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**THE CULTIVATION OF LICORICE ROOT
IN THE UNITED STATES.**

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Many interesting accounts of the cultivation of the licorice plant are to be found scattered through the works on materia medica, agriculture and gardening during the past one hundred years, and the methods therein described are essentially the same as those pursued at the present time, and which it is not the intention to reproduce here.

Licorice root is cultivated, in the true sense of that word, in so few places in the world, and to so small an extent as an article of commerce, as hardly to be worth mentioning. One or two places in England, and a like number in France and Germany, embrace all the localities I happen to be acquainted with, and the area of land under cultivation varies from a few rods to an acre or two, five acres being an exceptionally large field.

The large amount of licorice imported into this country, and which also supplies the needs of the world, grows wild, without any care or cultivation whatever. Italy and Spain supply a small percentage of the total amount, probably 5 to 8 per cent., while Southern Russia, along the line of the Transcaucasian Railway, supplies two-thirds of the remainder, and Asia Minor and Syria the other one-third. The total amount of all kinds imported into the United States is about 80,000,000 pounds per annum, on an average. In 1872, the imports were about 5,000,000 pounds, and the consumption still increases yearly.

The licorice plant grows over an area, extending from the shores of the Mediterranean, on the south (latitude 30°), to Siberia, on the north (latitude 55°), and from the western shores of Europe to the plains of Persia and farther India, and from low levels to 1,500 feet above the sea; thus showing over what an immense area of land and variety of soil and climate it will grow vigorously. In Afghanistan it forms the principal fuel. It is a hardy and tenacious plant, almost impossible to

eradicate where it once obtains a foothold, and growing without care or cultivation when once fairly started. The mention of these conditions under which the plant, which furnishes the root of commerce, is found, is to illustrate its hardy nature.

As the plant grows wild, and generally on wild and uncultivated land, and is dug and prepared for market by cheap Asiatic and Russian labor at starvation wages, the first question naturally is, would it pay to grow it in the United States? The answer to this is: if it is intended to grow it as root dried and sold in competition with this wild, imported root, probably not; but to propose and advance such an enterprise is not my object.

Licorice root, as found in commerce, is dried and pressed in bales. The root, when freshly dug, contains, on an average, 50 to 60 per cent. of moisture. This must first be dried out, which is done by exposure to the air, much as hay is made, requiring frequent turnings and handling to prevent, as much as possible, heating, fermenting and darkening during the drying, as well as the wetting by rain or snow, which may be frequent before the root is dry enough to press for shipment. The root, when nearly dry, and danger from further damage from the presence of moisture has passed, is piled up in large stacks until ready to be pressed. Around these stacks are dug ditches for draining the ground, and after a heavy shower, or prolonged period of rain or snow, these ditches will fill with a black water, containing a very strong taste and a high percentage of the extractive matter of the root; this, of course, deteriorates its value and is itself waste. When dry enough, it is pressed in powerful hydraulic presses worked by steam, so as to reduce the bulk to a minimum, and so save freight in shipment. The bales are bound with iron straps, and sometimes covered with canvas.

The plants, which supply the root as found in commerce, have been growing for a long time, some pieces being two to three inches in diameter when dry, indicating probably a growth of twenty or more years; but these very thick pieces are usually rejected as being worthless for making extract, as a root after four years' growth begins to deteriorate in value for the purpose of making extract, because of becoming too woody and fibrous, and lessening the percentage, of extractive matter. On the other hand, the very thin fibres of one year or less growth are equally worthless, yet the the shipper works in as much of both kinds in the bales as he dare, to say nothing of adhering soil and

debris. Root of three years is the most desirable, if it could be obtained, as being the richest in extractive matter.

It will be seen from the above that the preparation of licorice root for market, as we find it, is a tedious and expensive process —first, the organization of the business, in the employment of clerks, superintendents and a host of minor officials to superintend the diggers, receive and weigh the root at the various stations appointed in different localities, pressing, shipping, etc. The right to dig over a certain territory is obtained by lease or tithe, as the land is owned by the Government, the church, the village, or by individuals. Then there are the digging, drying, curing, pressing and baling, inland transportation, ocean freights, insurance, fire and marine, bankers' and brokers' commissions, interest and loss of weight in transportation. These expenses alone, throwing aside the cost of the freshly dug root, will represent fully 75 per cent. of the price of the root ex-ship in the United States. The foregoing expenses are fixed and unavoidable, as the fresh root could not be transported, owing to its perishable nature. These considerations have led me during the past four years to investigate the feasibility of growing this plant in the United States.

The consumption of the extract in this country is now so large and important, especially in the manufacture of chewing tobacco, that in case of a European war, a blockade of the Black Sea at the Dardanelles, or the Mediterranean at Gibraltar, would effectually cork up the world's supply, and throw the large American industry of tobacco-manufacturing into confusion. As licorice has become a more or less important ingredient in most brands of chewing tobacco, and the present generation of chewers has become so accustomed to its use, new brands omitting this ingredient might be unsalable.

Referring now to the vast and varied area over which the licorice plant grows wild, and the great variety of soil and climate in the United States, as well as cheapness of land and labor, and the ability to obtain large tracts of land of comparatively easy accessibility for transportation and labor, has led me to present the following information on the subject, of what I believe can be made a new and profitable industry in this country, with money and time intelligently expended. I believe it would, in time, pay better than either sugar cane, sugar beets, rice or cotton, although the industry would not be as large or important as any of those, which are all exotic, the cultivation of all of them having been

begun in a very small way in the United States.

Licorice extract can be made as well, or better, from fresh root than from the dry, and is so made in the countries that furnish the root; but the duty on it of five cents per pound restricts largely its importation, while the root is free.

The thought I have in mind, in introducing the growing of licorice here, is very much on the same lines as sugar is now made from cane and beets; that is, to have large tracts of land devoted exclusively to the growth of the plant, with the factory for making the extract from the fresh root in, or near, the fields. The present sugar factory, too, could easily be adapted to the manufacture of the licorice extract, the apparatus required being simply suitable crushers or shredding machinery, the diffusion battery and vacuum pans for evaporating. Sugar factories, too, could be utilized when not running on sugar, as the proper time for digging the root is from October to April, and if the root is not needed one year, it can be left in the ground until the next, not only without deterioration, but to its increased value in weight. It is not well, however, to allow the root to exceed five years in growth; three or four year root is the richest in extractive matter; as it becomes older it becomes more fibrous. Frost or drought do not injure the root when once well established; young and tender plants in the first year might be injured. The elaborate and expensive methods of culture, followed by the gardeners of Europe, would be entirely unnecessary here on a large scale. After selecting a suitable tract of land, having the necessary requirements of soil, location, etc. (prairie land, because it is open and easily tilled, would be my choice), it need only be plowed once to turn down the grass and weeds, harrowed, then laid out in furrows about 25 to 30 inches apart, and the buds or cuttings, set in the rows 6 or 8 inches apart, and covered by a plow, throwing a furrow over the buds from each side, or even cover them 3 or 4 inches with a hoe ; this is all. From time to time, during the growing season, a cultivator should be run between the rows to keep down weeds or grass. The tops, at the end of the growing season, should be cut off; this could be done with the mowing machine. The second and third year the treatment would be the same. In the fall of the third year the crop would be ready to harvest. The cost of harvesting would be the most expensive part of the business, and thus far I am unable to give any exact figures, but up to the point of harvesting, the cost of planting and cultivation would not exceed $\$4$ per acre per annum, or $\$12$ for the three years, including interest and

taxes. As the root grows to a great depth in a light soil, if digging had to be resorted to, the expense would be more, and some other mechanical means would have to be used, as a plow or digger. All the world over, digging by shovel and pick is the usual method; one reason for this is because labor is very cheap, and another is, the plants grow in patches often widely apart, and individual plants, so scattered over such an extensive area that no other plan is possible, while in the field, as proposed, the plants would be in rows and an acre very thickly grown.

An acre, with the rows 30 inches apart and the plants in the rows 6 to 8 inches apart, would contain 20,000 plants, and narrower rows and closer planting is permissible, so that many more than 20,000 plants can be grown to the acre. I prefer to take 20,000 plants per acre as a unit for calculation, to allow for loss in many ways of a liberal percentage, say one-third, by failure to grow and by dying after starting, etc. The growth each year is not so much in weight as one might be led to think by reading what has been written on this subject; but so far as I have been able to ascertain, there is nothing at all definite and specific published. The information herein is of my own investigation and experiment, and is only offered as approximate, as indeed the whole subject must be considered as still in an experimental stage, but, in my opinion, full of promise if properly entered upon with a view to making it a commercial success.

By obtaining plants from the growers of one, two, three and four years' growth drying and weighing them, I get the following results: plants of three years' growth will average when dried four ounces, equal to eight ounces fresh ; or to an acre of 20,000 plants 10,000 pounds as the crop at the end of the third year, costing, according to my estimates for growing and harvesting, \$15 for the crop of 10,000 pounds of fresh root, at the end of the period of three years.

I have not given the weights of the other root, as three year root is the basis on which I am working; four year growths would show much larger results, and younger roots are too immature to dig.

Allowing a loss in various ways of one-third the plant, leaving 13,300 yielding 1/2 pound each of fresh root, or 6,650 pounds at the end of the third year at a cost of \$15, or even \$20, and the enterprise would be profitable. The 6,650 pounds of fresh root represents one and a half tons dry, and the lowest price at which dry Russian Root, or Asiatic, can be

laid down in the United States, is about £8 per ton; the crop of a ton and a half would be worth \$60, costing \$20, or a net profit of \$40 per acre for the three years, equal to \$13 per acre per annum as the profit of growing the root; but if the fresh root is at once made into extract, as I propose, the profit would be much greater even at 4 cents per pound, just half the present price of the extract.

My own experience in growing the plant in the United States has thus far been very moderate in results, owing to causes that might have been prevented, viz.: inundations, unsuitable buds for planting, and possibly a want of care or interest, or experience, on the part of those in charge, to say nothing of the effect of unusually hot and dry weather on the young plants before they had become acclimated. I have grown the plants in several places in New Jersey, Pennsylvania, Louisiana and Florida, and still have some growing in the different localities, and believe it to be quite a feasible matter to introduce the industry on a large scale.

In 1856 W. R. Prince, of Flushing, L. I., contributed an article in *The Horticulturist*, Phila., on the cultivation of licorice root in the United States, showing the possibility of it. In 1854 the Department of Agriculture published in its annual report an account of its cultivation in this country.

In 1886 Mr. Isaac Lea, of Florin, near Sacramento, Cal., grew several acres very successfully, but abandoned it for want of a home market and for more profitable use of the land occupied by it. There are still some plants growing on that farm as well as in several other places in California. Mr. Lea was an enthusiast on the subject of growing the plant on a commercial scale, and had visited Louisiana and Florida with the object of establishing the enterprise in one or the other of those States ; but finally abandoned the project for personal and domestic reasons. I mention these facts to show that the plant has been grown here by practical men whose opinion was that it could be grown on an extensive scale, but who knew nothing of the manufacture of the extract from it.

This paper is far from being exhaustive of the subject,; much practical information has been accumulated and my experiments are still going on, and I believe with the necessary capital invested in the business on a sufficiently large scale, it need not be many years before the entire

wants of this country, of licorice paste, could be supplied from the home-grown root, as indicated.

STRUCTURE OF IRIS.

BY EDSON S. BASTIN.

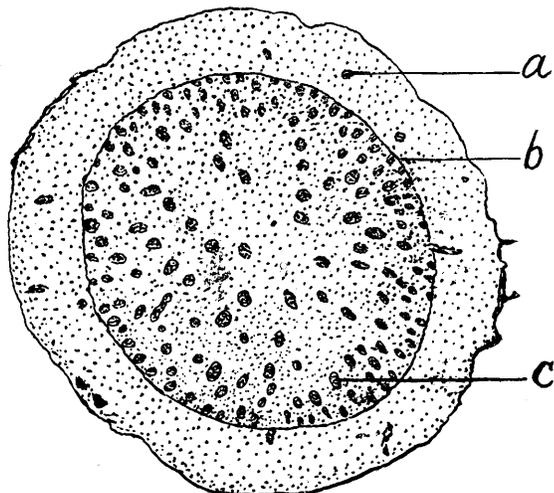


FIG. 1.

The Blue Flag, *Iris versicolor*, Linne, is one of the commonest of monocotyls in the eastern United States. The range of its habitat is from Canada to Florida, and from the Atlantic as far West as Minnesota and the Indian Territory. Its rhizomes are horizontally creeping, from 16 to 24 cm. long, more or less branched, and composed of joints, each from 3 to 10 cm. in length, and representing a year's growth. Each joint at or near its base is cylindrical or only slightly flattened, but toward its apex is larger and widened horizontally. At the anterior end on the upper surface of each joint is a more or less cup-shaped scar of a flowering stem. At this end also may occur two, or sometimes four, lateral branches arranged opposite each other in pairs. The surface of the joints is densely covered with scales consisting of the fibrous bases of the decayed leaves, and from the inferior surfaces, chiefly from the broader, flattened portion of the joints, spring numerous, sparingly branching, wrinkled rootlets, averaging 10 or 12 cm. long and about 1 1/2 mm. in thickness. These, together with the scales, are usually removed in preparing the drug for market. The dried drug, therefore, shows, except occasionally near the apex of the rhizome, only the crowded ring-like scars of the leaves and the small circular scars of the rootlets.

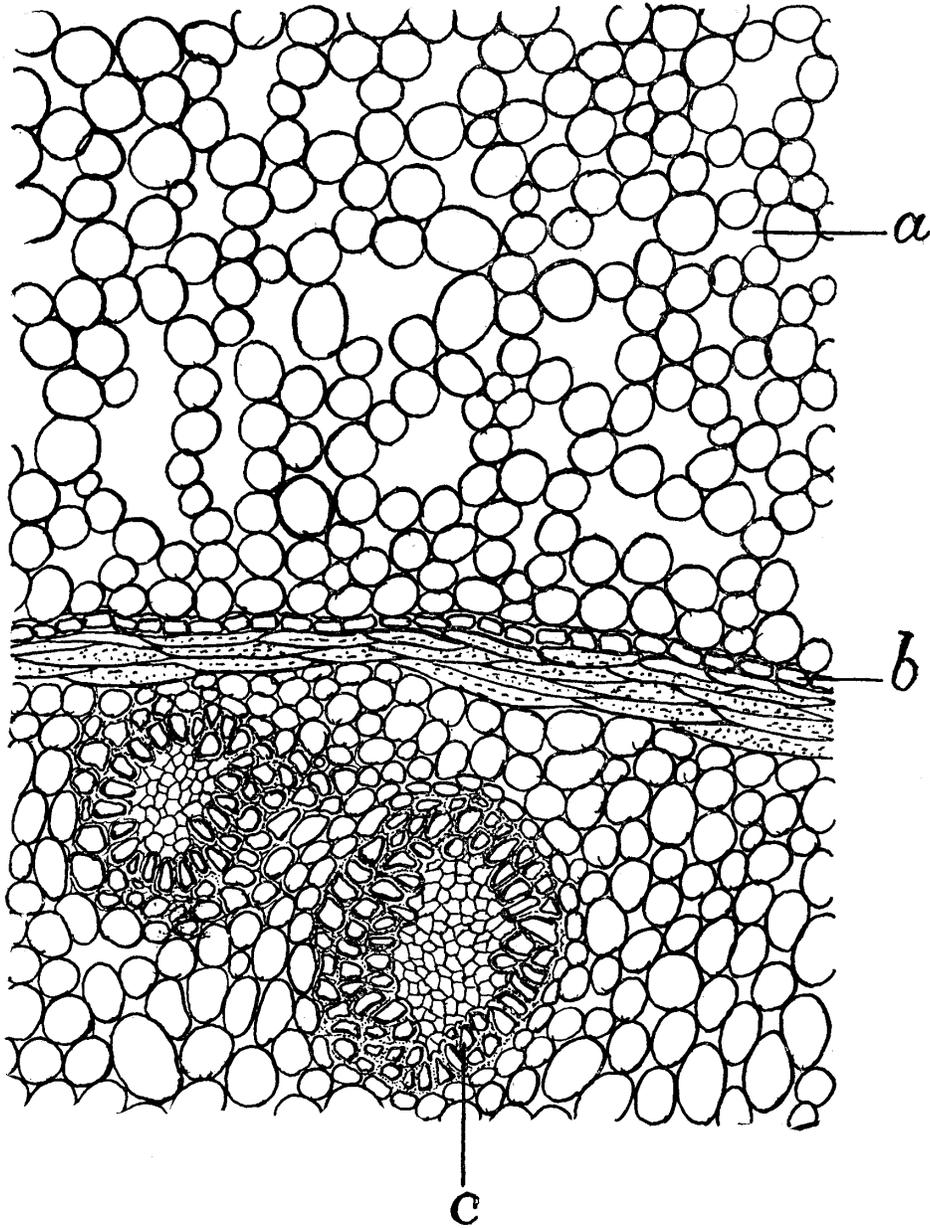


FIG. 2.

The rhizomes are also longitudinally wrinkled from shrinkage in drying, are commonly banded transversely with different shades of brown on the outside; the fracture is short, and the fractured surface is usually brownish or grayish brown.

A transverse section of the rhizome shows a distinct cylinder-sheath separating the central cylinder, which contains numerous scattered vascular-bundles, from the cortex, which contains relatively few. The thickness of the cortex, compared with the central cylinder, is about as

one to five. The sheath proper consists of a single row of tangentially elongated and thickish-walled cells, but is strengthened interiorly by two or three thicknesses of tangentially elongated, somewhat fibrous cells.

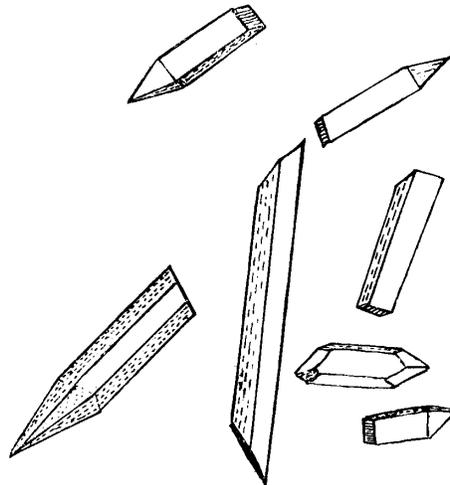


FIG. 3.

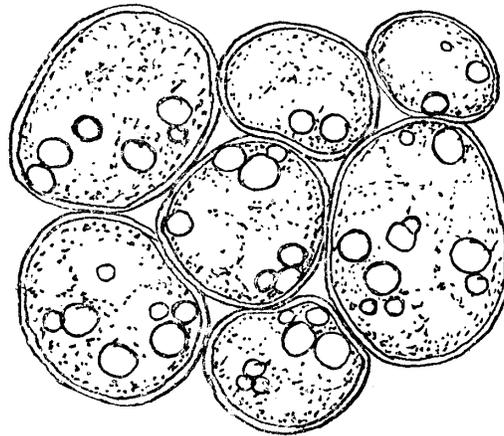


FIG. 4.

The vascular-bundles of the central cylinder are much more crowded toward the exterior of the cylinder next the sheath, and are mostly smaller than the more scattered ones toward the centre of the stem.

The bundles consist of that modification of the concentric type in which the xylem elements are exterior, and the phloem tissues central, and, as seen in transverse section, the bundles are either circular or somewhat elliptical in outline. The ducts are of rather small size. Each bundle has an imperfectly developed sheath of thin-walled cells, differing little from the cells of the adjacent parenchyma except in their smaller size.

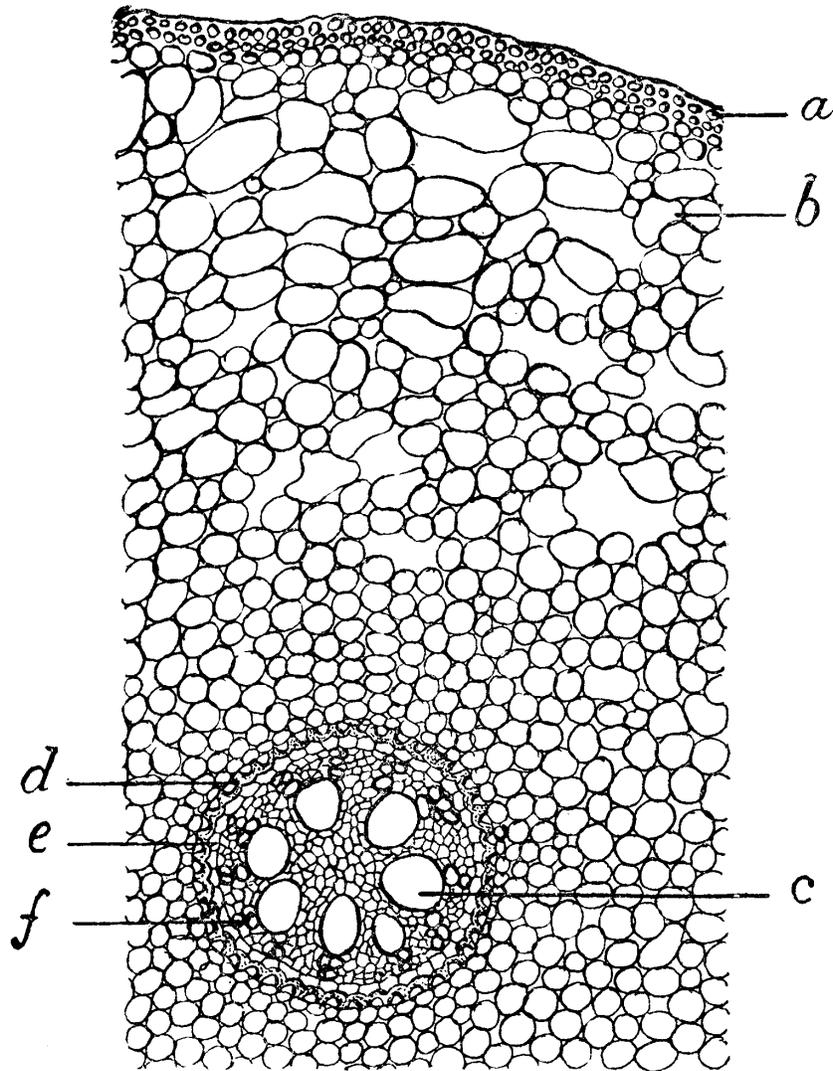


FIG. 5.

Aside from the xylem elements of the bundles and the cylinder-sheath with its strengthening layer of fibrous elements, the tissues of the rhizome are unligified. The cortex and fundamental tissues of the central cylinder consist of loosely arranged parenchyma. The cells of this parenchyma are notably unequal in size, and the intercellular spaces, though often large, are not regular either in size or in arrangement as they commonly are in the stems of other aquatic and marsh plants.

The parenchyma cells abound in rounded granular particles which look remarkably like starch grains, but which do not polarize light, and which stain brownish instead of blue with potassium-iodide iodine. In chloral-hydrate iodine they swell and gradually disappear, but without acquiring the blue color of ordinary starch. If sections be treated with a

15 per cent. solution of alpha-naphthol, afterwards with sulphuric acid, and then heated, the grains disappear and an intense violet color will be gradually developed in the tissues. This test justifies the suspicion that the grains, though behaving in some respects like proteid, may really be carbohydrate in their character, related to, if not in fact a modification of starch. But this matter requires further investigation.

There occur in the parenchyma, both of the cortex and of the central cylinder, rather numerous isolated crystals of calcium oxalate in the form of large-sized, mostly elongated and pointed prisms, which, between the crossed Nicols, show beautiful polarization effects.

The cross-section of a rootlet shows a structure so characteristic that it might be employed readily in the identification of the drug. The epidermis consists of two or three layers of rather small and thick-walled cells. The cortical parenchyma consists of very unequal-sized, quite loosely arranged cells, with irregular intercellular spaces. The central bundle is from ten to fifteen rayed. The rays terminate interiorly in about six or eight large ducts, which form a circle about a small pithy central portion. The endodermis is composed of cells very distinct from those of the adjacent tissues. Its cells are of nearly equal size and excessively thickened in their inner and radial walls, which are also lignified, while their exterior walls remain thin and unligified.

DESCRIPTION OF FIGURES.

- Fig. 1.—Diagram of cross-section of rhizome of *Iris versicolor*, the section passing through near the base of one of the joints; *a*, a vasal-bundle in the cortex; *b*, cylinder-sheath; *c*, a vasal-buudle in the central cylinder. Magnification, 6 diameters.
- Fig. 2.—Small portion of cross-section of same rhizome more highly magnified, showing portions of cortex, cylinder-sheath and central cylinder, *a*, in tercellular space in cortex; *b*, cylinder-sheath; *c*, xylem of one of the bundles in exterior portion of central cylinder. Magnification, 100 diameters.
- Fig. 3.—Crystals of calcium oxalate from rhizome. Magnification, 150 diameters.
- Fig. 4.—A few parenchyma cells from central cylinder of rliizome, showing granules similar in appearance to starch grains. Magnification, 495 diameters.
- Fig. 5.—Portion of cross-section of root of *Iris versicolor*, magnified 100 diameters, *a*, epidermis; *b*, cell of cortical parenchyma; *c*, large duct in vasal-bundle; *d*, endodermal cell; *e*, pericambium cell; *f*, small ducts at exterior end of xylem ray.

NOTES ON SOME SAPS AND SECRETIONS USED IN PHARMACY.

BY P. L. SIMMONDS, F.L.S.

There are very many of these which deserve special detailed notice, at all events as to their medicinal uses and statistics.

Four subdivisions might be established under which all the varieties of gums and resins might be grouped:

- (1) Gums.
- (2) Resins.
- (3) Oleo-resins.
- (4) Elastics and gums.

The first would include all gums, wholly or partially soluble in water, whether of the Acacia or Tragacanth kind.

The second would include resins more or less soluble in alcohol, such as copals, mastics and gum resins, like asafetida and ammoniacum.

The third would include turpentine, wood oil and balsams.

The fourth would contain India-rubber, balata and gutta-percha, with substances of a similar character.

A resin is entirely soluble in alcohol, but insoluble in water. A gum resin is intermediate in character between a gum and a resin; that is to say, it is partly soluble in water and partly soluble in alcohol.

A kino is the astringent inspissated sap of a tree.

The resins may be divided into four groups:

- (1) Solid or dry resins.
- (2) Turpentines.
- (3) Balsams.
- (4) Soft resins.

Perhaps it is better to arrange the products alphabetically under their

botanic names.

Abies balsamea, Marshall; *Abies balsamifera*, Michaux; *Pinus balsamea*, Lin.

Canada balsam is an oleo-resin produced from the stem of this tree by incision, and is also yielded by *Pinus Fraseri*, Pursh.

It is of a pale straw color, and is occasionally used medicinally, but is chiefly employed for mounting objects for the microscope, and as a fine transparent varnish for water-color drawings, which does not become darker with time.

Abies excelsa, Poiret; *Pinus picea*, Du Roi.

Pinus Abies, Lin. The resinous exudation of the Norway spruce fir, melted and strained, furnishes the concrete oleo-resin, true Burgundy pitch, the Thus or Frankincense of the London Pharmacopoea. The common frankincense or American Thus is from *Pinus palustris*, Lambert; *Pinus Taeda*, Lindl. It acts as a counter-irritant, and is applied to the chest in chronic pulmonary complaints, to the loins in lumbago, and to other parts to relieve local pains of a rheumatic character.

The Indian gums are coming in largely into European commerce to supplement the African gums, the exports of gums for India having averaged 37,000 cwt. in each of the last five years. The African gums may be recognized from Indian gums by an expert, being of a different shade of color, often with a pinkish hue. The imports of gum arable into the United States have declined by more than one-half of late years; in 1892 they were only 417,000 pounds, but recovered in 1893 to 915,855 pounds.

Acacia Catechu, Willd. The extract from this tree, known as "cutch," is used medicinally as an astringent, in fevers and other maladies, and the better qualities are equally as good medicinally as the Gambier of Singapore.

There are several kinds of cutch made in India and used in medicine.

A resinous extract is prepared by boiling down chips of the wood.

In Burma and Bombay the decoction is boiled down to a solid consistence and thrown into leaf moulds, or is baked into cakes and balls. This is the ordinary cutch of commerce, and instead of being a pale grayish color, it is deep reddish-brown, with a glassy fracture.

Another inferior kind is made from a decoction of the nut of the betel palm (*Areca Catechu*) This form exists in large slabs, about an inch in thickness, prepared on the leaves of the Teak tree. This substance is, however, rarely exported from India, but a considerable local trade is carried on in it in Madras and Mysore.

Cutch is prepared thus :

The tree is cut down to about six or twelve inches from the ground and chopped into small pieces, the smaller branches and bark being rejected. The chopped wood is then taken to the place of manufacture, generally under trees in the open air, and placed over a brisk fire in clay jars, filled with about two-thirds of water.

This is allowed to boil down till, with the extracted matter, it forms a liquid of a syrupy consistence. The contents of several jars are then poured into a larger jar, and again placed over a brisk fire for a period of from two to four hours, and, when sufficiently boiled down, it is poured over mats covered with ashes of cowdung and allowed to dry.

Catechu is used in medicine as a gentle tonic and a powerful astringent, on account of the large quantity of tannic acid (50 per cent.) which it contains. Combined with opium it answers a good purpose as an internal remedy in chronic diarrhoea, catarrh or dysentery.

Cutch is not specified in the American imports, but gambier is named, but appears among gums, with the old misnomer of "Terra japonica." The quantity imported fluctuates between 27,000,000 and 35,000,000 pounds.

SUGARS.—The maple tree, several palms, the white beet root, sorghums, the sugar cane, and other plants and trees, yield saccharine saps, but as the product of these have chiefly dietetic uses, rather than medicinal, I shall not enter into details on them.

Aloes Species.—The simply inspissated juice of the leaves of various

species of this gum constitutes the " aloes " drug of pharmacy. It is best obtained by using neither heat nor pressure for extracting the sap. By redissolving the aqueous part in cold water and reducing the liquid through boiling to dryness, the extract of aloes is prepared. All species are valuable in localities where they are hardy, and can be used (irrespective of their medicinal importance) to beautify any rocky or otherwise arid spot.

Aloe Ferox, Lamarck.—This yields the best Cape aloes, as observed by Dr. Pappé. Other species, such as *A. perfoliata*, Lin., also yield the drug. *A. africana*, Mill., and *A. plicatis*, Mill., and *A. commelini*, Salm., are said to yield a less powerful kind.

The following are also South African species: *A. arborescens*, Miller; *A. linguae-formis*, Mill.; *A. angulata*, Willd. From this species the purest gum resin is obtained.

A. purpurascens, Haworth, is one of the plants which furnish the Cape aloes of commerce. *A. spicata*, Lin., also provides Cape aloes. *A. Zeyheri*, Harvey, a magnificent, very tall species, is doubtless valuable like the rest. *A. soccotina*, Lamarck., is also indigenous to South Africa; *A. dichotoma*, Lin. fil., in Damara and Namaqualand, attains a height of 30 feet and expands occasionally with its branches so far as to give a circumference of 40 feet. The stem is remarkably smooth, with a girth sometimes of 12 feet. It is a yellow-flowering species. *A. Bainesii*, Baker and Dyer, is almost as gigantic as the foregoing. Both, doubtless, yield the medicinal gum resin, like several others.

In many parts of the Colony of Natal, a wild aloe is very abundant, and a few people make an industry of the preparation of the product for export. Shipments, of late years, have reached £400 in value. Small balls of it were shown in the Natal Court at the Colonial Exhibition in London.

A. indica, Royle.—There are many varieties of aloe met with in cultivation throughout India, some of which have gone wild, as, for example, on the coast of South India. The inspissated juice, as a medicine, is regarded as an aperient and deemed highly beneficial to persons predisposed to apoplexy. The fresh juice from the leaves is said to be cathartic, cooling and useful in fevers, spleen and liver disease, enlarged lymphatic glands, and as an external applicant in certain eye

diseases. The pulp of the leaves is, in native practice in India, applied to boils and is regarded as acting powerfully on the uterus. It is largely employed in veterinary medicine. The root is supposed to be efficacious in colic. *A. soccotrina*, Lamarck; *A. vera*, Miller, is usually imported in skins and casks from Bombay. Soccotrina aloes may be recognized by its reddish tint and by the fragments being nearly transparent, as well as by its odor. *A. Perryi*, Baker, is indigenous to the island of Socotra. In very large doses it is a powerful hepatic stimulant. In small doses the drug is used as a stomachic tonic, in larger doses purgative and, indirectly, emmenagogue. It is a remedy of great value in constipation caused by hysteria and atony of the intestinal muscular coat. It is also very useful in atonic dyspepsia, jaundice, amenorrhoea and chlorosis. Locally applied, dissolved in glycerin, it is valued in India as a stimulant application in skin diseases, and, for this purpose, is generally combined with myrrh, constituting the *Musanbar* of Bombay.

Hepatic aloes is a species of Arabian aloes, so called from its liver hue. It is duller and more opaque in color than other kinds, more bitter, and has a less pleasant aroma than the Socotrine aloes itself, but is believed to be the sediment deposited in Socotrine aloe juice.

A. vulgaris, Lamarck and Bauhin; *A. vera*, Lin.; *A. Barbadosis*, Miller, has long been cultivated in the Antilles, and furnishes from thence the main supply of the Barbadoes and Curacoa aloes.

This West Indian aloes may at once be distinguished by its disagreeable odor.

There are two varieties met with in commerce, one presenting a brown, the other a black fracture ; the former is the best.

The culture in Barbadoes is confined to the small farmers entirely, and is carried on chiefly in the parish of St. Philip, towards the seashore, where the soil is scanty and dry. The produce of an acre of land is about 140 pounds of extract. The plants require to be renewed about every fourth year.

It is this species which Professors Willkolm and Parlato record as truly wild in countries around the Mediterranean Sea, on the sandy or rocky sea coasts of Spain and Italy. Haworth found the leaves of this and of *A. striata*, more succulent than those of any other aloe.

Barbadoes aloes is usually imported in gourds, breaks with a dull conchoidal fracture, and has a bitter taste. Socotrine breaks with an irregular or smooth and resinous fracture, has a bitter taste and a strong but fragrant odor.

In my work on "The Commercial Products of the Vegetable Kingdom," published as far back as 1853, I described the production and commerce in Aloes, but much information has been published since then. The imports into London have been falling off of late years.

In 1890 the receipts were 7,360 cases and packages and 622 gourds; in 1892, they were only 2,652 cases and 277 gourds.

Anacardium occidentale, Lin.—The trunk and branches of the cashew-nut tree yield, on being wounded, during the monthly ascent of the sap, a white and transparent gum, similar to that of arabic. A full-grown tree will furnish an annual amount of ten or twelve pounds. The fresh acid juice of the flower stalks is used in lemonade ; wine and vinegar are made by fermenting it.

Anogeissus latifolia, Wall.—The gum from this Indian tree occurs in clear, straw-colored, elongated tears, adhering in masses, sometimes honey-colored, or even brown from impurities. As an adhesive gum it is inferior in strength to gum arable, in consequence of which it commands a much lower price in Europe, the more so since it is nearly always mixed with the bark of the tree, sand and other impurities.

BALSAMODENDRON SPECIES.

B. Ehrenbergi, Berg.—This species of the deserts of Arabia yields myrrh, and some other species produce the same resin. Professor Oliver unites this with *B. opobalsamum*, Kunth, which furnishes Mecca or Gilead balsam.

B. africanum, Arnott; *Heudelotia africana*, Rich.; *Amyris niottout*, Adans.

African bdellium is translucent, but has a dull fracture. The taste is slightly bitter.

B. kataf, Kunth; *Amyris kataf*, Forsk., furnishes the gum resin or African bdellium, which reaches Bombay from Berbera, the purer kinds very much resembling myrrh in perfume. The opaque bdellium of Guibourt is used for the extraction of the Guinea worm. It is of a yellowish white color, resembling ammoniacum.

B. mukul. Hooker, of Scinde and Beloochistan, furnishes the Indian bdellium, or "Gugul," which is used in native medicine as a demulcent, aperient, carminative and alterative; especially useful in leprosy, rheumatism and syphilitic disorders. It is also prescribed in nervous diseases, scrofulous affections, urinary disorders and skin diseases, and is employed in the preparation of an ointment for bad ulcers. A fragrant balsam is obtained in Arabia from the fruit of this species. The African bdellium is the product of another species.

B. myrrha, Nees.—This tree of Arabia and Africa yields the myrrh of commerce, which occurs in the form of tears, of irregular shape, of variable size, and of a yellow or reddish-yellow color, light, brittle, somewhat translucent, and at times shining. Fracture vitreous or conchoidal, of a bitter aromatic taste and peculiar smell. It contains a volatile oil, was used in ancient times as " frankincense," and is still so employed in China. Myrrh is used as a stimulating medicine, and as an ingredient in tooth powders. Bombay is the chief port at which myrrh is received and shipped. Four kinds are imported there: the African or true myrrh, which is considered the best quality; the Arabian, the Persian (source unknown), and the Siam. On the bags arriving at that port, they are opened and sorted into the different kinds.

The Aden agents of Bombay houses attend the annual fair at Berbera, and exchange goods for the gum resins. The bags or bales, when opened in Bombay, are found to be made up of (1) a large proportion of roundish masses of fine myrrh; (2) of a considerable proportion of small, semi-transparent pieces of myrrh of irregular shape; (3) of numerous pieces of dark-colored myrrh, mixed with bark and other refuse; (4) a small proportion of an opaque bdellium. When sorted the best myrrh goes to Europe, the darker pieces form a second quality and the refuse is exported to China, where it is probably used as incense.

Myrrh is beneficial in dyspepsia, amenorrhoea and chlorosis, and a useful astringent to all ulcerations or congestions of the mucous membrane. It makes a valued wash for the mouth and gums and a

gargle in ulcerated sore throat. It is a stimulant, expectorant, and much admired as a remedy for pulmonary affections, especially the asthma of the aged. Hakims, in India, use it for intestinal worms. It is detergent, siccative, astringent and aperient, a disperser of cold tumors and one of the most important of medicines, as it preserves the humors from corruption. Dissolved in milk it is dropped in the eye in purulent ophthalmia. It is useful in humid asthma and chronic catarrh, also in chlorosis and defective menstruation. Dose, in pill, powder or emulsion, 10 to 30 grains; of tincture, 1/2 to 1 fluidrachm.—Dr. George Watt.

B. opobalsam, Kunth; *Amyris opobalsam*, Lin.—This tree furnishes the balsam or balm of Gilead, which is not a true balsam, but an oleo-resin of a consistence like that of Chian turpentine. It has a fragrant odor and warm, aromatic taste, and was held in high esteem by the ancients, and accredited with a variety of medicinal properties. As a cosmetic and perfume it is still largely employed by Turkish ladies. There are references to it by many ancient writers, among others, Theophrastus, Dioscorides, Pliny and Galen, and also many mentions of it in the Bible. So highly prized was this balsam that, during the war of Titus against the Jews, two fierce contests took place for the orchards in Jericho, where it was produced, the last of which was to prevent the Jews from destroying the trees that the trade might not fall into the enemy's hands. The gardens were taken formal possession of as public property, an imperial guard was appointed to watch over them, and it appeared that the emperor increased their size and endeavored to propagate the plants. The imperial care was unavailing, for not a branch of the balsam tree is now to be found in all Palestine. The shrub was taken to Arabia and grown in a recess in the mountains between Mecca and Medina, whence the balsam is now exported, not as balm of Gilead, but balsam of Mecca. The substance is still eagerly sought for in Egypt and the East under this name. It is obtained by making incisions in the trunk or branches, but the yield is very small, only averaging three or four drops per diem. This fact accounts for the comparative rarity and the great costliness of the genuine article, as also for the numerous substitutes and imitations of the original. There are three qualities produced by art; the first and best is the opobalsam, expressed from the green berry and leaves ; the second is the carpo-balsam from the ripe seed or berry; and the last is obtained by bruising and boiling the young wood. The twigs, possibly after boiling, are sent to Venice, where they enter into that heterogeneous compound—Venice treacle.

B. Roxburghii, Lin.—This yields a gum resin of a greenish color, moist and easily broken, having a peculiar cedar-like odor.

Boswellia Carterii, Birdwood.—The Frankincense of commerce. This stimulating gum resin is also obtained from *B. Frereana* and other species; it is used medicinally and as a perfumery incense. The European frankincense is, however, distinct, being a resinous exudation from the spruce fir, used in the composition of plasters.

Olibanum consists of tears, often an inch in length, of an ovate or oblong clavate or stalactite form, and mixed with impurities. The pieces are light yellow to brown, pale green or colorless. There are two varieties, one of which is far inferior to the other. The best is found in pieces as large as a walnut, of a high yellowish' color, inclining to red or brown, covered on the outside with a white powder, the whole becoming a whitish dust when pounded. It burns with a clear and steady light, not easily extinguished, and diffuses a pleasant balsamic and resinous fragrance. This drug is constantly burnt as incense in the Hindu temples, under the names of "Khomda" or "Kunda" and "Luban," and also in Roman Catholic churches.

Bombay is the port from whence the greatest quantity is exported. England receives from 7,000 to 8,000 packages yearly. Olibanum is rarely used in medicine in Europe, but in India it is regarded as a demulcent, aperient and alterative, acting chiefly on the lungs and as a purifier of the blood. It is there used in rheumatism, nervous diseases, scrofulous affections and skin diseases. It is regarded as a diaphoretic and astringent, and is employed in the preparation of an ointment for carbuncles, boils, ulcerations and other sores. As a fumigating agent, it is employed to overpower unpleasant odors and to destroy noxious vapors.

B. glabra, Roxb., also yields this fragrant resinous substance. It is bitter and pungent; mixed with "ghee" or fluid butter, the native doctors prescribe it in gonorrhoea and other complaints.

B. serrata, Stackh., is sometimes called the Indian olibanum tree. Of this there are two varieties, one being the *B. thurifera* of Roxburgh and Colebrooke, and the other *B. glabra*, noticed above. The gum resin occurs as a transparent golden yellow semi-fluid substance, which hardens with time. It has a slightly aromatic and balsamic resinous

odor.

B. Thurifera, Coleb.; *B. serrata*, Stackh. This and some other species yield the gum resin. It has astringent and stimulant properties. Externally, it is useful as a rubefacient and antispasmodic, especially as a plaster in cramps of the stomach.

[To be continued.]

THE APOCYNACEAE IN MATERIA MEDICA.

BY GEORGE M. BERINGER.
(Continued from January).

In structure the fruit of *Holarrhena Antidysenterica*, approaches, in the main, that of strophanthus. Externally, is the epidermis with cells distinct and thickened on the outside. The mesocarp is formed of a fundamental tissue in which the cells are not flattened or pressed, but are distinctly visible without the aid of potassa. These cells have granular contents, the walls reddish-brown, and in the external zone, thickened nearly collenchymatous.

The internal region forms a fibro-vascular zone with white or yellowish white, very thick fibres, and vascular fascicles rounded or flattened, and with numerous laticiferous vessels. The endocarp is analogous to that of strophanthus.

The seeds of *Holarrhena* are quite small, 10 to 20 m.m. in length, 2 to 2 1/2 m.m. in breadth, and 1 to 1 1/2 m.m. in thickness. It requires forty of these seeds when dry to weigh 1 gramme. The shape is oblong, straight, elongated ; the extremities somewhat attenuated but blunt. The lower extremity is somewhat pointed, the upper bears a sort of collar, a very small swelling, upon which is inserted the characteristic tuft of hairs, but in commerce, these hairs are always absent. The seed is flat, or rather plano-convex, the dorsal face a little rounded, the ventral face flat or even concave in grooves. The margins of the seed enrolled a little toward this face, which is ordinarily marked by a small, whitish line extending from one extremity to the other. The color varies from a pale fawn or cinnamon with a little greenish, even to a chocolate brown. It is dull and ordinarily uniform.

The surface presents always quite large ridges, due to drying, but is not regularly and finely striated, as are those of *Wrightia*. Viewed with a lens, it is finely granulated, or even rugose. The fracture is easy, ordinarily greenish white, or at times brownish. The odor, while not marked, upon crushing approaches that of *Strophanthus*. The taste is frightfully bitter.

Macerated in water the seeds rapidly give to the liquid a disagreeable and nauseating odor and dissociate into their three elements. The envelope, brown and quite thin, often carries away with it the albumen in the form of a thin, peripheral sac of the embryo. The embryo is large, brownish ; the cotyledons are refolded several times upon themselves, a little rumped, but not rolled up. Five large nerves, well marked, start all at the base. The radicle is conical and relatively short. Sulphuric acid slowly produces, with the transverse section, a yellow coloration, changing to orange and finally red. The active principle is an alkaloid first isolated by Haines in 1858, and to which he gave later the name *conessine*. Stenhouse, in 1864, isolated from the seeds the same principle under the name, *Wrightine* and recently Warnecke obtained the *Wrightine* in a crystalline state.¹ The name *Wrightine* is still erroneously retained, as *Wrightia* does not yield this substance.

In India this drug is considered a valuable remedy against maladies of the bowels, especially dysentery. Its use is constant as a febrifuge, astringent and bitter tonic. It was imported into Europe toward the middle of the last century. Antoine de Jussieu employed it in 1730 and compared it with *simaruba*. It is said to be an excellent astringent, useful in dysentery, diarrhoea, vomiting of cholera and all inflammations of the digestive tract. It is used in hemorrhages, angina, as a lithontriptic, and as an antipyretic. Externally it is employed for haemorrhoids, itch, ulcers, etc., and has given good results in epizooty. The thick red fixed oil extracted from the seeds is considered an anthelmintic.

FRUITS WITH A FLESHY PERICARP.

These are classified as Toxics and as Comestibles.

¹ Herr Warnecke obtained on analysis of *Wrightine* figures corresponding to the formula $C_{11}H_{13}N$, and it is interesting as one of the few solid, non-oxygenated alkaloids occurring in nature.

G. M. B.

A. Toxics—THE SEEDS OF THEVETIA NERIIFOLIA. The *Thevetia neriifolia* Juss. [*Ahouai neriifolia* Plum., *Nerio affinis angustifolia* Pluk., *Cerbera foliis linearibus* Plum., *C. Thevetia*. L., *C. peruviana* Pers.), is indigenous to the West Indies, but has been introduced into India and the warmer parts of Asia, where it is frequently cultivated as an ornamental garden shrub and is employed here as in the country of its origin. In America the common names employed are: Ahouai, Yoire, Alelia de Matto, Jaca, Serpents nut, etc. in India: China Korobee, Kolkaphul, Exile or Yellow Oleander. It is an elegant small tree, with hard, white wood, with very fine grain; the leaves are linear, close together, alternate, nearly sessile, entire, shining, with a prominent mid-vein, very straight for their length (12 c.m. by 1 c.m.); the flower is large, yellow, fragrant; the bud resembles that of the Nerium.

The fruit is very characteristic, it is trigonal, 3 1/2 c.m. by 4, and about 2 1/2 c.m. thick, with the angles and borders blunt. At one of the angles is inserted the long peduncle and about this the five calycinal pieces; a circular line extends around the circumference of the fruit, and upon the broad upper margin is a small papilla. The fruit is at first green, then becomes black, shining; at maturity the surface is somewhat folded, the consistence is quite soft, the brownish pulp adhering to the stone. The endocarp is extremely hard, ligneous, yellow to brown in color. The kernel is very oily, bitter, and produces in a few moments a slight sensation of numbness on the tongue.

The active principle is *Thevetine*, isolated by DeVrij and studied by Bias and by Warden. It is a glucoside, crystallizable, splitting up by diluted acids into glucose and *Thevetine*, and which the experiments of Dumoutier show to be a tetanic; it is extremely bitter, possesses a metallic taste followed by a tingling of the tongue.

Warden has obtained from the mother-liquor, after the preparation of Thevetine, a yellow, amorphous, bitter substance, soluble in water, which appears much more active than Thevetine, and explains the extreme toxicity of the kernels.

Warden has discovered in the seeds and in the bark also a material, *pseudo-indican*, which was isolated as a yellow amorphous substance, probably a glucoside, and which yields with hydrochloric acid a blue coloration.

The seed of *Thevetia neriifolia* is a powerful poison, ordinarily considered an acrid narcotic, producing violent convulsions and gastrointestinal phenomena. It has been employed as a purgative in rheumatism and dropsical conditions in the dose of one-half kernel. It is especially as a febrifuge that it is used along with the bark. In certain regions of America the seeds are considered a good alexiteric; two of the seeds pulverized are macerated in rum, the liquid drunk in fractions and the expressed pulp applied to the wound.

THE FRUIT AND SEEDS OF AHOUI.—The *Thevetia Ahouai* A.DC (*Cerbera Ahouai* L.), is a native of Brazil, and is distinguished from the *Thevetia neriifolia* by having relatively broad leaves. The seed are identical with the preceding and possess the same properties and usages.

THE SEEDS OF YCCOTLI.—The *Thevetia Yccotli* A.DC. (*Cerbera thevetioides* Kunth), of Mexico, is one of the most poisonous of the Apocynaceae. The *T. ovata* A.DC., *T. cuneifolia* A.DC., var. *Andrieuxii* and *T. glabra*, all these species and varieties are known in the state of Jalisco as Narcisos amarillos.

The tree is named Yccotii, Icotii, Yccali, Joyottli, or Joyote. The Aztec word is Joyottli, which Hernandez transformed into Yccotli, adopted by DeCandolle as the specific name. The fruit is a drupe, with two papillae on the sides, rich in latex in the whitish mesocarp and contains a stone, a bony endocarp, yellowish, with four seeds or more often, two by abortion.

Herrera has separated from the seeds a non-drying fixed oil, by expression; another oil by ether and a white glucoside, crystallized, inodorous, non-volatile, very acrid, *Thevetosine*. Carpio has shown that the two oils are toxic in action upon pigeons, but not upon rabbits, and that the *Thevetosine* is extremely poisonous, emetic by action on the nerves, paralyzing the respiratory muscles first and then the other muscles and causing death by slow asphyxia. The substance has likewise some of the properties of the Digitalins.

The Mexicans use the seeds principally against haemorrhoids, cutaneous maladies, ulcers and tumors. It seems likewise to be used to cure the bite of the rattlesnake.

THE SEEDS OF THE TANGHIN.—The celebrated ordeal poison of Madagascar, the Tanghin is furnished by the *Tanghinia venenifera* Poir. (*Cerbera Tanghin*, Hook. *Cerbera venenifera* Stend., *Tanghinin veneniflua* Boj., *T. madagascariensis* Dup.—Th.). The tree inhabits Madagascar, especially the forests of the north and the eastern sides of the island. It is cultivated in the hot-houses of Europe, but has not fructified. It attains a height of ten metres. A bluish-white latex, very poisonous, abounds in all parts of the tree. The fruit and seeds are the only parts employed. The leaves are remarkable for their elongated shape, lengthily acuminate, their soft consistence and the black color which they assume in alcohol or by drying.

The fruit is a drupe, in the fresh state yellow or reddish, shaped like an egg or a peach, and in which the external region is a fleshy sarcocarp, fibrous and includes a ligneous, stony endocarp, which contains a single kernel. The shell resembles in form and appearance of the surface that of an almond.

The structure of the seed is analogous to that of *Thevetia*.

The toxicity of the kernel of the *Tanghin* is such that a single seed suffices to cause the death of a number of persons, according to some, as many as twenty. This kernel is frequently employed in its native country for the poisoning of criminals and the heads of the arrows are likewise frequently coated with the poison. But the reputation of Tanghin comes especially from its use as a legal poison in the ordeals or judicial trials.

The first physiological experiments were by Ollivier, who ranks the poison with the acrid narcotics. Then Pelikan and Kolliker, who employed the leaves and dry branches, concluded that there was a muscular action, and at the same time, or even before, a nervous action. J. Chatin, in 1873, admits, as a result of his experiments with the kernels, that it destroys the muscular irritability without reaching directly the nervous system. It is a paralyzer of the heart, acting equally by way of the stomach, or subcutaneously; more quickly by the latter way. The effects are obtained on the invertebrate animals likewise.

(To be Continued.)