The amylic alcohol extract consisted of a dark brown strongly acid glucosidal acid, soluble in water, and forming soluble compounds with alkalies, astringent matter giving a dirty greenish coloration with ferric chloride, and dark brown flocks insoluble in water, probably phlobaphene.

We injected ·495 of a gram of the amylic alcohol extract dissolved in water and a few drops of ammonia, into a fasting cat's stomach without inducing purgative effects. In another experiment we employed the dried leaves, which were extracted with alcohol, then dried, moistened with dilute sulphuric acid, and extracted with hot alcohol in the manner described by Stockman in his note on the active principle of Senna leaves (*Pharm. Journ.* [3] XV., 749). Operating in this manner we isolated a glucosidal acid which had some purgative action when injected into a cat's stomach, and which a more thorough investigation may prove to be similar to cathartic acid. The point is of some economic importance, as the plant is a very common one, and has the reputation of being a valuable cathartic.

CARISSA CARANDAS, *Linn.*

Fig.—*Wight Ic., t.* 426 and 1289; *Roxb. Cor. Pl. I., t.* 77; *Bedd. Fl. Sylv., t.* 19, *f.* 6.

Hab.—Throughout India, in dry, sandy or rocky ground.

The bark, leaves and fruit.

Vernacular.—Karaunda, Karonda, Timukhia (*Hind.*), Kurumia, Karamcha (*Beng.*), Karavanda (*Mar.*), Kalaka (*Tam.*), Kalivi-kaya (*Tel.*), Karekai, Korinda (*Can.*), Karamada (*Guz.*).

History, Uses, &c.—This shrub is the Karamardaka and Krishna-phala of Sanskrit writers, and is described in the Nighantas as heavy, hot, and acid when unripe, and a generator of the three humors; when ripe it is said to be sweet, light, and digestive, and an expellant of bilious and rheumatic humors. The fruit is generally made use of by both Europeans and natives

on account of its acid and antiscorbutic properties; when unripe it makes a good pickle and when ripe an excellent tart fruit. A jelly, similar to red currant jelly, is also made from it by Europeans. In Orissa a decoction of the leaves is much used at the commencement of febrile complaints. The root is acrid and bitterish, and is applied in the form of a paste with lime-juice and camphor as a remedy for itch and to keep off flies.

Description.—A large shrub, with many dichotomous, rigid, spreading branches; axils and nodes with two simple or forked thorns, sometimes 1 to 2 inches long. Leaves subsessile, 1½ to 3 by 1 to 1½ in., rather thinly coriaceous, base rounded or retuse, tip rarely mucronate. Drupes ½ to 1 in. long, ellipsoid, turning from green to red, then black, polished, four or more seeded. The root-bark is remarkable for its numerous large stone cells, often more than an inch in length, which form a network round the wood.

Chemical composition.—The roots were air-dried, reduced to powder, and digested with 80 per cent. alcohol. The alcohol-free extract was mixed with water, dilute sulphuric acid added, and agitated with benzole, which separated an oil of the consistence of honey at 75° F., and partly soluble in absolute alcohol with acid reaction. A trace of volatile oil was also present, with an odour similar to that of Piper Betle leaf oil. During agitation with benzole a mass of dark-yellowish resin separated, which caked. The liquid containing the separated resin was next agitated with ether. The ether extract was not more than a trace, and contained salicylic acid. The insoluble mass of resin was now separated, and the aqueous solution rendered alkaline and agitated with ether. The ether extract contained an alkaloid which gave marked precipitates with the usual reagents. The dark brown yellowish resin, insoluble in ether and benzole, was wholly soluble in ammonia, and on spontaneous evaporation left a brittle residue. The ammoniacal solution when freshly made was yellow, but on standing became green, and on spontaneous evaporation the solid residue was brownish.

PLUMERIA ACUTIFOLIA, *Poir.*

Fig.—*Wight Ic. t.* 471; *Bot. Mag. t.* 2952; *Bot. Reg. t.* 114. Jasmine tree. (*Eng.*), Frangipanier (*Fr.*).

Hab.—Uncertain. Cultivated throughout India. The bark and flowers.

Vernacular.—Khair-champa, Sufed-champa (*Hind.*), Gobarchampa (*Beng.*), Dolo-champa (*Guz.*), Khera-chapha (*Mar.*).

History, Uses, &c.— This plant is the *Flos convolutus* of Rumphius (vi. 43), who states that it is not used medicinally in Amboyna, but remarks that its juice partakes of the nature and properties of Gamboge. It appears to have been introduced into India by the Portuguese from Brazil, as it is usually planted in the churchyards of the native Christians, in order that it may deck the graves with its white deciduous flowers, which are produced almost all the year round. The Hindus make use of its flowers in religious ceremonies, and have given the Sanskrit name of Kshira-champa, "milky Champa," to the shrub. Mir Muhammad Husain describes the tree under the name of A'chin (آچن), and states that the root-bark is a strong purgative, and also a useful remedy in gonorrhœa and for venereal sores. He recommends buttermilk to be given in cases of excessive purgation after its use. Plasters made of the bark are said to be useful in dispersing hard tumours.

The natives of India frequently use the bark as a purgative and apply the heated leaves to dispel swellings, and the milky juice as a rubefacient in rheumatic pains, and with sandal-wood oil and camphor to cure itch.

The flower buds are eaten with Betel leaves as a febrifuge. Dr Hové, who visited Bombay in 1787, found the plant growing abundantly on Malabar Hill, which was then uninhabited. He remarks that the natives use it in intermittents as we do Cinchona.

Dr. A. J. Amadeo (*Pharm. Journ.*, April 21st, 1888,) has the following account of its medicinal uses in Porto Rico:—"In small doses (8 to 12 grains) given in emulsion the milk produces abundant bilious watery stools. The bark is a favourite remedy with the country people for gonorrhœa and gleet. Two ounces of the fresh powdered bark is placed in 8 pints of *eau sucrée* and exposed to the sun for four days, being shaken occasionally. A wineglassful is administered four or five times a day, together with refreshing and mucilaginous drinks, and the use of tepid baths. The action of the drug is at first purgative, afterwards diuretic. An extract of the bark may be used beginning with 3—4 grains daily to be gradually increased to 14 or 15 grains, or a wine (1 oz. to 1 litre) may be given in liqueur glassfuls three times a day. The decoction of the bark is a powerful antiherpetic.

Chemical composition.—The milky juice collected by de Vrij and evaporated to dryness at 100°, was found to yield 30·5 per cent. of residue, consisting chiefly of an organic calcium salt, a kind of caoutchouc, and resins. To isolate the calcium salt A. C. Oudemans exhausted the substance with petroleum-naphtha, and treated the residue with dilute acetic acid, which dissolved the salt, while parts of the plant and a humus-like mass remained behind. On concentrating the solution, calcium salts of different forms separate out, all, however, containing the same acid, *Plumieric*, $C^{10}H^{10}O^5$.

The free acid is obtained by converting the calcium salt into potassium plumierate, decomposing the latter with sulphuric acid, and extracting the solution with ether. It is readily soluble in alcohol and freely but slowly in ether. In cold water it dissolves but very sparingly, and from a hot solution it separates in microscopic crystals, or on slow evaporation in indistinct crusts. It melts at 139°, and decomposes at a temperature a few degrees higher, giving off first water and acetic acid, then an oily distillate having the odour of cinnamic aldehyde, while a small quantity of a crystalline substance sublimes. When the oil is oxidised, a crystalline acid is

formed. On melting plumieric acid with potash, an acid is formed, giving the characteristic reactions of salicylic acid.

Plumieric acid is most probably a methoxyl-hydroxycinnamic acid ($C^6H^2(OH)^2(CH^2OH)(COOH)$), and forms four series of salts, according as only the carboxylic hydrogen, or in addition one or more of the three hydroxylic hydrogens, is replaced by a metal, when plumieric acid is oxidised by a dilute solution of chromic acid, it is redissolved into formic acid (or carbon dioxide) and the acid $C^9H^8O^4$, which is very sparingly soluble in water; its silver salt, $C^9H^5Ag^3O^4$, separates from a warm solution in fibrous crystals.

When plumieric acid is heated with water and sodium amalgam on a water bath, it combines slowly with hydrogen to form hydroplumieric acid, $C^{10}H^{12}O^5$, which on evaporation of its ethereal solution, separates as a varnish, becoming crystalline on standing, and freely soluble in water. (*Watts' Dict. of Chem.* viii., p.1656.)

Toxicology.—The use of this bark as a purgative is not without danger, as several cases of death from excessive purging after its use have been recorded. In a case reported in 1886, by Surgeon K. R. Kirtikar (*Trans. Bombay Med. and Phys. Soc.*) the quantity taken was about a square inch; this was pounded, mixed with water, and swallowed by a man aged 25 as a remedy for colic. The symptoms were vomiting, depressed heart's action, and somewhat dilated pupils. S. Arjun (*Bombay Drugs*, p. 210,) states that the blunt ended branches are used to procure abortion. We are not in a position to state whether plumieric acid is the active principle or not.

Ichnocarpus frutescens, *Br. Wight Ic. t.* 430; *Burm. Zeyl.*, *t.* 12, *f.*1, is an extensive climber. Leaves very variable, 2 to 3 by ¾ to 1½ inch, petiole ¼ inch, cymes 1 to 3 inches, axillary and in terminal panicles, rusty-pubescent, branches short, trichotomously divided or 3-flowered, pedicels longer or shorter than the corolla, calyx-lobes ovate, obtuse or subacute, eglandular. Corolla about ¼ inch in diameter,

purplish, twice as long as the calyx, lobes twice as long as the tube, falcate, acuminate, mouth and margins sparingly bearded. Disc-glands, 5, erect, slender, capitate, much longer than the hairy ovary. Style very short. Follicles 3 to 6 by ¼ inch, very slender, cylindric, curved, acute. Seeds ½ inch, very slender, not beaked; coma scanty, white. (*Fl. Br. Ind.*) The plant is described by Roxburgh (*As. Res.* 1,261) under its native name of *Syama* or *Syamalata*; it is a native of the Western Himalaya, Upper Gangetic Plain, Bengal, the Deccan Peninsula and the Southern Concan. In the Northern Concan and Guzerat it appears to be unknown. In Hindustan and Bengal it is known as Syamalata, "black-creeper," and in the Deccan Peninsula as Krishna-sáriva; the Canarese name is Kari-umbu, "black-creeper."

The roots are somewhat similar in appearance to those of Hemidesmus, but have not the same coumarin odour. The bark is of a dark brown colour, and adheres closely to the wood, which is much harder, and differs in structure from that of Hemidesmus in having a large central pith. The roots are seldom branched, but here and there a few fine fibres are given off; they are almost tasteless. For the properties and uses of this plant, the reader is referred to Hemidesmus.

Chemical composition.—The root contains a caoutchouc-like substance soluble in benzol, and a soft, brown, tenacious resin soluble in ether. Treated with alcohol the powdered root affords about 10 per cent. of dry extract, containing red colouring matter, tannic acid, and a small quantity of coumarin. The tannic acid strikes a green colour with ferric chloride, and if to this green mixture a drop of soda solution is added, a bright blue zone is seen to surround the red coloured spot formed by the alkali. This reaction is peculiar to cinchotannic acid. No alkaloidal body could be detected in this drug.

Vinca pusilla is the Kupa-veela of Rheede (*Hort. Mal.* ix. 33), who states that the plant boiled in oil is rubbed on the loins in lumbago.

ASCLEPIADEÆ.

CRYPTOSTEGIA GRANDIFLORA, *Br.*

Fig.—*Bot. Reg., t.* 435; *Wight Ic., t.* 832, and *Ill.* ii., *t.* 182, *f.* 9; *Reichb. Ic. Exot., t.* 132.

Hab.—Africa or Madagascar. It is cultivated and has run wild in various parts of India.

Vernacular.—Viláyati-vákhandi (*Mar.*), Palai (*Mal.*).

History, Uses, &c.—This ornamental climbing shrub has been named *Vilayati-vákhandi*, "foreign Vakhandi," by the Marathas from the resemblance of its foliage to that of *Gymnema sylvestre* (Vákhandi).

It has attracted attention on account of a caoutchouc prepared from its milky juice at the botanic garden, Hyderabad, Sind, in 1882. (See *Watts' Dict. Econ. Prod. of India* ii., p. 625). We notice the plant as a case of poisoning by its leaves has been reported in the Bombay Chemical Analyser's Report for 1877-78. In this case the pounded leaves mixed with water are said to have been swallowed. Persistent vomiting came on half-an-hour afterwards, and the patient—a male adult—died in fifteen hours, apparently from exhaustion. There was no purging, and no head symptoms were present.

Description.—An extensive climbing shrub, leaves 3—4 by 1½ to 2 in., coriaceous, glossy above, nerves many, spreading, arched, faint, base acute; petiole ½ to ⅔ in.; cymes short, spreading, peduncles and branches stout, hoary or glabrous; bracts caducous; corolla pale pinkish purple, tube and throat 1½ in. long, limb often 2 in. diam., lobes acute; follicles 4—5 by 1—1½ in., broadest near the base, straight, woody; seeds ¼ in. long, oblong-ovate, compressed, narrowed upwards; coma 1½ in., very fine. (*Fl. Br. Ind.* iv., p. 6.)

Chemical composition.—The leaves contain a caoutchouc-like body (described by Warren—See *Watt's Dict. Econ. Prod.* Vol. ii., p. 625,) and afford 14·5 per cent. of ash. The aqueous solution of an alcoholic extract is coloured green with ferric chloride, precipitated yellow with plumbic acetate and strong alkalies, and is unaffected by tannin, alkaloidal reagents and gelatine. Evaporated portions were crystalline, and dissolved with evolution of gas in strong sulphuric acid with an orange colour, turning brown when heated. The solution when saturated with ether and allowed to stand with an excess of the ether, threw out a number of crystals on the sides of the vessel. These crystals appeared white in the presence of the mother liquor, but when removed by filtration and washed, they had a slight yellow tinge. They were soluble in alcohol, but sparingly so in ether and water, and insoluble in benzol and chloroform. Alkalies and lime and baryta water dissolved them with a yellow colour, and a soluble compound was formed with magnesia. No colour was given with ferric salts unless the substance was previously neutralized, and then a green solution was produced. The crystals dissolved with a yellow colour in sulphuric acid discharged on dilution with water, and in nitric acid with a transient red brown colour. The crystals were acid in reaction and blackened steel when left in contact with it; they melted at 168° C. The mother liquor turned green and precipitated with ammonia, and showed evidence of a large amount of glucose by readily reducing Fehling's solution.

The leaves were powdered and given to animals to test their alleged poisonous properties. 5 to 10 grain doses were given to several chickens, 2 grams was given to a dog, and 5 grams, representing 20 leaves, was given to a fowl, with no results whatever in either case. The inspissated aqueous extract from 20 grams of the leaves was administered to a guinea pig without affecting its health. We must therefore conclude that the leaves are not poisonous, and could not have been the cause of the persistent vomiting in the case reported by the Bombay Chemical Analyser.

ASCLEPIAS CURASSAVICA, *Linn.*

Fig.—*Bot. Reg.*, *t.* 81. Bastard Ipecacuanha (*Eng.*), Asclepiade de Curaçao (*Fr.*).

Hab.—West Indies. Introduced into India.

Vernacular.—Kurki (*Mar.*), Kakatundi (*Hind.*).

History, Uses, &c.—This perennial herb is indigenous to South America and the West Indies, where, in common with several other species of Asclepias, it is known as Milkweed, Silkweed or Wild Cotton. All of these plants have properties similar to Calotropis. The root of *A. curassavica* is employed in the West Indies as an emetic, and the milky juice which, when dry, forms a tough adhesive pellicle, is used to close wounds and excoriations of the skin. In Martinique the plant is called *Ipecacuanha blanc*, and in Guadaloupe *Herbe á Madame Boivin*, and the root is used in the same doses as Ipecacuanha. Introduced into India as a garden plant it has now run wild in many places, but, as far as we know, is not used medicinally by the natives.

Dr. Guimaraës (*Times and Gazette*, 1831, p. 661,) found it to act directly upon the organic muscular system, and especially upon the heart and blood vessels, causing great constriction of the latter and distension of the larger arteries. Secondarily it occasioned great dyspnœa, vomiting and diarrhœa.

Description.—Root-stock short, abruptly divided into numerous thin, pale yellowish-brown, and internally whitish rootlets. The bark is thin, and when fresh exudes a milky juice; taste bitter and somewhat acrid. A section of the root bark placed under the microscope shows from without inwards—1*st*, a suberous layer; 2*nd*, several rows of large cells containing conglomerate raphides, with starch and granular matter; 3*rd*, a vascular zone, two or three large dotted vessels being situated at the cambium end of each medullary ray, where it projects into the bark.

The plant may be easily recognised by its oleander-like leaves, and red and orange flowers in terminal bunches. The follicles are like radish pods.

Chemical composition.—Dr. Gram (*Archiv. f. exp. Path. u. Pharm.* xix., 384,) has found the plant to contain an active principle of a glucosidal character, which he has named *asclepiadin*, and appears to consider a purer form of the asclepiadin of Harnack and the *asclepin* of Feneulle. This substance was yellowish, amorphous, and when freshly prepared very soluble in water; but either in solution or in a dry state it quickly decomposed, sugar being separated, and the residual compound becoming in proportion insoluble in water and inert. From an ethereal solution crystals gradually separated out, apparently identical with List's *asclepione*, and quite inactive physiologically.

The physiological action of the unaltered asclepiadin was found to closely resemble that of emetin, but in view of the instability of the compound, Dr. Gram doubts whether it can be advantageously introduced into medicine.

Asclepione, $C^{40}H^{34}O^{6}$, was discovered by C. List in the milk sap of *Asclepias syriaca*. (*Gmelin Handb.* 17, 368.) Feneulle separated a resinous substance and a bitter principle (asclepin) from *Asclepias Vincetoxicum*. (*J. Pharm.* 11, 305.)

CALOTROPIS GIGANTEA, *R. Br.*

Fig.—*Wight Ill., t.* 155; *Griff. Ic. Pl. As., t.* 397, 398. Gigantic Swallowwort (*Eng.*), Arbre a soie (*Fr.*).

Hab.—Throughout India, Malay Islands, S. China.

CALOTROPIS PROCERA, *R. Br.*

Fig.—*Wight Ic., t.* 1278; *Bentl. and Trim., t.* 176

Hab.—W. and Central India, Ava, Persia to Africa. The root bark, milky juice and flowers.

Vernacular.—Ak, Madár (*Hind.*), Akanda (*Beng.*), Akra, Rui (*Mar.*), Erukku, Yercum (*Tam.*), Jilledu-chettu, Mandáramu (*Tel.*), Akado (*Guz.*), Ekke-, Yakke-gida (*Can.*)

History, Uses, &c.—Calotropis is mentioned by the earliest Hindu writers, the leaves, *arkapattra*, *arkaparna*, "sun leaf" or "lightning leaf," so called from their cuneiform shape, were used in Vedic times in Sun-worship. According to the Shatapatha Bráhmana every part of the human form was supposed to be represented in the different parts of the plant, nevertheless it would appear to have been dreaded (*Panchatantra* i. 57), and was supposed to blind those who approached it. (*Mahabhárata* i. 716.) These myths appear to have arisen from the Hindus attributing to the plant the properties possessed by lightning and the sun's rays. (*De Gubernatis.*) As a medicine Calotropis is noticed by Susruta and other medical writers, some of whom mention two varieties, *arka*, and *alarka*, "a white-flowered kind." Calotropis bears many synonyms in Sanskrit, such as Rudra, Aditya, Suryapattra and Mandára, from the last of which is derived the vernacular form Madár.

In Western India, and probably elsewhere, there is a curious superstition that a leaf of the Akra (Arka) fetched from the tree with certain ceremonies is of use in tedious labour. The friends of the woman take a packet of betelnut and leaf and a piece of money, and proceed to the plant, which they address in the most respectful manner, placing the betel packet at its root and asking for the loan of one of its leaves, which they promise to return shortly. They then take away a leaf and place it upon the head of the parturient woman, where it remains for a short time, and is afterwards returned to the plant. This practice appears to be connected with the worship of the Maruts or winds, demigods subject to Rudra, to whom these plants are sacred. The Maruts are worshipped on Saturday with a garland of the flowers. The twigs are used as *samidhas*, and the leaves are used by some in the *shati puja* to propitiate the goddess of parturition. Calotropis is also the *kul* or *Arbor generationis* of the Bhandári caste, whose business it is to tend the palm gardens and extract the juice of the trees. Another custom general amongst all castes of Hindus is that a man who has lost three wives must make his fourth marriage with

the Arka tree, after which he may take a fourth human wife. The object of this seems to be to transfer the man's ill-luck to the plant. The ancient Arab tribes appear to have held superstitious notions about Calotropis, probably connected with Sun-worship. *C. procera* was first described by Abu Hanifeh *circa* 270 A.H. in his Book of Plants. From the Kámus and the Táj-el-arús we learn that Ushar was used by the Arabs in the Time of Ignorance along with سلع (salaa) in the practice called تسليع (tasliaa) which was observed in time of drought or barrenness of the earth. It consisted in tying the dried plants to the tails of wild bulls, setting fire to them, and driving the animals down from the mountains, seeking to obtain rain by the flame of fire, which was likened to the gleaming of lightning. The *Salaa* from Abu Hanifeh's description appears to have been a kind of Cuscuta. According to the Burhan, عشر (ushr) is a Persian name for all plants having a milky juice, and especially for the plant known in Hindustan as Ák. It would therefore seem that Ushar is not an Arabic word, as generally stated in the Dictionaries, but of Arian origin, and perhaps connected with the Sanskrit verb उष् to burn. The wood is considered to make the best charcoal for the preparation of gunpowder, and Ushar silk خرنق is used to stuff cushions by the Arabs, and also to make tinder (makhad), called by the Tartars yálish. Ibn Sina notices Ushar, and an exudation obtained from it called Sakar-el-ushar; he also mentions a superstitious notion that it is fatal to sit under the tree. The author of the Minháj describes Sakar-el-ushar as a gum which exudes from the inflorescence of the plant and gradually hardens. (He remarks that people say that it is a dew which falls upon the plant and concretes like manna.). Some medical writers confound it with Sakar-el-tighál. Abu Hanifeh and the author of the Obáb describe it as an exudation from the flowering parts of the plant. The best authorities describe its properties as similar to those of the juice of the plant, it would therefore seem to be nothing more than an exudation of the juices of the plant which naturally contain some sugar. Calotropis is not mentioned by Greek or Roman writers, but some Mahometans give *Hejakiyus* as its

Yunani name; this appears to be a corruption of the word ἰγιάθεος, "most holy," or "under divine protection," and was probably applied to the plant by some of the Syrian physicians who instructed the Arabs in Greek medicine. The modern Persians call *C. procera* Khark and Darakht-i-zahrnàk, or "poison tree."

By Hindu physicians the root bark is said to promote the secretions and to be useful in skin diseases, enlargements of the abdominal viscera, intestinal worms, cough, ascites, anasarca, &c. The milky juice is regarded as a drastic purgative, and caustic, and is generally used as such in combination with the milky juice of *Euphorbia neriifolia*. The flowers are considered digestive, stomachic, tonic and useful in cough, asthma, catarrh and loss of appetite. The leaves mixed with rock salt are roasted within closed vessels, so that the fumes may not escape. The ashes thus produced are given with whey in ascites and enlargements of the abdominal viscera. The following inhalation is prescribed for cough: Soak the powdered root bark of Arka in its own milky juice and dry. Bougies are then prepared from the powder, and their fumes inhaled. The root bark, reduced to a paste with sour conjee (rice vinegar), is applied to elephantiasis of the legs and scrotum. The milky juices of *C. gigantea* and *Euphorbia neriifolia* are made into tents with the powdered wood of *Berberis asiatica*, for introduction into sinuses and *fistulæ in ano*. The milky juice is applied to carious teeth for relief of pain." An oily preparation (*Arka taila*) made by boiling together 8 parts Sesamum oil, 16 parts Calotropis juice, and one part turmeric, is said to be useful in eczema and other eruptive skin diseases. In the Concan the milk with powdered mustard is applied as a *lep* to rheumatic swellings, the flowering tops pounded and boiled with molasses, are given in doses of about one drachm every morning as a remedy for asthma. In want of virility the following prescription is in vogue: Take 125 of the flowers, dry and powder, then mix with one tolá each of cloves, nutmegs, mace and pellitory root, and make into pills of six massas each. One pill may be taken daily dissolved in milk.

The author of the *Makhzan-el-adwiya* says there are three varieties of Calotropis—1*st*, a large kind with white flowers, large leaves, and much milky juice, it is found near towns and the habitations of man; 2*nd*, a smaller kind with smaller leaves, the flowers white externally but lilac within; 3*rd*, a still smaller plant, with pale yellowish green flowers. The second and third kinds grow in sandy deserts. The properties of all three are similar, but the first kind is to be preferred, as it produces the largest quantity of milk. The juice is described as caustic, a purge for phlegm, depilatory, and the most acrid of all milky juices. Tanners use it to remove the hair from skins. Medicinally, it is useful in ringworm of the scalp, and to destroy piles; mixed with honey it may be applied to aphthæ of the mouth; a piece of cotton dipped in it may be inserted into a hollow tooth to relieve the pain. Hakím Mír Abdul Hamíd, in his commentary upon the Tuhfat, strongly recommends Calotropis in leprosy, hepatic and splenic enlargements, dropsy and worms. A peculiar method of administration is to steep different kinds of grain in the milk and then administer them. The milk itself is a favourite application to painful joints, swellings, &c., the fresh leaves also, slightly roasted, are used for the same purpose. Oil in which the leaves have been boiled is applied to paralysed parts; a powder of the dried leaves is dusted upon wounds to destroy excessive granulation and promote healthy action.

All parts of the plant are considered to have valuable alterative properties when taken in small doses.

C. procera was observed in Egypt by Prosper Alpinus (A. D. 1580—84), and upon his return to Italy was badly figured, and some account given of its medicinal properties. (*De plantis Ægypti*, Venet. 1592, cap. 25.) A much more correct figure was published in 1638 by his commentator Vesling. Rheede (*Hort. Mal.* ii., t. 31) figures a white-flowered Calotropis (*Bal-ericu*) and a lilac (*Ericu*), and Rumphius (*Hort. Amb.* vii., t. 14, f. 1) figures *C. gigantea* under the name of *Madorous*. Roxburgh (II., 30,) gives a botanical description of *C. gigantea* under the name of *Asclepias gigantea*, and

mentions the medicinal uses to which it is applied by the natives of India. Ainslie, in his *Materia Medica of Hindustan* (1813), mentions two kinds of Calotropis, and in the *Materia Indica* he says, "Both plants in their leaves and stalks contain much milky juice, which, when carefully dried, is considered as powerfully alterative and purgative, and has been long used as an efficacious remedy in the Koostum (lepra Arabum) of the Tamools; the dose about the quarter of a pagoda weight in the day, and continued for some weeks. The root of the *Yercum* has a bitter and somewhat acrid, or rather warm taste; it is occasionally given in infusion as a stimulant in low fever. Of the other variety, the *Vullerkoo*, the bark is warmish, and when powdered and mixed with a certain portion of margosa oil, is used as an external application in rheumatic affections. In the higher provinces of Bengal the Arka is supposed to have antispasmodic qualities. Mr. Robinson has written a paper on elephantiasis, which may be seen in Vol. X. of the *Journ. of the Medico-Chirurgical Society*, extolling the madar root (Yercum vayr) as most efficacious in that disease, as also in venereal affections. In elephantiasis he gave it in conjunction with calomel and antimonial powder, in a pill, consisting of half a grain of calomel, three of antimonial powder, and from six to ten of the bark of the madar root, every eight hours. Mr. Playfair has also written a paper on the same root which may be seen in Vol. I. of the *Edin. Med. Chirurg. Trans.*, p. 414, wherein he speaks in praise of the alterative, stimulant, and deobstruent virtues of the bark, or rather rind below the outer crust of the root, reduced to fine powder, in cases of syphilis, lepra, hectic fever, &c., dose from grs. 3 to 10 or 12, three times in the day, gradually increasing it. Messrs. Robertson, Playfair, and others seem chiefly to dwell on the virtues of the rind or bark of the root; but I must observe, that in Lower India, where I was for many years, I found the simple dried milky juice considered as infinitely more efficacious; and later communications from the East confirm me in this opinion." (*Op. cit.* I., p. 487.)

The emetic properties of Calotropis were brought to the notice of the profession in Europe by Dr. Duncan in 1829 (*Edin. Med. and Surg. Journ.*, XXXII., p. 65), and they are noticed in the *Bengal Dispensatory*, where the drug is recommended as a substitute for Ipecacuanha. Since the publication of that work abundant testimony in its favour has been collected, a summary of which will be found in the *Pharmacopœia of India*. Duncan (1829) made a chemical examination of the root bark, the activity of which he referred to an extractive matter which he termed *Mudarine*. A kind of gutta-percha was obtained from the juice of this plant by Dr. Riddell, Superintendent Surgeon H. H. the Nizam's Army, in 1851. (*Journ. Agri-Hort. Soc. of India*, Vol. VIII.) In 1853 it was examined by Prof. Redwood, who found it to possess many properties in common with the gutta-percha of commerce. No further trial of this substance appears to have been made during the last 37 years.

Modern physiological research has shown that the juice applied to the skin acts as an irritant, the practice of applying it with salt to bruises and sprains to remove pain is therefore rational; also the application of the fresh bark in chronic rheumatism. Given internally in small doses the drug stimulates the capillaries and acts powerfully upon the skin, it is therefore likely to be useful in elephantiasis and leprosy. (*Casanora.*) The benefit derived from the administration of the flowers in asthma is probably due to their nauseant action. In large doses Calotropis causes vomiting and purging, acting as an irritant emeto-cathartic.

Description.—The root barks of *C. gigantea* and *C. procera* are similar in appearance, and occur in short quilled pieces ⅛ to ¼ of an inch thick. The outer surface is yellowish-grey, soft and corky, fissured longitudinally, and can be easily separated from the middle cortical layer, which is white, friable, and traversed by narrow brown liber rays. The taste is mucilaginous, bitter and acrid, and the odour peculiar.

Microscopic structure.—In both kinds of root bark the suber consists of large thin-walled cells, generally polyhedral. The

parenchyme of the middle cortical layer is loaded with starch and contains some sclerenchymatous cells. The cells of the medullary rays also contain starch and crystals of oxalate of lime. In the middle layer are numerous laticiferous vessels, the contents of which are of a brown colour.

Chemical composition.—The authors of the *Pharmacographia* state, that by following the process of Duncan, 200 grammes of the powdered bark of *C. gigantea* yielded nothing like his mudarine, but 2·4 grammes of an acrid resin soluble in ether and alcohol. The latter solution reddens litmus; the former on evaporation yields the resin as an almost colourless mass. When the aqueous liquid is separated from the crude resin, and much absolute alcohol added, an abundant precipitate of mucilage is obtained, and the liquid now contains a bitter principle, which after due concentration may be separated by means of tannic acid. Similar results were obtained by exhausting the bark of *C. procera* with dilute alcohol. The tannic compound of the bitter principle was mixed with carbonate of lead, dried, and boiled with spirit of wine. This after evaporation furnished an amorphous, very bitter mass, not soluble in water, but readily so in absolute alcohol. The solution is not precipitated by an alcoholic solution of acetate of lead. By purifying the bitter principle with chloroform or ether, it is at last obtained colourless. This bitter matter is probably the active principle of Calotropis; they ascertained by means of the usual tests that no alkaloid occurs in the drug. (*Op. cit.*, 2nd Ed., p. 426.) Drs. Warden and Waddell (1881) commenced an examination of Madár root bark in Calcutta, and obtained a substance crystallizing in nodular masses, which they thought would prove to be the *Asclepione* of List, but subsequently (1885), upon Warden continuing the investigation of the drug in the Chemical Laboratory of the Gesundheits Amt, Berlin, he found the substance supposed to be asclepione to have a composition corresponding with the formula $C^{17}H^{28}O$, whereas List's asclepione is represented by the formula $C^{30}H^{54}O^{3}$.

The white cauliflower masses of crystals obtained in Berlin were found to agree closely, as regards their melting point and behaviour with solvents, with a substance called *Alban*, obtained by Payen from gutta-percha (*Jahresbericht über die Fortsch. der Chimie*, 1852, p. 643), they were accordingly named *Madar-alban*. A yellow resin associated with madar-alban in the drug was found to agree, in behaviour with reagents, with the *Fluavil* found by Payen in gutta-percha, but as regards chemical composition the madar-alban and madar-fluavil differed from the alban and fluavil of gutta-percha. Dr. Warden also separated from the drug a *yellow bitter resin*, which is probably the active principle, and *Caoutchouc*.

He found the percentage of the various principles (the results being calculated on the bark containing 8·079 per cent. of water) to be—

Madar-alban	0·640
Madar-fluavil	2·471
Black acid resin	0·997
Caoutchouc free from M.-alban and M.-fluavil	0·855
Yellow bitter resin (active principle)	0·093

The fact that the sap of the Madár plant contains in addition to Caoutchouc two principles analogous to the alban and fluavil of gutta-percha is a point of some interest, as madár gutta-percha has been recommended as a substitute for the commercial article. For full particulars of the chemical examination, see *Pharm. Journ.*, Aug. 22nd, 1885.

Toxicology.—In India Calotropis juice is used for the purpose of infanticide by the castes among which that custom prevails, being placed in the mouth of newly-born female infants. It is also, like other emeto-cathartics, sometimes taken by women to procure abortion, and a few cases are on record of its having been used for suicidal purposes. Like other irritant vegetable juices it is not uncommonly used locally to produce abortion; usually a stick is armed with cotton impregnated with the juice and an attempt is made to introduce it into the os uteri, and leave it there until uterine contractions

are induced, but this operation often fails from awkwardness on the part of the operator, and it is not unusual to find that the stick has been forced through the uterine walls. Another method of procedure is to select a twig of the plant, and after removing the leaves and making it as smooth as possible, to introduce it into the os uteri, or failing this to allow it to remain in contact with the parts. Pessaries also, containing the irritating juice of this and other plants, are placed in contact with the uterus to induce uterine action.

Commerce.—The flowers are to be found in the shops, but not the root bark, or leaves, no doubt from the circumstance that the plant is everywhere found wild and can be collected as required.

TYLOPHORA ASTHMATICA, *W. & A.*

Fig.—*Wight Ic., t.* 1277; *Bentl. and Trim., t.* 177; *Bot. Mag., t.* 1929.

Hab.—N. and E. Bengal, Assam to Burma, Deccan Peninsula, Ceylon. The root and leaves.

Vernacular.—Jangli-pikwán, Antamúl (*Hind.*), Antomúl (*Beng.*), Nach-churappán, Nay-pálai, Pey-pálai (*Tam.*), Pitkari, Kharakí-rásna (*Mar.*), Verri-pala, Kukka-pála (*Tel.*), Valli-pála (*Mal.*), Adumuttada (*Can.*).

History, Uses, &c.—The medicinal properties of this plant appear to have been long known to the natives of those parts of India in which it occurs, but we can find no evidence of its ever having been an article of commerce, nor are we aware of its having been described in any of the standard Hindu or Mahometan works on Materia Medica; though it may perhaps be the Antri or Antra-páchaka of Sanskrit writers. The Hindi name Antomúl is derived from *ánt*, "the entrails," and *mul*, "a root." The expression *ánt girna* signifies "to suffer from dysenteric symptoms," literally "to void the intestines." Roxburgh says of it:—"On the coast of Coromandel, the roots of this plant have often been used as a substitute

for Ipecacuanha. I have often prescribed it myself, and always found it answer as well as I could expect Ipecacuanha to do; I have also often had very favourable reports of its effects from others. It was a very useful medicine with our Europeans who where unfortunately prisoners with Hyder Ali during the war of 1780-83. In a pretty large dose it answered as an emetic; in smaller doses, often repeated, as a cathartic, and in both ways very effectually. Dr. Russell was informed by the Physician General at Madras (Dr. J. Anderson) that he had many years before known it used, both by the European and native troops, with great success in the dysentery which happened at that time to be epidemic in the camp. The store of Ipecacuanha had it seems been wholly expended, and Dr. Anderson finding the practice of the native doctors much more successful than his own, acknowledged with his usual candour that he was not ashamed to take instructions from them, which he pursued with good success; and collecting a quantity of the plant which they pointed out to him, he sent a large package of the roots to Madras. It is certainly an article of the Hindu Materia Medica highly deserving attention." (*Flora Indica* II., 34, 35.) Ainslie states that the Vytians prize the root for its expectorant and diaphoretic properties, and often prescribe it in infusion to the quantity of half a teacupful for the purpose of vomiting children who suffer much from phlegm. From possessing virtues somewhat similar to those of Ipecacuanha it has been found an extremely useful medicine in dysenteric complaints, and has, at times, been administered with the greatest success by the European practitioners of Lower India. (*Mat. Ind.* ii., 83.) More recently we have the testimony of O'Shaughnessy and Kirkpatrick to the value of the drug as an emetic, and as a substitute for Ipecacuanha in the treatment of dysentery, and the opinion of these physicians is confirmed by the reports furnished to the Committee who superintended the preparation of the *Pharmacopœia of India*, by Drs. Bidie, Oswald, Sheriff and others. Dr. J. Kirkpatrick (*Cat. of Mysore Drugs*) says:—"I have administered this medicine in at least a thousand

cases, and found it most valuable. In dysentery, and as a simple emetic, it is in every way comparable with Ipecacuanha. The dose is from 20 to 30 grains, with half a grain or a grain of Tartar Emetic, if strong emesis is required. If the dysentery distinctly arise from intermittent disease, Quinine is conjoined. The form of the medicine I use is the powder of the dry leaf." Tylophora is also employed in Mauritius, where it is known as *Ipeca sauvage* or *Ipeca du pays*. In the *Indian Pharmacopœia* the leaves have been made official. In the Concan 1 to 2 tolás of the juice are given as an emetic; it is also dried and made into pills which are administered in dysentery. The pills are as large as the seed of *Phaseolus Mungo*; one pill is sufficient to produce one copious stool.

Description.—The leaves are opposite, entire, from 2 to 5 inches long, ¾ to 2½ inches broad, somewhat variable in outline, ovate or sub-rotund, usually cordate at the base, abruptly acuminate or almost mucronate, rather leathery, glabrous above, more or less downy beneath with soft simple hairs. The pedicel which is channelled is ¼ to ¾ of an inch in length. In the dry state the leaves are rather thick and harsh, of a pale yellowish green; they have a not unpleasant herbaceous smell, with but very little taste. The root consists of a short, knotty, descending root stock, about ⅛ of an inch in thickness, emitting 2 to 3 aerial stems, and a considerable number of wiry roots. These roots are often 6 inches or more in length by ½ a line in diameter, and are very brittle. The whole drug is of a pale yellowish brown; it has no considerable odour, but a sweetish and subsequently acrid taste. In general appearance it is suggestive of valerian, but is somewhat stouter and larger.

Chemical composition.—A concentrated infusion of the leaves has a slightly acrid taste. It is abundantly precipitated by tannic acid, by neutral acetate of lead or caustic potash, and is turned greenish-black by perchloride of iron. Broughton of Ootacamund obtained from a large quantity of leaves a small amount of crystals—insufficient for analysis. Dissolved and injected into a small dog they occasioned purging and vomiting.

A re-examination of the drug by one of us (D. H.) shows that both the leaves and root contain an alkaloid, *Tylophorine*, which is crystalline and forms a crystalline hydrochlorate. The solution of the alkaloid is precipitated by tannin, iodine in potassium iodide, potassio-mercuric iodide, perchloride of mercury, picric acid, volatile and fixed alkalies. The alkaloid in a free state is very soluble in ether and alcohol, but only partially in water. With sulphuric acid it dissolves with a reddish colour changing to green and indigo. With HNO^3 it dissolves with a purplish red colour. Fröhde's reagent gives a deep sap-green solution. Sulphuric acid and $K^2Cr^2O^7$ a dirty violet. The leaves afford 15 per cent. of mineral matter.

Tylophora fasciculata, *Ham. Wight Ic.*, *t.* 848, Bhuidodi (*Mar.*), is abundant in the Southern Concan, and is used as a poison for rats and other vermin. Lyon (*Med. Juris. for India*, p. 453) records the following case in which it proved fatal to man:—"A Mahometan family, consisting of six adults and a servant-boy, æt. about fourteen, were attacked soon after a meal with symptoms of poisoning, the servant-boy died in about two hours. The others were seen the next morning, when they complained of dryness of the throat, great thirst, and a feeling of soreness over the whole body. Their pupils were dilated, and pulse full and slow. They stated that soon after taking their mid-day meal on the previous day, they felt some tingling sensation in the mouth, followed by dryness of the tongue and throat and giddiness, and loss of power over the extremities. After this they became insensible. Three of them vomited and recovered consciousness at about 8 P. M.; the other three remained insensible till midnight. On *post-mortem* examination of the body of the boy, the following appearances were noted:—Face bloated, tongue and eyes slightly protruding, veins of the neck turgid. Lungs engorged; right side of the heart full, left empty. Slight congestion of the pia mater. A small patch of redness on the mucous membrane of the stomach. Accused in this case, it was stated, who was at enmity with the persons poisoned, asked a friend to recommend him something to kill rats with. The friend advised

him to use *Bhui-dodi*. On this the accused, it was reported, obtained some *bhui-dodi* roots, and having reduced them to powder, mixed this with some flour, from which subsequently the food eaten at the meal referred to was prepared. Dr. G. G. Bopardikar of Pandharpur, who kindly supplied us with the plant, states that the leaves are generally used, pounded and mixed with flour to destroy rats. On enquiry the village Vaids informed him that the juice of the root is given with milk as a tonic, and that the leaves are pounded and used as an application to unhealthy ulcers and wounds to induce healthy granulation.

T. fasciculata is an erect or scarcely twining glabrous plant, with ovate, coriaceous leaves, decreasing in size upwards. The peduncles are erect, slender and flexuous, bearing at the flexures 2 to 3 few-flowered fascicles of minute flowers. The follicles are about 2 inches in length, ovoid-lanceolate and glabrous, with a very thick pericarp. The seeds are ¼ of an inch in length, broadly ovoid and quite flat. The root is thick, long and woody, from one to two inches in diameter at the crown. It is covered with a light brown corky bark, fissured longitudinally.

Chemical composition.—The leaves were very mucilaginous when treated with water, and even the alcoholic extract when evaporated to dryness made a thick solution with a large quantity of water. The latter solution was precipitated by alkaloidal reagents, and was most acrid to the taste. Shaken with ether a resinous body was removed, and then made alkaline with ammonia, which produced a slight precipitate, and again shaken with ether, a small quantity of an amorphous alkaloid was separated, which gave a yellowish brown colour with sulphuric acid, passing to a red. The leaves gave off slightly alkaline fumes when ignited, and left 12 per cent. of ash.

The roots reduced to fine powder were made into a tincture with strong spirit, and the evaporated tincture when treated with water left some resinous matter undissolved. The solu-

tion shaken with ether yielded up some more resinous substance, which became encrusted with feathery crystals when the solvent had been dissipated. A larger quantity of alkaloid was present in the root than in the leaves, but it appeared to possess similar characters. It was amorphous, but formed a slightly crystalline hydrochloride. The damp crystals of the hydrochloride brought into contact with the fumes from a drop of nitric acid produced a bluish-green coloration. With sulphuric acid the alkaloid was first coloured reddish-brown, passing to carmine, and then to purple. It was precipitated from solution by the usual reagents.

The alcoholic extract was emetic and purgative. A quantity from 2 grams of the leaves mixed with bread and given to a chicken produced frequent and watery stools. The aqueous extract from the leaves, after removal of all that was soluble by means of alcohol, had no effect upon a guinea-pig.

DÆMIA EXTENSA, *Br.*

Fig.—*Wight Ic., t.* 596; *Jacq. Ic. Rar., t.* 54: *Hook. f. in Bot. Mag., t.* 5704.

Hab.—Throughout India. The leaves.

Vernacular.—Utran, Ságováni (*Hind.*), Veli-parutti, Uttamani (*Tam.*), Jittupaku, Dushtupu-chettu, Guruti-chettu (*Tel.*), Veli-paritti (*Mal.*), Utarani, Utarandi (*Mar.*), Kuntiga, Juttuve, Talaváranaballi (*Can.*), Nágala-dudheli (*Guz.*), Chhágal-báti (*Beng.*).

History, Uses, &c.—The Sanskrit name of this plant is Phala-kantaka, in allusion to its echinate follicles. The Hindi name Utran as well as the Marathi names are evidently derived from the Sanskrit *Ut-tara*, "ejecting or vomiting," and the Tamil name Dushtupu is also of Sanskrit origin, and signifies "having tainted flowers." The flowers and leaves have a fetid odour; they are used as an emetic and expectorant by the natives, especially in the diseases of children. The stems yield a fibre, and the leaves are eaten by goats. The plant

was first fully described and figured by Jacquin; it is noticed by Ainslie under the name of *Cynanchum extensum*, who states that a decoction of the leaves is given to children as an anthelmintic, in doses not exceeding three table-spoonfuls, and that the juice is used as a remedy for asthma. Roxburgh describes the plant under the name of *Asclepias echinata*, but is silent about its medicinal properties. From the *Pharmacopœia of India* we learn on the authority of Dr. Oswald that it is used as an expectorant in the treatment of catarrhal affections, in ten grain doses, at the Pettah Hospital, Mysore. In the Southern Concan and Goa the juice of the leaves is applied to rheumatic swellings. Dr. B. Evers considers it a valuable emetic for children. He says:—"The leaves are washed and the juice expressed by rubbing them between the palms of the hands; the leaves of the dark *Tulsi* (*Ocimum sanctum*) are similarly treated, and then a mixture of the juices is given; this preparation is a stimulating emetic." Dr. P. S. Mootooswamy (*Ind. Med. Gaz.*, Feb., 1890,) notices the use of the juice in rheumatism in combination with ginger. He also states that it is used in the preparation of a purgative medicinal oil used in rheumatism, amenorrhœa and dysmenorrhœa, and that the root-bark is used as a purgative in rheumatic cases in doses of 1 to 2 drachms mixed with cow's milk.

Description.—The leaves are roundish, cordate, acuminate, pubescent, membranaceous, auricled at the base, glaucous beneath. They vary in size from one to two inches or more in diameter; the peduncles are long, slender and hoary. The plant has a disagreable mouse-like odour and a faintly bitter and somewhat nauseous taste; examined with a lens both the upper and under sides of the dry leaf present a green mossy surface, thickly studded with short white hairs. The flowers are dull white and drooping, the follicles have a curved beak, and are covered with soft bristles.

Chemical composition.—The leaves of *D. extensa*, like those of Tobacco and Adhatoda, evolve alkaline fumes when ignited, and like them contain an alkaloid. The alkaloid, which we

have provisionally named *Dæmine*, is soluble in ether, alcohol and water, and shows no disposition to crystallize from these and other solvents. In contact with strong sulphuric acid it dissolves with a reddish-violet colour, gradually fading; with Fröhde's reagent it gives a yellowish brown coloration. It forms crystalline deliquescent salts very soluble in water, with a bitter taste. An alkaloid having similar properties was separated from a sample of the root. The ash from a sample of the dried and powdered leaves amounted to 15·33 per cent.

DREGEA VOLUBILIS, *Benth.*

Fig.—*Wight Ic., t.* 586; *Rheede Hort. Mal. ix., t.* 15, var. *Lacuna*; *Dene. in Jacq. Voy. Bot.* 108, *t.* 114.

Hab.—Bengal, Assam, Deccan Peninsula, Ceylon. The root, herb, and fruit.

Vernacular.—Nakchikni (*Hind.*), Titakanga (*Beng.*), Hirandodi, Ambri (*Mar.*), Kodi-palai (*Tam.*), Dudhi-palla (*Tel.*).

History, Uses, &c.—This plant is not mentioned by Sanskrit writers; it is the *Watta Kakacodi* of Rheede, who states that the root is applied to snake-bites and given to women to cure headache after child-birth; and the *Kodie palay* of Ainslie (*Mat. Ind.* ii. 154), who remarks that "The root and tender stalks are supposed by the Vytians to possess virtues in dropsical cases; they sicken, and excite expectoration; though I could not obtain much information of a certain nature respecting them; it is to be presumed that they operate in a manner somewhat similar to the root of the *Asclepias curassavica*." The leaves are much employed by the Hindus as an application to boils and abscesses to promote suppuration, and the brown mealy substance with which the follicles are covered is applied to the galls and sores of draught cattle. The plant is noticed in the secondary list of the *Pharmacopœia of India*. The variety *Lacuna* is preferred for medicinal use by the natives. Irvine (*Stat. Med., Patna*), says the plant is used in colds and eye-diseases to cause

sneezing, whence the Hindi name Nakchikni. This property of the plant is also known in Madras, where the young shoots are cut and the exuding juice inserted into the nose. The follicles are frequently eaten by the natives in their curries, the process of boiling or cooking removes their bitterness and nauseating property.

Description.—A stout tall climber, branches often pustular, bark of the woody parts smooth, ash-coloured. Leaves 3 to 6 by 2 to 4 inches, rather coriaceous, base rounded or cordate; nerves 4 to 5 pairs; petiole 1 to 3 inches. Peduncles 1 to 3 inches, rather slender; umbels drooping, multifid, subglobose; pedicels ½ inch, slender, corolla ½ inch in diameter, cupular, lobes triangular. Stigma dome-shaped. Follicles horizontal, obtuse, about 3 to 4 inches long, and four in circumference at the base. In the variety *Lacvna* all parts of the plant, but especially the follicles, are covered with a brown mealy substance, which consists of moniliform hairs made up of cylindrical cells placed end to end. They can be well examined under the microscope with potash solution which colours them yellow.

Chemical composition.—The fresh follicles, freed from seeds and their comose appendages, were bruised in a mortar and the juice expressed. The juice was heated to boiling to coagulate albuminous matters and filtered, and the liquor, after evaporation to a small bulk, was treated with two volumes of spirit to remove mucilage and salts. After dissipating the spirit by a gentle heat, the acidulous solution had a bitterish taste, was free from tannic matters, and contained an abundance of glucose. It was shaken with ether, and the ethereal solution left a mass of light-coloured transparent scales, soluble in water with a peculiar bitterish-sweet taste and neutral or slightly acid reaction. This solution gave an abundant white precipitate with tannin, none with neutral plumbic acetate; and with alkaloidal reagents, such as potassio-mercuric iodide and iodine in potassium iodide, only if previously acidified. With strong aqueous alkali a precipitate, without colour,

was obtained. With sulphuric acid the dried scales dissolved with a brown colour, passing through cherry-red to purple, and finally separated as a black powder. With nitric acid no colour was manifested in the cold. Boiling with diluted acid destroyed the bitterness of the principle, with the formation of an insoluble brown substance, such as would attend the decomposition of a glucoside. We consider this glucoside to be the active principle of the fruits, and propose to name it *Dregein*.

HEMIDESMUS INDICUS, *Br.*

Fig.—*Wight Ic., t.* 594 ; *Rheede Hort. Mal. x., t.* 34 ; *Bentl. and Trim., t.* 174. Indian Sarsaparilla (*Eng.*), Salsepareille de l'Inde (*Fr.*).

Hab.—Northern, Western, and Southern India. The roots.

Vernacular.—Anantamul (*Hind., Beng.*), Upersára, Dudha sáli (*Mar.*), Nannári (*Tam.*), Sugandhi-pála (*Tel.*), Sogadé, Karibanta (*Can.*), Upalsári (*Guz.*).

History, Uses, &c.—Dutt. (*Hind. Mat. Med.*, p. 195) states that in Hindu medicine *H. indicus* and *Ichnocarpus frutescens* (see Apocynaceæ) are both called Sáriva, and are described under the name of Sárivadvaya, or the two Sárivas. They are often used together, and are considered to have similar properties. When however Sáriva is used in the singular number, it is the usual practise to interpret it as meaning *I. frutescens*. Other Sanskrit names for these plants are Nágajihva, "snake's tongue," and Gopa-kanga, "cowherd's daughter." *H. indicus* is distinguished as Utpala-sáriva. The Hindus consider them to be demulcent, alterative and tonic, and prescribe them in dyspepsia, skin diseases, syphilis, fever and dysentery; they are generally combined with bitters and aromatics. Under the name of Nannári, Hemidesmus is much used in Southern India, but in the northern part of the Bombay Presidency, though a common plant, it is seldom obtainable in the bazaars, imported sarsaparilla being offered when inquiries are made for it. In the more southern parts of the Concan

the milky juice is dropped into inflamed eyes; it causes copious lachrymation, and afterwards a sensation of coolness in the part. The root is tied up in plantain leaves and roasted in hot ashes; it is then beaten into a mass with cumin and sugar and administered with *ghi* as a remedy in heat or inflammation of the urinary passages. As a *lep* the root is applied to swellings. It is used in Madras in mixtures for purifying the blood as ordinary Sarsaparilla is in other countries, and it is an adjunct in chutneys and pickles simply as a flavouring agent.

Recent Mahometan physicians under the name of *ushbah* describe several kinds of sarsaparilla, of which they say the Western or Andalusian is the best. Another kind is described by the author of the *Makhzan-el-adwiya* as having flowers like yellow jasmine; this may possibly be Hemidesmus. The authors of the *Pharmacographia* remark that there is an Indian root figured as *Palo de Culebra* by Acosta (*Tractado de las Drogas de las Indias orientales*, 1578, *cap. LV.*) which is astonishingly like the drug in question. He describes it, moreover, as having a sweet smell of melilot. The plant he says is called in Canarese *Duda-sâli*. The figure is reproduced in Antoine Colin's translation, but not in that of Clusius. This plant must be the true Hemidesmus, as *Dudha-sâli* is a name it is known by in the Concan. In Goa at the present day Hemidesmus root is to be found in all the shops; it is known to the Portuguese as *Uperçao*, an evident corruption of the Maratha name. Ashburner in 1831 was the first to call the attention of the profession in Europe to its medicinal value, and in 1864 it was made official in the British Pharmacopœia. In India O'Shaughnessy found its diuretic action to be very remarkable; two ounces infused in a pint of water and allowed to cool was the quantity usually employed daily, and by such doses the discharge of urine was generally trebled or quadrupled. It also acted as a diaphoretic and tonic, and so increased the appetite that it became a most popular remedy in his hospital, the patients themselves entreating its administration and continuance. (*O'Shaugh-*

nessy, Dispensary, p. 456, *Beng. Pharm.*, p. 279—301). In 1868, Hemidesmus was made official in the *Pharmacopœia of India*. Lastly, in 1874, it was described by Flückiger and Hanbury in the *Pharmacographia*.

Description.—The drug is found in commerce in India in the form of little bundles, which consist of the entire roots of one or more plants, often several feet long, tied up with a portion of the stem.

The root is cylindrical, tortuous, from $\frac{6}{10}$ to $\frac{7}{10}$ of an inch in diameter, seldom branched. The bark is transversely cracked and fissured longitudinally, of a dark brown colour, sometimes with a slight violet hue when viewed in a strong light; the wood is yellow and porous. The fresh or freshly-dried root has a fine odour of tonka bean or melilot, and a sweet but slightly acrid taste.

Microscopic structure.—According to Flückiger and Hanbury, all the proper cortical tissue shows a uniform parenchyme, not distinctly separated into liber, medullary rays and mesophlœum. On making a longitudinal section, however, one can observe some elongated laticiferous vessels filled with the colourless concrete milky juice. In a transverse section, they are seen to be irregularly scattered through the bark, chiefly in its inner layers, yet even here in not very considerable number. They are frequently 30 mkm. in diameter and not branched.

The wood is traversed by small medullary rays, which are obvious only in the longitudinal section. The parenchymatous tissue of the root is loaded with large ovoid starch granules. Tannic matters do not occur to any considerable amount except in the outermost suberous layer.

Chemical composition.—The aroma and taste of the drug is due to the presence of coumarin (see Vol. I., p. 406), which can be obtained in part by boiling the root with water. Crystals of coumarin can be prepared from the residue after distillation by drying and extracting with alcohol. This is no

doubt the substance obtained by Garden in 1837, and called smilasperic acid, and subsequently by Scott in 1843, who described it as a crystalline stearopten.

Commerce.—In Southern India and Bengal the root is met with in commerce, but is often so old as to be quite worthless. In Bombay arrangements have to be made for its collection, which costs Re. ¼ per lb., owing to the difficulty of digging the roots in stony ground.

COSMOSTIGMA RACEMOSUM, *Wight.*

Fig.—*Wight Ic., t.* 591, 1270; *Rheede Hort. Mal. vii. t.* 32.

Hab.—Sylhet, Chittagong, W. India, Ceylon. The root and leaves.

Vernacular.—Gháraluvvu (*Can.*), Shendvel, Shendori, Márvel, Márvivel (*Mar.*), Vattu-valli (*Mal.*), Ghárphúl (*Goa.*).

History, Uses, &c.—This large woody climber running over high trees, has a medicinal reputation on the Western Coast, where its leaves are used to cure ulcerous sores Ghára (घाव) and the root bark is administered internally in Vataka (वातक), a disease in which white lumps of undigested food are passed. Rheede is the only European writer who notices its medicinal properties; he states it is called *Torique* by the Portuguese and *Pensbout* by the Dutch; after mentioning the use of the leaves, he remarks: "Cortex cum Sandalo et muliebri lacte in formam noduli adhibitus, præstantissimum *Causonis* remedium est." The disease he alludes to is the καυσος of the Greek physicians, and is described by Paracelsus as characterised by pungent heat internally, great heat of breath, desire of cold air, dryness of the tongue, lips, and skin, coldness of the extremities, the urine loaded with bile, watchfulness, and a quick, small and weak pulse. In modern medicine we should describe it as dyspepsia accompanied by a febrile condition and absence of bile in the stools. We have tried the root bark of this plant in such cases, given in five grain doses three times a day, and have found it to be a most efficient cholagogue; it had no purgative effect, but restored the natu-

ral colour of the stools after the usual remedies (mineral acids, podophyllin, euonymin, &c.,) had been abandoned in despair. The flowers of this plant are sweet and are eaten by the natives. A biscuit was made with the powder of two ounces of the root and given to a dog without any ill effects.

Description.—Leaves large, rather coriaceous, smooth, ovate-cordate, acuminate, but sometimes rounded with an obtuse tip, readily distinguished by a group of small, brown, dusty, prominent glands at the junction of the petiole with the leaf. Roots from ½ to 1 inch in diameter, externally light brown and scabrous; fracture starchy and friable, a transverse section shows them to be composed of a central woody column and a very thick greyish-white cortex. In the circumference, and sparingly scattered through the root, light yellow brown hard cells are seen. The root has no taste, and a faint ipecacuanha-like odour, which is more marked in the seeds. The latter are contained in a large, smooth, green follicle.

Chemical composition.—An ether extract of the powdered root contained some free, crystalline fatty acids, soluble in cold rectified spirit and aqueous alkalies. Petroleum ether dissolved the fatty acids from the extract, leaving a small quantity of an acid resin. An alcoholic extract, in addition to a resin, contained a sugar, and a substance affording the reactions of an alkaloid. The resin is decomposed by boiling with dilute acids, and gives a purplish colour with strong sulphuric acid. It is glucosidal and is related to jalapin. An aqueous extract contained gum and a carbohydrate having the properties of dextrin. The root was devoid of astringency. The powder mixed with milk of lime gave off ammonia. The larger roots left 3·16 per cent., the smaller ones 5·86 per cent. of inorganic matter on incineration.

GYMNEMA SYLVESTRE, *Br.*

Fig.—*Wight Ic., t.* 349.

Hab.—Banda, Deccan Peninsula. The leaves and root.

Vernacular.—Mera-singi (*Hind., Beng.*), Kavali, Vákhandi (*Mar.*), Siru-kurinja (*Tam.*), Sanna gerse (*Can.*).

History, Uses, &c.—This shrubby climbing plant is called Meshasringi, "ram's horn," in Sanskrit, but it is not mentioned in the Raja Nirghanta. It is considered to be the Meshasringi of Madanpal's Nighanta and of the Marathi and Guzerathi Nighantas, which are little more than translations of that work. It bears the following synonyms—Mesha vishánika, Meshavalli, Sarpa-darushtrika, Anyáda, Kshina-vartta, Vrikshikáli and Vishánika, and is described as having a pungent taste and the properties of an astringent and bitter stomachic; useful in cough, biliousness, boils, sore eyes, &c.

It is also in repute amongst the Hindus as a remedy for snake bite, the powdered root being applied to the part bitten, and a decoction administered internally. Its use for this purpose is well known to the natives of the Concan, and as appears from Ainslie (*Mat. Ind.* II., 390), also to the natives of Southern India. The root is also said to have virtues similar to Ipecacuanha. Roxburgh describes the plant under the name of *Asclepias geminata*, and remarks that the small yellow flowers, with the globular apex of the white common stigma, projecting in the centre, look like fine pearls set in gold. He says nothing of its medicinal properties. *G. sylvestre* is said to be the *binnuge* of the Cingalese. A curious circumstance connected with this plant was first noticed by Mr. Edgeworth, namely, that if chewed it destroys the power of the tongue to appreciate the taste of sugar and all saccharine substances. This property of the leaves has been recently (1887) tested carefully by Mr. D. Hooper, who says:—"After chewing one or two leaves it was proved undoubtedly that sugar had no taste immediately afterwards. Sugar in combination with other compounds in dietetic articles is plainly destroyed as to its taste after using these leaves. In ginger bread, for instance, the pungency of the ginger is alone detected, the rest is tasteless meal; in a sweet orange the taste of the sugar is so suppressed and that of the citric acid consequently developed, that in eating it resembles a lime in sourness. Among the several kinds of foods, drugs and beverages which affect the palate, *Gymnema* does not pretend to render them all taste-

less, it does not affect pungent saline things, astringents and acids. It is limited to apparently two diverse substances—sweets and bitters. It has been noted that sugar taken after the leaf tastes like sand, so I have found that sulphate of quinine taken after a good dose of the leaf tastes like so much chalk. I am not going to propose its use in the administration of nauseous drugs, until the medical properties of the *Gymnema* have been more studied, otherwise the quantity of the vehicle taken may prove to counteract the effect of the medicines. The experience of several friends as well as my own is that the effect does not last for twenty-four hours as stated, but for only one or two hours, after that time the tongue resumes its appreciation of all that is sweet or bitter." In the Concan the dried and powdered leaf is used as an errhine, and the fresh leaves crushed and mixed with water, as a cooling bath for children in the hot weather.

Description.—*G. sylvestre* is a shrubby climbing plant. The leaves are from 4 to 5 inches long, from ovate-lanceolate to obovate; upper surface dark green, shining, under surface pale green, shortly pubescent; venation transverse and reticulate with a marginal vein; taste saltish and acrid. The root is about the size of the little finger or less, not unlike *Hemidesmus*; it has a tough wood, and when fresh a soft spongy bark, which is reddish brown and fissured longitudinally, but loses much bulk in drying, and becomes loose and transversely fissured; the taste is acrid and saltish; the whole plant abounds in milky juice.

Microscopic structure.—The woody portion of the root has a radiate structure, and is traversed by large vessels; the extension of the medullary rays into the bark is distinct; the latter is made up of a thin-walled parenchyma, the cells of which contain much starch and tolerably numerous crystalline concretions. There are many laticiferous vessels, especially towards the inner part. The epidermis consists of several layers of flattened cells of a deep reddish brown colour.

Chemical composition.—The powdered leaves were submitted to the action of various solvents, and by this means it was ascertained, that the peculiar property of *Gymnema* leaves was

dissolved out by alcohol, and, as it occurred in the aqueous extract of the residue, it was therefore soluble in water. As benzine and ether took from the leaves certain principles of the same appearance and weight, it was conceived that nothing would be gained by using both solvents; the preliminary extraction was therefore made with rectified spirit. The ether extract consisted of chlorophyll and two resins separated by their solubility in alcohol. The resin insoluble in alcohol formed the larger portion; it was soluble in chloroform, bisulphide of carbon and benzine. It was elastic and tenacious, decomposed by warming with nitric acid, the product being precipitated with water; only partially saponified with caustic potash. Sulphuric acid dissolved it in the cold, giving a green solution. It seemed to consist principally of a neutral resin. The resin soluble in spirit was readily saponified with soda, and gave a permanent bluish green colour with sulphuric acid; like the former resin it was of an acrid nature, and left a tingling sensation in the throat. The alcoholic solution of the leaves was almost entirely soluble in water; in fact, by treating the leaves separately by alcohol and water, 36·37 per cent. of organic matter was extracted, by treating the drug with water alone 36 per cent. was removed. By direct experiment it was found that in the former extract 0·74 per cent. was an acrid resin similar to those found in the ether extract. The aqueous solution of the substances soluble in alcohol had a decidedly acid reaction, it gave no colouration with ferric chloride, showing absence of tannin. It was deepened in colour with alkalies, but gave a bulky precipitate with sulphuric, nitric, hydrochloric and acetic acid. It reduced Fehling's solution on boiling, and gave a cloudiness with Nessler, a precipitate with lead acetate, but none with tannin or picric acid. The precipitate caused by sulphuric acid was collected on a filter and washed till it ceased to give a cloudiness with barium chloride. It yielded a greenish powder, insoluble in water, but soluble in alcohol, ether, benzine and chloroform. With potash, soda and ammonia it afforded fine red solutions with orange coloured froth, but they were both

precipitated on the addition of the mineral acids. It dissolved in concentrated sulphuric and nitric acids with intense red colour, but in both mixtures it was destroyed and precipitated by water. It fused at about 60° C. into a blackish brittle mass. Heated in a test tube it gave off fumes of creasote, but no crystals were obtained in a subliming apparatus. Gently ignited it burnt with a bright flame, leaving no ash. It was thrown down as a bulky grey mass by acetate of lead, the lead salt decomposed by sulphuretted hydrogen in spirit left the substance in the reddish evaporated filtrate from the lead sulphide. The body just described has the characteristics of an organic acid related in some particulars to glycyrrhizic acid, but having some distinctly peculiar reactions and possessing the antisaccharine property ascribed to the leaves. I propose to call it *Gymnemic Acid*. Gymnemic acid forms more than six per cent. of the constituents of Gymnema leaves in combination with a base which is inorganic. It is a monatomic acid, having the formula, $C^{32}H^{53}O^{12}$, and requiring theoretically 14·63 per cent. of metallic silver and 15·20 per cent. of PbO for its silver and lead salts. It forms insoluble salts with alkaloids, and this accounts for its masking the taste of quinine. The acid is a glucoside. After boiling for about an hour with dilute hydrochloric acid, a dark resinous mass, devoid of the peculiar property of the leaves, remains, and the liquor contains a body which readily reduces Fehling's solution and crystallizes when evaporated. Another organic acid was present in the lead acetate precipitate, which was identified as tartaric acid. The filtrate from the insoluble lead compounds was treated with sulphuretted hydrogen gas, and the clear liquor after evaporation was examined for sugar. Glucose was detected in some quantity by its immediate and abundant reduction of Fehling's solution; the sugar examined in a polariscope had a left-handed rotation. Chloroform agitated with an alkaline solution of the leaf left a crystalline residue of a brownish colour; it had a bitter taste, and acted as a sialagogue. With the ordinary alkaloidal reagents it afforded coloured precipitates, but was a neutral principle.

A solution of one per cent. hydrochloric acid was employed to remove the oxalate of calcium; a microscopical examination of the powdered leaves showed a fair sprinkling of the conglomerate crystals or raphides so well known to exist in Rhubarb. The dilution of the acid menstruum rendered this process very tedious, so a stronger acid was used, and the marc washed with it until ammonia produced no cloudiness. The collected liquors were allowed to deposit, the sediment was then collected on a filter, dried and weighed, then incinerated and weighed again. The calcium carbonate was calculated into oxalate, and the difference between this and the first weighing was reckoned as pararabin, No oxalic acid was found in a free state. The ash of *Gymnema sylvestre* is very high, a fact in accordance with the amount of lime salts it contains. Gentle ignition of the air-dried leaves left as much as 11·65 per cent. and about one-half of this was calcium carbonate. One hundred parts contained:

15·41 soluble in water.
78·71 soluble in acid.
5·88 sand and siliceous residue.

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

Ether extract (chlorophyll and resins)	5·51
Alcoholic extract (gymnemic acid, tartaric acid, glucose, neutral bitter principle, resin, &c.)	10·50
Aqueous extract (gum 1·45 per cent., glucose, carbohydrate and extractive)	16·87
Alkaline extract, by difference (albuminous and coloring matters)	8·15
Acid solution { Calcium Oxalate	7·44
Acid solution { Pararabin	7·62
Ash (balance of)	5·69
Cellulose	27·86
Moisture	6·04
	1000

—(*Hooper in Pharm. Journ.*, April, 1887, and *Chem. News*, April, 1889.)

CEROPEGIA BULBOSA, *Roxb.*

Fig.—*Roxb. Cor. Pl. i.*, 11, *t.* 7; *Wight Ic., t.* 845; *Hook. Bot. Misc.* ii., 99; and *Suppl. t.* 2.

Hab.—From Western India, the Punjab and Upper Gangetic plain as far east as Allahabad, southwards to Travancore.

Vernacular.—Mánchi, Manda (*Tel., Tam.*), Gálot (*Punj.*), Khapparkadu, Gáyala (*Mar.*).

History, Uses, &c.—Several forms of this variable plant are described in the *Flora of British India* with leaves from nearly orbicular to linear-lanceolate. Roxburgh remarks that every part of the plant is eaten by the natives, either raw or stewed in their curries. Edgeworth and Dr. J. L. Stewart have recorded its use as a vegetable in the Punjab and at Mooltan, and in the *Materia Medica of Western India* it is stated that shepherds are fond of the tubers, which they consider to be tonic and digestive. R. Brown notices the use of *C. juncea* as a vegetable, and we have also observed that *C. tuberosa* is not distinguished by the natives from *C. bulbosa*. On the Nilgiris the tubers of *C. pusilla* are known as "Chutlan-killangu," and are much appreciated as an article of diet.

The tubers when boiled lose their bitterness, and pulped with milk form a sweet mucilaginous mixture not unlike salep, which, judging from their chemical composition, should be highly nutritious.

Description.—Root tuberous, a little flattened like a turnip, with several fibres from its base; it is about as large as a small apple. Stems twining, herbaceous, smooth, succulent; from 2 to 4 feet long. Leaves opposite, short petioled, obovate with a small point, entire, fleshy; size various. Umbels lateral, length of the leaves, peduncled, few-flowered. Flowers pretty large, erect, tube greenish, border purple. Follicles two, slender, singly, about 3 or 4 inches long. (*Roxburgh.*)

Chemical composition.—The tubers yielded on analysis—

Moisture	5·25
Fat	3·30
Sugar, gum, &c.	23·40
Albuminoids	3·48
Starch	42·52
Crude fibre	12·64
Ash	9·43
	100·00

The bitter principle of the tubers is an alkaloid, *Ceropegine*, soluble in ether, alcohol and water. The total nitrogen afforded by burning with soda-lime was 0·55 per cent. The ash contains manganese, and is constituted as follows :—

Soluble in water	61·7
Soluble in acid	14·9
Insoluble	23·4
	100·0

Caralluma attenuata, *Wight Ic., t.* 1268, Pulambari (*Tel.*), is used on the Eastern coast for ostensibly regenerating stale toddy. From information received from an Abkari Inspector, it appears that the bruised fresh plant is added to toddy to increase its gravity, and to give it the appearance and smell of that recently drawn. The toddy may be several days old, but so complete is the process of renewal that experienced judges are often deceived. The plant is acrid and bitter, and contains a caoutchouc-like substance, a resin similar to finavil and a bitter principle, and so far resembles the Calotropis.

The Sanskrit names Kshiri, Kshirini, Kshira-kshava, Dugdha, Dugdhika, Dugdhapáshána, &c., are loosely applied to a number of milky plants, but more especially to the edible Asclepiads, such as **Oxystelma esculentum, Holostemma Rheedii, Caralluma edulis** and **fimbriata**. These plants as well as other Asclepiads are also called Yugmaphalottama, and Uttama-phalini, in allusion to their "twin

pods," which are favourite vegetables of the Hindus. The central portion of the flowers of **Holostemma Rheedii, Cosmostigma racemosum,** and **Periploca aphylla** is sweet and is eaten by the natives. The acidulous and somewhat bitter stems of **Caralluma edulis** are eaten as a vegetable in the Punjab. The roots of **Holostemma Rheedii, Pentatropis spiralis** and **microphylla,** and the follicles of **Marsdenia Roylii** are considered to be cooling, and alterative, and are used in alterative decoctions and as a remedy in gonorrhœa. **Sarcostemma brevistigma** yields an abundant bland milky juice; this plant and **Periploca aphylla** are used as substitutes for the *Soma* of the Vedas, which from recent investigations appears to have been a species of *Ephedra,* and the same plant which is still brought from Persia to India as the *Homa* of the Parsis. **Stapelia reflexa** is used by the Afghan mountain tribes as a bitter tonic and febrifuge, and **Boucerosia Aucheriana** is considered to have similar properties. Dr. G. Bidie has shown that **Secamone emetica,** notwithstanding its specific name, is almost inert.

LOGANIACEÆ.

STRYCHNOS NUX-VOMICA, *Linn.*

Fig.—*Bedd. Fl. Sylv., t.* 243; *Bentl. and Trim., t.* 178; *Gärtn. Fruct.* ii. *t.* 179; *Rumph.* i. t. 25; *Rheede Hort. Mal.* i., t. 37. Poison nut, False Angostura bark (*Eng.*), Vomiquier (*Fr.*).

Hab.—Throughout tropical India. The stem, bark and seeds.

Vernacular.—Kuchila (*Hind, Beng.*), Kájra (*Mar.*), Yettiekottai (*Tam.*), Mushti-vittulu, Mushidi (*Tel.*), Hemmushti (*Can.*), Kanniirakkuru (*Mal.*), Bidara-laut (*Malay*).

History, Uses, &c.—No mention of Nux-vomica can be found in the older Sanskrit medical works. A drug called Vishamushti, mentioned by Sarangadhara, has by some been supposed to be nux-vomica, but according to the Bhavaprakasha, Vishamushti has an edible fruit, and is called Karerua in Hindi. The latter work gives Kupilu and Kulaka as Sanskrit names for Kuchila, but these names are generally referred to a kind of ebony. Another Sanskrit name given to the drug in recently compiled works is Kurachilla, an incorrect form of Kuruchilla, "a crab," to which animal the seeds bear some resemblance in shape. We think there can be little doubt that nux-vomica was not used medicinally by the ancient Hindus, but the Hindi name Kuchila or Kuchula occurs in ancient Persian, and appears to be derived from the Sanskrit कुञ्च (kunch) to make crooked. We also find an unidentified plant called Kuchela, mentioned by Sanskrit writers, with the synonyms of Avi-karni and Viddha-parni; the name Kuncha-phala is also met with, but it may possibly be only an incorrect rendering of Kucha-phala, a term for the pomegranate. We can hardly suppose that a plant having such marked poisonous properties can have escaped the notice of the earliest settlers in India, and there can be no doubt that the wood has been in use from a very early date as one of the kinds of Mushadi in Southern and Western India. We also find that in the Indian Archipelago, which was colonised at a very early date by the Hindus, the wood is used as a popular remedy for dysentery, fevers and dyspepsia, under the name of Bidara-laut by the Malays. This name appears to be of Sanskrit origin and to be derived from Vidara, "splitting or rending," and lata, "a tree or shrub," in allusion to the tetanic spasms produced by over-doses of the drug.

In the Rájá Nirghanta two kinds of Katuka are noticed; one of these with the vernacular synonym Kedár-katuki is doubtless *Picrorhiza Kurroa*, the other Katukavalli with the Canarese synonym Tonremattu, which does not appear in the vernacular Nighantas, must, we think, be referred to the bitter woods used as lignum colubrinum. (See *Strychnos colubrina*.)

It has been supposed by some that nux-vomica was the Jouz-el-máthil of the early Arabian writers, but this drug is described by Ibn Sina as studded with thick thorns, and as producing torpor when eaten; it is considered by all the more recent Mahometan writers to be Datura. The Jouz-el-kai of the Arabs has also been supposed to be nux-vomica, but there would seem to be no foundation for such a belief, as it is described as having properties similar to Jouz-el-máthil, and is probably the fruit of a Trichilia. All the Indian Mahometan physicians describe nux-vomica under the name of Azáráki; of this drug Ibn Sina merely says it is a kind of Zabad-el-bahr (foam of the sea), a name given by the Arabs to the cuttle-fish bone; he adds that it is not used internally, but applied externally in skin diseases and sciatica. Haji Zein-el-Attár (A.D. 1368) is the first who clearly identifies *Azáráki* with the Indian drug *Kuchala*; he gives the same description of its uses as Ibn Sina, and says the antidotes for it are fresh milk and oil (these are the popular antidotes for it at the present day in India, but in Madras dog excrement is also used). In the Makhzan-el-adwiya *azáráki* is said to be a Syrian word, but it appears to us more probable that it has been manufactured by the Syrian physicians, who instructed the Arabs in Greek medicine, from the words ἄζα and βυκία, and that it intended to be a Greek rendering of the Arabic Zabad-el-bahr. The author of tht Makhzan gives *Kuchila* as the Indian Indian name for nux-vomica, but says it is best known in Hindustan (Northern India) as Nirbhedin (a Sanskrit word which signifies splitting asunder, derived from निर्भेद). Nux-vomica is not mentioned by Garcia d'Orta who was in Goa, where the tree is very common, about the middle of the 16th century—a tolerably clear proof that it was not used medicinally at that time—but his contemporary Valerius Cordus in Europe describes it accurately. The seeds do not appear to have been used medicinally until about the middle of the 17th century, but Rheede mentions the root as an established remedy in Malabar, and we have much earlier records of its use on the Western Coast as a substitute for the true *Lignum Colubrinum*, a drug

held in high estimation as a tonic, antiperiodic and alexipharmic in Southern India under the name of *Nágamushidi*. On the whole we are of opinion that the Arabs were acquainted with nux-vomica seeds under the name of *azárâki*, but that they imagined them to be of marine origin,—a comparatively modern Arabico-Persian name for them is Fulús-mahi ("fish scales"); this is the more likely, as the tree is especially a native of the Western and Southern Coast districts of India, and the seeds like those of several other plants are liable to be carried to a distance by oceanic currents.

Ainslie speaks of nux-vomica as a drug which is little used; he rightly states that the pulp of the fruit is poisonous, and the authors of the *Pharmacographia* have since shown that it contains strychnine; nevertheless it is eaten by the hornbill and other birds. He also tells us that the Vytians are of opinion that if the seeds are not taken in sufficient quantity to cause death, they will produce mental derangement. Loureiro states that the seeds roasted to blackness are really useful, and can be given without danger in *fluor albus*. In the Concan small doses of the seeds are given with aromatics in colic, and the juice of the fresh wood (obtained by applying heat to the middle of a straight stick to both ends of which a small pot has been tied) is given in doses of a few drops in cholera and acute dysentery. In some districts small quantities of the seeds are taken, apparently as a stimulant, or in lieu of opium. They also enter into the composition of the *bakha* pills, used in the preparation of Mahwa and other country spirit (see *Bassia*). In European medicine strychnine is usually preferred to the crude drug in which the proportion of alkaloid varies considerably. In 1883 Professor Bentley drew attention to this fact as affecting the strength of the extract, stating that he had suffered serious personal inconvenience from the variation in strength of extracts prepared from different kinds of seed. This statement led to the examination of five samples of commercial nux-vomica by Messrs. Dunstan and Short, who found that the proportion of alkaloid contained in them ranged from 2·56 to 3·57 per cent. Subse-

quent experiments conducted by Dr. Schweissinger showed that the German official preparations varied considerably in strength, he therefore proposed that the strength of the tincture should be fixed at 0·2 per cent. of alkaloid; and that of the extract at 15 per cent., which would practically agree with the standards adopted in the new *British Pharmacopœia*. It must be borne in mind, however, that the tincture and extract of nux-vomica contain brucine and other constituents, and that therefore its medicinal action may differ from that of strychnine; indeed they are considered by some to be more efficient than that alkaloid in atonic dyspepsia.

H. Beckurts (*Arch. der Pharm.*, 1890, 330—347) remarks that if the physiological action of strychine and brucine is as given by Falck 1 : 38·5, then little is accomplished by a total alkaloid determination; it would be more to the point to require a fixed percentage of strychnine and disregard the brucine (of which an equal quantity could always be assumed). An extract with fixed strychnine percentage and a brucine percentage varying within 1·8 per cent. is undoubtedly more reliable than an extract containing a fixed quantity of total alkaloid in which the strychnine present might vary 1·8 per cent.

Beckurts obtained the following alkaloidal percentages from nine samples of nux-vomica:—Bombay, 2 samples, 2·33 and 2·30 per cent.; Malabar, 1 sample, 2·66 per cent.; Cochin, 3 samples, 2·51, 2·41 and 2·81 per cent.; Madras, 2 samples, 3·42 and 1·53 per cent.; Calcutta, 1 sample, 2·40 per cent. In a total of ten determinations made, assuming strychnine and brucine to be present in equal proportion, the yield of strychnine varied between 2·17 and 2·38 per cent.

Physiological action.—Nux-vomica affects animals very unequally. Cold-blooded animals are destroyed by it, but there is a considerable difference of opinion regarding its physiological action upon serpents and fish. The frog is affected with tetanic spasms if $\frac{1}{1000}$ of a grain of strychnine in solution is applied to its back, previously dried so as to impede the elimination of the

poison through the integument. It is well known in India that birds are comparatively insusceptible to the poison, and large doses of nux-vomica may be given to fowls without any injurious effect. Ruminating animals are less easily affected by strychnine administered with the food than other quadrupeds; dogs and rabbits are soon destroyed by it, whilst certain monkeys and some other animals are said to be comparatively insusceptible to its action. Injected into the circulation it probably affects all animals alike. Stillé and Maisch remark:—"The phenomena in the various cases in which its specific operation is developed consists of tremor, twitchings, and startings of the voluntary muscles, followed by tetanoid spasms, during which the heart's action is accelerated, the temperature raised, and the respiration and consciousness suspended. Between the spasms the circulation generally becomes normal, the consciousness returns, and cutaneous hyperæsthesia is observed, but the spasms may be renewed by any excitation, as a touch, a loud sound, or a sudden impression on the eye. Death may occur through asphyxia from tonic spasm of the respiratory muscles, by syncope, or by exhaustion. The heart continues to pulsate after the respiratory movements have ceased. Of these modes of death, that during spasm is by far the most frequent in cases of strychnine-poisoning. No lesion is uniformly found after death; the heart may be distended with black blood or empty, and, although congestion and serous effusion within the meninges of the brain and spinal cord are usual, they are not uniformly met with, and in the substance of these organs no characteristic alterations have been observed. Falck experimented on rabbits with brucine nitrate injected subcutaneously in doses from ·1 gram. to ·02 gram. per kilogram of body weight. He found that the symptoms induced might be arranged in three divisions:—

1st—Respiration is quickened, and in some cases a strange injection of the ear was noted: the pupils may be dilated,

2nd—Tetanic convulsions, trismus, opisthotonos, oppressed respiration and dilated pupils.

3rd—Moribund.

According to Falck the minimum lethal dose for rabbits is ·023 gram. per kilo of body-weight. Strychnine kills 3·06 times quicker, the intensity of the action of strychnine relative to brucine being as 1 to 117·4. (*Vierteljahrsschr. f. Gerichtl. Med., Band.* xxiii., p. 78, quoted by *Blyth on Poisons.*)

The experiments of Dr. W. H. Klapp (1878) led him to conclusions which may thus be summarized: 1, Strychnine produces no primary lesion of the nerve-substance proper. 2. Its convulsions are not cerebral. 3. It does not affect either the sensory or motor nerves at their periphery. 4. These nerves are unaffected by it in their course. 5. Its tetanizing effects depend upon its action on the gray matter of the spinal cord. 6. In small doses it excites the vaso-motor centre. In large doses it paralyzes that centre. 8. It slows the pulse by an immediate action upon the excito-motor ganglia of the heart. 9. It does not act on the pneumogastrics, but decreases the number of respiratory movements, at first from too little blood, and afterwards from too much blood flowing to the respiratory centres. 10. Artificial respiration always moderates the spasms, not by a reflex stimulation of the pneumogastrics, but by maintaining the oxygenation of the blood until the poison is eliminated.

It may, then, reasonably be believed—1, that strychnine does not act upon the muscles, the nervous extremities, or the nerve-trunks; 2, that it does act upon the nerve-centres in the medulla oblongata and medulla spinalis; and, 3, that it acts upon those centres first by stimulating them when given in small doses, and by exhausting them, and thereby exaggerating their reflex irritability, when poisonous doses are used, in this respect falling under the general law that the actions of small and of large doses of an active agent are antagonistic to one another. (Compare Poole, *Med. Record*, xix. 201.) The latter of the two effects is probably dependent, in part at least, upon the power of strychnine to contract the arteries and the heart and to slow the pulse. It is essentially through spasm, in so far as it throws the respiratory muscles into tonic

contraction and by rendering the chest immovable, that it tends to produce asphyxia, with its usual symptoms of dark venous congestion of the eyes and interior of the mouth. This explanation renders clear the agency of artificial respiration in saving the life of animals in strychnine-poisoning (Richet, *Med. News, etc.*, Nov. 1880, p. 659), and the effect of keeping the frog's skin moist in preventing or delaying the fatal action of the poison upon this animal. In both cases the blood continues to be oxygenated until the poisonous excess of strychnine has been eliminated." (*National Dispensatory.*)

Strychnine is generally supposed to have no action upon the brain, but E. Biernaki (*Ther. Mntsh.* Aug. 1890) from experiments made upon rabbits under the influence of chloroform found that the excitability of the cortical portion of the brain showed a diminution in from 8 to 10 minutes after the administration of strychnine, this diminution of excitability reached its maximum in from 27 to 30 minutes, then remained stationary for a time (according to the dose given) after which the brain gradually recovered its normal excitability. This depressing action may be due to the hyperexcitation of the medulla oblongata and medulla spinalis, which takes place, *pari passu*, with the diminution of sensibility in the cortical portion of the brain, as excitation of one portion of the central nervous system is known to produce a depressing action upon another portion.

The inhibitory action of strychnine upon the functions of the cortical portion of the brain explains the favorable effects obtained by its administration in alcoholism, insomnia and other diseases in which there is hyperexcitability of the brain.

As regards the treatment of strychnine poisoning, the stomach should be evacuated and a brisk purgative administered. The native remedies, oil and milk, may be given to retard the absorption of the drug. If the convulsions have begun chloral hydrate or chloroform may be administered, and when asphyxia threatens artificial respiration should be resorted to. In modern medicine nux-vomica is prescribed with

advantage in the catarrhal dyspepsia, accompanied by flatulence and want of contractile power in the intestines, which is so common in India. In such cases it appears to be preferable to the alkaloid strychnine. As a general tonic in relaxed conditions of the muscular system, and in delirium tremens, strychnine is an invaluable remedy. It is also used with advantage as a stimulant of the nervous centres in some forms of paralysis after the symptoms of irritation have subsided, and in sexual debility. Applied externally nux-vomica acts as an irritant, and if the skin is abraded its active principles may be absorbed and give rise to symptoms of poisoning.

Prof. C. Pavesi (*Bolletina Farmaceutiça*, 1881,) has demonstrated the antiseptic properties of the different species of Strychnos and their alkaloids, and suggests that the effectiveness of the species of Strychnos which are used in tropical countries against fevers and poisonous bites may possibly be owing to the antiseptic and anti-fermentative power of the alkaloids.

Lauder Brunton (*Practitioner*, Jan. 1888,) recommends strychnine in sleeplessness due to mental fatigue, caused by strain or worry, as preferable to opium, chloral and bromides. He has given $\frac{1}{200}$ to $\frac{1}{100}$ grain of the alkaloid, or 5 to 10 minims of tincture of nux vomica at bedtime, the dose being repeated if the patient wake within one or two hours.

G. A. Gibson (*Practitioner*, Dec. 1889,) strongly recommends the hypodermic injection of strychnine in cases of opium narcosis, or in any case of narcotic poisoning where there occurs any irregularity or interruption of the breathing that appears to threaten a failure of the respiratory centre.

Description.—The fruit is an indehiscent berry of the size and shape of a small orange, and of a rich orange-yellow colour; it is filled with a bitter gelatinous, white pulp, in which the seeds, from 1 to 5 in number, are placed vertically in an irregular manner. The seed is disc-like, or rather irregularly orbicular, a little less than an inch in diameter, by about a quarter of an inch in thickness, slighty concave on the dorsal, convex on the ventral surface, or nearly flat on either side, often furnished

with a broad, thickened margin, so that the central portion of the seed appears depressed. The outside edge is rounded or tapers into a keel-like ridge. Bombay nux-vomica usually has a bevelled margin, and Madras an obtuse one. Each seed has on its edge a small protuberance, from which is a faintly projecting line (raphe) passing to a central scar which is the hilum or umbilicus; a slight depression marks the opposite side of the seed. The seeds are of a light greyish hue, occasionally greenish, and have a satiny or glistening aspect, by reason of their being thickly covered with adpressed, radiating hairs. Nux-vomica is extremely compact and horny, and has a very bitter taste. (*Pharmacographia.*) The wood occurs in the shops in pieces of variable length, and from ¾ to 1 inch or more in diameter; it is covered by a thin light brown bark, which on one side of the stem is rougher than on the other, and is marked by numerous small light-coloured elliptic corky warts. A transverse section shows numerous very fine medullary rays; touched with nitric acid the section is stained a dull orange red.

Microscopic structure.—The hairs of nux-vomica are of remarkable structure. They are formed as usual of the elongated cells of the epidermis, and have their walls thickened by secondary deposits, which are interrupted by longitudinally extended pores; they are a striking object in polarized light. The albumen is made up of large cells, loaded with albuminoid matters and oily drops, but devoid of starch. If very thin slices of nux-vomica are kept for some time in glycerine, they develop feathery crystals, doubtless consisting of the alkaloids. (*Pharmacographia.*) The corky layer of the bark is composed of cubical cells of a reddish brown colour; within this is a wide zone of thin-walled cells arranged in radial and at the same time concentric rows; then come several rows of light-coloured stone cells; and lastly, a tolerably wide layer of thin-walled cells in which a few stone cells are scattered.

Chemical composition.—The bitter taste and highly poisonous action of nux-vomica are chiefly due to the presence of strych-

nine and brucine. Strychnine, $C^{21}H^{22}N^2O^2$, was first met with in 1818 by Pelletier and Caventou in St. Ignatius Beans, and immediately afterwards in nux-vomica. It crystallises from an alcoholic solution in large anhydrous prisms of the orthorhombic system. It requires for solution about 6,700 parts of cold or 2,500 of boiling water; the solution is of decidedly alkaline reaction, and an intensely bitter taste, which may be distinctly perceived, though it contains no more than $\frac{1}{60000}$ of the alkaloid. The best solvents for strychnine are spirits of wine or chloroform; it is but very sparingly soluble in absolute alcohol, benzol, amylic alcohol or ether. The alcoholic solution deviates the ray of polarized light to the left. The discovery of Brucine was made in 1819 by the same chemists, in nux-vomica bark, then supposed to be derived from *Brucea ferruginea*. Its presence in nux-vomica and St. Ignatius Bean was pointed out by them in 1824. Brucine, dried over sulphuric acid, has the formula $C^{23}H^{26}N^2O^4$, but it crystallises from its alcoholic solution with $4H^2O$. It readily neutralises acids, forming crystalline salts. In bitterness and poisonous properties, as well as in rotatory power, it closely resembles strychnine, differing, however, in the following particulars:—it is soluble in about 150 parts of boiling water, melts without alteration a little above 130° C. In common with its salts, it acquires a dark red colour when moistened with concentrated nitric acid.

In nux-vomica as well as in St. Ignatius' beans the alkaloids, according to their discoverers, are combined with strychnic or igasuric acid; Ludwig (1873), who prepared this body from the latter drug, describes it as a yellowish brown amorphous mass, having a strongly acid reaction and a sour astringent taste; and striking a dark green with ferric salts.

Nux-vomica dried at 100° C. yields when burnt with soda lime 1·822 per cent. of nitrogen, indicating about 11·3 per cent. of protein substances. The seeds contain 4·14 per cent. of fat. Meyer found it to yield butyric, capronic, caprylic, caprinic and other acids of the series of the common fatty acids, and also one acid richer in carbon than stearic acid.

Nux-vomica also contains mucilage and sugar. The latter, which according to Rebbling (1855), exists to the extent of 6 per cent., reduces cupric oxide without the aid of heat. When macerated in water, the seeds easily undergo lactic fermentation, not however attended with decomposition of the alkaloids. The stability of strychnine is remarkable, even after ten years of contact with putrescent animal substances. (*Pharmacographia.*)

W. R. Dunstan and F. W. Short discovered (1884) a new glucoside in the pulp of the fruit of *Strychnos Nux-vomica* to the extent of 4 to 5 per cent., and named it *Loganin*. This substance answers to the formula $C^{25}H^{34}O^{14}$. They have also shown that loganin is present in small quantity in the seeds and in preparations made from them. (*Pharm. Journ.* [3] XIV., 1025.)

In nine samples of nux-vomica seeds examined by Beckurts, the percentage of total alkaloids ranged from 1·53 to 3·42 per cent. The same chemist found the percentage of strychnine in ten determinations to vary between 2·17 and 2·38 per cent. (*Archiv. der Pharm.*, 1890, 330-347.) W. R. Dunstan and F. W. Short in a sample of seeds from Ceylon found as much as 5·34 per cent. of total alkaloids. They found the pulp of the fruit to contain 1·4 per cent. of strychnine and 1 per cent. of brucine. (*Pharm. Journ.* [3], XIV and XV.)

The wood and bark of *S. Nux-vomica* (Bidara Laut) have been examined by H. G. Greenish, who found 2·26 per cent. anhydrous brucine in the dry wood, and as much as 7·38 per cent. in the dry bark. No trace of strychnine could be detected. The bark of *S. Nux-vomica* has been found to contain varying amounts of brucine according to age: old bark, 1·68 per cent.; medium, 2·4 per cent.; and young bark, 3·1 per cent. (*Pharm. Journ* [3] IX., 1013.)

D. Hooper (*Pharm. Journ.* 1890) found the leaves of *S. Nux-vomica* to contain ½ of a per cent. of alkaloid consisting of brucine, but no strychnine could be detected.

Toxicology.—Nux-vomica is seldom used as a poison in India, probably on account of the difficulty experienced in powdering it. In Bengal, from 1880 to 1887, out of a total number of 1,766 cases of poisoning investigated by the Chemical Analyser to Government, only 3 were from nux-vomica. In the N.-W. Provinces and Oudh, during the same period, one case was observed in a total of 1,529 viscera examined. In the Punjab no case was recorded in a total of 1,871 viscera examined during the same period. In Madras, during the seven years from 1882 to 1888, three cases of poisoning with nux-vomica were recorded, all three occurred in 1886, and in all the nux-vomica had been mixed with orpiment. In Bombay Dr Lyon remarks that poisoning by nux-vomica is occasionally met with, the cases being generally suicidal or accidental; in the ten years ending 1884 he records one case of cattle poisoning by this drug. Among the causes leading to accidental poisoning may be mentioned the practise of nux-vomica eating, which many authorities state to be commonly practised in certain parts of India on account of its stimulant and aphrodisiac properties. (See *Chevers' Med. Juris.* p. 241.) Nux-vomica has been found by the Chemical Examiner at Madras to be sometimes added to arrack to increase its intoxicating effect. Accidental cases of poisoning with nux-vomica bark have also been recorded owing to its substitution for Holarrhena bark by ignorant druggists. In a case which occurred in Calcutta in 1882, the death of a child was traced to this substitution, and in a subsequent case, on a vendor's stock of Holarrhena bark being seized, about one-fourth of it was found to consist of nux-vomica bark.

Since the introduction of Strychnine into India as a medicine by Europeans, it has been not unfrequently used as a poison.

In Bengal the Chemical Examiner reported its detection in human viscera three times in 1880-81, once in 1881-82, once in 1882-83, twice in the remaining nine months of 1883, three times in 1885, and twice in 1886. In 1884 and 1887 no cases occurred, making a total of 12 cases of strychnine poisoning in 1,766 viscera examined.

In the Punjab, during the period between 1879 and 1887, only two cases were recorded—one in 1879 and one in 1887.

The total number of viscera examined was 1871.

In the N.-W. Provinces and Oudh no case is recorded during the same period.

In the Madras Chemical Examiner's reports we find under the head of "Human Viscera Examined, Class A," that in 1882 strychnine was detected in 2 out of 152 cases; in 1883, in 4 out of 123 cases; in 1884, in 8 out of 85 cases; in 1885, in 4 out of 81 cases; in 1886, none; and in 1887, in 2 out of 76 cases; in 1889, in 3 out of 101. Under the head of "Suspected Attempts to Poison" strychnine was detected in the articles examined twice in 1882, once in 1883, and once in 1887. In 1884 one case of cattle poisoning by strychnine is recorded.

The Reports of the Chemical Examiner, Bombay, for the ten years ending 1884 show that out of 947 cases in which poison was detected, strychnine was found 17 times.

Cattle poisoning from eating the leaves of *S. Nux-vomica* has been observed in the Madras Presidency and Mysore.

The following table, compiled by Assistant Surgeon C. L. Bose, Assistant Chemical Examiner to the Government of Bengal, shows the particulars of poisoning by Nux-vomica and Strychnia in India:—

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (seed or bark).		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liqr. Strychnia.		
Bengal	1873	...	...	...	...	.....	...	...	...	1	...	...	.....	.....
Do.	1874	...	...	...	...	.....	...	...	...	1	...	...	.....	.....
Do.	1877	2	...	...	...	.....	...	...	...	...	...	...	.....	.....
Do.	1878	4	...	1	...	.....	...	...	...	...	...	...	.....	"Of the four deaths from poisoning by strychnia, three were accidental and arose from strychnia having been in two instances mistaken for santonin. In one, a mother finding some medicines among her deceased husband's effects, set aside some powder which she took to be santonin, and subsequently administered a portion of this to two of her children. Both the children died, and the powder proved to be strychnia. In the other instance, the strychnia was sold from a dispensary in mistake for santonin. Both these accidents occurred in Calcutta. *Dur-*

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														ing the precious year (1877-78) a similar case came to this office from Sibsagar. A labourer in a tea-garden at Golaghat asked a fellow coolie for some santonin for himself and his son. Both the man and the boy died some hours after taking the dose given. Strychnia was detected in the stomach of both."
Do.	1879	5	...	...	...	...	...	...	...	...	...	...	...	"There were 5 deaths from poisoning by strychnia, against 4 in the previous year. Of these 5 cases only one was due to strychnia having been mistaken for santonin, against 3 deaths arising from a similar mistake in 1878-79."
Do.	1880	1	2	...	...	...	...	1	1	...	5	2	...	...	"A somewhat rare form of poisoning by the bark of the strychnos nux-vomica occurred in Calcutta, in which a young child was given a strong decoction of nux-vomica bark, *kuchila*, instead of a similar preparation of the bark of the *Holarrhena antidysenterica*, *kurchi*. From the evidence which transpired, it appeared that the child had been suffering from dysentery, and a native practitioner, who had some repute in the treatment of that disease, ordered his specific, the prescription being directed to be taken to his own dispensary for compounding. The compounder

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases						Suspected substances in connection with cattle poisoning cases.	Remarks
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica	Liq. Strychnia.		
Bengal.—(*contd.*)	1880													in charge, an unqualified man, finding no *kurchi* bark in store, purchased some from a bunniah. *Kuchila* bark was supplied instead, and not being recognized, the prescription was duly dispensed. An 8-oz. mixture was sent, the dose being one tablespoonful and the child of 2 years of age; the decoction was, I believe, of such a strength that one ounce represented the extractive matter from an ounce of the bark. Half a dose was administered, and was followed by death in 15 minutes. Brucia was detected in the mixture, and also in the stomach and vomit." "*Kuchila* and *kurchi* bark have certain points of resemblance: bunniahs sell both, and after the poisoning-case above referred to, the police obtained samples of *kurchi* bark from various

Do.	.....	1881	1	...	...	...	.....	..	...	...	...	...	...	.....
Do.	.....	1882	1	...	...	1	.....	..	...	1	5	...	1	.....

sources. In one instance the same bunniah sold nux-vomica bark for *kurchi* successively to two purchasers. It is impossible to surmise to what extent the substitution of *kuchila* for *kurchi* bark has occurred, but it is perfectly evident that bunniahs do not recognize the importance of distinguishing between the two drugs."

.....

"A fatal accident occurred in Calcutta by which a child was poisoned by the bark of nux-vomica, *kuchila* being substituted for *kurchi*. It appears that the child had been ordered decoction of *kurchi* bark, which is a bitter tonic and astringent. The drug was purchased from a bunniah, the medicine prepared, and its administration was followed by death."

"The Civil Surgeon of Sibsagar forwarded a few pills and wrote as follows:—'The pills were made by a Dr. D. P. Dass of Calcutta, and are stated to cure dysmenorrhœa, amenorrhœa, leucorrhœa, menorrhagia, and uterine diseases. A female patient took one of the pills, and about an hour afterwards was seized with violent spasms and became comatose.' The pills were found to contain strychnia and brucia."

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica. (bark or seed.)		Strychnia.	Brucia.	Strychnia and Brucia	Nux-vomica (bark or seed.	Ext. Nux-vomica.	Liq. Strychnia.		
Bengal—(*contd.*)...	1883	1	...	1	...	.....	...	...	...	2	...	...	.....	
Do	1884	...	...	...	2	.....	...	...	...	12	...	...	.....	"The seeds of *strychnos nux-vomica* were detected in the stomachs of two individuals, and the bark or seeds of this tree amongst 12 of the substances suspected to be poison or to contain poison."

"One of the two cases in which nux-vomica bark was detected in the stomach occurred at Pooree, where a native herbalist appears to have substituted nux-vomica bark for sahajmari bark. It was reported that Kapil Das, a Hindoo male, aged 35, ground together some bark of sahajmari, molasses, and ganja with water, and afterwards drank the mixture on the night of the 25th instant, and was found dead next morning with blood oozing from his mouth. Nux-vomica was detected in the stomach. The other case occurred at

Shahabad. Debdakin Julahin, a female, aged 30 years, was reported by the police to have died by eating opium. The relatives of the deceased stated that the death was due to cholera. The chemical examination detected nux-vomica."

"From Dinagepore, a case of alleged criminal poisoning by nux-vomica was reported. Nillo Nishya, a Hindu male, stated that, after taking his food, he felt a hot sensation in his mouth extending to his throat and stomach, and that this was immediately followed by vomiting. He suspected his wife of poisoning him, and had the house of his wife's paramour searched, and found there two flat beans and other herbs which were sent for chemical examination along with the vomited matter. The two beans were the seeds of *strychnos nux-vomica*. No poison was found in the other herbs or in the vomited matter. In a case of suspected poisoning at Purneah, a few packets of suspected substances were sent for examination, and nux vomica 'seeds' were detected in one of them."

"In a case at Tipperah, a Mohamedan male, named Jahan Buksh, died

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (seed or bark.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed)	Ext. Nux-vomica.	Strychnia.		
Bengal.—(*contd.*)	1884													suddenly after taking some medicine which was administered to him for the relief of a colic pain. A few pieces of the bark, of which he was said to have eaten, were sent for examination, and identified, physically and chemically, as nux-vomica bark." "There seems to be little doubt but that a considerable number of deaths are annually caused in Bengal through the carelessness of herbalists and others in subtituting nux-vomica bark for the bark of a non-poisonous medicinal tree. "Considerable insight was obtained in the month of May last as to how this substitution may occur. Kurchi bark is in great repute amongst natives as a mild antiperiodic and tonic for children, and a decoction of kurchi bark is also used in many native hos-

pitals. The apothecary of the Campbell Hospital when proceeding to make some decoction for hospital use, observed, amongst the kurchi bark, a piece of bark which he felt convinced was nux-vomica bark, and he reported the matter to Dr. Coull Mackenzie, the Superintendent of the Hospital. A second quantity of kurchi bark was sent for to the same native druggist who supplied the first lot, and this too contained several piece of nux-vomica bark. The police were then informed of the matter by Dr. Mackenzie. They proceeded to the shop of the druggist and seized the whole of his remaining stock of so-called kurchi bark, and forwarded the three lots of bark for chemical examination. Nux-vomica bark was found in all three lots in very large amount, making up about one-fourth of the entire quantity of the bark."

"One of the most remarkable features in the mortality returns of Calcutta is the enormously high death-rate from tetanus. During 1884, 1,204 deaths were registered under the heading of tetanus, and the mortality for 1884 in this respect was not unusually high. The large bulk of the

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (seed or bark.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica	Liq. Strychnin.		
Bengal—(*contd.*)...	1884													cases which figure in the returns under this heading occur in children and infants; and such enormously high prevalence of tetanus has never been satisfactorily explained. As the symptoms of strychnia poisoning very closely simulate those of tetanus, it is worth considering whether or not many of the cases of alleged tetanus may not really be cases of strychnia poisoning, when it is remembered that the deadly nux-vomica bark has been proved on several occasions to have been substituted for, or mixed with, the relatively harmless *kurchi* bark, and that this latter bark is extensively used by the people for infantile ailments."
Do.	1885	3	...	...	...	.....	4	...	...	5	...	...	3	
Do.	1886	1	1	...	...	.....	2	..	...	2	...	...	.....	The five substances in connection with cattle poisoning were found to be nux-vomica.
Do.	1887	...	..	...	...	.....	1	...	...	3	...	...	1	
Do.	1888	1	...	...	1	.....	1	...	...	1	...	...	.....	
Do.	1889	1	...	...	...	.....	3	...	...	3	...	...	1	

Bombay	1871	1	...	...	...	.....	...	...	...	...	...	...	.....	"In the case of poisoning by strychnia, the alkaloid was detected in the contents of the stomach and in the liver of a female. Marked symptoms of poisoning by strychnia were present during life. The exact quantity taken was not known. It was, however, ascertained that 10 grains by weight of strychnia was in the deceased's house shortly before she was attacked with symptoms of poisoning. After her death no portion of this quantity could be found. Only three other case of poisoning by strychnia (all non-fatal) have come before me during the past five years. Dr. Chever's remark that "commonly as the nux-vomica finds a place among the Bazaar drugs of Bengal, it would appear that it is by no means frequently employed in this country as a means of destroying life" is thus fully supported by the experience of the Bombay Chemical Analyser's office."
Do.	1872	...	...	...	1	...	...	...	...	...	...	.....	"The single case in which strychnia was detected was in some respects a curious one. A medical practitioner, resident in Bombay, sitting down to tiffin, cut off and gave to a favourite dog a piece of the meat before him. He was called away before he had time to eat any himself, and on his return

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (seed or bark).		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed).	Ext. Nux-vomica.	Ditr. Strychnia.		
Bombay—(*contd.*)	1872													about half an hour afterwards, found his dog dying. He naturally suspected that the meat he had given to the dog was poisoned and called in the police. On examination strychnia was detected in the contents of the stomach of the dog, but none could be found in the meat. The probable explanation of the case was that the dog had got hold of the poison from the police, who were at the time poisoning stray dogs in Bombay with strychnia."
Do.	1874	...	...	...	...	.....	...	...	...	...	...	...	.....	"The case in which strychnia was found was that of a man at Satara caught in the act of attempting to commit suicide by taking a white powder which on examination, proved to be strychnia. This he probably stole from the police, who use it for destroying dogs."

LOGANIACEÆ.

Do	.....	1876	...	...	...	...	.....	2	...	...	...	...	.....	"Two cases in which strychnia was detected came under notice during the year. One of these, except from the rarity of the poison, was not of particular medico-legal interest. The second case was as follows:—Two patients in a hospital were ordered mixtures containing the Liq Hydrarg. Perchloridi of the British Pharmacopœia. The quantities ordered were respectively 45 minims every 3rd hour for patient A, and one fluid drachm every 3rd hour for patient B. Patient A who was under treatment for some of the symptoms of Locomotor Ataxy, having taken two doses of his mixture was found suffering from intense headache and spasms of the extremities brought on by the least draught of air; and subsequently furious delirium set in. Patient B took only one dose of his medicine and was attacked with tetanic symptoms. Further administration of the mixtures was stopped, and what was left of them was sent to me for examination. I found both mixtures to correspond to the prescriptions, except that mercury was absent from them, and strychnia present; and it subsequently became clear that in making up the prescriptions the Liq. Strychnia of the British Pharmacopœia had by mistake been

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (seed or bark.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vo. mica.	Liq. Strych.		
Bombay—(*contd.*)	1878	2	...	...	...	.....	2	...	...	...	...	...	.....	substituted for the Liq. Hydrarg. Perchloridi which had been ordered. "This poison was detected in 4 cases (two of them fatal cases) during the year. Of the two fatal cases, one was sent up from Kaira, and was the case in which a man was stated to have committed suicide by swallowing a packet of poison used for killing dogs. On analysis, the poison was detected in the contents of the stomach and in the liver of the deceased: the other fatal case came from Bassim in the Berars. In this case, a boy, aged 11, is reported to have eaten some sugar given to him by a compounder employed in a charitable dispensary." The boy almost immediately complained of a bitter taste, and some pain about the right ear, and soon afterwards laid down, became violently convulsed, and died in about 15 minutes. On

examination, I detected strychnia in the contents of the stomach of the deceased. Of the non-fatal cases, one from Godra was a case where a constable, it is alleged, gave a man, also a police constable, two powders, stating that they were fever medicines. One of these powders the sufferer swallowed at about 3 P. M After taking the powder a bitter taste and feeling of nausea was noticed, very soon after "followed by convulsive movements of the arms and legs, and generally of all the voluntary muscles." The convulsive movements were accompanied by intervals of relaxation of the muscles. During the spasms the body was bent backwards. "There was giddiness and confusion of thoughts, which afterwards merged into insensibility." The symptoms disappeared at about 12 P. M The remaining powder on examination I found to be strychnia. The history of the other non-fatal case is thus detailed by the hospital assistant, Parunti dispensary :—"Complainant's wife gave bread to her daugher to eat, who complained of its bitter taste, upon which her mother tasted it, then her father (the complainant), as well as four or five men sitting at the time in the complainant's house, each and

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain a poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica	Igs. Strychnia.		

all complained of its bitter taste. They, therefore, got another bread prepared out of the remaining flour from which the first bread was prepared and gave it to a dog. The dog ate the whole, and after about a quarter of an hour, it fell down trembling, became convulsed, and soon after died." The bread was sent for examination, and on analysis strychnia was detected in it. During the seven years previous to the year under report, only 5 cases altogether of poisoning, or alleged poisoning in which strychnia was the poison employed, came before this office. This year I have had to notice 4 cases, and it will be observed that in two of these, and perhaps in all, the employment of strychnia as a poison is traceable to its introduction into use for the purpose of destroying dogs.

Bombay—(*contd.*)	1879	2	..	...	...	.....	1	...	...	1	...	...	.....	"In a case from Haveri, a packet containing seeds which on examination proved to be nux-vomica seeds, was forwarded with a request that I would state whether such seeds if administered to a pregnant female would be likely to cause abortion. Two fatal cases of poisoning by strychnia, one from Poona and the other from Dharamgaon (Khandesh District), were referred during the year. In the Poona case a boy, aged 5, died in about three quarters of an hour after eating some sweetmeat given to him and to his two brothers by, it was alleged, a police Havildar. Deceased's two brothers, finding the sweetmeat had a bitter taste, did not eat it. Strychnia was found on analysis in the contents of the stomach of the boy who died. The Dharamgaon case appears to have been an accidental one, arising out of some strychnia powders supplied to the police for the purpose of destroying dogs, having been mistaken for cinchona alkaloid powders supplied as a febrifuge."
Do.	1880	1	...	...	...	.....	1	...	...	...	...	...	.....	"Two cases came under notice during the past year in which strychnia was detected; one of these from Dharwar, was a case where this alkaloid was detected in the contents of the

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed).		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liq. Strychnia.		
														stomach of a hospital assistant, who, it was reported, had committed suicide while under the influence of liquor, by swallowing a quantity of strychnia. The symptoms in this case being somewhat peculiar, I transcribe from the report of the case the following account of them:—"Deceased, half an hour after taking the poison, was found lying on his cot on his stomach, and remained throughout in that position, returning to it every time an attempt was made to alter it. He could not answer questions. Respiration very hurried, rapid and stertorous. Jaws so firmly fixed that the stomach pump could not be used nor emetics efficiently administered; pulse quick and full at first; tongue much bitten and bleeding; eyelids firmly closed; *no convulsions*, merely slight muscular twitchings of face and arms. The second case was forwarded from

														Ratnagiri, and was one in which strychnia was detected in some vegetable powder found in a cup near the dead body of a man, who, it was suspected had committed suicide."
Do.	.....	1883	...	...	...	...	.....	1	...	...	1	..	...	.....	"A case was submitted by the Bombay Police in which some quack pills were found to contain a minute quantity of strychnia."
															"A case from Haveri, in which a nux vomica seed was found in the contents of a packet suspected to contain poison."
Do.	.....	1885	2	...	...	...	.....	...	...	...	...	...	...	.....	"Strychnia was detected in 2 cases, viz.—(1) In the contents of the stomach and liver of a young female who, it was reported, had committed suicide by swallowing powdered nux vomica seeds. This case was sent up from Sasvad (Poona District); (2) in a case which occurred in Bombay, where five prisoners, four of whom died, were accidentally poisoned by strychnia given to them by mistake for cinchona alkaloid."
Do.	.....	1887	...	...	...	...	.....	2	...	...	...	...	...	.....	"The poison was detected in two cases during the year, from respectively, Dindori (Nasik District) and Ahmednagar. In the first the alkaloid was

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed).		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liq. Strychnia.		
Bombay—(*contd.*)	1887													detected in the vomit of a young man who attempted to commit suicide. The sufferer was the son of a police constable, and the strychnia swallowed by him was a portion of some issued to his father for the purpose of destroying dogs. In the Ahmednagar case, strychnia was detected in some fragments of bread and also in some powders sent for examination therewith. Two boys, aged respectively 9 and 4, sons of a police constable, abstracted some strychnine powders from their father's bag. Of these they used two in poisoning dogs. Subsequently they appear to have mixed a third with the bread sent for examination, and were about giving this bread to some boys when they were stopped by the Police schoolmaster. The powders sent along with the bread were found hidden under some rubbish in the school-room."

Do.	.....	1889	...	...	...	...	.....	...	...	...	2	...	...	.....	(1) "A case from Nagar (Ahmednagar district) in which some seeds and powders were recognized as nux-vomica seeds and chalk mixed with red lead. They were found on the person of some accused, but no further history was forwarded. (2) A case from Patan (Satara district) in which nux-vomica seeds and powder of arsenious oxide and sulphate of copper were forwarded for identification, no notes of the case being afforded."
N.-W. P. & Oudh.	1870	.....	...	...	...	.....	...	...	...	...	...	...	...	.....	Strychnia—1. It is not mentioned whether the detection was in connection with human or animal poisoning cases.
Do.	...	1875	1	...	...	...	.....	1	...	...	...	...	...	...	.....	"Referred by the Superintendent of Tarai. This was a case of suicide, the person being Tarachand Bhaduri, an Assistant Surgeon at Kashipoor in the Tarai. After death two phials were found in his pockets, one empty and labelled "Prussic acid," the other labelled "Strychnia" and containing some of those substances. I made a careful search in the stomach and its contents for prussic acid but found none. I then tested for strychnia, and detected it by the usual process. From the history of

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (seed or bark.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liq. Strychnia.		
														the case it would appear that this unfortunate man must have taken a large dose, as the symptoms of the poison were not only well marked, but he died in about 5 minutes after the first symptoms were observed."
N.-W. P. & Oudh. (*contd.*)	1878	...	...	...	...	.....	...	...	...	...	...	...	.....	Strychnia—2. Detected in connection with human poisoning cases, but whether in the viscera or in the suspected substances it is not mentioned.
Do.	1879	...	...	...	...	.....	...	...	...	...	...	...	.....	Nux Vomica—1. Detected in connection with human poisoning cases, but whether found in the stomach or among the suspected substances it is not mentioned.
Do.	1881	...	...	...	...	.....	1	...	...	1	...	...	.....	"From Ballia. The substance examined was found to be nux-vomica. This is also a drug often to be found in bazaars and yet not much used as a poison."

Do.	1885	...	...	...	1		1	..	...	...	...	...	.....	"An officer of the Royal Artillery stationed in Meerut suspected that the tea made for him by his servants had been drugged with some poison used for killing mice, &c. I found the vermin killer contained a small quantity of strychnia, but I could not find a trace of this alkaloid in the tea."
Do.	1885	...	...	...	1		1	..	...	...	...	...	.....	"From Azimgarh. This was a case of suicide in which it was supposed that the subject of it, a woman of name unknown, had taken powdered nux-vomica; but finding that death came too slowly she drowned herself. Small fragments of nux-vomica were found among the contents of the stomach, and strychnia, the active principle of nux-vomica, was also found in the substance of the stomach."
Madras	1879	1	...	...	...	.....	...	...	...	1	...	...	.....	"Cattle case from Sitapore concerning poisoning a horse—poison used was nux-vomica."
Do.	1880	...	...	...	...	.....	...	...	...	2	...	...	.....	.....
														"A woman was believed to have committed suicide with nux-vomica leaves. No fragments of the leaves or traces of strychnia were contained in the stomach. Some leaves which were sent up were found to be leaves of nux-vomica."

Presidency.	Year.	Human viscera				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica. (bark or seed.)		Strychnia.	Brucia.	Strychnia and Brucia	Nux-vomica (bark or seed.)	Ext. Nux-vomicæ.	Extr. Strychnia.		
Madras—(*contd.*)	1881	2	...	...	...	.....	...	...	...	...	...	...	.....	.....
Do.	1882	2	...	...	...	.....	2	...	...	...	...	...	.....	"Strychnia was detected in viscera in two instances. One case may have been a case of suicide. In the other case a man who was suffering from leprosy seems to have been poisoned either accidentally or intentionally by his medical adviser. The medicine which was being used was found to contain a very large amount of strychnia and brucia with an immense quantity of pepper and ginger." "Nux-vomica seeds in powder were also found in a powder which a man was accused of having forcibly rubbed into the mouth of a woman before attempting to commit a rape upon her. The poison was also found twice in native medicines, the properties of which were required to be known."
Do.	1883	7	...	...	...	.....	3	...	...	...	...	...	.....	In seven instances strychnia was detected in the human viscera, and in three instances among substances suspected to be or to contain poison.

.....	1884	8	...	...	...	.....	...	...	...	...	...	...	1
Do.	1885	4	...	...	...	.....	...	...	...	...	...	...	.....
Do.	1886	...	...	...	3	.....	...	...	...	...	...	...	.....
Do.	1887	2	...	...	...	.....	1	...	...	...	...	...	.....

"Strychnia was detected in three cases. One from Godavari was said to be a case of suicidal poisoning by opium; no opium was found. In the second case from Nellore, a woman was reported to have vomited, been purged, and died within three hours. The third case from Salem is remarkable, because the victim was said to have died twenty-four days before the *post-mortem* examination of the body was held, and nearly two months before the chemical examination of the viscera took place. The history of the case indicated the probability of death having been produced by some irritant poison administered by an enemy of long-standing, who was supposed to have recently been reconciled to the deceased." No mention is found of the remaining five cases. Nux-vomica was detected in connection with the cattle-poisoning case.

.....

The nux-vomica was mixed with orpiment in all of the three cases.

In one case strychnia was discovered in large quantity where opium had also been used. The strychnia was detected not only in the viscera, but also in the urine which was drawn off *post-mortem*. The case was remark-

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (seed or bark.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica	Liq. Strychnia.		
														able from a medico-legal point of view, because the action of the strychnia was much delayed and modified by the opium taken along with it. The patient was taken ill at 10 A. M., and the symptoms then were occasional spasmodic contractions of the muscles of the upper extremities. Later on the temperature rose, but the spasms ceased. At 4 P. M. the patient vomited. At 7-15 P. M. he had a fit of convulsions and died. Zinc sulphate and apomorphia had been administered without effect.
Madras—(*contd.*)..	1889	1	...	...	...	.....	...	...	...	...	...	...	.....	"The corpse of a woman (widow) was dragged out of a well, and as the cause of death could not be ascertained at the inquest, the body was conveyed to the local dispensary by the police. On getting ready for the *post-mortem* examination, a dead foetus dropped out of the winding sheet, *post-*

mortem delivery having occurred on the way unnoticed by the bearers of the corpse. There were no signs indicating that any attempt to cause abortion had been made; there were no signs of drowning; the fœtus was seven or eight months old; and its delivery was accompanied by a total inversion of the uterus. Strychnia was found in the viscera sent. The occurrence of child-birth after the life of the mother had become extinct, without the aid of art, and indeed even after interment, has been recorded and vouched by many observers of established credit, the independent contractile power of the uterus, or cadaveric rigidity being stated to be the chief factors in the production of this accident. So-called "cadaveric spasm" also known to occur at or after death by strychnine poisoning, and to persist till true cadaveric rigidity comes on, disappearing only with it. In the present instance the body must have lain for about 18 hours in the water, cadaveric rigidity had all but passed away at the time of examination (only the upper limbs being slightly stiff) and no doubt expulsion of the fœtus occurred by the pressure of the gaseous products of putrefaction which filled the abdo-

Presidency.	Year.	Human viscera. Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases. Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liq. strychnia.	Suspected substances in connection with cattle poisoning cases.	Remarks.
														men. The possibility of this accident occurring is a point in obstetric jurisprudence, which should not be forgotten when examining the dead body of a female alleged to have miscarried.
Punjab.	1873	...	...	...	...	.....	...	...	...	1	...	...	1	Nux-vomica was detected in connection with the cattle-poisoning case.
Do.	1879	...	...	...	...	.....	...	...	...	1	...	...	1	"Nux-vomica is very rarely used for murder, as strychnia has one of the most bitter tastes known, suspicion would be at once aroused. During the last two years, only one case has been referred, that of a man poisoned by his wife by mistake, who gave him the drug by the advice of a fakeer as an aphrodisiac."
Do.	1880	2	...	...	...	.....	1	...	...	...	...	...	.....	"In one of the strychnia cases, a police officer took a quinine powder, as he supposed, from a drawer in which such were kept for distribution. From this drawer there were sent 93 powders of strychnine, each of 5 grains,

Do.	1881	...	...	...	...	...	...	...	1	...	...	.....	along with a large number of powders of cinchona febrifuge and sulphate of quinine. It was not stated whether they had been made up to poison beasts."
Do.	1882	...	...	...	...	...	...	...	1	...	...	.....	.....
Do.	1883	...	...	...	...	...	...	...	1	...	...	.....	.....
Do.	1884	...	...	...	...	1	...	...	2	...	...	.....	.....
Do.	1886	...	...	...	...	...	...	...	1	...	...	1	Used for procuring abortion. Nux-vomica was detected in connection with the cattle poisoning case.
Do.	1887	...	...	...	...	...	...	..	1	...	...	.....	.....
Do.	1888	...	...	...	...	...	...	...	3	...	...	.....	.....

The following cases of poisoning by nux-vomica and its alkaloids are recorded in Dr. Brown's Book on "Punjab Poisons":—

No 108. "In a case which was brought to the Medical College, Calcutta, in 1880, an old man put five of the seeds into a vessel of water and allowed it to stand all night long; the next morning he drank off the water. About half an hour afterwards he began to feel giddy and unable to stand, and at length he had a fit. About three hours after he was brought to the hospital, not having vomited, and the stomach pump was used; as soon as the tube of this passed the throat a spasmodic attack was occasioned, in which all his limbs became stiff and remained so for about 3 minutes; after this ceased, the tube was conveyed into the stomach, which was throughly cleaned out, and a dose of opium was administered. There was no return of the fit, and the next day he was quite well. The above forms a good example of a very mild case of this form of poisoning."

"Case No. 48 of 1862, Umballa.—A man ate some sugar; soon after he complained of twitchings and spasms in the throat and limbs; he vomited and afterwards recovered; strychnia was detected in the sugar used."

"Case No. 134 of 1869.—Several persons partook of food in which nux-vomica seeds had been put; within a minute they complained of a bitter taste in the mouth, twitchings of the throat, and giddiness and vomiting occurred; they subsequently suffered from cramps and twitching in the limbs, dimness of sight and weakness, but fell asleep two hours afterwards and then recovered. Nux-vomica seeds and strychnia were found in the vomited matter."

Collection.—Cochin nux-vomica is collected in the dry deciduous forests at the foot of the Travancore hills, and is sold to small native dealers at a low rate, who send it to the merchants. The Coconada nux-vomica is obtained from the Ganjam district and Godavery. The Madras seeds come from Nellore and several other parts of the Presidency. The dirty and discoloured seeds, such as those left by monkeys, hornbills and parrots only fetch half rates. The best seed is obtained by collecting the fruits, washing out the seeds and drying in the sun. The right of collection is sold by the Forest department over fixed areas, and in the upper taluks of the Godavery in 1889, 5,500 maunds were taken out on payment of seigniorage. The last Nellore sales fetched Rs. 12 per candy of 20 maunds, that is, Rs. 2-8-0 per cwt. in Madras. In the Concan the seed is collected in a similar manner by the Mhars and other outcastes, and is sold to the small dealers at an average rate of one anna per measure of about 4lbs.

Commerce.—Large quantities of nux-vomica are exported from India. The annual exports from Bombay amount to about 4,000 cwts., all shipped to the United Kingdom. Madras and Cochin export still larger quantities, and Calcutta rather less. An extensive business is done in this drug at Cocanada, from which port it is shipped to Calcutta, Madras, Alleppy, Cochin, Bombay and Europe. The bags are made up to contain 164—165 lbs. each, and are valued at Rs. 3 per bag.

Exports from Cochin.	Cwt.
1883-84	2,396
1885-86	10,787
1886-87	2,535
1887-88	7,575
1888-89	3,255
1889-90	17,716

STRYCHNOS IGNATII, *Berg.*

Fig.—*Rev. de Plant. Vasc. Filip. App., p.* 449. Saint. Ignatius' Bean (*Eng.*), Féve de Saint Ignace (*Fr.*).

Hab.—Philippine Islands. The seeds.

Vernacular.—Papita, from Spanish Pepita (*Ind. Bazars*).

History, Uses, &c.—The seeds were first described in Europe by Ray and Petiver (*Phil. Trans.*, 1699, xxi., 44, 87), from information furnished to them by the Jesuit missionary Camelli, and probably were brought to India by Jesuit missionaries about the same date. They are described in the *Makhzan-el-adwiya* of Mir Muhammad Husain (A.D. 1769) as the seeds of a fruit, about the size of an orange, brought from the New World; of a hot and dry nature, an excellent remedy in cholera and obstinate vomiting, and useful in all cold phlegmatic diseases, such as asthma, dropsy, rheumatism, &c. The dose is one to two grains, with two or three peppercorns rubbed down in water. There is a lengthy account of the seeds in the *Talif-i-sharifi*, which the author informs us is chiefly compiled from European works. Lonreiro says:—"I have often given and seen others give a whole seed weighing one drachm rubbed in water or wine to buffaloes, horses, cows and swine as an anthelmintic." The plant, hitherto imperfectly known to European botanists, has now been fully described and figured by Don Sebastian Vidal y Soler, Chief of the *Commission de la Flora Forestal de Filipinas*, in their "*Revision de plantas vasculares Filipinas*," published at Manilla in 1886.

The seeds are not now used medicinally in Europe, but when cheap are readily purchased for the manufacture of strychnia. They are officinal in the United States.

Description.—St. Ignatius' Beans are about an inch in length, their form is ovoid, but by mutual pressure it is rendered very irregular, and they are 3 to 4 or 5-sided, bluntly angular or flattish, with a conspicuous hilum at one end. In the fresh state they are covered with silvery adpressed hairs; portions of a shaggy brown epidermis are here and there perceptible on those found in commerce; but in the majority the seed shows the dull grey granular surface of the albumen itself. Notwithstanding the different outward appearance, the structure of St. Ignatius' Beans accords with that of Nux-vomica. The radicle however is longer, thicker, and frequently somewhat

bent, and the cotyledons are more pointed. The horny brownish albumen is translucent, very hard, and difficult to split. The whole seed swells considerably by prolonged digestion in warm water, and has then a heavy, earthy smell. The beans are intensely bitter, and highly poisonous.

Microscopic structure.—The hairs of the epidermis are of an analogous structure, but more simple than in nux-vomica. The albumen and cotyledons agree in structural features with those of the same parts in nux-vomica.

Chemical composition.—Pelletier and Caventou (1819) found the seeds to contain the same constituents, though in different proportions, as nux-vomica; they stated the yield of strychnine (still containing brucine) to be 1·4 per. cent. Geissler (1837) likewise found 1·5 per cent. of this alkaloid. F. F. Mayer (1863), on assaying ignatia with his solution, obtained from 2 troy ounces of the seeds 4·5 grains of strychnine and 13·73 grains of brucine, which correspond to 0·52 per cent. of the former and 1·43 per cent. of the latter. The dried seeds yield 1·78 per cent. of nitrogen, indicating about 10 per cent. of albuminoids. (*Pharmacographia.*)

Commerce.—The seeds sometimes reach India from the East *via* Singapore, or are imported from Europe. Value, extremely variable.

STRYCHNOS COLUBRINA, *Linn.*

Fig.—*Rheede Hort. Mal. vii., t.* 5.

Hab.—W. Deccan Peninsula, from the Concan to Cochin. The wood.

STRYCHNOS RHEEDII, *Clarke.*

Fig.—*Rheede Hort. Mal. viii., t.* 24. Serpent's wood (*Eng.*), Bois de couleuvre (*Fr.*).

Hab.—Malabar. The wood and leaves.

Vernacular.—Nága-musádi (*Tel.*), Modira-caniram (*Mal.*), Kuchila-lata (*Hind., Beng.*), Goagari-lakri (*Guz.*), Deva-kadu (*Mar.*).

History, Uses, &c.—The vernacular names we have given are applied to several scandent species of Strychnos, the wood of which is used medicinally in India, and is known in Europe as *lignum colubrinum*. In addition to the two plants placed at the head of this article, it appears to be probable that *S. Beddomei*, Clarke, *S. laurina*, Wall., and *S. cinnamomifolia*, Thwaites, yield some of the serpent's wood used by the natives, and it is well known that the wood of *S. Nux-vomica* is often sold under this name. Rheede (viii., p. 47), speaking of this wood, tells us that it is called *Pao de solor* or *Pao da cobra* by the Portuguese; and that the Malayalim word *modira* signifies mystax (μυστας), probably an allusion to the moustache-like tentacles of the plant. In addition to the well-known use of the wood, he says: "Folia cum zinzibere et lacte ad consistentiam unguenti cocta, arthritidem, *Vilvada* Malabaribus appelata abigit; balneum ex illis præparatum idem præstat." Vilvada is a term applied to neuralgic pains. The *arbor ligni colubrini* of Rumphius (1, 70) appears to have been *S. colubrina*; he states that it is used in Java as a febrifuge and anthelmintic, and also externally in certain skin diseases. This species is described by Rheede under the name of *Scheru-Katu-Valli-Caniram*. He says that the Dutch call it *Wild Klimmend Kraanoog*; that the bruised fruit is applied to the head in mania, that the root rubbed down with pepper is given to check diarrhœa, and that boiled with oil it is used as a liniment for pains in the joints. The bark and wood of the different species of Strychnos appears to be the Katukavalli of the Rájá Nirghanta, often confounded with Kutaja, the bark of *Holarrhena antidysenterica*. In the vernaculars the Sanskrit Katu, bitter, becomes Kadu, Karu, Kadva, Karva, Karo, Kaura, &c., and Kuta, a water pot, becomes Karva, Karua, Karaya, &c. These names are very loosely applied to many bitter medicines, and often lead to dangerous mistakes. Ainslie wrongly supposes *lignum colubrinum* to be the *Dand-el-sini* of Ibn Sina. The latter writer, speaking of Dand, says:—

الصيني مذر كالفستق والسنجرني مثل الخروع الاحمر منقط
بوعر والهندي اصغر من الصيني واكبر من السناجري