AMERICAN JOURNAL OF PHARMACY
Volume 70, #8, August, 1898

Botanical Medicine Monographs and Sundry

STRUCTURE OF GELSEMIUM.

By JOSEPH D. SEIBERLING, P.D.

The structure, and more especially the chemistry, of gelsemium have been frequently investigated. There are still a number of points in the development history, as well as morphology, of this important drug that require consideration. In order to be clear on the portions studied, whole rhizome, overground stem and root, Prof. Kraemer suggested that living specimens be procured. These were obtained from the nurseries of Mr. Meehan, Germantown, and Mr. Lamb, Fayetteville, N. C.

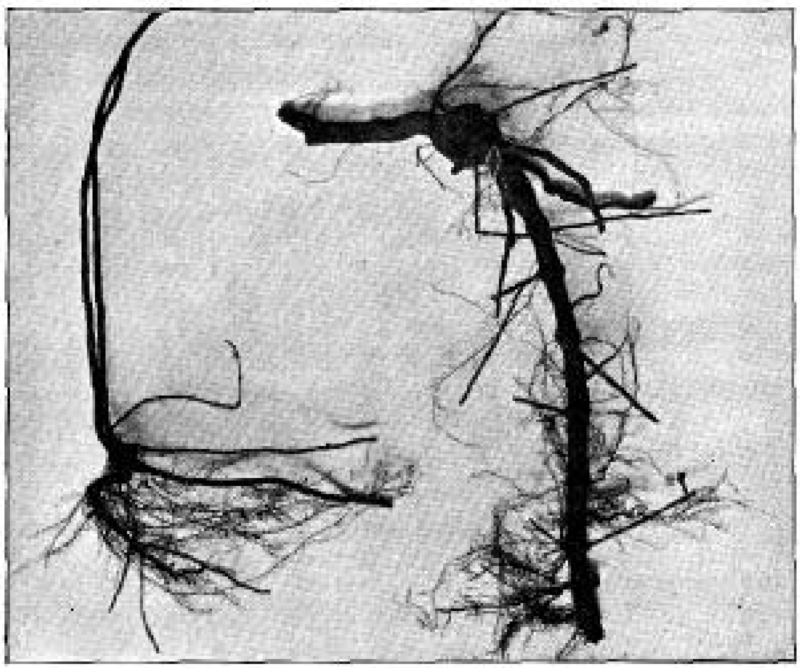

FIG. 1.—The left-hand illustration shows a portion of the rhizome and roots of *Gelsemium sempervirens* (L.), Pers., with a part of the overground stem. To the right is a portion of a large rhizome with roots.

Gelsemium sempervirens, (L) Pers. (also known as *G. nitidum*, Mx. and *Bignonia sempervirens*, L.) is a woody climber, growing in woods or thickets of the Southern United States and extending along the seaboard into Texas, Mexico and Guatemala. The underground stem is hardy, woody and of varying length. The overground stem is slender and purplish, climbing to a height of 15 to 20 feet or more. The leaves are perennial, lanceolate, short petioled, entire, and opposite. The flowers are large, in opposite axillary clusters, mostly solitary, although varying from one to six flowered. The calyx is short, consisting of five lobes. The corolla is large, funnel-shaped, bright yellow. Stamens are five in number and inserted upon the base of the corolla tube. "Stigmas in one form, short and anthers exserted; in the other form, longer and anthers included." The fruit is a dry capsule, of a brown color and dehisces septicidally into two boat-sbaped valves. Seeds several, rather large, flat with a broad wing at the summit.

Gelsemium flowers in April, and is popularly known as Yellow jessamine; also called Evening Trumpet flower and Carolina Wild Woodbine. The odor of the flowers is very sweet, and they are highly poisonous. Mr. Lamb, in a letter to the author, writes of the death of a daughter of the late Dr. Dick, from eating the flowers. In the Norfolk (Va.) Herald is recorded the death of a child four years old from eating the flowers of this plant; death ensued an hour after signs of illness were manifest.

Jesse G. Shoemaker (*AMER. JOUR. PHARM.*, 1884, P. 130) has contributed an article on the histology of gelsemium, in which stress is laid on the development of the medullary rays as being characteristic in distinguishing roots and stems. The author does not find this to be a diagnostic feature. Mr. Shoemaker gives as a second character "the tendency of the pith of the stem to be penetrated by several plates of large, thin-walled cells, which divide the pith more or less perfectly into four portions." This layer of cells is an internal phloem, similar to what we find in *Solanum Dulcamara* and many other plants, and which has been first accurately described in gelsemium by Miss Caroline Thompson (*Bot. Gaz.*, 1898, p. 118). This internal sieve zone is characteristic for the rhizome and overground stem of gelsemium, distinguishing them from the root.

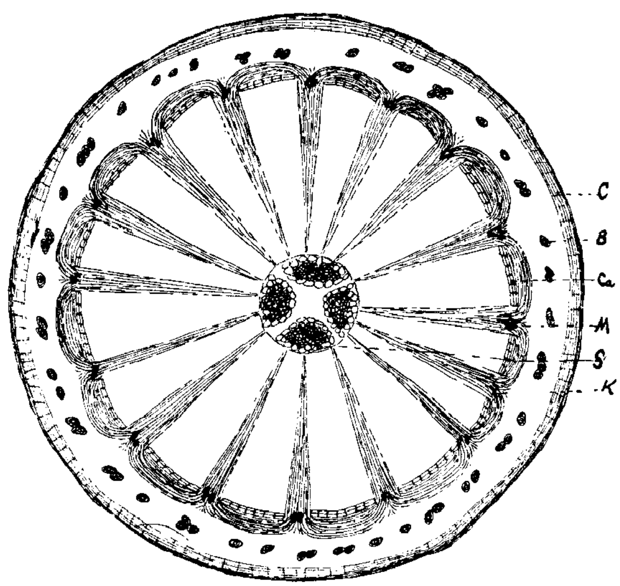

FIG. 2.—Diagram of overground stem of *Gelsemium sempervirens* (L.) Pers. *C*, cork; *B*, bast fibres; *Ca*, cambium; *M*, medullary rays; *K*, crystals of calcium oxalate; *S*, internal phloem.

L. E. Sayre (*Amer. Jour. Pharm.*, 1898, p. 11) gives the characteristic differences in structure between the overground stem and rhizome to be, that, "in the stem are found comparatively large bundles of bast near the wood, just outside the cambium. In the rhizome the bast is arranged near the axillary layer, and in an interrupted ring rather than in bundles." These differences in structure the writer, however, does not find to hold. The position and distribution of the bast fibers in the rhizome and overground stem of gelsemium are about the same. It is possible that in number the bast fibers in the rhizome may exceed those of the overground stems, still this cannot be said to constitute a difference to be relied upon. I will describe the morphology of the rhizome, overground stem and root of the living material that I examined.

OVERGROUND STEM.

The overground stem is that of a woody climber (Fig. 1). It is slender, on an average about 1/2 inch in diameter. Externally it is nearly smooth, marked by longitudinal wrinkles; internally (Fig. 2) it is whitish, marked with a pinhole cavity in the center. The epidermis is, in older plants, replaced by a thin layer of cork, from four to six cells thick. Beneath this there are a number of rows of collenchyma cells containing chlorophyll. In the parenchyma cells, lying beneath the latter, are found numerous starch grains, oil globules and large tetragonal or coffin-shaped crystals of calcium oxalate. The latter are found principally in the cells at the terminus of the medullary ray cells of the inner bark. The bast fibers are very long and silky, and arranged in an interrupted circle through the bark. Medullary rays are strongly lignified, provided with simple pores, are very regularly arranged, widening from within out, being about eight cells in width at the periphery. In the younger plants the internal phloem is not divided, while in the older ones it is divided into four parts, being situated central.

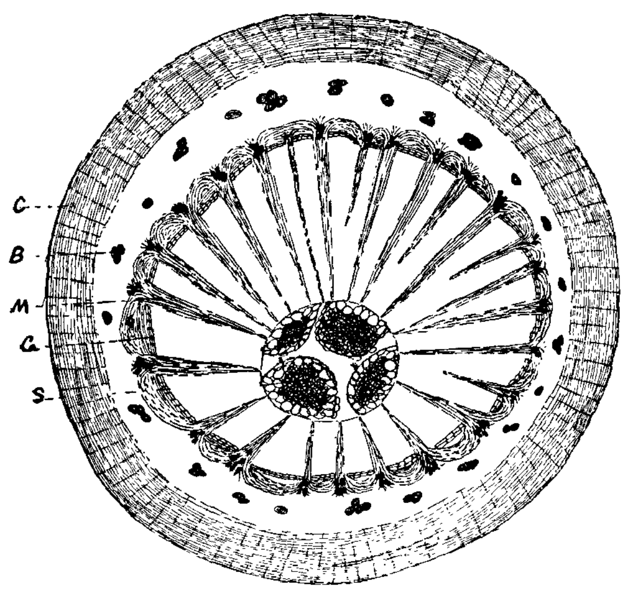

FIG. 3.—Diagram of rhizome of *Gelsemium sempervirens* (L.), Pers. *C*, cork; *B*, bast fibres; *M*, medullary rays, at the periphery of which are crystals of calcium oxalate; *Ca*, cambium; *S*, internal phloem.

RHIZOME.

The rhizome creeps very near to the surface (Fig. 1). It is externally of a brownish-yellow, and internally (Fig. 3) of a yellow color. The cork is about eighteen to twenty cells thick. Underneath this cork the parenchyma cells are large, and contain numerous starch grains and oil globules. The collenchyma cells of the overground stems with their chlorophyll contents are wanting here. In the medullary ray cells of the inner bark are found crystals of calcium oxalate. The latter are similar in size, shape and position to those found in the overground stem. The bast fibres are long, silky, and a little more numerous than in the overground stem. Medullary ray cells are about of the same shape, number and composition as those of the over-round stem. The internal phloem, in older plants, is pronounced, divided into four well-marked zones, as in the overground stem, It is similar to that in the overground stem in every respect save position, it being eccentric rather than central.

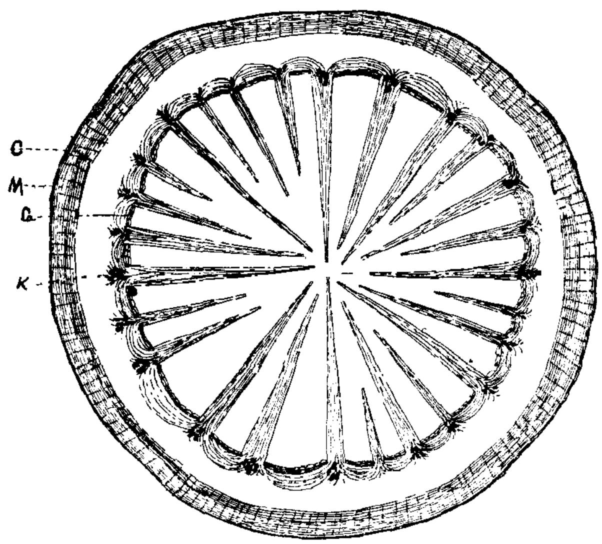

FIG. 4.—Diagram of root of *Gelsemium sempervirens* (L.), Pers. *C*, cork; *M*, medullary rays; *Ca*, cambium; *K*, crystals of calcium oxalate.

THE ROOT.

The root is quite long and spreading. It is externally of a dirty brownish-yellow, and internally (Fig. 4) of a yellow color. The thin epidermis in young roots is replaced by a thick layer of cork in the older plants, consisting of from sixteen to eighteen rows of cells. The collenchyma of the stem is wanting. Starch grains and oil globules are distributed throughout the parenchyma of the bark, as it is in the overground stem and rhizome. Similar crystals of calcium oxalate as already described are found in the medullary ray cells of the inner bark. The medullary rays are similar to those described in the overground stem and rhizome, but we find more secondary medullary rays.

To recapitulate:

Rhizome.	Overground Stem.	Root.
Cork 18 to 20 cells.	Cork 4 to 6 cells.	Cork 16 to 18 cells.
Collenchyma wanting.	Collenchyma, 4 to 7 cells, containing chlorophyll.	Collenchyma wanting.
Parenchyma, containing oil, starch and crystals calcium oxalate.	Parenchyma, containing starch, oil and crystals calcium oxalate.	Parenchyma, containing starch, oil and crystals calcium oxalate.
Bast fibres.	Bast fibres.	Bast fibres wanting.
Cambium.	Cambium.	Cambium.
Medullary rays.	Medullary rays.	Medullary rays.
Ducts & libriform tissue.	Ducts & libriform tissue.	Ducts & libriform tissue.
Internal phloem.	Internal phloem.	Internal phloem wanting.
Hollow center eccentric.	Hollow center central.	No hollow, but elements of primary fibro-vascular bundle in centre.

From this investigation certain new features have come to light regarding the structure of the rhizome, overground stem and root of gelsemium. Prof. Kraemer is of the opinion, from observations made, that all future investigations of the drug, to be of any value, must be made in the home of the plant. Even hothouse material is not sufficient to determine the morphological differences in these various plant portions with which we have to deal.

THE CHEMISTRY OF ALOES.

By ALFRED R. L. DOHME, PH.D.[1]

Aloes is the concentrated juice of the plants of the genus Aloe, principally the varieties Aloe Socotrina, Aloe ferox, Aloe plicatilis, Aloe vulgaris, Aloe Africana and Aloe Perryi. Strange to say, the much-talked-of and official Socotrine aloes does not grow on the island of Socotra, this variety being Aloe Perryi, named after our famous Commodore Perry, who observed it on the island in 1878. Commercially speaking, the varieties of aloes are Socotrine, Curaçoa, Barbadoes, Natal, Cape and Indian aloes. In England they prefer Barbadoes aloes; in Germany, Cape aloes, and in this country, Socotrine and Curaçoa aloes. A correct and reliable division and classification of the varieties of this important drug is as yet only a wished-for but not by any means realized fact. Much of the Socotrine aloes we buy, and, apparently knowing, label "True Socotrine Aloes," is a mixture containing various varieties, and no doubt largely Curaçoa aloes. As we all know, Socotrine aloes costs about 25 cents a pound, while Curaçoa aloes costs only about 3 cents a pound; and, as we also know, the pharmacist nearly always calls for and uses the former, thinking the latter a cheap, malodorous substitute. If any aloes can be called not malodorous, and if comparisons of malodor can be made by skilled pharmaceutical olfactory nerves, perhaps it is safe to say that Curaçoa aloes is the stronger in odor, although not as unpleasant as Cape

1 Read at the meeting of the Maryland State Pharmaceutical Association at Blue Mountain House, Maryland, on June 23, 1898.

aloes. Whether or not the famous saffron-like qualities of Socotrine aloes justify us in investing 22 cents a pound for the saffron aloes is, however, another question, and I would like to ask the many skilled pharmacists seated before me if they always prefer the saffron-flavored aloes because of its saffron or because it is official. If it could be shown that Curaçoa aloes or any other aloes is as efficient as its saffron-flavored sister, would they still stand by the U.S.P. and pay 22 cents tribute to the latter or to the saffron flavor? I certainly would not. Drugs have been but little studied, and our standards for the same are necessarily vague and indefinite. When, however, science has taken a drug in hand and given us standards, and thereby upset our former macroscopical and necessarily superficial criteria as to their relative value, should we not accept the results of her revelations and adopt the benefits thereof? We know that aloin is one of the active principles of aloes, and if not the only one, as I shall show, still the main one, and a principle that we all know perfectly well is uniformly efficient and gives us all the results of the drug. If we can show that Curaçoa aloes contains as much and frequently more aloin than Socotrine aloes, are we not reasonably certain that the one is as efficient and valuable as the other, for certainly the odor of the aloes has no influence on the lower bowel? I have made comparative assays of Socotrine, Curaçoa and Cape aloes, and have found that they contain approximately the following relative amounts of aloin : (M. P., 103º C.) Socotrine aloes, soft in monkey skins, $7^1/_2$ per cent. average of 3 assays. (M. P., 110º C.) Curaçoa aloes, hard and livery and of a light chocolate color, 18.5 per cent. in 3 assays. (M. P., 107º C.) Cape aloes, hard, glassy and black in color, $4^1/_2$ per cent. average 3 assays. Inasmuch as practically all the aloin in this country is made from Curaçoa aloes as it is in England from Barbadoes aloes, and we have all found that it is usually efficacious and produces the desired effects, we cannot but conclude in the face of the above assays that no reason exists, as far as we know, why we should not use Curaçoa aloes to the exclusion of the Socotrine, especially as it costs only about one-eighth as much. So much for the commercial side of aloes. T. and H. Smith, in 1851, and Stenhouse, Flückiger, Tilden, E. Schmidt, Liebelt and Groenewald since have studied aloes as to the aloin obtained therefrom. The Smiths operated on Barbadoes aloes, and obtained what they called barbaloin, formula $C_{17}H_{18}O_7 + H_2O$. FIückiger, in 1871, decided that the aloin he and Histed obtained from Socotrine aloes was not, as Pareira had stated, identical with barbaloin, but was $C_{15}H_{16}O_7$. From these aloins, notably barbaloin, Tilden had obtained by the action of strong oxidizing agents such as potass. bichromate, alaxanthin or methyl-tetraoxyanthraquinone, thus indicating that aloin was a derivative of anthraquinone. As we all know, aloes contains besides the aloin, quite a quantity of resin, which has, however, as yet not been investigated. Tschirch and his pupils at Bern have been these past four or five years investigating in order the various resins, beginning with tolu, benzoin, peru, etc. He has recently taken up the resin of aloes, and finds it to be like the other resins, an ester or organic salt, made up in case of Barbadoes aloes of cinnamic acid, and one of that peculiar and characteristic class of resin alcohols, which he finds in all resins and has named “resinotannols” and which he has named “aloresinotannol.” It is a gray-brown powder of formula $C_{22}H_{26}O_6$, and contains two hydroxyl groups, as he obtained from it a di-benzoyl derivative. The resin of Cape aloes was similarly treated, and yielded the same aloresinotannol ; but to demonstrate that the resin was different from that of Barbadoes aloes, he found that the acid in combination with it was not cinnamic but paracumaric acid. The resin of Socotrine aloes has not been taken up as yet, but the aloin from the three aloes was next considered. Here some most unexpected valuable and interesting observations were made, and as the result of close observation of a certain color reaction of aloe, known as Borntraeger's test for aloes. It is this: aloes or aloes solutions, when treated with either benzin or benzene, yield to these solvents a yellow substance which turns cherry-red on the addition of ammonia. It was noticed that Cape, Barbadoes and Curaçoa aloes gave the reaction, while Natal and liquid or true Socotrine aloes did not. The color was not due to the aloin or to the resin as both of these, when pure, did not give it, but to another substance which no one ever thought was contained in aloes, and which was obtained from the latter, or from aloin obtained from the first three kinds of aloes just mentioned. It is emodin, the great laxative, to which rhubarb, senna, cascara, frangula, owe their laxative properties. It can be obtained from aloin by extracting this with ether, from which it will crystallize, and can be purified by sublimation. Hence the so-called Borntraeger's reaction for aloin is not, correctly speaking, a reaction for aloin but for emodin; aloin that has been deprived of emodin not giving the reaction. A test of the emodin obtained from Barbadoes aloes showed that in doses of half to one grain it possesses marked purgative properties, and in smaller doses quite marked laxative properties, and it was shown that this property is due to increased peristalsis of the intestine. It was further shown that solutions of pure aloin, when allowed to stand exposed to the air, develop in a very short time quantities of emodin which were isolated and analyzed. The same result can be obtained by heating aloin with a 1 per cent. solution of caustic potash. Whether the reaction is one of oxidation or of saponification has not yet been determined, but it is believed that the laxative properties of aloin are due to emodin, and that even if our aloin that has been deprived of all emodin is taken into the system the conversion of the same into emodin in its passage through the system is the cause of its laxative property. While this does not detract from the value of aloin, it much increases our interest in this substance, and accounts for the unusual efficacy and popularity of cascara sagrada, whose active principle, the glucoside purshianin, which it was my good fortune to be the first to isolate, does, as we know easily by saponification, split up into sugar and this same emodin. The result of this valuable contribution to pharmaceutical science of Professor Tschirch and his pupil, G. Pedersen, will be to stimulate the interest in emodin, and probably to give us a ready means of making it on a large scale. To sum up the points brought out in this paper: (1) That Curaçoa aloes is as efficient and, being much cheaper, should be used in preference to Socotrine aloes, the greater portion of which as sold to-day is made up anyway of Curaçoa aloes. (2) That the resin of aloes is an ester or organic salt, and varies according to the kind of aloes, and that the varying constituent is the acid, the alcoholic constituent being aloresinotannol and being the same in both Barbadoes and Cape aloes, the only two thus far examined. (3) That aloin contains emodin, to which its laxative property is probably due. (4) That many laxative drugs, such as senna, cascara sagrada, rhubarb, buckthorn bark, besides aloes, owe their laxative property to this substance emodin or some substance like it, derived from anthraquinone, and homologous or isomeric with it.

Work is now in progress to show the exact relation of anthraquinone to our well-known laxatives.

GLEANINGS FROM THE MEDICAL JOURNALS.

by Clement B. Lowe, M.D.

THE ANTI-EMETIC PROPERTIES OF ICELAND MOSS.

Deguy and Bricemarct (*Journal des Practiencs, annali di farmacoterapia e chimica*, April), in making use of a tincture of this drug on account of its nutrient, demulcent and bitter tonic properties in cases of gastric disturbance, find that it possesses marked antiemetic properties. From 30 to 50 drops are administered in a little seltzer water. The drug does not seem to have any effect on hysterical vomiting, and the authors have not as yet had occasion to use it in the vomiting of pregnancy.—*Vide New York Med. Jour.*, May 2 1, 1898.

HYDRASTIS CANADENSIS.

In the *Independance Medicale* for April 17th, M. Marini, of Bagdad, relates his experience with this drug in the treatment of hemorrhage in case of hemorrhoids, tuberculosis and dysentery, and states that he has obtained remarkable results. He also maintains that it is the preferable remedy in the hemorrhages of fibromyomas, and that it is the best means of combating the hemorrhages of pregnancy at any stage, provided that it is taken at sufficiently prolonged intervals; that is, 20 drops of the fluid extract every three hours, or four times a day. He claims that it is a therapeutic substance which is very valuable in obstetric practice, and is certainly superior to ergot of rye; it does not present the inconveniences of the latter, and may be administered freely, either as a curative or as a prophylactic in the metrorrhagias in all stages of pregnancy, labor or delivery; and during the puerperium, it is also a much safer remedy in the hands of midwives than ergot of rye. *N. Y. Med. Jour.*, May 21, 1898.