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Botanical Medicine Monographs and Sundry

USEFUL PLANTS OF THE GENUS PSORALEA.[1]

By JOHN M. MAISCH.
Read before the Pennsylvania Pharmaceutical Association, June 5.

One of the most interesting groups of plants are those belonging to the order of leguminosae which-as remarked by Lindley—"is not only among the most extensive that are known, but also one of the most important to man, whether we consider the beauty of the numerous species, which are among the gayest-colored and most graceful plants of every region; or their applicability to a thousand useful purposes." Many of the plants are medicinal or yield medicinal products, quite a number of which have been admitted into the various pharmacopoeias, including some which are decidedly toxic, like physostigma.

Among the leguminous plants indigenous to the United States a species of Psoralea, common in our Southern States and west of the Alleghenies, has attracted some attention as a medicine, and though it does not seem to possess properties superior to other more generally known drugs, it will perhaps be of interest to collect together the most important facts, recently ascertained or heretofore known, regarding the medicinal or economic value of the different species of this genus.

The name of the genus is derived from the Greek *psoraleos*, which means "affected with the itch or with leprosy," and has reference to the usually blackish glandular points found on the calyx and often on other herbaceous portions of most of the species. The plants are botanically closely related to the genus *Amorpha*, of which the indigenous*A. fruticosa* has a bark rich in tannin and containing a brown-red coloring matter, dyeing yellow with alum. The genera *Glycyrrhiza, Astragalus, Indigofera, Robinia*, *Wistaria* and others belong to the same tribe. The genus *Psoralea* comprises herbs, also shrubs, having leaves mostly divided into three or five leaflets, and a spiked or racemed inflorescence, the flowers being mostly purplish or blueish; the fruit is a one-seeded, indehiscent, frequently rough or wrinkled legume, which is about the length of the persistent calyx. About one hundred species of Psoralea have been described, of which more than forty, or nearly one-half, belong to Southern Africa, five or six to South America, and about thirty to North America; the greater portion of the latter are confined to the Southern States and west of the Alleghanies, and eight are found in California.

Only a small number of the species have been used, some medicinally, others as food. The food plants as far as known, have their homes in the western section of North

[1] Current botanical names are listed in smaller case (as per Kartesz), although these are not universally accepted, with many authorities still using the older nomenclature - MM

America. Two were mentioned some years ago by Dr. Edward Palmer in a paper entitled “Plants Used by the Indians” (see AMERICAN JOURNAL OF PHARMACY, 1878, p. 545), namely:

Ps. castorea, Watson, *(Pediomelum castorium)* growing from Arizona to Nevada; the large white farinaceous roots are eaten by the Pah-Utes, raw as well as cooked, or made into bread or mush. The same tribe uses also the roots of

Ps. mephitica, Watson, *(Pediumelum megalanthum var retorsum)* which are small but farinaceous. The plant is abundant in low places in Southern Utah; its specific name refers to the unpleasant odor of the leaves.

Ps. esculenta, Pursh, *(Pediomelum esculentum)* has been more widely known than the preceding two species. In the beginning of the present century it was brought to Europe by Lamare-Picquot who recommended it as a substitute for the potato. It was cultivated for some time in France, where it became known as *picquotiane*; but the results were not encouraging, and at present it is rarely met with in Europe.

I am indebted to Mr. Clifford Richardson of Washington, D. C., for the following graphic, description of the plant, its tuberous root and the uses of the latter, written by Dr. V. Havard, Surgeon U. S. Army at Fort A. Lincoln, Dakota.

“The plant is the *pomme de prairie* or *pomme blanche* of the early Canadian voyageurs; the *prairie turnip* or *prairie potato* of the American settlers; the *tipsinah* of the Sioux, and the *taahgu* of the Osage Indians.

“Description: Perennial ; roughish hairy all over; stem stout, erect, somewhat branched, from 5 to 15 inches high, growing from a tuberous root ; leaves on long petioles, palmately 5-foliolate, the obtuse leaflets obovate, oblanceolate or oblong, about $1\frac{1}{4}$ inches long ; stipules free, lanceolate; flowers appearing in June and July in dense thick spikes about 2 inches long, borne on peduncles 2 to 3 inches long, exceeding the petioles; each three-flowered cluster subtended by a large bract; lobes of calyx lanceolate, acuminate, 4 to 6 lines long, equal to, or larger than, the gibbous tube, and but little shorter than the purplish corolla ; seed oval, 3 lines long, flat, smooth and shining.

“Soon after blossoming the plant dries up into a brown rigid mass, then breaks off and becomes a “tumble-weed” blown over the prairie, scattering its seeds as it goes.

“The tuber is two or three inches under ground. It is irregularly elliptical in shape, from ovoid to fusiform; in size ranging from a hen's egg to a large filbert, averaging $1\frac{1}{2}$ to 2 inches in length and one inch in diameter. The upper end shows the scars of previous years' stems; the lower end is produced into a long and very tough tap root. It is covered with a thick leathery skin, easily peeled off its white and smooth surface. Passing. through the axial line are clusters of fibers, which proceed from the stem and run into the tap root. These tough, fibrous clusters are the only inedible part of the skinned tubers. On section it is seen to be composed of a white granular mass, at first somewhat spongy, but becoming hard on drying, in which state it is friable and easily pulverized into a light starchy flour.

"The prairie turnip is a widely distributed plant. It is found from the lakes westward to the Rocky Mountains, and from the Saskatchawan River downward to Louisiana and Texas. It is on the dry table-lands of the Missouri, however, from Montana, through Dakota and Nebraska, to Kansas, that it is most abundant.

"The tuber of this plant has always been of great importance to the Indians, one of their vegetable staple foods. It is mentioned by all the explorers and voyageurs who first traded with the Indians of the Western prairies. It is in its best condition when the flowers begin to fade, in the latter part of July. At that time the squaws start out to gather their crop of tipsinah; formerly they used a strong pointed stick to pry the tuber out; now they use a small iron bar, one end of which is beaten into a narrow blade. The tuber, cut into slices and dried, can be kept for several years without deterioration. In this state it is found in the tents of the Sioux Indians, and formerly constituted an important ingredient of their winter food. Eaten raw it has a very palatable farinaceous flavor. The Indian children, when cutting teeth, are given pieces of it to chew, with apparent benefit; they are treated in the same manner, and likewise with good result, when suffering from bowel complaints. I am told by an old settler that on several occasions, when making long marches without water, he successfully appeased the sharp pangs of thirst by keeping pieces of it in his mouth, their effect, doubtless, being to stimulate the salivary glands. The Indians generally eat this root cooked, and as they appreciate the advantages of a mixed *pot-au-feu*, boll it with tripe, fattened pup, or other choice nitrogenous food.

"Although the prairie turnip is mostly found on high prairies, it does not follow that it prefers a sandy, barren soil; on the contrary, I have observed that it thrives best in deep and fertile soil, if, at the same time, dry and porous; under such conditions the root attains its maximum development. I have hardly any doubt that under patient cultivation for a few seasons it could be improved, perhaps to an extent that would make such cultivation profitable, and supply our market with another toothsome, wholesome and nutritious vegetable."

Dr. Havard bad sent some of the root to Mr. Clifford Richardson for analysis, which was completed last year, but has never been published, and was kindly furnished by him for publication with this paper. Mr. Richardson's results are as follows:

Water	9·49
Ash	1·74
Oil (with petroleum ether)	·37
Resinous substances (with ether)	·35
Sugar (with 80 per cent. alcohol)	4·77
Sweet substance (soluble in water)	1·14
Starch (by difference)	69·60
Globulin	1·04
Albumin soluble in water	1 02
Albumin insoluble in water	6·10
Non-albuminoid nitrogenous matter	·90
Fibre	3·48
	100·00

Mr. Richardson remarks that the roots are distinguished by their large amount of starch, the presence of a new sugar readily crystallizing, and by the varied forms of nitrogenous matter; he will further investigate the sugar isolated by him.

An analysis of the root, communicated by Payen to *Comptes rendus* in 1848, gave water 12.50, mineral matter 1.61, nitrogenous matter 4.09, and starch 81.80. The last-named item evidently includes other carbohydrates and compounds separated by Mr. Richardson.

The three American species named above are the only ones used as food, as far as I was able to ascertain. Of the species medicinally employed,

Psoralea glandulosa, Linné, attained some notoriety and created some confusion during the first half of the present century through an error into which the distinguished French naturalist, Alcide Dessalines d'Orbigny was led, more than sixty years ago, while traveling in South America, by referring to this plant the Paraguay tea, or *yerva maté*, which is extensively employed in South America. The parent plant of this tea had been previously named *Cassine Gongonha* by the German scientist, Karl Friedrich von Martius, and *Ilex paraguariensis* by the French botanist, Auguste de Saint-Hilaire. The name given by the last-named authority is generally recognized ; but d'Orbigny's error figured in scientific literature to some extent for about thirty years, and as late as 1850, Lenoble, when publishing an analysis of Paraguay tea, followed the erroneous nomenclature [see, AMER. JOUR. PHAR., xxiii., 182]. To the same mistake must also be attributed the origin of the statement current in some recent works, that the leaves of this species are used in Chili as a *substitute* for Paraguay tea. The leaves were exhibited at the Centennial Exposition in Philadelphia [see Proc. Am. Phar. Assoc., 1876, p. 765), under the vernacular name of *culen*. The odor can hardly be called agreeable; it resembles that of rue, and the leaves are in their native country employed as a tonic and anthelmintic, and externally as a vulnerary. The root possesses emetic properties. Both the leaves and root have been admitted into the Mexican pharmacopoeia under the name of *yolochiahitl* [Am. JOUR. PHAR., 1886, p. 171]. An analysis of either part does not appear to have been made.

Psoralea bituminosa, Linné, is a suffruticose plant of Southern Europe, the leaves being trifoliolate, like those of the preceding species; the specific name refers to the peculiar odor of the plant. The leaves have long been popularly employed as a tonic, stimulant and emmenagogue.

Ps. physodes, Douglas, *(Rupertia physodes)* likewise a species with three leaflets, is enumerated by Dr. W. P. Gibbons in a "list of the Medicinal Plants of California" (see Proceedings of Am. Phar. Assoc., 1871, p. 300), but its reputed properties or uses are not given. Neither is the plant mentioned by Carter.[2]

Ps. melilotoides, Michaux, s. *Ps. Melilotus*, Persoon, *(Orbexilum pedunculatum, Psoralea psoralioides var. eglandulosa)* grows from Virginia southward, and westward to Illinois. It is very common in middle and upper Carolina and in Georgia. Two students of the

[2] Synopsis of the Medicinal Botany of the United States. By J. M. G. Carter, M. D., 1888.

Philadelphia College of Pharmacy, Aug. Bradley and Edward D. MacNair, both from North Carolina, call attention to this plant in their graduating essays, which are mainly of a descriptive nature. As indicated by the specific names the plant resembles the melilot or sweet clover in appearance. It is somewhat pubescent and more or less glandular ; the stem grows to the height of two feet, is much branched, and bears trifoliolate leaves, the leaflets varying in shape between lanceolate and narrowly oblong; not unfrequently they are glandless, which is the main distinctive character of the form *Psoralea eglandulosa*, Elliott. The numerous small purplish flowers are in axillary and terminal long-peduncled oblong spikes, and produce oval or suborbicular, transversely wrinkled pods. The perennial root is fusiform, sending out stout branches of similar shape, $^1/_2$ to 1 inch thick, from 8 to 12 inches and more in length, externally light-brown, internally white, and tough and fibrous in the bark as well as in the meditullium. The plant is collected when in full bloom. The herbaceous portion being of a weaker odor and taste is used to some extent; but the root is the principal part employed. In the fresh state it has an agreeable aromatic odor, and a bitterish spicy, or even rather acrid taste; but odor and taste are much weaker after drying.

Mr. MacNair obtained from the fresh root about 2 per cent. of volatile oil, having the sp. gr. 0.93, a pungent and bitterish taste and a neutral reaction. Tannin appears to be absent; but a dark-green color is produced in the infusion and tincture by ferric chloride. Starch is present; also a bitter principle which has not been isolated.

Dr. Carter (*loc. cit.*) states that the drug is aromatic, bitter tonic, nervine, and is used in chronic strumous diarrhoea. The same properties were attributed to it by Dr. Mettauer, in 1867. It is said to have been much and very advantageously employed by the negroes in an affection of the digestive organs, known to them by the name of *poison*, and is usually given in the form of infusion made with the addition of a little chamomile and Canadian hemp (apocynum). Mr. MacNair has made a number of galenical preparations, among them

Tinctura Psoraleae composita, following the pharmacopoeial formula for compound tincture of gentian, substituting psoralea root for the gentian.

Extractum Psoraleae was prepared with diluted alcohol and *Extr. Psoraleae fluidum* with diluted alcohol, the finished preparation containing 5 per cent. of glycerin.

Mr. Bradley states that the drug is administered in the form of a 20 per cent. tincture, made with diluted alcohol, and given in doses of one to four drachms.

Some of the popular names of the drug are Samson's snake root, congo root, pigtail root, and Bob's root.

Psoralea pentaphylla, Linné, *(Pediomelum pentaphyllum)* is a Mexican species having five leaflets. During the past century the root was sent to Spain; it is mentioned in the universal pharmacopoeias of Jourdan (1828), and Geiger (1835), as *radix contrayervae novae, p. albae* (s. *majoris*, s. *mexicanae*); it had been recommended as a substitute for the South American contrayerva (*Dorstenia*), but like the latter had become obsolete. Though of Mexican origin, it appears to be at present little known in

that country, and is not mentioned in the Mexican Pharmacopeias of 1874 and 1884. The root was described as being of the thickness of a finger to about two inches, with a rugose brown bark, which is internally white and covers a white woody axis; taste aromatic and sweet.

Recently the drug was chemically examined by Mariano Lozano y Castro,[3] who obtained the following results: Moisture, 10.0; ash, 3.75; extracted by petroleum ether (fat, 1.38 ; resin and volatile oil, 0.12), 1.50 ; ether extract (crystalline acid, 0.40, fat, 0.50, resin and color, 2.40), 3.30; alcohol extract (alkaloid and glucose, 9.25 ; resin, 1.46), 10.71 ; water extract, gum and sugar, 8.336; starch, 26.5 ; albuminoids, 1.0 ; cellulose and lignin, 28.75 per cent. The presence of an alkaloid was inferred from the precipitates obtained in the aqueous solution of the alcohol extract by tannin, picric acid and platinic chloride. Subsequently Mr. Lozano prepared 8 per cent. (40 gm. from 500 gm. of the root) of what he considered nearly pure hydrochlorate of the alkaloid which gave alkaloidal reactions with other reagents (Mayer's and Marmé's), besides those mentioned before. It was obtained by mixing the powdered root with lime and water, after three days treating with water acidulated with HCl, concentrating the filtrate, mixing with alcohol, filtering, evaporating, treating the extract with alcohol, evaporating, taking up with water, repeating these operations several times, and finally decolorizing with animal charcoal. While it is possible, though by no means certain yet, that the root may contain an alkaloid, it has not yet been isolated, and the chemical reactions and physiological experiments described by Lozano were made with calcium chloride mixed with organic matter of unknown quantity and quality.

Psoralea corylifolia, Roxburgh, *(Cullen corylifolia)* is an annual plant with undivided leaves, the seeds of which have been long in use in India as a tonic and deobstruent and in skin diseases. In 1876 (*Proc. Am. Ph. A.*, 1877, 209), Dymock called attention to the use made in India with the oil expressed from the seeds, and later (*Ibid*. 1882, p. 245), the oleoresin of the seeds diluted with simple unguents was highly lauded for its efficiency in leucoderma. Sometimes it was used mixed with chalmugra oil, to which some of the alleged effects in skin diseases may have been due. But the writer has been unable to find any record of the results of experiments, which were said to have been undertaken in England with the oil and the oleoresin of these seeds, during the years 1881 and 1882.

Whether others of the North American species of Psoralea, besides those mentioned above, possess valuable medicinal properties must be left for future investigations to decide. The genus is certainly an interesting one, notwithstanding the economic and medical uses are confined to a small number of species and to limited localities.

ANDROMEDOTOXIN.[4]

By P. C. PLUGGE AND H. G. DE ZAAYER.

Plugge first obtained andromedotoxin, which he extracted from *Andromeda japonica, A. polifolia, A. Catesboei* and *A. calyculata* (see AM. JOUR. PHAR., 1883,196).

[3] La contrayerba blanca o de México. Mexico, 1889. Pp. 48.

[4] (*Arch. Pharm.* [3], xxvi., 997-998: reprinted from *Jour. Chem. Soc.*, March 1889, p 2781).

The aqueous extract of *Rhododendronponticum* leaves was treated successively with normal and basic lead acetate. From the filtrate, the lead was separated by hydrogen sulphide, and the liquid was concentrated by slow evaporation in the air, and treated repeatedly with considerable quantities of chloroform. The residue left on evaporating the chloroform was purified by re-solution in chloroform (or alcohol) and precipitation by the addition of a considerable amount of ether. This treatment several times repeated finally yielded wellformed, crystalline needles which melted at 228-229°. At 12.5°, water dissolves 2 81 per cent.; alcohol (of 94 per cent.) 11.1; amyl alcohol, 1.14; chloroform, 0.26; ether, 0.07; benzene, 0.004. The solutions in water, alcohol, and amyl alcohol are laevorotatory, whilst that in chloroform is dextrorotatory. Andromedotoxin) $C_{31}H_{51}O_{10}$, is an indifferent non-nitrogenous compound; its solution in different liquids has a neutral reaction, and it is not precipitated by any of the so-called general alkaloid reagents. Its reaction with dilute and concentrated mineral acids is characteristic, as with them it gives intensely red decomposition -products. Concentrated sulphuric acid gives a dark reddish-brown, which becomes deeper red on warming, and turns light mulberry-red on dilution with water. The addition of alkali removes the color, which reappears on acidifying. Evaporation with dilute (1:5) sulphuric acid gives a beautiful rose-red color. The pure material gives off no odor during this evaporation, but if not completely purified, a strong and very characteristic odor of ericinol is evolved. Evaporation with dilute hydrochloric acid gives a residue somewhat more violet-red in tint. Evaporation with phosphoric acid gives a mulberry-red residue, clearly perceptible with very minute quantities, as in the case of the other acids. The fatal dose for small animals has been found to vary from 0.1-0.45 mgrm. per kilo. body-weight. No chemical antidote is known as yet. In investigating poisoning cases, Dragendorff's process is recommended ; but no acid should be used for extraction, as the solubility of the poison is not thereby increased. After extraction and purification by evaporation, taking up in alcohol, etc., the substance may be agitated with light petroleum, then with chloroform, and to the residue left by the chloroform the characteristic tests given above may be applied.

NOTE BY THE EDITOR.—Professor Plugge has continued his researches on the presence of andromedotoxin in the order of ericaceae, and has published his results in *Archiv der Pharmacie*, February, 1889, pp. 164-172. The process for isolation was the one given above; to determine the presence of the principle, the physiological behavior and the most characteristic chemical reactions were used.

Andromedotoxin was found to be present in *Kalmia latifolia*, Lin.,[5] *Rhododendron maximum*, Lin. and *Rh. Chrysanthum*, Lin. To these must be added the following ericaceae, which had been previously found to contain the same poisonous principle: *Andromeda japonica*, Thunb., *A. polifolia*, Lin., *A. Catesbaei*, Walt., *A. calyculata*, Lin., *A. polifolia angustifolia*, *Rhododendron ponticum*, Lin., *Rh. hybridum* and *Azalea indica.*

The following plants were ascertained to be free from andromedotoxin: *Arctostaphylos officinalis*, Wimm., *Chimaphila umbellata*, Nutt., *Oxydendron arboreum*, De Cand., *Erica vulgaris*, Lin., *Ledum palustre*, Lin. To these must also be added the following,

[5] In quoting the literature, Prof. Plugge states that "G. W. Kennedy has found (Am. JOUR, PHAR., XLV, p, 115) the alkaloid (sic) arbutin." Prof. Plugge has evidently not seen the original paper which was published in AMERICAN JOURNAL OF PHARMACY, XLVII (1875) page 5, and in which the word alkaloid does not occur.—EDITOR Am. JOUR. PHAR.

which were previously ascertained to be free from this principle: *Gaultheria procumbens*, Lin. (by Prof. Power and N. C. Werbke), *Rhododendronhirsutum*, Lin., *Clethra arborea* and *alnifolia*, Lin.

From experiments made by Dr. de Zaayer in determining the lethal dose, for frogs and rabbits, of the fluid extract of *Kalmia latifolia*, and comparing with the effects of pure andromedotoxin, it is estimated that the former contains about 0.05 per cent. of this poisonous principle.

COMPOSITION OF THE RESIN FROM PINUS SILVESTRIS.[6]

By V. SHKATELOFF.

Owing to the discrepancies in the results obtained with the resin of *Pinus maritima*, *P. Larix*, and *P. Abies*, and the uncertain composition of pimaric, sylvic, pinic, and abietic acids, the author has investigated the crystalline acid from the Russian resin obtained from *Pinus silrestris*, growing in the Archangel and Wologda Governments. In order to remove the uncrystallizable substances, the resin, ground fine, was extracted with alcohol of 50-60 per cent. (Maly, *J. pr. Chem.*, lxxxvi, 111), and the residue, which was much whiter than before, was now treated with boiling spirit; the filtered alcohol solution, after remaining some time, becomes almost entirely converted into a crystalline mass. The crystals were washed with alcohol of 85 per cent. and again recrystalized. After thrice repeating, this process, 30 per cent. of a perfectly white product was obtained; whereas on repeating the same process with a resin that had been exposed to the action of air for one year, only 20 per cent. was obtained. In order to prevent this from becoming yellow and oxidizing in the air, the operations have to be carried on as quickly as possible; finally a compound, melting at 143°, was obtained. The acid, $C_{40}H_{58}O_5$, is insoluble in water, but easily soluble in alcohol, ether, acetic acid, and liquid hydrocarbons. After fusion, it solidifies to an amorphous, transparent mass, and when heated above 360°, a colorless, uncrystallizable distillate passes over. The rotatory power of the alcoholic solution was found, [*a*]*j*=—73.59°. It decomposes alkaline carbonates with liberation of carbonic anhydride, and the original acid is reprecipitated from the solution on adding a mineral acid. By the action of hydrogen chloride on the alcoholic solution, the acid is converted into an isomeric acid of the same composition—but of different properties, as it melts at 159-160°, and the rotatory power is [*a*]*j*=-92-58°. From the sodium salt of the original acid, other salts of the following composition were obtained: $C_{20}H_{29}AgO_3$; $(C_{20}H_{29}O_3)$,Ba+.$2H_2O$; $(C_{20}H_{29}O_3)$2Ca, and $(C_{20}H_{29}O_3)_2$Cu. The acid $C_{40}H_{58}O_5$ appears to be a partial anhydride of an acid which gives the above salts, and whose formation may be represented as follows:—$C_{40}H_{58}O_5+H_2O=2C_{20}H_{30}O_3$. The ethyl salt, C20H29O3Et, was obtained as a heavy oil by acting on the silver salt with ethyl iodide. On distillation, it decomposes with elimination of water and the formation of another ethyl salt, according to the equation $C_{20}H_{29}O_3Et=C_{20}H_{27}O_2Et+H_2O$. This new compound is a heavy yellow oil which yields a resin with potassium hydroxide. Finally the author shows that the resinification of the acid when exposed to the air consists in an oxidation accompanied by loss of water. The acid described above agrees in properties with Maly's abietic acid, but differs from it in composition.

[6] *J. Russ. Chem. Soc.*, 1888, xx, 477-4.85; reprinted from *Jour. Chem. Soc.*, April, p. 406.

NOTES ON ESSENTIAL OILS FROM MESSRS. SCHIMMEL AND CO.'S REPORT. Part 2 [7]

Citronelle Oil.—The exports of this oil from Ceylon during the year 1888 are estimated to have amounted to at least double the exports of the previous year, since in the month of August alone the shipments reached 2,322,890 ounces, or four times the average of the same month in the three previous years. This enormous export from Ceylon is driving the production of the oil in the Straits Settlements into the background.

Almond Oil.—Under this head reference is made to the advantage that would result in the improved color of almond oil if a practical method of blanching the almonds could be introduced. It would be an indispensable condition that the almonds should not require to be moistened, because otherwise the formation of the essential oil of bitter almonds would be induced and the fixed oil would acquire a strong bitter taste and contain a trace of hydrocyanic acid.

Cassia.—With respect to cassia oil Messrs. Schimmel state that the greater part of that found at present in commerce is sophisticated in the most shameful manner. The oil appears to be obtained by the dealers in Hongkong, Macao, and Canton through native agents who get it direct from the Chinese who produce it. As to the particular place from which it comes no information is available; only this is certain, that it is not manufactured in Macao, the place designated on all the labels. It is therefore thought most probable that it is sophisticated by the producer, and sent in this condition into the market. In Hongkong it is the custom among the dealers to have the oil examined in a "medical hall" and its genuineness certified. The value of this guarantee may be judged from the fact that a sample certified to be unadulterated oil of cassia, 1.060 sp. gr., dissolving readily in alcohol of 80° Tr. and perfectly volatile, proved to contain 20 per cent. of solid resincolophony or pitch and a corresponding quantity of petroleum, probably added to regulate the specific gravity and consistence. The three following brands are mentioned as having been found grossly adulterated: yellow label with the American eagle: Yan Loong, Macao; yellow label with sailing-vessel: Cheong Loong, Macao; rose-colored label with wreath of flowers: Luen Tai Macao. The oil was noticeable superficially for its dark brown color and consistency. Upon shaking it in a flask it remained adherent to the sides for a long time. The specific gravity corresponded tolerably well with the statement in the certificate, varying between 1.052 and 1.065. The boiling-point lay between 200° and 265° C. As a residue after distillation there remained in the retort from 23 to 26 per cent. of a solid brittle resin. In order to exclude any doubt as to whether this resin might possibly have resulted through heating over an open fire, several canisters of each of these brands of oil were submitted to distillation in a current of steam. The greater part of the, distillate sank in the water, but a portion collected on the surface and this lighter portion was identified as petroleum. In the residue after distillation there was found from 19 to 26 per cent, of the same solid brittle resin. On the other hand, a brand bearing a red label with the words, "Best Cassia Oil, Ying Chong, Macao," has been found to be of good quality, the loss on rectification being only 7 per cent., and the residue being liquid. The rectified oil should have a specific gravity of

[7] From the April *Bericht* of Messrs. Schimmel and Co. of Leipzig; reprinted from *Phar. Jour. and Trans*; April 6 and 20.

1.055 to 1.065.

Eucalyptol and Eucalyptus Oil.—The demand for pure crystallized eucalyptol, for medicinal purposes, is said to be continually increasing. Of the *Eucalyptus Globulus* oil there seems to be a probability of over production, the yield from upwards of 3,000,000 trees in Algeria being now available, besides the Californian oil, which is already placed with difficulty. The use of the ordinary eucalyptus oil as a perfume is criticized and a passage is quoted with approval from Piesse's 'Art of Perfumery,' to the effect that so long as perfumery is an art of sweet odors such an oil cannot be described as a perfume. More favorable mention is made of oils distilled experimentally from *Eucalyptus maculata*, var. *citriodora*, and *E. Staigeriana*, as having a beautiful melissa odor; from *E. dealbata*, as having a fine lemon and melissa odor; and from *Backhousia citriodora*, as having an intense verbena odor. The cost of the materials is, however, too great to allow of these oils being produced as commercial articles. Another oil, of which samples have been received recently from Adelaide, South Australia, is described as having been distilled from the leaves of *Eucalyptus odorata*, a material of which there is an abundance available. The samples included the crude oil, sp. gr. 0.903 at 16°C., and the rectified oil, sp. gr. 0.909 at 18°C., both of which gave a strong eucalyptol reaction with hydrobromic acid, but no phellandrene could be detected. In addition there was some "residue from the rectification," which appeared to be the portion of the oil having the highest boiling point (boiling between 220° and 260°C.). This fraction, which is a brown liquid and has a sp. gr. of 0.945 is said to be sought after in Australia as a soap perfume. The odor is said to strongly resemble that of cuminol, the presence in it of which body has been detected.

Eucalyptol (Cineol) appears to be one of the most widely-distributed constituents of essential oils. Up to the present it has been found in the following oils:

Oil.	Origin.	Discoverer.
Wormseed	*Artemisia Cina*	Wallach and Brass.
Cajeput	*Melaleuca Leucodendron*	Wallach.
Eucalyptus	*Eucalyptus globulus*	Jahns.
	E. amygdalina	Wallach and Gildemeister.
	E. Bayleyana	Schimmel and Co.
	E. microcorys	Schimmel and Co.
Rosemary	*Rosmarinus officinalis*	Weber.
Spike	*Lavandula spica*	Voiry.
Cheken leaves	*Myrtus Cheken*	Weiss.
Myrtle	*Myrtus communis*	Jahns.
Camphor	*Laurus Camphora*	Schimmel and Co.

Geranium Oil, Turkish.—This essential oil is said to be sometimes adulterated with fixed oils, cocoa-nut oil being used not unfrequently to the extent of 20 per cent. The adulteration can be detected by standing the flask containing the oil for some hours in a cooling mixture, when the cocoa-nut oil separates as a white substance.

Hop Oil.—The oil distilled from the unsulphured hops is said to be in good demand, whilst that distilled from lupulin appears to have gone quite out of use.

Iris Oil.—In the distillation of iris root the method of adding sulphuric acid in order to

convert the starch into dextrin and glucose is frequently followed. In this way the yield of oil is increased, but the delicacy of its odor is said to be injured. The pure oil, free from myristic acid, which is largely present in commercial specimens, is described as worth its weight in gold.

Kesso-root Oil.—The Kesso root which in a previous report was designated "Japanese valerian root," and attributed to *Patrinia scabiosaefolia*, Link., has been the subject of a communication from Mr. J. Murai, of Tokio. He says that the *Patrinia scabiosaefolia*, called by the Japanese "Ominameshi," and by the Chinese "Hai-sho"—literally, putrid soy—grows wild throughout Japan, but is collected for medicine only to a slight extent. The root is whitish, larger and harder than that of *Valeriana officinalis*, and does not smell so strongly after having been exposed to the air. Some Patrinia root collected and submitted to distillation last year by Mr. Murai yielded 0.25 per cent. of a deep green oil, having an odor quite different from that of valerian oil. On the other hand the Japanese valerian ("Kesso" or "Kanokoso") and the European valerian, both cultivated in the Botanical Gardens, Tokio, yielded respectively 3.78 and 1.69 per cent, of oil. He believes therefore that probably the "kesso root" distilled by Messrs. Schimmel was from *Valeriana officinalis*, L., var. *angustifolia*, and not from *Patrinia scabiosaefolia*, Link. In this opinion Messrs. Schimmel concur, since the "kesso root" worked by them was strikingly similar to European valerian root, and did not correspond to the above description of Patrinia root. The yield of oil obtained, however, from the sharply-dried root was about 8 per cent., though it is thought that this great difference in the yield may be due to Mr. Murai having used fresh undried root.

Petitgrains Oil.—The over-production of this article in Peru has greatly affected its value, and in large parcels it is said to be now quite unsaleable. In view of the possibility of stock remaining on hand a long time a hint is given as to the superiority of recent distilled oil.

Peppermint Oil.—In the case of peppermint oil also the consumption is considered not to stand in any,sound relation to its enormously increasing production. The following is an estimate of the production of this oil in different parts of the world in 1888:

	Kilos.
America—New York State	about 35,000
" Michigan State	" 27,000
England—Mitcham	" 5,000
" Cambridge and Lincolnshire	" 1,400
Japan	" 64,000
Italy	" 1,200
France	" 4,600
Germany	" 400
Russia	?
Total	138,600

Two samples of Italian peppermint oil examined gave the following results:—(1) "Foglie de Menta:" sp. gr. 0.921 at 19°; boiling point about 195°—222°; 44 per cent. distilled between 195° and 210°; 37 per cent. between 210° and 222°; residue 19 per

cent. (2) "Fiori di Menta:" sp. gr. 0.915 at 190°; boiling point about 195°—222°; 57 per cent. distilled between 195° and 210°; 36 per cent. between 210° and 225°; residue 19 per cent. Neither sample gave a separation of menthol upon being placed in a freezing mixture. It is considered that according to these results both these oils range in quality below line American oils. A sample of Russian peppermint oil gave:—Sp. gr. 0.908 at 20°; boiling point about 195°—222°; 46 per cent. distilled between 195° and 210°; 40 per cent. between 210° and 222°; residue 14 per cent. Placed in a cooling mixture the oil formed a thin paste; it contained consequently a small quantity of menthol.

Rose Oil.—Information is given as to the properties of a pure rose oil, and especially as to the characteristic stearoptene and the possible introduction of spermaceti. The stearoptene of rose oil is a hydrocarbon, C_nH_{2n}, which is not altered by boiling with alcoholic potash solution, whilst spermaceti, which is essentially palmitic-cetyl-ether, is saponified by that reagent, with the formation of potassium palmitate and cetyl alcohol. Upon this fact Messrs. Schimmel have based a method for the examination of the oil.

(1) Isolation and determination of the stearoptene. Fifty grams of oil are heated with 500 grams of 75 per cent. spirit to a temperature of 70° to 80°. Upon cooling the stearoptene separates nearly entirely. It is removed from the liquid and treated similarly with 200 grams more of 75 per cent. spirit, and this operation is repeated until the stearoptene is obtained perfectly odorless, a second treatment of the crude stearoptene being usually sufficient. In this way the following results were obtained with different samples of German and Turkish oil.

	Grams oil.	Grams stearoptene.	Per cent.
German, 1887	50	gave 16·2	=32½
" 1888	50	" 16·9	=34
Turkish, 1887	50	" 6·3	=12–13
" 1888	50	" 6·9	=14

(2) Determination of an Admixture of Spermaceti.—3-5 grams of the stearoptene are boiled for five or six hours in a return condenser with 20 to 25 grams of 5 per cent. alcoholic potash solution; the alcohol is then driven off and the residue treated with hot water. Upon cooling the greater part of the stearoptene separates on the surface as a crystalline mass. The alkaline liquor is then poured off, the stearoptene washed with some cold water, then again melted down with hot water, allowed to cool and the water poured off, and this is repeated until the wash-water is neutral. The united aqueous liquor is shaken twice with ether, to remove suspended stearoptene, and after separation of the ether is acidulated with dilute sulphuric acid and again extracted with ether, which upon evaporation should leave no residue (fat acid). As a check the stearoptene, including that withdrawn from the alkaline liquid, is dried at 90° and weighed. There will, however, be a small loss due to the volatilization of some stearoptene. In a control experiment in which equal to 1.7 per cent. of spermaceti was added to a sample of Turkish oil 1.5 per cent. was recovered.

The melting-points of stearoptene from samples of German rose oil ranged from 35° to 36.5°; those of stearoptene from Turkish oil from 33.5° to 35°; that of the

stearoptene from the oil to which 1.7 per cent. of spermaceti had been added was 31.5°—32°.

Rose oil, from which stearoptene has been removed in the above-described manner, is perfectly liquid at 0°; but when placed in a cooling mixture it solidifies to a gelatinous mass, so that it is not quite free from stearoptene. This liquid oil is described as having an extraordinarily fine powerful odor, and as presenting the advantage that when used dissolved in spirit it does not give rise to any crystalline separation.

The following new oils have been prepared experimentally by Messrs. Schimmel during the last six months:

Mountain Wormwood Oil.—A distillate of the herb *Artemisia glacialis*, known in commerce as "genepi herb" (*genepi des alpes*). One hundred kilograms of the herb yielded 250 grams of an essential oil sp. gr. 0.964 at 20°, which solidified to the consistence of butter at 0', in consequence of it containing a fat acid melting at 61°C. The boiling point of the oil was between 195° and 310°. It had an unusually powerful aromatic odor, and it is thought it might be suitable for making "Benedictine" and "Chartreuse," for which purpose the herb is said to be used in France.

Bear-root Oil.—Distillate of the root of *Meum anthamanticum*, Jaq. 100 kilos of the dried root of commerce gave 670 grams of a dark yellow essential oil, the odor of which much resembled that of lovage. Sp. gr. at 21° 0.999. It commenced to boil at 170°, but the temperature mounted to above 300°, when a green-blue fraction passed over, having a celery odor.

Carlina Root Oil.—Distillate of the root of *Carlina acaulis*. From 100 kilos of dried root was obtained 2 kilos of an essential oil having a heavy narcotic odor, of which one-half boiled between 265° and 300° , when decomposition commenced; the remainder resinified. Sp. gr. 1.030 at 18° This oil is recommended as worthy of a scientific investigation.

Muscatel Sage Oil.—Distillate of the herb and flowers of *Salvia Sclarea*, the so-called "muscatel sage," a plant growing wild in Southern Europe and the east, and cultivated in South Germany. The oil has the characteristic spicy odor and taste of the herb. The yield amounts to only one-fifth per cent., and probably the cost of its production would be too high to allow of it coming into practical use.

Onion Oil.—The pure essential oil of the common onion (*Allium Cepa*). About 5000 kilos of onions yielded 233 grams of a red-brown oil, sp. gr. 1.036 at 19°. The same yield leads to the presumption that during distillation a loss occurs through decomposition. On the other hand, as the onion consists of 90 per cent. of water and only 10 per cent. of solid substance, the result from this point of view appears less unfavorable.

The following distillates have been received from Japan

Hinoki Oil.—The essential oil from *Retinospora obtusa*, a plant occurring frequently in Japan, resembling savin or thuja oil in odor. Probably with out practical value. The

low boiling point of this oil is remarkable: about one-half of its volume passes over between 110° and 160° C. and the remainder between 160° and 210°.

Kuro-moji Oil.—Essential oil from the leaves of *Lindera sericea*, Bl, a lauraceous shrub widely distributed in Japan. The oil has a very fine aromatic balsamic odor, and might, it is thought, find use in perfumery, especially as it is not expensive. Sp. gr. 0.901 at 18°. A sample separated by distillation into three fractions gave (1) between 180° and 200°, a fraction having the agreeable odor of myrtle and coriander; (2) boiling between 200° and 220°, a fraction with an agreeable balsamic odor, recalling somewhat lign-aloe oil, but finer and more fragrant; (3) boiling between 220° and 240°, a fraction resembling the carvol contained in curled mint.

Coumarin.—The following list of plants in which the presence of coumarin has been detected, is quoted from a communication by H. Lojander upon the distribution of coumarin in the vegetable kingdom:

Orders.	Genera and species.	Part of plant.
Filices	*Adiantum pedatum*	Plant.
	A. peruvianum	Plant.
	A. trapeziforme	Plant.
Palmæ	*Phœnix dactylifera*	The date.
Gramineæ	*Anthoxanthum odoratum*	Flowers.
	Cinna arundinacea	Plant.
	Hierochloa alpina	Plant.
	H. australis	Plant.
	H. borealis	Rhizome.
	Milium effusum	Plant.
Orchidaceæ	*Aceras anthropophora*	Plant.
	Angrœcum fragrans	Leaves.
	Nigritella angustifolia	Plant.
	Orchis fusca	Plant.
Caryophyllaceæ	*Herniaria glabra*	Plant.
Rutaceæ	*Ruta graveolens*	Plant.
Papilionaceæ	*Dipterix odorata*	Ripe seed.
	D. oppositifolia	Ripe seed.
	D. Pteropus	Ripe seed.
	Melilotus albus	Flowers and plant.
	M. altissimus	Flowers and plant.
	M. hamatus	Flowers and plant.
	M. leucanthus	Flowers and plant.
	M. officinalis	Flowers and plant.
Cassiaceæ	*Toluifera balsamum*	Fruit.
Apocynaceæ	*Alyxia stellata*	Bark.
Rubiaceæ	*Asperula odorata*	Plant.
	Galium triflorum	Plant.
Compositæ	*Liatris odoratissima*	Plant.
	L. spicata	Plant.

In addition, Molisch and Zeisel have reported the occurrence of coumarin in *Ageratum mexicanum*, Sims. This plant, when dry, smells of coumarin, of which it yielded 0.06 per cent.; but when in fresh condition, has quite another odor, probably derived from an essential oil.

Thymol.—Reference is made to the occurrence in commerce of thymol containing thymene, which can be recognized by its odor, or by the oil stain left upon pressing a fragment between blotting paper. The following method is given for its more exact determination: Pure thymol dissolves clear in five times its weight of 10 per cent. soda solution when heated to 30° or 40° C., the solution being colorless or faintly reddish, but darkening upon standing. If the thymol contains thymene it gives a more or less turbid solution, from which the thymene separates in the form of oil drops.

Musk.—The following information as to the manner in which musk comes into commerce is quoted from a report by the German consul at Shanghai: "The article comes into the market in simple wood cases of 9 to 14 catties. Every parcel contains a number of adulterated pods, which have also to be bought. The parcels are then, as a rule, broken up by the exporter and sorted for the London market. On an average they give about 50 to 55 per cent. of 'pile I,' a fine thin-skinned article; 20 to 30 per cent. of 'pile I and II,' partially or entirely falsified pods; and 20 to 25 per cent. of skin refuse and loss of weight. The sophistication consists of earth, rasped wood, and small pieces of leather or skin, which are inserted in the pods after the musk has been removed. Less frequently the sophistication is effected with lead, heavy pieces of flesh, or paper inserted between the thin inner and thick outer skin, which can only be discovered upon cutting it. In the last year or two the adulteration has gone up to 80 per cent., but in the absence of better qualities, even such an article has found buyers."