this worked out by Pudemans formula, showed, that it consisted of:—

	grams.	percent
Sulphate of quinine	2.32	72.73
" Cinchonidine	.87	27.27

The tartrates from the mother liquor rotated $[\alpha]_D = -150^\circ.0$, which is equivalent to the following proportions:—

	grams.	percent
Sulphate of quinine	.17	20.98
" Cinchonidine	.64	79.02

The figures resulting from the examination of four grams of the sample, it is only necessary to add together the respective sulphates, and division will reveal the following percentage composition:—

Sulphate of quinine	62.25
" Cinchonidine	37.75
	<hr/> 100.00

The second sample was a well-prepared article of good appearance, from the manufactory of a well known Continental firm. It yielded 92.03 per cent of tartrate which had the specific rotary power $[\alpha]_D = -205^\circ.88$ and calculation indicated

indicated the following composition. ²³

Sulphate of quinine	88.52
" Cinchonidine	11.48

On conducting the second part of the experiment by fractional crystallization, 86 per cent of dried sulphate of quinine was recovered by filtration. The rotation of the tartrate precipitate was $[\alpha]_D = -208^\circ.22$, which shows by the usual calculations:—

	grams.	percent
Sulphate of quinine	3.14	91.22
" Cinchonidine	.30	8.78

The tartrates from the filtrate, when dried, gave the angle of rotation $[\alpha]_D = -194^\circ.0$, showing by calculation:—

	grams	percent
Sulphate of quinine	.41	73.21
" Cinchonidine	.15	26.79

The separate sulphates added together, and knowing that they are obtained from four grams, it will be seen that the sample examined was composed of:—

Sulphate of quinine	88.75
" Cinchonidine	11.25

The third sample was of English manufacture. It was a good commercial article, as it answered the test of the present Pharmacopœia for containing less than 5 per cent sulphate of cinchonidine. It yielded 94.59 per cent

per cent. of tartrate polarizing $[\alpha]_D = -23.33$,
and calculating as before. —

Sulphate of quinine	97.11
" " Cinchonidine	2.89.

The amount of sulphates recovered after recrystallization was larger than the previous samples; this, I take it, is a confirmatory indication of its purity. When the crop of crystals had been dried and converted into tartrate, it was found that the rotatory power as approximated that of Oudemans' constant for pure sulphate of quinine, that when calculated it showed only 0.25 per cent. cinchonidine sulphate, the remainder of this salt was therefore contained in the filtered solution. I did not take the tartrates from this solution. They were in such small quantities, as would not afford a reliable estimation, and no more of the original sample was at hand. These experiments tend to illustrate the fact, that has been noticed by recent writers, that very few recrystallizations are sufficient to obtain an absolutely pure sulphate of quinine.

The above mentioned experiments
have

have been made upon commercial salts, but a great deal could be said with equal satisfaction regarding the examination of the tartrates derived from mixed alkaloids in bark analysis. In this manner, I have found that there is a relation between the amounts of the laevorotatory alkaloids in distinct species of cinchona. For instance, there is twice the quantity of quinine than cinchonidine in natural bark of C. officinalis, while in the natural bark of C. succirubra, this order is reversed; and double the amount of cinchonidine exists to every one part of quinine.

Of course a great deal more could be said on this subject, but I only wished to draw attention to the physical method of analysis. I have shown that the examination of the fractions corresponds and substantiates the examination of the whole, and when the results turn out in entire accord with one another, it shows that the method of working is proved with the exactitude of demonstration of a proposition in Euclid.

It must be remembered that these
operations

operations have been conducted at a tropical hill station, where temperature, altitude, latitude and other climatic influences are diverse from those of the countries where previous communications have originated. There are numerous processes often applicable to a single object, such as the estimation of quinine, and in a place where some of these processes are not practicable, it is as well to keep to a method which gives satisfaction to those who are in the habit of using it.

Octacene and Indis.

Chemical News
LONDON.

Nov. 11th 1887.

13.
27.
The Phenomenon of Decrepitation in
Organic Substances.

Decrepitation is usually defined as "the crackling of certain salts when suddenly heated, accompanied by a violent explosion of their particles". Illustrations of this phenomena are found in some anhydrous salts, such as potassium chlorate, sodium chloride, and plumbic nitrate, certain natural minerals having distinct crystalline structure; and a few imperfect conductors of heat, as glass and cast-iron, — all of which are inorganic.

Two causes are assigned to the behaviour of these bodies when heated. In the crystals, water is mechanically enclosed between the solid particles, and the explosion is owing to the expansive force of the steam suddenly generated. In the non-crystalline substances there is an unequal expansion of the laminae which compose the mass, and a consequent breaking up, as the heat is conducted into it.

In the analysis of organic compounds, it must have been often observed that,

in evaporating aqueous and alcoholic extracts to dryness, a crackling frequently takes place, as they are cooling; the film of dry extract becomes fissured in all directions, and some portions are detached, and fly off or fall to the bottom of the vessel, in which the operation is conducted.

A peculiar phase of this phenomenon was noticed some months ago, when examining the bark of Michelia Nilagrica. The tannin had been precipitated by cupric acetate, and the washed precipitate in a moist state was dried in a water-oven, and weighed when it ceased to lose water. The tannate of copper, left in a glass dish, in a few moments began to crackle, and fragments of the compound became disrupted and fell like a shower upon the counter, covering it within a radius of some 10 to 12 inches.

This peculiarity was noticed a second time during the investigation of a resin in Musambra, a country made also of India. The purified resin insoluble in acetic acid, was dried at 100°C , and weighed. A few moments afterwards the precipitates began to crack, and great commotion ensued, as small

Small splintery fragments were violently ejected on all sides. This continued for about fifteen minutes, when the fountain ceased. The loss of resin amounted to about 5 per centum. Another quantity of this resin was precipitated, and dried altogether over sulphuric acid, until it became constant in weight; it was then transferred to a water-oven, and dried at 100°C . In this case no decrepitation took place after being cooled, but the resin gradually assumed the amount of moisture it held, previous to its desiccation at 100°C .

The explanation of the cause of this phenomenon in organic extracts might, with very good reasons, be the same as that which is used in the physical description of the old "Rupert's drop." There seems to be in both an accidental cohesion of matter, having elastic properties. The rapid drying of the resin, from a moist to an anhydrous condition, unequally contracted the mass without allowing it an opportunity to assume its natural state, when combined with water of hydration. In regaining this water, an expansive force was exerted on the exterior portions of the mass, and caused the violent disruption of the particles. As a practical matter, this inconvenience might-

might be avoided by the more careful and not too rapid drying of these substances.

In evaporating a chloroformic solution of pure strychnine in an assay of nuxvomica, a spluttering often takes place, as the final portion of the solvent is being dissipated. This is a different case to those I have been describing. Here the decrepitation, if it may be so called, occurs during the evaporation, and not during or after the cooling. It appears to be due to the assumption of the crystalline state by the alkaloid on the immediate disappearance of the chloroform.

Ootacamund, India

October 11th 1887.

Waras: its composition and Relation to Kamala.

Pharm. Journ. 10.9.87
Within the ^{last} four years waras or wars has been the subject of various notes in the Pharmaceutical Journal, in which its history, histology and botany have been discussed by several pharmacologists. The present paper is a supplement to what has already appeared, inasmuch as it deals with some chemical and technical experiments with the authenticated drug of Southern India, and critically compares it with the Kamala of the Pharmacopœias.

Source and Collection. The plant which yields the red glands known as waras is Flemingia grahamiana (Ward & A.) a small leguminous under-shrub growing on the northerly slopes of the Nilgiri plateau, as well as in other districts of India. The sample that came to my hands was from above the Gudalur ghaut, and collected by Mr. M. A. Lawson, Government Botanist in the Madras Presidency. Mr. Lawson has studied the species of Flemingia afforded by this part of India, and concludes that F. rhodocarpa of Baker is not specifically

Specifically distinct from *F. Grahamiana*.
 The fruits ripen in November, towards the
 close of the north-east monsoon, when
 they are covered with the peculiar red
 glands. The drug is collected by cutting off
 the clusters of pods from the ends of the
 branches and laying them in the sun to
 dry for one or two days. They are placed
 upon boards or paper, as during the
 process of drying much of the powder
 falls and would be lost unless
 such a precaution were taken. The
 pods are then pressed or rubbed together
 by hand over sieves. The powder is
 mixed with hairs, stones and pieces of
 stalk; it is readily removed from these
 impurities by finally passing it through
 a fine muslin or lawn sieve. Although
 the plant occurs pretty frequently in
 Southern India, very little seems to be
 known by the natives of its colouring
 or medicinal properties, and from the
 inquiries made of Canarese traders north
 of the Nilgiris and Tamil people to the
 south, no information could be
 gleaned of its glands, being a
 marketable article; but at a
 recent

recent exhibition of the Agri. Horticultural
 Society at Madras some of the powder
 was shown by a native dyer.

Terminology. — Waras, warus, warrus, wurhus,
 wos, waw, var, and huars are some of the
 names which have been applied, at
 different times to the glands from *Flemingia*
 pods, and like most Eastern words, when
 translated into English characters, are
 variously written with an endeavour to
 to represent the foreign accent. Daniel
 Hanbury, in 'Science Papers,' gives the Urdu
 or Hindustani name of the drug as used by
 the merchants at Aden, and renders the
 English equivalent as "waras" This word
 is distinctly bisyllabic in pronunciation;
 it signifies the "saffron" - like colour of the
 pigment, and, as Hanbury states, very
 probably originated with the Mahamma-
 dans of India. "Waras" has always been
 used by the authorities at Kew in their
 reports and correspondence, but Professor
 Flückiger and Dr. Symock resent uni-
 formity in this respect by continuing
 to employ the term "Wart"

Characters and Tests. Waras is a
 granular

granules, mobile powder of a deep purplish-red colour, and without any marked odour or taste. Under the microscope, it is in the form of cylindrical or subconical grains, with oblong resin. cells, arranged in rows in the interior. The powder ignites like *Lycopodium* when thrown into the flame of a lamp. The specific gravity is 1.37. It is insoluble in cold water; when mixed together it at first floats on the surface, and if left in contact, it slowly becomes wetted, and sinks. If, however, it is rubbed up in a mortar before added to the water, or if it is boiled in it, the glands become broken, and a bright yellow emulsion is formed; if this emulsion is allowed to stand, the resinous matter will subside, and leave a yellow sweetish solution. The greater portion of waras is dissolved by ether and warm alcohol, the resulting solution being of a bright orange colour; when treated with caustic alkalis the solution is intensely red. It sinks in oil of turpentine, imparting a slight colour to it

after a time. When rubbed up in a mortar with water and the mixture submitted to distillation, an odour between that of caraway and lemon was observed in the distillate, and a greasy film in the receiver indicated traces of a volatile oil as its source. Heated in a crucible, it at first blackened, giving off aromatic vapours, then intumescend and evolved inflammable gases which burnt with smoky flame; when the charred mass was destroyed by prolonged ignition a residue was left of a grey-coloured ash consisting mainly of finely divided sand.

Chemical Composition. — The resinous colouring matter which constitutes the chief part of waras has a brittle consistence, it is of a deep garnet-red colour in bulk, and orange-red when observed in thin strata. It is soluble in ether, alcohol, benzol chloroform, carbon disulphide, acetic acid, and in solutions of potash, soda, ammonia and the alkaline carbonates. It forms soluble compounds with lime and magnesia. It is precipitated from

from its solutions in the alkalies by acids in an apparently unaltered condition. Sulphuric acid dissolves it in the cold. Heated with nitric acid it rapidly oxidizes, yielding yellow-coloured products and a resin soluble in alcohol. A solution in spirit is partially precipitated by acetate of lead. Diluted alcohol appears to separate it into two resins; a soluble one of a yellow colour and an insoluble of a deep red. Heated with potash or soda an odour of Citron is evolved. An ethereal solution of the resin allowed to evaporate spontaneously deposits a mass of crystals. The crystals are of a lighter colour than that of the surrounding red resin; examined microscopically they appear as crops of acicular prisms radiating from a common centre. Ether and other liquids were added with a view to remove the crystals from the resin or *vice versa*, but all the volatile solvents tried resulted in forming a solution of

both, and this rendered the separation ³⁾an insuperable difficulty.

Besides the resinous and crystalline principles of waras, there is a volatile oil, already noticed, albuminous and saccharine matters soluble in water, and an amount of ash rarely falling below 5 per cent.

Waras and Kamala Compared.— That the secretion from the pods of a leguminous shrub should have the same properties and similar constituents to the secretion from the capsules of an euphorbiaceous tree will always remain an interesting fact, but from the above description and chemical examination of waras, there are so many points of resemblance to kamala, ^{to make} that in order a comparison of any value, a quantitative as well as a qualitative analysis is necessary. Dr. Anderson, of Glasgow, in 1855 worked out the proximate constituents of kamala, which are tabulated below. By its side are placed the results of an analysis of waras made by the author:—

Resinous

Resinous colouring matters	Waras 72.83	Kamala 78.19
Albuminous matter, &c.	8.20	7.34
Cellulose	9.50	7.14
Water	3.44	3.49
Ash (principally sand)	6.03	3.84
Volatile oil	trace	trace
	100.00	100.00

There is a smaller proportion of resin in the waras, and as there is consequently a larger amount of aqueous extract and cellulose, this might probably account for its blackening when heated, as noticed, by Hanbury. As might be expected, there is more mineral matter in waras than in kamala; so much of the Flemingia plant is gathered in preparing the powder, but only the capsules and stalks of Mallostus are taken for this purpose, so that as they are both collected in the dry weather, the former would afford

afford more sand. In the Pharmacopœia, the minimum quantity of ash indicated as yielded by kamala on ignition is 4 per cent. It may be difficult to procure a commercial article giving less than this, but the specimen used in my experiments was procured by an ordinary coolie from trees growing on the Goonoor ghaut and left only 2.86 per cent of ash.

The following are some points of difference between the two drugs:

	Waras	Kamala
Colour	purplish-red	brick red.
Specific gravity	1.37	1.32
Solution in S.V.R. (1 in 20)	deep orange red	orange red.
Solution in alkali	deep crimson brown	deep orange red.
Heating to 100°C.	blackened	no change.
During ignition	moderate intumes- cence	violent intumes- cence.
Boiling water	emulsion formed	yellow solution.
Heated with soda	odour of citron	odour of bitter almonds

Boiling water is a very distinctive test.

test, The Pharmacopœia does not notice the yellow colour imparted by kamala, but boiling water exercises at least a slight solvent action. The microscopic description of these two drugs has been given by Mr. W. Kirkby in a recent Journal, and by the authors of the 'Pharmacographia'.

Waras and kamala are both granular, mobile, non-hygroscopic powders of no smell or taste, and exhibit their resinous nature by rapidly igniting when thrown into the flame of a lamp. Both are insoluble in cold water, and are equally wetted when left in that medium. The solvents employed in removing the colouring matter of the one answer as well as the other. They have a lemon or melon-like odour, which is volatile and is found in the spirituous extract. They intumesce, but in different degrees, when burnt. The resinous colouring matters have the same chemical reactions, and agree in containing a crystalline

Constituents

constituents not easily isolated.

Dr Anderson obtained from kamala by the agency of ether a substance named Rotlerin, $C_{11}H_{10}O_3$ in the form of platy yellow crystals of a fine satiny lustre. Hanbury and Grouse were, however, unsuccessful in preparing it from the crude drug in a crystalline state. As the result of some later investigations, A. G. and W. H. Perkins, Juniors (Ber., XIX., 3109) have prepared and analysed Mallotoxin, $C_{11}H_{10}O_3$ or $C_{13}H_{16}O_5$ appearing as flesh-coloured needles, and having the property of the resin. Later still L. Jarvin (Ber., XX., 182) obtained a yellow crystalline substance melting at 200° , to which he has given the same name and formula as Dr Anderson's extract.

The crystals observed in waras might be denominated "flemingin"; the compound premises, upon ultimate analysis, to belong to the same family of chemical principles as rotlerin, if it be not its twin brother.

Spectrum of the Colouring Matter of Waras.—

An alcoholic tincture observed through a

spectroscope

Spectroscope showed a complete absorption, as far as the Fraunhofer line **D**, and partial absorption up to **d**; no bands appeared in the visible portion which was formed by the red end of the spectrum. A more diluted solution gave less absorption on the violet side, consequently a wider spectrum was exposed, extending to 55° on a scale of 170° ; and although the yellow, orange and red portions were seen, no bands could be distinguished.

Kamala was examined in a tincture that was made to imitate that of the waras in tint, but not in strength; the spectra of these solutions were so much allied that it was impossible to determine one from the other. My friend, Professor Michie Smith, of Madras, also kindly examined specimens of Kamala and waras at my request, and he confirmed the identity of their spectroscopic characters.

Waras as Dye-Staff. - A dye-bath was

was made of waras, with solution of alum and sodium and potassium carbonates, and in the boiling liquor were separately immersed pieces of silk, wool, linen and cotton. The colour formed on the silk was a brilliant orange-brown of a much superior tint than that on the wool, while the linen and cotton were of a dull brown, and became fainter when washed. The colour being adapted for an animal fabric, as silk, more than for vegetable tissues, is another indication of its alliance to Kamala, an article used in India, and elsewhere, essentially, as a dye for silk.

To obtain a more valuable testimony to its artistic use, Mr. Lawson forwarded a large sample of waras to Sir Joseph Hooker, and from him it was sent to Mr. Thomas Wardle, the well known silk dyer, of Leic., Staffordshire. Mr. Wardle made several experiments with the dye upon mulberry silk, Tassar silk, and wool, and reports as follows: -

"This substance contains only a small amount

amount of colouring matter, compared with the vegetable yellow dyes of commerce, and no colours can be obtained from it which will bear comparison, in depth and richness, with those of Kamala, for which, it is stated in "The Report" for 1880, it is used, as a substitute, and which is certainly a very much more valuable dye-stuff. As far as my observations have gone waras is inferior to Kamala in permanence, as regards the action of light. The colour produced by waras is easily turned brown by alkaline solutions, whilst Kamala is only slightly reddened. Both dyes, however, resist the action of acids very well. Waras is a suitable dye for silk, more than for wool, and it is useless as a dye for cotton. I have tried it on cotton with most of my mordants, as well as without mordant, and the result is only a very pale shade of yellow."

Sir Joseph Hooker, on receiving the specimens

Specimens of China silk dyed with waras by Mr. Wardle, ^{stated} that they showed great delicacy of tint, and he did not see why the dye, the use of which in India from an indigenous source appears to have been previously unknown, should not have, at least, a local interest.

Bark of *Michelia Nilagirica*

Pharm. Journ.

Jan. 14th 1886

One of the most abundant and perhaps the most characteristic of the forest trees of the Nilgiri hills is the *Michelia Nilagirica* of Zentker. In the rainy season, especially in August and September, its large white and fragrant flowers make the tree very attractive; later in the year it sheds on all sides an abundance of scarlet seeds, and it may be always recognized by its evergreen leaves having a paler colour than the *Eugénias* and other "shola" companions. It is the tila champa of the hills, and is known locally by its Tamil name shemprangan or sempragum. The real champa (*M. Champaca*) and the white magnolia (*M. excelsa*) are allied timber trees growing mostly in Northern India; they

they differ from the champa of the Nilgiris on the number of ovules and other respects, but most prominently in the former having yellow flowers and the latter being deciduous.

The bark is said to have febrifugal properties, when made into decoctions, or infusions; but I have been unable to discover any substantial grounds for such a reputation. As it seems to have attracted notice on the continent as the source of a new aromatic essential oil, I would venture to offer some descriptive notes on the subject of the bark, and its chemistry.

The bark is covered with a light brown corky layer, which scales off, or may easily be removed when dry; it is brittle, and its irregularly broken surface is frequently beset with lichens and mosses. Between the cork and intermediate layer are pinkish masses of various forms. The surface of the middle layer is pale brown; in the fresh

fresh state, it is marked with longitudinal green stripes; it is hard and dense, and very much resembles in appearance the bone at the base of horns. A fracture shows that the middle layer is dense and of a reddish colour, and the inner layer is dirty yellowish-brown, and tough and fibrous in consistence. The inner surface of the bark is russet-brown, striated with the fine longitudinal marks of the white liber tissue. A transverse section, touched with a drop of ferric chloride solution, shows that tannin is present in the two inner layers, by the greenish-black colour it produces, the outer or corky layer is unaffected. The bark affords a light cinnamon-brown powder, slightly bitter in taste, with a faint cerebintinate odour.

The above description applies to the stem bark of large sized trees,

which dries up into single quills or channelled pieces, between $\frac{1}{4}$ and $\frac{1}{2}$ of an inch in thickness. The bark of the branches and younger stems has a papyraceous cork which is removable, the colour throughout is uniformly pale brown. The quills, without the outer coat, are suggestive of cassia; the taste is not so bitter, and the odour is more aromatic than that of older specimens.

The microscope revealed an abundance of rounded starch granules, varying in size, each with a prominent hilum. There were also numerous rhomboid crystals of calcium oxalate present in the vascular tissue.

The powdered bark contained 10.6 per cent. of moisture, when dried in a water-oven, and left 9.7 per cent. of ash, when ignited at a dull red heat.

An ether extraction made from 30 grams of the same powder afforded volatile and fixed oils, and an acid, resinous substance. The volatile oil had an odour that could not be referred, with precision, to any of the known oils, but, if anything,

it approached those of the coniferæ. The fixed oil was insoluble in rectified spirit, and yielded, by boiling with soda solution, a mixture of fatty acids, fluid at 60°F. The resin was intensely bitter and acid, and of a brown colour that deepened on the addition of a fixed alkali. This extract constituted 4.5 per cent of the bark.

An extraction with rectified spirit separated a tannin, giving a greenish-black colour with ferric salts, sugar, and a bitter principle, not of an alkaloidal nature. These amounted to 8.1 per cent of the drug.

Boiled water made to exhaust the residual bark dissolved out mucilage and an additional quantity of tannin. Search was made for alkaloids in this, and the previous extracts, with negative results; neither was mannite, a constituent of some allied barks, detected here. The aqueous extract was 18.1 per cent.

Albuminous and colouring
matters

matters to the extent of 6.3 per cent. were removed by means of a dilute solution of soda. The remaining crude fibre, (without the silicious ash) together with 6.2 per cent of starch, formed 42.7 per cent. of the entire bark.

A cold aqueous infusion of the bark has a brown colour, a bitter aromatic taste and an acid reaction; it is precipitated by neutral plumbic acetate, which removes from solution all the tannic matters and mucilage.

A cold filtered decoction of the powdered bark, treated with a few drops of iodine solution, gave a blue-black coloration on first mixing, but it instantly disappeared; it was only after the addition of a considerable quantity of the reagent that the colour became tolerably permanent. The mixture, allowed to stand for some hours, gradually resumed its brown

brown appearance, at the same time depositing a brown sediment. The filtered liquor, after further treatment with iodine, gave the transient colour, and again deposited on standing. One gram of the powder, boiled with water, gave a decoction, which required 3 c.c. of decinormal solution of iodine until permanent coloration was produced. This reaction has hitherto been peculiar to cinnamon and Cassia barks.

As far as this *Michelia* bark is concerned, it would seem that the property of decolorizing starched iodine does not reside in an essential oil, as the reaction was equally noticeable when the bark had been exhausted with pure ether and alcohol. The authors of the 'Pharmacographia' found that the spirit of wine and boiling ether failed to remove the agent in cinnamon that modified the iodine test, so it could not be

be *hannin* matters. In the absence of further investigation in this subject, it would appear that the peculiar property occurs in the aqueous or alkaline extract of the barks, and might be referred to some albuminous compound.

The bark of *Michelia* *Magirica* has features corresponding with other well-known barks of the materia medica affording aromatic oils. Cinnamon and Cassia, of the natural order *Lauraceae*, contain allied bodies, as essential oil, sugar, starch and *hannin*. These are related to two drugs in the natural order *Canellaceae*, viz., the barks of *Canella alba* (white cinnamon) and *Cinnamodendron corticosum*, the false winter's bark. The true winter's bark is from a tree (*Drinys Winteri*) belonging to the natural order *Magnoliaceae*, the same as that which includes the *Michelia*s.

Michelia bark may be distinguished from cinnamon and Cassia by the odour, from canella by containing *hannin*, and from *Cinnamodendron* by its exfoliating cork.

cork. The barks of the hill Michelia and Prunus have similar constituents in essential oil, starch, resin, mucilage, and tannin. An addition of potash of a cold aqueous infusion of the latter yields a dark, somewhat violet liquid, while the Michelia bark under the same circumstances yields an orange-brown liquor, probably caused by the action of the alkali on the tannin present.

Pharm Journ.

Feb. 18th 1885.

Bark of Rhamnus Nightii

The rhamnias have long been known to yield important products, used in medicine and the arts, and their active principles have been the subjects of many interesting investigations. The green dye of the Chinese has been traced to barks of some species of this family, and the juice of the berries of Rhamnus catharticus has been employed as an aperient since the thirteenth century. The introduction of the barks of black alder (R. Frangula) of North America into the last British Pharmacopœia is a testimony to the medicinal value of two other species, while the following notes are a contribution to the knowledge of a third kind of drug bark obtained from a buckthorn of Asia.

Rhamnus Nightii, W. A. is a common shrub in the more elevated parts of the

the western forests of Madras and Bombay, inhabiting the highest hills of the Concan, southwards to the Nilgiris. It also grows in the most elevated parts of the central province of Ceylon, with *R. Anottianus*, and is therefore one of the most tropical of all the usually temperate *Phamniads*. It forms a feature in the *sholas*, or wooded ravines, around Ootacamund, when it reaches an elevation of nearly 8000 feet above sea level.

It is a large unarmed shrub. The leaves are glabrous, sub-opposite, elliptic, shortly acuminate, sharply serrate, and sub-coriaceous. Pedicels axillary, fascicled, much shorter than the petiole; calyx 5 cleft. Petals cuneate-obovate, with short point, flat; flowers greenish yellow. Styles three to four, diverging. Ovary three to four celled. The younger parts turn black in drying. The plant is figured in Wright's 'Icones Plantarum Indiae Orientalis', plate 159.

The

The bark is mentioned in Bolander's 'Hand-book of Indian Flora', and by Dr. Dynebeck in his 'Vegetable Materia of Western India', where the drug is reputed to have tonic, astringent, and deobstruent properties. It is sold in the Bombay shops for 2 Annas, or about 3d. per pound. Scammon, however, discovers anything about it on the Nilgiris, and it is not sold in the local bazaar.

The bark which formed the subject of my investigations was taken from the branches and stems of middle-aged trees, and pretty uniformly answered to the following description:—The dried bark occurs as single quills or incurved pieces from 2 to 3 millimetres in thickness. The outer surface is dull brown in colour, beset with numerous corky protuberances or lenticels opening longitudinally, and sometimes closely covered with whitish or greenish lichen. The younger barks are ashy-grey with fewer lenticels; the older barks present a more rugged surface;

surface, due to the growth of cork and the occurrence of deep transverse cracks, and are much thicker. The outer surface of the middle layer is reddish-brown, and exhibits indentations and transverse markings, corresponding with the warts and cracks of the exterior layer. The inner layers consist of pale liber fibers running through a mass of cells containing yellowish-brown colouring matter of a waxy consistency. The inner surface is dark chocolate-brown, becoming black when kept for some weeks. The fracture is short externally, and tough and fibrous internally. A section touched with a drop of potash solution becomes intensely red, with ferric chloride, dirty green, and with iodine solution, black. The taste is astringent and bitter, but not unpleasant; a sweetish after-taste is left on the palate. The odour of the bark recalls that of *Fan*.

A.

A microscopic examination showed that throughout the parenchyma, especially of the mesophloem, there were a number of aggregate crystals, more plentiful in older specimens. The mesophloem contained many thick-walled cells. The medullary rays and inner cellular layers were filled with starch granules. A yellow colouring matter, residing principally in the liber and cambium, became brilliantly red in contact with potash solution. In the cells surrounding the liber vessels were numerous large rhomboidal crystals. The crystals were also very abundant in the pith of the wood, associated with starch.

Chemical Examination. - Fifty grams of the finely powdered bark were shaken up occasionally during twenty-four hours with crude ether

and

and the percolated liquid distilled at a gentle temperature until the ether was removed. The dark brown extract in spirit and water was allowed to stand for some hours, and then filtered. The residue on the filter paper was composed of a crystalline substance and a light brown resin; their separation was effected by using proof spirit to dissolve the previous component. The fluid portion was then mixed with water, well stirred, and allowed to repose over night; in this manner a red resin was deposited, apparently in a granular condition, and some ferric matter was removed by the water.

The residual bark, after desiccation, was macerated in rectified spirit for two days, and then filtered. In this extract, the total solids, and the parts soluble

soluble and insoluble in water were determined. The resins were treated with diluted ammonia, which left an "indifferent β -resin" undissolved; the filtrate on the addition of acetic acid, threw down an "acid resin soluble in alcohol". The acidulated filtrate was fluorescent, and was not changed on further adding acids or alkalis; the acid solution shaken with ether was relieved of a body which afforded "candleflower"-like crystals on evaporation; its alkaline solution imparted a fluorescent appearance to this solvent. This resin appears to be of a complex nature; it is altered during its evaporation with acids, and is not re-dissolved. I have named it an "indifferent α -resin".

The aqueous solution of the alcoholic extract was precipitated by neutral plumbic acetate, which removed a

Hammin

tannin giving a greenish colour with ferric chloride. The filtrate, freed from lead, contained a bitter principle, separable by twice evaporating to dryness and resolution. The saccharine fluid was made up to a certain volume and estimated by means of Fehling's solution; a fraction only was reduced by this method. The sugars were decolorized with animal charcoal, and observed through a tube in a Laurent's polariscope, and found to indicate a slight right-handed rotation.

It might be mentioned, incidentally, that isodulcite, or phannodulcite has the same property with regard to polarized light.

The aqueous extract of the bark was divided into two portions; in one the total solids and ash were estimated, and in the other gum carbohydrates and organic acids were sought for.

The

The precipitate caused by adding two volumes of spirit to a concentrated solution was dark coloured, and became partly crystalline when left for six days in a covered vessel. It was ignited, and the ash weighed and deducted; the amount of ash was very high, compared with that afforded by mucilages and carbo-hydrates, and indicated a calcium malate. Calcium bitartrate exists in tobacco leaves and other vegetable products, and would leave 18.3 per cent. of CaO , the neutral malate as much as 32.5 per cent. the precipitate in question left a quantity of calcium carbonate equivalent to 29.8 per cent of CaO . The further addition of four volumes of spirit to the evaporated filtrate caused an inappreciable deposit. The spirit was dissipated at a gentle heat, and the liquid began to show signs of decomposition, and a portion became insoluble.

This

This substance was found to contain nitrogen, and gave evidence of a glucosidal nature by abundantly reducing Fehling's solution after boiling for a short time with diluted sulphuric acid. The organic acid was estimated in a fresh portion of the extract by means of neutral plumbic acetate, and when liberated from its lead compound by sulphuretted hydrogen gave many reactions peculiar to cathartic acid.

The bark left, after treatment with the previous solvents, was exhausted with diluted soda solution, removing all luminous and colouring matters, not wholly precipitated by acetic and alcohol. A combustion of a fresh sample of the powdered bark was made by burning with soda-lime, and passing the resulting gases through standard sulphuric acid; the nitrogen calculated

calculated from the ammonia obtained in this manner, after deducting that required for cathartic acid, was multiplied by 6 to determine the proteids. The amount of proteids shown in the experiment was subtracted from the total extract obtained by the soda solution, and the difference was assigned to a "modification of arabin removed by alkali."

The extraction of the powdered drug was then continued with diluted hydrochloric acid, and removed a considerable quantity of calcium oxalate, which was estimated from the amount of calcium carbonate left on igniting the precipitate resulting in the acid liquor, after supersaturating with ammonia. The marc was then boiled in an inverted condenser for four hours, with water containing 1 per cent. of hydrochloric acid, and the

Starch was calculated from the amount of glucose found in the filtrate. A careful weighing of the bark, before and after the treatment with cold and boiling acid, showed the quantity removed, so that by subtracting the calcium oxalate and starch from the whole, the difference might be denominated, in view of recent researches made in this direction "modification of arabin soluble in acid".

The crude fibre was halved, and one part was digested in chlorine water, for four days, until the brown colour was destroyed; it was washed with water, potash solution and water, dried and digested in nitric acid, and a little potassium chlorate, until colourless; the cellulose was weighed, and the ash subtracted. The second half was immersed in sulphuric acid of specific gravity 1.53 for thirty hours, and the lignin, after washing with ammonia, was weighed. The difference between these two weighings and that

that of the crude fibre would represent the suberin and cuticular substances, but owing to the rather low results usually obtained by the sulphuric acid method, the lignin should be somewhat higher than it is represented.

The first of the following tables will show the proximate amount of extracts removed by the different solvents, and the second table will give the results of their elaboration, and the percentage of the different principles, as they were separated and determined:—

Ethereal extract	2.82
Alcoholic	27.98
Aqueous	7.18
Alkaline	8.42
Acidulated	20.80
Residue	32.80

100.00

Stryoballine

Crystalline principle	0.47
Light brown resin soluble in ether	0.85
Red resin soluble in ether	1.15
Red acid resin soluble in alcohol	4.56
In different α -resin soluble in alcohol	3.80
In different β -resin soluble in alcohol	1.64
Tannin	2.68
Bitter principle	1.23
Sugar, reducing	2.20
Sugar, non-reducing	10.12
Malic acid (?)	0.89
Gathartic acid	4.42
Extractive soluble in water	0.65
Aluminous matter	6.67
Modification of arabin soluble in alkali	1.75
Calcium oxalate	7.43
Starch	7.82
Modification of arabin soluble in acid	5.54
Cellulose	16.17
Inulin &c.	6.38
Leignin	9.80
Ash (balance of)	2.39
Moisture and loss	0.28
	<u>100.00</u>

The inorganic matter of this
 buckthorn bark forms an important
 item

69
 item in its analysis, and I consider
 that in all vegetable products contain-
 ing organic acids, the mineral constituents
 should not be overlooked. As the ashes
 of other barks of this family do not
 appear to have been examined, or in
 any way noticed, I desire to record
 my work on the ash of the bark under
 consideration. A mean of six esti-
 mations showed the presence of
 9.20 per cent. of almost white ash,
 and its richness in calcium car-
 bonate was found to be due to this
 salt forming four-fifths of the whole,
 and nearly all of which was combined
 with the organic acids in the bark.

The ash gave the following
 analysis: —

Soluble in water	8.65
" " acid	89.97
" " "	1.48
Insoluble	<u>100.00</u>

Insoluble

Insoluble silica	1.48
Soluble	18
Iron and alumina	1.55
Lime	47.04
Magnesia	2.91
Carbonic anhydride	35.52
Phosphoric — "	1.78
Sulphuric — "	68
Chlorine	trace
Alkalies, &c. by difference	8.86
	<hr/> 100.00

The crystalline body found in the ethereal extract appeared under the microscope as white transparent prisms, and was sparingly soluble in water, ether, alcohol, and boiling disulphide of carbon. When freed from adherent resin, it was not coloured by strong sulphuric acid, or potash solution. The crystals melted, and partly sublimed when heated, leaving a deposit of carbon. It had similar reactions with the "crystallizable body" obtained by Prescott from Casarea Sagrada.

The light

The light brown resin was soluble in rectified spirit, and gave a fine rose colour, with diluted alkalis. When heated, it melted to a reddish mass, and gave off greenish-yellow vapour, which sublimed, and had similar characters to the original resin. It was semi-crystalline, when observed under the microscope.

The red resin, soluble in ether gave a fine purplish-red colour with the alkalis, and was totally precipitated from solution by acids. It gave a crimson colour fading to a yellow, and dissolved in concentrated sulphuric acid. With nitric acid, it became an orange-brown solution, and was precipitated on the addition of water. It was quite tasteless, and had no crystalline structure, when evaporated from different solvents.

The red acid resin soluble in alcohol constituted the larger part of the resins present. It differed

58
the resins soluble in ether by its rapid decolorization and removal from solutions, when shaken with animal charcoal. It is coloured deep red. Brown with potash, and is at once thrown down, when neutralized, with acids.

The different resins have already been noticed. The α -resin appears to be changed by heat and acids into the red resin soluble in alcohol. The β -resin is known by its insolubility in ammonia and fixed alkalis, but it affords red solutions with stearic and sulphuric acids. It has a brown colour which changes to green on exposure to the air. It resembles the light yellow resin or "natural body" found by Prescott in the bark before mentioned.

The Liquid Extract. - A liquid extract of Rhamnus Frangula bark is made according to the directions

59
of the British Pharmacopoeia ^{23rd} formula for the preparation of the Rhamnus Frangula bark. The coarsely powdered ~~drug~~ was boiled three times with water, and the liquors were evaporated. During this process, a green deposit occurred, which would be called by ancient dyers "flowers," or "feculæ." When the liquid had been reduced to the required volume, and spirit added, as directed, there was still a large quantity of the deposit refused to dissolve. The sediment consisted mostly of the resins soluble in alcohol; a small quantity shaken up with acid and ether, showed the peculiar crystal, like cauliflower, when the ethereal solution was evaporated. The clear liquid extract also deposited largely, when kept for some weeks. A preparation that does not retain the resins of the bark cannot be considered to represent its full activity, and I

cestrum?

certainly advocate the use of spirituous extraction of this bark in making its liquid extract.

Note - Rhamnus Nightii bark appears to have many principles, which have been obtained from other medicinal barks of this order, as those of Black Alder, and Cascara Sagrada, but as the present investigation deals with one having a reputation for its astringency, I have endeavored to discover what this active principle really is. The analyses of the other aperient barks have been ~~qualitative~~, this has been quantitative, and the difference in the medicinal activity will perhaps be attributable to the amount of these resins and other principles, and not to their presence or absence.

A summary of the composition of the other two barks has been given in Bentley's 'Organic Materia Medica'.

1. Frangula contains 'a yellow crystal-
lizable

75/
lizable principle termed rhamnonanthin or frangulin, an amorphous bitter principle of a resinous nature, smodin, resin, and a little tannic acid. That of R. Picrosianus "three resins, a white sublimable crystalline principle, tannic acid, a small quantity of volatile oil, and other unimportant constituents". Rhamnus Nightii resembles mostly the composition of the North American drugs. Its medical properties are now being tried, and it is hoped that it will afford to those residing in this country as useful a medicine, as others that are so largely imported.

Pharm Journ
April 7th 1888.

63
Leaves of *Adhatoda vasica*, Nees.

Botanical Characters. — *Adhatoda vasica* is a plant belonging to the natural order Acanthaceae. It has been placed by botanists in various genera, and on this account will be found in older works on botany under the following names: — *Justicia Adhatoda* Linn., *Grandæva Adhatoda*, Planch. *Adhatoda pubescens*, Moench. It is a dense shrub, 4-8 feet high, sometimes aborescent, and 20 feet high. Leaves, opposite, elliptic, acute at both ends, entire, smooth or minutely pubescent, 6 to 8 inches long, and 1½ to 3 inches broad; petiole, 1 inch. Spikes dense, short, long-peduncled, covered with large bracts. Bracts herbaceous, glabrous, ovate, permanent, one flowered. Flowers large, white, with brown dots. Flowering in the cold season, from February to April.

Habitat

Habitat.— Adhatoda vasica is stated in the 'Flora of British India' to occur from the Punjab to Assam, Ceylon and Singapore, and distributed in the Malay Peninsula. It is common and frequently cultivated throughout India, and, indeed, it would be difficult to mention a more widely distributed plant in the country. In addition to its being found in the plains, it occurs on the lower mountain ranges of the Himalayas at an altitude of 4000 feet above the sea, and higher still in the salt ranges, and is pretty common on the Ghats of the Western Coast.

Use in Medicine. The leaves of the Vasaka have a reputation as expectorant, and antispasmodic, and are employed in consumption, coughs, chronic bronchitis, asthma, and other pulmonary and catarrhal affections. It is usually administered with some spice, as ginger

or pepper. Dr. H. C. Dutta remarks that there is a saying that no man suffering from phthisis need despair as long as Vasaka plant exists. Drury mentions that the leaves given in conjunction with those of Solanum trilobatum and S. Jacquinii are employed by the Vythians internally in decoction as anthelmintic. Belkew states that they are given to cattle as a medicine, but under this head, it should be noticed that animals do not as a rule browse on it, and goats only have been known to crop a few leaves. In Bengal, the leaves are smoked as a remedy for asthma, and several European and Native physicians have given evidence of some very satisfactory results.

Use in the Arts.— A yellow colouring matter is present in the leaves, and may be extracted either with hot or cold water. Like many other indigenous dyes it is of little value in itself,

but in combination with indigo it forms a useful green.

Use in Agriculture. — Dr. L. Watt has brought to notice the use of Adhatoda vasica leaves in rice cultivation in the Gubbj Valley. The fresh leaves are scattered over recently flooded fields prepared for the rice crop, and the native cultivators say that the leaves not only act as a manure, but also as a medicine or poison to kill the aquatic weeds that otherwise would greatly injure the rice. Fields not treated in this way are covered with a green scum, through the growth of minute specimens of vegetable life; but after the leaves are added, they are supposed to impart an objectionable flavour to the water, which kills the floating duck weeds (Lemnae), and the submerged Characeae, and prevents their propagation.

Chemical.

Chemical Examination. The leaves, which have been described under the botanical characters of the plant, when dried and powdered, have a light-green colour, with a strong fœculet odour and a bitter disagreeable taste. Soaked in water, and then boiled, the powder afforded 34 per cent of a reddish-brown extract, having the characteristic properties of the leaves. Incinerated at a low red heat, a quantity of ash was left amounting to 17 per cent.

A remarkable alkalinity pervaded the drug, which was noticeable in the cold aqueous infusion, in the distillate obtained by boiling with water, and in the fumes given off when burning. About 8 grams of the powdered leaves were smoked in the ordinary way in a clean clay pipe, to notice experimentally its chemical and medicinal effects, and to compare it with tobacco. With the author,

who

who is an inveterate smoker, the experiment was attended with no unpleasant results, and no narcotic influences; with one unaccustomed to the weed, a few whiffs left only a disagreeable taste in the mouth. The chief result of the smoking was the evolution of an abundance of ammoniacal vapour among the other products of combustion, and to the inhalation of this vapour is probably due the efficacy of the leaves in the relief of asthma.

A well-defined alkaloid appears to be the most important constituent; it constitutes the bitter principle, and to all intents and purposes is the active principle. It occurs in white transparent crystals belonging to the square prismatic system, without any odour, but with a decidedly bitter taste. It is soluble in water with an alkaline reaction and in ether, but

but more so in alcohol. It readily forms salts with most of the acids, as sulphuric, hydrochloric, nitric and acetic; these salts are crystalline, and their solutions may be evaporated without apparent decomposition. It is precipitated by potassium-mercuric iodide, iodine in potassium iodide, tannin and Nessler's reagent. A solution of the sulphate observed in a Laurent's polariscope possessed a slight right-handed rotation. Heated on platinum foil, it fused to a yellowish, and then to a fine red mass, which afterwards blackened and decomposed. Distilled with strong potash it yielded an oily body resembling chinoline, together with ammonia and other volatile bases. I propose to call this alkaloid "vasicine", after the Sanskrit name of the plant.

In a proximate analysis of the leaves, petroleum ether was first used to remove the volatile oil, or stearopten, which formed one of the odorous principles. Ether was then employed to extract chlorophyll, wax, resins, and a small quantity of alkaloid.

The alcoholic extract was the most interesting, as it contained most of the alkaloid in neutral combination with an organic acid. This extract was of a reddish colour, when concentrated, and some soft resin was separated by treatment with water; the aqueous solution evaporated spontaneously, fell into a mass of crystals, exhibiting right-angled ramifications. On adding neutral acetate of lead to some of the solution, nearly all the colouring matter was removed, as an orange precipitate, and an almost pure solution of the acetate of the alkaloid was left in the filtrate.

The organic acid, presumably the colouring agent of the leaves, when liberated from its lead salt by sulphurated hydrogen, had an acid reaction, was soluble in water and spirit, and gave a dark olive green colour with ferric chloride. The colouring matter was intensified by the addition of the fixed and volatile alkalis, and was not immediately precipitated by the mineral acids. Its lead salt after gentle ignition left

left 28.3 per cent. of oxide. I would suggest for this organic body the name of "adhatodic acid" after the South Indian name of the plant. The occurrence of this organic acid and the alkaloid in the aqueous solution of the alcoholic extract would indicate their natural existence in a state of combination, so that adhatodite of vasicine has scientific claims to be regarded as the active principle of the leaves of Adhatoda vasica.

The subsequent treatment of the powdered leaves with cold water dissolved out a further quantity of colouring matter, besides mucilage and salts of calcium, potassium and ammonium. A one per cent. solution of sodium hydrate removed other soluble matters, which were not examined.

The analysis of the leaves reveals certain principles resembling those found

found in tobacco, as for instance, an odorous volatile principle, an alkaloid, but not volatile like nicotine, one or more organic acids, sugar, mucilage and a large percentage of mineral salts.

The leaves of *Adiantum* submitted to dry distillation evolved substances similar to tobacco under the same conditions. At first water condensed, and an intolerable odour arose from a yellow oily liquid which followed.

Then a brown oily substance came over, associated with the pungent vapours of ammonia; and finally a thick brown micaceous solid was driven from the retort to the condenser. These products were all strongly alkaline.

The following table gives the results of the proximate analysis of the leaves:—

Volatile

Volatile odorous principle	21.20
Chlorophyll, fat, resins and alkaloid extracted by ether	3.20
Adhucate of vascine, resin and sugar extracted by alcohol	12.50
Gum	3.87
Colouring matter, precipitated by lead	4.83
Other organic matters and salts extracted by water	10.38
Extracted by soda solution	4.72
Residue organic	40.71
" inorganic	9.59
Moisture and loss	10.00
	100.00

The ash was constituted as follows:—

Soluble in water	23.38
Soluble in acid	75.12
Residue	1.50
	100.00

The portion soluble in water was alkaline, and contained chlorides and sulphates.

Further experiments with the leaves.

A sample of pond water containing *Spirogyra* and numerous animalcules was mixed with a few drops of a strong infusion of *Adiantum* leaves.

The

The chlorophyll gradually disappeared from the weeds, and the cells became broken up. The oxygen was given off with less frequency, and at length ceased. Some insect pupae rose to the surface of the water, and there died. Numerous Paramecia remained active for some time, but eventually succumbed to the action of the poison. In twenty-four hours the beaker containing the water that had been thus treated showed only a brown mass lying at the bottom, while some water in a beaker by its side, without this treatment, contained the green aquatic weeds evolving oxygen, and the animalcules alive.

A solution of the sulphate of vasine was added to some water in a basin containing a live frog. The frog immediately sank, and without the slightest movement, gave in a short time unmistakable evidence of being dead.

89-
dead. Some small black leeches adhering to the frog before the vasine was dropped into the water, at once left it afterwards, and came to the surface; those that did not succeed in escaping from the vessel in an hour's time were quite lifeless.

An aqueous solution of the alcoholic extract of the leaves was tried upon flies, fleas, mosquitoes, centipedes and other insects, and in every case the application met with poisonous results. The solution appeared to kill them without previous intoxication.

On the higher animals the leaves do not seem to have such an effect. A quantity of the alcoholic extract representing 15 grams of the leaf was given to a small dog, and the administration was not attended with any inconvenient symptoms.

These experiments show that the reputed use of the leaves in destroying injurious

injurious weeds in submerged fields is founded upon very scientific principles. The infusion, containing, as it does, the alkaloid in soluble combination, acts upon the cells, in the same manner, as certain chemical reagent, by contracting their contents (readily seen under a microscope) and causing their disintegration. The poisonous properties of the adhatoda on the lower orders of animal life will perhaps find for it a use in destroying insect pests, and make an important addition to the materia agricolarum in India.

Pharm. Record.
New York
Aug 13 1888

The Clerodendrons and their Chemical Constituents

The Clerodendrons are of genus of verbenaceous plants growing in tropical districts in Asia, Africa and America. About 22 species are natives of British India. An American species (C. aculeatum Linn.) and two Chinese species (C. fragrans Vent, and C. canescens Wall) are along with several of the native species, cultivated in Indian gardens.

The Indian Clerodendrons used medically are:

C. infortunatum, Gärtner. Rheede Hort. Mal. II. t. 25.

C. Liphonanthus, Br. Ham. Ill. t. 79, f. 1. Wight Ill. t. 173.

C. inermis, Gärtner. Rheede Hort. Mal. V. t. 49. Jacq. Col. t. 4 f. 1.

C. phlomisoides, Linn. f. Wight & A. t. 1473. Burm. Ind. t. 45. f. 1.

C. Senatum, Jacq. Wight & A. t. 1472. Bot. Mag. t. 2536.

C.

C. infortunatum grows throughout India, from Gurwal and Assam to Ceylon, and Singapore in the warm region, and in Malaya. The leaves are very bitter, and are said to be a good substitute for Chrota. The fresh juice of the leaves has been used as a vermifuge, but the plant is little used at the present time.

C. siphonanthus occurs from ^{Sikkim} and Assam to Tenasserim, also in the mountains of the Bcan Pannoula, and in Kumaon and Puna-ta. It is supposed by some to be the Brahmayashika and Bhargi of Sanskrit writers, but this is doubtful, as the drug used under this name is from C. serratum. The Persian name is Dana-i-mubarak, which means the "Blessed Medicine". The root is bitter, slightly astringent, and yields a small quantity of resin. It is used chiefly in syphilitic rheumatism.

C. inerme is a shrub, the medicinal properties of which are widely known in the East. It is the Gambier-plant of Java, the Wael-bu-raenda of Ceylon, and the

the Tanfu-mun of Cochinchina. ⁹³Andrieux says the juice of the leaves and root is considered alterative in scrofulous and venereal affections, the dose being a table spoonful with or without a little castor oil. Rheede speaks of the use of the dried leaves for the same purpose, and of a poultice of the leaves to resolve buboes; he also says a bath prepared with them is used in mania, while the root boiled in oil affords a liniment useful in rheumatism. C. inerme is the Jasminum litoreum and Pharmacum litoreum of Rampkins (Lil. vii. cap. 47), who says the Amboyna name is Wale-puti-lohaha, which means "white strand cord". The Molays and Macassars administer the berries or the root to people poisoned by eating unwholesome fish; the leaves smeared with oil are heated over the fire, and applied to recent wounds; they are also one of the leaves used for preparing the green rice of the Molays.

Malays; he concludes by saying "Carya ac fausta natura in cunctis fere litoribus hanc obviam profert plantam" In Bombay the plant has a great reputation as a febrifuge; the juice of the leaves is used in doses of half an ounce. It is mucilaginous, very bitter, somewhat saline, and with a fragrant, apple-like odor.

C. phloroides. — The bitter juice of the root is said to be alterative, but it is not in general use.

— C. serratum is the Bharrangi or Varangimul of the druggists, it occurs from the Himalayas east of the Sutlej, to Ceylon and Siam, is very common in Bengal, and also in Salsette, and the Concan south of Bombay. The natives eat the flowering tops of the plant; and are very fond of it as a vegetable. The leaves, boiled with oil and butter, are made into an ointment, useful as an application

in Cephalalgia and ophthalmia, The name of the plant in Telugu (the language of the Northern Circars, where it grows in such abundance) is Bharamamari, or bee-killa, in allusion to its supposed insecticidal properties; the leaves have been used to kill vermin, and prevent fly-blows. The roots are described by Sanskrit writers on medicines as useful in asthma, cough and scrofulous affections, they are rubbed down with ginger in warm water as a remedy for asthma, (Chakradatta) and enter into the composition of decoctions prescribed for coughs. The Bhargigudipak (a confection of the consistence of ginger) is prepared from this drug, along with the Dasamula or ten drugs, chebulamyrabolans, molasses and spices; it is used for asthma. Although the root has been known from ancient times, it is only within the last few years that its botanical origin has been identified.

It was exhibited at the Madras Exhibition of 1855, under the name of Gantubharangi, among several chemical and pharmaceutical products. It is mentioned in Sir Walter Elliot's "Flora Andhrica" published in 1859, and referred to an unknown species of *Clorodendron*, which he says, might be called *acaulis*; the plant is there said to grow about Sammasingi, to the west of Vizagapatam, whence it is exported to Madras and Bombay, to the amount of several thousands and upwards every year. The root is still dug up, and sent as an article of commerce to Bombay, but the present collector of Vizagapatam informs me that the trade in the drug has recently fallen off, and the price hardly repays the labor of digging out the root, which is

considerable

considerable.

The genus *Clorodendron* is named after two Greek words, *chloros* a lot, and *dendron* a tree, as the species were formerly supposed to have uncertain medicinal properties; but as our knowledge of these plants has increased, we have been able to discover that not only this genus, but also several other plants of the natural order of *Verbenaceae* are characterized by possessing bitter and aromatic principles, and tonic and stimulating effects in medicine. European doctors in India have found the leaves to be of great value in fevers of a malarial kind, when other remedies have not been available, and the natives generally are acquainted with the plants, they frequently cultivate them for the purpose of being able to eat the leaves with their ordinary diet to keep off the return of ague or fever.

With

With a view to examine these plants, chemically, and to investigate the nature of the bitter principle, some authentic specimens have been obtained from their respective habitats. Leaves of C. inermis were sent from the Madras Coast; leaves of C. infortunatum were forwarded from Bombay by Dr. W. Dyinock, and the roots of C. serratum were obtained by the superintendent of the Cotacamund Botanic Gardens from the Sezor Ghaut, north of the Nilgiri Hills. The three drugs are thus described: C. inermis leaves are small, from one to two inches long, smooth, shining, fleshy, oval or elliptic, both sides dotted; they have a rather agreeable acid and bitter taste and an apple-like odor. C. infortunatum leaves are altogether different to the preceding. They are from 8 to 10 inches long, and from 7 to 8 inches broad at the base, ovate-cordate, hairy on both sides odor disu-

agreeable, taste bitter and slightly astringent. The ganu Bharangi is a light-coloured root, very often contorted and seldom more than an inch in diameter. A light brown epidermis and thin bark cover the tough woody portion, showing well marked medullary rays and concentric rings. The drug contains much starch, it is feebly bitter, and has no peculiar odor. The bitter principle of the leaves is entirely removed by ether, and the subsequent treatment of the leaves by alcohol and water affords extracts which are free from any bitter taste. Ether, alcohol and water independently exhaust the leaves of this principle, but the former removes it with less admixture of foreign substances. The ether extract, evaporated and mixed with water, will give up the bitter property to the solvent, and thus by gradual evaporation leaves it in an almost pure condition. It will be found by experiment that this process for separating the bitter principle applies equally well for either of the

three drugs under examination. It is obtained as a viscid mass, which in process of time and by exposure to the air hardens, and may be reduced to a non-hygroscopic powder. It is soluble in water, with a slightly acid reaction, and is partially rendered insoluble by neutral plumbic acetate, thus giving evidence of its compound nature. The portion precipitated by the lead salt, when liberated from the metal by hydrogen sulphide, was a light coloured amorphous acid powder, soluble in water, spirits of wine and ether, and reducing Fehling's solution when in aqueous solution. The bitter principle that escaped precipitation by plumbic acetate, was readily shaken out of the acid filtrate with ether. This was a whitish amorphous powder, soluble in water, with neutral reaction, and did not reduce Fehling's solution; it was not precipitated by alkalis, and was not coloured with ferric chloride; it was chiefly distinguished by

by its being precipitated by tannin, and affording a transient red-brown color, with strong sulphuric acid. The dual nature of the bitter principle of the *clerodendrons*, as far as may be judged from an examination of three of the species, seems to show a very remarkable resemblance with that found in *Cikiretta*, (*Ophelia Chinata*), a gentianaceous plant. *Phurotta* has been investigated by Hohn, who found the drug to contain *Ophelic acid* $C_{13} H_{20} O_{10}$ and *Chiratin* $C_{26} H_{48} O_{16}$, an acid and neutral bitter principle respectively, and representing the activity of the herb.

A comparison of the results of proximate analysis of the leaves of the two species of *clerodendron* are interesting in showing how allied plants differ in their chemical composition; although their active principles may be analagous, they possess other peculiar bodies, which are not common to both.

88
C. inermis

Ethereal extract	4.77	C. infortunatum
Alcoholic extract	5.70	10.87
Aqueous extract	15.57	16.40
Alkaline extract	11.48	15.20
Organic residue	50.06	8.97
Inorganic residue	6.44	38.47
Moisture	6.01	5.93
Total	100.00	14.22
		100.00

Ash soluble in water	44.14	16.83
Ash soluble in acid	47.10	72.86
Sand and silicates	8.76	10.30
Total	100.00	100.00

Sodium chloride in ash	24.01	5.58
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The leaves of *C. inermis*, when distilled with water, yield a stearopten-like body having the fruity flavor of the fresh plant. The ether extract was fragrant, green, and of a greasy consistence. The alcoholic extract contained some resinous matter, and much of the salt, which was left as cubical crystals when evaporated. Water dissolved out gum and brown coloring matter. Neither tannin nor starch was present in the leaves.

They left, on gentle incineration, as much as 15.29 per cent. of ash, and the large

amount

89

1835

amount of salt in this ash indicates the habitat of the plant as being in close proximity to the sea.

The leaves of *C. infortunatum* were devoid of the odorous principle noticed in the former species, and yielded no volatile constituent, when boiled with water. The ether extract contained a quantity of resinous matter, and gave up the bitter principles when treated with water; it was of a less fatty consistence than that from the *C. inermis* leaves. The spirituous extract was also much larger than the previous sample, and was differently constituted, inasmuch as it almost entirely consisted of a tannin, giving a green color with ferric chloride. These leaves contain much more soluble organic matter than the former, but the percentage composition of the ash shows that the soluble inorganic salts are much smaller. The ash of these leaves amounted to 12.3 per cent.

The root of *C. serratum*, or *gantu bharangi*, did not yield anything of great activity

when

when examined by chemical methods, and this proves that there is little to recommend it as a medical agent. The wood of the root is almost inert and tasteless, the thin bark constitutes only one-fifth of the weight of the dried root and contains a small quantity of the peculiar bitter principle, dissolved out by ether, associated with an acid resinous substance, and some fatty material. The reputation of this drug appears to be dying out rapidly, and there is good reason that it should, considering the minute proportion in which the supposed active constituents exist. It is interesting to observe, however, that the reactions of the bitter principle, although occurring in such small quantity, were identical with that obtained in the leaves of the other two species, where it formed from $\frac{1}{2}$ to 1 per cent. of the total.

Pharm. Journ.
LONDON.

Aug 12th 1888.

Proximate Analysis of *Saxifraga* *Ligulata*

The habitat of the Indian *Saxifraga* is mostly confined to the northern and mountainous parts of the peninsula, as the Himalayan ranges from Bhutan to Kashmir, at elevations of 7-10,000 feet, and the Khasia Hills. *Saxifraga ligulata*, Wall. grows abundantly in the Punjab Himalayas, and the rhizome, or officinal part of the plant, is sent down to the plains, and sold in the bazaar of the North West Provinces and Bengal. Dr. J. L. Stewart in "Punjab Plants" gives the little information we possess about this drug. He says, "The root is bruised and applied to boils and ophthalmia, in some places, where the plant grows. It is reckoned absorbent, and is given in dysentery and cough. The bazaar names are Pakhambes Indiana, and Mashin."

An authentic sample of the drug has been supplied me for chemical examination, by Dr. Symcock of Bombay. It occurs in pieces, 1 to 2 inches long, and about half to 1 inch in diameter. The external surface is

is brown, wrinkled and scaly, and bears numerous scars, rootlets and circular markings. The substance is dense and hard, with a reddish colour. The rhizome appears to have been cut up before drying. The red colour of the sections is evidently developed by age, as a fresh cut shows the interior to be much lighter, or almost white. Under the microscope, there were seen numerous conglomerate crystals and oval starch cells. The taste is slightly astringent, and the odour is similar to that of bar, but more aromatic.

The ethereal extract of the finely-powdered rhizome was of a pale brown colour, somewhat crystalline, and contained the peculiar odorous principle of the drug. The aqueous solution of this extract gave ink-like mixtures with ferric and ferrous salts, and precipitated gelatin solution. The mixture of tannic and gallic acids was shaken up in solution with pure ether, and the supernatant liquor afforded the gallic acid

acid in a pure condition. Known by its reactions with strong sulphuric acid and alkalis, by mixing clear with gelatin. Alcohol removed from the residue of this extract an odorous body of soft fatty consistency, and the remainder of the extract was a wax, melting about 48°C . The wax was insoluble in cold alcohol, but almost entirely dissolved on boiling, separating into a mass of crystalline plates when cooled, not wholly dissolved after prolonged boiling with alcoholic potash, not soluble in cold or hot sulphuric acid; in the latter, it first turned red, then melted and blackened; nitric decomposed it into a yellow brittle resin.

The alcoholic extract of the powdered drug contained a large quantity of a tannic acid, with some uncrystallizable sugar. The tannic acid was soluble in hot water, and reprecipitated on cooling; its insolubility was prevented by adding ammonia, until the cold solution was neutral; neutral plumbic acetate then removed

Removed the whole in the form of a reddish-brown sediment. The acid gave a blue-black solution, with ferric salts, a precipitate with gelatine, and showed evidence of its glucosidal nature. The acid was very similar to the gallo-tannic acid of oak-galls. The resemblance is very close, when comparing their lead salts: gallo-tannic acid leaves 50.00 per cent. of lead oxide, the tannic acid under examination left 50.45 per cent. of oxide as the mean of two fairly concordant estimations.

The filtrate from the lead precipitate, after treatment with hydrogen sulphide, was composed entirely of a sugar, readily reducing Fehling's solution. No alkaloids or mineral salts were detected.

The aqueous extract contained gum, tannic acid, sugar and a small amount of inorganic salts.

The treatment

The treatment of the residual powder with a one per cent. soda solution, dissolved out some red colouring material, and metarabin. On adding acetic acid to the solution, it at once pectinized; this effect was produced also when ferric chloride, iodine in potassium iodide, and sulphuric and hydrochloric acids were added. This pectinization was very remarkable. As it would have required an enormous amount of spirit to cause the precipitate to separate, its estimation would have attended by a great loss. In the following table, the metarabin, albumen, &c., is the loss on the powdered drug sustained in exhausting it with diluted soda. After prolonged boiling with acid, previous to the treatment with soda, the pectinization of the metarabin did not take place, when made neutral with acid.

The calcium oxalate was dissolved out by means of five per cent. hydrochloric acid. This salt was in the plant in the form

form of conglomerate raphides, and its reduction to the form of carbonate, when the plant was burnt, constituted the major portion of the ash, which amounted to 12.87 per cent.

The starch was estimated by conversion into glucose by boiling it with a 1 per cent. hydrochloric acid solution for four hours, and titrating the resulting liquor with Fehling's copper tartrate solution.

The following table gives the quantity of the different constituents of the rhizome of *Saxifraga ligulata*, as far as they were identified, in the foregoing analysis.

Wax and odorous principle	0.92
Gallic acid	1.17
Tannic acid	14.28
Glucose	5.60
Mucilage	2.78
Metarabin, albumen, &c.	7.85
Starch	19.00
Calcium oxalate	11.61
Mineral salts	3.80
Sand	.58
Brude fibre	20.80
Moisture and loss	11.61
	<u>100.00</u>

The plants of the natural order
Saxifragaceae

Saxifragaceae have been very little examined, chemically, but they are usually regarded, according to some text books, as being astringent. The root of *Heuchera americana*, official in the old United States Pharmacopoeia, is a powerful astringent, and is called on this account alum root. On the other hand, the root of *Pichroa febrifuga* does not possess this property, and no tannin matters have been found in it. Some allied plants, the hydrangeas; for instance, do not contain an astringent property. The root of *Polygonum bistorta* contains some of the same constituents, as those found in *Saxifraga ligulata*, a circumstance of some importance to the native druggists, as the vulgar name of the latter, *muzlin*, is applied equally to the *Bistorta* root, and

Dr. Stewart informs us that the
one is often sold for the other.

Pharm. Journ.

Sept. 22, 1888

Some Drugs of British Sikkim

The portion of the Himalayan mountain zone, known as Sikkim in the Bengal Presidency, has a rich and extensive flora. It embraces the plains called the Terai, at the south of the hills, and a gradual series of mountain ranges up to 10,000 feet above sea-level. The vegetation varies from the tropical cotton, banyan, figs, and bamboos, through forests of sal, teak, bamboo, laurels, maple, and oaks, to the region of magnolia and arboreal rhododendron. Among such a variety of plants, it is not a matter of surprise to find many of them yielding products used in medicine, either by the natives themselves, or collected for purposes of trade. During a recent visit to the neighbourhood of Darjeeling, a number of drugs were met with, which are not commonly known in other parts of India, and the following notes from personal observation are arranged according to

to the "List of trees, shrubs, and large
climbers found in the Darjeeling
district, Bengal" by Mr. J. Sykes Gamble,
M. A.

Mernispermaceae

Tinospora cordifolia, Miq. (Gurje, Paharia
name). - A climber in waste places
of the Terai. The wood of the stem
and root is very soft, when dried it
is ground up, and used by the Paharias
to cure cattle of pains in the stomach.
Elephants are particularly fond of
the succulent stems.

Bixineae

Gynocardium odorata, R. Br. (Tik-tung,
Lepcha). - The tree is pretty common
about the lower hill forests. The fruits
are round, hard, and rough on the
surface, and, like the jack-fruit, grow on
the stems and main branches. The
pulp is used by the Lepchas to poison
fish; after boiling with water, the pulp is
eaten. The seeds which yield Chaulmu-
gra oil are not collected here.

The

The bark has lately been supplied
to the Mauritius for use in fever. It is
a thin bark, breaking with a short
fracture, pale brown externally, and
red on the inner surface; it contains
starch and tannin, and its infusion
is characterized by the odour of
essential oil of bitter almonds.

Ternstroemaceae

Schima Wallichii, Choisy. - A very
large tree in the forests between
3000 and 6000 feet. The bark is nearly
black externally, with deep clefts;
the liber is made up of an abun-
dant of white, needle-shaped
cells, which are readily detached, and
act, as courage, in producing painful
irritation when brought into contact
with the skin. The tree is called
Chilanni (or itching tree) by the
Paharias on account of this property.

Dipterocarpaceae

Shorea robusta, Gaertn. (Sal, Hindustani).

The

The Gal tree grows as a forest in the inner valleys of the Tista river, and is the most valuable timber tree in the district. It yields a quantity of resin, found in large pieces, often nearly 30-40 cubic inches in size, in the ground at the foot of the trees.

Theriacaceae

Pterospermum acerifolium, Willd. (Hattipaila, P.) A very handsome tree with large flowers, and large leaves, with white tomentose hair beneath. The soft tomentum is used by Paharias to stop bleeding in wounds.

Burseraceae

Canarium Bengalese, Roxb. (Gogul-shup, P.) — A huge forest tree of the lower hills. A light yellow resinous exudation is found on the bark, at nearly all seasons of the year. It is soft, tenacious, and has a slightly fragrant odour; the only use to which this resin appears to be

to be put by the Lepchas is to burn it as an incense in their religious observances.

Rhamnaceae

Gouania leptostachya, D.C. (Batwasi, P. Jungchongmouik, L.) — The leaves are used by Lepchas to make poultices for sores.

Leguminosae

Milletia pachycarpa, Bth. (Kopulara, P. Brudung, L.) The roots of this large climber are used by the Lepchas for killing fish.

Entada scandens, Bth. (Pangia, P. Takdokhyem, L.) The fruit is often 2 or more feet long, with large seeds. The Lepchas eat these seeds, after long roasting, and soaking to extract the poison. They are used by the Paharias to wash the hair.

Saxifragaceae

Dichroa febrifuga, Lour. (Besak, P. Singnamook, Bluntia, Gebokanaki, L.) — A shrub of the upper hill forests from 4000 to 8000 feet. In many forests, it forms the chief undergrowth. The yellow bark peels off in

in flakes. The root bark, which is used as a febrifuge by the Paharias, is of a light colour, soft and corky in structure, and almost tasteless. It appears to have no active effects, unless it be taken in large quantity in the form of decoction. The natives take it in dose, large enough to make them sick, and so indirectly to cure the fever. Loureiro, who discovered and named the plant, is the only one who notices its medicinal uses. The following is a translation of what he says: — "It is febrifuge, and cures quotidian, tertian and quartan fevers; if taken in the crude state, it usually causes vomiting, but if slowly stewed in wine, until the latter has evaporated, it purges the bowels and removes obstructions of the viscera. The natives use a decoction of the leaves, which acts more mildly, if combined with liquorice; it is not a very safe remedy for old and weak people. The root bark contains starch, but no Lannin."

Cambaceae.

Cambaceae.

119

Terminalia Chebula, Rob. (Hana, P., Salm-kung, S.). — The kernels of the fruit of this tree are eaten. The fruits are used as a medicine for sore-throat by the Paharias, who call it "Koti."

Myrtaceae.

Eugenia obovata, Wall. (Bara Saman, P., Samvikol, S.). An evergreen tree growing on dry ridges in the lower hill forests. The bark ground up is said to be used by Paharias to stop headache; it is used like smelling salts, or snuff.

Rubiaceae.

Randia Dumetorum, Lam. (Amiki, P., Madal, P., Gundrow, S.). — The fruit is about 1-1½ inches in diameter, the Meechis, or inhabitant of the Terai, use it to kill fish.

Paederia foetida, Willd. (Paediri, P., Takpaediri, S.). A common small climbing shrub. Flowers red and fringed like the Cinchona. The fruit is used to blacken the teeth by Lepchas and Paharias; this, they say, is a specific against toothache.

Vaccineaceae.

Pentstemonium serpens, Bth. (Kall
hanchu)

hurchu, P., (Loombosten, L.) - Small bulbous rooted shrub. It is used as a medicine to cure cattle of lameness, previously ground and applied as a poultice.

Labiatae

Trucium Anacrostachyum, Wall.
(Gurapis, P., Chung-kung, L.) - Very common in cleared places in upper hill forests. It has long upright spikes of yellow-white flowers, with long stamens, somewhat resembling a bottle brush when rather old. A quantity of sweet juice exudes from the flowers, and this is sucked up by Paharia herdsmen.

Kolobrochia oppositifolia, - Sm. (Losul, P.). A large shrub of the Sal forests of the Tista and Rungit valleys. The down on the stem and leaves is used by Paharias to extract worms from bad sores on their legs.

Polygonaceae

Polygonum molle, Don. (Totapo, P.) - A large

¹²¹
A large trailing shrub, common over the hill near Darjeeling. The stems grow to 1 foot in girth; the shoots are eaten by Paharias and Lepchas, and resemble rhubarb in flavour.

Lauraceae

Guinamomum Tamala, Steud. (Singoli, P., Nipsorg. Kung, L.) - The aromatic bark is largely exported to Lower Bengal under the name of "kaj." The leaves also are aromatic, and are collected, dried and sold in the bazaars by the name of "tepel." The bark and leaves of other species are aromatic, but are not so much used as the above.

Euphorbiaceae

Macaranga sp. (Sing-Kung, L.) - A tree of the middle hill forests, with leaves turning golden-red before falling in December. They are used by Lepchas to poison fish, and their juice is said to raise blisters, if applied to the skin.

In the forests of British Sikkim are trees

trees affording many useful gums, among them are the following:—

Bauhinia Vahlia, Albizia procera,
A. stipulata, Croton oblongifolius,
Macaranga gummiflua, Ostodes
pariculata, Garcinia stipulata,
Bombax malabaricum, Sterculia villosa,
Garuga pinnata, Ocina woderi,
Spatholobus Roxburghii, and Butea
frondosa.

Laurel-Nut Oil

123

Pharm. Journ.
Jan. 5th 1859

The Alexandrian Laurel (Calophyllum
inophyllum) is distributed throughout India
and Malaya, and is especially abundant on the
western Coast, and in the native state of Travancore.
The Hindustani name of the tree is
Sultan Champa, the Tamil and Malayalam
name is Punnai. Its thick green and glossy leaves
resemble those of a Laurel, but the tree is far re-
moved from this family of plants, as it is really
a guttifer, belonging to the natural Order Clusiaceae.
The fruit is about the size of a bantanus egg, when
ripe, and of a greenish yellow colour; when dry
it is brown or black, and has a hard wrinkled
surface. The seed, consisting of two white closely
united hemispherical cotyledons, loses in drying
30 per cent. of water and the dried seed yields 68 per
cent. of fixed oil. This oil is largely used for burning
and is occasionally used for making varnishes
and soap. In medicine the oil is employed, either
alone, or mixed with more powerful remedies, as
a liniment for rheumatism, and is applied to
ringworm, and various skin eruptions. The tariff
valuation of Laurel nuts in Travancore is Rs 7 per
cwt, and the oil Rs 8, as against coconut oil
Rs 14 per cwt. The value of the exports of Laurel
nut oil from Travancore during the past five
years has been as follows. 1882-83 Rs 74,314;

1883-84, Rs 68,767; 1884-85, Rs 48,997; 1885-86 Rs 78,845; 1886-87, Rs 57,148. In 1886-87 63 cwt. was exported from Alleppey. Dr Watt says that although this oil cannot compete with castor oil for industrial purposes in the Calcutta market, it fetches about four times the Calcutta price of castor oil in Burma. In the Colonial and Indian Exhibition in 1886, this oil was shown from India, Ceylon, Straits Settlements, Queensland & Fiji. It is known out of India as Dombai, Dilo, or Idilo oil.

Laurel nut oil is greenish yellow, bitter and aromatic, but it has not been investigated chemically. Lépine found a sample to have the sp. gr. of 0.942, and to solidify at $+5^{\circ}$. During a recent visit to Travancore, I found a large trade being done in the nuts & oil of Cateophyllum Inophyllum, in the village of Neyoor, about 16 miles from Cape Comorin; and here I purchased a sample of oil for examination. The oil was similar in appearance to some I expressed myself from some freshly dried almonds obtained from Neyoor. The following notes give the results of a chemical examination made with the assistance of Allen's 'Commercial Organic Analysis.'

The oil had a greenish yellow colour, thick consistence, fragrant odour & bitter taste. It commenced to congeal at the temperature of 19°C and became quite solid at 16°C , when it had a specific gravity of 0.9315.

The free acidity of the oil was found by shaking a weighed portion with alcohol, and titrating the solution with normal alkali, using phthalokin as an indicator. 1000 gram

the oil required 1.89 gram of caustic potash to neutralize the free acids.

The oil was saponified by boiling a weighed quantity for 1 hour with alcoholic potash, and the excess of alkali was determined by titration with normal hydrochloric acid. It was found that 100 grams required 19.6 grams of KHO to convert it into a soap; the saponification equivalent was therefore 285.6. The soap solution in alcohol; allowed to stand for a few hours partially crystallized into lustrous white scales.

The volatile fatty acids obtained by Reichert's distillation process were very small in quantity. 2.412 grams of oil required the equivalent of 0.1 cc. of normal alkali for saturating the volatile acids, which is equal to 0.23 per cent. of KHO.

Two drops of sulphuric acid added to 20 drops of the oil gave a red coloration with orange streaks; after stirring the whole became an orange brown mixture. The oil shaken up with an equal volume of nitric acid, sp. gr. 1.4, formed a light reddish brown emulsion, after standing for an hour. The oil separated with a rich mahogany brown colour, and the lower acid liquor was red. Treating the oil, according to Pontet's elaidin reaction, and working at a temperature of 20°C , the mixture of oil and nitric oxide solution congealed in $2\frac{1}{2}$ hours; after 24 hours it remained as a firm butter like solid.

112

of a dull lemon colour and yielding to the pressure of the finger.

5.045 grams of the oil were on Nov 7, exposed to the air in a watch glass, under a bell-jar, and weighed daily for one month. The increase in weight was just appreciable after the exposure; the weight on December 7th was 5.047. This quantity of oil, heated in a water-oven at 93°C , for eight hours gained 0.006 gram only.

The insoluble fatty acids amounted to 90.85 per cent. They crystallized into radiating tufts of acicular crystals having a melting point of 37.6 , and a sp. gr. 0.9237 (solid) at 16° , and of 0.8688 at 90° . Their mean combining weight obtained by titrating the washed and dried acids with normal alkali and using phenolphthalein as an indicator was found to be 283.1. A lead soap of the fatty acids was made by decomposing the potash soap with a hot solution of plumbic acetate. After washing and drying, 1 gram was washed out, and shaken up with ether; the oleate of lead or soluble lead soap, weighed .46 gram after the ether had been rapidly driven off. The lead soap insoluble in ether was decomposed and the purified fatty acids had a melting point of 58° .

The oil agitated with 85 percent. alcohol removed the green colouring matter and a sticky extract possessing the peculiar lilac-like odour & bitter taste

113

This extract amounted to about 7 percent; it was almost entirely soluble in dilute alkalis with an orange colour, precipitated unaltered on the addition of acids, and was perfectly soluble in ether & chloroform. The green mass was boiled with water, and the filtered liquor evaporated had the odour of coumarin, but no rhombic crystals could be observed in the slight residue when examined under a microscope. The alcoholic residue was crystalline, and contained some free fatty acids of the oil.

The conclusion arrived at from the examination of the camel-nut oil is that it cannot be regarded as a drying oil, nor altogether as non drying, but must take up an intermediate position between the two. In endeavouring to classify this oil with those that have already been investigated, the task is not difficult. Most of the experiments exhibit in a very striking manner a strong relationship to those of the cotton-seed oil group. The saponification equivalent, the high melting point of the fatty acids and the free acids are very remarkable, and the sulphuric and nitric acid tests are particularly allied to those performed upon cotton seed oil.

114
Chemical
news.
Vol. LIX.
No. 1532
April 5th 1889

115
Gymnemic acid

129

Some years ago, it was discovered by Mr. Edgeworth that the leaves of Gymnema sylvestre had the peculiar property of destroying the power of the tongue to appreciate the taste of sweet substances. In the early part of 1887, Sir M. E. Grant Duff, then Governor of Madras, interested himself in the subject, & forwarded me, from his grounds in Guindy Park, a supply of the leaves for investigation. A paper containing the results of a chemical examination, with their proximate analysis, has already been published, and now some notes are sent relating to the chemistry of the principle possessing this singular property which was discovered at that time.

Gymnemic acid exists in the leaves in the form of a potassium salt, and is best prepared by treating the aqueous solution of the alcoholic extract, with a mineral acid, washing the precipitate, and drying in a current of hot air or over a desiccator.

The acid is a brittle black resinous substance, of a greenish colour when reduced to powder. It is insoluble in water, soluble in alcohol (with an acid reaction), ether, benzol, chloroform, and slightly in amyllic alcohol and carbon bisulphide. With potash, soda, & ammonia, it affords fine red solutions, with

116.
 an orange coloured froth, and precipitated on the addition of water. It dissolves in concentrated sulphuric and nitric acids, with intense red colour, and in both mixtures it is destroyed and precipitated by water. Prolonged contact with nitric acid forms a soluble nitro-compound, or product, soluble in water. It fuses at about 60°C . into a black liquid of thick consistence; above 100° it gives off oleaginous fumes, and at a higher temperature, burns with a bright smoky flame, leaving no ash. It is thrown down as a bulky green mass, with plumbic acetate, and the lead salt may be decomposed by hydrogen sulphide, in the presence of spirit. It is also precipitated by ferric chloride, silver nitrate, barium & calcium salts, but not by tannin, picric acid and gelatin solution. It forms insoluble salts with alkaloids, and this accounts for its masking the taste of quinine and other bitter substances.

The acid dried at 100°C . was submitted to combustion with cupric oxide.

- (a) 0.2132 gm. gave 0.4807 gm CO_2 + 0.1706 H_2O
 (b) 0.2738 " " 0.6080 " " " 0.2124 "

From these experiments may be deduced the empirical formula $\text{C}_{32}\text{H}_{55}\text{O}_{12}$; the recalculation of the elements from such a formula shows a close correspondence with the mean percentages found.

	a	b	mean	calculated for ($\text{C}_{32}\text{H}_{55}\text{O}_{12}$)
Carbon	60.92	60.55	60.73	60.85
Hydrogen	8.80	8.61	8.71	8.71
Oxygen	30.28	30.84	30.56	30.44

117
 The silver salt of gymnemic acid is a black brittle powder; it afforded 14.02 per cent. of metal on combustion. Theory for $\text{C}_{32}\text{H}_{54}\text{O}_{12}\text{Ag}$ requires 14.63 per cent. of metallic silver.

Gymnematate of lead is insoluble in acetic acid, and forms a black uncrystallisable powder. A weighed portion of the dried salt gave 15.19 per cent. of plumbic oxide. Theory for $(\text{C}_{32}\text{H}_{54}\text{O}_{12})\text{Pb}$ requires 15.20 per cent of PbO .

There is evidence that gymnemic acid is a monatomic acid from the composition of its silver and lead salts, and its molecular weight 631, agrees with its power of saturating alkali. It was found by experiment that 0.631 gm. of the acid treated with centinormal solution of caustic soda did not strike a red colour, with phenol. phthalein, until sufficient equivalent to about 0.040 gram of NaOH had been added.

I have not obtained the acid or its salts in anything approaching a crystalline condition; they dry, as do tannic acid, and the tannates. Ammonium gymnematate exhibits the characters of the drug better than other salts.

The acid is a glucoside. After boiling for about an hour with dilute hydrochloric acid, a dark viscous mass devoid of the peculiar property of the gymnema leaves, remains, and the liquor contains a body which readily reduces Fehling's solution and crystallises when evaporated.

Gymnemic acid occurs in other species of Gymnema besides sylvestre. Gymnema hirsuta contains a considerable quantity +

¹¹⁸
G. montanum leaves contain it in smaller proportion.

¹¹⁹
Podophyllum Emodi

133-

Phar. Journ.

Jan. 26 1889

The genus Podophyllum contains only four species, one Himalayan, one American, and two Chinese. The Indian species (P. emodi Wallich) inhabits shady valleys in the inner ranges of the Himalaya, and is very abundant at Kunawar, & Cashmere. The remarkable appearance of its bright red fruit would lead one to suppose that it must have attracted the attention of the Hindus, and judging by the Hindi name, "papra", and "bhawan bakra" it is probable that it was one of the bile-expelling plants described by Sanskrit writers under the names of "papata" and its synonym "rakra". In Hindi, the Sanskrit "papata" becomes "rakra", and "papra" changes into "bakra", the prefix "bhawan" probably means hill, and the Hindi name would thus signify 'hill rakra', as distinguished from 'kshetra-rakra', or 'kshetra-papata', i.e. field rakra, or papata, a name applied to one or more species of Oldenlandia. The modern medical literature of India contains hardly any information about the plant. A specimen of the root was sent to the Committee for investigating Bengal drugs, by Dr. Falconer, about fifty years ago,

but no examination appears to be made of it. The plant is mentioned in the Pharmacopœia of India, as a possible source of podophyllin; and Stewart says that the fruit is used medicinally in Lahor.

Description. Stem or scape 6 to 12 inches, erect, stout, herbaceous; leaves 2, vernal, alternate, long-petioled, plicate and deflexed in veneration, 6 to 10 inches in diameter, orbicular, 3 to 5 lobed to the middle or base; lobes cuneate, acutely serrate; peduncle terminal in bud, then apparently supra-axillary or inserted on the petiole of the upper leaf; flowers 1 to 1½ inch in diameter; sepals very deciduous; petals 6, sometimes 4 (Doyle), obovate-oblong; berry 1 to 2 inches long, red (Flora of British India). The root agrees in most particulars with that of *P. peltatum*, but differs in the intervals of the knots, whence the aerial stems are given off, the knots being more frequent in this species. The rhizome is cylindrical, or depressed, crowded above with tuberosities marked by oval, or circular scars, and giving off numerous long, simple rootlets below. The terminal bud is enclosed in whitish papery sheaths. The colour is yellowish brown, paler in the rootlets. The fracture is short and horny, or mealy, disclosing a white pecton with an irregular circular arrangement of vascular bundles, bounded on the outside by a thin brown cortical layer.

Chemical Composition. The resin of the *Podophyllum* of the Pharmacopœias being the chief constituent, the drug under discussion was examined with a view to ascertain the amount and properties of an allied principle. A weighed quantity of the powdered rhizome, rootlets macerated in rectified spirit for four days, gave a tincture of light yellowish brown colour, which left 27 per cent. of extract, when evaporated to dryness. The extract washed with cold water lost a considerable quantity of bitter colouring matter and glucose, and a resinous residuum was left amounting to 10 per cent. of the drug, another estimation was made of a fresh supply, and it was found that by exhausting the powdered drug with rectified spirit over 30 per cent. of extract was obtained, and after being washed with water, acidulated with hydrochloric acid, 12 per cent. of resin or resins remained insoluble. The resin was amorphous, pale orange brown in colour, darker if dried at a high temperature. It was soluble in alcohol, ether, & chloroform, and almost entirely so in ammonia water. It was reprecipitated from its alcoholic solution by water, & from its alkaline solutions by acids. The tincture of the drug gave a deep olive green colour, with ferric chloride, and caused a reduction of copper oxide in Fehling's solution. The resin left no ash when incinerated.

Podophyllum peltatum according to the Pharmacopœia yields 2 per cent. of purified resin. From the records of the American drug manufacturers

122
it seems that $3\frac{1}{2}$ to 5 per cent. is the average yield of the so-called podophyllin.

Physiological action. It only remained to test the medicinal activity of the drug in order to compare it with the May apple. It was found that half a grain of the resin, mixed with a little sugar, produced unmistakable cathartic effects in the course of a few hours. A slight griping sensation was produced which usually attended the administration of podophyllum when not combined with aromatics, or carminatives.

As there is a great resemblance between the Indian and American species of Podophyllum in their botanical and technical characters, and as the former yields such a large quantity, as 10 to 12 per cent. of an active principle, and is at present a drug almost entirely unknown, it is desirable that attention be drawn to such a promising and useful medicinal remedy.

123.
Musambra, a Variety of East
Indian Aloes. 137

Pharm. Journ.

Aug. 17th 1889

Writers on Indian materia medica have described an impure aloes, called Musambra, said to be made in India. In looking through vernacular lists of drugs of the present day, the word musambra, or some other form of it, is seen to be applied, generally, to aloes, whether imported into India or not; and it will be seen from the following list that the appellation is not restricted to any one part of the peninsula. Mussabar, musabbar (Hindustani); musambar, moosumbis (Dukini); moshabbar (Bengali); mussbar, sibas (Kashmiri); musambara-bolla (Malhatti); mustambarum, moosumbum (Telugu); musambra (Canarese). The Telugu name is that used on the Madras Railway, a line running between Madras & Calcut.

The name, speaking with etymological accuracy, is a compound of mus and sib, the Arabic names for the two drugs myrrh and aloes. I cannot find, however, that such a compound exists as an article of commerce. It might be difficult to detect the admixture of a small quantity of myrrh in aloes, but any considerable quantity would increase the amount of resins present, and interfere with the odour. The samples of musambra examined in my laboratory were free from the addition of any myrrh, and this seems to be the usual experience. Under the head of "Aloes" in the catalogue of the Calcutta Exhibition, it is

124
stated that this drug, combined with myth, constitutes the musambra of Bombay, but I have not been able to obtain a sample. Dr Dymocke says the term musambra is incorrectly applied to aloes, which must be true in many parts of India, but as the name has been known for at least a century in Mysore, and as a sample found in that country is different from hitherto described varieties of Indian aloes, it seems to be a subject worth investigating.

Ainslie in "Materia Indica" Pt. I, p. 10 says: "There is a coarse kind of Aloes called musambra common in the bazaars, which is prepared perhaps in India from this species (*A. perfoliata*, Linn). . . . This species of the plant is common in India, though I cannot learn for certain that any of the drug is prepared from it."

J. J. Wood in the revised edition of *Materia Indica* published in Madras in 1871, gives a note as follows: - "Aloes met with in the bazaars as prepared in the provinces, is variable in quality, usually inferior, being darker in colour than the other kinds, extremely bitter, and having a nauseous taste."

Kanny Loll Dey, in "Indigenous Drugs of India" has a paragraph to the following effect: - "The bitter inspissated juice (of *A. Indica*) constitutes the medicinal aloes musambra of the bazaars."

Dr Kirkpatrick of Mysore, some twenty years ago, compiled a list of Asiatic Medicines used by the Hakeems, with uses and doses, giving in each case the Canarese and English names of the drugs. Under the name of Moosambra

125
he describes the properties and doses of aloes, without giving a description of the drug, or its botanical origin. 139.

Dr O'Shaughnessy in "Bengal Dispensatory" under the article "Aloes Indica, Royle," says it is probably the source of some of the common aloes (musambra) of the bazaars, which is "black; brittle, of semivitreous fracture, and too impure for medical use."

Most of the above authorities designate the most impure kind of Indian aloes as musambra, but not one of them speaks with certainty of its local manufacture in the country.

The classification of Indian aloes was attempted by O'Shaughnessy and Pereira, and a reference to the varieties distinguished by the names of the countries whence they were obtained, will be of interest in comparing them with our present knowledge of the drug. O'Shaughnessy mentions three kinds viz: -

Locoine, imported; 82 per cent. soluble in water.
Kurachi, nearly black, opaque, rather vascular, shelly structure, of fracture, faint smell, powder blackish. It is identical with the better kinds of musambra of the Bengal bazaars. Water dissolves 52 per cent.

Dekkan, deep brown, of earthy, slightly resinous fracture, faint odour, powder brown, Soluble in water in proportion of 98 per cent.

Dr Pereira (*Materia Medica*. Vol. II. p. 193) describes six kinds of aloes in India: -

Kurachi, nearly black, opaque.

Dekkan, deep brown

North India, dull black, brittle, little odour.

Gujerat, dark, more gummy, more difficult to fracture

Salem, in blackish masses, with numerous large air cavities, odour of Locoine.

Trichinopoly, resembling Cape aloes,

Dr Dymock in 1881, discovered the source of an aloes prepared in Jafferabad. It occurs in cakes of a black colour, and pitch like lustre. The Kurrachi, previously described, might now be perhaps referred to Jafferabad aloes, and the Salem aloes of Dr Pereira to Musambra. The Socotrine aloes as imported might account for some of the other varieties known as "Indian".

The specimen of aloes known as Musambra, and bought by the author two years ago in Bangalore, has the following characters. It occurs in thick cylindrical pieces of half pound to one pound, or more. The colour is black, and lives coloured in places where it is broken, or rubbed. It breaks, or crumbles up, into small angular fragments, not into laminae or splinters, as in other kinds of aloes. It is distinctly porous, and small stones and other impurities are seen to be imbedded in its substance. The odour is appreciable. The powder is dull umber-brown. When moistened and examined under the microscope the crystals of aloin only slowly made their appearance in the spirit, which would imply that there was a smaller quantity than usual of the active principle.

A proximate analysis of the drug gave the following result:-

Water extract	53.8
Resin (sol. in acetic acid)	10.4
Resin (insol. in acetic acid)	8.5
Insoluble in proof spirit	1.9
Mineral impurities	21.8
Moisture	3.6
	<u>100.0</u>

The drug responded to the general tests for aloes: Bontragers test = rose colour; Cripps + Dymond's test = deep orange-red;

ditto with ammonia = claret; nitric acid in the cold = deep red; nitric acid vapour passed over some of the powder mixed with sulphuric acid gave no blue colour. The last two tests are characteristic of Barbadoes aloes.

Some plants of the Mysore aloes were obtained from Mr J Cameron, of the Dal Bagh, Bangalore, about two years ago, and were planted out in the Botanic Gardens, Ootacamund, for the purpose of flowering them for identification; but the elevation and cold were unfavourable to the growth. Last year, during a tour through Travancore, amalo, similar to the Mysore plant, was found to be very abundant, and to be used by the natives in medicine. Flowers, fruits, and leaves were brought back, and submitted to Mr Lawson, the Madras Government Botanist, who with very little hesitation referred them to Aloe vulgaris, Lamark, the figure of which is represented in Bentley & Trimen's "Medicinal Plants", plate 282. The A. Indica and A. littoralis mentioned in the Pharmacopoeia of India, as has been suggested before, might be placed under the denomination of A. vulgaris, a plant which seems to be well established, at least in Southern India. A. vulgaris affords the Barbadoes aloes of commerce, which gives peculiar reactions with nitric acid and its vapour. The Mysore aloes, in giving similar reactions, confirms to some extent the evidence of its being made in the country from a plant which is so abundant. If the imported

article should ever become scarce, the natives will not be backward in manufacturing the drug for themselves, if, indeed, this is not already done. The aloe plant is not a true native of India, and the introduced A. vulgare is not at present recognized in modern works of Materia Medica of this country, but considering its easy growth, & the extensive uses to which it is put by the natives in medicine, it will shortly have to take up an official position with other indigenous drugs.

Balsamodendron Berry 443

Pharm. Journ.
Aug 25th 1889

Buchanan's interesting "Journey through Mysore, Canara, and Malabar," mentions (p. 8. Vol II) a species of myrrh, about which little is known. "Many of the hedges here, and in other parts of Coimbatore, are made of a thorn called Mulukilivary. It seems from its habit to be a Rhus; but not having found the fructification, I am very uncertain concerning its place in the botanical system. It makes a very good fence; cuttings 3 or 4 cubits long are put into the ground between March ~~15~~ and April 10. The ends are buried in the earth about a span, and very soon shoot out roots. From the moment it is planted, it forms a fence against cattle; but seems to require a better soil than either Euphorbia Tirucalli or E. antiquorum, which are the most common hedges here, and will grow anywhere."

The Mulukilivary in the above excerpt is the Balsamodendron, Arnott, and Coimbatore, the habitat of the plant, is a district lying to the south of the Nilgiri Hills. Hearing that a gum-resin, similar to the official myrrh, could be obtained from this shrub, enquiry was made for samples, and for information respecting it. The District Forest Officer of North Coimbatore, forwarded me a sample of the gum-resin in October last, & furnished the following information. The gum-resin is used here by the natives medicinally. It is not collected for commercial purposes, & may be more abundantly procured between the months of February & July. The cost of collection would come to Rs 4 per maund (of 25 lbs). The District Forest Officer of South Coimbatore sent

130
me a sample, rather inferior to the first, pointing out that the exudation was not used by the natives in the district in medicine or the art, nor was it collected for commercial purposes.

The gum-resin was in pale yellow, yellowish brown, or brown translucent fragments, tough, and breaking with a shining conchoidal fracture. The surface had an oily appearance, & when scratched, or rubbed with some hard implement, showed milk white markings. Pieces of reddish brown bark were attached to some fragments, and others were adhering to cloth in which it had been collected. Powder of a dirty white colour, and when rubbed up with water made a thin emulsion. The odour was oily, not fragrant. Col. Beddome alludes however to an aroma given off by the plant. The taste was simply mucilaginous. It dissolves for the most part in water, leaving a few flocks of resin and impurities undissolved.

A selected sample of the gum-resin gave to water 84 per cent. of gum; it contained 5 per cent. of moisture, and 6.6 per cent. of mineral matter. The gum was gelatinized by ferric chloride, and like that from true myrrh, was not precipitated by neutral plumbic acetate. The resin was soft, transparent, tasteless, odourless and neutral in reaction. It was soluble in alcohol, ether, bisulphide of carbon & chloroform. The solution in alcohol was not coloured by ferric chloride, & gave a right handed rotation when examined with polarized light. The resin, moistened with alcohol, gave no colour with concentrated nitric or hydrochloric acid, and no violet liquid was obtained when bromine was added to its solution in carbon bisulphide. The resin, separated by alcohol and evaporated, was exposed to the heat of a water-bath for a mark

131
and remained soft & tenacious; after this it was exposed to the air for about two months, but its consistency was not altered, and when examined under the microscope was seen to be perfectly amorphous.

The myrrh from the Mulukiliwary is evidently distinct from the true Myrrh, Arabian Myrrh, and Bessa Bel. Its freedom from bitterness and fragrance would render it unfit as a medicinal agent. It gives off no odour when burnt, & is therefore unsuitable as an ingredient in incense. It forms a good adhesive mucilage, and might be used as a convenient addition to some kinds of confectionery. An allied species of myrrh yielding a similar exudation is the Balsamodendron pubeescens, growing in Beluchistan, and remarkable for the large proportion of gum in the gum-resin.

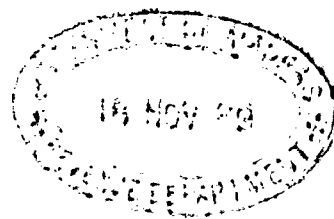
(True Copy)

David Hooper.

Govt. Quinologist

by
Mr. David Hooper F.C.S., F.I.C.
Government Quinologist

1. An Examination of the Leaves of *Gymnema Sylvestre*
2. *Naregamia Alata*, The Goanese *Specacanth*
3. The Mineral Concretion of the Teak Tree
4. The Optical method of analysis for quinine Sulphate
5. The Phenomenon of Dye-repitation in organic substances.
6. *Waras*, its Composition and Relation to *Kamala*.
7. Bark of *Michelia Nilagirica*
8. Bark of *Phamrus Wightii*.
9. Leaves of *Adhatoda Vasica*, Nees.
10. The *Clorodendrons* and their chemical Constituents.
11. Proximate Analysis of *Saxifraga ligulata*.
12. Some Drugs of British Sikkim.
13. Laurel Nut oil.
14. *Gymnemic Acid*.
15. *Podophyllum Emodi*.
16. *Musambra*, a Variety of East Indian Aloes.
17. *Balsamodendron Berrigi*.



Rev. 87/64/875

Rev. 83/90.

No. 45

Director's Office,

OOTACAMUND, 16th November 1889.

151

From

M. A. LAWSON, Esq.,

GOVERNMENT BOTANIST AND DIRECTOR OF

GOVERNMENT CINCHONA PLANTATIONS, &C.,

Nilgiris.

To

The Secretary to Government
Revenue Department
Fort St George

SIR,

In continuation of para 5
of my letter, No 44 dated the 1st November
1889, I have the honor, with reference to
para 6 of G. O. No 854 dated the 18th
October 1889, — Revenue — to forward the
copies of the Scientific papers of
Mr. D. Hooper, the Government Arinologist,
as specified in the accompanying
list.

by Book post

I have the honor to be

Sir

Yours Most obedient Servant

M. A. Lawson

Govt Botanist and Director

Rev. 89 64/89
Rev. 53/90

3/2

OFFICE OF SURGEON-GENERAL

WITH THE GOVERNMENT OF MADRAS,

Fort St. George, 6 Jan'y 1890

No. 3

From G. Bidie Esq. B. 13, C. I. E.
THE SURGEON-GENERAL WITH THE

GOVERNMENT OF MADRAS,

FORT ST. GEORGE,

To

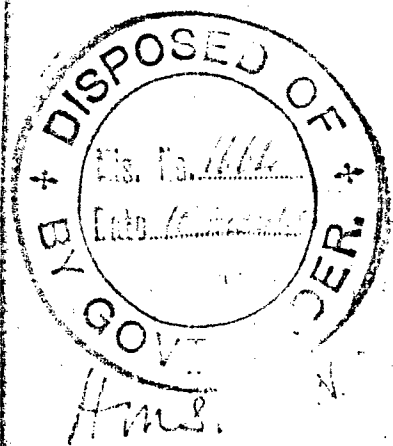
THE Secretary to Government

Revenue Department

SIR,

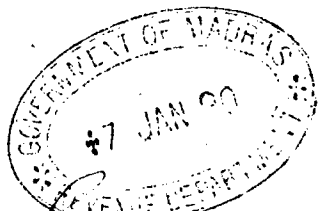
In returning the scientific papers of the Government Zoologist, referred under your docket Memo No. 7706 of 28th November 1889, I have the honor to state that they are all interesting and valuable, although some are of more practical value than others. Papers Nos. 1 and 4 relate to the same species but the latter is more complete than the former. No. 12 would not be of very much interest in Madras, and is purely of a descriptive character. The whole of the papers except No. 1 (regarding which no information is given) have already been published and all the more important ones in European periodicals which are read by scientific men. Had this not been so, I have had no hesitation in saying that even if they should be published in the reports of Government but this hardly seems necessary now seeing that they have already been before the scientific world. It might be

Revenue (1st^o) Department
 No 53
 From G. Bidie Esq. L.B., C.S.E.
 Surgeon General with Govt.
 Fort St George



No 3

Dated 6th Jan.
 Recd 7th Jan.
 Enclosure



Subject

Submits remarks on the
 scientific papers of the Govt. Zoologists

encs.
 R. 24/11

7. 7206
 29.10.87

2rs

submitted that the
 Genl's suggestions
 be adopted.

Run

13.1.
 14/1/88

20 Jan
 again Co. 7706
 28-11-89
 also Cus 53/90
 order. 10/11/89

suggestions of the
 Genl will be adopted,
 & a list of the papers
 be added as an appendix
 1. no. 852. dt. 18.10.87.

Run

22.1. 1888
 23/1/88

Encl with Govt.
 Botanist.
 Dec 12-3

