burning of the soles of the feet, and with black pepper is rubbed round the orbit as a cure for night blindness. The Sanskrit name is Káravella, the muricated variety is called Sushavi, and bears the synonym Kándira or "armed with arrows." The author of the *Makhzan-el-Adwiya* describes the fruit as tonic and stomachic, and says that it is useful in rheumatism and gout, and in diseases of the spleen and liver; he also mentions its anthelmintic properties. He points out that some have erroneously supposed it to be identical with the Katha-el-himár of the Arabs, which is a violent purgative. Drury has the following description of *M. Charantia*:—"Climbing, stem more or less hairy; leaves palmately 5-lobed, sinuate, toothed, when young more or less villous on the underside, particularly on the nerves; peduncles slender, with a reniform bracteole about the middle, female with it near the base; fruit oblong or ovate, more or less tubercled or muricated; seeds with a thick notched margin and red aril; flowers middle-sized, pale yellow." In the rainy season the plant may be seen in almost every garden in India. The fruit is also offered for sale in the market, and when well cultivated attains the size of a cucumber.

MOMORDICA CYMBALARIA, *Fenzl.*

Fig.—Lyon *Med. Jurisp. for India, p.* 200, *f.* 14.

Hab.—Deccan Peninsula, Mysore, Concan. The tubers.

Vernacular.—Kadavanchi (*Mar.*).

History, Uses, &c.—The whole plant is acrid; it is mentioned here as a number of the tubers were forwarded to the Chemical Analyser to Government, Bombay, from Satara, as having been found in the possession of a person suspected of administering drugs to procure abortion. Our specimen was grown from one of these tubers. Dr. Lyon, the Chemical Analyser, informs us that on reference to the records of his office he finds that the Kadavanchi tubers have been three times sent to him within the last four years as having been used to procure abortion. In 1889, the tubers were again

forwarded to Dr. Barry, Acting Chemical Analyser, in connection with a case of abortion.

Description.—Root tuberous, ovoid; the tubers had the odour of cucumbers, and examined under the microscope, the central portion was seen to consist of starch cells, between this portion and the epidermal layer irregular masses of a resinous substance were observed; leaves 1—2 inch broad, 5-angular or slightly 5-lobed, middle lobe not elongated, glabrous or slightly pubescent, often punctulate on both surfaces, dentate: petiole ½—1½ in. Male raceme 1—2 in., with usually only two to four flowers; calyx-lobes lanceolate; petals ¼ in., white; filaments two, one 2-fid, one 3-fid, so each with one anther-cell; filaments inserted near the top of the calyx tube, anthers completely exsert. Female peduncle ¾—2 in., one flowered, ebracteate (the male peduncle has a minute bract). Fruit ¾—1 by ¼ in. Seeds ⅛—¼ in., few, shortly obovoid, smooth, shining. (*Fl. of Brit. India.*) The fruit has eight prominent ribs, and is covered with silky hairs; while still green, it dehisces into four parts, and discharges its seeds, which are obovoid, dark brown, slightly warty, as large as a small peppercorn, and with a prominent hilum.

Chemical composition.—A bitter glucoside was isolated from the portion of the alcoholic extract of the tubers soluble in water. It was almost insoluble in ether, and was precipitable from its aqueous solution by tannin and alkaloidal reagents. With strong sulphuric acid it turned bright red and the colour gradually changed to purple, which remained for several hours.

A yellow acid resin of very acrid properties was present in the tincture, together with a saccharine principle.

A tuber weighing 2 grams was incinerated, the ash amounted to 6 per cent.

LUFFA ACUTANGULA, *Roxb. Var. amara.*

Fig.—*Bot. Mag.* 1638.

Hab.—Throughout India. The fruit and wine.

Vernacular.—Karela-toria, Karvi-turai (*Hind.*), Kadu-sirola, Kadu-dorka (*Mar.*), Ghosha-lata, Tito-torai (*Beng.*), Pé-pirkkam

(*Tam.*), Chedu-bira, Verri-bira (*Tel.*), Kadvi-ghisodi (*Guz.*), Hire-balli (*Can.*).

History, Uses, &c.—This plant is called in Sanskrit Koshataki, a general name for the genus Luffa, from *kosha*, the cocoon of a silk-worm, and in allusion to the way in which the seeds are enclosed within a fibrous network. The names Dalika and Ghoshaka appear more particularly to appertain to this species. The Hindus apply the juice of the immature gourd, which has been slightly roasted, to the temples to cure headache, and administer an infusion of the ripe fruit as a vomit and purge. Roxburgh notices the cathartic and emetic properties of the fruit. In the *Pharmacopœia of India* the plant is described as a bitter tonic and diuretic, and is recommended in enlargements of the spleen on the authority of Dr. J. A. Green and Mr. J. C. Dickenson. The juice of the leaves is used as an external application to sores, and the bites of venomous animals, and the pulp of the fruit is administered internally in the latter class of cases to cause vomiting and purging, just as colocynth is used where that plant is abundant. The dried fruit is powdered and made into a snuff for those suffering from jaundice, and the root with equal parts of *Hibiscus Rosa-sinensis* root and *Hemidesmus* is given with milk, cumin and sugar in gonorrhœa.

Description.—The vine of *L. amara* resembles that of the cultivated plant. The fruit is smooth, from 3 to 5 inches long, ovoid, marked with ten prominent, sharp longitudinal ridges; at the apex is a small operculum rather more than half an inch in diameter, which is deciduous. Internally it is filled with white spongy pulp, of a cucumber odour. The seeds are grey and marked with small irregular black prominent specks. The leaves are bitter, the fruit less so.

LUFFA ECHINATA, *Roxb.*

Fig.—*Lyon, Med. Juris. for India, p.* 201.

Hab.—Guzerat, Sind, Bengal, Dacca. The fruit.

Vernacular.—Kukar-lata, Bindál, Ghagar-bel, Deodáil (*Hind.*), Kukar-vel, Vápala (*Guz.*), Deodangri, Deotádi (*Mar.*), Deodáli (*Can.*).

History, Uses, &c.—This plant is used medicinally in most parts of India. In the Nighantas it bears the following Sanskrit names: Devadáli, Vrata-kosha, Devatádi, Garáa, Jimúta, Taraki, Veni, Jálani, and Akhu-visha-ha; it is described as expelling bile, phlegm, and removing piles, swellings, jaundice, phthisis, hiccough, worms and fever, and acting as an emetic.

In Guzerat the fruit is well known as Vápala-bij, a name derived from the Sanskrit *vápa*, "weaving," in allusion to the cocoon-like network in which the seeds are enclosed. The drug is a frequent ingredient in the compound decoctions which are prescribed for bilious fevers. In the Concan a few grains of the bitter fibrous contents of the fruit are given in infusion for snake-bite and in cholera after each stool; in putrid fevers the infusion is applied to the whole body, and in jaundice it is applied to the head and also given internally; the infusion has also a reputation as a remedy for colic. We have not met with any notice of the medicinal use of this plant in European works on the Materia Medica of India.

Description.—The stems are herbaceous, scandent, five-sided, slightly hairy; tendrils two cleft; leaves generally five-lobed, somewhat hairy, margins scallop-toothed; petioles as long as the leaves, ribbed; fruit oval, the size of a nutmeg, armed with numerous long, rather soft, diverging bristles, obscurely divided into three cells by a network of dry fibres, and opening at the top with a perforated stopple, which falls off when the seeds are ripe; seeds about 18, ovate, compressed, black and scabrous; testa very hard; kernel white. The fibrous substance in which the seeds are enclosed is intensely bitter.

Chemical composition.—The air-dried fruit deprived of seeds as much as possible was agitated with 80 per cent. alcohol: the greater part of the spirit removed by distillation, and the remainder allowed to evaporate by exposure to air. During spontaneous evaporation the tincture gelatinized. When the extract no longer smelt of alcohol it was gently warmed on the water bath, water added, and when cold the turbid mixture

repeatedly agitated with ether. The ether was much coloured; gelatinous flocks separated during agitation.

The ethereal solution contained a large amount of chlorophyll, and after evaporation of the ether, the residue became partly crystalline. The extract was repeatedly treated with light petroleum ether, which removed some waxy and much colouring matter, and a crystalline principle, appearing as needles and stellate masses under the microscope, which was not further examined. The dark residue insoluble in petroleum ether was then boiled with water; the aqueous solution was slightly yellow, became turbid on cooling, and possessed an extremely bitter taste. This aqueous solution was agitated with ether; on spontaneous evaporation a yellow transparent varnish was left, destitute of any crystalline structure. The extract treated with water afforded a white curdy precipitate with tannic acid: no precipitate with Mayer's reagent: with ferric chloride it afforded a slight greenish coloration; after boiling with dilute sulphuric acid, the solution readily reduced Fehling's solution. This principle would appear to be allied to, if not identical with, *colocynthitin*.

Its physiological action was tried in the following experiment:—0·0296 gram. was dissolved in a few drops of alcohol and warm water, and injected into a full grown, fasting cat's stomach at 10-50 a. m.

11-20 a. m.—Vomited several times, first contents of the stomach, and then white frothy mucus, not tinged with blood.

12-0 noon.—Passed a solid stool: lying on its side breathing slow.

1-40 p. m.—Passed a semi-solid stool tinged with blood; pupils somewhat dilated; now and again contraction of abdominal muscles: uneasy, chiefly on its side, but shifts its position frequently.

2-45 p. m.—Pupils widely dilated: less of power in hind legs, unable to stand: appears to have some difficulty in raising its head, which it keeps between its fore paws, which are extended; expression anxious.

2-55 p. m.—Slight convulsive movements of hind legs; breathing very shallow; pupils widely dilated; position as before.

2-57 p. m.—Marked convulsive movements of hind legs; breathing spasmodic and loud.

3-4 p. m.—Spasmodic gasps at intervals of about 10 seconds.

3-15 p. m.—Died; no further convulsive movements.

Death thus resulted in 4 hours 25 minutes after introduction of the drug into the stomach, and only one stool was passed which could be ascribed as being due to its action.

Post-mortem examination 20 minutes after death:—Both lungs pale and collapsed; no fluid in pleural cavity.

Heart contracted, and empty; no clots.

Stomach contained frothy glairy mucus, and a deep yellow fluid, walls darkly congested; no effusion of blood.

Liver congested. Spleen normal. Kidneys, central portions lightly congested.

Intestines—Rectum highly congested, with bloody adherent mucus; the lower portion of the jejunum comparatively slightly congested in patches, the upper portion more deeply congested, until the duodenum is reached, when the whole of the gut was of a dark claret colour, from uniform congestion. The ilium was wholly free from congestion and was bile stained.

The gelatinous flocks which separated on agitating the aqueous alcoholic extract with ether had the following properties:—By boiling with water an opalescent solution was obtained, which was filtered. The insoluble residue on the filter was soluble in boiling absolute alcohol, on concentration microscopic needles, rods, and plates separated. This residue was not further examined; it did not exceed a trace. The aqueous filtrate gelatinized before it was quite cold. A portion was evaporated to dryness and boiled with absolute alcohol, when with the exception of a trace of insoluble matter, it wholly dissolved, forming a yellowish and bitter solution. On spontaneous evaporation opalescent masses separated on the sides of the beaker, and the solution formed a jelly. On completely evapo-

rating off the alcohol, brittle yellowish flakes were left. In ammonia the principle dissolved forming a deep yellow solution; on the addition of acids the colour was discharged, slightly yellowish flocks being precipitated, which redissolved in alkalies with a deep yellow coloration: with tannin no precipitate was produced. Fröhde's reagent gave a yellow colour in the cold, becoming emerald green on heating, and changing on cooling to blue, green, and finally to yellow. Nitric acid gave a yellow colour. Mayer's reagent, after acidulation with sulphuric acid, gave no precipitate. Concentrated sulphuric acid gave a deep yellow: on the addition of bichromate of potash there was no special colour reaction. On boiling with dilute sulphuric acid, yellow flocks separated, only slightly soluble in boiling water, and not gelatinizing; slightly soluble in ether; dissolving in alkalies with a deep yellow coloration and reprecipitated in gelatinous flocks by acids. The aqueous acid filtrate after digestion with Barium carbonate was slightly bitter, and precipitated an alkaline copper solution on boiling.

The gelatinizing properties of this principle appear to be very marked. ·1016 gram when dissolved in 100 c. c. of boiling water, gelatinized when the temperature fell to 35° C., so that the beaker containing the solution could be inverted. We have provisionally termed this principle "*luffein*," and we think it not unlikely that it will be found in the fruit of most other plants of the same and allied orders; it differs from pectin, vegetable mucilage, &c., by being soluble in alcohol. From the original aqueous solution after dissolved ether had been expelled, agitation with acetic ether yielded an extractive, highly bitter, which afforded reactions similar to those of colocynthin.

We were unable to obtain the principle in a crystalline form.

The seeds contain a bland fluid oil free from bitterness, and which possesses some siccative properties.

Toxicology.—Dr. Burton Brown (*Punjab Poisons*, p. 206,) notices the use of the fruit as an abortifacient. In 1887, Dr.

Kirtikar recorded (*Trans. Bomb. Med. and Phys. Soc.*) a case of poisoning with symptoms resembling those of cholera, after the administration of one fruit as a purgative; this dose proved fatal. The drug must therefore be used with great caution.

CEPHALANDRA INDICA, *Naud.*

Fig.—*Wight Ill., t.* 105; *Hook. Ic. Pl. I., t.* 138.

Hab.—Throughout India.

Vernacular.—Kunduri (*Hind.*), Telakucha (*Beng.*), Kovai (*Tam.*), Rán-tondla (*Mar.*), Gholi (*Guz.*), Tonde-konde (*Can.*).

History, Uses, &c.—This plant is called in Sanskrit Vimba, Vimbaja, Tundkéri and Tundika; it has a scarlet fruit, and Indian beauties are described as Vimboshta, "red or cherry-lipped," by poets and story tellers. The root and juice of the leaves is used medicinally; the wild fruit is very bitter, but that of the cultivated form is sweet and is much used as a vegetable. In Hindu medicine the juice of the tuberous root is used as an adjunct to the metallic preparations prescribed in diabetes in doses of one tola (180 grs.) every morning. Dutt states that he has known several patients who were benefited by its use. Ainslie notices its use in southern India, and says that the juice of the leaves is applied to the bites of animals, Moodeen Sheriff states that in the bazars of the south the root is sold as a substitute for Caper root. In the Concan the root pounded with the juice of the leaves is applied to the whole body to induce perspiration in fever, and the green fruit is chewed to cure sores on the tongue. We have found the deep green leaves useful as a colouring agent in preparing Savine ointment from the essential oil.

Description.—Fruit bitter, fleshy, cylindrical, smooth, green, with ten white stripes when unripe, in which state it is used when cultivated and free from bitterness; when ripe scarlet, indehiscent, about 2 inches long by one in diameter; seeds numerous. The natural form of the root is a long tapering tuber, but it is often much deformed when growing in

stony ground and becomes crooked and knotty. It is perennial and often attains a considerable size, but the average diameter in the wild plant is from 1 to 2 inches at the thickest part a little below the crown. Externally the root is of a pale yellowish-brown colour, with indistinct circular constrictions and longitudinal furrows. The transverse section is yellow with distinct medullary rays. The root is traversed by numerous bundles of stout woody fibres; when wounded a clear juice exudes having a cucumber odour, which dries into an opalescent gum. The root has an acid and astringent taste, and is not quite free from bitterness.

Chemical composition.—The sliced tubers were dried at a low temperature, reduced to powder, and the powder sifted from woody-fibre. Dried at 100° C. the powder lost 6·76 per cent. of moisture. The ash amounted to 15·52 per cent., there was nothing special to note regarding its composition; it did not contain any manganese. The powdered tubers were exhausted with 80 per cent. alcohol; the tincture was of a yellow colour: on concentration resin and oily particles separated; the addition of water caused a turbidity; the turbid solution was heated to drive off the last traces of alcohol: the liquid had a strongly acid reaction. To the turbid acid solution more water was added and the liquid agitated with ether. The separated ether was agitated with dilute hydrochloric acid; the acid solution gave indications of the presence of an alkaloid. The separated ether left on evaporation a soft yellowish non-crystalline residue, possessing a fragrant odour. This extract was insoluble in alkalies, easily soluble in alcohol, ether and benzol. The aqueous solution after separation of ether was rendered alkaline with carbonate of soda, and agitated with ether. The hydrochloric acid solution referred to above was treated in a similar manner, and the separated ethers mixed. The mixed ethereal solution left on spontaneous evaporation a soft yellow non-crystalline residue, possessing a fruity odour, which was considerably increased by the addition of dilute sulphuric acid. In dilute acids the extract was partly soluble; the acid solution gave a precipitate with all alkaloidal

reagents. The special properties of this alkaloid will be considered later. The principle insoluble in acids had the properties of a resin.

The alkaline aqueous solution was subsequently agitated with chloroform, and then with amylic alcohol. In both cases extracts were yielded partly soluble in dilute acids, the solutions affording precipitates with alkaloidal reagents. From colour reactions and the physical properties of these alkaloids, they appeared to be similar to the one first extracted by ether. The three acid solutions were consequently mixed, agitated with amylic alcohol, which removed a trace of resin; the acid then neutralized with carbonate of soda, and the solution agitated with fresh amylic alcohol. On evaporating off the amylic alcohol, a varnish-like residue was left, easily soluble in alcohol and amylic alcohol, but less readily dissolved by ether chloroform. In water the extract was only very slightly soluble; in dilute sulphuric acid it was not wholly soluble, a trace of resin being left. The acid solution was strongly bitter. With alkaline carbonates it gave a white precipitate; with platinic and auric chlorides amorphous precipitates: it also yielded precipitates with phosphomolybdic acid, potassio-mercuric iodide, teriodide of potassium, picric acid, &c. With concentrated nitric acid it afforded no colour reaction in the cold, but on the application of a gentle heat a slight yellow colour was developed: concentrated hydrochloric acid gave no reaction in the cold or on heating; concentrated sulphuric acid gave a light brown tint in the cold, which became reddish-brown on heating. Fröhde's reagent gave a lilac tint in the cold, which became reddish on heating and blue as the liquid cooled. Bichromate of potassium and sulphuric acid afforded no special colour reaction; ferric chloride gave no colour reaction. This alkaloid was only present in very small amount, hardly more than a marked trace.

Ether chloroform and amylic alcohol also extracted a golden brown resin, insoluble in alkaline carbonates, easily soluble in caustic soda, and less readily dissolved by ammonia. In amylic alcohol the resin was more easily soluble than in ether or

chloroform. From its alkaline solutions it was precipitated by dilute acids in yellowish flocks.

After agitation with amylic alcohol the alkaline solution was precipitated with plumbic acetate; on decomposing the lead salt with hydro-sulphuric acid an organic acid was obtained, which afforded the reactions of citric acid. The liquid after separation of the lead precipitate was treated with hydro-sulphuric acid, the filtrate evaporated to a syrup, and heated for some hours on the water bath, on diluting with water a strongly acid solution was obtained, the acidity of which was not due to acetic acid; the nature of this organic acid was not determined.

A principle which easily reduced an alkaline cupric solution was also present in the liquid.

The tubers contained starch; they did not afford any tannic matter.

ZEHNERIA UMBELLATA, *Thwaites.*

Fig.—*Rheede Hort. Mal. viii., t.* 26.

Hab.—Throughout India. The fruit and roots.

Vernacular.—Tarali (*Hind.*), Kudari (*Beng.*), Gometta (*Mar.*), Tid-dúnda (*Tel.*), Karivi-valli (*Mal.*).

History, Uses, &c.—This plant is the Gointhi or Karivi-valli of Rheede, who notices its use by the Hindus of Malabar as a depurative, useful in gonorrhœa, dysuria and diseases supposed to arise from adust bile in the blood. The Portuguese call it *Popinho do Patare* and the Dutch *Karlingen*. Roxburgh describes it under the name of *Momordica umbellata*, and notices the use of the fruit and roots as a medicine by the natives, but does not give any particulars. The root is usually prescribed as a *Paushtika* or invigorating medicine, combined with roasted onions, cumin, sugar and melted butter, forming a *ghritapaka* or medicated butter; sometimes the root is given beaten up with milk and sugar, to which cumin is added if it is prescribed as a remedy for gonorrhœa.

In the Concan the juice of the leaves is applied to parts which have become inflamed from the application of the juice of the marking nut (*Semicarpus Anacardium*).

Description.—From the *Flora of British India* it will be seen that this is a very variable plant common on hedges throughout India, Ceylon, Malaya, China and North Australia. It is diœcious, and has a root consisting of many pendulous tubers.

The leaves are shortly petioled, cordate or sagittate or hastate at the base, the lobes longer than the petiole, 3 to 5-lobed, or palmately 5-partite, sinuate and sharply toothed; male flowers umbelled or shortly racemose at the apex of a long slender peduncle; female on a different plant, solitary, short-peduncled; berry oval or oblong, size of a pigeon's egg, smooth, red when ripe. The tubers are of an irregular, elongated form, usually about one inch in diameter; brown externally, white internally; they have a faint nauseous taste.

CORALLOCARPUS EPIGÆA, *Hook. f.*

Fig.—*Wight Ic., t.* 503.

Hab.—Punjab, Sind. Guzerat, Deccan. The tubers.

Vernacular.—Akás-gadda, Chhilihinda, Garaj-phal (*Hind.*), Karvi-nai (*Guz.*), Akásha-garudan, Gollan-kovaik-kizhangu (*Tam.*), Akásha-garuda-gaddalu, Nága-donda (*Tel.*), Akasha-garuda-gadde (*Can.*), Siva-linga (*Mar.*).

History, Uses, &c.—This plant is called in Sanskrit Chhilihinda, Pátála-garuda and Maha-mula or "great-root." It is described in the Nighantas as very strengthening, and a begetter of phlegmatic humors, and a valuable remedy for rheumatism. Ainslie remarks that the Vytians hold it in great estimation, and prescribe it in the latter stages of dysentery, and old venereal complaints. It is usually administered

in powder, the dose being about one drachm in the 24 hours, and continued for eight or ten days together; this quantity generally produces one or two loose motions every day. It is also considered anthelmintic. For external use in chronic rheumatism it is made into a liniment with cumin seed, onions, and castor oil. In the Deccan and Mysore the root has a repute as a remedy for snake-bite; it is administered internally and applied to the bitten part. This plant is used in India as a substitute for the Lúf or Lúfa of the Arabian and Persian physicians, the *Bryonia dioica* of more Western countries, and the ἄμπελος λευκη of Dioscorides. The Arabic word *Lúfa* is probably a corruption of λευκη.

The vernacular names are mostly compounds of Ákás, "the sky," and Gadda, "a tuberous root." The Marathi name signifies "the linga of Síva," and is an allusion to the shape of the fruit.

Description.—The root is a turnip-shaped tuber, sometimes weighing as much as 5 to 6 pounds. Externally it is yellowish white and marked with raised circular rings; the taste is bitter, mucilaginous, and subacid. When cut the tuber exudes a viscid juice, which soon hardens into an opalescent gum.

Chemical composition.—The bitter principle of *C. epigæa* can be removed from an aqueous extract, previously separated from mucilage by treatment with alcohol, by agitation with chloroform or amylic alcohol. It is a whitish amorphous mass soluble in water and spirit, and very slightly soluble in ether. Its solution is precipitated by tannin and not by either basic or neutral plumbic acetate. It is coloured reddish-brown by sulphuric acid, and after several hours assumes a purplish hue owing to the gradual deposition of a black powder. The purple colour is not so well marked as that afforded by *trichosanthin* and the bitter principle of *Momordica Cymbalaria*. It dissolves in nitric acid without colour. This bitter principle is the same as *bryonin*, which has been found by Walz in common

Bryony root, and we have been able to confirm this by finding in the decomposition products two resinoid bodies differing in their solubility in ether. Bryonin is a glucoside resolved by boiling with dilute sulphuric acid into glucose and two amorphous bodies, bryoretin, soluble in ether, and hydrobryoretin, insoluble in ether but soluble in alcohol

$$C^{42}H^{64}O^{21} = C^{21}H^{36}O^{7} + C^{21}H^{37}O^{9} + C^{6}H^{12}O^{6}.$$

Bryonin Bryoretin Hydrobryoretin Glucose.

We have been unable to find a second bitter principle in these tubers, for on washing the lead precipitate of the extract until free from bryonin, and treating the lead compound with hydrogen sulphide, the solution was free from bitterness, and the evaporated residue was not coloured by sulphuric acid. The tubers contained much starch, a little resin, and 10 per cent. of white saline ash.

BRYONIA LACINIOSA, *Linn.*

Fig.—*Wight Ic., t.* 500; *Rheede Hort. Mal. viii.*, 19.

Hab.—From the Himalaya to Ceylon, Pegu. The plant.

Vernacular.—Bajguriya, Ghargu-nárn (*Hind.*), Kavadori, Kavale-che-dole (*Mar.*), Nehoemeka (*Mal.*), Lingatondi (*Can.*).

History, Uses, &c.—This plant appears to be the Baja of Sanskrit writers, and is said to have been used in Vedic times to frighten away evil spirits; it is still known in Hindi as Bajguriya or "Baja beads." It is also probably one of the plants included by the name Ghantáli (see *Mukia scabrella*). Rheede (viii. 19) calls it Nehoemeka, and says that the Portuguese call it *Nhola*, and the Dutch *Slitten*. The vernacular name *Ghargu-náru* signifies a string of ankle bells, such as are worn by dancing girls. These bells have vertical slits in them, resembling the white vertical lines on the fruit of this Bryony. The juice of *B. laciniosa* is given with milk, honey, or sugar in bilious attacks, and in the commencement of fevers when there is flatulence and constipation; it clears

out the bowels, and is often sufficient without further treatment in cases of this kind which arise from over eating.

Description.—A climbing plant with a smooth stem common in hedges. The leaves are palmately 5-lobed, more or less deeply divided, segments oblong, lanceolate acuminated, serrated; petioles muricated, upper surface of the leaf thickly studded with white, jointed, calcareous hairs, rising from a calcareous areola; male and female flowers, in the same axils, the peduncles of the male flowers, which are numerous, remaining until the fruit ripens; flowers small, pale yellow; fruit round, smooth, marked with white vertical stripes, the size of a marble, red when ripe, with the exception of the stripes, which remain of a dead white. The whole plant is very bitter.

Chemical composition.—An alcoholic extract of the plant was made with 84 per cent. alcohol, water added, and the turbid mixture agitated with light petroleum ether, which removed colouring matter and a small amount of fat.

After separation of the petroleum ether the bright yellow aqueous solution was agitated with chloroform. The chloroform extract was yellowish, non-crystalline and very bitter. Treated with warm water the greater part dissolved, the aqueous solution on evaporation left a residue which gave a white precipitate with tannic acid, and which reduced an alkaline copper solution after boiling with dilute sulphuric acid. Generally the reactions afforded by this bitter principle were similar to those described as being produced by bryonin. With concentrated sulphuric acid a brownish red coloration was produced; whereas in Watts' *Dictionary of Chemistry*, 1st Edition, sulphuric acid is stated to dissolve bryonin "forming a blue liquid which changes to green." Gmelin, however, (*Handbook of Chemistry*) states that it is coloured red brown by oil of vitriol. We have tested the action of concentrated sulphuric acid on a specimen of bryonin obtained from Dr. Schuchardt, and find that no such reaction as is described in Watts' *Dictionary* occurs, the colour tint being brownish red.

MUKIA SCABRELLA, *Arn.*

Fig.—*Wight Ic., t.* 501; *Rheede Hort. Mal. viii.*, 13.

Hab.—Throughout India. The plant in fruit.

Vernacular.—Agamaki (*Hind.*), Mosumúski (*Tam.*), Putenbudinga, Núdhosa (*Tel.*), Chiráti (*Mar.*), Mucca-piri (*Mal.*).

History, Uses, &c.—Ainslie gives *Ahilaykum* as the Sanskrit name of this plant in Southern India. This is evidently a corruption of अहिलेखन (Ahilékhana), "marked like a snake," in allusion to the vertical white stripes upon the fruit. Another Sanskrit name which appears to have been applied to this plant as well as to *Bryonia laciniosa* is Ghantáli, which signifies a row or string of bells (Ghantá-áli), such as are worn by dancing girls, and which have vertical slits resembling the vertical marks on the fruit of these plants. Ainslie informs us that this herb is considered to be gently aperient and stomachic, the infusion being given in doses of half a cupful twice daily. It is used for the same purposes now, and it enters into mixtures frequently given to children. Rheede mentions its use as a diuretic.

Description.—Plant hispid and scabrous; tendrils simple; leaves cordate, lobed or angled; flowers short-peduncled, male numerous, fascicled; female, 1 to 4, small, campanulate, yellow; berry globular, size of a pea, scarlet when ripe, marked with white vertical lines, smooth or sprinkled with a few bristly hairs. Plant and fruit bitter. The fruits ripen in October to December.

ZANONIA INDICA, *Linn.*

Fig.—*Wight Ill., t.* 103; *Lam. Ill., t.* 816; *Rheede Hort. Mal. viii., tt.* 47, 48, 49.

Hab.—Assam, E. Bengal, W. Peninsula, Ceylon.

Vernacular.—Chirpota (*Hind., Mar.*), Penar-valli (*Mal.*).

History, Uses, &c.—In the Nighantas this plant bears the Sanskrit names of Chirpota, Dirghapatra, Kuntali and Tiktaka; it is described as cold, dry, and aperient, and beneficial in asthma and cough. Rheede (viii., 47, 48, 49,) calls it Penar-valli, which appears to be a corruption of the Sanskrit Pinda-valli; he says that the Dutch call it *Naet-klim* and the Portuguese *Fruita bandoliera*. The latter name is given to the fruit from its resemblance to the leather cases called bandoleers, each containing a charge of powder, of which every musketeer wore twelve, suspended by a shoulder belt. In Malabar a bath made by boiling the leaves in water is used to remove the nervous irritation caused by boils, and an antispasmodic liniment is made by pounding the leaves with milk and butter. In Ceylon the plant is used as a febrifuge.

Description.—Leaves 6 to 8 by 3 to 4 inches, usually acute; petiole one inch; male flowers very small, pedicels ½ to ¾ inch; female flowers, including the ovary, ½ inch; ovary early becoming one-celled by the separation of the three fleshy placentas; seeds much compressed, hardly 1-10 inch thick; capsule large, like a candle extinguisher.

ECBALLIUM ELATERIUM, *A. Richard.*

Fig.—*Bentl. and Trim., t.* 115. Squirting Cucumber (*Eng.*), Concombre d'âne (*Fr.*).

Hab.—Europe, Northern Asia. The fruit.

Vernacular.—Khiyár-i-khar, Katha-el-himar (*Pers., Arab.*), Kátri-indráyan (*Ind. Bazars*).

History, Uses, &c.—The fruit occasionally reaches India in a dry state. It is imported from Persia, and has evidently been gathered while immature, as the contents have not been discharged. *E. Elaterium* is reported to grow in abundance about Tiflis and on the banks of the river Kura, and in Georgian popular medicine, under the name of *Kitrana*, it has a good reputation as a remedy in malarial fevers. At a meeting

of the Caucasian Medical Society in 1885, Dr. Minkevitch referred to the subject, and stated that the paroxysms may be arrested by the use of the drug, but the relief is only temporary, as they return in two or three weeks. Drs. Lisitzeff and Astvaturoff also stated that in Kakhetian popular medicine, *Kitrana* is used as a narcotic, and is believed to be specially serviceable in cases of hydrophobia. (*Pharm. Journ.*, Feb. 27th 1886, *from Med. Record.*) Elaterium does not appear to be known in Hindu medicine, but the Arabs and Persians are well acquainted with it. The former call the fruit Katha-el-himár (asses' cucumber), and the latter Khiyár-i-khar, which has the same meaning, or Khiarzeh (little cucumber). Haji Zein gives Ispheridagrion (*σφαίριδιον ἄγριον*) as the Greek name. The author of the *Makhzan-el-Adwiya* describes it, and also the method of preparing elaterium. To prepare this he directs the fruit to be sliced, thrown upon a strainer and pressed, the pulp is then to be twice washed with water, and the deposit, which is thrown down from the water, collected and dried. It is then to be finely powdered and made into lozenges, with an equal weight of gum arabic or calamine, or half its weight of starch.* The Mahometan writers attach considerable importance to elaterium as a purgative of the diseased humours which they suppose to be the cause of a great number of diseases. They also use poultices made with the fruit, leaves, and root of the plant, and direct the juice of the fruit to be snuffed up the nose to purge the brain, and to be dropped into the ears in otitis. It is worthy of remark that the Hindus use their bitter and purgative cucurbitaceous fruits in the same manner. Elaterin injected subcutaneously acts on the nervous system, causing salivation, insensibility, tetanus and dyspnœa; large doses administered by the mouth cause gastro-enteritis and collapse.

Chemical composition.—The active principle, *Elaterin*, $C^{20}H^{28}O^5$, is best obtained by exhausting elaterium with chloroform. From this solution a white crystalline deposit of

* Compare with Dioscorides *περὶ ελατηριου* and Pliny 20, 3.

elaterin is immediately separated by addition of ether. It should be washed with a little ether and recrystallized from chloroform.

Elaterin forms hexagonal tables, insoluble in water, slightly soluble in ether, very soluble in alcohol. It gives a carmine colour with phenol and $H^2 SO^4$. (*Fresenius' Zeit. f. anal. Chem.* 17, 500 ; 24, 156.)

Several other cucurbitaceous plants are more or less in use medicinally. Among these we may mention **Modecca palmata**, *Lam.* (*Rheede Hort. Mal. viii.*, 20, 23), the juice of which with cocoanut milk is used as a pectoral in Malabar, and the roots as an ingredient in strengthening medicines (Paushtiks).

Trichosanthes nervifolia, *Linn.* (*Rheede Hort. Mal. viii.*, 16, 17,) is used in the same part of the country to drive away evil spirits. According to Ainslie, the root of **Rhynchocarpa fœtida**, *Schrad.*, is prescribed internally in electuary, in cases of piles, and in powder is sometimes ordered as a demulcent in humoral asthma. The root is about the size of a man's finger, light grey, and has a sweet mucilaginous taste. The Tamil name is Appakovay.

The seeds of **Ampelosicyos scandens**, *Thou.*, *Bot. Mag.* 2681, 2751-2, have been introduced into Bombay from Zanzibar as a vermifuge; they are flat and almost circular, about an inch and a half across ; the external envelope resembles delicate basket work, and is very tough and strong ; the kernel yields a quantity of bland oil. The entire fruit is from 2 to 3 feet in length and 8 to 10 inches thick, marked with deep longitudinal furrows, the inside is divided into from three to six cells, and often contains as many as 250 seeds.

DATISCEÆ.

DATISCA CANNABINA, *Linn.*

Fig.—*Lam. Ill.*, *t.* 823; *Sibth. Fl. Græc.*, *t.* 960.

Hab.—Himalaya from Cashmir to Nepal; Sind. The herb and roots.

Vernacular.—Akalbar (*Hind.*), Bayr-bunja, Bhangjala (*Punj.*).

Uses.—Datisca is bitter and purgative, and is occasionally used in fevers and in gastric and scrofulous complaints. In Khagan the bruised root is applied to the head as a sedative, and Madden states that under the name *of Bujr Bunga* it is used medicinally in Kurnool. (*Stewart, Cleghorn.*) The plant may be administered in doses of from 5 to 15 grains in intermittents.

Description.—Stem 2—6 ft., stout, branching. Lower leaves 1 ft., pinnate; leaflets 7—11, 6 by 1½ in., petioled; upper much smaller and less divided; floral simple, 3 by 1½ in. Pedicels often carrying linear bracts; anthers oblong, rather large; filaments very short; styles ¼ inch; capsule ⅓ by less than ¼ inch (*Fl. Br. Ind.*), one-celled, opening at the apex; seeds numerous, striated, with a cup-like covering at the base.

Chemical composition.—The leaves and roots contain a glucoside, *Datiscin*, $C^{21}H^{22}O^{12}$, which may be obtained by exhausting them with alcohol, evaporating to a syrup, and precipitating the resin with water; from the decanted liquid crystals may be obtained, which should be re-dissolved in alcohol and the remaining traces of resin removed by reprecipitation with water. Datiscin may then be obtained in colourless silky needles or scales, little soluble in cold water and only sparingly so in warm water and ether. The crystals are neutral and have a bitter taste; they melt at 180° C. (*Braconnot, Ann. de Chim. et. de Phys.* iii., 277; *Stenhouse, Ann. der Chem. u. Pharm.* xcviii., 106,) *quoted in Wurtz, Dict. de Chim.*, i., 1134.

CACTEÆ.

OPUNTIA DILLENII, *Haw.*

Fig.—*Wight Ill.* 114. Prickly pear (*Eng.*).

Hab.—America. Naturalized in India. The fruit.

Vernacular.—Nágphani, Bidar (*Hind., Beng.*), Naga-kali (*Tam.*), Naga-dali (*Tel.*), Chappál-send, Vilayati-nevarung (*Mar.*), Kattali-Papas, Mullugalli (*Can.*).

History, Uses, &c.—This plant is a native of Mexico and Central America, and was introduced into India by the Portuguese, doubtless with the object of feeding the Cochineal insect upon it, but it is uncertain whether they ever carried out their intention. It is called by the Portuguese *Palmatoria d' inferno*, from the resemblance of its flat branches to a *palmatoria*, or flat piece of wood used in their schools to beat children upon the hand. The Hindus have given it the Sanskrit names of Vidara, "tearing asunder," and Vishva-sáraka, "having all essence."

In 1793—97, Drs. Anderson and Barry attempted to introduce the Cochineal insect, but they appear to have been supplied with the Cochinilla sylvestre, or wild Cochineal, which is said to be small and deficient in colouring matter; this insect is still found in India upon *O. Dillenii*. Dr Fontana, in a communication to the *As. Ann. Regist.* in 1799, states that the Cochineal insect thrived best on the *O. Dillenii*, but the insects from Bengal were found to contain only 10 to 16 per cent. of colouring matter, and fetched only Rs 5 per seer, whereas Mexican cochineal at the time was worth Rs. 16 to 20. The cultivation was subsequently abandoned, probably on account of the more profitable cultivation of Indigo.

Dr. Buchanan in 1801 found cochineal being reared in Mysore. The young insects were put upon the cactus hedges immediately after the rainy season. In six months they had increased sufficiently to begin to collect them; a year more elapsed before the whole plants were consumed. After pay-

ing all expenses, the farmer sold the cochineal for 11 pence a pound. Dr. Buchanan calls the plants Nopals, their Mexican name, but states that it is the cactus "aboriginal of the country"; he also reports that the insect is of the bad kind recently introduced.

Roxburgh, speaking of *Cactus indicus* (*O. Dillenii*), says:—"Upon this plant the Cochineal insects lately brought from America thrive and multiply abundantly." In 1833-45, the culture of cochineal was again attempted by *M.* Sundt and others upon *O. Tuna* with the true Cochineal insect, and this culture appears to have been carried on to a certain extent, as in 1857 silver grain Cochineal from Chittledroog and Oosoor grown upon this plant was shown at the Madras Exhibition.

In 1848, Dr. Dempster successfully dyed woollen cloths with dye extracted from the insect found on the common prickly pear. The quantity of lake obtained by him from the native Cochineal exceeded that obtained from an equal amount of imported Cochineal, and was also of a more brilliant hue. Dr. Dempster laid particular stress on the advantage of cultivating the native insect in preference to importing foreign varieties, and his views were corroborated by Dr. McClelland of the Calcutta Botanic Gardens, who wrote on the subject in 1848. In the same year, Dr. Fleming found numerous villagers near Amritsar engaged in gathering Cochineal insects from the hedges of cactus or prickly pear. The Cochineal was dried and sold to the Amritsar dyers at one rupee a seer. It appears, however, that the growth of wild Cochineal is very irregular, the insects completely destroy the cactus plants wherever they appear, and some time must elapse before the plants can grow again. The quantity of native Cochineal produced in India is not known. Dr. Bidie, reporting on the culture of Cochineal in India in 1882, remarks:—"The efforts made about the beginning of the present century to establish the industry failed, owing to the introduction of an inferior variety of the Cochineal insect. One of the species of cactus on which the insect feeds in Brazil having been introduced with it in 1795 by Capt. Neilson, H. M. 7th Regiment, it has been naturalised, and

there are various other species here on which the insect will feed." The report concludes with a description of a Mexican Nopalry or cactus garden, which could be easily imitated in many parts of India.

The Indo-Portuguese of the present day, as well as the natives of India, highly esteem the fruits of *O. Dillenii* as a remedy in whooping cough and asthma. From a few experiments we have made with a syrup of the fruit, which is of a splendid purple colour, it appears to increase the secretion of bile when given in teaspoonful doses 3 to 4 times a day, and to control the spasmodic cough and expectoration. In one case of asthma, due to the irritation of pregnancy, after every remedy which could be suggested had failed, it put a stop to the paroxysms which before its administration occurred regularly after sunset; but if the remedy was omitted they at once returned. Eventually a cure was effected. In several cases of whooping cough, a similar effect was produced as long as the syrup was taken daily, and in a case of bronchial catarrh in the chronic stage with copious expectoration, it almost entirely stopped the cough and expectoration within 24 hours. Its action is probably due to the soluble malate of manganese which we have found contained in the fruit. Kobert has shown that the salts of this metal when injected into the blood or subcutaneously, paralyse voluntary movement and reflex action, and stop the heart in diastole; the paralysis of reflex action being due to the destruction of the transverse conduction of the spinal cord, longitudinal conduction remaining intact.

Chemical composition.—The air-dried fruit heated to 100° C. lost 26·21 per cent. in weight. The ash amounted to 9·65 per cent., and was of a very light dirty reddish colour. Chemically the ash was of interest on account of the extremely large amount of manganese present. Boiling water extracted 46·95 per cent. of yellowish extractive, which contained 4·00 per cent. of ash. The solution had an acid reaction, and readily reduced an alkaline cupric solution on boiling. The acidity was due to malic acid, a trace of citric acid was also present.

The total free acidity of the air-dried fruit calculated as malic acid amounted to ·63 per cent. The saccharine matter calculated as grape sugar amounted to 29·76 per cent. of the air-dried fruit.

An alcoholic extract of the fruit contained a fluid fatty acid in small amount, also some wax, resinous matter, malic acid, colouring matter, sugar, &c., &c. No alkaloidal principle could be detected.

FICOIDEÆ.

TRIANTHEMA MONOGYNA, *Linn.*

Fig.—*Dc. Pl. Grass.* 109; *Wight Ic., t.* 228.

Hab.—Throughout India. The root.

Vernacular.—Násarjanghi, Bishkhapra (*Hind.*), Vishkhápra (*Mar.*), Satudo (*Guz.*), Sharunnay (*Tam.*), Ghalijeroo (*Tel.*), Sabuni (*Beng.*).

History, Uses, &c.—This plant has been given the Sanskrit name of Sveta Punarnava, or white Bœrhaavia, from the resemblance of its foliage when young to that of *Boerhaavia diffusa*. Both plants when in this condition are eaten as vegetables after being well boiled. In common with *T. pentandra* and *T. decandra* its root is known to the natives of India as having cathartic and irritant properties, and is said to be sometimes given to women to procure abortion. Ainslie says: "The root, which is bitter and nauseous, is given in powder in combination with ginger as a cathartic; when fresh it is somewhat sweet." (*Mat. Ind.* ii., 370.) He also notices similar properties in *T. decandra*, and Stewart records that *T. pentandra* is said to be used in the Punjab to procure abortion. In native practise these roots are considered useful in obstructions of the liver, asthma and amenorrhœa. The dose as a purgative is about two drachms of the powdered root to be repeated until the desired effect is produced.

Description.—A diffuse, prostrate, branched, glabrous, fleshy plant, which appears at the commencement of the rainy

season; leaves ½ to 1½ in., obovate; petiole ¼ in.; flowers solitary; calyx-lobes obtuse, cuspidate; stamens 10 to 20; capsule ⅛ in., scarious below, beak exserted, coriaceous, somewhat mitriform, adnate to the enclosed seed, lower part 3 to 5-seeded. Seeds black, scarcely shining, with concentric, broken, and undulating, raised lines. (*Fl. Br. Ind.*)

Chemical composition.—The plant affords a thick mucilaginous decoction unaffected by iodine solution, and precipitated by ferric chloride and neutral acetate of lead. It gives a precipitate with barium hydrate, which contains a glucoside having similar properties to saponin; the insoluble decomposition product when weighed pointed to the presence of a small amount of this body.

MOLLUGO STRICTA, *Linn.*

Fig.—*Rheede Hort. Mal. x., t.* 26.

Hab.—Throughout India. The plant.

MOLLUGO SPERGULA, *Linn.*

Fig.—*Rheede Hort. Mal. x., t.* 24.

Hab.—Throughout India, except the N.-Western districts.

Vernacular,—Jima (*Hind., Beng.*), Toora-elley, Kacchantharai (*Tam.*), Chayntáráshiákoo (*Tel.*), Jharasi (*Mar.*), Kaipajira (*Mal.*), Parpataka (*Can.*).

History, Uses, &c.—These plants are called in Sanskrit Grishma-sundaraka and Phani-ja, and are in general use as a pot herb. The Hindi name is derived from the Sanskrit जिम or जम, to eat. Medicinally they are considered to be stomachic, aperient and antiseptic.

Rheede, speaking of *M. stricta*, says:—"Apozema ex tota hac planta confectum choleræ medetur; præparatur et ex illa balneum contra variolas. Succus vino permixtus, tridui spatio bis de die assumptus, variolas expellit, febrem concomitantem minuit." Ainslie (ii., 431,) writes to the same effect concern-

ing *M. Spergula*, and adds that the plant is administered for suppression of the lochia, and when applied warm and moistened with a little castor oil, is reckoned a good application for earache. He considers that it is justly held in estimation by the native practitioners. In Pudukota the juice of *M. Spergula* is applied to itch and other skin diseases, and that of *M. hirta* (Sirooseroopadi, *Tam.*,) is administered internally to weak children. The latter plant is stated by Watt to be prescribed in the Punjab and Sind for diarrhœa under the names of Poprang, Gandi-buti and Kottruk.

Description.—*M. stricta:* Glabrous, stems much branched, leafy, often a foot high in rich wet soil, sometimes only a few inches where the situation is unfavourable Leaves ¼ to 1½ in., whorled or opposite, from lanceolate acute to obovate obtuse, much narrowed at the base; petiole hence obscure. Cymes compound, the branches sometimes racemed. Sepals $\frac{1}{15}$ in., elliptic or round. Stamens 3 to 5, filaments dilated. Styles 3, short, linear. Capsule as long as the sepals, globose, many-seeded, the walls thin. Seeds dark chestnut-coloured; embryo curled into three quarters of a complete circle. (*Fl. Br. Ind.*)

M. Spergula: Glabrous or nearly so, branching, diffuse, leafy. Leaves ½ to 1 in., usually whorled, spathulate lanceolate or elliptic; petiole 0 to ⅛ in. Pedicels ⅛ to ½ in. Sepals ⅛ to ⅛ in., oblong, margins often membranaceous. Stamens 5 to 10. Stigmas 3, minute. Capsule ellipsoid, a little shorter than the sepals. Seeds many, covered with raised tubercular points, and appendaged by a minute short subulate bristle, and sometimes by a second, yet more minute bristle. (*Fl. Br. Ind.*)

Chemical composition.—The bitter principle of *M. stricta* is soluble in ether, alcohol and water, and is precipitated from the aqueous solution by tannin, but not by neutral lead acetate. It solution does not respond to alkaloidal tests, and it is decomposed by boiling with dilute hydrochloric acid. Evaporated portions dissolve in strong sulphuric acid with a brown colour. A bitter resin is also dissolved out of the herb by rectified spirit, and the chief constituent of the watery extract

is a gum gelatinizing with ferric chloride. The dried herb deflagrated occasionally during the process of combustion in the open air; this was found to be due to the presence of alkaline nitrates. The white ash amounted to 68·1 per cent.

GISEKIA PHARNACEOIDES, *Linn.*

Fig.—*Wight Ic., tt.* 1167, 1168.

Hab.—The Punjab, Sind, South Deccan Peninsula, Ceylon. The plant.

Vernacular.—Bálu-ka-ság (*Hind.*), Walu-chi-bháji (*Mar.*), Manal-kirai (*Tam.*), Isaka-dasarikura (*Tel.*), Attirilla-pála (*Cing.*), Báluka (*Beng.*).

History, Uses, &c.—This plant is called in Sanskrit Bálu, Báluka, Váluka and Elaváluka on account of the number of large raphides contained in the leaves, and which give them the appearance of being full of sand (válu). Báluka is considered by the Hindus to be aromatic, aperient and anthelmintic, and is used as a vegetable like the Mollugos; the Hindi and Marathi names signify "sandy potherb." Capt. W. H. Lowther (*Journ. of Agri.-Hort. Soc. of India*, 1857, vol. ix., p. 285,) appears to have been the first to bring the anthelmintic properties of this plant to the notice of Europeans. The fresh plant, including the leaves, stalks, and capsules, is directed to be employed in cases of tænia, in doses of about an ounce, ground up in a mortar with sufficient water to make a draught. This is to be repeated three times at an interval of four days, the patient each time taking it after fasting for some hours.

Description.—A diffuse branched herb. Leaves opposite or falsely whorled, fleshy, ⅛ to 1¼ in., oblong or elliptic, entire, narrowed at the base; petiole 0 to ¼ in. Sepals ⅛ in. Filaments dilated below. Carpels usually 5, in fruit as long as the sepals. Seeds blackish, smooth, minutely glandular-punctate; embryo curved less than a semicircle. (*Fl. Br. Ind.*)

Chemical composition.—The most interesting principles present in the seeds are astringent principles which we provisionally call α and β *Gisekia tannin.* α Gisekia tannin is obtained by agitating an alcoholic extract of the seeds with ether, it forms an orange varnish, in which nodules gradually form on standing, which on microscopic examination are seen to consist of narrow plates and a few needles of a deep yellow colour. The ether extract is easily soluble in alkalies with deep orange coloration, and is reprecipitated by acids in yellow flocks. In water the ether extract is nearly wholly soluble with yellow colour and astringent taste. Ferric and ferrous salts give a dirty deep brown coloration, without any tinge of blue. Potassium cyanide a deep orange coloration. Both acetates of lead gave a dirty yellow precipitate; cupric sulphate no precipitate. Lime water in excess a dirty reddish precipitate; Barium chloride and ammonia a similar precipitate. Potassium bichromate deep yellow, slowly changing to yellowish brown. Bromine water dirty brownish yellow. It reduces an alkaline copper solution on boiling and precipitates gelatine in white flocks.

β Gisekia tannin occurs as a deep orange powder, and is obtained by acidulating the aqueous alcoholic extract after agitation with ether, when the tannin is precipitated. In cold water it is slightly soluble, but dissolves easily in boiling water with a yellow coloration, the liquid becoming turbid on cooling. It is easily soluble in amylic alcohol Ferric salts afford a nearly black precipitate, without any tinge of blue. In alkalies it dissolves with a wine red coloration, the tint being brighter with ammonia than with the fixed alkalies. Potassic cyanide gives a similar coloration. Both acetates of lead afford flesh coloured precipitates. Bromine water a yellowish precipitate, sulphate of copper whitish. It precipitates gelatine in white flocks, and reduces slightly an alkaline copper solution on boiling.

We failed to detect any alkaloidal principle in the seeds. The anthelmintic properties of the seeds are very probably due to these tannin-like principles.

Commerce.—The seeds under the name of Baluka are sold by druggists in Bengal.

UMBELLIFERÆ.

HYDROCOTYLE ASIATICA, *Linn.*

Fig.—*Hort. Mal. x.*, 46; *Wight Ic.*, t. 565; *Bentl. and Trim.*, t. 117. Indian Pennywort (*Eng.*), Bevilacque (*Maurice*).

Hab.— India. The plant.

Vernacular.—Brahmamanduki, Khulakhudi, Brahmi (*Hind.*), Thalkuri (*Beng.*), Karivana, Karinga (*Mar.*), Vallárai (*Tam.*), Khar-brahmi, Khi-brahmi (*Guz.*), Babassa (*Tel.*), Ondelaga (*Can.*).

History, Uses, &c.—In Sanskrit works this plant is called Brahmi and Mandukaparni Chakradatta directs the fresh juice to be given with milk and liquorice. In the Nighantas it bears many synonyms, and is described as cold, moist, sweet, light and alterative; it is said to improve the memory and understanding, and to cure leprosy, jaundice, gonorrhœa and fever. The plant was known to Rheede by its Malayalim name of Codogam or Kutakan, and also to Rumphius. Ainslie informs us that an infusion of the toasted leaves in conjunction with fenugreek is given to children suffering from bowel complaints and fever in doses of half a teacupful, also that the leaves on the Coromandel Coast are applied to parts that have suffered from blows and bruises, having, it is supposed, the power of keeping off inflammation. In Java, according to Horsfield, they are considered diuretic, and on the Malabar Coast the plant is one of the remedies for leprosy. As a remedy in this disease it was first brought prominently to notice by Boileau, in 1859. Dr. A. Hunter, who tried it in the Madras Leper Hospital, came to the conclusion that it had no claim to consideration as a specific in leprosy, but he found it most useful in ameliorating the symptoms and improving the

general health. In the *Pharmacopœia of India* it has been made official, and is described as an alterative, tonic and local stimulant, more especially useful in syphilitic skin diseases, in which it may be used both as an internal and local remedy. Directions for making a powder and poultice are given. More recent reports from Europe (1885) confirm this statement, and there has been some enquiry for the drug in Bombay which has led to its cultivation on a small scale. In the neighbourhood of Bombay the plant is rare in a wild state, but may often be seen in gardens; it is a popular remedy for the slight dysenteric derangements of the bowels to which children are subject; 3 to 4 leaves are given with cumin and sugar, and the pounded leaves are applied to the navel. In the Concan one or two leaves are given every morning to cure stuttering; and the juice is applied to skin eruptions supposed to arise from heat of blood.* Dr. Clement Daruty de Grandpré (*Nouveaux Remèdes, 8th April,* 1888,) states that this plant is so abundant in Mauritius that it serves as forage for cattle, whose milk it improves; it is also greedily eaten by pigs and other domestic animals. He says it should be very carefully dried and bottled to preserve the volatile oil which is the active principle, the whole plant should be used, including roots and fruit, as he finds it more active than the leaves only. Dr. Daruty observes that the administration of this drug to lepers causes at first a sensation of warmth and pricking in the skin, especially of the hands and feet; this is followed after a few days by a general sensation of warmth, sometimes almost unbearable; the capillary circulation is accelerated, and after about a week the appetite improves, and in time the skin becomes softer, throws off the thickened epidermis, and recovers its transpiratory function. Hydrocotyle augments the excretions from the bowels and kidneys. The dose is 10 grs. of the powder three times a day; in short, this drug is in small doses a powerful stimulant, especially of the cutaneous system, with the results above described in the case of lepers. In large doses it

* Generally as a *lêp* with Cadamba bark, Ghi, and Black Cumin.

acts as a stupefying narcotic, producing headache, giddiness, and with some people a tendency to coma.

Description.—The plant grows freely all the year round if watered, sending out long runners, which produce leaves, roots and fruit at the joints. The peduncles and petioles are fascicled; the latter are frequently three to four inches long; the peduncles are very short, and bear a 3 or 4-flowered simple umbel with very short rays; the leaves are reniform, crenate, ½ to 2 inches in diameter, 7-nerved, glabrous, or when young somewhat hairy on the under side; the fruit is laterally compressed, orbicular, acute on the back; the mericarps reticulated, sometimes a little hairy, with 3 to 5 curved ribs; they have no vittæ. The fresh herb has an aromatic somewhat ivy-like odour when crushed and a nauseous bitter taste, but these qualities are to a great extent lost in drying.

Chemical composition.—Hydrocotyle has been analysed by Lépine of Pondicherry (*Journ. de Pharm. et de Chim.* [3] xxviii., p. 46), who found in it a peculiar body which he named *Vellarin*, and described as being obtainable from the dry plant to the extent of 0·8 to 1·0 per cent. He describes it as an oily non-volatile liquid, with the odour and taste of the fresh herb, soluble in spirit, ether, caustic ammonia, and partially in hydrochloric acid, and volatilizing at 120°. The authors of the *Pharmacographia* remark that these singular properties do not enable us to rank vellarin in any well characterised class of organic compounds; moreover, they failed to obtain anything like it from the dry herb.

We find that the fresh leaves contain about 78 per cent. of water.

Distilled with water some traces of a stearopten-like body were condensed and the distillate was neutral. The ether extract contained a white crystalline substance possessing the odour of the drug, with resin and fat amounting to 8·9 per cent. of the dried leaves. Alcohol dissolved 24·5 per cent. of tannin and sugar, the tannin gives a bulky green precipitate with ferric chloride and neutral acetate of lead, dissolves in alka-

line solutions, and is reprecipitated by acids. 11·5 per cent. of gum, sugar, and salts was extracted by water, and 12·5 per cent. of albuminous matter by diluted caustic soda. The powdered leaves yielded 12·4 per cent. of ash, nearly half of which consists of alkaline sulphates. Lépine's vellarin was most probably a mixed substance composed of the odorous fatty body with some resin.

Commerce.—The dried herb is kept by the druggists. Value, Rs. 7 to 8 per Surat maund of 37½ lbs. It is generally much mixed with grass and weeds.

CONIUM MACULATUM, *Linn.*

Fig.—*Bentl. and Trim., t.* 118. Hemlock (*Eng.*), Cigue (*Fr.*).

Hab.—Europe, Northern Asia. The fruit and root.

Vernacular.—Kirdamána, Kurdumána,* Khorasani-ajwán (*Ind. Bazars*).

History, Uses, &c.—We have met with no mention of Hemlock in Hindu works on Materia Medica. It is now generally admitted to have been the κώνειον of Greek writers, the celebrated *Athenian state poison*, by which Socrates died, and the Cicuta of the Romans.† Moreover, κώνειον is the modern Greek name for Hemlock. Ibn Sina identifies the شوکران (hemlock) of the Arabs and Persians with the κώνειον of Dioscorides. Ibn Baitár and Háji Zein-el-attár (A.D. 1368) also identify Showkrán with the κώνειον of the Greeks and Cicuta of the Romans; the former tells us that it is called Hafúz in Spain, and the latter writer says that it is known as *Dúras* in the district of Yezd, and that the best is obtained from the hills

* Kurdumána according to the Burhán, where it is described as wild caraway, mountain caraway, Syrian caraway and Turkish caraway. The author of the Makhzan describes Kurdamána as an aromatic seed, and does not identify it with Conium.

† See Theophrastes H. P., i., 8; vi, 2; ix., 8. Dioscorides iv., 77; vi., 11. Pliny 25, 95. Plato, Lys. 219 E; Xenophon Hell. 2, 3, 56. Hippocrates 681, 4.

of Taft and is called *Duras-i-Tafti*, and its root *Bikh-i-Tafti*; he describes the symptoms of poisoning by hemlock very correctly, and its termination by convulsions and failure of the respiration. The Indian bazar names, which signify "Syrian or wild caraway" and "Khorasán Ajowan" are apparently euphemistic.

The ancients were well acquainted with the properties of hemlock, and it is said that the priests of Eleusis, who were under a vow of chastity, used to rub their bodies with its juice. The Arabian and Persian physicians repeat almost word for word the opinions held by the Greeks concerning the medicinal properties of the plant; these opinions it is unnecessary to recapitulate, as they were those held by modern European physicians up to a comparatively recent date. The preparation of the plant recommmended for medicinal use by the Arabians is an extract made by expressing the juice of the unripe fruit and drying it; this preparation is doubtless far more efficient than the extract and tincture of our Pharmacopœias. Harley (*The Old Vegetable Neurotics*, 1869,) has shown that the green unripe fruits are the most active part of the plant, and that they may be even dried without loss of activity. From modern pharmacological research we learn that coniine paralyses the ends of the motor nerves and of the vagus, like curare, and afterwards paralyses the motor centres in the brain and spinal cord. It causes death by paralysing the respiratory muscles. Death is usually accompanied by convulsions in warm, but not in cold-blooded animals. There is dilatation of the pupil and ptosis from paralysis of the endings of the third nerve. Locally applied, it appears to paralyse the ends of the sensory nerves. Methyl-coniine acts on the spinal cord, causing paralysis of reflex action. Dimethyl-coniine and conhydrine have an action similar to that of coniine, but less powerful. (*Lauder Brunton.*)

In Europe hemlock is now chiefly used as a neurotic, the expressed and preserved juice of the unripe fruit being preferred to the old preparations, which contain hardly any of the active principles. It has been tried in tetanus and strychnia

poisoning, but without success. In the East it is prescribed as a neurotic in painful affections of the skin and subjacent tissues, and as an antaphrodisiac. Mir Muhammad Mumin has a curious preparation in the Tuhfat, which he has named "*Umru's raisins*," and which he recommends as a preservative of the seminal fluid. It is made by stewing together 5 dirhams each of hemlock root and hyoscyamus seeds with 150 large raisins and 150 miskals of water until dry; the raisins are then removed and preserved. The dose is from one to three daily.

Description.—Kirdamana resembles English hemlock fruit, but is a little larger and of a darker grey colour; it appears to have been collected when mature or nearly so. If a section of the fruit is examined under the microscope it will be seen that there are no vittæ, and that the cells of the endocarp contain a brown substance, which consists of coniine and the other alkaloids together with a small quantity of volatile oil. Surrounding the albumen is a peculiar layer of small cubic cells. When crushed in a mortar with a few drops of *liquor potassæ*, kirdamana seeds have a mousey odour.

Chemical composition—The most important constituent of hemlock fruit is the volatile alkaloid coniine ($C^8H^{17}N$), a colorless, inflammable, oily fluid, specific gravity ·846 at 12°·5 C. Coniine has a strong alkaline reaction, a penetrating suffocating odour, and boils when pure at 168° to 169° C. It is soluble in all proportions in alcohol, ether, chloroform, benzol, benzine, and fixed oils, is less freely soluble in carbon bisulphide, and requires 100 parts of cold water for solution. Like ammonia, it forms dense white fumes with volatile acids, it precipitates most metallic salts, some of the precipitates, like silver, being soluble in an excess. It neutralizes acids, forming salts which are freely soluble in water and alcohol, are usually deliquescent, and occasionally uncrystallizable, and are not precipitated by platinic chloride. Its hydrochlorate and hydrobromate are, according to A. W. Hofmann (1881), easily obtained by dissolving coniine in anhydrous ether and passing into the solution dry hydrochloric or hydrobromic acid gas. The salts, being

insoluble in ether, are precipitated in a white crystalline form; both are very soluble in water and alcohol, are not deliquescent and may be dried at 100° C. without decomposition.

Coniine is accompanied by *Conhydrine* ($C^8H^{17}NO$) and often by Methyl-coniine ($C^9H^{17}N$), the former of which is left in the retort on the careful distillation of crude coniine. Hemlock fruit contains also a fixed oil, a minute portion of non-poisonous volatile oil having the odour of cumin, and probably malic acid in combination with the alkaloids. The fully grown green fruit yields about 0·8 per cent. of coniine, *conhydrine* is always present in a very small proportion. According to Wernecke the fruit yields 6·69 per cent. of ash.

Coniine has been made synthetically by Ladenburg and its nature and derivation clearly shown. It is the dextro-rotatory *a* normal propyl-piperidine. In obtaining it, pyridine is first converted into *a* allyl-pyridine, which reduced by sodium in alcoholic solution yields an optically inactive *a* normal propyl-piperidine. The tartrate of this base is made and crystallized, when, following the analogy of the splitting of racemic acid into dextro-rotatory and lævo-rotatory tartaric acid, we get a dextro and a lævo coniine, of which the first is the true alkaloid of hemlock.

Toxicology.—No cases of hemlock poisoning appear to have been recorded in India. For white mice the lethal dose is ·0758 grm. per kilo body weight; whilst ·075 grm. does not cause death. (*Ladenburg.*)

Commerce.—The Persian seed is sold for Re. ½ per lb.

CUMINUM CYMINUM, *Linn.*

Fig.—*Bentl. and Trim., t.* 134. Cumin (*Eng., Fr.*).

Hab.—Africa. Cultivated in India. The fruit.

Vernacular.—Jira, Safed-jira (*Hind., Beng.*), Shiragam (*Tam.*), Jilakara, Jiraka, Jirana (*Tel.*), Jirakam (*Mal.*), Jirige (*Can.*), Jiré (*Mar.*), Sufed-Jirun (*Guz.*).

History, Uses, &c.—The use of cumin as a spice and medicine is of the highest antiquity, and appears to have spread from the cradle of civilization in Egypt to Arabia, Persia, India and China. Cumin is mentioned in the Hebrew Bible, it is the κύμινον of the Greeks, and Theophrastus (H. P. IX.) tells us that it was the custom to utter curses when sowing it (probably to avert the evil eye). Dioscorides (iii., 61,) calls it κύμινον ἥμερον, and notices its medicinal properties; in the same chapter he mentions another kind of cumin, "the king's cumin of Hippocrates," which the Arabians identify with *ajowan*, and in the next chapter two kinds of wild cumin. Popular allusions to cumin are common in the writings of the Greeks and Romans, cumin and salt was a symbol of friendship (*Plut. Symp.* 5, 10, 1). Pliny tells us that students eat it to make themselves look pale and interesting. Greek writers mention a κυμινο-δοκον or cumin-box which was placed on the table like a salt-cellar. Flückiger and Hanbury trace its use during the Middle Ages, when it appears to have been much valued in Europe. Mannhardt (*Baumkultus der Germanen*) says that bread was spiced with cumin to protect it from the demons, and De Gubernatis (*Myth. des Plant.*) states that it is used for the same purpose in Italy, and on account of its supposed retentive powers is given to domestic animals to keep them from straying, and by girls to their sweethearts for the same reason.

Jira and Jirana, the Sanskrit names for cumin, as well as the Persian Zhireh or Zireh, and all the Indian vernacular names appear to be derived from the root Jri, and to allude to the digestive properties of the seeds; other Sanskrit names are Ajáji "that overcomes goats," ajamoda "goat's delight" and Kunchicka. The Arabic name Kamún is doubtless derived from the Greek. Ibn Sina and the Eastern Arabs, and also the Persians follow Dioscorides in describing four kinds of cumin, which they name Kirmáni or black, Farsi or yellow, Shámí (Syrian) and Nabti (Egyptian). They also mention along with them Karawya or caraway as a seed like anise. In the absence of accurate descriptions it is impossible to say what

these four kinds were, but it seems probable that the Kirmáni or black cumin is correctly identified by the Indian Mahometans with the seeds known in India as Siyah-Jira, a species of caraway peculiar to Central Asia. The Nabti or Egyptian kind is probably true cumin.

Cumin is much used as a condiment in India, and is an essential ingredient in all the mixed spices and curry powders of the natives. Medicinally they regard it as stomachic, carminative and astringent, and prescribe it in chronic diarrhœa and dyspepsia. A medicinal oil is expressed from the seeds. Cumin is applied in the form of a plaster to allay pain and irritation. It is thought to be very cooling, and on this account it is an ingredient in most antaphrodisiac prescriptions, and is administered in gonorrhœa.

Description.—The fruit consists of two mericarps which remain united together when dry, and form an elongated ovoid body about $\frac{1}{4}$ inch long and $\frac{1}{16}$ broad in the middle, surmounted by the styles; each mericarp has five primary ridges and four secondary, the vittæ are six in number, two of them being situated on the commissural side; the seed is pentangular with rounded angles.

Chemical composition.—Cumin fruits yielded to Bley (1829) 7·7 per cent. of fat oil, 13·5 per cent. of resin, 8 of mucilage and gum, 15·5 of protein compounds, and a large amount of malates. Their peculiar, strong, aromatic smell and taste depend on the essential oil, of which they afford about 4 per cent. It contains about 56 per cent. of *Cuminol* (or *Cuminaldehyde*), $C^{10}H^{12}O$, a liquid of sp. gr. 0·972, boiling point 237° C. By boiling cuminol with potash in alcoholic solution, cuminalcohol, $C^{10}H^{14}O$, as well as the potassium salt of cuminic acid, $C^{10}H^{12}O^2$, are formed.

The oil of cumin, secondly, contains a mixture of hydrocarbons. That which constitutes about one-half of the crude oil was first obtained in 1841 by Gerhardt and Cahours and called *Cymene* or *Cymol*. It is a liquid of sp. gr. 0·860 at 15° C. boiling at 175° C. and has a lemon-like odour.

Cymene $C^{10}H^{14}$ may also be artificially obtained from a large number of essential oils having the composition $C^{10}H^{16}$, $C^{10}H^{14}O$, $C^{10}H^{16}O$, or $C^{10}H^{18}O$. It differs very remarkably from the oil of the formula $C^{10}H^{16}$, inasmuch as cymene yields crystallizable cymensulphonic acid, when it is warmed with concentrated sulphuric acid.

There is also present in oil of cumin a small amount of a terpene, $C^{10}H^{16}$, boiling at 155°·8 C.

Warnecke obtained 8·09 per cent. of ash from cumin fruit.

Commerce.—Cumin is grown in Northern India and is also imported from Persia and sometimes from Asia Minor. The exports, which range from 10 to 12 thousand cwts., are chiefly to Eastern ports, many of them Indian, Europe only taking from 500 to 600 cwts. The average value in India may be stated at from Rs. 6 to 8 per Surat maund of 37½ lbs.

CARUM COPTICUM, *Benth.*

Fig.—*Wight Ic., t.* 566; *Jacq. Hort. Vind, tt.* 52, 200; *Bentl. and Trim., t.* 120. Bishop's weed, Lovage (*Eng.*), Ammi de l'Inde (*Fr.*).

Hab.—Africa, cultivated in India. The fruit.

Vernacular.—Ajwain, Ajwán (*Hind*), Joán, Ajowán (*Beng.*), Ova, Ajma (*Mar.*), Ajamo (*Guz.*), Omam (*Tam.*), Omamu, Vámamu (*Tel.*), Omu (*Can.*).

History, Uses, &c.—A small African seed called ἄμμι is described by Dioscorides (iii., 63); it had an odour like *origanon*, was of a very hot and dry nature, and was used as a carminative, &c. This seed was also called βασιλικὸν κύμινον or "king's cumin." A similar, if not identical drug is mentioned by early Sanskrit writers under the name of Yaváni or Yavánika, "of foreign origin," and appears to have been one of several seeds to which the name Ajmoda was also applied. In Persia also a similar seed was in use from a very early date as a seasoning for bread, under the names of zhinian (ژنیان) and nánkháh (نانخواه), the latter name being a compound of *nán* 'bread'

and *khák* 'relish.' Ibn Sina notices it under the name of Nankhah, but does not identify it with any of the kinds of cumin which he mentions. Pliny (20, 58,) says that ammi and king's cumin are considered to be identical. Haji Zein-el-Attár (A. D. 1368) identifies *nankhah* with the ammi of Dioscorides and Paulus Ægineta, and quotes the opinions of those physicians concerning its medicinal properties. He also informs us that the drug has a reputation for its antiseptic properties, and is used to promote the healing of foul sores, and to remove the offensive odour of the discharges from them.

The author of the Tuhfat-el-muminin, and other Mahometan physicians, who have written in India, identify Ajowán with the *ammi* or *basilikon kuminon* of Dioscorides, and also with the *zhinian* and *nánkháh* of Persia; they give it the Arabic name of Kamún-el-mulúki, "king's cumin."

The authors of the *Pharmacographia* speaking of Fructus Ajowan, remark: "Owing to their having been confounded with some other very small umbelliferous fruits it is difficult to trace them precisely in many of the older writers on Materia Medica. It is however probable that they are the *Ammi* of Anguillaria (1561), and the *Ammi perpusillum* of Lobel (1571), in whose time the seeds were obtained from Egypt. They are certainly the *Ajave seeds* of Percival (1773), who obtained them from India." The plant is the *Ptychotis Ajowán* of later European writers on Indian Materia Medica.

In native practice, ajowán is much used as a carminative, either alone or in combination with rock salt, asafœtida, myrobalans, &c. It is also thought to check discharges of a chronic kind, and is therefore used in making lotions, collyria, &c.; upon the same principle it is prescribed in bronchitis with copious expectoration. A plaster or poultice of the crushed fruit is said to relieve pain. The *Ark* or distilled water of ajowan is prepared and sold in the bazars, and the stearopten under the name of *Ajowan ke phúl* (flowers of ajowan) is prepared at Oojein and elsewhere in Central India, by exposing the oil to spontaneous evaporation at a low temperature.

Description.—The fruits are of the size and shape of those of parsley, of a greyish-brown colour, with a tuberculur surface. Each mericarp has five prominent ridges, the intervening channels being dark brown, with a single vitta in each. The commissural side bears two vittæ. The odour resembles that of thyme.

Chemical composition.—The fruits according to Stenhouse (1855) yield 5 to 6 per cent. of an agreeably aromatic, volatile oil, sp. gr. 0·896. At the same time there collects on the surface of the distilled water, a crystalline substance. This stearopten, under the name of *Ajowan-ke-phul*, was first made known by Stocks, and was examined by Stenhouse and by Haines, who showed its identity with thymol, as contained in *Thymus vulgaris*. (*Pharmacographia.*) Thymol is the phenol of cymene, and its composition is shown by the formula C^6H^3, C^3H^7, CH^3, OH. Widman (1882) has succeeded in preparing it synthetically from cuminol by converting this into nitrocuminol, acting upon this with phosphorus pentachloride, when nitro-cymylene chloride, $C^{10}H^{11}(NO^2)Cl^2$, is formed, and treating this with nascent hydrogen, first at a low temperature, afterwards with the aid of heat, to obtain cymidin, $C^{10}H^{15}$, NH^2. A dilute solution of cymidin sulphate is treated with potassium nitrite, and finally distilled, when thymol is obtained, having the melting-point 44° C., which is the same as found by Lallemand and Stenhouse for thymol from the oils of thyme and of ajowan. (*Stillé and Maisch.*) Thymol is most conveniently and completely extracted from oil of ajowan by shaking it repeatedly with caustic lye, and neutralizing the latter.

According to Wernecke ajowan seeds yield 10·45 per cent. of ash.

Cultivation and Commerce.—Ajowan is cultivated on the plains of India along with coriander, fenugreek and other crops which require similar treatment. The sowing season is October to November; the reaping time is February. The soil required is a deep rich loam thoroughly worked and manured with a small quantity of ashes from fuel prepared from

cattle droppings. Strong manures are considered injurious to this crop. During the growing season of ajowan the climate is comparatively cool and very dry, rain falls at very irregular intervals, but at the sowing season, the soil will probably be saturated with moisture, and heavy dews prevail during the early half of the growing season. The temperature in the shade varies from 80° to 50° F.

Rain or irrigation to the extent of about ¼ inch weekly is required, therefore the soil is prepared for irrigation by making level beds about 8 feet square enclosed by ridges about six inches high. The ajowan is sown on the ridges by dibbling in the seeds about 6 inches apart, and coriander or fenugreek occupies the central bed. Assuming that the whole field was occupied by ajowan the quantity of seed required per acre would be 10 lbs., and the out-turn nearly 100 lbs. (*G. M. Woodrow.*) The average value of ajowan seed is about Rs. 2 per pharrah (35 lbs.). In 1881-82, Bombay exported 1,195 cwts. of the seed valued at Rs. 6,066.

The crude thymol manufactured in India has an average value of Rs. 8 per lb.

CARUM CARUI, *Linn.*

Fig.—*Bentl. and Trim., t.* 121. Caraway (*Eng.*), Carvi (*Fr.*).

Hab.—Cashmir, Gurhwal, Persia. The fruits.

Vernacular.—Indian caraways: Siyah-jira (*Hind.*), Guniyún (*Cashmere.*), Umbhú (*Ladak.*), Sa-jirè (*Mar.*), Shimai-shiragam, Pilappu-shiragam (*Tam.*), Sima-jilakara (*Tel.*), Shimejirige (*Can.*), Shia-jira (*Beng.*), Kalun-jirun (*Guz.*).

European caraways: Vilayati-jira (*Hind., Mar., Guz.*), Kekku virai, Shimai-shombu (*Tam.*), Kekku-vittulu, Shima-sopu (*Tel.*) Shime-sopu (*Can.*), Bilati-jira (*Beng.*).

History, Uses, &c.—A kind of caraway called Sushava and Krishna-jiraka* or "black cumin" appears to have been

* This name is also applied to the seeds of *Nigella sativa.*

known to the Hindus before the introduction into India of European caraway seeds. Royle is the first European writer who notices *Zeera seeah* as a kind of caraway imported from Kunawar, and as they are of a much darker colour than ordinary caraways he named them *Carum nigrum* (*Him. Bot.* 229). Stewart reduces Royle's *C. nigrum* to *C. Carui*, and in this view he appears to be supported by Mr. C. B. Clarke in the *Flora of British India*. The same variety of caraway is known in Persia as Zireh-i-siyah, and as it is principally cultivated in the neighbourhood of Kirmán, is also called Zireh-i-Kirmáni.

The European caraway is first mentioned by the Arabians under the name of Carawiya. Ibn Sina, Edrisi and Ibn Baitar all treat of it as distinct from cumin. The καρον of the Greeks, so often identified with the caraway, appears to have been quite a different plant, as it afforded a root in common use as a vegetable which Paulus Ægineta classes with parsnips and carrots. The Mahometan physicians derive the name Karawiya or Kuruya from the Syrian Kârui, and give ἀρμένιον as the Greek for caraways, a word applied by Greek and Latin writers to several of the products of Armenia. They describe the seeds as aromatic, carminative and astringent; from them they prepare an eyewash, which is supposed to strengthen the sight; they are also used as a pectoral, and considered to be diuretic and anthelmintic. A caraway bath is recommended for painful swellings of the womb, and a poultice for painful and protruding piles.

Description.—The fruits are ovoid, slightly arched, laterally compressed, crowned by the style; they vary in size, but are generally about 1-6th of an inch long and 1-20th in diameter. The colour is brown, but the ribs are of a lighter colour than the furrows. The mericarps are generally separated; each on transverse section is seen to have five ridges, and to be of a pentagonal form with unequal sides; between the ridges are four vittæ, the commissural side being provided with two, which are placed close together. Within the pericarp is the seed, which is conform to the fruit. Caraways, like cumin,

have a powerful odour. The black caraway approaches very nearly to cumin both in odour and flavour, the fruit is more slender and of a darker colour than the common caraway, but a transverse section shows a similar structure.

Chemical composition.—Trommsdorff besides volatile oil found in caraways a green fixed oil, a little wax, resin, sugar, mucilage, and some tannin. By repeated fractional distillation Völkel (1840) separated *carvene*, $C^{10}H^{16}$, which has little odour and taste, boils at 173° C., and has a strong dextrogyrate rotation. The higher boiling fraction contains *carvol*, $C^{10}H^{14}O$, which is liquid, has an agreeable caraway odour, boils at 227° C. (*Gladstone*) or at 250° C. (*Varrentrapp*), and has a levogyrate rotation. Carvol is isomeric with menthol, myristicol, thymol, and cumin alcohol. According to Warnecke the fruit yields 5·27 per cent. of ash.

Commerce.—European caraways are imported into India from England, and occasionally from the Levant, and are sold for about Re. 1 per lb. The black caraway is imported into Northern India from Afghanistan, Cashmere, and other parts of the Punjab Himalaya, also from Persia. The average value is Rs. 8 per Surat maund of 37½ lbs. if purchased in bulk, but as the bales contain much trash, the retail price of the clean seeds is not less than 8 annas per lb. In 1881-82 the imports into Bombay from Persia amounted to 2,683 cwts., valued at Rs. 71,886. The exports were 5 cwts. to Mauritius and 4 cwts. to Aden.

Carum Roxburghianum, *Benth. Wight Ic.* 567, Ajmod (*Hind.*), Rándhani (*Beng.*), Rándhani, Karonjha (*Mar.*) is an herbaceous plant resembling single parsley, and is supposed to be a cultivated form of *C. stictocarpum* common in the Concan, and bearing the same Marathi name as the cultivated plant. In many parts of India it is cultivated for its fruit, which is used in native cookery; elsewhere it occurs as a weed of cultivation, or is grown on a small scale to be used instead of parsley, for which it is a fair substitute, though objected to

by some on account of its coriander-like flavour. It is worthy of remark that the Marathi name rán-dhani (wild coriander) is in use in Bengal. The fruit of this plant must not be confounded with the Bori-ajmod or Tukm-i-karafs of the shops, which is celery fruit imported from Persia. Ráindhani is sometimes used as a carminative in dyspepsia, and is probably a fair substitute for caraways. The fruit is about $\frac{1}{12}$ of an inch in length, and is studded with blunt simple hairs; each mericarp has five ridges, which are paler than the spaces between them, and about 15 vittæ. The wild form (*C. stictocarpum*) is a much more slender plant, and has fruit about half the size of the cultivated variety.

APIUM GRAVEOLENS, *Linn.*

Fig.—*Eng. Bot. xvii., t.* 1210. Celery (*Eng.*), Céleri (*Fr.*).

Hab.—N.-W. Himalaya, Persia. The fruit.

Vernacular.—Karafs (*Arab., Ind. Bazars*), Ajmod (*Hind.*), Bodiajamo (*Guz.*).

History, Uses, &c.—Celery does not appear to have been known to the ancient Hindus. The Arabians probably obtained their knowledge of it from the Greeks. Dioscorides describes five kinds of σελίνον. Sprengel refers two of these to *Apium graveolens, viz.*, σελίνον κηπαῖον and ἐλειοσέλινον, var. *sativum et sylvestre.** The Selinon of Theophrastus (*H. P.* i., 15, 16, 19; iv. 9, viii. 5) was probably Celery; he also mentions Eleioselinon (vii., 6). Hipposelinon (ix., 1.), a diuretic, the root yielding a gum like scammony and Oreoselinon (vii., 6). Muhammad Husain, who wrote in India about one hundred and twenty years ago, informs us that Karafs is the celery of the Europeans and the Udasaliyun of the Greeks. He describes three other kinds, *viz.*, Sakhrí, in Greek Fitarasaliyun; Nabti, in Greek Akûsaliyun; and Tari, in Greek Shamarîniyun. What

* Conf. Dios. iii., 67, 68, 69, 70, 71. Hipp. περὶ νουσεων ii. 19. περὶ διαιτης ii, 25. περὶ παθων 48. The Ancients made chaplets of celery, which were given to the victors at the Isthmian and Nemean games, and hung upon tombs. It is the Apium of Pliny; 19, 46.

all of these may be, it is difficult to decide. Fituraşaliyun is now the bazar name in Bombay for the fruits of *Prangos pabularia*, but it is evidently a corruption of the Greek Petroselinon, and had once a different meaning, being described in Arabic works as like Ajowan.* The fruits imported into Bombay from Persia under the name of Karafs, and sold in the bazars as Borí-ajmúd, agree in structure with those of *A. graveolens*. Mahometan writers describe Karafs as deobstruent and resolvent, and use it in the form of a poultice with barley meal; they recommend it internally as a pectoral and as a tonic and carminative adjunct to purgatives, also as a diuretic, emmenagogue, lithontriptic, and alexipharmic.

In European medicine *apiol*, a camphor common to the fruits of this plant and of parsley, has been recommended as an emmenagogue and febrifuge, but more exact observation has proved its inutility. The physiological effects produced by this substance are headache and passing intoxication, and after repeated ingestion, digestive disturbances, loss of appetite, and even fever.

Description.—Karafs or Borí-ajmud imported into Bombay from Persia is a very small fruit, which, when the two mericarps are united, as is often the case, is almost globular; it is quite smooth and remarkable for the size and prominence of its ridges; the vittæ are 11 to 12 in number, two of these are on the commissural side. The taste is at first like anise, but afterwards bitter. The odour like anise, but faint.

Chemical composition.—Celery seeds, like those of parsley, contain *Apiin*, a substance first obtained by Rump in 1836 from the leaves, stalks, and seeds of common parsley; it was afterwards more exactly examined by Lindenborn, who obtained it by careful evaporation of the alcoholic solution in needles, which gave by analysis 54·71—55·25 per cent. carbon and 5·49—5·60 hydrogen, and further showed that it is a glucoside, splitting up, when boiled with dilute sulphuric acid, into

* Adams considers πετροσέλινον to be the Stone Parsley, *Petroselinum macedonicum*, still cultivated in Europe.

glucose and *Apigenin* (66·13 per cent. C. 3·9 H.). From these numbers Lindenborn inferred that apigenen is isomeric with quinone, and assigned to apiin the formula $C^{12}H^{14}O^7$, representing its decomposition by the equation, $C^{12}H^{14}O^7 + H^2O = C^6H^4O^2 + C^6H^{12}O^6$. Quite recently apiin has been further examined by E. v. Gerichten (*Deut. Chem. Ges. Ber.* IX., 1121), whose results agree in the main with those of Lindenborn, his analysis of apiin giving 53·55 per cent. C., 5·36 H., and that of apigenin 65·12—66·21 C., and 3·75 —3·91 H.

Apiin is slightly soluble in cold, easily in hot water, still more easily in hot alcohol, insoluble in ether; from the aqueous or alcoholic solution, it always separates by slow cooling in the form of a jelly. It dissolves in alkalies with a light yellow colour. Its hot aqueous solution gives no precipitate with silver nitrate, lead nitrate, or copper sulphate, a brown-red precipitate with ferric chloride, a blood-red coloration with ferrous sulphate. Apiin is powerfully dextrogyrate, its specific rotatory power for yellow light being + 173°. (*Gmelin's Handb.* 16, 94; *Watts' Dict. of Chem.* VIII., Pt. I., 117.) The seeds and herb yield a colourless or pale yellow essential oil, sp. gr. 0·881. *Apiol* or Parsley camphor, which has lately been obtained from parsley seeds, is also found in those of Celery.

Commerce.—Value, Rs. 6 per Surat maund of 37½ lbs.

FŒNICULUM VULGARE, *Gärtn.*

Fig.—*Benth. and Trim., t.* 123. Fennel (*Eng.*), Fenouil (*Fr.*).

Hab.—Cultivated in India. The fruit and root.

Vernacular.—Bari saunf (*Hind.*), Panmohuri (*Beng.*), Wariári (*Guz.*), Bari-shopha (*Mar.*), Shombu (*Tam.*), Sopu (*Tel.*), Somp (*Can.*).

History, Uses, &c.—Fennel is identified by Mahometan writers as the μάραθον of the Greeks, who also called it μάραθρον. It is mentioned by Hippocrates and Dioscorides as a diuretic and emmenagogue, and the juice was supposed to sharpen the eyesight. Nicander and Pliny mention certain superstitious

notions concerning fennel, which are expressed in the following lines by Macer Floridus (*De Vir. Herb.*):—

Cum vino cunctis obstat hæc herba venenis;
Hac morsa, serpens oculos caligine purgat,
Indeque compertum est humanis posse mederi
Illam luminibus, atque experiendo probatum—
Urinas purgat et menstrua sumpta resolvit,
Vel si trita super pecten hæc herba ligetur—
Tradunt auctores *ejus juvenescere gustu*.
Serpentes, et ob hoc *senibus prodesse putatur*.

Indian Sweet Fennel is rather smaller and straighter than the European article, but in other respects is similar to it. Fennel fruit is used by the natives of India as a condiment and as an aromatic adjunct to medicines. A distilled water, known as Ark-i-bádián, is prepared from it. The Sanskrit name is Madhurika (sweet). As pointed out by Mr. M. Sheriff in his Appendix to the *Pharmacopœia of India*, this plant and the anise are often confounded in Arabic and Persian works on Materia Medica. The Persians call the fruits of both Razianah, but the Hindu dealers in Bombay call Fennel Wariarí and Anise Erva-dos. The root of fennel is rather an important medicine in native practice, being to the present day esteemed as one of the five opening roots of the ancients.*

Description.—The fruits are oblong, cylindrical, about 3-10ths of an inch long and 1-10th in diameter, nearly straight, terminating with the two-pointed base of the style and smooth on the surface. Each mericarp has five prominent ridges. Between the ridges are vittæ, and there are two on the commissural surface. The colour of the fruit is a pale greenish yellow, the odour like that of anise, and the taste sweet and aromatic.

Chemical composition.—Fennel fruit yields about 3 per cent. of volatile oil, which consists of *anethol* or anise camphor, $C^{10}H^{12}O$, and variable proportions of a liquid isomeric with

* The five opening roots are Fennel, Parsley, Wild Celery, Asparagus and Butcher's Broom (*Ruscus aculeatus*). The wild bitter Fennel is probably the μαραθρον of Dioscorides (iii., 74) and of Theophrastus, H. P. i. 18, 19, vi. 3 2; vii. 3).

oil of turpentine. Anethol is obtainable from fennel in two forms, the solid and the liquid; crystals of the former are deposited when the oil is subjected to a somewhat low temperature; the liquid anethol may be got by collecting the portion of the crude oil passing over at 225° C. The crystals of anethol fuse between 16 and 20° C., the liquid form of anethol remains fluid even at —10° C. By long keeping the crystals slowly become liquid, and lose their power of reassuming the crystalline form. (*Pharmacographia.*) Wernecke found 7·25 per cent. of ash in the fruit.

Commerce.—Fennel is largely cultivated on the table lands of India. The fruit sells for Rs. 3 to 4 per Surat maund of 37½ lbs. The exports from Bombay in 1881-82 were 2,201 cwts., valued at Rs. 16,630; only 5 cwts. went to the United Kingdom, and the rest to Eastern ports.

PEUCEDANUM GRANDE, *C. B. Clarke.*

Hab.—Hills of Western India. The fruit.

Vernacular.—Dúkú (*Hind., Bomb.*), Báphali (*Mar.*).

History, Uses, &c.—The fruit of this plant has been adopted in India as a substitute for the Daucus seeds of the ancients, which were obtained from a species of Athamanta growing in Crete. This adoption was probably due to the early visits of Greek travellers and traders to Thana, and to the subsequent resort to the same port of the Mahometans early in the 14th century. The plant is common on the hills of the Concan, and was probably brought for sale to Thana in those days, as it still is at the present time. In Royles' Materia Medica, Falconer is quoted as describing Dúkú as a fruit resembling that of Asafetida, and as probably derived from some species of Ferula; this is just such a fruit. Dúkú was justly considered by the ancients as carminative, stimulant, and diuretic. Other umbelliferous fruits are not unfrequently substituted for this drug. We have received those of *Dorema Ammoniacum* from Bengal, and those of an Asafetida plant from Northern India. Haji Zein under the name of

(marmaj) mentions an Indian seed having the appearance and properties of Daucus.

Description.—Plant three to seven feet high, having very much the appearance of a garden parsnip which has run to seed; root large, perennial, all quite smooth; leaves mostly radical, long-petioled, bipinnate; leaflets trilobate; lobes large, rounded; margins crenate serrate, shining on both sides; cauline leaves 1 to 2, biternate; stem round, smooth, striated, involucre and involucel leaves oblong or obovate, obtuse, partial rays numerous, many flowered; flowers yellow; fruit large, broadly elliptical, varying in size, the largest are § of an inch long and § broad; foliaceous, convex in the middle, with a dilated border, consisting of coarse cellular tissue; colour reddish yellow over the seed, margin pale yellow; dorsal ridges seven, the three central filiform; vittæ in dorsal furrows ten to thirteen; vittæ of commissure six. The fruit has a powerful lemon odour with a *soupçon* of carrot.

Chemical composition.—Twenty-five pounds of the fruit distilled with water yielded 6 fluid ounces of a light yellow essential oil having the odour of the fruit; it was dextrogyre, a column of 100 m. m. rotating 36 degrees. The specific gravity at 15°·5 C. was ·9008. Cooled to — 14° C. it was still liquid and no crystals separated. After dehydration the oil commenced to boil at 76° C., the temperature rapidly rose to 100° C., when a few drops distilled over; the temperature continued to rise rapidly to 185° C., up to this temperature 2 per cent. distilled over. The subsequent progress of the distillation may be tabulated as follows:—

2nd fraction	..... 185° to 190°	 17	per cent.
3rd ,,	..... 191° to 196°	 15	,,
4th ,,	..... 196° to 200°	..... 12·5	,,
5th ,,	..... 200° to 205°	..... 9·6	,,
6th ,,	..... 206° to 210°	..... 6·4	,,
7th ,,	..... 210° to 220°	..... 4·5	,,
8th ,,	..... 220° to 225°	..... 4·0	,,
9th ,,	..... 226° to 228°	..... 3·0	,,

The residue left in the flask boiled constantly at the last recorded temperature and amounted to 26 per cent. The

fractions up to the 6th were colourless, those below of a yellow colour. The residue in the flask was viscid and of a deep yellow tint. Treated with reagents the oil in its original state afforded the following reactions:—Bromine dissolved in chloroform, at first nearly colourless, turning to dirty brown with a tinge of red, and finally to a dirty sage green. Concentrated sulphuric acid, deep orange to red. Frohde's reagent, yellow, deep brown, violet to deep blue, the changes in colour being extremely rapid. Nitric acid gave a yellow coloration. Picric acid dissolved in the oil. With solid iodine much heat was evolved. Gaseous hydrochloric acid was passed into the oil for some time, but on cooling the liquid no crystalline deposit separated. A slight precipitate of silver was produced from an ammoniacal solution of the nitrate.

Commerce.—The fruit is worth about Rs. 6 per pharrah (about 25 lbs.).

PEUCEDANUM GRAVEOLENS, *Benth.*

Fig.—*Bentl. and Trim., t.* 132. Dill, (*Eng.*), Aneth, Fenouil puant (*Fr.*)

Hab.—Cultivated in India. The fruit.

Vernacular.—Sowa (*Hind.*), (Shepu *Mar.*), Shoyikirai-virai, Shatakuppi-virai (*Tam.*), Shatakuppi-vittulu (*Tel.*), Sabbasagi (*Can.*), Shonva (*Beng.*), Suva (*Guz.*).

History, Uses, &c.—Dill seed is much esteemed by the natives of India, who use it as a condiment and medicine. An infusion of it is given as a cordial drink to women after confinement. The leaves moistened with oil are used as a stimulating poultice or suppurative. The Sanskrit names are Misreyá and Shatapushpa. Mahometan writers describe Shibbit as resolvent and deobstruent, carminative, diuretic, and emmenagogue. The Persian name is Shúd and the Yunáni Anitun.*

* Compare with Dioscorides περὶ ανηθου (iii., 60). Pliny (20, 74). Hippocrates περί διαιτης (ii., 25). Many Greek writers speak of Anethon and Anison as one and the same plant, but Alexis Αἰβ. 2, 7, distinguishes them.

Description.—The fruits of the Indian plant, which has by some been called *Anethum Sowa*, do not differ in any important respect from those of the European plant. The mericarps are somewhat narrower and more convex, the ridges more distinct, and the border less winged.

Chemical composition.—Dill fruits yield from 3 to 4 per cent. of an essential oil, a large proportion of which was found by Gladstone (1864-72) to be a hydrocarbon, $C^{10}H^{16}$, to which he gave the name *Anethene*. This substance has a lemon-like odour, sp. gr. 0·846, and boils at 172° C. It deviates a ray of polarized light strongly to the right. Nietzki (1874) ascertained that there is, moreover, present another hydrocarbon, $C^{10}H^{16}$, in a very small proportion, which boils at 155 to 160°. A third constituent of oil of Dill is in all probability identical with carvol. (*Pharmacographia*, 2nd Ed., p. 328.)

Commerce.—Suva is cultivated throughout tropical and sub-tropical India in the cold season. Value, Rs. 3§ per pharrah (about 35 lbs.).

CORIANDRUM SATIVUM, *Linn.*

Fig.—*Bentl. and Trim., t.* 133. Coriander (*Eng.*), Coriandre (*Fr.*).

Hab.—Cultivated in India. The fruit.

Vernacular.—Dhanya (*Hind.*), Dhanya, Dhana (*Mar., Guz.*), Kotamalli (*Tam.*), Danyalu (*Tel.*), Kottumbari (*Can.*).

History, Uses, &c.—The Coriander plant is called Kothmir, a name derived from the Sanskrit Kusthumbari; when young it is much used in preparing chutneys and sauces. The fruits are largely used by natives as a condiment; as a medicine they are considered carminative, diuretic, tonic, and aphrodisiac, and are often prescribed in dyspepsia. A cooling drink is prepared from them pounded with fennel fruit, poppy seeds, Kanchan flowers, rosebuds, cardamoms, cubebs, almonds and a little black pepper; it is sweetened with sugar. Mahometan writers describe them as sedative, pectoral and carmi-

native; they prepare an eyewash from them which is supposed to prevent small-pox from destroying the sight, and to be useful in chronic conjunctivitis. Coriander is also thought to lessen the intoxicating effects of spirituous preparations, and with Barley meal to form a useful poultice for indolent swellings. It is the Kuzbura of the Arabs and Kishníz of the Persians, who identify it with the Koriyun of the Greeks.* The opinion that it has great cooling properties prevailed amongst Western physicians, "coriandrum siccum frangit coitum, et erectionem virgæ impedit." Apuleius says it assists women in child-birth and protects them from fever. The following is an example of a cooling confection of the time of Charles the First:—R. Seminis Lactucæ, Portulacæ. Coriandri ana ana ʒi. Menth. siccæ ʒss, Sacchari alb. ʒiv. Pulverisentur omnia subtiliter, et post ea simul misce aqua nenupharis, f. confectis solida in morsulis, ex his sumat mane unum quum surgat.

Description.—Indian Coriander is much larger than that grown in Europe, and of an ovoid form; it consists of two mericarps firmly joined together, they are crowned by the stylopodium and calicinal teeth. Hanbury and Flückiger have the following excellent description of the fruit:—"The pericarp bears on each half four perfectly straight sharpish ridges, regarded as secondary (juga secundaria); two other ridges often of darker colour, belonging to the mericarps in common, the separation of which takes place in a rather sinuous line. The shallow depression between each pair of these straight ridges is occupied by a zigzag raised line (jugum primarium), of which there are therefore 5 in each mericarp. It will thus be seen that each mericarp has five (zigzag) so-called primary ridges, and four (keeled and more prominent) secondary, besides the lateral ridges, which mark the suture or line of separation. There are no vittæ on the outer surface of the pericarp. Of the five teeth of the calyx, two often grow into

* Confer. Dios. περι κοριου, iii., 64. Theophr. H. P. (κόριαννον), vii., 1, 3, 4, 6. Pliny, 20, 82.

long pointed, persistent lobes; they proceed from the outer flowers of the umbel. Though the two mericarps are closely united, they adhere only by the thin pericarp, enclosing when ripe a lenticular cavity. On each side of this cavity, the skin of the fruit separates from that of the seed, displaying the two brown vittæ of each mericarp. In transverse section, the albumen appears crescent-shaped, the concave side being towards the cavity. The carpophore stands in the middle of the latter as a column, connected with the pericarp only at the top and bottom."

Chemical composition.—The essential oil is isomeric with borneol, formula $C^{10}H^{18}O$. According to Kawalier, if the elements of water are extracted by phosphoric anhydride, it is converted into an oil of offensive odour, formula $C^{10}H^{16}$.

The fruits yield from 0·7 to 1·1 per cent. of volatile oil and 13 per cent. of fixed oil.

Flückiger obtained from the green herb from 0·57 to 1·1 per mille of an oil having an offensive odour, which deviated the ray of polarized light 1·1° to the right when examined in a column of 50 mm. long. The oil distilled by him from ripe fruit deviated 5·1° to the right.

Warnecke has found in Coriander fruit 5·21 per cent. of ash.

Commerce.— Coriander is cultivated throughout tropical and sub-tropical India; it is worth about Rs. 3 per pharrah (about 35 lbs.). It is largely exported to eastern ports.

PIMPINELLA ANISUM, *Linn.*

Fig.— *Bentl. and Trim., t.* 122. Anise (*Eng.*), Anis (*Fr.*).

Hab.—Persia, Europe, cultivated. The fruit.

Vernacular.— Erva-dos (*Bomb.*). The Indian names for Anise are the same as those for Dill.

History, Uses, &c.—Anise does not appear to have been known to the ancient Hindus, and is not mentioned in Sanskrit works. It was introduced into India by the Maho-

metans from Persia, whence the supply for the Bombay market still comes. Anise is now grown in Northern India.

The natives use anise in the same way as we do. The Persians call it Ráziánah, which the Arabs corrupt into Razianaj. They identify it with the Anisum of the Greeks,* and the Mahometan druggists of India know it by this name. The Bombay name, Ervados, is a corruption of the Portuguese 'Herba doce.' M. Sheriff states that the seeds of *Carum Roxburyhianum* are sold in Southern India as Anisum.

Description.—The fruit varies a good deal in size; if well grown it should be about 2-10th of an inch long. The mericarps often adhere together with the pedicel attached, forming an ovoid body crowned by a pair of styles. Each fruit has 10 ridges, and is covered with short hairs. The taste is remarkably sweet and aromatic. The vittæ, which contain the essential oil, are very numerous, each mericarp being provided with about fifteen.

Chemical composition.—The fruit yields from 2 to 3 per cent. of essential oil, which is a colourless liquid, but after a time becomes yellow. It has the taste and odour of the fruit, sp. gr. 0·977 to 0·983. At from 10 to 15° C. it becomes a crystalline mass. Oil of anise resembles oil of fennel (*vide* Fennel) in that it consists almost entirely of anethol. Wannecke found 6·70 per cent. of ash in the fruit.

Commerce.—Anise is imported from Persia Value, Rs. 5 to Rs. 6 per Surat maund of 37½ lbs.

ANTHRISCUS CEREFOLIUM, *Hoffm.*

Fig.—*Eng. Bot.*, 1268; *Jacq. Aust.*, 390. Chervil (*Eng.*) Cerfeuil (*Fr.*).

Hab.—Europe. Cultivated elsewhere.

Vernacular.—Atrilál (*Ind. Bazars*).

History, Uses, &c.—One of the oldest of cultivated potherbs. It is mentioned by Aristophanes, who wrote about

* Comp. Dios, περὶ ἀνίσου, iii., 58, and Plin. 20, 72, 73.

430 B.C., as a herb sold by the greengrocers. In his Acharnes (line 478) he has σκάνδικά μοι δὸς, μητρόθεν δεδεγμένος in allusion to the mother of Euripedes being a seller of Chervil. Theophrastus and Dioscorides were well acquainted with it, and describe it as diuretic, stomachic and deobstruent. Pliny (22, 38,) speaks of Scandix and Anthriscum as nearly the same plants,—the latter appears to have been the cultivated chervil—he says :—" Its principal virtue is that it re-invigorates the body when exhausted by sexual excesses, and acts as a stimulant upon the enfeebled powers of old age." Ibn Sina calls it Rijl-el-ghurâb, and says that Paulus and others have recommended it in colic. Haji Zein-el-Attar (A.D. 1368) has the following account of Atrilál; " There are two kinds of seed, dark and light-coloured like celery seed in size, and cumin in shape, very bitter. The light coloured is the largest, and is the kind called Khilal-i-Khalil in Persian; this is true Atrilál, different from the Egyptian : it grows at Ahwaz. The Egyptian kind is also called Rijl-el-tair, Rijl-el-ghurâb, and Harj-es-shayatin " devil's bane". Atrilál is useful in white leprosy and tetter. One dirham alone, or with one dang of Pyrethrum, is rubbed down with honey and administered; the patient then sits in the sun until he sweats; this causes the formation of blisters and the discharge of yellow serum from the affected part, and the skin recovers its natural colour. The powdered seeds used as a snuff cause abortion." In the Madd-el-kámus, Lane has the following summary from Arabian authorities :—Rijl-el-ghurâb signifies a certain herb called, in the language of the Barbar, Itrilál, and in the present day Zir-el-ákileh, resembling the *Shibith* in its stem and in its *jummeh* (or node whence the flower grows) and in its lower part, or root, except that its flower is white, and it forms grains nearly like those of Makdúnis (parsley). A dirham of its seeds, bruised and mixed with honey, is a tried remedy for eradicating the برص (white leprosy) and the بهق (tetter) being drunk,—and sometimes is added to it a quarter of a dirham of pellitory,—the patient sitting in a hot sun, with the diseased part uncovered. In Bocthor's Dict. Français-Arabe, the names Rijl-el-ghurâb and

Atrilál are given to Chervil and Buckshorn plantain (*Plantago coronopus*).

Chervil has been cultivated in England since A.D. 1590, and has run wild in some parts of the country; it is much used on the continent of Europe as a pot-herb. *A. sylvestris*, or wild Chervil, is said to be poisonous; it has an acrid bitter taste.

Description.—Fruits lanceolate, laterally compressed, almost cylindrical, black, smooth, terminating in a short 5-angled beak, crowned with the depressed wavy receptacle of the flower. Taste aromatic, free from bitterness.

Commerce.—In the Indian bazars the fruit of *Vernonia anthelmintica* is generally supplied for Atrilál by Mahometan druggists; the genuine article is hardly ever obtainable.

DAUCUS CAROTA, *Linn.*

Fig.—*Wight Ill.*, *t.* 117, *fig.* 7.

Hab.—Cashmere, Western Himalaya. Cultivated throughout India.

Vernacular.—Gájar (*Hind.*, *Guz.*, *Mar.*, *Beng.*), Gájjara-kelangu, Manjal-mutlangi (*Tam.*), Gájjara-gadda, Pita-kanda (*Tel.*)

History, Uses, &c.—The wild carrot is a native of temperate climates, and in the Himalaya grows to the height of six feet. It is called in Sanskrit *Garjara*, and has probably been in cultivation in India from a very remote period. There is a custom amongst the Hindu women of presenting trays containing carrots or radishes along with different kinds of fruit, green gram (*Cicer arietinum*) and sweetmeats, especially those made from Sesamum seeds, at the festival of *Makar Sankránti*, when the sun is worshipped upon his entry into the sign of Makar (Capricorn). These offerings are made upon the second day of the festival, which is called Kar, to friends and relations. In the temple of Apollo at Delphi, radishes were offered upon golden plates as typical of nutriment, and the Indian offering appears to have the same meaning. The

Greeks cultivated the carrot (σταφυλίνος) and also the Romans who called it *Pastinaca erratica*. It is clearly described by Dioscorides, and his commentator Marcellus Vergilius remarks that Pliny says "Est et quartum genus in eadem similitudine pastinacæ nascens, quam nostri Gallicam vocant, Græci vero daucon." From this we may conclude that the Daucus was like the pastinaca erratica or carrot, but not the same plant. The carrot was also called by the Greeks κέρας from its similarity to a horn; in the old Greek lexicons we read "σταφυλίνος ἄγριος ὃν ἔνιοι κέρας καλοῦσι". The Daucus of the Greeks, according to Dioscorides, was of three kinds, the best or Cretan kind had acrid, white, hairy, odoriferous fruit; the second kind was a plant like Celery, with a pungent taste and aromatic odour; and the third kind had an acrid fruit, having the appearance of Cumin. The first kind is generally considered to have been a species of *Athamanta* growing in Crete. Of the third kind, Gronovius says:—"Daucus tertius Dioscoridis, incolis Zarneb, Melchi, Rauwolf. Hodoep., Pt. I. c. 9, p. 116 et Pt. II., c. 2, p. 146. Seseli Cretense nodosum umbella lutea, Moris. Hist. iii., p. 287, f. 9." (*See Trachydium.*) Apicius, a writer on cookery, about A. D. 230, mentions an edible root called *Carota*, which no doubt was the same as our Carrot; as is also the Gazar of the Persians and the Jazar of the Arabians, which they do not identify with the Daucus of Dioscorides, but with his Staphylinos. The old writers on Materia Medica describe Carrots as hot in the extreme of the second degree, moist in the first, diuretic, laxative, emollient, strengthening the venereal faculty, emmenagogue and antiseptic. A decoction of carrots was long a popular remedy for jaundice in Europe, and the dried peduncle is a favourite toothpick among the Arabs on account of its aroma. In India, the seeds are popularly supposed to cause abortion, and are kept by all the native druggists. In those parts of the country where the root is cultivated, it is used with salt as an antiseptic poultice. In modern medicine the carrot poultice has been superseded by more powerful antiseptics, but the fruits still hold a place among our stimulant diuretics, the action being apparently

due to the volatile oil which they contain, acting locally upon the vessels or nervous structures of the kidney, during its excretion.

Description.—Fruit somewhat compressed from the back, ovate or oblong; mericarps with the five primary ridges filiform and bristly, the three middle ones at the back; the two lateral on the plane of the commissure; the four secondary ridges equal, more prominent, winged, split into a simple row of spines; channels beneath the secondary ridges vittate. Seed anteriorly flattish. (*Pereira.*)

Chemical composition.—The chief constituents of carrot root are carotin, hydrocarotin, oil, sugar, pectin, nitrogen compounds and a little volatile oil. Carotin is a crystalline ruby-red, tasteless, neutral substance, said to be probably formed by oxidation from hydrocarotin, which is a colourless substance. Landsberg describes the essential oil of the fruit as pure yellow, of an agreeable carrot odour and acrid taste; sp. gr. at 20° C., 0·8829. It is levogyre, free from sulphur or nitrogen, and acid in reaction from the presence of acetic acid. The two principal constituents are a terpene belonging to Wallach's pinene group, and an oxygenated body ($C^{10}H^{18}O$) standing in near relation to cineol (eucalyptol).

TRACHYDIUM LEHMANNI, *Benth. et Hook. f.*

Fig.—*Trans. Linn. Soc.* 2 *Ser. Bot., Vol. iii., Pt.* 1., *pl.* 11.

Hab.—Persia.

Vernacular.—Shekákul (*Pers., Indian bazars*).

History, Uses, &c.—Shekákul or Sháshkákul, now spelt with the Arabian *káf*, is a Persian word. It is explained in the Burhán as the wild carrot root, the touch of which is supposed to cause a pregnant woman to abort. Haji Zèin-el-attár says that the plant is called *Kirs-giyah* "bear's wort" in Persian, and a kind of it at Shiráz *Badrán*; he describes the foliage as like that of anise or fennel, and says that the flower is yellow and pubescent. Ibn Sina mentions Shekákul as an

aphrodisiac, but gives no description of it. Other Arabian physicians give a similar account of it, and quote Dioscorides as an authority for its use in dropsy as a diuretic (cf. Diosc. *sub-voce* καυκαλις). The Mahometans identify the drug with the Caucalis of Theophrastus, Dioscorides, Galen, Nicander and Oribasius; the best is said to be that which comes from Egypt, and is heavy and of a yellowish-brown colour. Theophrastus classes caucalis among the ἀρουραιον or weeds of cultivation, and Galen says that it has the same taste and properties as Daucus. Pliny notices it as an edible plant, and attributes to it a number of properties not mentioned by the earlier Greek writers. Gronovius in his *Flora Orientalis* has the following notice of Shekákul:—"Tordylium orientale, Secacul Mauris, Rauwolf. Hodoep. Pt. iv., t. 13. Sisarum Syriacum, Bauh. Pin. 155. Apium Syriacum radice ampla eduli, Moris. Hist. iii., p. 292. Secacul Arabum, Pastinaca Syriaca, Germanis gerelen, sive Sisarum species. Dalech App. 23. Ic., p. 24. Cresit juxta sepes et hortos urbis Halepi, locis præsertim apricis et sub arboribus." Sheik Dáwood of Antioch describes shekakul as like a small carrot and of a sweetish taste; he says we call the plant لفيل حرنى (Hard-un-nil). It would appear that in Western countries at least two species of Tordylium, one growing in Syria (*cf. Jacq. Vind.* 1, *t.* 54) and one in the Levant (*cf. Cam. Hort.* 37, *t.* 11,) have been used as shekákul, but whether either of these plants was the caucalis of the Greeks it is impossible to say. In Persia, *Trachydium Lehmanni*, a very nearly allied plant, produces the shekakul of Asia. Aitchison, when travelling in the Badghis district with the Afghan Boundary Commission, observed the roots of this plant being collected for export to India as shekákul.

Description.—A root of the shape and size of a small carrot, with a conical leaf-bud rising from the crown; externally it is wrinkled and longitudinally furrowed, and is of a light brown colour; internally it is white, starchy and friable; taste amylaceous and sweetish.

Buzidan.—*Caucalis orientalis*, the βουσαιδαν and μπουσαιταν of the later Greek physicians, is closely allied to Shekakul, and is con-

sidered by Haji Zein-el-attar to be the καυκαλις of Galen. After a discussion in which he says that the true drug comes from Egypt, he concludes by saying that women call this drug and Shekákul, *Shirza* (*shir* milk, and *za* begetting). A drug considered by some to be identical with *buzidán*, and by others to be only similar to it, is called by the Arabs Mustanjil and Uruk-el-bid (hen's root), and an English name for *Caucalis daucoides* is hen's claw. For further information concerning Buzidán, see *Tanacetum*. Another kind of Shekákul is occasionally met with in India; it is a shrivelled rhizome of a light brown colour, marked with transverse scars like Galangal, the taste is sweet and gummy; when soaked in water it swells greatly, becomes quite soft, and is easily cut like preserved ginger. The drug comes from China.

PRANGOS PABULARIA, *Lindl.*

Fig.—*Wall. Pl. As. Rar. ii.*, 7, *t.* 212.

Hab.—Thibet, Cashmere.

Vernacular.—Prangos (*Thib.*), Komal (*Hind.*), Fitarasaliyun (*Indian Bazars*), Badián-i-kohi (*Afghan.*).

History, Uses, &c.—Sanskrit writers mention a plant called Komal and Avi-priya, or "dear to sheep," which is probably *P. pabularia*. In the first quarter of the present century this plant created considerable interest in England. Mr. William Moorcroft, a veterinary surgeon of the Bengal Army, had heard that it was an important factor as a food for cattle, and was occasionally used as a medicine. When on an expedition in 1822 to Upper Assam, for the purpose of opening trade relations with the Chinese authorities at Ela, he made an excursion to Draz, in order to collect specimens of the plant and to study its use as a fodder plant by the natives. The plant which hitherto had been unknown to botanists, was sent to the Director of the Horticultural Society of London as deserving special attention as a fodder plant of particular value, well worthy to be cultivated in England and her colonies for the following reasons:—In its native country the dried plant

is used as a winter fodder for sheep and goats; it is described as being heating and fat producing, besides being a reliable remedy against the dangerous *Fasciola hepatica*, which often causes the death of thousands of sheep, especially after a wet autumn. Mr. Moorcroft drew special attention to the fact that the plant possessed a remarkable vital force, and thrived well in very poor soil without requiring culture or manure.

Only one bad quality was ascribed to it, *viz.*, its having been observed that horses fed on its fruit suffered frequently from inflammation of the eyes and were sometimes subject to temporary blindness. Its cultivation was then tried in various colonies, especially at the Cape, but it seems that the great advantages expected from it were not realised, for no later information is available.

As a medicine Prangos commands a certain amount of interest, its fruit being sold by Mahometan druggists in India under the name of Fitúrasaliyun as a substitute for the Petroselinon or Rock parsley of the Greeks, and Karafs-el-jibali of the Arabs, a plant which has not been identified, and which is described by Dioscorides as having fruit like Ammi, and as being carminative, diuretic and emmenagogue.

The late Dr. Royle was of opinion that Prangos was probably the kind of Silphium mentioned by Arrian, the historian of the campaigns of Alexander the Great, who records that in the part of the Caucasian mountains which corresponds to the present Hindu Kush, only pines and silphium grow, and as the country is inhabited by a numerous people keeping large flocks of sheep the silphium acquires great importance. Its smell attracts the animals from afar—they feed on the flowers and also dig up the roots and eat them. Of the root, which measures from 18 to 22 inches in length, a fine illustration will be found in Wallich. It must not, however, be forgotten that *Ferula ovina*, Boiss., is greedily depastured by sheep, and may have been the silphium of Arrian.

Description.—The fruit consists of a pair of mericarps about ¼ inch long, which together form an elongated oblong

body crowned by the stylopodium and calycinal teeth; each mericarp has five very prominent convoluted ridges, and measures 5·8 m.m. in length, and 3·4 m.m. in breadth, the colour is a dirty yellow; under pressure the fruit separates into two halves which remain attached to the carpophore. Secondary ribs are not present. Under the microscope a transverse section of the mericarp shows five large irregularly formed ribs traversed by as many bundles of vessels, two more bundles are to be found on each side of the narrow uneven fissure surface. The rest of the tissue consists of parenchyme cells. The pericarp incloses the seed, which is surrounded by many, large, oval-shaped oil vessels, about 40 in number. This cell-line bends itself on both sides towards the interior, thus giving the seed the appearance of a horseshoe. The oil vessels are filled with a yellowish-brown oil, having an odour of caraways. The endosperm consists of a series of rows of many-sided cells, containing a fatty oil and grains of aleurone; it surrounds the embryo, which is dark brown and rather large. Starch is not present. (*H. Lojander Archiv. d. Pharm.* 1887.)

Chemical composition.—An examination of the air-dried fruit resulted in the detection of the following constituents:—

An essential oil.
Traces of fixed oil.
Resins.
Traces of an alkaloid.
Quercitrin in large amount.
An ethereal salt of valeric acid.

Sixty pounds of the fruit were distilled with water in two portions, the water from the distillate of the first distillation being used with the second portion of fruit. The oil was almost entirely soluble in the water of the distillate, and had to be separated by shaking with ether. The yield was very small, about half an ounce. The ethereal oil recalled both the odour of menthol and xanthoxylon oil with an after odour of caraways; it was a mixture of more than one oil, but the amount at our disposal was not sufficient to admit of thorough fractional distillation: it was lighter than water, and after distillation

with water, the colour was slightly yellow. With reagents it afforded the following colour reactions:—Bromine dissolved in chloroform deep dirty red; alcoholic hydrochloric acid yellow; concentrated sulphuric acid deep orange red; concentrated nitric acid deep red. Treated with solid iodine some heat was developed, but no marked reaction, the iodine freely dissolved; with Fröhde's reagent a deep red was produced, rapidly changing to deep blue. Sulphuric acid and ferric chloride gave a dirty red. Picric acid dissolved in the oil easily in the cold. No crystals separated on cooling to 1°·5 C. The alkaloid afforded marked precipitates with alkaloidal reagents:—concentrated nitric acid yellow; sulphuric acid brown: no reaction with ferric chloride. An alcoholic extract was agitated with ether, and after driving off the ether, the ethereal extract was heated with caustic soda, when an odour was developed very similar to that of otto of roses.

FERULA ALLIACEA, *Boiss.*

Hab.—Persia. The gum-resin.

Vernacular.—Hing (*Hind.*, *Beng.*), Káyam, Perun-gáyam (*Tam.*), Inguva (*Tel.*), Ingu (*Can.*), Vagárni, Hing (*Guz.*).

History, Uses, &c.—The old Greek and Latin writers on Materia Medica mention two kinds of *Silphium*—one good or sweet, and the other fetid. Theophrastus in his History of Plants (vi., 3), speaks of two varieties, *of the stem* and *of the root*. He says: ὀπὸν δὲ διττὸν ἔχει, τὸν μὲν ἀπο τοῦ καυλοῦ τὸν δέ ἀπὸ τῆς ῥιζης, δι δ'καλοῦσι τὸν μὲν καυλίαν τὸν δε ῥιζιαν. Dioscorides mentions two kinds, one coming from Cyrene and the other from Asia. Some consider the silphium of Cyrene to have been entirely different from our Asafœtida, but from a passage in Strabo this does not appear to have been the case. He says:—ὁ Μηδικὸς καλόυμενος, ὀπὸς ὀυ πολὺ λειπὸμενος του Κυρηναικου. Pliny's account of silphium or laserpitium is very confused, but he has collected some information which we now know to be correct. N. Myrepsicus appears to be the first writer who mentions the name ἀσαφίτιδα, which he says is an Italian name for the σκορδολάσαρον

of the Greeks of his day. In the Rudens of Plautus (B. C. 220) the scene of which is near Cyrene, frequent allusion is made to the growth of Laserpitium there, and the preparation and export of the gum-resin, as forming the staple article of trade. The Greek and Latin authors agree in saying that the silphium or laser of Cyrene was the best, but from the works of Pliny and Scribonius Largus we learn that it was almost if not quite unobtainable in their time. Pliny relates that a single plant was presented to the Emperor Nero as a curiosity. The gum resin of *F. alliacea* is the Hing of the natives of India, the other kind being seldom used by them. In Sanskrit it is called Hingu, and is said to be so called from its killing or overpowering all other odours. In the Nighantas it bears various synonyms, amongst which may be mentioned Balhika, "coming from Balkh"; Rámatha, Bhúta-násana, "destroying demons"; and Sula-násana, "removing pain in the stomach"; it is described as hot, digestive, appetizing, pungent; a remedy for phlegm, rheumatism, griping, flatulence, diseases of the belly, satiety and worms. It increases the secretion of bile.

Hindu medical writers direct it to be fried before being used. It is in great repute as a condiment among vegetarians, also as an antispasmodic in nervous affections; taken daily it is thought to ward off attacks of malarial fever.

Asafœtida must have been used in India from a very remote period, as the earliest Sanskrit writers mention it.

The plant is called Jatuka on Játuka, a word derived from Jatu, "gum or lac"; it is described as a fragrant plant. Of the Mahometan writers on Materia Medica, Ibn Sina mentions two kinds of Asafœtida—*tyib* (good) and *muntin* (fetid), but gives no description of them. Ali Istakhri, who also lived in the 10th century, states that the drug is produced abundantly in the desert between Sistan and Makran, and is much used by the people as a condiment. The geographer Edrisi, who wrote about the middle of the 12th century, asserts that Asafœtida, called in Arabic Hiltit, is collected largely in Western Afghanistan. Haji Zein the druggist, in the 14th

century, tells us that the two kinds of Asafœtida are produced by two different plants, the black and the white *Anjudán*, and that the later plant produces the kind known as *tyib* (good). Mir Muhammad Mumin of Shiraz, who wrote in the 17th century, remarks that the Asafœtida known as *tyib* has a reddish colour, and is produced by a plant vulgarly known as Kulah-par (cap-leaf), that known as *muntin* has a disagreeable odour like a leek, and is called at Ispahan Angusht-gandah, "stink finger." Aitchison, who travelled in Eastern Persia, and the neighbouring districts of Beluchistan and Afghanistan, with the Afghan Boundary Delimitation Commission (1884—85) found that the name *Kema* (كما) was applied generally by the peasantry to the large umbelliferous plants in those parts, the Asafœtida plant being distinguished as Anghuzah-kema and the Ammoniacum as Kandal-kema. The primary meaning of this word in Persian is a sleeve, and there can be no doubt that the similarity between the large sheathing petioles of these plants, and the loose Persian sleeve has suggested the comparison. It would appear then that the kind of Asafœtida called *tyib* by the Arabs and their followers is the drug of European commerce, the produce of *Ferula fœtida*, Regel, and not that of *F. alliacea*, Boiss., which produces the Hing of India. In describing the medicinal properties of the drug, the Mahometan physicians closely follow Dioscorides.

The flowering stems of the Asafœtida plants are eaten as a vegetable, as stated by Pliny. Aitchison notices their use for this purpose, and Dr. Peters forwarded to one of us the flowering stem of *F. fœtida*, Regel, which he had purchased in the bazar at Quetta.

Guibourt (1850) was the first European writer to point out the difference between the Asafœtida of India known as *Hing* and that of the European Pharmacopœias which is called in India *Hingra*. Vigier, *Gommes-résines des Ombelliféres* (1869) calls *Hing* Asafœtida nauséeuse. We are indebted to Mr. Ardeshir Mehrban, a merchant of Yezd, for most of the following particulars regarding the source of this drug. Mr.

Ardeshir, having himself visited the hills where the plant grows, was able to speak from personal observation. The plant which produces the Asafœtida used in India (Darakht-i-Anghuzeh-i-khális) grows wild on the hills of Khorasán in very stony ground. The hill-men collect the gum-resin, taking an advance from the merchants. The time for collecting it is in the spring. The plant is not nearly so large as that which produces the Asafœtida of European commerce (Darakht-i-Anghuzeh-i-Lári), the diameter at the crown of the root being seldom more than two inches. The collectors protect each plant by building a small cairn of stones round it; they also remove the soil from the upper portion of the root, making a kind of circular basin. When the stem begins to grow it is cut off, and the upper part of the root being wounded, a small quantity of very choice gum is collected, which seldom finds its way into the market. Afterwards a slice of the root, about ¼ inch thick, is removed every two or three days with the exudation adhering to it, until the root is exhausted. The collected mass, consisting of alternate layers of root and gum-resin, when packed in skins (in quantities of about 100 lbs.) forms the *Hing* of Indian commerce; it is imported into Bombay in large quantities (about 2,500 cwts. annually), and is valued at the Custom House for assessment at Rs. 55 per cwt., commercial Asafœtida (Hingra) being only valued at Rs. 20. Early in 1874, the late Mr. Hanbury was kind enough to forward to one of us the proof-sheets of the article upon Asafœtida in the *Pharmacographia*, with a request for further information upon the subject. Unfortunately this could not be obtained in time for publication in the first edition of that work, as it involved sending to Persia for specimens of the plant and drug. In August, 1874, through the kindness of Mr. Ardeshir Mehrban, the first box of specimens was obtained, collected in the neighbourhood of Yezd. It contained—1*st*, the fresh root, with gum-resin adhering to the broken portions, and from which, upon section, a further exudation took place, at first opaque and milky, but drying in the course of a day or two into a light brown translucent substance;

2nd, the flower stem with flowers and very immature fruit; 3rd, the leaves. The plant arrived in a broken state, and was forwarded to Mr. Hanbury. Upon its receipt, he wrote:—"This morning I have devoted to the Asafœtida plant, and to a comparison of it with the figures and descriptions published by Borszczow, Balfour, and Hooker; but to decide on its botanical name is at present a difficult, if not impossible, task. I suppose it to be either the Narthex of the Edinburgh garden, or the Scorodosma of Borszczow, admitting for the moment that these are two good species; but the specimen does not furnish all the characters requisite for a strict comparison. I cannot tell whether the plant has the great sheathing petioles that form so striking a feature of the Narthex, nor is it possible to say whether the flower stem bore umbels arranged in a tall regular obelisk as Narthex, or crowded towards the summit as in Scorodosma. The foliage might do for either plant, though in having shorter segments it better agrees with the latter. The inflorescence which I have soaked and dissected consists of fertile female, and abortive flowers, none staminiferous. They are remarkably glabrous, not pubescent, as in Borszczow's plant; but this is of small moment."

Early in 1875, another box of specimens, with ripe fruit and a large supply of leaves, was obtained. In acknowledging it, Mr. Hanbury wrote:—"The box containing the Asafœtida plant arrived on the 29th January in excellent order, and its contents have given me great pleasure. The large plant though it had been rudely broken up and stuffed into a narrow space, proved to be fairly perfect; and by soaking in cold water I was able to restore it to shape, and then to fix it together so as to make a really beautiful specimen, measuring three feet six inches in height. The leaves, also, by soaking them and taking some pains, form very decent herbarium specimens, and there are enough of them to supply several collections. But the chief point with me has been to determine the plant. From the foliage, the pink colour of the stem, and the size of the fruit, I judged it might be the *Ferula alliacea* of Boissier; but there being no specimen of this at

Kew, I had to transmit a portion to *M.* Boissier, in Switzerland. His reply was definite. The plant from Yezd agrees in foliage exactly with *F. alliacea*, in stature, size of fruit, and other respects; but the fruit has a broader margin than in *M.* Boissier's specimens. However, *M.* Boissier thinks it may be set down as that species, a conclusion in which I entirely agree. *Ferula alliacea* was previously known to me only by description. You will observe that we have named it in the *Pharmacographia* as a possible source of Asafœtida. I have thought it right to make a wide distribution of the fine supply of seeds with which you have favoured me, and I have therefore sent packets to the Botanical Gardens of Kew, Edinburgh, Oxford, Paris, St. Petersburg, Bern, Strassburg, Florence, Pisa, Naples, Palermo, Athens, and to botanical friends on the Mediterranean Coast, in South Africa, and a few other places. As the seeds seemed fresh and good, I am in hopes that many plants may be raised."*

Chemical composition.—According to Hirschsohn, Asafœtidas may be divided into two groups—*viz.*, those which yield umbelliferon amongst other products upon dry distillation, and those which do not. The first group of umbelliferon yielding samples, to which the European commercial Asafœtidas belong, is distinguished by the alcoholic tincture being precipitated by acetate of lead and the fluorescence of the sulphuric acid solutions. The second group to which the Bombay kind belongs are not precipitated by acetate of lead, and their sulphuric acid solutions are not fluorescent. The turning of a red colour on exposure to light, and the malachite-green spots produced by nitric acid (first observed by Flückiger) also distinguish the common Asafœtidas from the Indian; it may also be particularly mentioned that stem-remains are found in some kinds of common Asafœtida, while the Bombay kind always contains slices of roots.

Petroleum-ether, besides extracting the essential oil, extracts a non-volatile substance which greases paper. The

* For a review of the botanical literature of the Asafœtida plants, see Holmes in *Pharm. Journ.* 3rd Ser. xix., 21-34; 41-44; 365-368.

extractive matter can be used to distinguish the two kinds of Asafœtida, and also to estimate their worth; Asafœtida of an ordinary commercial quality in tears yields at least 7 per cent. extract to petroleum-ether, lump at least 5 per cent. The volatile constituents should not be less than 5 per cent. in tear or 3 per cent. in lump Asafœtida. Good Indian Asafœtida should yield at least 11 per cent. to petroleum-ether, and this residue should not lose more than 6 per cent. when heated to 120° C.

Flückiger has obtained from Hing a reddish essential oil having a specific gravity of 1·02 at 25 C., and deviating 38·8 to the right, when examined in a column of 100 millimetres in length.

Commerce.—Hing is known in the Bombay market as Abushaherí Hing; it arrives in skins which contain about 100 lbs.; latterly some boxes have been received. The quality varies greatly, inferior parcels contain an undue portion of the root; in Bombay it is often still further adulterated by mixing it with gum Arabic in different proportions, according to the priced article required. To do this the package is broken up and moistened, the gum is then added, and the whole trodden together by men with naked feet upon a mat. When sufficiently mixed, it is sewn up in skins to imitate the original packages. Recently adulteration with sliced potato has been observed. Hing of good quality is worth about Rs. 80 per cwt. in Bombay.

FERULA FŒTIDA, *Regel.*

Fig.—*Bentl. and Trim., t.* 127; *Trans. Linn. Soc. 2d. Ser. Botany, Vol. iii., Pt. i., pl.* 12, 13, 14.

Hab.—Persia, Afghanistan. The gum-resin.

Vernacular.—Hing (*Hind.*), Hingra (*Guz.*), Káyam, Perungáyam (*Tam.*), Inguva (*Tel.*), Ingu (*Can.*)

History, Uses, &c.—Commercial Asafœtida is collected from this plant in Western Afghanistan and Persia; in May,

the mature roots begin to send up a flowering stem, which is cut off and the juice collected in the manner described by Kæmpfer, who witnessed its collection in the province of Laristan in Persia. It was long supposed that commercial Asafœtida was the produce of *F. Narthex*, Boiss., a Tibetan plant which was discovered by Falconer in Astor, but there is no evidence of the drug ever having been collected from it. In May, 1884, Dr. Peters, of the Bombay Medical Service, when stationed at Quetta, observed the flowering stem of an Asafœtida plant which was being offered for sale in the bazar as a vegetable by the Kákar Pathans. Specimens which he kindly forwarded to one of us were identified by Mr. E. M. Holmes as *F. fœtida*, Regel. Dr. Peters also found the dried root of the same plant in the drug shops, and learned that it was the plant from which Asafœtida was collected in Western Afghanistan. These facts were confirmed by Aitchison in May 1885, both as regards the source of commercial Asafœtida, and the use of the flower stalk as a vegetable. In his report upon the Botany of the Afghan Delimitation Commission, he remarks:—"In all stages of its growth, every part of the plant exudes upon abrasion a milky juice, which is collected and constitutes the drug of commerce. The stem in a young state is eaten raw or cooked." Aitchison says that a red clay called Tawah (طوا) is mixed with the gum-resin at Herat, a statement which is only applicable to the kind of Asafœtida known in commerce as *Kandahari Hing*, to be presently noticed. Concerning the Láristan plant we are still without exact information, but we think it will prove to be *F. fœtida*. The remarks made respecting the use of Asafœtida by the natives of India under *F. alliacea* are more or less applicable to the present article, which is often imposed upon the poorer classes as a substitute for the more expensive Hing. In modern European medicine, Asafœtida is used as a stimulant and antispasmodic in chronic bronchitis, hysteria and tympanitis; it is often administered in the form of enema, as it is apt to give rise to a sense of weight and heat in the stomach when given by the mouth. Dr. Paolo Negri has reported the

successful treatment of two cases of abortion with Asafœtida administered to the extent of one gram daily. In the first case the woman had aborted twice and in the second four times; both patients were free from syphilitic taint, and no cause for the abortion could be detected.

Description.—The best Hingra occurs in tears or flat pieces, upon the under-surface of which particles of sand often adhere; the external surface is yellowish; but the fresh fracture is of a pearly white, which by exposure to the air becomes bright pink and finally dirty yellow. Inferior samples consist of agglutinated tears, with a certain proportion of moist brown clammy gum-resin filling up the interspaces between them. Sometimes the Asafœtida which comes from Persia is a homogeneous soft white mass like clotted cream; these parcels upon exposure to the air develop an unusually bright pink colour. The drug has a powerful but not purely alliaceous odour, and a bitter acrid taste.

Microscopic structure.—In the root, portions of which may sometimes be obtained from a mass of second sort Asafœtida, there may be seen a perfectly regular arrangement of the zones, contrasting strongly with the root of *F. alliacea*. It is like that root remarkable for very large laticiferous vessels, but these are distributed symmetrically, the largest occupying the outer radius of the section.

Chemical composition.—Asafœtida consists of resin, gum and essential oil, in varying proportions, but the resin generally amounting to more than one-half. The authors of the *Pharmacographia* say:—

"As to the oil we have repeatedly obtained from 6 to 9 per cent. by distilling it from common copper stills. It is light yellow, has a repulsive, very pungent odour of Asafœtida, tastes at first mild, then irritating, but does not stimulate like oil of mustard when applied to the skin. It is neutral, but after exposure to the air acquires an acid reaction and different odour; it evolves sulphuretted hydrogen. In the fresh state, the oil is free [illegible] boiling-point of 135° to 140°

C., but with continued evolution of hydrogen sulphide, so that we did not succeed in preparing it of constant composition, the amount of sulphur varying from 20 to 25 per cent.

"We found it to have a sp. gr. of 0·951 at 25° C., and a strong dextrogyrate power. If a drop of it is allowed to float on water it assumes a fine violet hue on exposure to the vapours of bromine.

"The essential oil of Asafœtida submitted to fractional distillation yielded us, at 300°, a considerable proportion of a most beautifully blue-coloured oil. By very cautiously oxidizing the crude oil, we obtained a small amount of extremely deliquescent crystals of a sulphonic acid. Sodium or Potassium decomposes the oil with evolution of gas, forming Potassium sulphide; the residual oil is found to have the odour of cinnamon.

"The resin of Asafœtida is not wholly soluble in ether or in chloroform, but dissolves with decomposition in warm concentrated nitric acid. It contains a little *Ferulaic acid*, crystallizing in iridescent needles, soluble in boiling water; it is homologous with eugetic acid.

"Fused with potash, ferulaic acid yields oxalic and carbonic acids, several acids of the fatty series and protacatechuic acid. The purified resin treated in like manner yields resorcin; and by dry distillation, oils of green, blue, violet, or red tint, besides about ¼ per cent. of Umbelliferon, $C^9H^6O^3$."—(*Pharmacographia, 2nd Ed., p.* 318). E. Schmidt (*Archiv. der Pharm.* (3) xxiv., 534, 535,) has extracted small quantities of Vanillin from Asafœtida by the following process:—The powdered Asafœtida was repeatedly exhausted with ether, the filtrate shaken up with concentrated hydrogen sodium sulphite solution, and the liquid thus obtained supersaturated with dilute sulphuric acid. After expelling sulpharous anhydride, the extraction with ether and subsequent treatment was repeated, and a third extraction made. After removing the ether by distillation, the resulting vanillin was dissolved in water, and the filtered solution allowed to evaporate over sulphuric acid;

Kandahari Hing.—This substance appears to have been quite unknown in Europe, until brought to the notice of Professor Flückiger and the late Mr. Hanbury by one of us. We have not as yet been able to obtain authentic specimens of the plant, but for the following reasons we consider it likely that it will prove to be the same as that which produces the officinal drug:—

1. Bellew mentions a very high-priced Asafœtida obtained by wounding the leaf-bud of the plant which produces ordinary Asafœtida; our article is generally mixed with numerous leaf-buds, which have evidently been cut off by a sharp knife; its price is also much higher than that of any other kind.

2. When examining a number of bales of common Asafœtida from Kandahar, we found some of them to contain particles of the more expensive drug, and a large quantity of what appeared to be gum-resin in a transition stage between the transparency of Kandahar Hing and the opacity of the commercial article.

3. A portion of root found in a bale of Kandahar Hing agreed exactly with a piece obtained from a bale of common asafœtida.

4. Aitchison describes the juice of *F. fœtida* as a thick gummy reddish substance, and notices its adulteration with red clay; this adulteration is only found in bales of Kandahari Hing.

Kandahari Hing comes to Bombay in small quantities; it is sewn up in goat skins, forming small oblong bales, with the hair outside. When it first arrives it is in moist flaky pieces and tears, from which a quantity of reddish-yellow oil separates on pressure; the gum-resin also is of a dull reddish-yellow colour, soft, and somewhat elastic, with an odour recalling that of garlic and oil of caraways. By keeping, it gradually hardens and becomes brittle and of a rich red-brown colour; the odour also becomes more purely alliaceous, and approaches that of the commercial kind. This kind of Hing is almost entirely consumed in Bombay by the manufacturers of adulterated

asafœtida, its strong odour and flavour make it especially valuable for this purpose. The average value is Rs. 25 per Surat maund of 37½ lbs., but as the bales often contain masses of a red clay, the actual price of the clean gum-resin is much higher.

Commerce.—Hingra arrives in Bombay from Persia and Afghanistan. The Persian is produced in the province of Láristán, and is known to Persian merchants as Anghuzeh-i-Lári; it often arrives in a moist condition, but soon hardens. The latter comes from the country about Herat *viâ* Kandahar, and is generally hard and dry. Very fine samples in tears are not uncommon. The stony asafœtida described by Pereira is also met with in India; it is simply a mixture of very fluid common asafœtida with the white sandy soil of the country in which the plant grows; it fetches a very low price, and as far as we can make out, the mixture is made more for convenience of carriage than for the purpose of deception. Besides, when the juice is unusually fluid, it runs out upon the surrounding ground and becomes mixed with the sand. The imports of Hingra into Bombay are about 2,500 cwts. annually from Persia and Afghanistan. Value Rs. 10 to 20 per maund of 37½ lbs. The total imports of Asafœtida of all kinds into British India during the last five years have been 37,306 cwts., the aggregate exports have only been 2,014 cwts.

FERULA GALBANIFLUA, *Boiss et Buhse.*

Fig.—*Trans. Linn. Soc. 2d Ser. Bot. Vol. iii., Pt. i.*, 15, 16, 17.

Hab.—Persia. The gum-resin.

Vernacular.—Jawáshir (*Arab., Ind. bazars*), Gaoshir, Barzhad, Biriz (*Pers.*).

History, Uses, &c.—Besides the plant which is placed at the head of this article, Boissier makes another species, *F. rubricaulis*, to grow in Persia. Borszczow, however, regards it as only a variety of *F. galbaniflua*. He states, though not from personal observation, that its gum-resin, which constitutes

Persian galbanum is collected for commercial purposes round Hamadan. Aitchison says that *F. galbaniflua* is called in the Badghis territory near Herat *Badra-kema*, and that the fresh plant has an odour like celery. The gum-resin which usually exudes from cracks at the base of the stem is called by the peasantry *Shilm-i-barzad* or *Barzad-i-gaoshir* or *jawáshir*; it is said to be given to parturient women, and to be hung round the house to keep evil spirits away at the time of parturition.

Persian brokers in Bombay state that the galbanum plant is very abundant between Shiráz and Kirman, and there would seem to be no reason to doubt that the Indian market is partly supplied from that district.

The old Hindu writers make no mention of galbanum; Ainslie found that the Tamil physicians were unacquainted with it. In many Mahometan works the notices of galbanum appear to have been copied from Greek writers, the synonyms given being generally Barzad and Kinneh, but Haji Zein in the Ikhtiarát, A.D. 1368, describes two kinds of the drug,—one hard and whitish, and the other soft and yellow, like honey; the latter, he says, is called Jákushi at Shiraz.

The author of the Makhzan-el-Adwiya, speaking of Barzad, says it is called Kinneh in Arabic, Khalbani in Greek,* and Bireja or Ganda-biroza in Hindí, and is the produce of an umbelliferous plant like that which produces Sagapenum; but, he adds, that the drug which he has met with in India under these names is the produce of a tree called Deodar growing in the North of India. His experience accords with that of the present day, the only Ganda-biroza obtainable being the turpentine of *Pinus longifolia*. In India Persian galbanum is known as Jawáshir; on referring to the Makhzan we find this word explained as an Arabic corruption of the Persian Gaoshir. The author says, that it is a fetid gum-resin, and describes its collection from an umbelliferous plant, its

* Conf. Dios. περι χαλβάνης iii., 88; Theoph. H. P. ix., 1; Pliny 12 56; 24, 13.

appearance, &c., and with regard to its properties informs us that it is attenuant, detergent, antispasmodic and expectorant, and is prescribed in paralytic affections, hysteria, chronic bronchitis and asthma,* also on account of its supposed stimulant action upon the uterus. Externally it is used as a plaster. In short, he enumerates the uses to which galbanum is generally applied. It appears then that the Mahometan physicians of the East have been in doubt as to the identity of the Persian Jawáshir and the galbanum of Greek writers. In India galbanum is little used, the bulk of what is imported into Bombay being sent to Egypt and Turkey as Jawáshir. It is hardly necessary to add that those writers who have identified Jawáshir with Opoponax can never have seen the latter drug. We have never met with Opoponax in India.

Description.—Persian galbanum as met with in the Indian market is a yellow or greenish yellow semi-fluid substance having an odour between that of Levant galbanum and sagapenum; it is generally mixed with portions of the stem, flowers, and fruit of the plant: in some samples the outline of separate tears may be traced. When kept for some time it gradually becomes quite hard and dry. Occasionally samples, which seem to have been collected in a different manner, find their way to India: these contain slices of root and gum-resin in hard, dry tears, like that of Levant galbanum.

Chemical composition.—According to Hirschsohn, good Persian galbanum should yield to petroleum spirit not less than 65 per cent. consisting of volatile oil and resin, the average yield of Levant galbanum being between 60 and 63 per cent. The amount of ash in Persian galbanum should not exceed 4 per cent., being less than the ash of ordinary lump Levant galbanum by 2 per cent. The best Levant in tears gives the same ash as clean Persian. As a qualitative reaction to distinguish the varieties of galbanum, hydrochloric acid can be used, as it colours the Persian resin yellow-red

* The Jawáshir pill often prescribed in asthma consists of equal parts of Jawáshir and colocynth pulp rubbed up with honey.

passing into red, and the Levant different shades of violet. The petroleum spirit-extracts from the Persian sorts give with nitric acid a rose-red colour; those from the Levant sorts different shades of violet. Bromine vapour colours the Persian weakly or intensely violet, but the Levant yellow.

The ether-resin from both kinds of galbanum upon boiling with water, gives indications of umbelliferon.

As to the origin of galbanum, the author believes from its varied behaviour with reagents, the different action of the volatile oils upon polarized light, and the different proportions of volatile oil to the gum-resin, that it is derived from different plants. He also points out that the Levant galbanum occurring in commerce contains no fruit and seldom stalks, but always slices of root, whilst the Persian galbanum always contains fruit and stalks.

According to Messrs. Schimmel & Co., galbanum oil is of a pale yellow colour, and possesses a pronounced odour of the gum. Its specific gravity at 15° C. is 0·914; it boils, apparently without decomposing, between 165° and 300°.

A sample of galbanum, collected from *F. galbaniflua* in Persia by Aitchison, and examined by E. G. Baker in 1886, gave the following results:—

Volatile oil	3·108
Resin soluble in ether	61·200
„ „ alcohol	7·576
Gum soluble in water	17·028
Insoluble matter	10·560
	99·472

Sulphuric acid coloured the gum-resin a dark brown; cold hydrochloric acid hardly affected it, but when boiled the mixture turned a dirty red colour, which was not altered by alcohol. A small portion of gum-resin boiled in water and allowed to cool gave on the addition of ammonia a faint blue fluorescence indicating the presence of umbelliferon; it contained no sulphur. (*Pharm. Journ.*, 1886, *p.* 468.)

Commerce.—Galbanum is imported from Persia into Bombay. It is collected in the Hari-rud Valley and Bádghis (*Aitchison*); it is also said to be collected between Shiráz and Kirmán. The imports are very irregular, most of it is re-exported to Egypt and Turkey. Average value, Rs. 8 per maund of 37½ lbs.

DOREMA AMMONIACUM, *Don.*

Fig.—*Trans. Linn. Soc. 2nd Ser. Bot. Vol.* iii. *Pt. i.*, 23, 24, 25; *Jaub. et Spach. Ill. Pl. Or.* I., *t.* 40.

Hab.—Persia, Afghanistan. The gum-resin.

Vernacular.—Ushak (*Arab., Pers., Indian bazars*), Kandal (*Afghan*).

History, Uses, &c.—This plant and *D. glabrum*, Fisch et Mey., both natives of Persia, are known to produce a gum-resin, but, according to Aitchison, that of the former plant is alone collected. Of the latter plant he says: It yields a yellow gum-resin; but I did not hear of its being collected; it is called Kema-i-ásp (horse Kema). Dioscorides speaks of ammoniacum as the juice of a narthex growing about Cyrene in Libya,* and it appears to have derived its name from the temple of Ammon. Pliny † derives it from 'Ammos,' sand. Most Greek and Latin writers on medicine mention its use in fumigation, and speak of it as *Thus Libycum, Ammoniacum thymiana*, or *Ammoniacum suffimen*. This kind of ammoniacum has now been ascertained to be the gum-resin of *Ferula Tingitana, Linn.*, which grows in Morocco. It was probably the only kind known in Europe in olden times. (*Confer. Pharmacographia, p.* 288.) The time when Persian ammoniacum first came into use cannot be exactly fixed.

* Diosc. *περὶ αμμωνιακοῦ*, iii., 89. It had a reputation as a resolvent, especially in enlargements of the liver and spleen. Scrib. Comp. 128, 131. Persian ammoniacum has a similar reputation in India.

† 24, 14.

It is not mentioned by the Greeks or Romans. Ibn Sina states that Ushak is the gum of the Tarthúth, and is called Lazák-el-dahab (= χρυσόκολλα), because it is used in gilding. His ammoniacum is doubtless Persian, like that of Abu Mansur Mowàjik, a Persian physician of the eleventh century, and of Ansári of the middle of the fourteenth century. The latter writer states that the Shirazí name for Ushak is Badrán. In Bokhara the gum-resin bears the name Kandal. According to Bunge and Bienert, the same name, and Kama, are given to the plant in Persia. Aitchison, who observed the plant in the Hari-rud valley, found it to be known to the natives as Ushak and Kandal-kema. He remarks: "No sooner is the fruit well formed and beginning to ripen than the plant is attacked by some boring insect, which causes the milky juice to escape. This dries into hard blocks, frequently enclosing the fruit."

According to Borszczow, *D. Ammoniacum* is called by the Kirghises Bal-kurai or "Honey-cane." The author of the *Makhzan-el-Adwiya* says that Ushak is an Arabic corruption of the Persian Ushnah or Ooshah, and that the drug is also called Khalbani, and in Arabic Ushajj, Wushajj, Wushok and Lazák-el-dahab. He gives the Greek names as Athánikun, Ammoniakun and Paruaksh, the Egyptian as Kinna, Shak and Kalakh, and the Indian as Kandar. Some Persian writers give Tarthúth as the Arabic and Samgh-i-bal-i-shírín as the Persian name. According to the dictionaries, Bal is the Persian for Tarthúth. Baghdádi tells us that Tarthúth is not the same as ammoniacum. In Bombay the current Persian name is Ushak. Mahometan works on Materia Medica describe the drug as discutient and attenuant; for more particular opinions respecting it the reader may consult the *Makhzan-el-Adwiya*, article Ushak. Sanskrit writers do not mention it. Besides the gum-resin, the root of *D. Ammoniacum* is largely imported into Bombay, and is one of the substances used by the Parsees as incense under the name of *Boi*, a word cognate with *Bu*, or *Bo*, fragrance. It is popularly spoken of as a wood. There can be little doubt that the use of this substance as an incense must date from a very remote period, otherwise the modern Parsees

would not be at the trouble of importing it into India. Mr. K. R. Cama informs us that the "wood of fragrant trees" is mentioned in the Avesta as a class, and that one wood in particular is named, "*Hadha Nâeptanam*," which would mean translated into Persian, "Hamisheh naft," always moist, *i.e.*, green. He says: "In modern days we identify this wood, most likely mistakenly, with Pomegranate wood." It would appear then, that there is no specific description of Boi in the Avesta, but that it is traditionally understood to be one of the fragrant woods mentioned therein. It is this root which was some years ago exported to Europe as Bombay Sumbul, after having been cut up and impregnated with musk. When old and worm-eaten it becomes of a loose and spongy texture, and might easily be mistaken for Sumbul by a superficial observer.

Description. – Bombay is the chief mart for ammoniacum, and it is here that the original packages which come from the Persian Gulf ports are opened and sorted for the various markets.

The bales, generally of matting or coarse canvas, frequently contain all parts of the plant broken up and encrusted with the adherent exudation. Seed in the mature state is separated in large quantities, and is readily eaten by cattle. It would appear then that the collection takes place after the plant has matured its fruit, and that hardly any attempt is made by the collectors to separate the plant from the gum-resin; the latter exudes from every part, even the fruit is coated with it, and perforated by insects in the same manner as the stem.

Ammoniacum is usually sorted into three qualities—large tears, middle-sized tears, and small; the last kind is often carelessly picked, and contains dirt and other refuse. If the drug is kept in Bombay during the monsoon, the tears get soft and unite into a lump.

The roots vary in size, the largest being three inches in diameter at the crown; they are generally more or less forked; the root bark is thin and papery like that of the Sumbul, but the root itself is compact, and has a resinous section. A small

specimen, powdered and exhausted with boiling water, yielded about one ounce of dark-coloured ammoniacum.

Chemical composition.—The following account is extracted from the *Pharmacographia*.—"Ammoniacum is a mixture of volatile oil with resin and gum. We obtained only ½ per cent. of oil, which we find to be dextrogyrate; we failed in obtaining a terpine from it.

"The volatile oil, which is lighter than water, and has the precise odour of the drug, contains, according to our experiments, no sulphur; a similar observation was made by Przeciszewski. Vigier, who obtained the oil to the extent of 1·8 per cent. by distilling the gum-resin with water, asserts that it blackens silver, and that by oxidation with nitric acid, he detected in it sulphuric acid. He states that with hydrochloric acid, the oil acquires a fine violet tint, passing by all shades to black; we failed in obtaining this coloration. By diluting the oil with bisulphide of carbon, and then adding mineral acids, we observed only yellow coloration. The oil diluted with alcohol acquires a red hue with ferric chloride.

"The resin in ammoniacum usually amounts to about 70 per cent. It is separable, according to Przeciszewski, into two substances—the one a resin having acid properties, the other an indifferent resin. He asserts that the indifferent resin when heated yields sulphuretted hydrogen. Our own experiments failed to show the presence of sulphur in the crude drug; and the same negative result has been more recently obtained in some careful experiments by Moss. Water, when boiled with the resin, acquires a yellow hue and slightly acid reaction; the liquid assumes an intense red coloration on addition of ferric chloride.

"Ammoniacum yields no umbelliferon; when melted with caustic potash it affords a little resorcin. The mucilaginous matter of the drug consists of a gum readily soluble in water, and a smaller quantity of about ¼ of an insoluble part, no doubt identical with that occurring in Asafœtida and galbanum. The aqueous solution of the gum of ammoniacum is very slightly

levogyre." (*Confer. Hirschsohn Phar. Zeitscrift für Russland, April* 15, 1875, p. 225.)

Commerce.—All the Ammoniacum which reaches Bombay comes from Persia.

Value, about Re. ¼ per lb.

The root is also imported from Persia. Value, Rs. 4 to Rs. 5 per Bombay maund of 28 lbs.

DOREMA AUREUM, *Stocks.*

Fig.—*Hooker's Jour. of Botany, iv., p.* 149.

Hab.—Beluchistan.

The gum-resin of this plant, gathered by Dr. Stocks in Beluchistan, is described as being an opaque cream-coloured substance, closely resembling in taste, smell and general appearance the ammoniacum of commerce. We have made enquiries for it in the Sind bazars, but cannot find that it is anywhere an article of commerce.

SAGAPENUM.

Vernacular.—No Indian names. Sagbinaj (*Arab, Indian bazars*), Iskabinah (*Pers.*).

History, Uses, &c.—This drug is supposed to be the juice of *Ferula Szovitsiana*, DC., but there appears to be no record of its collection from that plant. Aitchison speaks of *F. Szovitsiana* as a rigid herb, scarcely two feet high; common in the stony country and gravelly plains of the Hari-rud valley, the root stock of which possesses a slight odour of asafœtida. The fruit frequently present in commercial sagapenum is similar in shape to that of *F. galbaniflua*, but larger and of a yellow colour.

Sagapenum was known to the Greeks, and through them the early Arabian writers probably became acquainted with its medicinal properties. Dioscorides speaks of it as the juice of a ferulaceous plant growing in Media, and says that it has an odour between that of silphium and galbanum, whence we may

infer that the odour of silphium was alliaceous. Pliny says that it is used to adulterate laser and galbanum. We see no reason to suppose that the ancient Hindus knew the drug, although Kundel is in some books given as the Sanskrit and Hindí name for it. The author of the *Makhzan-el-Adwiya* gives a sufficiently accurate description of Sagbínaj, and tells us that it is obtained from the district of Mah, near Ispahán. Persian brokers in Bombay state that the drug brought to this market is collected in the country between Shiraz and Kirmán. It is necessary to remark that Persian Sagapenum is distinctly different from what is known as Levant Sagapenum. Mahometan physicians consider Sagapenum to be attenuant and resolvent; when combined with purgatives it is thought to exert its resolvent power upon every part of the system, removing noxious humours; they also value it as an anthelmintic and emmenagogue. For a full account of the diseases in which it is prescribed, we must refer the reader to the *Makhzan-el-Adwiya*, article Sagbînaj. A sagapenum pill is often prescribed in flatulent dyspepsia; it contains equal parts of Aloes, Sagapenum, Bdellium and Agaric. Two to three dirhems are to be taken with warm water.

Description.—Sagapenum generally arrives in Bombay in masses weighing from four to ten pounds, tied up in coarse cloth, but occasionally parcels consisting of fine, dry, separate tears are seen.

The masses are made up principally of tears, which being mixed with a proportion of soft gum-resin, adhere together, forming a brownish-yellow cake; when fresh some of the tears have a greenish tinge, and are more or less opaque, but by keeping they all become brownish-yellow and translucent. The dry tears are always of a brownish-yellow.

The odour is distinctly alliaceous, but in other respects is much like that of Persian Galbanum.

Chemical composition.—Persian Sagapenum and Persian Galbanum closely resemble each other, and the same may be said of Levant Sapagenum and Levant Galbanum. As charac-

ters for distinguishing Sagapeum from Galbanum may be used—(1*st*), the presence of sulphur in Sagapenum; and (2*nd*), their behaviour towards petroleum spirit, Persian Sagapenum yielding to it 2 to 5 per cent. and Levant 6 to 12 per cent. of resin, whilst the resinous residue from Persian Galbanum amounts at the most to 0·2 to 0·3 per cent. and that from Levant Galbanum to 1 per cent. (*Confer. Hirschsohn Phar. Zeitschrift für Russland, April* 15, 1875, *p.* 225.)

Commerce.—The quantity annually imported into Bombay varies greatly; most of it goes to London. It is seldom to be obtained in the retail shops. Value, Re. ½ to Re. ¾ per lb.

ARALIACEÆ.

Many species of Aralia are cultivated in gardens in India on account of their foliage. Loureiro tells us that they are used medicinally in Cochin-China, and are aperient, diuretic and diaphoretic. The famous *Ginseng* of China is derived from this family, and our Indian gardeners have discovered antifebrile properties in *Aralia Guilfoylia*, which they have named *Tápmári*, "fever killer." We have found that a syrup prepared from the leaves is a useful expectorant in cough. The leaves of most of the Aralias have a strong odour of Ivy when crushed. *A. Guilfoylia* is the *Frutex aquosus femina* of Rumphius (VI., 51), who states that it reduces heat in fever. *Aralia Pseudo-ginseng*, Benth., *Wall. Pl. As. Rar. t.* 137, is a native of Nepal, Sikkim, Bhotan and the Khasia mountains. Mr. C. B. Clarke considers it to be doubtfully separable from the true Ginseng of Japan, *Panax Ginseng*, C. A. Meyer, which differs by having broader, more obovate, less bristly leaves, and not by the characters relied on by Meyer. The Indian examples show every form of root stock and tuber attributed specially to *P. Ginseng* and to *P. quinquefolius*, Linn.; the scale at the base of the stem is persistent even in some of Wallich's specimens. (*Fl. Br. India.*) Ginseng enjoys in its native country the reputation of a panacea, and especially of

being aphrodisiac. The affections for the cure of which it is most esteemed, are such as are usually treated by aromatic stimulants, including dyspepsia, vomiting, and nervous affections. It is used as a masticatory and also in infusion, and is occasionally brought to India by the Chinese.

Description.—Ginseng root is fusiform, 4 to 6 inches long, with a rounded head, closely annulate, and with few wrinkles above, dividing below into two, or occasionally three, branches of even size. The branches are not, or are but slightly, annulate, and are longitudinally wrinkled. The root is externally of a brownish-yellow colour, internally white, breaks with a short and mealy fracture, and has a faint sweetish odour and a sweet slightly aromatic taste. The transverse section shows a thick bark, with numerous scattered brown-red resin-cells, and in older roots is radially striate from the bast-wedges; it is separated by a brown cambium-line from the central portion, which consists of linear wedge-shaped yellowish wood-bundles and broad medullary rays.

Chemical composition.—Besides starch, gum, albumen, and resin, S. S. Garrigues (1854) isolated a sweet principle, *panaquilon*, $C^{12}H^{25}O^{9}$, by adding to the syrupy infusion a concentrated solution of sodium sulphate and dissolving the precipitate in alcohol. It is yellow, amorphous, sweet, insoluble in ether, and precipitated by tannin. Concentrated sulphuric acid dissolves it with a purple-red colour, converting it at the same time into *panacon*, $C^{11}H^{19}O^{4}$, which is white, tasteless, and insoluble in water and ether, but soluble in alcohol.—(*Stillé and Maisch.*)

We have examined the leaves of *Aralia Guilfoylia*, which have an odour like fœnugreek, due to an odorous principle which was dissolved out by ether and stronger alcohol, but could not be obtained by distillation. The distillate was slightly acid, and contained a white fatty substance like a stearopten having quite a distinct odour from that of the drug. The aqueous solution of the ethereal extract was viscid, partly soluble in water, and the portion soluble gave