A History of the principal drugs of vegetables origin met with in British India.
Vol. II
by
William Dymock

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CORRIGENDA.

Page 81, 3rd line from bottom, *for* Deodáil *read* Deodáli.
„ 84, 17th „ „ top, *for* lightly *read* slightly.
„ 124, 2nd „ „ „ *for* apigenen *read* apigenin.
„ 130, 16th „ „ „ *for* confectis *read* confectio.
„ 272, 10th „ „ „ Arabic letters [illegible]'5 misplaced.
„ 291, 10th „ „ „ *for* either *read* ether.

OPINIONS OF THE PRESS.

Pharmacographia Indica.

PART II.

We have received Part II. of the "*Pharmacographia Indica*," which completes the first volume. This portion fully sustains the promise of the previous one, and contains a large quantity of original information relative to Indian Vegetable drugs, as well as carefully collected extracts from the most reliable sources. Under the heading "History, Uses, &c.," the authors have got together some highly instructive notes, which will be useful reading, not only to those interested in drugs and chemicals, but to the general reader likewise.—*Times of India.*

It will be seen that every thing wanting to be known about an Indian drug is made available, and such a book should be in the hands of medical officers and magistrates, both in the chief towns and the Mofussil. There is always a market in England, Germany, and America for Indian drugs of acknowledged merit, and to those who speculate, or experiment with such a commodity we should recommend the "*Pharmacographia Indica*" as a flail to separate the wheat from the chaff.—*Madras Mail.*

Die vorstehenden Mittheilungen aus der *Pharmacographia Indica* bestätigen, dass in dem Werke ein wichtiger Beitrag zur Kenntniss indischer Helpflanzen und Nutzpflanzen geboten wird, welcher der Aufmerksamkeit vieler Kreise in hohem Grade werth ist.—*Pharm. Zeitung.*

The drugs are too numerous to be mentioned in a review of the work, but we are satisfied that we shall frequently have occasion to refer to *Pharmacographia Indica* for reliable information on Indian drugs, and more particularly such which are not, or only to a limited extent, articles of European or American commerce. Part II. is fully equal to Part I. in interest and completeness of information. The work is to be recommended to all interested in Materia Medica, and more particularly that of the East Indies.—*Am. Jour. Pharm.*

Part II. of this valuable work has recently been put before us. It affords the same evidence of careful study as was exhibited by its predecessor, and it shows that the three joint authors have endeavoured to fill a gap that has long existed. We do not mean merely that such a book as this has long been needed, but that the native pharmacopœia has been too long neglected. . . . The arrangement of the work before us is convenient for easy reference, and it seems certain that the work will be found one of great value to every practitioner in this country. Elsewhere also it might be found extremely useful.—*Madras Times.*

The "*Pharmacographia Indica*" is, however, not valuable merely to those residing in India and to merchants importing Indian drugs, but also to students of materia medica in this country, since the information on a large number of the drugs used in Europe is brought more closely up to date than in almost any other work on Materia Medica. . . . The chemical work that has been done in India, although in many cases not carried to a definite conclusion, consisting rather of proximate analyses, is of great value for future reference, since the exact modes of treating the various drugs, and the solvents used are always stated. The physiological action is in many instances described, and the reputation of the drug among the natives confirmed, or contradicted, as the case may be. There is thus placed before Western nations a repertory of materia medica, replete with valuable, because practical information, from which the searcher for new remedies may cull many promising articles.— . . . Dr. Dymock and his colleagues may be heartily congratulated on having brought to such a pitch of perfection this useful work, which it may confidently be predicted will take as high a place in the pharmaceutical literature of the East as its namesake has in that of the West.—*Pharm. Journ., Aug. 9th,* 1890.

In regard to materia medica generally it must always hold a high place as a book of reference. The favourable opinion which we formed on the first part of the volume is enhanced by the uniformly good quality of the matter in this second one. We were at first disposed to think that this was a book which only specialists would have use for; but it grows so interesting, and is so full of valuable information, that we can recommend it to all pharmacists who have a love for books.—*Chemist and Druggist, July 26th,* 1890.

PHARMACOGRAPHIA INDICA.

COMBRETACEÆ.

TERMINALIA CHEBULA, *Retz.*

Fig.—*Roxb. Cor. Pl., t.* 197; *Bedd. Fl. Sylv. t.* 27; *Gärtn. Fruct.* ii., *t.* 97. Chebulic myrobalan (*Eng.*), Myrobalan Chébule (*Fr.*).

Hab.—India (table lands). The fruit.

Vernacular.—Har, Hara (*Hind.*), Hirada (*Mar.*), Kaduk-kai (*Tam., Mal.*), Hora, Haritaki (*Beng.*), Karakkaya (*Tel.*), Alalekay (*Can.*), Harade (*Guz.*), Hana (*Pahari*), Silim-kung (*Lepcha*).

History Uses, &c.—There are several varieties of this tree, some of which have probably been produced by cultivation. *T. citrina*, Roxb., is considered by some to be a separate species. Dutt (Hindu Materia Medica) informs us that Chebulic myrobalans, in Sanskrit *Haritaki, Abhaya,* and *Pathyá,* were highly extolled by the ancient Hindus as a powerful alterative and tonic. They have received the names of *Pranada* or life-giver, *Sudha* or nectar, *Bhishakpriya* or Physician's favourite and so forth.* A mythological origin has also been attributed to the tree. "It is said that when Indra was drinking *amrita* in heaven a drop of the fluid fell on the earth and produced the plant." On this account it is called *Shakra-srishtá* "created

* The following are the synonyms of Haritaki in the Raja-nirghantu:—Har, Sivá, Pathyá, Chetaki, Vijayá, Jayá, Pramatthyá, Pramathá, Amoghá, Káyasthá, Pránadá, Amritá, Jivaniyá, Hemavati, Pútaná, Brantaná, Abhayá, Javasthá, Nandini, Sreyasi, Rohini. In Sankrit prescriptions any one of these names may be used.

by Indra." Indian writers describe seven varieties of Haritaki, which however are nothing more than the same fruit in different stages of maturity. Very large fruit are considered particularly valuable, and fetch a fancy price. Chebulic myrobalans are considered to be laxative, stomachic, tonic, and alterative. They are prescribed alone or in combination with Emblic and Beleric myrobalans in a vast number of diseases, chiefly those affecting the chest and abdomen. The three myrobalans together are called *triphala* or the *three fruits* in Sanskrit. Various original receipts for their administration will be found in Dutt's Hindu Materia Medica. Myrobalans were known to the early Arabian writers, and through them to the Greek writer Actuarius, who mentions five kinds. Nicolas Myrepsicus also notices them. The author of the Makhzan-el-Adwiya, on the subject of chebulic myrobalans, says that the very young fruit, about the size of cumin seeds, are called *Halileh-i-zira;* when about the size of a grain of barley, *Halileh-i-jawi;* when of the size of a raisin, *Halileh-i-zangi* or *Halileh-i-hindi;* when half arrived at maturity and yellowish, *Halileh-i-chini;* when still further advanced, *Halileh-i-asfar;* and lastly, when quite mature, *Halileh-i-kabuli.* Of these six varieties of chebulic myrobalans, the second, third, and last only are in general use for medicinal purposes, the fourth and fifth, also known as *Rangâri har* or *hirade,* are chiefly used by tanners. The Mahometans, like the Hindus, attribute a great many fanciful properties to the drug; shortly, we may say, that the ripe fruit is chiefly used as a purgative, and is considered to remove bile, phlegm, and adust bile; it should be combined with aromatics, such as fennel seeds, caraways, &c. The Arabs say,—"*Ihlilaj* is in the stomach like an intelligent housewife, who is a good manager of the house." The unripe fruit (*Halileh-i-hindi* or *Himaja*) is most valued on account of its astringent and aperient properties, and is a useful medicine in dysentery and diarrhœa; it should also be given with aromatics. Locally it is applied as an astringent. The first and second kind are supposed to have the same properties as the third in a less degree, and the fourth and fifth the same as the sixth in

a less degree. The best way of administering myrobalans as a purgative is to make an infusion or decoction of from 2 to 4 drachms of fruit pulp with the addition of a pinch of caraway seeds and a little honey or sugar.

Ainslie notices their use as an application to aphthæ. In the *Pharmacopœia of India*, Dr. Waring mentions his having found six of the mature fruit an efficient and safe purgative, producing four or five copious stools, unattended by griping, nausea or other ill effects; probably those used by him were not of the largest kind. Dr. Hové in his account of a visit to the Myrobalan Plantation at Bungar in the Concan in 1787, states that he found one fruit a sufficient purgative, though the manager of the plantation told him that two were generally used. Twining (*Diseases of Bengal*, Vol. I., p. 407,) speaks very favourably of the immature fruit (*Halileh-i-zangi*) as a tonic and aperient in enlargements of the abdominal viscera. We have found them a useful medicine in diarrhœa and dysentery, given in doses of a drachm twice a day. Recently, *M.* P. Apéry has brought to the notice of the profession in Europe the value of these black myrobalans in dysentery, choleraic diarrhœa, and chronic diarrhœa; he administers them in pills of 25 centigrams each, the dose being from 4 to 12 pills or even more in the 24 hours. (*Journ. de Pharm. et de Chim.* Feb. 1st, 1888.) Roxburgh states that the tender leaves, while scarce unfolded, are said to be punctured by an an insect, and its eggs deposited therein, which by the extravasation of the sap, become enlarged into hollow galls of various shapes and sizes, but rarely exceeding an inch in diameter. They are powerfully astringent, and make as good ink as oak galls. They also yield the chintz painters on the coast of Coromandel their best and most durable yellow. They are called by the Tamils *Kadu-cai-pu*, and by the Telingas *Aldicai*, (*Fl. Ind.* II., 435.) In the *Pharmacopœia of India* they are noticed on the authority of the Rev. J. Kearns of Tinnevelly as a valuable astringent in diarrhœa. The Himalayan tribes eat the kernels of this myrobalan, and use the fruit as a remedy for sore throat under the name of *Khoki*.

Description—The mature myrobalan is of an ovoid form, from 1—1½ inches long, sometimes tapering towards the lower extremity, obscurely 5 or 6-sided, more or less furrowed longitudinally, covered with a smooth yellowish brown epidermis, within which is an astringent pulp, enclosing a large rough bony, one-celled endocarp.

The unripe fruits are shrivelled, black, ovoid, brittle bodies, from ⅓ to ⅔ of an inch in length, having a shining fracture and an astringent taste; on careful examination the rudiments of the nut may be distinguished.

Chemical composition.—According to Stenhouse (1843), chebulic myrobalans contain about 45 per cent. tannin, also gallic acid, mucilage and a brownish yellow colouring matter. Hummel has obtained 31 per cent. of tannic acid, and Paul 32·82, and 26·81 of gallotannic acid from two ordinary samples of the commercial article, but from a sample of inferior quality only 6·11 per cent.

Herr Fridolin (1884) reported to the Dorpat Naturforscher Gesellschaft the isolation from chebulic myrobalans of a new organic acid, which he has named *chebulinic acid*, and considers to be probably the source of the gallic and tannic acids detected by previous observers. He obtains it by saturating an aqueous solution of an alcoholic extract of the fruit with sodium chloride, dissolving the matter that separates in water, and shaking the solution with acetic ether, which takes up the chebulinic acid together with tannic acid. The residue after the evaporation of the ether is dissolved in a little water and allowed to stand for a few days, when the chebulinic acid crystallizes out in rhombic prisms. The acid, which is odourless and sweet, dissolves very readily in alcohol and hot water, not so freely in ether, and with great difficulty in cold water, the solutions having an acid reaction. In aqueous solution the chebulinic acid reduces Fehling's solution, and in some of its reactions it closely resembles gallic acid, but differs from it in affording no colour reaction with potassium cyanide. Herr Fridolin suggests as a formula probably representing its composition, $C^{28}H^{24}O^{19}$. ($C^{7}H^{6}O^{5}$?) When decomposed

by heating an aqueous solution in a closed tube, chebulinic acid takes up the elements of water, and the molecule is split up into two molecules of gallic acid and one of tannic acid. Herr Fridolin suggests the possibility of the existence in other instances of an organic compound splitting up into tannic and gallic acids.

According to *M.* P. Apéry, black myrobalans contain an oleo-resin of a green colour soluble in alcohol, ether, petroleum spirit and oil of turpentine; this oleo-resin, which has been named by him *myrobalanin*, is coloured red by nitric acid. (*Journ. de Pharm. et de Chim.*, Feb. 1st, 1888.)

Commerce.—See next article. Very large chebulic myrobalans are sold in the bazars as Sarvári or Sardári har, and often fetch a rupee each. Fictitious myrobalans of very large size are manufactured by glueing slices of the pulp upon a natural fruit.

TERMINALIA BELERICA, *Roxb.*

Fig.—*Bedd. Fl. Sylv., t.* 19; *Wight Ic., t.* 91; *Rheede Hort. Mal. iv., t.* 10. Beleric myrobalan (*Eng.*), Myrobalan belériс (*Fr.*).

Hab.—India.

Vernacular.—Bahera, Bharla, Balra (*Hind.*), Bahera, Bohora (*Beng.*), Behada, Vahela (*Mar.*), Tánrik-kay, Thani (*Tam.*), Tándra-káya (*Tel.*), Tári-káyi (*Can.*).

History, Uses, &c.—This tree, in Sanskrit Vibhita and Vibhitaka (fearless), is avoided by the Hindus of Northern India, who will not sit in its shade, as it is supposed to be inhabited by demons. Two varieties of *T. belerica* are found in India, one with nearly globular fruit, ½ to ¾ inch in diameter, the other with ovate and much larger fruit. The pulp of the fruit (Beleric myrobalan) is considered by Hindu physicians to be astringent and laxative, and is prescribed with salt and long pepper in affections of the throat and chest. As a constituent of the *triphala* (three fruits), *i.e.*, emblic, beleric and chebulic

myrobalans, it is employed in a great number of diseases, and the kernel is sometimes used as an external application to inflamed parts. On account of its medicinal properties the tree bears the Sanskrit synonym of Anila-ghnaka, or "wind-killing." According to the Nighantás the kernels are narcotic. Mahometan writers describe Balilaj (the beleric myrobalan) as astringent, tonic, digestive, attenuant, and aperient, and useful as an astringent application to the eyes. As long as the doctrines of the Arabian school prevailed, myrobalans were used medicinally in Europe, having been introduced by the Arabs from India. The μυροβαλανος of the classical Greek and Latin writers was a fruit from which the perfumers obtained oil for their unguents. According to Theophrastus, the outer cortical portion was pounded to extract the oil, as that part only was sweet smelling. It is uncertain what this fruit was, but it appears to have been something similar to that of the African oil palm (*Elæis guineensis*), the outer fleshy coating of which yields an oil of the consistence of butter, having a rather pleasant violet-like odour when fresh. The later Greek physicians apply the terms μυροβαλανος and μυρεψικος to Indian myrobalans.

T. belerica produces a quantity of gum of the Bassora type, which is collected and mixed with soluble gums for sale as country gum.

Description.—The fruit of the smaller variety of this myrobalan is nearly globular, and suddenly narrowed into a short stalk, it is from ½ to ¾ inch in diameter, fleshy, covered with a close fulvous tomentum; the stone is hard and pentagonal, and contains a sweet oily kernel, having three prominent ridges from base to apex. In the larger variety the fruit is ovoid and about double the size, and the flowers have a powerful stercoraceous odour exactly resembling that of the wood of *Celtis reticulosa* in which W. A. Dunstan has demonstrated the presence of skatole. The gum is mostly in vermicular pieces of a yellowish-brown colour; in water it forms a bulky gelatinous mass of insipid taste.

Chemical composition.—The percentage of tannic acid in these myrobalans appears to vary considerably. Hummel ob-

tained 17·4 per cent.; he remarks that the fruit consists of two distinct portions, an outer and inner; 100 parts contains 75·4 per cent. outer, and 24·6 per cent. inner. The inner portion only contains 1·25 per cent. of tannic acid. Paul obtained from two commercial samples of beleric myrobalans 5·03 and 6·70 of gallotannic acid. (*Watt., Selections from the Records of the Govt. of India*, Vol. I., pp. 88 and 93.) We have examined the pulp of the smaller myrobalan removed from the shell enclosing the kernel, and the kernels separately, with the following results:—

	Pulp.	Kernel.
Moisture	8·00	11·38 per cent.
Ash	4·28	4·38 ,,
Petroleum ether extract ...	·12	29·82 ,,
Ether extract	·41	·61 ,,
Alcoholic ,, ...	6·42	·61 ,,
Aqueous ,, ...	38·56	25·26 ,,

Pulp.—The moisture was determined by heating to 100° C. the finely powdered material. The ash contained no manganese.

The petroleum ether extract consisted of greenish yellow oil.

The ethereal extract contained colouring matter, resins, a trace of gallic acid, and oil. No alkaloid was present.

The alcoholic extract was yellow, brittle, and highly astringent. In warm water it was partly soluble. The aqueous solution gave the following tannin reactions: with ferric chloride indigo-blue, changing to damson on the addition of ammonia; with lime water a light yellow precipitate, turning greenish blue on adding an excess; with bichromate of potash a dirty reddish brown precipitate; with bromine water no precipitate; with sulphate of copper a slight precipitate; on adding ammonia a dense nearly white precipitate, rapidly becoming yellow and then yellowish brown. No alkaloidal principle was detected.

Kernels.—The moisture was determined first by exposure over sulphuric acid in a vacuum: and then at 100° C. The ash contained no manganese.

The petroleum ether extract consisted of a pale yellow, thin, nutty flavoured oil, non-drying, and insoluble in alcohol; on

standing no crystalline deposit was formed; there was nothing specially noteworthy regarding its colour reactions. No alkaloidal principle was detected. The ethereal extract was whitish and oily; in light petroleum ether ·52 per cent. was soluble, which added to the petroleum ether extract, would increase the oil content of the kernels to 30·44 per cent.; the residue insoluble in light petroleum ether amounted to ·09 per cent., and did not afford reactions for alkaloidal principles. Braunt states that the oil behaves in the same manner as mastic oil when obtained by expression, and he describes it as a green fluid oil, from which a white fat of the consistence of butter separates.

The alcoholic extract was whitish and partly soluble in hot water with acid reaction, tasteless; no alkaloid was detected.

The aqueous extract did not reduce an alkaline copper solution until after boiling with a dilute acid. The extract was specially examined for saponin with negative results.

The powdered air-dried bark of the large variety of *T. belerica* contained 3·71 per cent of moisture, and 18·61 per cent of ash, in which no trace of manganese could be detected.

With the exception of astringent matter, giving a brownish coloration with ferric salts, nothing of special importance was detected in either the bark or leaves—no alkaloids or glucosides were detected. An alcoholic extract, after separation of the alcohol, obtained from 10 grams of the bark injected into a cat's stomach, afforded the following symptoms :—

Injected at 10-50 a. m. into a cat's stomach which had fasted for about 10 hours.

11-15. Vomited twice.
11-25. Solid motion.
11-45. Vomited.

No further symptoms were noted, and the following day the cat appeared to be in its normal condition.

In the case of the leaves an alcoholic extract induced almost immediate vomiting without any other symptoms.

In neither of the experiments was there heaviness, inability to move, or any symptoms of intoxication noticed.

Toxicology.—Roxburgh and Graham notice the popular belief that certain trees of *T. belerica* bear fruit the kernels of which have intoxicating properties; these trees are said by some to be always those of the large fruited variety. Native evidence on this point is conflicting, some people say that they have eaten both kinds of the seeds freely without experiencing any narcotic effects, but that when water is taken after eating them giddiness and a sense of intoxication is experienced. If vomiting occurs these symptoms soon pass off. There is no doubt that children often spend many hours under these trees eating the seeds, and it is quite possible that severe attacks of indigestion may follow such excesses.

The only cases of poisoning by the Bahira have been recorded by Mr. Raddock, Sub-Assistant Surgeon in charge of the Malwa Bheel Corps. Three boys, from five to nine years of age, picked up and ate some of the dry nuts near the house of a Chamar, who had brought them from the jungles for the purpose of colouring leather. Two of these boys, became drowsy, complained of headache and sickness at stomach, and vomited freely a thick white frothy mucus The third, a rather weakly boy of seven, was first seen by Mr. Raddock on the following morning. He was in his father's lap, and appeared as if asleep; the legs and arms were relaxed and bent; eyes closed, breathing soft. There was total insensibility; and shaking and calling did not make him stir in the least, or answer. The pulse was scarcely perceptible, action of the heart frequent and weak. Body of natural warmth, legs cold, eyes rather glistening, pupils fixed, neither contracted nor dilated, jaws closed, and only to be opened by much force. This child had eaten the largest quantity of kernels—between 20 and 30. At the time, or subsequently, nothing was complained of. He played all day and at night before going to bed; went to sleep, and was not noticed until next morning, when he was found insensible, and was supposed to be dead. With difficulty he was made to vomit

three or four times, the eyes opened with a heavy dull expression, and closed again; though he relapsed his condition was now improved, the insensibility was not so deep, and his hand was moved to his throat. Small quantities of strong black tea were administered. About 10 a. m. he became sensible, opened his eyes, and answered, when spoken to; towards the afternoon he walked about and improved greatly. At 5 in the evening he was sensible but drowsy, pulse small and rapid, complained of being giddy, had vomited twice since morning, with relief to the symptoms. His recovery was speedy. Mr. Raddock justly infers from these cases that the Bahira is a mild narcotic poison. In the last mentioned case he is convinced that it would have proved fatal had the stomach-pump not been used, or had emetics failed. He adds that, in two of the boys who ate about the same quantity, no effects were produced till about eight hours after, and the poison was got rid of by vomiting. In the third, who ate the most, no effects were produced in 12 hours; at least no vomiting resulted, and during sleep, insensibility came on.

Dr. Burton Brown in citing this case says that *Terminalia belerica* is sometimes added to spirit in bazaars, in conjunction with the Chebulic myrobalan (*hara*) and the Emblic myrobalan (*avola*), so that it is possible that an accident might occur from the use of spirit so drugged.

Royle and Birdwood merely say that the seeds of the *Terminalia bêlerica* are eaten as nuts. O'Shaughnessy, however, adds that they "are deemed intoxicating." (*Chevers.*)

As regards the seeds eaten in moderation, our experiments lead to the conclusion that they are perfectly harmless; one of us has eaten kernels without any ill effects. In one of our experiments we injected into a cat's stomach an alcoholic extract from 9 grams of the kernels with negative results. In another experiment we mixed 13·2 grams of kernels, equal to about 35—40 kernels, reduced to a fine pulp, with about 30 grams of raw meat, also pulped: this mixture was readily eaten at 11·5 a. m. by a cat which had been fasting for many hours:

when the laboratory was closed at 4 p. m. the cat appeared in its usual condition, no symptoms having been induced, and on the following morning it appeared to be perfectly well. We learn that Jogis consider that one kernel eaten daily increases the appetite for sexual indulgence. Our experiments appear to be fairly conclusive that these kernels do not possess any toxic properties.

Commerce.—Myrobalans are one of the principal forest products of India; they are collected in large quantities on Government account, and yearly auctions are held by the Forest Conservancy Department. Both chebulic and beleric myrobalans are largely exported for tanning and dyeing. The exports from the whole of India were:—In 1885-86, 706,000 cwts., valued at 30 lakhs of rupees; in 1886-87, 597,000 cwts., valued at 23 lakhs of rupees; in 1887-88, 678,000 cwts., valued at 25 lakhs of rupees.

TERMINALIA ARJUNA, *Bedd.*

Fig.—*Fl. Syl., t.* 28; *D C. Mem. Combr. t.* 2.

Hab.—Deccan, Ceylon, North-West Provinces. The bark.

Vernacular.—Kahu, Arjun (*Hind.*), Vellai-maruda-maram (*Tam.*), Tella-maddi-chettu (*Tel.*), Arjun, Shárdul, Pinjal (*Mar.*), Arjun (*Beng.*), Tora-billi-matti (*Can.*).

History, Uses, &c.—This tree is the Arjuna and Kukubha of Chakradatta, who describes it as tonic, astringent, and cooling, and prescribes it in heart disease and for those purposes for which astringents are generally applied. He recommends it to be given in milk, treacle or water when used internally, or as a *ghrita* (medicinal butter) made with the decoction and powder of the bark.

Hindu physicians think that the bark has some special virtue in promoting the union of fractures, and the dispersion of ecchymosis when given internally. It is considered to be *Asmari-hara*, or lithontriptic, and a reference to the chemical composition will show that the ash of the bark contains an

extraordinarily large proportion of calcium carbonate. Externally it is used in the form of an astringent wash to ulcers.

Description.—The bark is generally sold in short half quills, from ⅛ to ⅜ of an inch thick, and several inches long; it has a pinkish colour, which is seen through the thin grey epidermis; its substance is fibrous and gritty under the teeth; it breaks with a short fracture, the internal surface being of a lighter colour and finely striated. The taste is agreeably astringent. The bark when magnified shows remarkably large cells in the medullary rays, and numerous large stone cells of a bright yellow colour contrast strikingly with the pinkish tinge of the other structures. It contains much crystalline matter.

Chemical composition.—This is most remarkable, the ash amounts to 34 per cent. of almost pure calcium carbonate, which if calculated into oxalate would amount to 43·5 per cent. The watery extract is 23 per cent. with 16 per cent. of tannin; very little colouring matter besides the tannin is extracted by alcohol. The tannin gave a blue-black precipitate with ferric salts.

ANOGEISSUS LATIFOLIA, *Wall.*

Fig.—*Bedd. Fl. Sylv., t.* 15; *Royle Ill., t.* 45; *Wight Ic., t.* 994.

Hab.—Himalayas to Ceylon. The gum and leaves.

Syn.—*Conocarpus latifolia.*

Vernacular.—Dhâoya, Dhaura, Dhava, Bakla (*Hind.*), Davda (*Guz., Mar.*), Vallai-naga, Vakkali (*Tam.*), Chiruman, Yellamaddi (*Tel.*), Dinduga (*Can.*).

History, Uses, &c.—A large and very common tree called in Sanskrit Dhava, Dhavala, Madhura-tvacha and Vaka-vriksha, or "crane tree," on account of the resemblance of its fruit to the head of a crane (vaka). The wood is hard but not durable; it affords a good fuel and excellent charcoal. The tree is remarkable for the large amount of gum which

flows from it, whence the Sanskrit name Dhava, from धू, to flow. The gum has a great reputation in India among calico-printers for use with certain dye-stuffs, such as turmeric. The leaves are used in most parts of the country for tanning.

Description.—Leaves short petioled, ovate, generally emarginate, entire, smooth, from one to four inches long, and from one and a half to two broad. Taste very astringent. In the variety *villosa* the leaves are rusty villose on both surfaces, and in the variety *parvifolia* they are very small and silky pubescent. For a description of the gum the reader is referred to the article upon the *Substitutes for Gum Acacia*, Vol. I., p. 544.

Chemical composition.—The leaves have been examined by Hummel, who obtained from them a pale yellow decoction, and 15·5 per cent. of tannic acid. (*Watt, Selections from the Records of the Govt. of India* Vol. I., p. 93.) Lyon, who has also examined them, obtained a similar result.

QUISQUALIS INDICA, *Linn.*

Fig.—*Lam. Ill.*, *t.* 357; *Wight Ill.*, *t.* 92; *Bot. Reg. N. S. XXX.*, *t* 15. Rangoon creeper (*Eng.*), Liane vermifuge (*Fr.*).

Hab.—Malaya. India, cultivated. The seeds.

Vernacular.—Rangun-ki-bel(*Hind.*), Vilayati-chameli(*Mar.*), Irangun-malli (*Tam.*), Rangunu-malle-chettu (*Tel.*).

History, Uses, &c.—In the Moluccas the seeds have long been held in repute as an anthelmintic, and in 1833 they were brought forward by Dr. Oxley and Mr. Gordon of Singapore. (*Calcutta Med. and Phys. Trans.*, vii., p. 488.) The testimony adduced in their favour by these authorities is strong, and is to the effect that in cases of *lumbrici*, four or five of these seeds, bruised and given in electuary with honey or jam, suffice for the expulsion of the entozoa in children. Bouton (*Med. Plants of Mauritius*, p. 58), who gives *Liane vermifuge*

as the name of the shrub in the Mauritius, states that if more than four or five seeds are given they are apt, in some constitutions, to cause spasm and other ill effects. (*Pharm. of India.*) Loureiro states that the leaves are astringent. This plant is cultivated as a flowering shrub in most parts of India, but except in the Southern Provinces it very seldom ripens its fruit, and its medicinal properties are consequently unknown in most parts of the country.

Description.—The fruits are about an inch in length, oval or oblong, pointed at either extremity, and sharply pentagonal; they dehisce from the apex. The woody pericarp is thin, fragile and of a deep mahogany colour; it encloses a pentagonal seed nearly black when dry, yellowish and oily internally. (*Fig. in Hanbury's Science Papers, p.* 282.)

Chemical composition.—Quisqualis fruits consist of 41 parts shells and 59 parts kernels in 100 parts. The fixed oil obtained by ether amounts to 15 per cent.; it is of a yellow colour, peculiar odour, and has a specific gravity of ·9169. It yields on saponification 94·7 per cent. of fatty acids melting at 43° C. The oil with sulphuric acid passes from a reddish-brown colour through red and green to purple. The alcoholic extract, after removal of the oil, is intensely sweet owing to the presence of an amorphous fermentable sugar similar to levulose; the solution in water acidified with acetic acid and shaken with ether affords on evaporation of the ether a crystalline residue, soluble in sulphuric acid without colour, striking an orange colour with caustic soda, and giving in watery solution precipitates with the alkaloidal reagents. The drug now treated with water yields a deep reddish brown colouring matter of the nature of an organic acid. It darkens slightly with iron salts, gives no precipitate with gelatine, and is wholly removed from solution by neutral plumbic acetate, and the precipitate after standing some days remains in an amorphous condition. This aqueous extract was rendered turbid by alcohol, mineral acids and tannin solution, and decomposed when evaporated. The behaviour of the extract points to the

presence of cathartic acid, or an analogous acid of the amidic series. The seeds afford 7 per cent. of an alkaline deliquescent ash.

CALYCOPTERIS FLORIBUNDA, *Lam.*

Fig.—*Roxb. Cor. Pl., t.* 87.

Hab.—Western India, Assam. The leaves, root, and fruit.

Vernacular.—Bandi-murududu (*Tel.*), Báguli, Ukshi (*Mar.*), Kokoranj, (*Hind.*), Marsada, Báguli (*Can.*).

History, Uses, &c.—This is a dense climbing shrub. The Marathi name Ukshi is evidently derived from the Sanskrit उक्ष, to sprinkle or moisten, as plants loving shade and moisture, such as *Naregamia alata*, flourish beneath it. The leaves are bitter and astringent, and are chewed by the natives and the juice swallowed as a remedy for colic. The root ground to a paste with that of *Croton oblongifolium* is applied to bites of the Phoorsa snake (*Echis carinata*). In *pandurog* (jaundice) ukshi fruit and various spices, of each one part, are made into a compound powder, of which the dose is two massas.

The fruit, with the root of *Grewia pilosa*, Lam., is rubbed into a paste with honey and applied to ulcers.

Description.—Leaves opposite, shortly petioled, elliptic or ovate, acuminate, entire. On the upper surface are thinly scattered long hairs which are most abundant at the edges; the under surface is rusty tomentose, the tomentum being collected in little tufts giving rise to a dotted appearance in the fully mature leaf; taste very astringent and somewhat bitter. The fruit is about ½ inch in length, ovoid, 5-ribbed, villous, 1-seeded, and is surmounted by the enlarged calyx; cotyledons convolute.

Chemical composition.—The leaves assayed by Löwenthal's permanganate and gelatine process yield 6·86 per cent. of tannin, expressed in terms of gallo-tannic acid using Neubauer's equivalent.

The plants of minor importance belonging to this Order, which are sometimes used medicinally, are:—

Terminalia tomentosa, *Bedd. Fl. Sylv.*, t. 17, and its variety, *T. glabra, Vern.*—Asan (*Hind.*), Ain (*Mar.*), Kurrupu-maruta-maram (*Tam.*), Piasal (*Beng.*), Nalla-maddi-chettu (*Tel.*), Tembavu (*Mal.*), trees common in most parts of India, have an astringent bark which is used for tanning, and has been recommended for medicinal use by Dr. Æ. Ross. Powdered and mixed with oil it is used for aphthæ. The ash of the bark contains much potash and is eaten by the natives, and the leaves are used for manuring rice fields. (*Bourdillon.*) Paul found 5·97 per cent. of tannin in the bark, and Hummel 4·0 per cent. We find that the bark of the variety *glabra* contains moisture 9·59, ash 14·94, and tannin 7·2 per cent. The alcoholic extract contained 13·9 per cent. of tannin and colouring matters precipitated by lead. The tannin gave a blue-black precipitate with ferric salts.

The flowers of **Terminalia paniculata,** *Roth., Bedd. Fl. Sylv., t.* 20, Maruthu (*Tam., Mal.*), a tree of Malabar, the Nilgiris and Coorg, are used medicinally by the country people, pounded with the root of *Cissampelos Pareira*, as a remedy in cholera. The juice of the flowers along with that of Guava bark is administered as an antidote in poisoning by opium. If the flowers are not obtainable the bark may be used. The juice of the flowers or bark, with melted butter and rock salt, is applied externally in parotitis. The Marathi name for this tree is *Kinjal*, the Tamils call it *Maruthu* and *Vella-maruthu* or *Ola-maruthu.*

Terminalia Catappa, *Linn., Bot. Mag.* 3004; *Bedd. Fl. Sylv.*, t. 18, the *Catappa* of the Malays, is now cultivated all over India, and is known as the almond tree (*Badam*) to both natives and Europeans. The fruit is an oval, compressed, smooth drupe, with two elevated grooved margins; it is about 2 inches long and of a dull purple colour when ripe, the pulp being bright purple. The nut is rough, hard and thick, and

the kernel which is about half the size of an almond and nearly cylindrical, is in common use in Bengal, amongst Europeans under the name of "leaf nut." According to Braunt the almonds contain 28 per cent. of oil, which excels almond oil as regards flavour and mildness, and has the further advantage of keeping well. It is of a pale yellowish colour and entirely inodorous. Its specific gravity is 918 at 15° C., and it is composed chiefly of stearin and olein, the stearin separating at 5° C. The bark is astringent, and has been recommended for internal administration in the form of decoction as a remedy for gonorrhœa and leucorrhœa. (*Pharm. de St. Dominque.*) The tree yields a gum of the Bassora type.

MYRTACEÆ.

BARRINGTONIA ACUTANGULA, *Gärtn.*

Fig.—*Bedd. Fl. Sylv., t.* 204. The fruit, *Gärtn. Fruct. ii.* 97, *t.* 101.

Hab.—Throughout India. The seeds.

Vernacular.—Hijjal, Samandar-phal (*Hind., Beng.*), Samudar-phal (*Guz.*), Samutra-pullam, Kadapum (*Tam.*), Kadamik, Kanapa (*Tel.*), Pivar, Sáthphal, Dhátriphal, Ingli (*Mar. Can.*).

History, Uses, &c.—This is an evergreen tree of moderate size, called by Sanskrit writers Hijja or Hijjala. The fruit is spoken of as Samudra-phala and Dhátriphala or "nurse's fruit," and is one of the best known domestic remedies. When children suffer from a cold in the chest, the seed is rubbed down on a stone with water and applied over the sternum, and if there is much dyspnœa a few grains with or without the juice of fresh ginger are administered internally and seldom fail to induce vomiting and the expulsion of mucus from the air passages. To reduce the enlarged abdomen of children it

is given in doses of from 2 to 3 grains in milk. Rumphius states that the roots are used to kill fish, and this use of the bark is known in most parts of India. The fish are said to be not unwholesome.

B. racemosa, *Blume*, has similar properties, the bark, root and seed being bitter. Ainslie states that in Java and in Ternate the seeds are used for intoxicating fish. The powdered seeds of these plants induces sneezing.

Description.—The dry seeds as met with in the shops resemble a nutmeg in size and shape; externally they are somewhat rough, brown, and marked with longitudinal striæ; internally horny, hard and brittle when dry, but easily softened by immersion in water; the bulk of the seed consists of starch. Taste sweet at first, afterwards bitter and nauseous.

Chemical composition.—The active principle of these seeds appears to reside in a body allied to saponin. The aqueous solution forms a stable froth when shaken, and tastes at first sweet and afterwards bitter and acrid. This solution precipitated with barium hydrate, the precipitate collected, dissolved in hydrochloric acid, the barium removed as sulphate, and the clear liquor boiled, threw out an insoluble substance related to sapogenin, and the filtrate gave the reactions for glucose. The aqueous extract gave an immediate precipitate of a proteid nature with acids, which, dissolving to some extent when heated and separating again in the cold, resembled albumose; after removal of this proteid, the acid liquor was boiled, and the formation of a flocculent deposit and an increase in the amount of glucose were noticed, which confirmed the presence of a glucosidal body such as saponin. Rectified spirit dissolved 24 per cent. of extract containing gallic acid, sugar and some saponin; and the subsequent treatment with water removed more saponin together with gum and proteids. The remaining principles that could be identified were a fat, caoutchouc, a very large quantity of starch and cellulose, the ash consisting of alkaline and deliquescent salts.

CAREYA ARBOREA, *Roxb.*

Fig.—*Roxb. Cor. Pl. iii.*, 14, *t.* 218; *Wight Ill.*, 99, 100; *Bedd. Fl. Sylv.*, *t.* 205. Pera brava (*Port.*), Wild Guava (*Eng.*).

Hab.—Throughout India.

Vernacular.—Kumbhi (*Hind., Beng.*), Kumbha (*Mar., Guz.*), Putai-tanni-maram, Arjama (*Tam.*), Kumbhia, Gonju (*Can.*), Kumbhi, Dudippi, Gavuldu (*Tel.*), Peru (*Mal.*). The dried calices, Vákumbha (*Guz.*), Bakumbha (*Beng.*).

History, Uses, &c.—*C. arborea* is a large deciduous tree, the leaves of which turn red in the cold season. It is the Kumbhi of Sanskrit writers, and appears to have been so named on account of the hollow on the top of the fruit giving it somewhat the appearance of a water-pot. The bark of the tree and the calices of the flowers are well known Indian remedies, and are valued on account of their astringent and mucilaginous properties, being administered internally in coughs and colds and applied externally as an embrocation. Rheede (*Hort. Mal. iii.*, 36,) states that wild pigs are very fond of the bark, and that it is used by hunters to attract them. An astringent gum exudes from the fruit and stem, and the bark is made into coarse cordage. (*Bourdillon.*) The Tamil name Puta-tanni-maram signifies "water-bark-tree," in allusion to the exudation trickling down the bark in dry weather.

Description.—Calyx ¾ to 1 inch, terete, campanulate, obscurely pubescent, lobes ovate, obtuse, ovules in two rows in each cell of the ovary. Fruit 2½ by 2 inches, globose, surmounted by an enlarged mouth having a depressed pit at the vertex within the calyx teeth. Bark thick, fibrous, externally ash-coloured, internally reddish when dry, the whole plant abounds with thick mucilage.

Chemical composition.—The thick red bark from old trees contained 8·7 per cent. of tannin, giving a blue-black colour with

iron salts and containing 29 per cent of Pb O in its lead salt. The tannin was in a free state. The bark left 10·6 per cent. of carbonated ash from the reduced calcium oxalate which occurred in large simple crystals in the liber.

CARYOPHYLLUS AROMATICUS, *Linn.*

Fig.—*Bentl. and Trim.*, t. 112. Clove tree (*Eng.*), Giroflier aromatique (*Fr.*).

Hab.—Moluccas, cultivated elsewhere. The flower buds and fruit.

Vernacular.—Laung (*Hind.*), Lavanga (*Mar., Can.*), Long (*Beng.*), Lavang (*Guz.*), Lavangálu, Lavanga-pu (*Tel.*), Kirámbu, Ilavangap-pu, Karuvap-pu (*Tam.*). The fruit, Narlaung (*Ind. Bazar*).

History, Uses, &c.—The clove tree is said to be indigenous only in the five small islands, which constitute the Moluccas proper, *viz.*, Tarnati, Tidori, Mortir, Makiyan and Bachian. It was afterwards introduced into other neighbouring islands, where it is now cultivated, and at a later period into Zanzibar and Pemba on the East coast of Africa. Cloves appear to have been known in China as early as B.C 266. At that time it was customary for the officers of the court to hold the spice in the mouth before addressing the sovereign in order that their breath might have an agreeable odour. (*Pharmacographia.*) It is difficult to say when they were first introduced into India, but they are mentioned by Charaka, who is considered to be the oldest Sanskrit medical writer, under the name of *Lavanga*, a name which, with various modifications, is applied to cloves all over India. They are regarded by Sanskrit writers as light, cooling, stomachic, digestive and useful in thirst, vomiting, flatulence, colic, &c., and are prescribed with other spices and with rock salt. (*Dutt's Hindu Materia Medica.*) A paste of cloves is applied to the forehead and nose

as a remedy for colds. A clove roasted in the flame of a lamp and held in the mouth is a popular remedy for sore throat. The early Arabian writers call them Karanfal, a name evidently derived from the Indian languages of the Malabar Coast, Ceylon, and the Straits*; this name appears to us to have been the source from whence the Greeks have derived the name καρυοφυλλον which we meet with in Galen and Pliny; the latter writer speaks of Caryophyllon as resembling pepper but longer and more brittle and imported for the sake of its odour. We do not think it possible that a spice in such common use in the East can have escaped their notice. Paulus describes cloves as the flowers of a tree, and καρφιοειδη (like a nail). Myrepsicus in a prescription calls mother cloves γαρεόφαλον το μέγα το λεγόμενον παρ' Ιταλοις ἀνθοφυλον. In the debased Greek of the later Greek physicians, the name takes various forms more nearly corresponding to the Arabic. Later Arabian and Persian authors of treatises on Materia Medica describe cloves as the fruit of a tree growing in Java or Batavia, a territory belonging to the Dutch Christians. In the *Makhzan-el-Adwiya*, a work written about one hundred years ago, it is distinctly stated that they are only produced in the Dutch possessions, and that they are of two kinds, male and female. The fruit of the clove is called Narlaung (male clove) in India, a strange mistake but a common one among Asiatics, who argue that the seed-bearing organ or plant must be the male. Mahometan writers describe cloves as hot and dry, and consider them to be alexipharmic and cephalic, whether taken internally or applied externally; they also recommend them for strengthening the gums and perfuming the breath, and on account of their pectoral, cardiacal, tonic, and digestive qualities. They have a curious superstition to the effect that one male clove eaten daily will prevent conception. On the other hand, they tell us that the saliva after cloves have been chewed, if applied to the orifice of the male urethra before connection, increases the sexual orgasm in both parties. In modern medicine cloves are used as a

* Kirámbu, *Tamil*; Karámpu, *Malay*; Karámbu, *Cingalese*.

carminative and stimulant; to relieve irritation of the throat accompanied by racking cough, and to deaden the pain of toothache.

Description.—The flowers of the Clove grow in cymes, when fit for gathering the calyx tube is of a bright red colour, and the tree presents a very beautiful appearance. The collection as witnessed by one of us at Zanzibar is by hand, each clove being picked singly. They are afterwards dried upon mats in the sun, which takes about three days. The dried clove is about two-thirds of an inch long, and consists of the calyx-tube, which divides above into four pointed spreading sepals, surmounted by a globular bud, consisting of 4 petals and enclosing a number of stamens. All parts of the clove abound in oil cells. If of good quality it should be plump, of a rich brown colour, and the oil should exude upon pressure being made with the finger nail; the taste should be aromatic and very pungent.

Mother cloves, called in India *Narlaung* (male cloves), are ovate-oblong berries about an inch long, and contain two dark-brown oblong cotyledons which abound in starch; they have the odour of cloves, but contain much less essential oil.

Clove stalks, in Guzerathi *Vikunia*, are only brought to India for re-export to Europe.

The *oil of cloves* of the Indian bazars is made by steeping cloves in sweet oil. No essential oil is manufactured in the country.

Chemical composition.—Oleum Caryophylli, which is the most important constituent of cloves, is obtainable to the extent of 16 to 20 per cent. But to extract the whole, the distillation must be long continued, the water being returned to the same material.

The oil is a colourless or yellowish liquid with a powerful odour and taste of cloves; sp. gr. 1·046 to 1·058. It is a mixture of a terpene and an oxygenated oil called *Eugenol*, in variable

proportions. According to Schimmel & Co., the genuine oil of cloves has a specific gravity of 1·067, and the oil of clove stalks a specific gravity of 1·060 to 1·063. The former, which is termed *light oil of cloves*, and comes over in the first period of the distillation, has the composition $C^{15}H^{24}$, a specific gravity of 0·918, and boils at 254° C. Vapour density 7·7. It deviates the plane of polarization slightly to the left, and is not coloured on the addition of ferric chloride; it is converted by Br into $C^{15}H^{22}$ (250°—260°). (*Beckett and Wright Journ. Chem. Soc.* 29, 1.) Eugenol has a specific gravity of about 1·080 at 0° C., and possesses the taste and odour of cloves. Its boiling point is 252° (*Church*), vapour density 6·4. Eugenol, $C^{10}H^{12}O^2$, is devoid of rotatory power, it belongs to the phenol class, and has been met with in the oils of pimento, bay, canella, cinnamon, &c. According to G. Laube and H. Aldendorff, the percentage composition of cloves is water 16·39, nitrogenous matter 5·99, volatile oil 16·98, fat 6·20, sugar 1·32, nitrogen free extractive 37·72, cellulose 10·56, ash 4·84. The dried spice yielded nitrogen 1·15, volatile oil and fat 27·72. A principle called *caryophyllin*, which occurs in silky needles in stellate groups, has been isolated from cloves; by the action of nitric acid it is converted into caryophyllic acid. (*Watts, Dict. Chem., 2nd Ed.*)

Commerce.—The imports of cloves into India in 1884-85 were 4,791,006 lbs., valued at Rs. 11,09,841, all from the east coast of Africa and Zanzibar. Of this quantity 4,598,419 lbs. came to Bombay. During the same year Bombay re-exported 1,618,465 lbs., of which 1,112,224 lbs. went to the United Kingdom, and 473,799 lbs. to China and the Straits.

MELALEUCA LEUCADENDRON, *Linn.*

Fig.—*Bentl. and Trim., t.* 108.

Hab.—Indian Archipelago, Malay Peninsula. The essential oil.

Vernacular.—Kayaputi-ka-tel (*Hind.*), Kaiyappudai-tailam (*Tam.*), Kayaputi-tail (*Beng.*), Kayputi-nu-tel (*Guz.*), Kayaputi-che-tel (*Mar.*).

History, Uses, &c.—This oil appears to have been first prepared as an article of commerce by the Dutch about 1727. Rumphius, who passed nearly fifty years in the Dutch East Indies, and died at Amboyna in 1702, was the first to bring to notice that the Malays and Javanese made use of the leaves on account of their aromatic properties; this led to their distillation, and Rumphius relates how the oil was obtained in very small quantities, and was regarded as a powerful sudorific. It was probably unknown in India before the commencement of the present century, about the time when it first became an article of commerce in England. The island of Bouro in the Molucca Sea is stated by Bickmore, an American traveller, who passed some time there, to produce about 8,000 bottles annually; but from the trade returns of the Straits Settlements it appears that the largest quantity is shipped from Celebes. (*Pharmacographia.*) The oil is much used in India as an external application for rheumatism, and has also been given internally in chronic cases with advantage. It is a powerful stimulant and antispasmodic in choleraic diarrhœa, and on account of its stimulant and rubefacient action it is a useful local application in the chronic forms of pityriasis, psoriasis, eczema and acne so common in India.

Description.—Cajuput oil varies in colour from yellowish green to bluish green; it is a transparent mobile fluid, with an agreeable camphoraceous odour, and bitter aromatic taste, sp. gr. 0·926, it remains liquid at 13° C., and deviates the ray of polarized light to the left.

Chemical composition.—The researches of Schmidt and other chemists have shown that cajuput oil consists chiefly of hydrate of cajuputal or cineol, $C^{10}H^{18}O$, which may be obtained from the crude oil by fractional distillation at 174° C. If it is repeatedly distilled from P^2O^5 it is converted into terpenes. Cineol, a liquid smelling like camphor, is the chief constituent of Ol. Cinæ and Ol. Cajuputi; it occurs also in oil of Rosemary. (*Weber.*) For its reactions and chemical composition the reader is referred to Watt's Dict. of Chem. by Morley and

Muir (ii. 187). R. Voiry (*Chem. News*, June 15th 1888, p. 241,) states that on fractional distillation cajuput oil yields a terpilenol, which has no action on polarized light. He further obtained acetic, butyric and valerianic ethers mixed with a carbide boiling at 160° in a vacuum.

The green tint of the oil is due to copper, a minute proportion of which metal is usually present in all that is imported. It may be made evident by agitating the oil with very dilute hydrochloric acid. To the acid, after it has been put into a platinum capsule, a little zinc should be added, when the copper will be immediately deposited on the platinum. The liquid may be then poured off, and the copper dissolved and tested. When the oil is rectified, it is obtained colourless, but it readily becomes green if in contact for a short time with metallic copper.

Commerce.—The oil is imported into India from Singapore in large quantities packed in common black quart bottles. From the official trade reports of the latter port it appears that India is the chief market for this article. Average value, Re. 1½ per bottle.

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EUGENIA JAMBOLANA, *Lam.*

Fig.—*Wight Ic., t.* 535 ; *Bedd. Fl. Sylv. i., t.* 197.

Hab.—India. The fruit, leaves, seeds and bark.

Vernacular.—Jámun (*Hind.*), Kálájám (*Beng.*), Jámbú (*Mar.*), Navel (*Tam.*), Jambúdo (*Guz.*), Neredi (*Tel.*), Nevale (*Can.*).

History, Uses, &c.—This tree, which yields an abundant crop of subacid edible fruit, during the hot weather, is common all over the country. In some places the fruit attains the size of a pigeon's egg, and is of superior quality. In Guzerat this large kind is called *Páras-jambudo*. The Jambu has numerous synonyms in Sanskrit, it is called *Meghavarna* (cloud-coloured), *Meghabha* (cloud-like), *Nilaphala* (black-fruited), *Raja-*

phala (king's-fruit), &c. According to the Dirghama-Sutra it is one of the four colossal mythic trees which mark the four cardinal points, standing to the south of Mount Méru; four great rivers rise at its foot. The Vishnupurana states that the continent of Jambudvipa takes its name from this tree. Ibn Batuta, who visited India in 1332, mentions جامن (*Jamún*) as one of the fruits of Delhi. A vinegar prepared from the juice of the ripe fruit is an agreeable stomachic and carminative; it is also used as a diuretic. A sort of spirituous liquor, called Jámbáva, is described in recent Sanskrit works as prepared by distillation from the juice. The bark is astringent, and is used, alone or in combination with other medicines of its class, in the preparation of astringent decoctions, gargles and washes. The fresh juice of the bark is given with goat's milk in the diarrhœa of children. (*Chakradatta.*) The expressed juice of the leaves s used alone or in combination with other astringents in dysentery, as for example in the following prescription:—Take of the fresh juice of the leaves of *E. Jambolana* and the Mango about a drachm each, Emblic myrobalans a drachm, and administer with goat's milk and honey. (*Bhavaprakasa.*)

The author of the Makhzan notices the Jamún at considerable length; after describing the tree, he says that the fruit is a useful astringent in bilious diarrhœa, and makes a good gargle for sore throat or lotion for ringworm of the head. The root and seeds, he observes, are useful astringents, also the leaves. He tells us that a kind of wine is made from the fruit, and that the juice of the leaves dissolves iron filings, or, as he expresses it, reduces them to so light a condition that they float upon the surface of the liquid as a scum. This when collected and washed he recommends as a tonic and astringent. A wine and syrup of the fruit has been shown to us by Mr. M. C. Pereira of Bombay; they much resemble in flavour similar preparations made with red currants, and appear to have stomachic and astringent properties. Some years ago at Monghyr, in Bengal, excellent brandy was prepared from the fermented fruit. Of late years the seeds of this tree have been recommended as a remedy in diabetes.

Dr. C. Graeser, of Bonn, has published in the *Centralblatt für Klinische Medicin* a highly-interesting account of a series of experiments with the extract of the fruit of *Syzygium Jambolanum* on dogs, which had previously been made diabetic by the administration of phloridzin.

Dr. Graeser thought that the best way of studying the physiological and therapeutic action of the new drug was to administer it to dogs which had artificially been made diabetic by a method introduced by V. Mehring, who found that artificial diabetes can at any moment be produced in dogs by the administration of phloridzin.

A young dog of 2,700 to 4,800 grammes body weight, to which 2·5 to 4·8 grammes of phloridzin (1 gramme to 1 kilo body weight) have been given, in the course of a day will show an excretion of sugar, lasting for twenty-four to thirty hours, and amounting to 5·89 to 12·45 grammes. Graeser first gave the daily dose of phloridzin, but later on he split the quantity into doses of 1 gramme, given every two to three hours. In both cases the excretion of sugar was the same. Diarrhœa was caused by phloridzin in three cases. After Graeser had experimented for some time with phloridzin alone he began to administer simultaneously phloridzin and extract of *Syzygium Jambolanum*. The latter was given before, along with, or after phloridzin, and invariably had the effect of reducing the expected excretion of sugar most considerably. This reduction amounted to at least half, in some cases even to nine-tenths, of the quantity of sugar which would have resulted had phloridzin alone been given. At the same time the duration of the diabetes was shortened. Dogs, which under phloridzin alone had excreted 5·89 to 12·45 grammes of sugar, showed under the jambul treatment a maximum excretion of 2·906 grammes of sugar, and a minimum excretion of 1·5 gramme.

As jambul showed such a powerful effect on the artificially-produced diabetes, it may be anticipated that when given at the proper time and in a large dose it will entirely prevent the excretion of sugar.

It is not yet known how jambul given in large doses acts on the pathological diabetes mellitus of man. But it is well worth trying. The experiments on man are all the more justified as no ill effect has ever yet been produced by the new drug. A favourable effect of such experiments would prove that phloridzin diabetes and pathological diabetes are of a similar nature.

In all the animals on which Graeser experimented no signs of any secondary effects of jambul extract were observed, not even after doses of 18 grammes. In one case diarrhœa set in, which, as further experiments proved, was caused by phloridzin and not by jambul.

All his experiments were made with extract of jambul prepared by Mr. R. H. Davies, F.I.C., chemist to the Society of Apothecaries, London, from seeds which the author had himself brought over to Europe. As the fruit contains great quantities of starch, it was thought advisable to eliminate this as much as possible in preparing the extract. Several extracts were prepared out of the whole fruit, or solely out of the kernel or solely out of the pericarp; 100 grammes of the fruit gave 16¼ grammes kernel-extract, and 11⅝ grammes pericarp extract. The most given in one single dose was 6 grammes, the maximum daily dose 18 grammes.

Whether the active principle is contained in the pericarp or kernel cannot as yet be decided to a certainty. Probably it is contained in both, but to a greater extent in the pericarp.

From the long series of experiments which he has made, Graeser draws the following conclusions:—

1. Phloridzin diabetes is considerably lessened by jambul extract.

2. Jambul extract is non-poisonous, and does not cause any ill effect.

3. The active principle contained in jambul is not yet known. It will have to be determined by careful analysis and further experiments. (*Chem. and Druggist* 1889.)

With reference to Graeser's experiments, G. I. Iaveine (*Vratch.*, 1889, p. 1029,) records having obtained negative re-

sults with the seeds in three cases of diabetes in which the urine contained from 6 to 7 per cent. of sugar. In these cases the powdered seeds were given in doses of one gram 4 to 6 times a day.

Description.—The fruit unless improved by cultivation is about the size and shape of a small olive, of a purple colour, and very astringent; within it is a thin white papery shell, which encloses a large green kernel, also very astringent. The bark is grey and fissured externally; internally it is red and fibrous; its minute structure is remarkable in having several rows of very large, pitted, oblong-oval cells, which can be easily seen with the naked eye. The odour is like that of oak-bark, and the taste very astringent. The leaves are 3 to 6 inches long, ovate or oblong, obtuse, more or less acuminate, coriaceous, smooth, shining, closely nerved, the numerous nerves uniting within the margin. When crushed they have an agreeable terebinthinate odour, and on distillation yield a bright green oil.

Chemical composition.—The proximate composition of dry Jambul seeds according to Elborne is—

Essential oil	a trace
Chlorophyll and fat	0·37
Resin soluble in alcohol and ether	0·30
Gallic acid	1·65
Albumin	1·25
Coloured extractive soluble in water	2·70
Moisture	10·00
Insoluble residue	83·73
	100·00

Jambulin, a glucoside, is stated to have been found in the seeds; it is said to have the power of preventing the diastatic conversion of starch, &c., into sugar. The bark of the tree contains 12 per cent. of tannin and affords a Kino-like gum.

Commerce.—The fruit and seeds are sold in the Indian markets.

PSIDIUM GUYAVA, *Linn.*

Fig.—*Rheede Hort. Mal.* iii., *t.* 34, 35; *Rumph. Amb. i., t.* 47. Guava tree (*Eng.*), Goyavier (*Fr.*).

Hab.—America, naturalized in India. The bark and leaves.

Vernacular.—Lál-safri-ám, Sufed-safri-ám (*Hind.*), Lál-jám, Sufed-jám (*Duk.*), Támbara peru, Pándhara peru (*Mar.*), Shivappu-goyyá-pazham, Vellai-goyyá-pazham (*Tam.*), Tella-jám-pandu, Erra-jám-pandu (*Tel.*), Bili-shibe-hannu, Kempu-shibé-hannu (*Can.*), Dhop-goachhi-phal, Lal-goachhi-phal (*Beng.*).

History, Uses, &c.—The red and white guavas appear to be only varieties of one and the same species. They have been introduced into India from America, probably by the Portuguese, and are now universally cultivated, and in some parts of the country have run wild. The fruit is a favourite with the natives, who like its strong aromatic flavour. It is astringent and has a tendency to cause costiveness. Europeans generally prefer it cooked, or in the form of jelly. In Goa the Portuguese make a kind of cheese of it. The bark, which is also astringent, is recommended in the *Pharmacopœia of India* as a remedy for the chronic diarrhœa of children. Dr. Waitz (*Diseases of Children in Hot Climates*, p. 225,) directs half an ounce of the root bark with six ounces of water to be boiled down to 3 ounces; of this decoction, the dose is one or more teaspoonfuls three or four times a day. He also recommends the same preparation as an external astringent in the prolapsus ani of children (p. 233). The leaves have also been used successfully as an astringent in diarrhœa.

Discourtilz places this plant among the aromatic antispasmodics; a decoction of the young leaves and shoots is prescribed in the West Indies in febrifuge and antispasmodic baths, an infusion of the leaves in cerebral affections, nephritis and cachexia; the pounded leaves are locally applied in rheumatism; an extract is used in epilepsy and chorea; the tincture is rubbed into the spine of children suffering from convulsions. The fruit and its

conserve are astringent and suitable to those suffering from diarrhœa and dysentery. (*Corre et Lejanne, Résumé de la Mat. Med. Coloniale*, p. 108.)

Description.—The external surface of the bark when fresh is smooth and brown, marked by superficial scars indicating the separation of squamous plates of dead bark. These plates sometimes remain partially attached. Beneath the brown epidermis the fresh bark is green; its inner surface is marked by longitudinal striæ, and is of a light brown colour. The taste is astringent and agreeably acid. The leaves are aromatic, egg-shaped or oblong, short stalked, covered with soft down underneath, and with the principal veins very prominent.

Microscopic structure.—Sections show that the bark consists of an epidermis, made up of two rows of brick-shaped brown cells, and alternate zones of vascular and parenchymatous tissue, varied towards the inner part by three broken circles of liber cells. The medullary rays are numerous, and together with the parenchyma of the outer part of the bark, loaded with green colouring matter; in the rays this extends some distance into its substance, and makes them very conspicuous. The vascular system is loaded with crystals, and contains a few starch granules.

Chemical composition.—The watery extract of the bark contains, as the mean of two determinations, 27·4 per cent. of tannin. Spirit dissolves the same amount of extract from it as water, about 33 per cent. The tannin gives a blue-black colour with ferric salts, a pinkish precipitate with gelatine, and a dirty green with acetate of lead; the lead compound when perfectly dry yields 29 per cent. of oxide.

After exhausting the bark by means of water and alcohol, another colouring matter is removed by soda, probably oxidized tannin. Ether extracts chlorophyll, and a little resin soluble with a bright red colour in alkaline liquids. No alkaloids or ammonia are present. The mineral matter obtained by incineration is 10 per cent., and consists of calcium carbonate

afforded by the calcium oxalate which is present in the bark in the form of simple crystals. The tannage or inspissated watery extract of guava bark is reddish brown and brittle, very soluble in water, and containing as it does tannin in a free state, should be a useful astringent.

MYRTUS COMMUNIS, *Linn.*

Fig.—*Duhamel ed. nov. t.* 43. Myrtle (*Eng.*), Myrte (*Fr.*)

Hab.—Europe. Cultivated in India. The leaves, fruit and bark.

Vernacular.—Aas (*Arab.*), Vilayati-mehndi (*Hind.*). The berries, Hab-el-aas (*Arab., Ind. bazars*).

History, Uses, &c.—Amongst the ancients the Myrtle (μυρσίνη) was a phallic emblem sacred to Venus, at the festival of Myrrha, the incestuous mother of Adonis, married women wore wreaths of the leaves; and in Virgil's infernal regions the victims of love concealed themselves among the myrtles. At Rome this plant was not allowed to be placed upon the altar of *Bona Dea*, but at the festivals of Eleusis every one was crowned with it; it was supposed not only to inspire love, but to maintain it. According to a Greek myth, the nymph Myrsine, having outstripped Athene in a race, was turned into a myrtle bush by the goddess, who, however, repenting of her cruelty afterwards, became particularly attached to the plant. The Romans, after they had intended fighting for the Sabine women whom they had carried off, purified themselves with sprigs of myrtle, *ideo tunc lecta* (says Pliny) *quoneam conjuctioni et huic arbori præest Venus*. Pliny also tells us that Romulus planted two myrtles at Rome, one of which afterwards became the favourite of the patricians, and the other of the people; when the former had the upper hand the plebeian myrtle withered, but when the power of the latter was in the ascendant the patrician myrtle faded. Before pepper was known myrtle berries were employed as a spice to season food, and wine was flavoured with them. (*Hist. Nat.* 15, 35.) For many other

superstitions concerning the myrtle extending down to modern times, see De Gubernatis (*Myth. des Plantes, II.*, 233).

The myrtle occupies a prominent place in the writings of Hippocrates, Pliny, Dioscorides, Galen, and the Arabian writers. Pliny furnishes an account of it, of which the following is a summary: The berries arrest hæmoptöe; they are used in dysentery and as an application to indolent ulcers and inflamed eyes; and in wine are an antidote to the poison of mushrooms; they also cure the bites of scorpions, inflammation of the bladder, headaches, abscesses, aphthæ, leucorrhœa, and other mucous discharges. The juice is diuretic, but constipates. An ointment made with it cures eruptions of the skin and darkens the hair. The dried leaves in powder arrest sweats; in fomentations check the white flux, correct prolapsus of the womb and rectum, and are employed to cure ulcers, burns, erysipelas, otorrhœa, alopecia, and eruptions of the skin, to arrest hæmorrhage, and as an application to lentigo, pterygion, panaris, condylomata, and swelled testicles. A wine made from the berries was used for most of these purposes, and was regarded as tonic. This catalogue of virtues is repeated, but hardly enlarged, by subsequent ancient writers, who, however, following Galen, ascribe to myrtle the opposite qualities of cold and hot, or astringent and stimulant, the former residing chiefly in the leaves, the latter in the berries.

In 1876 attention was directed to the medicinal properties of the plant by Delioux de Savignac, who recommended an infusion or diluted tincture of the leaves as an astringent lotion, and the finely powdered leaves as an application to ulcers, &c. He also used the powder in doses of 1 to 4 grams internally in chronic catarrh of the bladder and in menorrhagia; and the infusion in chronic bronchitis. The *Oxymyrsine* or "wild myrtle," mentioned by the ancients, the *Aas-el-bari* of Mahometan writers, is not a myrtle, but the *Ruscus aculeatus* or "butcher's broom."

Of late years the volatile oil of myrtle leaves has been brought to notice as an antiseptic and rubefacient when used externally; given internally, in small doses (0·06 to 0·09 gram), it

promotes digestion like myrtle berries, but in large doses it acts as an irritant. It is excreted by the kidneys and through the respiratory tracts, and communicates a peculiar odour to the urine. According to Lauder Brunton the urine of persons taking it gives a precipitate with nitric acid; he considers that like copaiba it may be used as an expectorant in chronic bronchitis with profuse expectoration and in chronic inflammation of the bladder or urethra. It is best administered in gelatine capsules containing 4 to 5 drops of the oil. The fragrant water distilled from the flowers and leaves is known in France as *Eau d' ange*. According to Brannt, the manufacturers of volatile oils in Southern France place a myrtle water upon the market which is actually prepared from the oil.

Chemical composition.—Riegel (1849) obtained from the ripe berries a volatile oil, resin, tannin, citric acid, malic acid, sugar, etc. Rayband (1834) found the volatile oil, as distilled from the leaves, flowers, and fruit, to have a yellowish or greenish-yellow colour, and to be lighter than water. Gladstone (1863) ascertained it to have a specific gravity of ·891, to be dextrogyre, and to consist mostly of a hydrocarbon, $C^{10}H^{16}$, boiling between 160° and 170° C. E Jahns (1889) examined a sample of Spanish origin, having a sp. gr. of ·910 at 16°, and a rotatory power of $[a] = +26·7°$. On fractional distillation the terpene, $C^{10}H^{16}$, came over at 158°–160°; rotatory power $[a]_D = +36·8°$, and corresponded in its chemical properties with dextropinene. Cineol, boiling at 170°, a second constituent, was obtained by Wallach's process. A little camphor was also present but could not be isolated. (*Journ. Chem. Soc.*, June, 1889.) The bitter principle has not been investigated; it is probably a glucoside.

Commerce.—Dried myrtle berries are obtainable in most of the Indian bazars.

MELASTOMACEÆ.

MEMECYLON EDULE, *Roxb.*

Fig.—*Roxb. Cor. Pl. I., t.* 82; *Wight Ic., t.* 278. Iron-wood tree (*Eng.*), Mémecylon comestible (*Fr.*).

Hab.—Eastern and Western Peninsulas, Ceylon.

Vernacular.—Anjana, Yálki, Kurpa, Lokhandi (*Mar.*), Kashamaraia (*Tam.*), Alli-cheddu (*Tel.*), Surpa (*Can.*), Warikaha, Seroo-kaya (*Cingh.*).

History, Uses, &c.—*M. edule*, also called *M. tinctorium* from its use in dyeing, is a shrub or small tree growing on hilly ground. In Sanskrit it is called Anjani, a name derived from *anjana*, a pigment or collyrium. The leaves are used in India and Ceylon as a dye, and afford an evanescent yellow lake when used alone. They are chiefly valued on account of their action as a mordant, and are used with myrobalans and Sappan wood or Chayroot (*Oldenlandia umbellata*) in preference to alum in producing a deep red colour much used by matmakers in Madras. Medicinally, an infusion of the leaves is used as an astringent collyrium in conjunctivitis, and a decoction of the root in menorrhagia. The pounded bark with aromatics, such as ajwan, pepper, and zedoary is tied up in a cloth for fomentation or applied as a plaster (*lep*) to bruises. Dr. Peters has brought to our notice the use of the leaves in the Deccan as a remedy for gonorrhœa of considerable repute. Sprengel, apparently misled by the Cinghalese name Warikaha, supposed the leaves to be source of the Wars dye of the Arabians.

Description.—The *Flora of British India* notices twelve varieties of this extremely variable plant, which is generally a large bush, remarkable for its bright green foliage, and clusters of purplish-blue flowers on the bare branches, which are succeeded by globose deep purple berries about ¼ inch in diameter, and crowned with the 4-toothed limb of the calyx. The berries are edible but astringent. The leaves are from 1½ to 3½ inches in length, and 1 to 1¾ inch broad, entire, firm, and leathery, with short petioles, and very indistinct lateral venation, they turn yellowish-green when dry; the taste is acid, bitter and astringent.

Chemical composition.—Prof. Dragendorff (*Pharm. Zeitchr. für Russland*, xxi., 232,) proved the absence of an alkaloid,

and the presence of a yellow glucoside in the leaves. The latter he considered not to bear any resemblance to chrysophanic acid.

A proximate analysis of the leaves, which we have made, indicated the following constituents :—

Moisture	6·90
Chlorophyll and resins	5·59
Resins, malic acid and glucose; spirit extract	16·00
Colouring matter, gum, malates and glucose; water extract	17·94
Dissolved by soda solution	4·42
Starch and pararabin removed by boiling dilute HCl	23·32
Crude fibre and silica	25·83
	100·00

The total malic acid amounted to 6·48 per cent., glucose 6·25, and the total inorganic matter 11·80 per cent. The alcoholic extract was brown in colour, sweet and styptic to the taste, and nearly all soluble in water; the solution readily reduced Fehling's solution, and gave a crystalline precipitate with lead acetate. The aqueous solution was yellow-coloured; it afforded a precipitate of mucilage and salts with two volumes of alcohol, and gave a crystalline precipitate with lead acetate. A decoction of the leaves afforded a green colour with iodine solution through the blending of the natural colour with the starch iodide. The colouring matter is freely soluble in water, sparingly in spirit, and insoluble in ether. The aqueous solution is turned greenish-brown by ferric chloride and is not affected by gelatine, the colour is not precipitated by neutral plumbic acetate or by acids; it is intensified by the fixed and volatile alkalies. The glucosidal decomposition is preferably effected by boiling with dilute hydrochloric acid, which results in the deposition of a red powder attended with the formation of a volatile substance having the odour of saffron. The red decomposition product is very sparingly soluble in water, insoluble in ether, and very soluble in rectified spirit and dilute alkaline liquors; a spirit solution is precipitated by ether. It

affords an intense yellow colour with diluted alkali, and orange brown when concentrated, and is precipitated in brown flocks by acids. Sulphuric acid forms with it a yellowish-brown solution, from which it separates on standing in a pulverulent condition; nitric acid dissolves it with the formation of a fine red hue. The decomposition product is resinoid and amorphous, and is neutral in reaction.

LYTHRACEÆ.

AMMANNIA BACCIFERA, *Linn.*

Fig.—*Lam. Ill., t. 77, f. 5.*

Hab.—Tropical India. The herb.

Vernacular.—Dád-mári (*Hind.*), Guren, Bhár-jambúl (*Mar.*), Kallurivi, Nirumel-neruppu (*Tam.*), Agni-venda-páku (*Tel.*), Kallur-vanchi (*Mal.*)

History, Uses, &c.—Ammannia is supposed by some to be the Agni-garbha, "or plant pregnant with fire" of Sanskrit writers, but this is very doubtful, as the same name is applied to the Arani or soft wood used in the production of the sacrificial fire. The properties of this plant and its use by the natives as a blistering agent appear to have been first brought to the notice of Europeans by Roxburgh. Ainslie quotes him, and remarks that the plant has a strong muriatic smell, but not disagreeable; the leaves are extremely acrid, and are used by the natives to raise blisters in rheumatism, fevers, &c., the fresh leaves bruised and applied to the part intended to be blistered, perform their office in half an hour, and most effectually. In Pudukota, under the name of *Sigappup-pugai*, the plant is used to prepare a liniment which is applied to the temples as a remedy for burning pain in the eyes. The author of the *Bengal Dispensatory* states that he made a trial of the leaves in eight instances; "blisters were not produced in less than twelve hours in any, and in three individuals not for 24 hours. The bruised leaves had been

removed from all after half an hour. The pain occasioned was absolutely agonizing until the blister rose; they caused more pain than cantharides, and were far inferior to the *Plumbago rosea* in celerity and certainty of action." According to Fleming, the leaves are applied to cure herpetic eruptions. The authors of the *Pharmacopœia of India* merely notice the unfavourable opinion of the drug expressed in the *Bengal Dispensatory*. We have made some experiments with an ethereal tincture of the leaves, which lead us to form a much more favourable opinion of them; in several instances it blistered rapidly, effectually, and without causing more pain than the liquor epispasticus of the *Pharmacopœia*, which it resembles in colour. Upon evaporation of the ether a dark green resinous extract is left. A spirituous tincture was also tried, but it was not nearly so efficient. Dr. Bholanath Bhose describes a mode of treatment of obstinate spleen disease by the juice of the leaves administered internally, but its administration in this manner has been objected to as causing pain and yielding uncertain results. In the Concan the juice is given with water to animals when in heat to extinguish sexual appetite; the plant fresh or dried is administered in decoction with ginger and Cyperus root for intermittent fevers, and its ashes are mixed with oil and applied to herpetic eruptions. Ammannia is common in low moist ground in India, and flowers in November and December.

Description.—An herbaceous, erect, much-branched plant, having foliage something like that of rosemary; stems 4-sided; leaves sessile, opposite, lanceolate, attenuated, about an inch long and ⅛ inch broad, much smaller on the upper parts of the plant; calyx 4-cleft to the middle; lobes acute; accessory teeth very small; flowers very minute, aggregated in the axils of the leaves, almost sessile; tube of the calyx at first narrow and tightened round the ovary, in fruit cup-shaped; petals wanting; capsule longer than the calyx, 1-celled; flowers red. The whole plant has an aromatic and rather agreeable odour.

Chemical composition.—An alcoholic extract prepared with 80 per cent. alcohol was made from the air-dried and powdered

plant: the greater part of the alcohol distilled off, and the remainder allowed to evaporate by exposure to air. When free from alcohol the extract was boiled with water, and the liquid separated from insoluble matter while hot. The filtrate was at first of a dark reddish brown colour, but became turbid on cooling, a dark resin separating on the sides of the capsule: no crystalline matter separated. After standing for some days the fluid was separated from suspended matter, and agitated with ether. The ether extract was of a yellow colour, indistinctly crystalline, possessed a very aromatic odour, and had a strongly acid reaction. An aqueous solution gave a deep brownish, almost black precipitate with ferric salts: with ammonia a deep caramel yellow colour, which darkened somewhat on exposure. With alkaloidal reagents negative results were obtained; after boiling with dilute sulphuric acid, the solution slightly reduced Fehling's solution, indicating the probable presence of a glucoside. Some of the aqueous solution rubbed on the skin of the arm produced no vesication. The dark resin which separated on the sides of the capsule on boiling the alcoholic extract with water, dried to a brittle black mass, but with a purple tinge, in thin layers. This substance was easily soluble in alkalies, and was reprecipitated by acids in cinnamon coloured flocks. With cold nitric acid it dissolved at once, forming a deep reddish liquid, which after standing for a short time evolved nitrous fumes. In acetic acid it was also soluble, but less readily than in nitric acid. In ether it was insoluble. An alcoholic solution gave with ferric chloride a black precipitate, which was changed to dark brown on the addition of acids. Applied to the skin in alcoholic solution negative results were obtained. That portion of the alcoholic extract originally insoluble in water consisted of resinous matter. Some of the powdered plant was distilled with water, the distillate had a slight odour, but yielded practically no extractive when agitated with ether. In one experiment the distillate afforded a very faint red coloration with ammonia, but on repeating the experiment negative results were obtained. An alcoholic tincture of the plant applied to the skin of the arm produced no vesication, and a similar negative

result was also obtained with an ethereal solution, and though there is very little doubt that plumbagin is the active principle of the drug, only in one experiment was any reaction similar to that yielded by plumbagin obtained. It is probable that the sample operated on was inactive from the failure to obtain any vesication with an ethereal solution of the whole plant, more especially as a subsequent distillation of seven pounds of the dried and powdered drug from another source yielded a distillate having the strong aromatic odour of plumbagin, and which when shaken with ether afforded a yellow crystalline substance which, on re-solution, gave a red colour with alkalies.

WOODFORDIA FLORIBUNDA, *Salisb.*

Fig.—*Roxb. Cor. Pl., t.* 31; *Bot. Mag., t.* 1906. Downy Grislea (*Eng.*), Grisléa multiflore (*Fr.*).

Hab.—Throughout India. The flowers.

Vernacular.—Dhái, Dávi, Devti (*Hind.*), Dhaití, Dhaoshi, Phulsatti (*Mar.*), Dhaiphul (*Beng.*), Serinjí (*Tel.*), Dhátaki (*Can.*).

History, Uses, &c.—The Sanskrit names of this shrub well describe its prominent characters. It is called Agni-jvála (fire-flame), Tamra-pushpi (red-flowered), Guchchha-pushpi (cluster-flower), Párvatí (hill-born). The usual name is Dhátaki. It is mentioned by Chakradatta and Sarangadhara on account of its astringent properties. As a medicine the flowers are chiefly prescribed by the natives in dysentery, beaten up with honey into a kind of confection. They are also thought to be of use in menorrhagia; externally they may be used as an astringent. The natives of the Concan in bilious sickness fill the patient's mouth with sesamum oil, and apply the juice of the leaves to the crown of the head; this is said to cause the oil in the mouth to become yellow from absorption of bile; fresh oil is then given repeatedly until it ceases to turn yellow. Commercially the flowers are of considerable importance as a dyeing and tanning material.

Description.—The flowers and their calices are red, the latter are permanent, and retain their colour after the flower has faded. As met with in commerce the calices generally contain the nearly mature capsules, which are two-celled and two-valved and completely enclosed. The seeds are light brown, very minute, oblong and very numerous; if the calyx is soaked in water it will be seen to be 12-toothed. In ordinary samples of the article some of the flowers are in small racemes, and a good many lanceolate leaves with a whitish under surface studded with black dots are mixed with them; both sides of the leaf will, if examined with a lens, be seen to be covered by a close dense tomentum. The enlarged calices are very astringent.

Chemical composition.—The flowers yielded to Hummel 20·6 per cent. of tannic acid, which explains their use by the Hindus in connection with alum as a mordant and with other dye-stuffs. (*Watt, Select. from the Records of the Govt. of India, Vol. I., pp.* 91 *and* 93.)

Commerce.—The article is collected in large quantities. Value, Rs. 15—25 per kandy of 5¼ cwts. The variation in price depends upon the quantity in the market.

LAWSONIA ALBA, *Lam.*

Fig.—*Lam. Ill., t.* 296, *f.* 2; *Wight Ill., t.* 87; *Griff. Ic. Pl. Asiat. t.* 580. Henna (*Eng.*), Henné (*Fr.*).

Hab.—Western India; cultivated throughout India. The leaves and flowers.

Vernacular.—Méhndí (*Hind.*), Mendi (*Mar., Guz.*), Marutonri, Aivanam (*Tam.*), Méhédi (*Beng.*), Goranta (*Tel.*), Gorante (*Can.*).

History, Uses, &c.—Henna is the Mendika and Rakta-garbha, or "plant pregnant with red colouring matter," of Sanskrit writers. It is much esteemed by the Mahometans. There is a tradition that their Prophet spoke of it as "*Syyadu*

riáhin" (the best of herbs). In Arabic it is called Hinna. Arabic and Persian works give Arkán and Fákúliyún as the Greek names;* they describe the leaves as a valuable external application in headache, combined with oil so as to form a paste, to which resin is sometimes added. They are applied to the soles of the feet in small-pox, and are supposed to prevent the eyes being affected by the disease. They also have the reputation of promoting the healthy growth of the hair and nails. An ointment made from the leaves is spoken of as having valuable healing properties, and a decoction is used as an astringent gargle. The bark is given in jaundice and enlargement of the spleen, also in calculous affections, and as an alterative in leprosy and obstinate skin diseases, in decoction it is applied to burns, scalds, &c. The seeds, with honey and tragacanth, are described as cephalic. An infusion of the flowers is said to cure headache, and to be a good application to bruises; a pillow stuffed with them has the reputation of acting as a soporific. (*Dr. Emerson.*) An ointment is also applied to bruises, and a perfumed oil is prepared from them, which is called in Arabic Duhn-el-fághiya and is used as a cosmetic.

Ainslie notices the use of an extract prepared from the flowers and leaves by the Tamil physicians of Southern India as a remedy in lepra, half a teaspoonful twice a day being the dose. He also says that the leaves are applied externally in cutaneous affections. In the Concan the leaf-juice mixed with water and sugar is given as a remedy for spermatorrhœa, and with milk in the condition popularly known as "hot and cold fits."

In the *Pharmacopœia of India* attention is drawn to their use in an obscure affection called "burning of the feet," often met with in India; and the editor mentions his having himself witnessed, when in Burmah, a great amount of tempo-

* The κυπρος of Dioscorides (i., 109,) and Cyprus of Pliny (13, 51; 23, 46) appear to be Henna, as 'the leaves dye the hair of an orange colour.' Arkan ﻋﺮﻕ is an Arabic word meaning a blight or disease which turns plants or men yellow (jaundice).

vary relief from the remedy when numerous other means had previously failed. The fresh leaves beaten up into a paste with vinegar were applied as a poultice to the soles of the feet in most cases, but some patients obtained greater relief from using strong frictions with the bruised leaves over the part. In Southern India Henna seeds are called *Iswan*, a corruption of the Persian word Isband or Ispand, a name applied to the seeds of *Peganum Harmala* by the Persians. They are used by the Mahometans of those parts as a substitute for the true Ispand in certain superstitious observances. (*See Peganum.*)

The use of Henna for dyeing the hands and feet appears to be common among Mahometans in Asia and Africa, and was probably practised by the ancient Egyptians and Jews. Sir G. Birdwood has the following remarks upon its history in more Western countries:—"Solomon is supposed by Sprengel to refer to the Henna plant in his Epithalamium (I. 14), 'My beloved is unto me as a cluster of Samphire (or Cypress or Camphire) in the vineyards of Engedi.'" It is undoubtedly the κυπρος of Dioscorides and "Cyprus in Egypt" of Pliny. It is mentioned by Avicenna also under the name of "Henna."*

Description.—Leaves opposite, smooth, short petioled, oblong, or broad lanceolate, pointed at both ends, an inch or more long and less than half an inch broad; the flowers are in terminal, globular, cross-armed panicles, small, greenish white and very fragrant; the fruit is round, the size of a pepper-corn, four-grooved, with the apex depressed, four-celled: the seeds are angular. The decoction of the leaves is of a deep orange colour, which is destroyed by acids, and deepened by alkalies and vegetable astringents; it stains the skin of an orange red colour, which does not disappear until the epidermis has been renewed.

Chemical composition.—The colouring matter of Henna is a kind of tannin to which M. Abd-el-Aziz Herraory has given the name of *hennotannic acid*. This principle is brown, of a

* Cf. P. Bellonius Obs. II. 64. He visited Egypt in A. D. 1547.

resinoid appearance, and soluble in boiling water. It possesses the properties of tannin, such as blackening ferric salts and precipitating gelatine. It reduces oxide of copper in Trommer's test, and heat decomposes it, with the production of crystalline needles, which reduce nitrate of silver. (*Jour. de Pharmacie, Jan.* 1863.) According to C. J. S. Thompson the leaves yield to boiling water from 12 to 15 per cent. of the brown colouring matter, which is soluble in glycerine, strong solutions of potash and ammonia, and dilute acids, but very slightly in ether, chloroform or alcohol: the leaves also yield 2 per cent. of an olive-green resin soluble in ether and alcohol.

PUNICA GRANATUM, *Linn.*

Fig.—*Bentl.* and *Trim.*, *t.* 113. Pomegranate (*Eng.*), Grenadier commun (*Fr.*).

Hab.—Socotra, Arabia, Africa (?). Cultivated throughout India. The fruit, rind, and root bark.

Vernacular.—Anár, Dárim (*Hind.*), Dálim (*Beng.*), Dálimba (*Mar.*), Dádam (*Guz.*), Mádalai (*Tam.*), Dánimma (*Tel.*), Dálimbe (*Can.*); the flowers, Julnár, Gulnár (*Arab., Pers., Hind.*), Pu-madalai (*Tam.*), Puvvu-dánimma (*Tel.*), Hushi-dálimbe (*Can.*).

History, Uses, &c.—The pomegranate, which by Dierbach's account is the Ροα Σίδη of Hippocrates, is in culture in the south of Europe, Arabia, Japan, Persia, and Barbary. It is also much cultivated in India, but the Indian fruit is greatly inferior to that which is imported from the Persian Gulf ports. The Sanskrit name is Dádima, and the fruit is called Shukadana (parrots' food) and Kuchaphala (breast fruit). Hindu physicians prescribe the juice of the ripe fruit combined with saffron as a cooling medicine. They also use the rind of the fruit and the flowers, combined with aromatics, such as cloves, cinnamon, coriander, pepper, &c., as an astringent in such bowel affections as are not accompanied with tenesmus. In the Concan the juice of the green fruit, rubbed with galls, cloves

and ginger is given in honey as a remedy for piles. The juice of the flowers with Durva root juice (*Cynodon dactylon*) is used to stop bleeding from the nose. The root bark does not appear to be mentioned in any Sanskrit works on Materia Medica. The Arabs call the pomegranate Rummán; Anár is the Persian name. Mahometan writers describe three kinds, sweet, sour, and subacid. The Rummán-i-bari or Wild Pomegranate of these writers is, perhaps, the *P. protopunica* discovered by Balfour in Socotra, and which probably exists in the neighbouring continents of Africa and Arabia, but this name is also applied by the Arabs to the Tutsan or large Hypericum. Besides using the flowers and rind in a variety of ways on account of their astringency, they recommend the root bark as being the most astringent part of the plant, and a perfect specific in cases of tapeworm: it is given, in decoction, prepared with two ounces of fresh bark, boiled in a pint and a half of water till but three-quarters of a pint remain; of this when cold a wineglassful may be drunk every half hour, till the whole is taken. This dose sometimes sickens the stomach a little, but seldom fails to destroy the worm, which is soon after passed.*

The seeds of the pomegranate are considered to be stomachic, the pulp cardiacal and stomachic. It would appear that the Arabs derived their knowledge of the medicinal qualities of this plant from the ancients, as a similar account of them is found in Dioscorides and Pliny. The *balaustium* of these writers is the double pomegranate flower, a word which in the corrupted form of Balusitun is common in Arabic and Persian books.† The root bark and rind of the fruit are official in the *Pharmacopœia of India*. The official preparation of pomegranate root bark is open to objection on account of its nauseousness, and Mr. Siebold, in order to obviate this, has suggested a process for removing the astringent principles. (*Pharm. Journ.* [3], XIV., 396.) With a similar object Dr. Von Schroeder

* Compare with Dioscorides i., 131, *περὶ ῥόας*.

† Plin. 13, 34; 23, 57 to 61; Scribon. Comp. 85 and 112; Dios. i., 132; it is used to stop bleeding in accordance with the doctrine of signatures.

has recommended the use of an extract free from tannic acid, but containing all the alkaloids of the bark. (*Pharm. Zeit.*, 1886, *Sept.* 18, p. 556.) The extract is prepared by treating a decoction of the bark with milk of lime to remove the tannic acid, filtering, neutralizing the filtrate exactly with sulphuric acid, evaporating it on a water bath almost to dryness, treating the residue with 70 per cent. alcohol, and then driving off the alcohol from the extract obtained, the product is described as nearly entirely crystalline and soluble in water with a slight turbidity. The yield is about one gram of extract from twenty grams of bark. In order to retard as much as possible the absorption of the pelletierine, which is present in the extract as a sulphate, it is recommended to add to this quantity one or two grains of tannic acid to convert the alkaloid into the difficultly soluble tannate.

It has been stated occasionally that the administration of pelletierine to adults has been followed by symptoms of poisoning, though not very serious ones, and this has caused hesitation in administering it to children. Some recently reported cases appear, however, to indicate that the physiological action of this tænifuge is relatively less energetic in infants than in adults. (*Archiv. der Pharm., Sept.* 1886, p. 409.) Dr. Méplain administered six centigrams of pelletierine to a child two and a half years old, and Dr. Bétencès the same quantity to a child five years old without the least symptom of poisoning, but with the removal of the worm in both cases. In another case a dose of ten centigrams was successfully administered to a child ten years of age. (*Pharm. Journ., Oct.* 2, 1886.)

Description.—The fruit of the pomegranate tree, in botanical language a *balausta*, is a spherical somewhat flattened and obscurely six-sided berry of the size of a common orange, and often much larger, crowned by the thick, tubular, 5 to 9-toothed calyx. It has a smooth, hard, coriaceous skin, which, when the fruit is ripe, is of a brownish yellow tint, often finely shaded with red. Membranous dissepiments, about 6 in number meeting in the axis of the fruit, divide the upper and larger portion into equal

cells; below these, a confused conical diaphragm separates the lower and smaller half, which in its turn is divided into 4 or 5 irregular cells. Each cell is filled with a large number of grains, crowded on thick spongy placentæ, which in the upper cells are parietal but in the lower appear to be central. The grains, which are about ½ an inch in length, are oblong or obconical and many-sided, and consist of a thin transparent vesicle, containing an acid, saccharine, red juicy pulp surrounding an elongated angular seed.

The peel as imported is in irregular, more or less concave fragments, some of which have the toothed, tubular calyx still enclosing the stamens and style. It is $\frac{1}{20}$ to $\frac{1}{10}$ of an inch thick, easily breaking with a short corky fracture; externally it is rather rough, of a yellowish brown or reddish colour. Internally it is more or less brown or yellow, and honeycombed with depressions left by the seeds. It has hardly any odour, but has a strongly astringent taste. The bark occurs in rather thin quills or fragments, 3 to 4 inches long. Their outer surface is yellowish grey, sometimes marked with fine longitudinal striations or reticulated wrinkles, but more often furrowed by bands of cork, running together in the thickest pieces into broad flat conchoidal scales. The inner surface, which is smooth or marked with fine striæ, and is of a greyish yellow, has often strips of the tough whitish wood attached to it. The bark breaks short and granular; it has a purely astringent taste, but scarcely any odour. (*Pharmacographia.*)

Microscopic structure.—The middle layer of the peel consists of large thin-walled and elongated, sometimes even branched, cells, among which occur thick-walled cells and fibro-vascular bundles. Both the outer and the inner surface are made up of smaller, nearly cubic and densely-packed cells. Small starch granules occur sparingly throughout the tissue, as well as crystals of oxalate of calcium. In a transverse section of the bark, the liber is seen to be the prevailing part of the cortical tissue. The former consists of alternating layers of two kinds of cells, one of them loaded with tufted crystals of oxalate of calcium, the other filled with starch granules and astringent matter. The

bark is traversed by narrow medullary rays, and very large sclerenchymatous cells are scattered through the liber. Touched with a dilute solution of a persalt of iron, the bark assumes a dark blackish blue tint.

Chemical composition.—"The bark contains, according to Wackenroder (1824), more than 22 per cent. of tannic acid, which Rembold (1867) has ascertained to consist for the most part of a peculiar variety called Punico-tannic Acid, $C^{20}H^{16}O^{13}$; when boiled with dilute sulphuric acid, it is resolved into Ellagic Acid, $C^{14}H^{8}O^{9}$, and sugar. Punico-tannic acid is accompanied by common tannic acid, yielding by means of sulphuric acid, gallic acid, which appears sometimes to pre-exist in the bark. If a decoction of pomegranate bark is precipitated by acetate of lead, and the lead is separated from the filtered liquid, the latter on evaporation yields a considerable amount of mannite. This is probably the Punicin or Granatin of former observers." (*Pharmacographia, 2nd Ed., p.* 291.) Tanret (1878) announced the discovery of a liquid alkaloid which has the tænicide power of the bark. The alkaloid is obtained in a pure state by distilling its ethereal solution in a current of hydrogen, and maintaining the residue at a temperature of 130° to 140° C. until it no longer gives off the vapour of water. The temperature is then raised, and the liquid collected that distils between 180° and 185° C.

Pelletierine so obtained is colourless, but in the open air or in flasks incompletely filled it becomes coloured very rapidly. At zero its sp. gr. is. 0·999 and at 21° C. 0·985. It is very soluble in water, with which it undergoes a contraction of volume, a mixture of 1 part of pelletierine with 2·5 parts of water having at 21° C. a sp. gr. of 1·021.

Pelletierine is dextrogyre, having in aqueous solution a rotatory power of $[a]_D = +80$, that of the sulphate prepared with the distilled alkaloid is +5·98. With sulphuric acid and potassium bichromate pelletierine gives a green colour as intense as alcohol under the same conditions.

Analyses of the alkaloid as well as of the crystalline salts that it forms with sulphuric and hydrochloric acids indicate the

formula $C^9H^{15}NO$. It therefore furnishes another example of a volatile oxygenated base, near to conhydrine, $C^8H^{17}NO$ and tropine, $C^8H^{15}NO$. From some experiments made by Tanret it appears that the bark of the fibrillæ of the roots contains by far the largest proportion of alkaloid, *viz.*, 2·25 per cent. when dry. Tanret subsequently obtained from the bark a second alkaloid, *isopelletierine*, having anthelmintic properties, and two inactive alkaloids.

Commerce.—Pomegranate root bark is seldom to be met with in the shops, as few gardens are without the plant; it is freshly dug when required. The rind is brought to Bombay from the Persian Gulf ports chiefly. Value, Re. $1\frac{1}{8}$ per maund of $37\frac{1}{2}$ lbs. The dried seeds are also imported.

ONAGRACEÆ.

JUSSIÆA SUFFRUTICOSA, *Linn.*

Fig.—*Rheede Hort. Mal. ii., t.* 50; *Lam. Ill., t.* 230, *f.* 3.

Hab.—India, Ceylon. The plant.

Vernacular.—Lál-bon-lavanga (*Beng.*), Ban-laung (*Hind.*), Pána-lavanga (*Mar.*), Nir-kirambu (*Tam.*), Kavacula (*Can.*), Hæmarago (*Cingh.*).

History, Uses, &c.—Rheede under the name of *Carambu* describes this plant as medicinal, and gives as its Sanskrit name Bhállavi-anga; no such name, however, appears in the list of plants mentioned by Sanskrit writers. Bhállavi is the name of a man, and Bhállavi-anga would signify "having a body like Bhállavi." According to Rheede a decoction of this plant is used in Malabar to dissipate flatulence, act as a diuretic, purge the body and destroy worms; when ground small and steeped in butter-milk it is administered in dysentery. Ainslie quotes Rheede, and says that the plant is called *Hæmarago* in Ceylon. Miller, he says, has noticed the resemblance of its fruit to the clove, and in Jamaica *J. repens* is used as an astringent in spitting of blood and flux. (*Mat. Ind. ii.*, 66.) The plant is

also noticed by Loureiro (*Fl. Cochin.* 226) under the name of *Epilobium fruticosum*. The Indian vernacular names all bear testimony to the resemblance of the fruit to a clove, and the Marathi name "water-clove" indicates the habitat of the plant, which is similar to that of our European willow herb (*Epilobium angustifolium*). The astringent properties of Jussiæa appear to be known to the peasantry in most parts of India.

Description.—An erect, branching, suffruticose plant, 4 to 6 ft. Leaves 3 by ¾ in., more or less villous, ovate-lanceolate, sometimes nearly linear, shortly petioled or sessile. Pedicel very short. Calyx-lobes broadly lanceolate or ovate. Petals 4, yellow, obovate. Capsule 1-2 in., linear-cylindric, more or less villous, 8-ribbed, membranous, breaking up between the ribs.

SAMYDACEÆ.

CASEARIA ESCULENTA, *Roxb.*

Fig.—*Bedd. Fl. Syl., t.* 208.

Hab.—Malabar, Bombay to Coorg, Ceylon.

Vernacular.—Mora-ágerú, Bithori, Pingri, Mormassi (*Mar.*), Sátaganda (*Goa.*), Gundu-gungura (*Tel.*), Kaddlashingi, (*Tam.*), Chilla, Chilara, Bairi (*Hind*).

History, Uses, &c.—The species of Casearia found in India are not numerous, most of the genus being natives of America, where several species are used medicinally. *C. esculenta* is a small shrub of very variable appearance and not unlike the species *tomentosa* figured by Rheede (*Hort. Mal. v.*, 50) which he calls *Tsjerou-kanelli*, and for which he gives the following synonyms.—Fruita caurina do mato (*Port.*), "Wild cowrie fruit," Wilde dwerg appelen (*Dutch*), "Wild dog apple." Bedousi (*Brah.*).

Roxburgh tells us that the roots of *C. esculenta* are used as a purgative by the inhabitants of the Circar hills, that he tried unsuccessfully to extract a colouring matter from the fruit, and that the young leaves are eaten in stews.

In Western India the root has a great reputation as a remedy for hepatic enlargements and for piles. A decoction made by boiling 90 to 120 grains of it for a dose in a pint of water down to one quarter of a pint is administered internally three times a day, and a paste made by braying the root on a stone is sometimes applied locally as well when piles are present. The administration of the drug promotes the action of the liver, and the local application may be of use as the root is astringent. The Marathi word मोड (*mora*) signifies a pile, and आगोड (*ágera*) the intestinum rectum. Sátagauda is compounded of सात (*sáta*) seven, and गांड (*ganda*) a ring, and is applied to this plant because the transverse section of the largest roots shows seven concentric dark rings. Mormassi is a compound of Mora with a corruption of the Sanskrit मषी (*mashi*), which signifies a soft tumour. The root has long been known as a drug used by the Goanese in Bombay, but its source was only accidentally discovered in 1888 when breaking up some waste land for cultivation. In native practice the root is administered in decoction with garlic, and sometimes the leaves and root are given on the Western coast. We have received the root from Dr. P. S. Mootooswamy of Tanjore, who states that it is used in the South as a remedy for diabetes, for which disease it is considered to be a specific. An extract of the root has been administered by us in doses of from 10 to 20 grains or more in a number of cases of chronic hepatic congestion with decided benefit; it removes the feeling of weight and tension in the hepatic region and acts as a gentle aperient upon the bowels. A syrup of the strength of 20 grains of extract in two fluid drachms has also been found to be an efficient preparation.

Description.—The root is from ½ to 2 inches in diameter, often very crooked, forming angular bends; it consists of a central red woody column, having seven or a less number of lark concentric rings. The bark is of a deep dull-red colour, thick, and extremely hard, it is covered with a thin papery suber of an ochre-yellow colour. The taste is astringent. The root yields to water an abundant dark reddish-brown extract.

The powder has a cobweb-like character due to the length and silkiness of the liber cells.

Chemical composition.—Operating upon the root-bark, ether removed 3 per cent. of brownish-yellow resin, partly soluble in spirit, with a neutral reaction. Alcohol extracted about 13 per cent. of dark-red colouring matter consisting mostly of tannic acid. This extract was only partly soluble in water, the insoluble portion became clear with ammonia, but the liquid rapidly pectinised. The tannic acid gave a brownish-green colour with ferric salts. The aqueous extract was also dark coloured, and nearly half of it was precipitated by neutral plumbic acetate as one or more organic acids. This extract and that part of it forming a lead compound was tested physiologically and found to have a cathartic effect; the lead compound gave 53·5 per cent. of Pb O, and the acid separated from lead by sulphuretted hydrogen possessed some of the characters of cathartic acid. The portion of aqueous extract not precipitated by lead contained a neutral principle crystallizing in white transparent prisms. The root had still another colouring matter removed by soda solution, a small quantity of starch, and it left 4·8 per cent. of mineral matter when burnt. The tannin of Casearia root is related to Ratanhia-tannic acid, in the composition of its lead salt and in yielding a crystalline sugar when boiled with acids. The insoluble tannin is also similar to the Ratanhia red.

PASSIFLOREÆ.

CARICA PAPAYA, *Linn.*

Fig.— *Bot. Reg.* 459. Papaw (*Eng.*), Papayer (*Fr.*).

Hab.—America. Cultivated throughout India. The milky juice.

Vernacular.—Papiya, Arand-kharbuz (*Hind.*), Painpai (*Beng.*) Papai (*Mar.*), Pappali-maram (*Tam.*), Bapaia-pandu (*Tel.*), Parangi (*Can.*)

History, Uses, &c.—In the Brazils the hermaphrodite variety of *C. Papaya* is called mamao macho (male mamao), the fruit-bearing variety mamao femea (female mamao), and a cultivated variety of the latter mamao melao (melon mamao). The anthelmintic properties of the milky juice were first noticed in the 17th century by Hernandez. Its digestive action upon meat was probably known in the West Indies at a very early date, and appears to have been communicated to the inhabitants of India upon the introduction of the tree by the Portuguese, as it has long been the practice to render meat tender by rubbing it with the juice of the unripe fruit or by wrapping it in the leaves. The author of the Makhzan-el-adwiya (A.D. 1770) accurately describes the tree, and mentions the use of the juice, mixed with that of fresh ginger, for making meat tender. Medicinally, he says, it is a remedy for hæmoptysis, bleeding piles, and ulcers of the urinary passages; it is also useful in dyspepsia; rubbing the milk in two or three times cures ringworm, or psoriasis (برص) causing a copious serous exudation attended with itching. (*Op. cit. sub voce Papiya.*) The attention of the profession in India was called to the use of the milk as an anthelmintic in 1810 by Dr. Fleming (*Asiatic Researches*, Vol. XI.), who cites an interesting passage from the writings of M. Charpentier Cossigni in support of its alleged virtues. Further confirmatory evidence has more recently been adduced by M. Bouton (*Med. Plants of Mauritius*, 1857, p. 65), and it may justly be concluded that the statements as to its efficacy as an anthelmintic are founded on fact. The following mode of administration employed by the late Dr. Lemarchand, of the Mauritius (cited by Bouton), it would be desirable to adopt in all future trials with this remedy. Take of fresh Papaw milk, honey, of each a tablespoonful; mix thoroughly, gradually add three or four tablespoonfuls of boiling water; and when sufficiently cool take the whole at a draught, following its administration two hours subsequently by a dose of castor oil, to which a portion of lime-juice or vinegar may be added. This may be repeated two days successively if required. The above is a dose for an adult; half

the quantity may be given to children between 7 and 10 years of age; and a third or teaspoonful to children under 3 years. If it cause griping, as it occasionally does, enemas containing sugar have been found effectual in relieving it. Taking the dose above named as correct, the statement of Sir W. O'Shaughnessy (*Bengal Dispensatory*, p. 352), that he had administered the milky juice as an anthelmintic, in doses of from 20 to 60 drops without obvious effect, is fully explained. It is principally effectual in the expulsion of lumbrici. On tænia it is reported to have little effect. Anthelmintic virtues have also been assigned to the seeds, but the evidence of their efficacy is very inconclusive. A belief in their emmenagogue properties prevails amongst all classes of women in Southern and Western India, and also in Bengal; so much so, that they assert that if a pregnant woman partake of them, even in moderate quantities, abortion will be the probable result; the same prejudice exists against eating the fruit. Facts in support of the alleged emmenagogue properties of the Papaw are still wanting. (*Phar. of India*, p. 97.) Lt.-Col. Cox has brought to the notice of the Madras Agri-Horti-cultural Society that the leaves are used in the south to extract guinea-worms; an ounce of the leaf is rubbed with 60 grains of opium and 60 grains of common salt, and the paste applied to the part. "Of course the worm has to be wound out in the usual manner, but it always comes out more quickly and easily when treated in this way."

Evers has employed the milk in the treatment of splenic and hepatic enlargement with good results; a teaspoonful with an equal quantity of sugar divided into three doses was administered daily. (*Ind. Med. Gaz., Feb.* 1875.) In 1877, the milky juice began to attract attention in Europe as a digestive ferment, and Herr Wittmack (1878) examined its properties with the following results:—He obtained, after repeated incision of a half ripe fruit, 1·195 grammes of white milky juice of the consistence of cream. This dried in a watch glass to a hard vitreous white mass, having what appeared to be greasy spots on the surface, but which really were flocks of a gelatinous substance that always adheres to the more hardened material.

The odour and flavour of the fresh juice recalled that of petroleum or of vulcanised india-rubber. The microscope showed it to be a fine granuous mass containing some larger particles and isolated starch grains. Iodine coloured the juice yellowish brown. A portion of the juice was dissolved in three times its weight of water, and this was placed with 10 grammes of quite fresh lean beef in one piece in distilled water, and boiled for five minutes. Below the boiling point the meat fell into several pieces, and at the close of the experiment it had separated into coarse shreds. In the control experiments made without the juice the boiled meat was visibly harder. Hard boiled albumen, digested with a little juice at a temperature of 20° C., could after twenty-four hours be easily broken up with a glass rod. 50 grammes of beef in one piece, enveloped in a leaf of *C. papaya* during 24 hours at 15° C., after a short boiling became perfectly tender; a similar piece wrapped in paper and heated in the same manner remained quite hard. Some comparative experiments were also made with pepsin, and the following are the conclusions arrived at by the author:—

(1) The milky juice of the *Carica papaya* is (or contains) a ferment which has an extraordinarily energetic action upon nitrogenous substances, and like pepsin curdles milk; (2) this juice differs from pepsin in being active without the addition of free acid, probably it contains a small quantity, and further it operates at a higher temperature (about 60° to 65° C.) and in a shorter time (5 minutes at most); (3) the filtered juice differs chemically from pepsin in that it gives no precipitate on boiling, and further that it is precipitated by mercuric chloride, iodine, and all the mineral acids; (4) it resembles pepsin in being precipitated by neutral acetate of lead, and not giving a precipitate with sulphate of copper and perchloride of iron. (*Pharm. Jour., Nov.* 30, 1878.)

The active principle has since been separated and given the name of *Papain*; it is now an article of commerce in Europe for medicinal purposes, and is said to be capable of digesting 200 times its weight of fibrin; it has been used as a solvent of diphtheritic false membrane, and also as a local application

in old standing cases of chronic eczema, more especially of the palms of the hands, and where other remedies failed great benefit has attended its application in the following way :—12 grains of papain, and 5 grains of powdered borax, in 2 drachms of distilled water, to be painted on the parts twice daily.

In the *Therapeutic Gazette* (1886), Dr. A. Jacobi records successful results in several cases in which papain was applied topically to diphtheritic membranes. In these cases a mixture of one part of papain and two parts each of glycerine and water were applied with a brush; within twelve hours the membrane began to slough off, and was freely expectorated. Similar results were obtained in England a few years before this, but a want of uniformity and hence uncertainty to a certain extent prevented the remedy coming into general use.

Dr. George Herschell (*Brit. Med. Journ.*, 1886, p. 640,) records the treatment of the chronic stomach catarrh of children with powders composed of *Papain-Finkler*, gr. ½ to 1; Sacch. lactis, gr. i; Sodii Bicarb., gr. v., to be taken after every meal. This relieves the aggravating symptoms of dyspepsia, such as loss of appetite and sleep, irritability, headache, and sometimes a cough, which so much affect children. Dr. Herschell believes that the remedy acts by dissolving the mucus, which accumulates in unusual quantity upon the stomach and intestines and prevents absorption of food. In the acid dyspepsia of adults, when heartburn and flatulence are the chief indications of impaired digestion, he finds papain valuable in conjunction with carbolic acid and an alkali, as in the following draught :—Sodii Bicarb. gr. xv., Glycer. acid. carbolic., m. viii.; Spt. Ammon. Arom., m. xx., Aquæ ad ℥iss. This is to be taken an hour after food along with 2 grains of Papain-Finkler. (*Chem. and Druggist*, 1886.)

Description.—The tree is from 20 to 30 feet high, without branches when young, but old trees often produce a number of separate heads. The leaves are alternate, palmate, 7-partite; segments oblong, acute, sinuated, the middle one 3-fid; corolla tubular in the male and 5-lobed in the female,

divided nearly to the base into five segments; male flowers axillary in slightly compound racemes or panicles, white; female generally on a different tree, in the axils of the leaves, large and fleshy, yellowish; fruit succulent, oblong, furrowed; the size of a small melon, yellowish-green when ripe, and containing a number of round, grey, slimy seeds, which smell like cress. In the unripe state the fruit abounds in a thick milky juice.

Chemical composition and Physiological action.—The fruit has been examined by Dr. T. Peckolt (*Zeitschr. des Oesterr. Apoth. Ver.* 1879, 361—373); it was gathered in the full-grown but unripe condition, when it contains a considerable quantity of milky juice, which disappears almost entirely after it has been kept for a few days. The analysis of the fresh fruit of the three varieties freed from acid gave the following numbers:—

	Fruit of female plant.	Fruit of female cultivated plant.	Fruit of Hermaphrodite plant.
Caoutchouc-like substance	.....	.....	0·046
Soft yellow resin	0·165	.....	.....
Reddish yellow fat	.....	0·020	.....
Albuminoids	1·070	0·500	0·735
Sugar	3·238	3·580	4·333
Pectinous matter	1·315		
Tartaric acid	0·075		
Citric acid (Combined with bases.)	0·020	0·483	3·332
Malic acid	0·083		
Dextrin, &c.	5·503		
Water	85·351	92·500	89·445
Cellulose	3·180	2·920	5·091

The fresh fruit of the female plant gave 1·239 per cent. of ash, and the dried fruit 8·457 per cent. It contained a large amount of soda, potash, and phosphoric acid. The ripe fruit contained no free acids.

The seeds contain an oil, *papaya oil*; *caricin*, an oil-like substance with a disagreeable taste and smell, soluble in ether and alcohol; an acid similar to palmitic acid, *Carica fat acid*; a crystalline acid, *Papayic acid*, insoluble in cold water, but

soluble in hot water and alcohol; a resin acid, having an irritating and bitter taste, insoluble in water and ether, soluble in alcohol and alkalies; and a soft resin similar to that found in the fruit flesh of the female plant. (*Year-Book of Pharmacy*, 1880, p. 212.) Dr. Sidney Martin (*Journ. Physiol.* V., 213—230, and VI., 336—360; *Journ. Chem. Soc.* 1886, 641,) has shown papain to be a protolytic ferment, which acts very similarly to trypsin.

Experiments performed with fibrin and white of egg showed that some degree of digestion occurs when the liquid is faintly acid (0·05 per cent. of HCl); the presence of more acid than this hinders the action of the ferment. Digestion takes place actively only in neutral or in alkaline solutions (0·25 per cent. of sodium carbonate); it occurs most readily at a temperature between 35° and 40° C. The results of digestion are peptones, leucine and tyrosine and an intermediate globulin-like substance, similar to that formed in pancreatic digestion.

In the author's second paper on the same subject the ferment in papaw juice is shown to be associated with an albumose, and to give the following reactions in addition to those previously described by Wurtz:—The solution gives a biuret reaction, and it is precipitated from a neutral solution of sodium, magnesium sulphate or sodium chloride alone, as globulins are. It is soluble in glycerol, and if precipitated from this solution by alcohol, the filtrate has no proteolytic power. The kind of albumose is one nearly akin to the protalbumose of Kühne and Chittenden, and is called α-phytalbumose. Papaw juice also contains a milk-curdling ferment. The proteids present in papaw juice were found to be as follows:—

(1) Globulin, resembling serum globulin in its most important properties.

(2) Albumin.

(3) β-phytalbumose precipitated almost completely by heat, by saturation with neutral salts, but not by dialysis. It differs from the heteroalbumose of Kühne and Chittenden by not being precipitated by dialysis, by copper sulphate, or by mercuric chloride.

(4) α-phytalbumose; soluble in cold or boiling water; not precipitated by saturation with neutral salts, except in an acid solution. This is the vegetable peptone referred to by Vines (*Journ. Physiol.* iii.) as hemialbumose. It differs from the protalbumose of Kühne and Chittenden by its non-precipitation by sodium chloride or by copper sulphate. Both these albumoses give the biuret reaction.

No peptones occur in the juice, but leucine and tyrosine are present. By a series of digestion experiments carried out on each of these proteids by papain in a neutral liquid, it was found that both the globulin and albumen are changed into β-phytalbumose, and that this becomes a peptone-like substance, and forms leucine and tyrosine. The α-phytalbumose becomes a similar peptone-like substance, leucine and tyrosine being formed. This peptone-like substance resembles the deuteroalbumose of Kühne and Chittenden, except that a solution of it, when rendered acid by acetic acid in the presence of sodium chloride, does not become cloudy on warming. No true peptones are formed. Probably digestion in the plant itself is very slow, as much more liquid was used in the experiments than is present in the juice. The albumose forms probably the circulating proteid in the plant. (*Year-Book of Pharm.*, 1886, p. 97).

CUCURBITACEÆ.

CITRULLUS COLOCYNTHIS, *Schrad.*

Fig.—*Wight Ic., t.* 498; *Bentl. and Trim.*, 114. Bitter apple (*Eng.*), Coloquinte (*Fr.*).

Hab.—India, Asia, Africa. The fruit and root.

Vernacular.—Indráyan (*Hind.*), Indráyan (*Guz.*), Peykomatti, Tumatti (*Tam.*), Kuruvrandawan (*Mar.*), Eti-puchcha, Chittipápara (*Tel.*), Dodda-hal-mekki (*Can.*), Indráyan (*Beng.*).

History, Uses, &c.—Wild colocynth is common in waste tracts of North-West, Central and South India, and

ripens in the cold season. Aitchison observes that it is very common all over the desert country of Beluchistan, where it is called *Khar-kushta*. The fresh fruit is brought for sale by the herbalists; it is grown in the North-West Provinces for the use of the Government Sanitary Establishments.

Sanskrit writers describe the fruit as bitter, acrid, cathartic and useful in biliousness, constipation, fever and worms. They also mention the root as a useful cathartic in jaundice, ascites, enlargements of the abdominal viscera, urinary diseases, rheumatism, &c. Sarangadhara gives a receipt for a compound pill, which contains Mercury 1 part, Colocynth pulp, Sulphur, Cardamoms, Long Pepper, Chebulic myrobalans, and Pellitory root, of each 4 parts. The Sanskrit names for colocynth are Indravárani and Vishálá. In India the fruit or root, with or without nux vomica, is rubbed into a paste with water and applied to boils and pimples. In rheumatism equal parts of the root and long pepper are given in pills. A paste of the root is applied to the enlarged abdomen of children. (*Compare with Scrib. Comp.* 80, *and Pliny* 20, 8.)

Mahometan writers call the colocynth plant Hanzal, and discuss its properties at great length. They consider it to be a very drastic purgative, removing phlegm from all parts of the system, and direct the fruit, leaves and root to be used. The drug is prescribed as with us, when the bowels are obstinately costive from disease or lesion of the nervous centres, also in dropsy, jaundice, colic, worms, elephantiasis, &c. Its irritant action upon the uterus is noticed, and fumigation with it is said to be of use for bringing on the menstrual flow.* The author of the Makhzan describes a curious method of administration. A small hole is made at one end of the fruit and pepper-corns are introduced, the hole is then closed, the fruit enveloped in a coating of clay and buried in the hot ashes near the fire-place for some days; the pepper is then removed and used as a carminative aperient. A similar preparation is made with rhubarb root instead of pepper. The same author tells us that the seeds are purgative, and mentions their use for preserving the

* Compare Hippocrates de morb. mulier. ii., 50.

hair from turning grey, a purpose for which *"bitter apples"* are apparently employed in England in the present day. As regards the purgative properties of the seeds he is incorrect, for when thoroughly washed they are eaten by the Arabs in time of famine. Colocynth was familiar to the Greeks and Romans.*

Description.—The Indian fruit is nearly globular, of the size of an orange, smooth, marbled with green and yellow when fresh, yellowish-brown when dry, and contains a scanty greyish-white pulp in which a number of brown seeds are embedded. This pulp in the fresh fruit is spongy and juicy, and occupies the whole of the interior of the fruit. Peeled colocynth is unknown in the Indian market except as an import from Europe. The seeds are disposed in vertical rows on three thick parietal placentæ, which project to the centre of the fruit, then divide and turn back, forming two branches directed towards one another. The seeds are of flattened ovoid form, 3-10ths of an inch long by 2-10ths broad, not bordered. The testa is hard and thick, with a finely-granulated surface, and is marked on each side of its smaller end by two furrows directed towards the hilum. The leaves are glabrous and nearly smooth above, muricated beneath, with small, white, hair-bearing tubercles, many cleft and lobed, the lobes obtuse. The root is fibrous, tough and stringy, of a yellowish-white colour. All parts of the plant are very bitter, and the dust when dry very irritating to the eyes and nostrils.

Chemical composition.—The bitter principle was isolated by Hübschmann in 1847, by Lebourdais in 1848, and by Walz (1858), who treated alcoholic extract of colocynth with water, and mixed the solution firstly with neutral acetate of lead, and subsequently with basic acetate of lead. From the filtered liquid the lead was separated by means of sulphuretted hydrogen, and then tannic acid added to it. The latter caused the colocynthin to be precipitated; the precipitate washed and dried

* κολοκύνθις, Theophr. H. P i., 19, 22. vii., 1, 3, 6; Dios. iv., 171; Colocynthis, Plin. 20, 8.

was decomposed by oxide of lead, and, finally, the colocynthin was dissolved out by ether.

Walz thus obtained about ½ per cent. of a yellowish mass or tufts, which he considered as possessing crystalline structure, and to which he gave the name *colocynthin*. He assigns to it the formula $C^{36}H^{34}O^{23}$. Colocynthin is a violent purgative.

Colocynthin is decomposed, according to Walz, by boiling dilute hydrochloric acid, and then yields *colocynthein*, $C^{44}H^{64}O^{15}$, and grape sugar.

The same chemist termed *colocynthitin* that part of the alcoholic extract of colocynth, which is soluble in ether, but not in water. Purified with boiling alcohol, colocynthitin forms a tasteless crystalline powder.

The pulp perfectly freed from seeds and dried at 100°C., affords 11 per cent. of ash; the seeds alone yield only 2·7 per cent. (*Pharmacographia.*) The seeds contain after decortication about 48 per cent. of fatty oil and 18 per cent albuminous substances besides a small quantity of sugar. (*Flückiger.*)

We have examined the roots dried at 50° C., and reduced to powder; the powder contained a large amount of starch and woody fibre; for the chemical examination, no separation of fragments of woody fibre by a sieve was attempted, the powdered roots being used as a whole.

Dry ether was digested with a known weight of the powder for some days, and was found to extract ·14 per cent. only. The extractive was of a yellow colour, bitter, and consisted chiefly of oily matter. Water digested with this extract acquired a very bitter taste. Another portion of the powder was exhausted with 84 per cent. alcohol, by which treatment 12·62 per cent. of a soft yellow non-crystalline extract was obtained dried at 100° C.

By the action of cold water on the extract, ·88 per cent. of insoluble, soft yellow residue was left; this residue was not bitter, and its alcoholic solution had a marked acid reaction. It had the properties of a fat acid. The aqueous extractive was somewhat milky; repeated filtration failed to make it bright: it

was acidulated with acetic acid and agitated with acetic ether. The acetic ether extract was yellow and most intensely bitter, it amounted to ·3 per cent. calculated on the roots. The greater part of this extract was soluble in water, the solution being intensely bitter. The residue insoluble in water consisted of fatty matter, and after repeated washing with water, it still had a bitter taste. The aqueous solution of the acetic extract gave with tannic acid a white curdy precipitate.

Acetic ether appears to be a better solvent for colocynthin than light petroleum ether, and it can be separated from either an acid or alkaline solution by the reagent. The acetic ether extract soluble in water may be looked upon as crude colocynthin. Henke appears to have obtained about ·6 per cent. of colocynthin from the commercial drug freed from seeds, while Walz obtained about ·25 per cent.

Commerce.—In the months of December and January fresh colocynth fruit is brought into the towns for sale. The dried entire fruit is sold in the shops. Large parcels collected and dried up-country sometimes make their appearance in the drug market. Average value, Re. 1 per 100 fruits. The fruit supplied from Saharunpore, N.-W. Provinces, in no way differs from that collected in the Deccan.

The extract prepared in India for use in the Government hospitals is made from the dry fruit after the seeds have been shaken out, as the scanty pulp cannot well be separated from the rind. This extract is quite as active as the best quality obtainable in Europe. The yield is about 110 lbs. of the compound extract from 60 lbs of dried fruit.

CITRULLUS VULGARIS, *Schrad.*

Fig.—*Hook. Kew Journ. Bot., iii., t.* 3. Water-melon (*Eng.*), Melon d'eau (*Fr.*)

Hab.—Cultivated throughout the East. The seeds.

Vernacular.—Tarbuj (*Hind.*), Tarmuj (*Beng.*), Kalingada (*Mar.*), Pitcha-pullum (*Tam.*), Kárigu (*Guz.*).

History, Uses, &c.—The distinction between the Water-melon and the cultivated form of *C. Colocynthis* is very small. The water-melon has either sweet or bitter fruit: when the latter, it is the *Citrullus amarus* of authors. *C. fistulosus*, Stocks, has thick stems, leaves sparingly lobed, and is plentifully supplied with long somewhat hispid hairs. (*Fl. Br. Ind.*) In India a small cultivated variety of *C. vulgaris*, known as *Dilpasand*, is commonly cultivated as a vegetable; it is globular, about as large as colocynth fruit, does not become sweet when ripe, and is used in the same manner as the Vegetable Marrow. The seeds of the water-melon are of interest as being one of the four cold cucurbitaceous seeds of the ancients, which, according to Guibourt, were originally those of *Cucumis sativus*, L., *Cucumis Citrullus*, DC., (the water-melon), *Cucumis Melo*, L., and *Lagenaria, vulg. clavata*, DC., but he remarks that in Paris the seeds of *Cucurbita Pepo*, Duch., and *Cucurbita maxima* (the *potiron* of the French) are now substituted for those of *Cucumis Citrullus* and *Lagenaria vulgaris*. In India the four cold cucurbitaceous seeds sold in the bazars are those of *Cucumis utilissimus*, *Benincasa cerifera*, *Cucumis Melo*, and *Citrullus vulgaris*. These seeds are in constant demand, and are kept decorticated and ready for use. The natives always use them together, and consider them to be cooling, diuretic, and strengthening. They are sold for about Re. $\frac{3}{4}$ per pound. The juice of the water-melon is used with cumin and sugar as a cooling drink. In Sind the dried fruit of *Citrullus amarus*, under the name of *Kirbut*, is used as an emetic, and in small doses with honey as a stomachic for children. (*Murray.*) Popularly the use of water melons is supposed to be specially conducive to choleraic seizures, but the evidence upon which this opinion is based appears to us wholly inconclusive. According to Braunt the seeds of this melon are brought from Senegal to France, where they are pressed, yielding as much as 30 per cent. of a fluid pale yellow oil which is used as a table oil and in the manufacture of soap.

CUCUMIS TRIGONUS, *Roxb.*

Fig.—*Wight Ill., t.* 105; *Ic., t.* 497; *Rheede, Hort. Mal.* viii., 11. Var. pubescens, *Royle Ill., t.* 47; *Wight Ic., t.* 496.

Hab.—India. The fruit.

Vernacular.—Bislambhi (*Hind.*), Káttut-tumatti (*Tam.*), Adavi-puchcha (*Tel.*), Kátvel, Kárit (*Mar.*), Hal-mekki (*Can.*).

Var. pubescens, Takmaki (*Mar.*).

History, Uses, &c.—This plant occurs in two very distinct forms, the wild bitter form has smooth fruits about the size and shape of a small egg, marked with green and yellow streaks like colocynth. The pubescent or semi-cultivated form has velvety fruits which are quite sweet when ripe, and are eaten as a vegetable when green. The wild fruits are never eaten, but are used sometimes medicinally in the same way as *Citrullus amarus*. The seeds are considered very cooling, and are beaten into a paste with the juice of *Cynodon dactylon* (Durva) and applied to herpetic eruptions.

The bitter gourd, is like colocynth, called Vishálá in Sanskrit, and is brought for sale in the Concan at the feast of the Divali or new year of the Hindus, as there is a custom at that season of crushing it under the foot and then applying it to the tongue and forehead to avert disease during the new year. This custom is unknown in the Deccan.* In Malabar the plant is

* Dr. R. G. Bhandarkar informs us that a Kârit is crushed after the ceremonial bath early in the morning on the Naraka Chaturdasî, or the first day of the Divâlî. The religious manuals usually consulted direct the whirling round oneself while bathing of a twig of Apâmârga (*Achyranthes aspera*), of Tambî (*Leucas zeylanica*) and of Prapunâta or Chakramarda (*Cassia Tora*), and in the verse that is repeated on the occasion, the Apâmârga is prayed to to remove sins. Probably some purificatory properties were observed in these three plants, and on that account the power of spiritual purification was also attributed to them. But the idea associated with the Kârit does not seem to be this. It is probably the same as that which underlies the practice of eating Nimba leaves on new year's day or the Varsha-pratipadâ. These leaves are bitter and supposed to improve the digestive power; by eating them, therefore, one clears off the indigestions of the previous year, and fits oneself for entering on another year's course. The Kârit being bitter, probably came to be used for the same reason, especially as one has to eat a great many sweet things during the Divâlî festival. The religious manuals do not prescribe the use of Kârit or even allude to it.

supposed to be alexipharmic, and to have the power of removing all pains and aches. The fruit pounded or boiled with cow's milk and applied to the head is supposed to prevent insanity, strengthen the memory, and remove vertigo. It is the Baliamucca-piri of Rheede, who gives *Tindalica* as the Portuguese, and *Milten* as the Dutch name. His brahminical name *Carinti* is Marathi, and most of his brahminical names are derived from the South Concan dialect of that language, showing that he obtained his information concerning the medicinal properties of plants from Shenvi and Sarasvat Brahmins who had migrated to Malabar from the Southern Concan. Modern investigation has shown that the medicinal properties of this gourd in no way differ from those of colocynth.

Chemical composition.—The dried fruit was digested with 84 per cent. alcohol, and the resulting tincture concentrated until most of the alcohol had been expelled; water was then added, and the mixture agitated with petroleum ether. The petroleum ether extract consisted of a soft dark reddish brown residue, which left a greasy stain on paper: with the exception of a few flocks it was soluble in alcohol, with acid reaction and bitter taste. On allowing the alcoholic solution to evaporate, some small warty masses separated which were destitute of crystalline structure under the microscope. After agitation with petroleum ether, the aqueous solution, still containing some alcohol, was heated on the water bath to drive off all the spirit, and the soft extract was then mixed with water and agitated with acetic ether containing some acetic acid. The acetic ether extract was reddish brown, very bitter and partly soluble in boiling water. The insoluble residue was brittle when cold and very bitter, and had the properties of a resin, and would appear to correspond with the *resin of colocynth* described by Meissner and others.

The aqueous solution obtained by the action of boiling water on the acetic ether extract was cooled and mixed with aqueous tannic acid, and the curdy precipitate separated by filtration and slightly washed; thorough washing was not possible owing the precipitate caking on the sides of the filter. The drained

but still moist precipitate together with the filter was now well triturated with freshly precipitated carbonate of lead and the creamy mixture dried. The dry residue was boiled with alcohol, and on evaporating off the alcohol a slightly yellow amorphous residue was left, brittle when cold and easily reduced to a slightly yellow powder, which possessed an extremely bitter taste. On spontaneous evaporation of an alcoholic solution, a crystalline residue was obtained, in which prisms were detected on microscopic examination. Generally the reactions afforded by this bitter principle agreed with those usually ascribed to colocynthin. It failed, however, to yield any *dark green greasy precipitate* with boiling aqueous hydrochloric acid, as is mentioned in Muir and Morley's edition of *Watts' Chemical Dictionary*. We further tested a sample of colocinthin, which had been obtained from Dr. Schuchardt of Görlitz, for this reaction, but with negative results. Regarding the production of this dark green greasy precipitate; on boiling colocynthin with concentrated aqueous hydrochloric acid, the first effect of heat was the formation of a clear reddish yellow solution; on continued ebullition the liquid became darker and turbid, and on the surface a dirty white scum appeared, wholly destitute of any green tinge, and on diluting with water, the scum became of a light reddish dirty tint.

The dried fruit with a few seeds lost 12·22 per cent. when heated to 100° C. The ash amounted to 9·74 per cent.

LAGENARIA VULGARIS, *Seringe.*

Fig.—*Rheede Hort. Mal. viii., t.* 5; *Wight Ill., t.* 105. The bottle gourd (*Eng.*).

Hab.—Cultivated throughout India. The fruit.

Vernacular.—Tumba, Belaschora-tumbi, Karwa-tumba (*Hind.*), Tikta-lau (*Beng.*), Karu-bhopala, Bhopala (*Mar.*), Shorakai (*Tam.*), Anapa-kai (*Tel.*), Gara-dudi (*Mal.*).

History, Uses, &c.—The shell of this gourd when dried is much used in the East as a vessel for holding fluids

of all kinds, and for making the native guitar or *Tambura*. The fruit often attains an enormous size, and is used as a buoy for crossing rivers and transporting baggage. Amongst the Hindus as amongst the Greeks gourds are considered to be emblematic of fecundity, prosperity, and good health. There are two varieties of the bottle gourd, a sweet one, called in Sanskrit *Alábu*, and a bitter one known as *Katutumbi*. The fruit varies much in shape. The outer rind is hard and ligneous, and encloses a spongy white flesh, very bitter, and powerfully emetic and purgative. The seeds are grey, flat, and elliptical, surrounded by a border which is inflated at the sides but notched at the apex; their kernels are white, oily, and sweet. In India the pulp in combination with other drugs is used in native practice as a purgative; it is also applied externally as a poultice. The seeds were originally one of the four cold cucurbitaceous seeds of the ancients, but pumpkin seeds are now usually substituted for them.

The Hindus administer a decoction of the leaves in jaundice; it has a purgative action.

Toxicology.—Dr. Burton Brown notices the poisonous properties of the bitter variety of this gourd, the symptoms observed being similar to those after poisoning by elaterium or colocynth.

BENINCASA CERIFERA, *Savi.*

Fig.—*Rheede Hort. Mal. viii., t. 3.*

Hab.—Cultivated throughout India. The fruit.

Vernacular.—Petha (*Hind.*), Kumra (*Beng.*), Kohala (*Mar.*), Búrda-gúmúdu (*Tel.*), Bhurun-koholun (*Guz.*), Kumbuli (*Tam.*), Kuvali (*Mal.*).

History, Uses, &c.—Dutt in his Hindu Materia Medica gives us the following account of the medicinal use of this gourd which is called Kushmánda in Sanskrit:—"The fruit is considered tonic, nutritive and diuretic, and a specific for hæmoptysis and other hæmorrhages from internal organs. It

would appear that the old Sanskrit writers were not acquainted with its peculiar action on the circulatory system by which it rapidly puts a check to hæmorrhage from the lungs. The Raja Nirghantu, the oldest work on therapeutics, gives a long account of its virtues, but does not allude to its use in phthisis or hæmoptysis. Neither does Susruta mention it in his chapters on the treatment of hæmorrhage and phthisis, though the plant is alluded to by him elsewhere. The more recent compilations, such as Chakradatta Sangraha, Sarangadhara, &c., give numerous preparations of the article; of these Khanda Kushmándaka or the confection may be taken as an example. In preparing this medicine, old ripe gourds are selected. Those not at least a year old are not approved. They are longitudinally divided into two halves, and the pulp scraped out in thin flakes by an iron comb or scraper. The watery juice that oozes out abundantly during this process is preserved, the seeds being rejected. The pulp is boiled in the juice until soft. It is then tied up tightly in a cloth, and the fluid portion allowed to drain away. The softened and drained pulp is dried in the sun, and the watery portion preserved for future use. Fifty tolás of the prepared pulp are fried in sixteen tolás of clarified butter, and again boiled in the juice of the fruit, till reduced to the consistence of honey. To this are added fifty tolás of refined sugar, and the whole is heated over a gentle fire till the mass assumes such a consistence as to adhere to the ladle. The pot is now removed from the fire, and the following substances, namely, long pepper and ginger, each two tolás, cumin seeds, cardamoms, cinnamon, folia malabathri, black pepper and coriander, each half a tolá in fine powder, are added to the syrup and stirred briskly with a ladle, till the mass is cool. Eight tolás of honey are now added to the confection, which is preserved in a new earthen pot. The dose is from one to two tolás, according to the age and strength of the patient. It is prescribed in hæmoptysis, phthisis, marasmus, cough, asthma, &c., &c."

In the Concan this preparation is made by steaming the rind and pulp cut fine, when well softened it is tied up in a cloth

and allowed to drain, saffron, nutmeg, cardamoms and melted sugar are then added.

In insanity, epilepsy and other nervous diseases the fresh juice of the fruit is given either with sugar or as an adjunct to other medicines. According to Dr. Savinge of Rajamundry it has been used with success in diabetes, 4 ozs. of the juice with 100 grs. each of saffron, and the bran of red rice, are given morning and evening and a strict diet enjoined.

The fruit of *B. cerifera* is sub-rotund, 12 to 15 inches in diameter, hairy when young, smooth with a whitish bloom when ripe.

TRICHOSANTHES PALMATA, *Roxb.*

Fig.—*Wight Ill., tt.* 104, 105.

Hab.—Throughout India. The fruit and stem.

Vernacular.—Lal-indráyan (*Hind.*), Kaundal (*Mar.*), Mákál (*Beng.*), Koratti, Shavari (*Tam.*), Avagude (*Can.*), Kakapalam (*Mal.*), Avaguda, Abuvva (*Tel.*).

History, Uses, &c.—Sanskrit writers describe Mahákála as a kind of gourd with an exterior resembling an orange, but with pulp like cowdung. Mahákala is also a name of Ganesha, the god of wisdom, the causer and remover of obstacles, the son of Shiva and Parvati. This gourd is used as a ear ornament (kundala) for the figure of Ganesha or Ganpati, which is dressed up and seated in state in every Hindu house once a year, to bring good luck to the inmates. At this season large quantities of the fruit are brought for sale in the markets. The plant and fruit are considered medicinal. According to Ainslie, the fruit pounded and intimately blended with warm cocoanut oil is considered a valuable application for cleaning and healing offensive sores inside the ears, and is also used to cure ozæna. The root is said by Wight to be used as a cattle medicine, especially in inflammation of the lungs. In the *Bengal Dispensatory* it is stated that numerous trials were made

with the fruit to ascertain whether it had purgative properties. Three grain doses thrice daily produced no sensible effect.

In Bombay the natives sometimes smoke it as a remedy for asthma. Sir T. Madava Row proposed in the Indian papers (1888) this remedy for the Crown Prince of Germany.—"Take the external cover of the fruit of *T. palmata*, powder it, and inhale the smoke of it, like that of tobacco. Do this three times a day for three days. This is found in an important work in Sanskrit on medicine." The root with an equal portion of colocynth root is rubbed into a paste and applied to carbuncles; combined with equal portions of the three myrobalans and turmeric, it affords an infusion which is flavoured with honey and given in gonorrhœa. *T. palmata* is supposed by some to be the *Hanzal ahmar* or red colocynth of Mahometan writers.

Description.—The fruit is round, oval, or pyriform, the size of a small apple, crimson when fresh, of a dull orange colour when dry, marked at one end by a deep cicatrix with sharp raised edges, at the other there is a prominence to which a portion of the stalk sometimes remains attached. In the dry fruit, which has a thin, brittle, very bitter shell, the segments of pulp with their seeds are loose, so that the contents of the gourd rattle. If a dry segment be soaked in water it soon softens, yielding a dark green pulp which smells like savine, and has an acrid and bitter taste. The seeds, ranging in number from 60 to 100 in each fruit, are flat, but very irregular in shape, generally somewhat triangular, and average 7-16ths of an inch in length; they have a hard blackish shell, and sweet oily kernel. The vine is perennial, often as thick as a man's arm; it has a warty grey bark, marked by seven deep longitudinal fissures, which correspond to the medullary divisions between seven wedge-shaped woody and vascular bundles into which the stem is divided. The vine is not bitter.

Chemical composition.—The rind and pulp of the fruit contain an amorphous bitter principle soluble in water and alcohol, and very slightly in ether. It gives an abundant precipitate with tannin and reduces Fehling's solution. Sulphuric acid forms

at first, a yellow solution passing to orange red and purple. Fröhde's reagent colours it first orange, then reddish brown, and finally greenish brown. The bitter principle resembles to some extent colocynthin, and the name "*trichosanthin*" is proposed for it. The fruits when being burnt, and when decomposing in moist situations, give off large quantities of ammonia.

The green pulp in the interior of the fruit in which the seeds are embedded, contains a colouring matter which has more of the red in its fluorescence than chlorophyll, and its spectrum shows a different arrangement of bands than is seen in the usual green colouring matter of plants. Prof. Michie Smith (*Proc. Roy. Soc. Edin.* 1890), comparing the absorption spectra of this colouring matter with chlorophyll, finds in the former two very dark bands, one in the red extending from near C to about half way between C and D, the other in the yellow on the more refrangible side of D. There are two other fainter bands, one on each side of E. The action of hydrochloric acid and ammonium sulphide upon the colouring matter alters the spectrum in a characteristic manner that completely distinguishes it from chlorophyll.

Toxicology.—Roxburgh informs us that the fruit is reckoned poisonous. The Madras Chemical Examiner (1888) reported: "A woman who is said to have eaten the seeds (fruit?) of this plant with suicidal intent, suffered from vomiting, purging, and griping, and died collapsed. No alkaloid was found in the viscera, and a portion of the fruit was found non-poisonous with a guinea-pig."

TRICHOSANTHES DIOICA, *Roxb.*

Hab.—Throughout the plain of North India, Guzerat to Assam, Bengal.

TRICHOSANTHES CUCUMERINA, *Linn.*

Fig.—*Rheede Hort. Mal. viii., t.* 15. Sabino (*Port.*), Kalpert (*Dutch*).

Hab.—Throughout India and Ceylon. The plant in fruit.

Vernacular.—Jangli-chichonda, Palwal (*Hind.*), Patol, Bonpatol (*Beng.*), Rán-parval, Karu-parval (*Mar.*), Parwar (*Guz.*), Kattup-pepudal (*Tam.*), Chyad-potta (*Tel.*), Gwal-kakri (*Punj.*), Dummaala (*Cingh.*), Padavalam (*Mal.*).

History, Uses, &c.—In Northern India, Bengal and Guzerat the fruit of *T. dioica* is considered to be the Patola of Sanskrit writers, and in Western and Southern India, where *T. dioica* is not found, *T. cucumerina* is used as Patola. Patola or Patolaka, "shaped like a muscle shell," is a medicine in great repute amongst the Hindus as a febrifuge and laxative in bilious fevers, the decoction of the whole plant being administered in combination with other bitters. It is also considered to purify the blood and remove boils and skin eruptions; aromatics may be added to the decoction. The following prescription from Chakradatta may be taken as an example:—Take of Patola, Tinospora, Cyperus, Chiretta, Neem-bark, Catechu, Oldenlandia, Root bark of Adhatoda, equal parts, in all two tolas (360 grains), and prepare a decoction which is afterwards to be boiled down to one-fourth, and taken in divided doses during 24 hours. The drug is also administered in combination with Turbith as a drastic purgative in jaundice and dropsy; the *Patoladya churna* is a compound purgative powder of this kind. Both of these plants are found in a wild and in a cultivated condition; for medicinal purposes, the wild plants are used, the cultivated fruits, though still bitter, are favourite vegetables with the Hindus and exert a mild aperient action when freely eaten.

Mahometan writers describe the plant as cardiacal, tonic, alterative and antifebrile, and say that it is a useful medicine for boils and intestinal worms. The author of the Makhzan remarks that the Hindus in obstinate cases of fever infuse 180 grains of the plant with an equal quantity of Coriander for a night, and in the morning add honey to it and strain the liquor; this quantity makes two doses, one of which is taken in the morning and one at night. In the Concan the leaf juice is rubbed over the liver or even the whole body in remittent fevers. In Guzerat the fruit of the cultivated *T. dioica* is

steamed, stuffed with spices, fried in melted butter, and eaten with wheaten bread as a remedy for spermatorrhœa. Ainslie, under the name of *T. laciniosa*, notices the use of *T. cucumerina* as a stomachic and laxative medicine among the Tamools, and says it is the Patola of Southern India. Rheede gives the following account of its medicinal properties:—"Decoctum cum saccharo sumptum, digestioni confert, tormina intestinorum, ac alios ventris dolores sedat, phlegmata expectorat, pectoris angustiam tollit; febres minuit, humores attemperat, vermes enecat. Succus expressus idem præstat et vomitum provocat. Radicis succus ad quantitatem duarum unciarum epotus, valde purgativus est, in ipsa accessione februm quotidianarum ac quartanarum ex pituita provenientium, frigus vel diminuit vel in totum tollit, per vomitum scilicet: stipes in decocto datus phlegmati expectorando conducit: fructus quaquo modo sumpti tumores expellunt."

From our observation of the action of these plants we cannot find that they differ in any way from colocynth; like that drug they require to be combined with aromatics to prevent griping. Their febrifuge action appears to depend upon their purgative properties.

Description.—*T. dioica*—Stems twining, more or less woolly and scabrous. Leaves 3 by 2 in., harsh, sinuate-dentate, not lobed; petiole ¾ in.; tendrils 2-fid. Male peduncles in pairs. Calyx-tube 1¼ in., narrow. Fruit 2 to 3½ in., oblong, acute, orange-red. Seeds ⅜ to ½ in., half-ellipsoid, compressed, corrugate on the margin. Plant dicœcious.

T. cucumerina—Stems twining, more or less pubescent. Leaves 2 to 4 in., usually 5-lobed about half-way down, lobes obtuse, or if acute not acuminate; petiole ¾ in.; tendrils 2-fid. Male peduncles in pairs, often racemed. Calyx-tube 1 inch. Fruit 1 to 4 in., oblong, acute, red. Seeds ¾ to ½ in., half-ellipsoid, compressed, corrugate. Plant dicœcious. (*Fl. Br. Ind.*)

MOMORDICA DIOICA, *Roxb.*

Fig.—*Wight Ic., tt.* 505, 506; *Rheede, Hort. Mal. viii.*, 12.

Hab.—Throughout India The tubers.

Vernacular.—Kirara, Dhár-karela (*Hind.*), Karantoli (*Mar.*), Palupaghel-kalung (*Tam.*), Agokara, Angakara (*Tel.*), Erimapavel (*Mal.*), Madahagala (*Can.*).

Uses, Description, &c.—The muricated fruit of this plant is called Váhasa by Sanskrit writers, that of the wild plant is extremely bitter, but under cultivation it loses much of its bitterness and is commonly used as a vegetable. The fruits burst irregularly when ripe showing the red arillus of the seeds, which are black, shining, and almost spherical. The plants are male and female, and have rather large yellow blossoms. The tubers of the female plant are the largest, and are used medicinally. Rheede says that the plant is truly cephalic, for mixed with cocoanut, pepper, red sandal, and other ingredients, and applied in the form of liniment, it stops all pains in the head. Ainslie notices the use of the root by Hindu doctors in the form of electuary in cases of bleeding piles, and in certain bowel affections connected with such complaints, the dose being about 2 drachms or more twice daily. In the Concan the juice of the root is a domestic remedy for the inflammation caused by the contact with the urine of the House-lizard. The roots, which often weigh a pound or more, much resemble a turnip, but are more elongated; they are of a yellowish-white colour, and marked externally with whitish, raised circular rings; the taste is astringent.

Chemical composition.—The air-dried roots lost 72·78 per cent. when heated to 100° C., and afforded 3·42 per cent. of ash. The ash contained a slight trace of manganese.

The coarsely-powdered roots were exhausted with 80 per cent. alcohol; from the resulting tincture most of the alcohol was distilled off, and the remainder allowed to evaporate by exposure to the air. During evaporation a deep yellow oily looking matter separated, and the liquid gelatinized. The alcoholic extract was somewhat bitter, and left an unpleasant metallic taste in the mouth. By the addition of water the extract was converted into a turbid orange yellow mixture, which was agitated with petroleum ether.

The petroleum ether extract was of a light yellow colour, soft, non-crystalline, and possessed a fragrant odour similar to that of methyl salicylate. In ether it was wholly soluble; and with the exception of a few white flocks it was also soluble in absolute alcohol, with acid reaction. In cold aqueous caustic soda it was insoluble, but when gently warmed a portion dissolved, and the liquid assumed a deep orange colour; the addition of an acid to the alkaline solution caused a milkiness: during digestion with the caustic soda solution a very fragrant odour was noticed. The agitation of an ethereal solution of the petroleum ether extract with dilute hydrochloric acid, afforded traces of an alkaloid.

The aqueous residue after treatment with petroleum spirit was agitated with ether. The ethereal extract was yellowish, soft, indistinctly crystalline, and had an odour similar to that noted in the petroleum ether extract. In water the extract was partly soluble with strongly acid reaction, and the solution gave marked indications of the presence of an alkaloid; with ferric chloride the solution gave a dirty violet-reddish coloration. The residue insoluble in water was yellowish, and partly soluble in ammonia with yellow coloration: the insoluble residue was whitish. The addition of acids to the ammoniacal solution caused the precipitation of white flocks.

The original aqueous solution after separation of ether was rendered alkaline with carbonate of soda and agitated with ether; the ethereal extract amounted only to a trace, but afforded indications of an alkaloid with the usual reagents: no special colour reactions were noted.

After separation of ether, the aqueous alkaline residue was acidified with acetic acid and agitated with acetic ether: the extract thus obtained was reddish, and partly gelatinized on evaporation: it was partly soluble in acetic acid, a turbidity being produced by dilution with water.

In order to ascertain whether a purgative principle was present or not, an alcoholic extract from 10 grams of the root was rubbed up with water and injected into a cat's stomach, no purgative action was produced, and with the exception of an

attack of vomiting one hour and ten minutes after administration of the drug, no symptoms appeared to be induced.

MOMORDICA COCHINCHINENSIS, *Spreng.*

Fig.—*Bot. Mag.*, *t.* 5145.

Hab.—Bengal to Tenasserim, Deccan Peninsula, Canara. The seeds.

Vernacular.—Kakrol (*Hind.*, *Beng.*).

History, Uses, &c.—The seeds after the shells have been removed are fried and eaten either alone or with other food. (*Makhzan.*) They are considered to be good for cough and pains in the chest. Powdered they form one of the ingredients of the hot stuff known as *Jhál* in Bengal, which, mixed with melted butter, is given to women immediately after parturition, and daily for a few days afterwards. *Jhál* is believed to act as a stimulant, destroying the excess of phlegmatic humours which are supposed to be produced in the body after delivery. (*C. L. Bose.*) A plaster made with the roots is said to promote the growth of the hair, and prevent its falling off. The plant is called in Sanskrit Karkataka, from the resemblance of the seeds to the shell of a crab. This plant is the *Muricia cochinchinensis* of Loureiro, who says that the berries are used for colouring food, and that the seeds and leaves are aperient and abstergent and useful in hepatic and splenic obstructions, in unhealthy ulcerations, lumbago; and externally in *procidentia uteri et ani*, fractures and luxations of the bones.

Description.—The seeds are $\frac{7}{8}$ by $\frac{5}{8}$ of an inch in diameter, and $\frac{1}{3}$ of an inch thick, ovate, compressed, black; corrugated on the margins and sculptured on the faces. The shell is fragile, and encloses an oily kernel.

Chemical composition.—Kakrol seeds deprived of their husks yielded 43·74 per cent. of a slightly greenish oil when treated with light petroleum ether. The oil possessed very powerful siccative properties; smeared in a thin layer on a glass plate,

and exposed to a temperature of 100° C., in the course of an hour the oil assumed a translucent white appearance, and could be scraped off the glass as a white powder which, when boiled with petroleum ether, yielded only a trace of soluble matter, consisting of oil. Exposed to the air without being heated, in 24 hours a thin layer presented numberless little white cauliflower like masses, while a portion of the oil assumed an arborescent pattern on the glass. After saponification of the oil, and decomposition of the soap, the separated fatty acids had a melting point of 48°—49° C.

In addition to oil, a very slightly bitter glucoside was present, which afforded no special colour reactions with reagents.

MOMORDICA CHARANTIA, *Linn.*

Fig.—*Bot. Mag., t.* 2455; *Wight Ic., t.* 504; *Bot. Reg., t.* 980.

Hab.—Throughout India. The fruit.

Vernacular.—Karela (*Hind.*), Kárálá (*Mar.*), Paya-kai, Pávakkapchedi (*Tam.*), Kákara-chettu (*Tel.*), Karala (*Beng.*).

Muricated var., Uchchhe (*Beng.*), Hagala (*Can.*).

Description, Uses, &c.—There are two chief varieties differing in the form of the fruit, the one being longer and more oblong, and the other smaller, more ovate, muricated and tubercled. There are besides many intermediate gradations. The fruit is bitter but wholesome, and is eaten by the natives. It requires, however, to be steeped in salt water before being cooked; the smaller variety is most esteemed. (*Drury.*) From Rheede, Wight and Gibson we learn that the Hindus use the whole plant combined with cinnamon, long pepper, rice and the oil of *Hydnocarpus Wightiana*, as an external application in scabies and other cutaneous diseases. The fruit and leaves are administered as an anthelmintic, and are applied externally in leprosy. One-eighth of a seer of the juice of the leaves is given in bilious affections, as an emetic and purgative, alone or combined with aromatics; the juice is rubbed in, in