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Botanical Medicine Monographs and Sundry

RHUS AROMATICA, AITON—FRAGRANT SUMACH.

Syn. Sweet Sumach, Stink or Skunk Bush.

BY HARRY WINSTON HARPER, PH.G.

From an Inaugural Essay.

Nat. Ord. *Anacardiaceæ*

The fragrant sumach is a small aromatic shrub, not poisonous, grow in dry, rocky soil, in hedges and thickets, in Canada and the United States. Its height varies from three to six feet; it is erect, sometimes decumbent, branching, glabrous. The stem has a large pith, of a pinkish color, and a thin circular layer of white wood, which is covered with a thin bark, the outer surface of which is of a brown-gray color, the inner surface yellowish-green. The leaves are alternate, petiolate, exstipulate and trifoliate, with sessile, dark green, rhombic-ovate, unequally cut-toothed leaflets, two to three inches in length; pubescent when young, thickish when old. The lateral leaflets are uneven at the base, while the larger terminal one is wedge-shaped. The flowers are in close aments preceding the leaves; yellowish, with a five-lobed glandular disk. The fruit is drupaceous, subglobular, one-fourth of an inch in diameter; scarlet, densely covered with purplish-red hairs, and incloses a roundish, slightly flattened, oblong putamen. It has an odor similar to that of rose geranium, and a pleasant acidulous taste, and ripens in May and June.

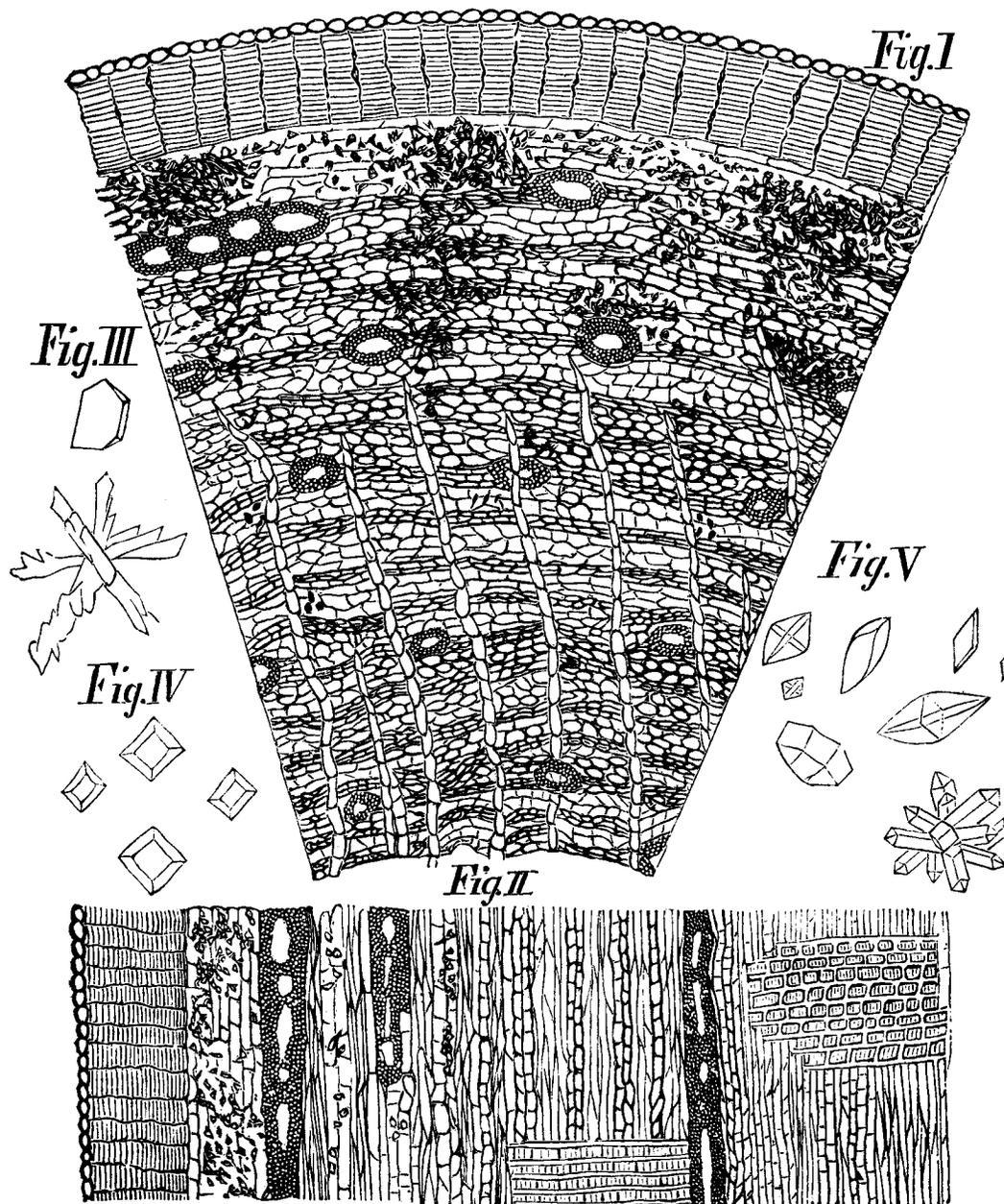
The roots are branched, vary in diameter from $\frac{1}{12}$ to $\frac{1}{2}$ inch, and contain a whitish ligneous medullium interspersed with ducts, which are not apparent to the naked eye. The bark, which is the medicinal portion, is in quills, one to four inches in length, $\frac{1}{16}$ to $\frac{1}{2}$ inch in diameter, and from $\frac{1}{20}$ to $\frac{1}{12}$ of an inch thick. The outer surface varies in color from light to dark brown, and is marked with corky protuberances and transverse fissures. When the corky layer is removed the outer bark is brought to view, which is of an orange-red color, is longitudinally wrinkled and transversely fissured. The inner surface is whitish or flesh-

colored, and striate. The bark is brittle, breaks with a somewhat granular fracture, yields an ochre-colored powder, and has a distinct, rather pleasant odor, more marked when green than when dry; its taste is astringent, aromatic and slightly bitter when fresh, with a flavor peculiar to the plant from which it is derived. It should be collected in the spring of the year.



Leaves of *Rhus Aromatica*, *Aiton*.

Upon microscopical examination the bark appears to be radially and tangentially striate, and is marked throughout with oil tubes and crystals, as is shown in the accompanying drawing.



Bark of the root *Rhus Aromatica*, *Aiton*.

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|---------------------------------|---------------------------|
| 1. Transverse section. | 2. Longitudinal section. |
| 3. Crystals of phosphates. | 4. Crystals of chlorides. |
| 5. Crystals of calcium oxalate. | |

Fig. I. A transverse section of the bark magnified to about forty or fifty diameters. The epidermis consists of a single row of cells, the walls of which are of a dark brown color. The corky layer is somewhat lighter brown, and the cells number, radially, from sixteen to twenty-five; mostly, however, eighteen. The first layer beneath the cork consists of

three rows of flattened tangentially elongated parenchyma cells, followed by one of loose parenchyma and sieve tubes. The next layer consists of three rows of bast cells, interrupted by oil tubes. The succeeding layers are composed of ordinary parenchyma, sieve tubes and bast cells, some of the rows of the latter being interrupted by oil tubes the same as those just described. The medullary rays extend more than half through the bark and consist mostly of a single row of cells. The oil tubes are generally in the bast rows, arranged with some regularity. In some of the sections examined three or four of the oil tubes were found coalesced, as in Fig. I. The bark is studded with crystals, which seem to be mostly confined to the portion beyond the medullary rays. The crystals were examined under a high magnifying power, which showed them as represented in Figs. III, IV and V, the latter predominating, only a few of Figs. III and IV being clearly made out.

Fig. II. A longitudinal section of the bark, in a radial direction (magnified the same as Fig. I), showing the longitudinal arrangement of the tissues, oil tubes and crystals, sections of two medullary rays being quite prominent.

Fig. III represents crystals of the phosphates, Fig. IV crystals of the chlorides, and Fig. V crystals of oxalate of calcium as they appeared under a high magnifying power.

Chemical Investigation.—Five grams of the air-dry bark subjected to a heat of 100°C. until it ceased to lose weight weighed 4.651 grams, showing a loss of .349 gram — 6.98 per cent. amount of moisture.

Five grams of the air-dry bark were incinerated, and yielded .644 gram of ash, equal to 13.85 per cent., of which 16.967 per cent. was soluble in water, 74.007 per cent. soluble in hydrochloric acid, and 9.025 per cent. soluble in boiling sodic hydrate. An analysis showed the presence of potassium, sodium, aluminium, calcium and silica, combined as sulphates, chlorides and phosphates in the aqueous solution, and as phosphates and carbonates in the portion soluble in hydrochloric acid; the carbonates very likely were produced during the incineration.

Twenty grams of the powdered bark were exhausted with pure benzol by maceration and percolation; the percolate was allowed to evaporate spontaneously, yielding an extract weighing 1.272 gram — 6.36 per

cent. This extract was treated with warm water, allowed to cool, filtered, and filtrate tested for alkaloids and glucosides with negative results. The undissolved extract was removed from the filters and dishes by solution in benzol, the benzol solution again evaporated to dryness, the residue treated with warm dilute sulphuric acid, allowed to cool and then filtered. The filtrate was tested for alkaloids and glucosides; negative results. The still undissolved residue was thoroughly washed with water to free from any adhering sulphuric acid, treated with absolute alcohol, filtered, and the filtrate evaporated. This left a soft oily mass, of an acid reaction, entirely soluble in ether, benzol, volatile and fixed oils, partly soluble in alcohol, sp. gr. .817, and aqueous alkalies; it has a peculiar odor, and an acrid, somewhat bitter taste, similar to that of copaiba, is soluble in concentrated sulphuric acid, with a deep brown color; strikes a similar color with concentrated nitric acid, but is insoluble in it, and gives with concentrated nitric and sulphuric acids a red-brown color, which turns lemon-yellows This substance was considered to be an oleoreain, as it left a permanent greasy stain upon paper (fixed oil), and when treated with alcohol, sp. gr. .817, and the filtrate evaporated, left a residue of a resinous nature which gave reactions with sulphuric and nitric acids, the same as those noted above. The fixed oil was boiled with a solution of sodic hydrate, filtered and precipitated with a solution of sodic chloride; the result was a yellow-brown soap.

A fresh portion of the benzol extract was dissolved in ether, allowed to evaporate spontaneously, redissolved in ether and evaporated a second time, when the odor of butyric acid was produced. It was then treated with potassic hydrate, alcohol and sulphuric acid, and when heated the odor of ethyl butyrate was produced.

The drug exhausted with benzol was dried and treated with stronger alcohol until the percolate left no residue when evaporated; the entire percolate was carefully evaporated, the extract weighing 4.774 grams — 23.87 per cent. This extract was treated with several portions of absolute alcohol, sp. gr. .7938 at 15.6°C.

A. SOLUBLE IN ABSOLUTE ALCOHOL.—Evaporated to dryness, powdered and treated with distilled water.

a. Soluble in water, acid reaction.

a¹. Precipitate by subacetate of lead.—Ochre color; was washed,

suspended in water, saturated with hydrosulphuric acid to precipitate the lead, filtered, filtrate boiled to free from H₂S; the amber-colored solution reduced Fehling's solution when heated, formed precipitates with solutions of gelatin, tartrate of antimony and potassium and ferric chloride, the latter giving a blue-black, which is altered only a very little upon boiling. These reactions show the presence of tannin, the reduction of Fehling's solution being due, probably, to a contamination with glucose. Negative reactions for alkaloids. The tannin, thus obtained, after continued treatment with acids, gave reactions with milk of lime, nitrate of silver and ferric salts, identical with those produced by gallic acid; this, therefore, seems to be a gallotannin.

a². Filtrate from precipitate by subacetate of lead.—The lead was precipitated by hydrosulphuric acid, the filtrate boiled to free from H₂S; concentrated and divided into several portions:

1. Acid reaction (from the acetic acid of the lead), mercurio-potassic iodide gave no precipitate; absence of alkaloids.

2. Solution of iodine in potassium iodide; no precipitate; absence of alkaloids.

3. Reduces Fehling's solution without heating; glucose.

4. Evaporated to dryness, the residue had a sweet taste and a somewhat aromatic odor; was soluble in water and alcohol and consisted of two portions, one soluble in a mixture of alcohol and ether (3 to 1), the other insoluble in this menstruum. Both reduced Fehling's solution without the aid of heat and were considered to be "extractive" matter and glucose.

b. Insoluble in water.

b¹. Soluble in dilute sulphuric acid.—Coloring matter only; soluble when heated, deposited upon cooling. Negative reactions for glucosides and alkaloids.

b². Insoluble in dilute sulphuric acid.—Entirely soluble in dilute ammoniac hydrate, reprecipitated upon the addition of an acid. This was considered to be an acid resin; it was thoroughly washed and its characteristics noted as follows: Blackish-brown color, brittle, lustrous,

opaque in mass, translucent in scales. Odor and taste similar to that of parched coffee; concentrated alcoholic solution has an acid reaction. Insoluble in cold water, ether, benzol and dilute acids; soluble in boiling water (reprecipitated upon cooling), alcohol and alkalies. Concentrated sulphuric acid dissolves it slowly ; the solution is dark-brown at first, assuming a pinkish hue around the edges upon standing.. Ferric salts give a black precipitate not unlike that produced by tannin. Its solution in alcohol is wholly precipitated by an alcoholic solution of acetate of lead, the precipitate being of a yellowish color at first, but changes to a dark-brown. The resin is dissipated at a red heat, and when boiled with dilute sulphuric acid, the solution treated with barium carbonate to get rid of the acid, the resulting solution does not reduce Fehling's solution—proving that the substance is not a glucoside.

B. INSOLUBLE IN ABSOLUTE ALCOHOL.

c. Soluble in water.

c¹. Precipitate by subacetate of lead.—Coloring matter only.

c². Filtrate from precipitate by subacetate of lead.—The excess of lead was precipitated by hydrosulphuric acid, the filtrate boiled, divided into three portions, two of which were tested for alkaloids and gluco-sides with negative results. The third, portion was evaporated to dry-ness. A crystalline substance of an amber color remained, which, upon analyzing proved to be sodium and potassium salts together with a little organic matter.

d. Insoluble in water.

d¹. Soluble in dilute sulphuric acid.—Coloring matter only.

d². Insoluble in dilute sulphuric acid.—A. small amount of “extractives” and color substances remained.

The drug previously exhausted with benzol and alcohol was exhausted with distilled water. An aliquot part of the aqueous solution was evaporated to dryness and the per cent. extracted by water estimated, which amounted to 4.85. The reserved solution yielded, with alcohol, a gummy precipitate which, with ammonic oxalate, was found to contain calcium. Coloring matter was also extracted by water.

The drug remaining after the above treatment was free from odor and taste, so it was not thought necessary to carry the analysis further.

A decoction of the fresh bark gave a blue reaction with solution of iodine in potassic iodide, indicating the presence of starch. The absence of starch granules in the microscopical sections is due to the fact that the bark from which they were made was previously repeatedly boiled with water to clear the tissues.

The bark treated with solution of potassic carbonate (to extract the organic acids) yielded an extract containing an oxalate, but free from malates and tartrates.

The fresh bark, when distilled with water, yielded a volatile oil, which, when first distilled has a disgusting odor resembling very much the odor of bed-bugs, but when the distillate is treated with ether, the ethereal solution allowed to evaporate, the oil remaining left in contact with the air for twenty-four hours, it acquires a pleasant odor, distinct in itself.

Recapitulation.

1. Moisture: 6.95 per cent.							
2. Ash: 13.85 per cent.	<table border="0"> <tr> <td style="border-right: 1px solid black; padding-right: 5px;">Sol. in H₂O. 16.967 per cent. (K and Na together with the radicals of H₂SO₄, HCl and H₃PO₄).</td> <td></td> </tr> <tr> <td style="border-right: 1px solid black; padding-right: 5px;">Insol. in H₂O. Sol. in HCl. 74.007 per cent. (Al, Ca and a trace of Na with radical of H₃PO₄).</td> <td></td> </tr> <tr> <td style="border-right: 1px solid black; padding-right: 5px;">Insol. in H₂O, and HCl. Sol. in Na OH. 9.025 per cent. (Silica).</td> <td></td> </tr> </table>	Sol. in H ₂ O. 16.967 per cent. (K and Na together with the radicals of H ₂ SO ₄ , HCl and H ₃ PO ₄).		Insol. in H ₂ O. Sol. in HCl. 74.007 per cent. (Al, Ca and a trace of Na with radical of H ₃ PO ₄).		Insol. in H ₂ O, and HCl. Sol. in Na OH. 9.025 per cent. (Silica).	
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3. Benzol extract: 6.36 per cent.	<table border="0"> <tr> <td style="border-right: 1px solid black; padding-right: 5px;">Consisting of volatile and fixed oils, resin, wax and butyric acid.</td> <td></td> </tr> </table>	Consisting of volatile and fixed oils, resin, wax and butyric acid.					
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4. Alcoholic extract: 23.87 per cent.	<table border="0"> <tr> <td style="border-right: 1px solid black; padding-right: 5px;">Tannin, glucose, an acid resin, "extractive" and coloring matter.</td> <td></td> </tr> </table>	Tannin, glucose, an acid resin, "extractive" and coloring matter.					
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5. Cold water extract: 4.85 per cent.	<table border="0"> <tr> <td style="border-right: 1px solid black; padding-right: 5px;">Gum and coloring matter.</td> <td></td> </tr> </table>	Gum and coloring matter.					
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6. Decoction:	<table border="0"> <tr> <td style="border-right: 1px solid black; padding-right: 5px;">Starch, etc.</td> <td></td> </tr> </table>	Starch, etc.					
Starch, etc.							
7. Potassic carbonate extract:	<table border="0"> <tr> <td style="border-right: 1px solid black; padding-right: 5px;">Oxalates, etc.</td> <td></td> </tr> </table>	Oxalates, etc.					
Oxalates, etc.							
8. Distillation with water:	<table border="0"> <tr> <td style="border-right: 1px solid black; padding-right: 5px;">Volatile oil.</td> <td></td> </tr> </table>	Volatile oil.					
Volatile oil.							

Medical Action and Uses.—Rhus aromatica was introduced to the profession at large in the spring of 1878 by Dr. J. F. McClanahan, of Boonville, Mo., as "a remedy highly useful in the treatment of *diabetes, enuresis, hcematuria, uterine hemorrhages, menorrhagia* and other excessive discharges, accompanied by a relaxed condition of the uterus,

diarrhoea and other atonic diseases of the bowels." Drs. John Gray and F. McClanahan had used this remedy extensively in their practice in such cases as above mentioned with marked benefit, but left it for the son to bring before the public. Since its introduction many physicians have tested its virtues, and their statements corroborate those of the discoverers. That it is an efficacious remedy in the treatment of *enuresis* there can be no doubt, for the author of this essay has seen it tried with success in several cases. A tincture containing the oleoresin, acid resin, gallotannin and extractives of the crude drug and representing 4 troy-ounces to a pint of stronger alcohol may be made by macerating the ground drug in the menstruum for seven days, with frequent agitation and then percolating until one pint of tincture is obtained. It is obvious that preparations of *Rhus aromatica* should not be mixed with solutions containing salts of iron.

The dose of the powdered drug is from 20 to 60 grain (gm. 1/3 to 4.0); the fluid extract 5 to 40 drops (gm. .3 to 2.5); the tincture 20 drops to a teaspoonful (gm. 1.0 to 4.0) given in water and repeated as often as necessary. As a topical remedy to control hemorrhage a decoction of the bark will be found efficacious.

In conclusion, I desire to state that the process followed in the chemical investigation was the one reported by Mr. Henry B. Parsons in the "American Journal of Pharmacy," 1880, p. 210; the analysis was made in the laboratory of the Philadelphia College of Pharmacy, under the supervision of Prof. J. M. Maisch and Dr. F. B. Power, and I am indebted to Mr. F. L. Slocum for the use his of microscope, with which I have been enabled to produce the drawings of the sections.

NOTES ON THE XANTHORRHOEA RESINS.

BY JOHN M. MAISCH.

Read at the Pharmaceutical Meeting, April 19.

At the last pharmaceutical meeting a resin was exhibited under the name of *gum acroides*, and it was stated to be a new Australian product. Shortly afterwards, during a visit to New York, I made some inquiries in relation to this supposed new commercial article and was surprised to learn that at one wholesale drug house it had been in stock fully ten years ago, and subsequently I learned from Mr. Chas. Bullock that a

quantity of the same article had been on hand at the store formerly kept by Mr. Daniel B. Smith more than a quarter of a century ago. It was evident from the information received that the resin was not a new article in this country, and on examination numerous notices of it were found, from which it became evident that the appellation *acroides* is a corruption of *acaroides*, and that the resin is identical with Botany Bay resin, which name is better known, at least to the writer. Dunglison's dictionary says of the genus *Xanthorrhoea*: "There are several species. Two resins are obtained from them; one, the *yellow resin of Xanthorrhoea* or of *New Holland*, *resina lutea Novi Belgii*, *Botany Bay resin* or *gum*, *ac'aroid resin* or *gum*, *resina vel gummi acaroi'des*, which probably resembles tolu and storax in medicinal properties; the other, the *red resin of Xanthorrhoea* or *blackboy gum*."

This quotation gives the various synonyms of the substance in question and points also to its origin. A tolerably full account of it and the allied resin or resins may be found in Pereira's *Materia-Medica*, in Guibourt's *Drogues simples*, etc. The following notes are compiled from these and other sources.

The genus *Xanthorrhoea* belongs to the natural order of *liliaceæ*, is confined to Australia and consists of shrubby or arborescent plants, somewhat palm-like in appearance and having at the summit dense tufts of very long, wiry, narrow, two-edged or somewhat triangular leaves, resembling grass leaves; hence the name *grasstrees*, by which the species are known in Australia. The leaves are used as fodder for cattle, and the somewhat sheathing base of the inner leaves and the buds are eatable and form, particularly when roasted, an agreeable article of food. From the centre of the leaf tuft there rises a long cylindrical scape, which terminates with a long spike of small white flowers situated in the axils of the imbricate bracts and producing triangular three-celled capsules, containing flatfish, hard, black seeds.

R. Brown (1810) described seven species, viz.: *X. arborea*, *australis*, *hastilis*, *media*, *minor*, *bracteata* and *pumilio*. The two first-named species are arborescent, while the third and fourth have short stems, that of *X. hastilis* being about four feet high, and is said to sometimes attain a diameter of one foot and then to be probably more than a century old, owing to its slow growth. The last three species named before are stemless, i. e., the stems remain buried in the soil or rise scarcely above ground.

All the species abound in a resinous juice which, on exposure, hardens and as obtained from the different species, undoubtedly differs in appearance and also in composition. Guibourt distinguishes three xanthorrhoea resins—one yellow, one brown and one red. The dark-colored resin is still ascribed by some authors to *X. hastilis*, but Drummond (1840) pointed out that an arborescent species, probably *X. arborea*, is in Australia called *black boy*, and the Pharmaceutical Society of Victoria state that *X. australis* (which is arborescent) yields a large quantity of a brilliant ruby-colored resin. On the other hand, the botanist Smith refers the yellow resin to *X. hastilis* and some other species. The last named is the *X. resinosa* of Persoon, and of it *Acaroides resinifera* is quoted as a synonym in Gray's Supplement. The name acaroid resin is thus explained. The different xanthorrhoea resins have been described more especially in regard to their uses in papers by Mr. Bedford as a polishing material in "Amer. Jour. Phar.," 1863, p. 453, 454, and by Mr. P. L. Simmonds, in the same journal, 1857, p. 226 to 228, and in 1866, p. 465 to 468; the papers last quoted refer chiefly to the use of the resin in the manufacture of illuminating gas. The resins seem to be obtained as natural exudations, the subterraneous portions of the plant producing them in some species, at least, apparently in great abundance; but resin is also found covering the base of the leaves and it is secreted in such quantity in the woody stems that after crushing the latter it may be sifted from the chips to the extent of a hundred-weight per diem by one laborer.

The *acaroid resin* which was first noticed in 1789 by Governor Phillips (Voyage to Botany Bay) is met with in tears and in large masses usually, on account of its brittleness, broken into irregular pieces. It is intermixed with portions of wood, stalks, earth, etc., and when fractured has a speckled or granitic character. The pure resin is reddish yellow; the commercial article is externally brownish yellow, and internally opaque and of a pure yellow color, resembling that of gamboge, but always much lighter. This color description by Guibourt agrees with the sample presented here; but since the resin is described by some authors as being of a deeper yellow than gamboge, it is evident that it must be sometimes collected from different species. Triturated with water, it does not form an emulsion. When fresh it has an odor analogous to that of poplar buds, but much more agreeable (Guibourt); to us the odor appears to approach very nearly that of benzoin mixed with a little storax. By age the odor becomes weaker and gradually disappears, but

it is always developed on powdering or by fusion. The resin dissolves in alcohol, leaving only 0.07 of a gum insoluble in water and analogous to bassorin. When heated it gives off white vapors, condensing into brilliant small laminae, which Laugier regarded as benzoic acid, but which Stenhouse (1848) found to consist largely of cinnamic acid.

The *brown resin* has a more balsamic odor than the preceding; the tears are roundish, externally deep red-brown and resembling dragon's blood; but the fracture is shining, glass-like, and in thin splinters it is perfectly transparent and of a hyacinth-red color. It is completely soluble in alcohol and contains more volatile oil, rendering it viscous and somewhat adhesive.

The red resin is in distinct tears of a deep brown-red and sometimes externally bright red; its fracture is glass-like; thin splinters are transparent and ruby-red; it is completely soluble in alcohol, the ligneous intermixtures excepted, and its balsamic odor becomes always apparent on heating.

Regarding the composition of the Xanthorrhoea resins, Pereira quotes the analyses of Lichtenstein (1799), Schrader, Laugier, Widman (1825), Trommsdorff (1826) and Stenhouse (1848). Heated with manganic binoxide and sulphuric acid acaroid resin evolves the odor of oil of bitter almonds, and by the action of nitric acid it yields a large proportion of carbazotic (picric) acid with little nitrobenzoic and oxalic acid (Stenhouse). Trommsdorff found the volatile oil to be colorless, fragrant and of a pungent aromatic taste. The resin is soluble in solutions of the alkalis and alkaline earths. On dry distillation much carbolic acid is obtained, with a small quantity of a light oil, but according to Sommer no umbelliferon. In 1866, Hiasiwetz and Barth ascertained that acaroid resin on being treated with fusing potassa yields large quantities of paraoxybenzoic acid, and from the mother-liquor of the ethereal solution a little resorcin and pyrocatechin was obtained, together with the double compound of protocatechuic and paraoxy benzoic acids — $C_{14}H_{12}O_7 \cdot 2H_2O$, which had been previously obtained from benzoin.

Three different xanthorrhoea resins were found by Hirschsohn (1877) to be incompletely soluble in chloroform and ether, but to dissolve completely in alcohol, the solutions acquiring a brown-black color with ferric chloride. The solution of the acaroid resin is yellow and yields with lead acetate a precipitate, while the solutions of the other two resins are

red, that of *X. quadrangulare* being not disturbed by acetate of lead, while that of *X. arborea* produces with the same reagent a turbidity; the chloroformic solution of the latter is yellow, that of the former colorless.

The xanthorrhoea resins have been repeatedly suggested as possessing some value in perfumery; but they appear to be inferior for this purpose to benzoin, storax and the balsams of Peru and Tolu. Their medicinal properties appear to be likewise not well marked. As early as 1795 acaroid resin was said by Kite to neither vomit, purge nor bind the belly, nor to act materially as a diuretic or diaphoretic. Dr. Fish ("Boston Journal," x, p. 94) employed it in the form of tincture with opium in fluxus hepaticus and the colliquative diarrhoea of phthisis, and it has been recommended in chronic catarrhs. A tincture of acaroid resin, which has been given in doses of 1 - 2 drams, mixed with milk or a mucilaginous liquid, has been recommended to be made of equal weights of the resin and alcohol, and according to another formula of resin 2 ounces to alcohol 16 ounces. If used at all, the latter formula would appear to furnish a preparation of proper strength.

ON QUEBRACHO BARK.

BY PROF. ED. SCHAER.

Translated and abridged from "Archiv der Pharmacie," Bd. xv, pp. 81 to 102, Feb., 1881.

BY FREDERICK B. POWER.

As in the case of jaborandi, much confusion has prevailed in medical and pharmaceutical circles with relation to this new medicinal drug, which can only be prejudicial to the proper application or judgment of a possibly valuable medicament. Those interested in the subject will therefore welcome the very serviceable monograph of Dr. A. Hansen in Eriangen ("Die Quebracho-Rinde, botanisch-pharmacognostische Studie," Berlin: J. Springer), by which it has been made possible to distinguish the genuine quebracho bark from the various false barks, which have long enough maintained the field nearly alone, and by the procuration and pharmaceutical application of the genuine drug, to clear the path for rational medical experiences and judgment in regard to this novelty. The above-mentioned essay, which, besides being accompanied by several explanatory anatomical tables, contains also a series of further pharmacologically important communications, and is deserving, therefore, of special consideration in pharmaceutical circles.

In the following the most important deductions from Hansen's pamphlet will be produced, accompanied by some special notes of the author.

In regard to the derivation of the genuine quebracho bark, it is supposed to be known that it was first, in the course of the year 1878, sent by a resident German in the Argentine Republic, F. Schickedanz, together with other products of the country, to Erlangen, with the observation that the bark had served for a long time in those districts, and particularly in Tucuman and the surrounding country, as a fever remedy, and in many instances in its action was accorded an equal position with cinchona bark. While the bark sent by Schickedanz was obtained from the western portion of the Argentine Republic, where the quebracho tree is said to occur chiefly in the province of Santiago and in the district of Catamarca, it appears, according to other reports, to occur also in neighboring Chili, and may possibly be also found in Bolivia and some districts of southern Brazil.

The above-mentioned quantitatively not significant export was subjected to a double seizure, as simultaneously a chemical examination of the drug was made in Munich, and a series of therapeutical experiments with pharmaceutical preparations of the bark performed by Dr. Penzoldt in Erlangen.

The result of the chemical examination was the isolation of an alkaloid, aspidospermia, by Fraude (see this journal, 1879, p. 192), who, supported by the composition ($C_{22}H_{30}N_2O_2$) and the chemical behavior of this new vegetable base, proved on the one hand its close relation to quinia, and on the other to strychnia.

The medico-clinical experiments, without indeed confirming a decided anti-febrile action, led to the discovery of its beneficial properties in difficulty of respiration, which had not remained unknown in the native country of the bark, and after the declaration of these results there soon followed from medical and pharmaceutical sections a demand for quebracho bark. In consequence of the difficulty of quickly procuring the genuine drug the supplies were much less than the demand, and as the result of a deficiency of knowledge in regard to its true derivation, various substitutes were created leading to manifold contradictions in regard to the medicinal activity of quebracho bark, which, for nearly two years, had partially found application in the form of two or three

other barks, without any certain knowledge prevailing as to their spurious nature.

A very essential part in the confusion with regard to quebracho bark is due to the circumstance that in South America, and particularly in the southern districts, the name "Quebracho" (the etymology of which is derived from the Spanish words "quebrar" [to break] and "hacha" [axe]) is a common designation, a peculiar vulgar name for various heterogenous trees with very hard wood, whereby occasionally the different species of wood and the trees from which they are derived are given in addition thereto, and further distinguished by special adjectives as "blanco, flojo," etc. But even these more complete designations can serve by no means as a criterion, and may vary with the country or province. While the genuine quebracho bark is derived from the apocynaceous *Aspidosperma quebracho*, Schlechtendal, in the western part of the Argentine Republic at least two other trees, a Terebinthacea and an Ilicinea, are designated as "Quebracho," the former with the surname "Colorado" and the latter with the attribute "flojo" (soft, loose), the tree *Aspidosperma quebracho* being known as "Quebracho blanco," and, according to the trustworthy statement of Professor Hieronymus of Cordoba., exclusively so. It was chiefly the tree known in the Argentine Republic as Quebracho Colorado which was confused with the Quebracho blanco, and the bark and wood of which was medicinally applied in Europe as "Quebracho" instead of the original Q. blanco bark, the two plants appearing to be closely connected both in relation to their history as also in their technical application.

Both trees, the "blanco" as also the "Colorado," were signalized by former travelers in the La Plata States, particularly by Burmeister, who, however, considered the two Quebrachio trees as simple varieties, which were distinguished to some extent by the form of the leaf, and particularly by the color of the wood. The portion of the white quebracho sent by Burmeister to Europe induced Schlechtendal to determine the species, which he accordingly named "*Aspidosperma quebracho blanco*" and, misled by the relationship of names, he connected the red quebracho tree as a further species with the name of "*Aspidosperma quebracho Colorado*."

It was more than ten years later that this error was corrected by the publication by Grisebach of the "Plantse Lorentzianse" (a revision of the Argentine plants collected by Prof. Lorentz in Cordoba), and, at the

same time, reported that the Q. Colorado plant, supposed to belong to "Aspidosperma," was a Terebinthacea, and related to the genus "Anacardium." It thereby received a correct description and the botanical name "*Loxopterygium Lorenzii*, Orisebach."

From a technical view, it remains to be said that the wood of both trees, Q. blanco and Q. Colorado, is employed in South American countries for tanning purposes, and has repeatedly figured as such at the world's expositions. The very small amount of tannin contained in the aspidosperma wood (about 3 per cent.) does not permit of its competition with other similar materials, while the loxopterygium wood, with 15 to 20 per cent. of tannin, was introduced some time since into Europe, where it is employed either in the rasped condition or in the form of extract. As this tanning wood occurs in trade under the simple name of quebracho wood, its substitution for the preparations of the bark and wood of Q. blanco, as recommended from Erlangen, was not difficult, and the above-mentioned extract of the Q. Colorado wood was therefore also drawn into medicinal use.

The mother-plant of the genuine quebracho bark *Aspidosperma quebracho*, Schl., is connected with other likewise South American aspidosperma species, amounting in number to as many as 40, and is described as a high, perpendicular tree, with a finely branched summit, the habitus of which is said to resemble the crown of the weeping willow.

The leathery, smooth, lanceolate leaves, whose points terminate in a spine, are arranged to the number of three on each branch. The dichotomously-branched inflorescence shows flowers with a calyx composed of five sepals and a five-partite corolla, five anthers, one style and a superior ovary.

The Quebracho blanco bark from the Argentine Republic, as it occurs in commerce, appears to consist of pieces from the older trees, about 70 years of age, and shows an average thickness of 2 centimeters. Less frequently younger barks are found with a very moderately developed periderm, or the latter even entirely wanting.

The most striking peculiarity in the outer structure of the quebracho bark is the relatively exceedingly strongly developed cork, which penetrates very deeply into the bark, often to the extent of over one-

half. Upon a cross-section of pieces of the bark a boundary line passing approximately through the middle of the bark separates very distinctly the two portions of tissue, the cork and the unchanged bark tissue, which are also sharply distinguished by their color and internal structure. The lens permits of recognition on a cross-section of the cork, the outer surface of which is grayish, or in scarified places reddish, a yellowish-red fundamental mass with tangentially penetrating serpentine lines, differing in color, and between the same plainly evident white points. The inner cortical layer consists for the most part of a light brown, or occasionally also of a much lighter dirty yellow tissues, with very numerous and irregularly distributed whitish dots corresponding to those of the cork tissues.

While the outer bark, which has been converted into bork, possesses a somewhat crumbly consistence, the inner portion of the bark connected with the stem is hard and composed of long, splint-like fragments.

By a microscopical observation of the quebracho bark on a cross section, the outer cortical tissue shows in a marked degree the structural relations which appear in the preponderating cork. In the parenchymatous tissue with brown, often carmine colored cell walls, the above indicated secondary corky layers appear, consisting of uniform rows of smaller, almost colorless cells, and between the same the white points or grains, which are at once recognized as sclerenchyma, or groups of strongly thickened cells, with a small lumen. A very similar structure is shown by the inner cortical layer, situated between the bork and the cambium, although deviating somewhat in the coloration of the cellular tissue; and here also the groups of stone cells, which microscopically form large white points, are dispersed in a brown colored, often also lighter, parenchymatous tissue containing starch, although the tangential cork bands are wanting; and of the radially extending medullary rays, in consequence of the irregular structure of this tissue only a few are plainly recognizable.

Among the mentioned sclerenchyma cells there are many which are distinguished from the others by a particularly uniform circular outline of the cross section, and are, in part, combined with them in groups or occur isolated throughout the bark. These peculiar cells, which aggregate particularly in the inner portion of the bark and which cause its fibrous, splint-like structure, prove themselves true sclerenchyma fibres of considerable length, and are characterized by being

surrounded by a closed integument, which consists of numerous small cells and each of which contains an oxalate crystal. These integument cells surround, as well upon the cross as upon the longitudinal section, the contour of the thickened fibres most closely, and are organically connected with them, so that the separate fibres, isolated from the tissue, present an over-surface consisting entirely of these small crystal cells.

The occurrence of these spindle-shaped fibres covered with crystal cells, accompanied by the approximately parenchymatous stone cells, which, upon a longitudinal section, appear through the cork as bright, punctate cells, is highly characteristic of the genuine quebracho bark, and a priori adapted to distinguish it from the false barks which have appeared in commerce, which is even possible with the use of a strong lens.

It may be observed that, according to Hansen, in the younger barks of the quebracho plant very deviating anatomical relations prevail. The integuments of the crystal ducts first exist after the complete formation of the sclerenchyma fibres and, indeed, from the surrounding parenchyma cells. The formation of the entire duct tissue proceeds quite slowly. Cross sections through younger barks show that nowhere a ring of cells containing crystals surrounds a younger fibre, but that this is closely surrounded by the parenchyma cells of the cortical tissue.

The author subsequently considers the microscopical structure of the wood of quebracho, which, in the case of the true *Q. blanco*, like the bark, possesses some medicinal activity, although to a very slight extent, and together with the wood of *Q. Colorado*, on account of its extreme hardness, is much employed in its native country for building purposes.

In consideration of the most important false quebracho barks which have served as substitutions for the *Aspidosperma* bark there is to be mentioned, in the first place, a bark which has been much sold and applied as quebracho, although deviating so much from the true *Q. blanco* bark that its continued substitution is scarcely to be thought of. The bark in question was soon recognized as belonging to the genus *Oroton* (Euphorbiaceae) by Pohl, and was afterwards identified by Hansen as copalchi bark, which was long known in the drug market, although now obsolete in pharmacy; it belongs to the group of cascarilla barks and is derived from the Mexican *Croton pseudochina*, Schl.

(*Croton niveus*, Jacq.). As is known, the copalchi bark agrees with this false quebracho by occurring in tubular pieces several inches long, provided with a grayish-white powdery periderm, and varies in thickness from $\frac{1}{2}$ to 2 lines. The cross section of the bark shows with the lens a structure entirely different from the *aspidosperma* bark, i. e., a homogenous yellowish-white outer bark, and a brown bast portion, which, by means of the small bast bundles becoming pointed towards the periphery assumes a flame-like appearance. Moreover, the croton bark possesses a spicy odor and taste, which is not present in true quebracho. Another bark of undetermined botanical derivation consists of dark-brown pieces with a grayish or gray-brown cork layer, and shows many furrows on the inner side, without, however, possessing a similarity with *aspidosperma* bark. The same may be said of a bark of unknown botanical derivation, which as "Cortex Quebracho verus" has been sold at a high price, and has been found by Hansen to differ from all previous quebracho varieties. This bark, which is also distinguishable from the *aspidosperma* by a microscopical examination, consists of pieces from 1 to $1\frac{1}{2}$ inch in thickness, of a brown color and firm consistence, characterized by numerous light-colored cork bands on a cross section, and with a slightly developed inner bark. It appears to contain a large amount of tannin, but does not possess the remarkable bitterness of the genuine quebracho bark. Finally, the bark of the Q., Colorado tree appears occasionally to have taken the place of the "Q. blanco" bark, although it can hardly be confounded with the true quebracho.

The Q., Colorado bark is of a brown or dark-brown color on the exterior and possesses frequently a covering of lichens. The cross section is light-brown and shows concentric darker cork bands, as also light radially extending lines, which prove to be the medullary rays. Between these latter uniformly arranged groups of sclerenchyma fibres are situated, which groups, several in number and standing behind each other, impart to the bark a checkered appearance. Although these fibres show a structure similar to the crystal-covered fibres of the *aspidosperma* bark, they are, however, considerably smaller and are situated not alone, but, as stated, in bundles of nearly right angular form. By the use of a lens, or by microscopical examination, the bark of Q. Colorado may thus be easily distinguished from the Q. blanco, even when the difference in taste is not considered;

In concluding his valuable review of quebracho bark the author gives also a sketch of the development of the chemistry of the subject, for the

principal results of which the reader is referred to abstracts in this journal (1879, p. 192 and 554-557), as also to the more recent contribution of O. Hesse, contained in the last number.

CULTIVATION OF RHUBARB IN FRANCE.

The cultivation of *Rheum undulatum* and *R. rhaponticum* has for some time past been carried on profitably at Clamart, near Paris, and the products of both plants, as so cultivated, are confounded in commerce under the name of French rhubarb. Recently, M. Gallais has been making some experiments in the cultivation of *Rheum officinale* at Ruffec, in the Charente department, and he has communicated his manner of proceeding and results to the Paris Société d'Acclimatation.¹

In the selecting of a suitable spot for the experiment, M. Gallais states that he was guided by the following considerations: The *Rheum officinale* grows in Asia, between the 30th and 39th parallels of latitude, at an elevation of 4,000 feet above the sea level. The isothermal line of 12.9° of temperature passes by Peking, of which the latitude is 39° 54' 13" N., and above Milan rises to latitude 45° 54', running to the west of Europe. By taking this isothermal line and adding half a degree of temperature for each degree of latitude towards the south, and deducting one degree of temperature for each 172 meters of elevation above the level of the sea, he arrived at the conclusion that in the natural habitat of the plant the average climatic temperature was 19° in summer and zero in winter. Ruffec, the place where M. Gallais' experiment has been carried on, is situated in latitude 46° 11" N., longitude 2° 8' 17" has an average temperature of 17° C. in summer and 1.2°C. in winter, and is at an elevation of 96 meters above the sea level.

According to the analyses of Fremy and Pelouze, the rhubarb plant is rather rich in potash and sulphuric acid, less so in silica, more or less rich in lime, and rich in phosphoric acid. The soil at Ruffec is calcareous, sandy and very nitrogenous, being composed partly of sands proceeding from old degradations. These sands contain a considerable abundance of silicious and aluminous matters. The soil is very permeable, requiring during the summer months about 5 cubic meters of water per acre.

M. Gallais commenced operations with a plant obtained from Dr.

¹ "Bulletin" [3], vol. vii, p. 667.

Giraudeau, which, in its turn, was derived from the original plant grown in the Botanical garden of the Paris Medical School, from which the species *Rheum officinale* was described by Professor Planchon in 1872.²

The plant cultivated in the shade, with a northern exposure, and in moist places, developed a luxuriant vegetation, both in the size of its root and the amplitude of the leaves. But the product under such conditions appears to have been of doubtful quality.

Whilst working upon the plant in the spring a very short stem was noticed, appearing like a ball covered with black scales, from which issued in the first days of March an enormous bud, resembling, both in size and color, a hen's egg. This bud gradually developed and gave off leaves, which in the first year of the plantation attained a diameter of 1 meter.

In the month of June, desiring to develop a vigorous vegetation whilst preserving the medicinal principles, M. Gallais dressed each of the plants with 100 grams of Peruvian guano. Being freely watered, the root then grew considerably and formed upon every side axillary buds, which produced in their turn leaves that were smaller than those which issued from the parent stem. Such buds, in developing, give rise in the prolonged stalk to changes which, upon section, become apparent as the marblings that are held as characteristics in commerce, and are the work of nature only. The plant was left during the second year, with only such attention as was necessary, to gather strength and to allow its cellular structure to become more compact by the concentration of its particular juices.

The collection was made at the end of the second year; in the case of the plant growing spontaneously, the Chinese are said not to make a collection until the end of the sixth year. The art of cultivating this plant for medicinal purposes, M. Gallais considers to lie not only in assisting the growth of the plant, but in favoring the development of the active principles, so that the plant may arrive in a couple of years at the age which, when growing wild, it attains in six. The known characters of French rhubarb he attributes to the collection having been made before the plants had arrived at maturity. As to reproduction, M. Gallais has obtained the best results with offshoots. At Ruffec the plant seeds with

² See "Pharmaceutical Journal" [3], vol. iv, p. 690.

difficulty in the second year, and its, cultivation from seeds is not always successful, especially in rainy and cold seasons.

Every second year, in July or August, according to the season and the growth of the plant, the roots or prolonged stems were collected, and from these stalks a considerable number of offsets or buds were separated with a knife. The offshoots were then planted quincuncially in well-prepared soil, with a clear interval of a meter between each. As soon as the rainy and cold season set in these offsets commenced to develop, and continued during the autumn, forming rounded roots, which have supported the severest cold of the district, reaching 13° below zero.

Last year M. Gallais possessed eighteen plants, which, when pulled up, cleansed and dried, yielded 28 kilograms of product, described as being of good quality, and samples of which were exhibited to the Society. The gathering and drying, however, are looked upon by M. Gallais as more important operations than even the cultivation.

In the month of August the leaves of the plant become completely dry, and a period arrives when usually the soil surrounding the stem cracks and exposes the enormous roots. It is just at this time of apparent stagnation that M. Gallais pulls up the roots and "divides them most artistically into pieces to imitate those imported, whether from Tartary, Russia or Persia." These pieces are cleansed carefully and thrown at once into clean water that has been acidulated by some vinegar or a few drops of sulphuric acid, in order to prevent their becoming blackened or taking a bad color through exposure to the air. After a momentary immersion they are drained on hurdles and placed immediately in a stove at a temperature of 30°C. This operation has for its object to form a hard casing around the pieces, to compress the juice and to prevent mouldiness and consequent fermentation. After some days of continued drying, the pieces are strung upon cords so as to form large chaplets, and these are hung in a bake-house or kitchen chimney, or, when the quantity makes it worth while, in a stove. It is said that the Tartars attach small chaplets of rhubarb to the horns of their goats and sheep, and thus dry them by exposure to the sun's rays. M. Gallais thinks, however, that another account is more correct, which says that the rhubarb, cut into fragments and cleansed, is placed by the natives upon slowly heated stones, and carefully turned from time to time, being afterwards strung to complete the drying process. He is inclined to

believe, however, that a quicker drying would be preferable, and proposes to place some of his next yield in an oven immediately after the removal of the bread.

Last year M. Gallais made the experiment of drying the root in the sun, but the result was not satisfactory. The thick pieces dried slowly and became completely decolorized, instead of retaining their dirty yellow tint, whilst the cellular tissue underwent a considerable alteration, due to a slight fermentation. M. Gallais considers that these alterations would be prevented by a rapid drying, and the juice being concentrated in the interior of the piece its aroma would be preserved, whilst the pieces would consequently acquire a commercial value in proportion to their thickness.

M. Gallais' operations have as yet been carried on upon a limited scale, but he makes an estimate in which he values the product at six francs per kilogram, from which it would appear that the cultivation could be carried on profitably.—*Phar. Jour. and Trans.*, March 12.