AMERICAN JOURNAL OF PHARMACY
Volume 67, #6, June, 1895

Botanical Medicine Monographs and Sundry

AN EXAMINATION OF COMMERCIAL FLUID EXTRACTS.

BY FREDERICK W. HAUSSMANN.

Every pharmacist who has handled fluid extracts obtained from different manufacturers, must have noticed the variation in their physical properties, as pertaining to color, odor and taste, and also as shown in their miscibility with water or other liquids.

These variations, which were in a number of instances of a striking nature, induced the writer to make a series of examinations, not primarily regarding their chemical composition, such as the alkaloidal percentage, but more particularly the menstruum, as compared with that required by the Pharmacopoeia, and also to determine the causes which led to the differences mentioned in their physical properties.

The first feature to which our attention is called, lies in the various shades of color which are frequently observed in fluid extracts prepared from the same drug.

Due to the high degree of heat at which some fluid extracts are evaporated, variations in odor and taste are also noticeable at times. Extracts whose properties are due to volatile principles, such as buchu, cubeb, eucalyptus, etc., are liable to be affected in this manner.

The physical condition of fluid extracts, as regards their fluidity, varies considerably, and in this respect, as probably in no other, the preparations of some manufacturers are characterized.

Some we find of a decidedly syrupy consistence, especially those with a low alcohol percentage, while others are more approximate to the pharmacopoeial products. These variations may be partly due to differences in the physical properties of crude drugs, but in many cases also to the tendency of some manufacturers to economize that most important menstruum constituent, alcohol. Unfortunately,. specific

gravity is no criterion of the alcohol percentage of fluid extracts.

It is true, that an extract of a high specific gravity, for which the Pharmacopoeia directs a largely alcoholic menstruum, must be regarded with suspicion, but it does not furnish the means to determine the alcohol percentage of the employed menstruum with any degree of accuracy.

While handling a number of commercial fluid extracts, the high specific gravity of some, contrary to his experience with the same official fluid extracts, induced the writer to determine their alcohol percentage.

Taking the menstrua of the Pharmacopoeia as the standard authority, with which the manufacturer, as well as the pharmacist, should comply, comparisons were made between the alcohol percentage found and that required. The extracts examined were taken at random from the preparations of different firms, and regarded as representing the respective average percentage of their preparations. The following table gives the results obtained :

Fluid Extract.	Sp. Gr.	Pharmacopœial Menstruum in Alcohol Percentage by Volume of Official.	Alcohol Percentage Found.	
			Weight.	Volume.
Buchu	·885	Alcohol.	76	82
Buchu	·956	"	56	64
Cimicifuga	·873	"	76	82
Cubeb	·882	"	73	80
Rhubarb	1·0095	80	55	63
Serpentaria	·9255	80	61	69
Calumba	1·042	75	34	41
Senega	1·0085	75	43	51
Chirata	·989	66	38	45
Digitalis	1·008	"	43	50
Phytolacca Root.	·9855	"	51	59
Hydrastis	1·080	60	26	31
Gentian	1·0985	50	27	32
Rhamnus Pursh.	1·052	"	12	15
Senna	1 080	"	25	31
Stillingia	·9855	"	36	43
Taraxacum	1·103	"	12	15
Glycyrrhiza	1·0395	30	23	28
Sarsaparilla Comp.	1·0465	"	6	7
Triticum	1·1296	25	17	21
Prunus Virginiana	1·1025	—	30	36

In the last-mentioned extract, the exact alcoholic percentage of the menstruum cannot be stated, as the Pharmacopoeia directs the drug to be macerated with a mixture of water and glycerin, to be followed by percolation with a mixture of 85 parts alcohol and 15 parts water.

The largest percentage of alcohol in fluid extracts, whose menstruum consists entirely of that liquid, was found in F. E. Cimicifuga, the smallest in F. E. Buchu.

The two samples examined of the latter were from different manufacturers, and a glance upon the table will reveal a decided difference in their respective alcohol percentages. Fluid extracts for which the Pharmacopoeia directs a menstruum of 2 parts of alcohol to 1 of water, contained a comparatively larger alcohol percentage than those for which the same authority requests an alcoholic menstruum of 3 parts of alcohol to 1 part of water. F. E. of Calumba, which belongs to the latter class, was found to contain only 34 per cent. of absolute alcohol, while F. E. Phytolacca, representing the former, contained 51 per cent.

A small alcoholic percentage was also found in a syrupy F. E. Hydrastis.

Remarkable variations were found in fluid extracts with a supposed to-be diluted alcohol menstruum. The largest percentage found was in F. E. Stillingia, 36 per cent., which is closely approximate to the pharmacopoeial requirement.

F. E. Cascara Sagrada and Taraxacum contained only 12 per cent. of alcohol, by weight.

Compound F. E. Sarsaparilla, with a menstruum of 30 per cent. of alcohol, was found to contain 6 per cent., by weight, while F. E. Glycyrrhiza, with the same alcoholic menstruum percentage, contained 23 per cent.

GLUCOSE IN FLUID EXTRACTS.

The syrupy condition of some commercial fluid extracts, and the sweet taste, occasionally observed in preparations from bitter or acrid drugs, induced the writer to determine the percentage of glucose, or, what is perhaps a more correct statement, an allied substance, which likewise

has the property of giving the various glucose reactions.

In addition to this, the negative result experienced in some instances, where the preparations were made from drugs, which are not stated to have an appreciable saccharine percentage, or whose sugar, if present, is stated not to possess the power of reducing Fehling's solution, was also the basis for these examinations.

Such was, for instance, found to be the case with several samples of F. E. Gentian, which showed by repeated examination the presence of 5 per cent. of a substance corresponding to glucose in every respect.

According to published authorities, gentianose, the sugar present in gentian root, does not reduce Fehling's solution. This has not been the writer's experience, either in the commercial fluid extract or in a sample which was prepared strictly according to the phar-macopoeial directions. The remarkably high sugar percentage of some fluid extracts prepared from ranunculaceous plant drugs, which, on comparison with similar official fluid extracts, showed a vast difference, was likewise another reason for this investigation.

Glucose is a normal constituent of many plants, also laevulose, or fruit sugar, which possesses likewise the property of reducing Fehling's solution.

In the process of preparation of galenical preparations, it may also be produced by the decomposition of other compounds, such as inulin, triticin, particularly in the presence of heat. These may be regarded as being some of the natural sources of the sugar which is liable to be present in fluid extracts. Again, excessive heat in their evaporation will have the effect of caramelizing some of the constituents, which, however, by careful observation of pharmacopoeial directions, is obviated. Besides this, the claim is made, that caramel is frequently added by manufacturers of fluid extracts on a large scale, for the purpose of coloring their preparations.

The fallacious popular idea that darkness in color is an indication of strength and a criterion of quality is unfortunately also accepted by a number of pharmacists.

Caramel also has the property of reducing Fehling's solution, and forms,

in some fluid extracts, when examined for glucose, an important factor.

Glucose cannot be detected with certainty directly in fluid extracts, or liquids containing other vegetable matter. These compounds, as, for instance, tannin, have also the property of reducing Fehling's solution, and must, therefore, first be removed.

The process recommended in Dragendorff's Plant Analysis, precipitation with basic lead acetate, and subsequent treatment with sulphuric acid, was employed.

Ten c.c. of the fluid extract under examination was diluted with water to 20 c.c.

In most cases the mixture became cloudy, and filtration, until a clear liquid was obtained, was necessary.

The mixture was then precipitated with basic lead acetate solution, filtered from the precipitate and the excess of lead in the filtrate carefully precipitated by diluted sulphuric acid.

The liquid, by means of washing the precipitate with water, was made up to the original volume of 20 c.c.

As a rule the effect of picric acid test solution upon the liquid representing 50 per cent. of the fluid extract, was first noted, and also a superficial examination for glucose made by means of the picric acid and potash method of Braun with the intention of determining the necessary degree of dilution before making the volumetric examination with Fehling's solution.

A few statements must be made regarding fluid extracts in general, before quoting the results obtained. In samples containing caramel, if the same is present in considerable amount, the filtrate, after the lead and acid treatment, is of a brown color.

Caramel is not precipitated by basic lead acetate, and through this fact evidence of its presence was shown in a number of fluid extracts.

For instance, in a sample of F. E. Taraxacum, prepared by the writer according to the Pharmacopoeia, the final filtrate, after this treatment,

was almost colorless, while in several commercial specimens, similarly treated, the same was decidedly brown. A like observation was also made with F. E. Gentian and several others.

The preparations examined by the writer comprised the products of eight different manufacturing firms, the samples all being selected at random, preferring, however, those official, wherever obtainable.

The amount of glucose, or, perhaps, more appropriately, the substance which reduces Fehling's solution and gives reactions with other glucose reagents, varied considerably, some extracts showing a high percentage, while others only contained scarcely appreciable traces. Due to lack of time, the percentage was not ascertained in some, while in a number several determinations were made.

The following were the figures obtained:

(1) Twenty samples were examined of this firm, and they are arranged according to the amount of glucose found.

Five percent, and over. F. E. Taraxacum, Triticum, Gentian and Cimicifuga.

Four per cent. F. E. Cascara Sagrada. 3-5 per cent. F. E. Rheum.

2-5 per cent. Buchu, Primus Virginiana, Senna, Hydrastis, Ascle-pias.

One per cent. Grindelia Robusta, .833 per cent. Humulus and Digitalis, .5 per cent. Ipecacuanha.

F. E. Belladonna leaves, Calumba and Nux Vomica, also contained sugar in small amount, but no quantitative estimation was made.

F. E. Coca contained less than 0-5 per cent.

F. E. Cubeb, which was also examined, was found perfectly free from all saccharine matter.

(2) From this source 8 samples were examined, quantitative determinations being made in each case.

The largest percentage found was 5 per cent. in F. E. Pulsatilla ;

3.5 per cent. was found in Cypripedium; 3 per cent. in Buchu; 2.5 per cent. each in Frangula, Ipecacuanha and Pilocarpus; .5 per cent. in Rhus Glabra, while the smallest amount found was in F. E. Damiana, namely, .35 per cent.

(3) Five extracts were examined from this source.

The average glucose percentage of these preparations was small, the largest amount being found in F. E. Stillingia, which contained 1.66 per cent., the smallest in F. E. Aconite Root, which only gave indication to the extent of .1 per cent.

F. E. Dulcamara contained about 1.5 per cent.; Belladonna root, 1.25 percent.; and Eucalyptus, .625 per cent.

(4) This source furnished 5 samples.

The largest amount was found in F. E. of Phytollacca, the fruit, which was over 7 per cent.

This is, however, no criterion, as the drug contains considerable fruit sugar.

F. E. Granati Rad. Cortex gave indication of .67 per cent.; Euphorbia pilulifera, .5 per cent.

F. E. Pichi and Quebracho were also examined, and revealed but small amounts, so that a quantitative estimation was not made.

(5) Four samples were examined from this source. The largest percentage was found in F. E. Bryonia, 1.668, per cent., in Hydrangea .712, while in F. E. Xanthoxylum and Lippia Mexicana the exact amount was not ascertained.

(6) Three samples were procured from this source. The largest percentage, was found in F. E. Convallaria, which was 2.5 per cent.; F. E. Stigmata Maydis contained 1 per cent., while F. E. Belladonna Leaves showed 5 per cent.

(7) Two samples were obtained from this firm. The largest amount of glucose was found in F. E. Burdock Root, which was 5 per cent. F. E. Pimpinella contained 1.67 per cent.

(8) The two samples from this source were F. E. Coca and Humulus.

The hop fluid extract contained the largest amount, 2 per cent.; the other contained 1 per cent.

A few remarks may perhaps be not inappropriate regarding these determinations.

The remarkably high glucose percentage in some of the representatives of the Ranunculaceae, 5 percent, each in F. E. Cimicifuga and Pulsatilla, obtained, by the way, from different manufacturers, induced the writer to determine the amount of glucose in F. E. Cimicifuga, prepared by himself.

While traces of glucose were present, determinations by Fehling's solution showed the presence of less than 1 per cent.

The small amount present was also indicated by the fact that Brain's or Boettger's bismuth test, when applied, responded but feebly.

This is remarkable, as the commercial extract examined bore but little evidence of the presence of caramel. (In the pulsatilla sample, the presence of the latter was, however, very evident.)

To determine whether the process of evaporation of the final percolate produced any material change in the glucose percentage found, examination was made respectively before and after the evaporated extract was incorporated with the reserved portion, but no material difference was revealed.

Similar determinations were made with fluid extracts of gentian and rhubarb, with a like result.

Evaporation at the temperature directed by the Pharmacopoeia does not appear to produce any material change—in particular, no appreciable increase of the glucose percentage.

Comparison was also made between fluid extracts, prepared from the same drug and obtained from different manufacturers.

As already stated, considerable variation in color is frequently observable, and this is in many instances due to the presence of caramel.

Regarding their glucose percentage, some variation also exists.

In a sample of F. E. Buchu, the percentage of one sample was 2.5 ; of another, 3 per cent. The filtrate of the former, after the lead and acid treatment, was almost colorless; of the latter, a decided brown.

In F. E. Belladonna leaves the glucose percentage of one sample was .5 per cent.; of another, less than .2 per cent. Incidentally may be noticed, that the narcotic fluid extracts in general appear to contain but little sugar.

This was observed in F. E. Belladonna leaves, hyoscyamus and also in digitalis.

F. E. Coca leaves, of a deep black color, obtained from one firm, showed a glucose percentage of 1, while the dark green preparation of another firm showed less than .5 per cent.

F. E. Humulus, from one firm, strongly alcoholic, precipitating resin on dilution with water, gave indication of about .830 per cent. of glucose, while the dark brown miscible extract from another source indicated 2 per cent.

F. E. Ipecacuanha showed in one instance a percentage of .5; in another, 2.5 per cent.

Other comparisons were also made, but the above may illustrate the claim that commercial fluid extracts, as a rule, are not alike in physical properties and composition as obtained from different manufacturers.

Interesting revelations are made in some fluid extracts after subjecting them to the lead and acid treatment mentioned.

If to the final filtrate picric acid test solution is added, alkaloids, if present in the drug, will be indicated.

Among those affected in this manner may be mentioned F. E. Coca, Ipecac, Hydrastis, Quebracho, Cimicifuga, Xanthoxylum, Calumba, and a number of others.

Fluorescent compounds were revealed in the filtrates from F. E. Pichi and Hydrangea, the fluorescence in each being increased by the addition of an alkali.

Comparison was also made between commercial fluid extracts and some prepared from the same drug according to pharmacopoeial directions.

F. E. Cimicifuga has already received mention.

F. E. Gentian readily reduces Fehling's solution, both in the official and commercial preparations.

The samples of the commercial extracts examined, however, showed a glucose percentage of over 5 per cent., while the official preparation was found to contain 2.5 per cent. A like result was also found in F. E. Taraxacum.

This preparation, when made according to the Pharmacopoeia, contained between 2 and 3 per cent. of glucose, while two samples of the commercial fluid extract, showed between 5 and 6 per cent. to be present. The presence of caramel was, however, noticeable in both.

A sample of commercial F. E. Calumba gave ready indication of the presence of glucose, while the preparation made from the drug by the writer was found to be perfectly free from the same. All the available tests for glucose gave a negative indication of its presence.

F. E. Rhubarb, prepared by the writer, was found to contain about 1 per cent. of glucose.

Two commercial samples were found to contain respectively 3 and 4 per cent

A number of similar comparisons were also made, furnishing, in the

main, like results.

Incidentally it may also be mentioned that, while making the above examinations, the presence of possible metallic contamination was also inquired into. In a number of commercial samples the presence of copper was easily detected, showing that but little discrimination was used in the selection of the working utensils.

The importance of self-manufacture in this class of preparations cannot be too strongly urged upon the pharmacist, if it is his desire to comply strictly with the Pharmacopoeia.

While it is impossible for him to do so in every instance, there is no reason why he should not manufacture those frequently used, and in whose reliability he can have absolute confidence.

In commercial fluid extracts his only authority is the manufacturer's statement upon the label.

STRUCTURE OF SASSAFRAS.

BY EDSON S.. BASTIN.

This American tree is the only living species of its genus, though the fossil remains from the cretaceous rocks of our Northwest prove that there were once several at least, and probably the genus was once as abundant in species as are now the oaks. This species has probably persisted beyond its congeners by reason of its ability to endure a wide range of conditions. This is evidenced by the fact that it thrives almost equally in the austere climate of Canada and in sub-tropical Florida, and that it endures almost every condition found in the forest regions between these Northern and Southern limits, and between the great plains on the West and the Atlantic coast on the East.

In the North it is a shrub, in middle and southern latitudes it is a tree, often with a trunk that attains a diameter of a foot or more, and a height of fifty or sixty feet. Its top, when growing in open ground, is also dense and shapely, so that the tree is not without value as an ornament to our parks and roadsides. The trunk is covered with a grayish, strongly-fissured bark, but the twigs remain green for several years, the corky layer being slow to form beneath the epidermis.

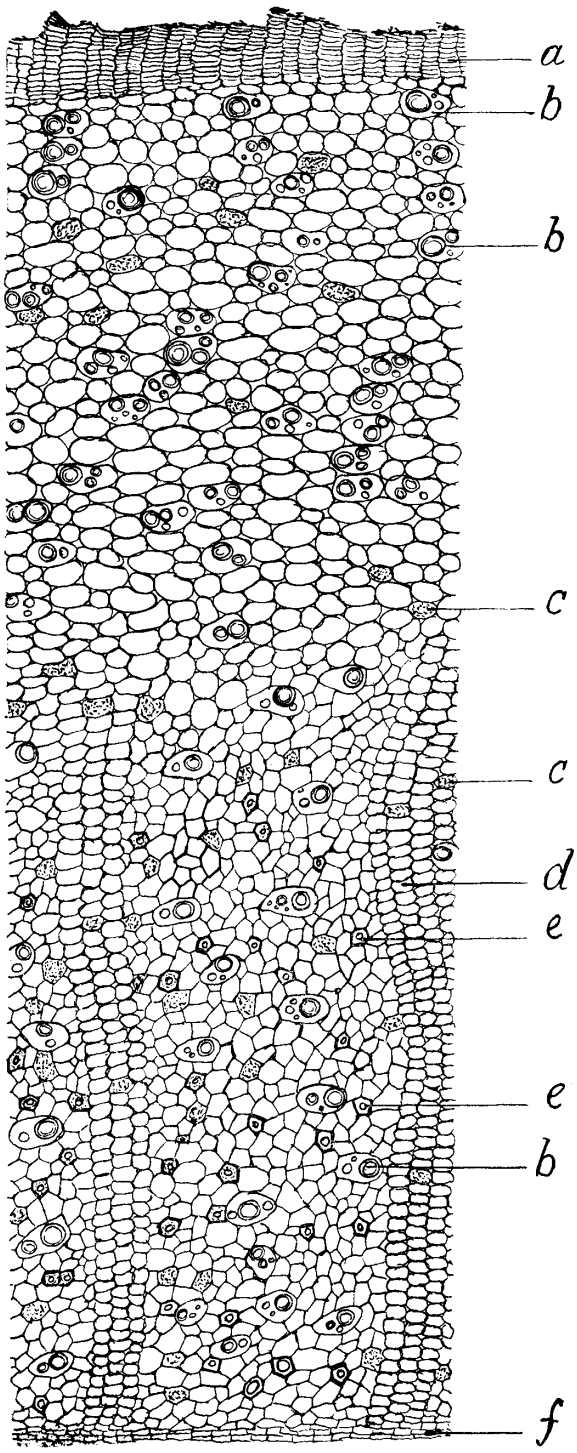

FIG. 1.

The alternate exstipulate, petiolate, deciduous leaves are remarkable for the variety of their forms on the same tree. Some are entire, oval and acute or obtuse, while others are more or less deeply separated into two

or three unequal lobes, the lateral lobes being the shorter. This variability in the foliage of the tree has given origin to one of its botanical names, that recognized in the last edition of our Pharmacopoeia, namely, *Sassafras variifolium*. This tree, in fact, well illustrates the vicissitudes of our botanical nomenclature. In the earlier editions of Gray's Manual we find it named *Laurus sassafras*, following Linnaeus. In the later editions it is called *Sassafras officinale*, the name given it by Nees. Salisbury named it *Laurus variifolius*, and now in the recent "List of Pteridophyta and Spermaphyta, growing without cultivation in Northeastern North America," the name *Sassafras Sassafras* (Linne) Karsten, is adopted, a name doubtless applied in strict accordance with the new rules for botanical nomenclature, but whose unpleasant effect upon the ear could not well be endured except in the hope that sometime between now and the millennium our botanical nomenclature will acquire something like a stable equilibrium.[1]

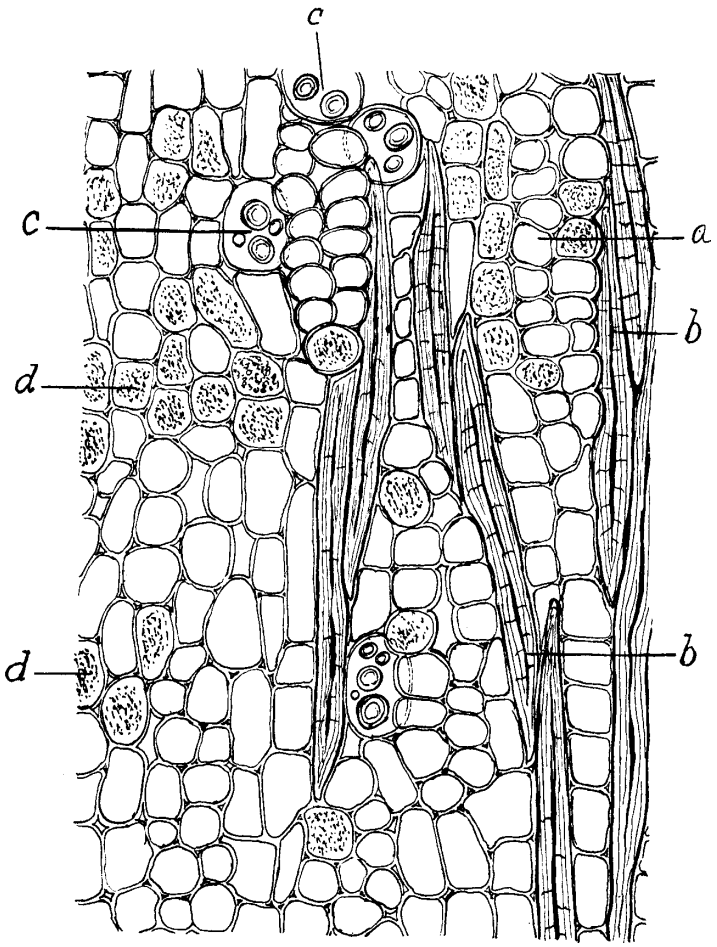

FIG. 2.

1 I only Wish! - MM

The tree is dioecious and the inconspicuous flowers appear in early spring, before or with the leaves. They are arranged in clustered corymb-like racemes which are involucrate with scaly bracts. The sepals, six in number and spreading, are yellowish-green, and in the staminate flowers the nine stamens are inserted in three whorls on the base of the calyx. The stamens of the inner whorl differ from the rest in bearing at. the base of each filament a pair of stalked glands, probably representing stipules. The anthers of all the stamens are introrse and have two pairs of loculi, one pair smaller and superposed over the other, and the loculi dehisce by valves.

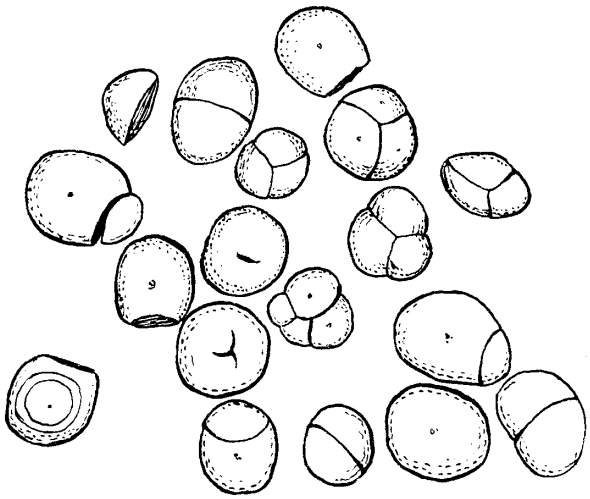

FIG. 3.

The pistil in the staminate flower is wholly aborted. In the pistillate flower six stamens are present, but with wholly or partly aborted anthers and without pollen. The pistil is single, with an ovoid ovary and a single, rather short style terminated by a discoid stigma. The ovary contains usually a single ovule, which is ana tropous and suspended from the top of the ovary.

The fruit is a bluish-black, ovoid drupe of the size of a pea, supported on a fleshy, club-shaped, reddish pedicel, crowned by the persistent reddish calyx teeth, which clasp the fruit at its base. The seed is exalbuminous.

All parts of the plant contain more or less.of volatile oil, but this is much more abundant in the bark of the root, which, therefore, constitutes the most important medicinal portion.

The leaves and young twigs, particularly the pith of the latter, are rich in mucilage, which causes them to be employed, to some extent, for demulcent purposes.

A cross-section of the bark of a root which has attained a diameter of two inches or more shows a structure which is represented in the illustration, Fig. 1.

The friable exterior corky layer shows the usual microscopic appearance of corky tissue. The thickish middle bark beneath it is rich in oil cells, which average larger in size than the parenchyma cells among which they are scattered.

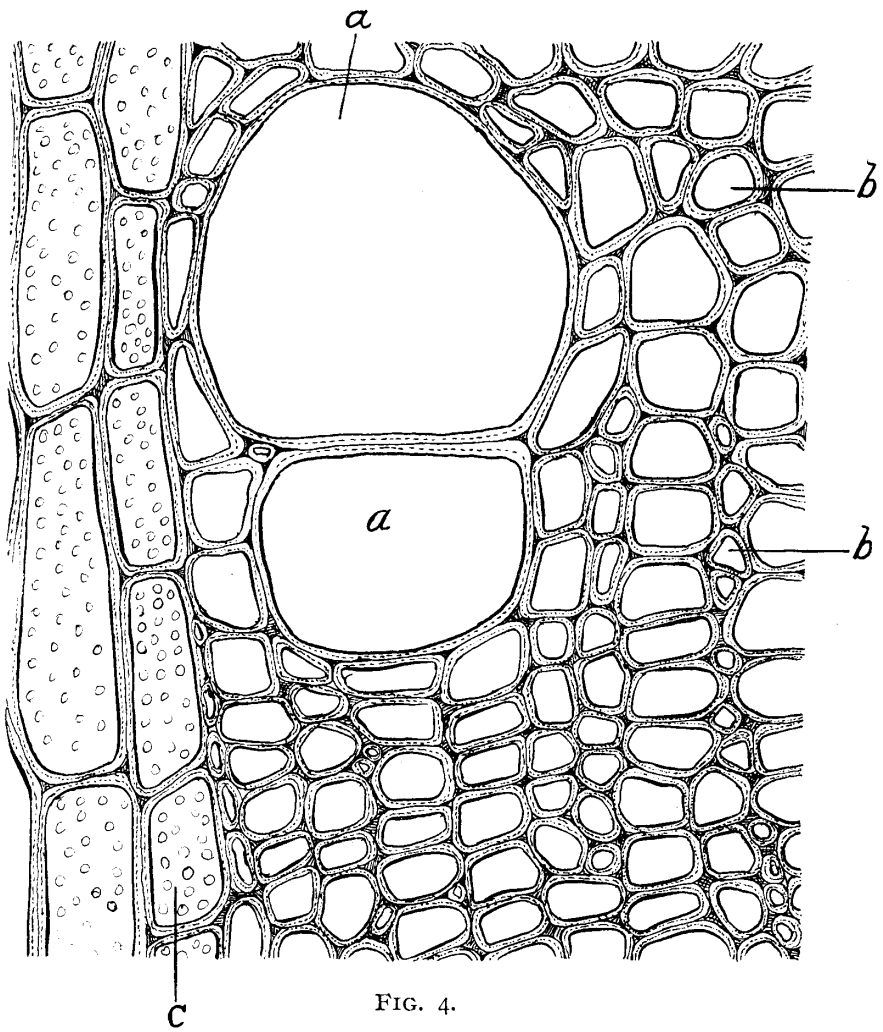

FIG. 4.

Oil cells are not confined to this layer, but occur, though somewhat less abundantly, among the sieve and companion cells of the inner layer of the bark. Parenchyma cells, rich in tannic matters, are also freely scattered through the middle and inner layers.

The medullary rays^whose course in the bark is usually somewhat wavy, are composed sometimes of one, sometimes of two, and more rarely of three rows of cells.

No primary bast fibres are formed in the root bark, and the bark of roots not more than two or three years old is usually destitute of bast fibres of any kind.

Later on, however, secondary bast fibres are formed, but these are never so abundant as to give an evident fibrous fracture to the inner layer of the bark. They are scattered without apparent order through the bast wedges, and are not usually clustered, though occasionally two or three may be seen in juxtaposition.

They are excessively thick-walled, and, for bast fibres, short, their length being not more than from ten to fifteen times their thickness. They are also hard and brittle.

If the bark be gathered in late autumn or in very early spring, the parenchyma cells of the bark, and even the thinnish-walled wood cells and medullary ray cells of the meditullium, are found to be heavily charged with starch grains. These are of rather small size, and, when single, are spherical or spheroidal in shape, with a central hilum, which sometimes shows a few stratification circles about it. The circles, however, are usually indistinct or wanting. The hilum is usually entire, and appears, even under a very high power, as a mere point, but it is sometimes angularly fissured. Compound grains, however, are more common than simple ones, the commonest being double and triple ones, though more complex forms are not uncommon.

In most structural characters the wood of the root and that of the stem resemble each other closely. The ducts, which are mostly of the pitted variety, with the pits closely arranged, are, in both, of large diameter, and usually grouped in twos or threes, but sometimes single. They agree also in the fact that the walls of the wood cells do not become so strongly thickened as they do in many other woody plants, and in the fact that

the medullary ray cells are of rather large diameter as compared with the wood cells, are usually elongated in a radial direction, and are finely pitted. They differ chiefly in the conspicuous large-celled pith of the stem, which, of course, does net occur in the root at all, and in the fact that in the stem the medullary rays are rather more numerous and inclined to become fewer-rowed, three-rowed rays being seldom found.

The differences between the bark of the stem and that of the root are more conspicuous. Besides the inevitable difference due to the presence of chlorophyll in the middle bark of the former and its absence in the latter, and the difference in cork formation already alluded to, namely, the fact of its much more tardy'formation in the bark of the stem, the stem-bark contains clusters of numerous primary bast fibres associated with stone cells, which form an interrupted zone at the junction of the middle with the inner bark. Both primary bast fibres and stone cells are wholly wanting in the root-bark. The secondary bast fibres of the stem are similar in structure and arrangement to those of the root.

The volatile oil cells of the stem-bark, while they have a distribution quite similar to that in the root-bark, are very much less abundant.

DESCRIPTION OF FIGURES.

Fig. 1.—Transverse section of the root-bark of sassafras taken from a root about 2 inches in diameter. Magnification about 50 diameters, *a*, cork; *b, b, b*, volatile oil cells; *c, c*, cells containing tannic matters; *d*, medullary ray; *e, e*, bast fibres; *f*, cambium.

Fig. 2.—Small portion of longitudinal-tangential section of inner bark. *a*, medullary ray cell; *b, b*, bast fibres; *c, c*, volatile oil cells; *d, d*, cells containing tannic matters. Magnification about no diameters.

Fig. 3.—Starch of sassafras bark. Magnified 750 diameters.

Fig. 4.—Small portion of meditullium of root. Magnified 370 diameters. *a, a*, pitted ducts; *b, b*, wood cells; *c*, medullary ray cell.

NOTES ON SOME SAPS AND SECRETIONS USED IN PHARMACY.

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

[Continued from May]

Narthex asafoetida, Falconer; *Ferula Narthex*, Boissier. The *Ferula asafoefida*, Linne, of Persia, Afghanistan and Turkestan yields the ordinary medicinal gum resinous exudation locally known as Anguzi, but in India the pure drug is called “Hing," and the coarser kind "Hingra." Asafoetida contains two essential oils; although the odors of oil of garlic, oil of onions and asafoetida are similar, asafoetida contains no trace of allyl. An exhaustive paper on this essential oil has been published by Dr. Semmler. Its density is about 0.984.

Asafoetida is commonly used by the Mahomedan population of India and the vegetarian Hindoo classes, as a favorite ingredient in their curries, sauce for pillaus, and other dishes, especially mixed with rice and dal or pulse on account of its stimulant, stomachic properties. The Turkomans are very fond of the young shoots dipped in vinegar. But it is not an article of general consumption in Afghanistan itself. The fresh leaves of the plant, which have the same peculiar odor as its secretion, when cooked, are commonly used as a diet by those near whose abode the plant grows. The white inner part of the stem of the full-grown plant is considered a delicacy when roasted and flavored with salt and butter. India seems to be the principal consumer of this gum resin, as the imports there range from eight to nine thousand hundredweight annually. Its uses in Persia are very numerous, especially as a medicine. There are people there who are so accustomed to its use for nervous complaints that it is like opium to the opium eaters—one of the necessaries of life. Its excellent anti-spasmodic qualities are too little known and appreciated in Europe.

The liquid form of asafoetida has, from the remotest times, been held in great estimation by Eastern doctors, and was once regarded as worth its weight in silver. It is highly esteemed as a carminative and condiment. If taken daily it is said to prevent the attacks of malarious fever.

Among the ancients, condiments to stimulate the sluggish appetite seemed to be in chief demand. Amongst these asafoetida, which is to-day

highly relished in Persia and the East, was an indispensable ingredient; and it is even now used moderately by cooks in Europe to give flavor to some dishes and meats.

Opopanax Chironium, Koch. This gum resinous exudation from the juice of the roots is met with in lumps and tears, is opaque, of a disagreeable balsamic odor, of a bitter acrid taste. It has a slight resemblance externally to myrrh. In most of its properties it closely resembles asafoetida, and is now scarcely used in medicine in Europe, although found in the bazars of India.

Papaver somniferum, Linne. The concrete, inspissated juice from the capsules of this poppy, known as opium, is a valuable narcotic and anodyne, obtained by scratching the capsules and collecting the juice. Great Britain imports from 400,000 to 500,000 pounds of opium annually for medicinal purposes, chiefly from Turkey and Persia. The imports into the United States since the duty has been removed, on October 2, 1890, have increased. The imports, in 1890, were 473,095 pounds of crude or unmanufactured, valued at £1,183,712 and 34,465 pounds prepared for smoking, value £69,586.

In the financial year ending to 1893, the imports were, of crude, 615,957 pounds, value £1,186,824.

The chief seat for the production of opium is India, where the export trade to China used to average 126,000 cwts., valued at £10,000,000, but of late years has been falling off.

The exports were:

	Cwts.
1869	74,955
1879	125,765
1889	122,160

The exports from India in the recent financial years, ending in March, have been as follows:

	Quantity, Cwts.	Value.
1891–92	121,701	£9,562,260
1892–93	104,658	9,255,013
1893–94	97,910	8,019,428
1895 (11 months, to February 7th)	89,865	8,617,604

The poppy is largely grown for the opium it yields in many of the

provinces of China, hence the Indian exports now go to many other countries, especially Cochin China and the Straits settlements. The export share of the two provinces has been as follows, in late years:

	Cwts. Bengal.	Cwts. Bombay.
1891–92	83,221	38,480
1892–93	70,615	34.043
1893–94	63,853	34,057

The imports of sorts of opium into China in each of the last two calendar years (January to December) have been as follows, in piculs, of 1 1/4 cwt.:

	1892. Piculs.	1893. Piculs.
Malwa (Bombay)	27,782	28,694
Patna	18,877	20,295
Benares	15,353	12,121
Persian	7,770	6,998
	70,782	68,108

The returns for 1894 are not yet to hand, but the Statistical Secretary of the Customs at Shanghai, in his report for 1893, stated: " The protection of the rupee enhanced the price of opium so greatly that it placed the Indian drug beyond the means of a vast number of consumers, and this rise taking place concurrently with adequate supplies of native opium—which has so improved in quality that, it is averred, smokers prefer it to Malwa—renders it almost hopeless for the imported drug to continue to compete successfully with the excellent and ever-improving home-grown product."

There are two kinds of opium made in India ; that for export to China is called "provision opium;" that to be used locally is known as "excise opium," and is moulded into cakes, which are stamped with the device of an Imperial Crown, and the legend "Benares Abkari," from being made in that district.

Excise opium, for internal consumption, is retailed to the consumer as a decoction, or in the form of two smoking mixtures, known, respectively, as Chandu and Madat. The excise opium yields to the Indian Government a revenue of about 1,000,000 sterling.

The opium for export is made up into round cakes or balls, about the size of a 24-lb. spherical shot. These are packed for shipment in chests,

in two layers of 20 each, and the chests weigh about 140 pounds.

The expediency of the Government production and supply of Indian opium to China has been much discussed and questioned, and a commission has been taking evidence and reported on it.

It is doubtful whether the moderate use of opium smoking is more injurious to the system than other narcotics and intoxicants, and especially when the habit has been confirmed and is almost general in China, and the culture of the poppy is allowed and fostered in many of the provinces of the Empire.

The stimulant effects of opium are most apparent from small doses, which increase the energy of the mind, the frequency of the pulse, etc. These effects are succeeded by languor and lassitude. In excessive doses it proves a violent and fatal poison.

In disease it is chiefly employed to mitigate, pain, produce sleep, and to check diarrhoea and other excessive discharges. It is also used with good effect in intermittent and other fevers. Combined with calomel, it is employed in cases of inflammation from local causes, such as wounds, fractures, etc.; it is also employed in smallpox, dysentery, cholera, and many other complaints. It is taken in various forms in different countries.

The Chinese both smoke and swallow it. In Turkey it is chiefly taken in pills, being sometimes mixed with syrup to render it more palatable.

In England the drug is administered either in its solid state, made into pills, or as a tincture in the shape of laudanum. The natives of India take it in pills or dissolved in water. In upper India an intoxicating liquor is prepared by beating the capsules of the poppy with jaggery and water.

The native practitioners consider opium to be injurious in typhus fever, but they administer it in intermittents, lockjaw, and in certain stages of dysentery; externally, they recommend it in conjunction with arrach, aloes, benzoin and bdellium, in rheumatic affections. They consider, however, after all, that it is merely efficacious in giving temporary relief.

Persian opium is cultivated principally in Yezd and Ispahan, and partly

in the districts of Khorassan, Kerman, Fars and Shushtes.

That grown in Yezd is considered to be better than that of Ispahan and elsewhere, owing to the climate and soil of the place being better adapted to the growth of the poppy. The crop comes to hand in May and June, and the greater part of the opium finds its way to the shipping ports between September and January. These ports are Bushire and Bunder Affas. The Persian opium was formerly not much liked in China, owing to its having a peculiar flavor, caused by the mixture of a large quantity of oil during the process of preparation, and owing, also, to its being sometimes found adulterated. It, however, finds a better market in London, inasmuch as it contains, on an average, a larger quantity of morphia. From Yezd a quantity of opium prepared in the shape, of small sticks or cylinders, is sent to Herat, and a small quantity in this form is locally consumed for smoking and eating.

Opium smoking is very prevalent in Yezd, and it is said that more is used in this place in that way than in any other town in Persia, with the single exception of Kerman. The habit is gaining ground daily throughout the country.

In late years there has been a decided decrease in-the crop of Persian opium. A few years ago an average crop would be reckoned at 4,000 boxes; in 1889, a fair year, it was about 3,000; in 1893 it was only about some 2,000, but for 1894 an area was planted which is calculated to give some 2,500 boxes. It was anticipated that in 1895 a very much larger quantity will be planted. The Persian merchants are looking with keen and anxious eyes to the report of the opium commission in India, and their future conduct will be greatly biased by it.

In Khorassan the cultivation of the poppy has increased ten-fold within the last fifteen years. That destined for China is mixed with linseed oil, in the proportion of 6 or 7 pounds to each chest. That sent to England is pure. Persian opium is fast overtaking Patna opium in Chinese estimation, according to the advancing prices. A very few years ago it was quoted at less than half the price of the Indian drug.

The poppy is now grown in many parts of Europe, France, Germany, etc., and is even extending to Australia and Africa. Opium raised in Europe is stated to yield from 8 to 13 per cent. of morphine. The main value of opium depends on its contents of morphia, for which the genus

Papaver (as far as heretofore known) remains the sole source.

Not less than fourteen alkaloids have been detected in opium by the progressive strides of organic chemistry.

The Persian opium is packed in chests containing a little over i cwt. The price in 1894 was £71,10s. to £72,10s. per chest. It is nearly all prepared for the China market, and there are only one or two native merchants who have sufficient knowledge to prepare the high-class article required by the London market. The crop was smaller than in previous years.

The total quantity prepared in Shiraz was about 1,300 chests, of an approximate value of £93,500.

The partial destruction of the opium crops in 1893 was a heavy blow to Persian commerce. The yield for the year was very poor, and the value of the total export shows a decrease of £132,000 when compared with the export of 1892. The exports from the port of Bunder Affas in 1892 and 1893 were as follows :

	Chests.	Value.
1892	746	£37,300
1893	743	36,578

Peucedanum Galbaniferum and *Polylophium Galbanum*.—These two plants are said to furnish the medicinal gum resinous exudation known as galbanum. It used to be referred to *Ferula galbaniflua*, Boissier, a Persian species. Galbanum may be distinguished from other gum resins by its somewhat musky odor, and by being easily indented by the finger nail, especially where the tears have a blueish tint. It is more or less brownish-yellow, at ordinary temperatures tough, brittle when cold, of disagreeable smell, and acrid, nauseous, bitter taste. It is indigenous to Africa and sent to Constantinople under the name of "Khasni." The root is of a roundish form and about the size and shape of a large black radish, with two spreading shoots. The British imports are merely nominal. Galbanum is frequently used for plasters, and inwardly for menstrual illnesses in the country of its growth.

(To be continued.]

SAGO CULTIVATION IN NORTH BORNEO.

(*Metroxylon Sagu*, Rottb. *Metroxylon Rumphii*, Mart.)

The sago of commerce is a kind of starch prepared from the soft internal stems of certain palms, natives of the Malay Archipelago, Borneo, New Guinea, and possibly of Fiji. The word sago or sagu is said to be Papuan for bread.

There are two well-recognized species of sago palms. The smooth or spineless sago palm (*Metroxylon Sagu*) is specially abundant in Sumatra and adjacent islands. It does not reach so far eastward as New Guinea. In North Borneo it is known as rumbia benar. Wet, rich soils, especially at the base of mountains, are its favorite localities. This species is regarded as the principal botanical source of the sago received in Europe.

The thorny sago palm (*Metroxylon Rumphii*) is found further east than the other species. It is plentiful in New Guinea, and in the Moluccas and Amboyna.

Both sago palms resemble each other in general appearance, but the latter is a smaller tree, and it has its leaf-stalk and the sheaths enveloping the lower part of the flower spikes armed with sharp spines from one-half an inch to about one inch long. It has, moreover, decided littoral tendencies, and is abundant along the shores of many small islands, forming a dense, impenetrable belt. In North Borneo the thorny sago palm is known as *rumbia berduri*, or *rumbia salak*.

Some sago is obtained from the sugar palm (*Arenga saccharifera*) after the plant is exhausted of its saccharine juice. The sago palm of India is *Caryota urens*. The farinaceous part of the trunk of old trees is said by Roxburgh to equal the best sago from the Malay islands. In China, Japan and Florida, sago, differing in character of the starch grains from palm sago, is obtained from species of *Cycas* such as *C. revoluta* and *C. circinalis*. The commercial importance of the latter is very slight.

The cultivation of the true sago palms is entirely confined to the Eastern Archipelagos. The plants are difficult to grow elsewhere, and it is improbable that the industry will extend beyond its present limits. Both species of *Metroxylon* are monocarpic, and die after the seeds are

ripened. The life of the plant lasts for about fifteen to twenty years, at the end of which period the terminal inflorescence is foimed. In spite of the abundance of flowers very few fruits are produced; these occupy two or three years in ripening. The propagation of these palms is usually effected by means of suckers or stolons formed around the base of old trees.

An interesting account of sago cultivation in Province Dent, in British North Borneo, is included by Governor Creagh in the report on the Blue Book of Labuan for 1893. (*Colonial Reports*, No. 122, Annual, 1894.) As the subject has not hitherto been dealt with in these pages, the report, which has evidently been carefully prepared on the spot by Mr. J. G. G. Wheatley, is reproduced for general information.

A REPORT ON SAGO CULTIVATION IN PROVINCE DENT.

The sago palm, from which is manufactured the well-known sago flour of commerce, resembles in appearance the cocoanut tree. The former is valued for its trunk alone, the nuts are useless, and the tree dies if allowed to fruit.

VARIETIES OF SAGO PALM.

(1) There are only two kinds of sago palm which are cultivated, the "rumbia benar " (true sago), and the "rumbia berduri" (the thorny sago), also known as "rumbia salak." In appearance both are the same, but on close inspection the stems of the latter, to which the leaves are attached, known as "pallapa," will be found to be covered with bunches of thorns about 1 1/2 to 3 inches long.

MODE OF PLANTING.

(2) Sago grows chiefly on damp ground, subject to floods at cer tain times of the year. If grown in swamps, less sago is produced, and the trunks do not attain as great a height as when planted on clayey damp soil subject to floods periodically. Once planted, the tree withstands floods and brackish water, but in the latter it does not grow as fast and the trunks are small. Sago is planted chiefly by suckers sent out by the parent tree, which are carefully cut off under ground. In swampy ground the shoots are planted out at once, but in other localities the shoots are tied together in bundles and placed in wet, muddy ground

until they have begun to send out roots, when they are planted out in holes 12 inches deep, I foot in diameter, and 4 to 6 fathoms apart. No earth is placed about the roots, but the plants are supported in an upright position by two sticks fixed on either side. The earth gradually fills the holes during rains and floods. One man with an assistant can plant 300 plants a day. After this, further attention is generally unnecessary for a year, and in some cases two years, when the jungle growth is cleared around the growing tree. Some planters regularly clear around the roots and cut away suckers if they are too abundant. Rumbia berduri is preferred to the *rumbia benar*, chiefly because the wild pigs do not attempt to destroy young plants, on account of the thorns. In planting *rumbia benar*, fences have to be made to keep out the pigs, which are very destructive. *Rumbia berduri* is also reported to produce more raw sago, but the quality of flour is the same in both species. Each tree produces from four to five pikuls of raw sago (133 lbs.= 1 pikul), being at the rate of one pikul per fathom of trunk. Both trees grow to the same dimensions, 24 to 42 feet in height, and in 1 1/2 to 3 feet in diameter at the base of trunk. The sago palm is not subject to any disease; but, if a deep cut is made at the base of the trunk close to the earth, the pith is attacked by large maggots, which gradually eat their way into the centre of the tree, and in three or four months destroy the whole trunk. This is a favorite way of paying off a grudge among the natives. The sago tree takes from five to seven years to mature, according to the nature of the soil. During the third year the plant begins to send out shoots. These grow up with the parent tree, and in time give out suckers. If these are allowed to grow too freely they form a dense thicket around the mature trunks and give a great deal of trouble to the workers. Every year each clump produces a large number of workable trunks. During the fifth year the parent tree is ready to be cut down. In the meantime, the young shoots are rapidly developing, and in the seventh year probably three or four trees are ready, and so on, so that the sago tree, once planted, continuously supplies the planter with logs without giving him any trouble as regards their cultivation. The natives compare their sago plantation to a herd of cattle, and it would be difficult to reckon the number of logs that each clump may have produced in the space of forty or fifty years. When the sago tree is allowed to flower, the pith begins to diminish, and, if the mature trunks are not cut down regularly, the whole clump gradually deteriorates and the trees become stunted bushes instead of growing to the usual height. Nothing of the sago tree is lost. The trunk supplies the sago, the leaves and stems are largely used by natives for building purposes, the former

for roofs and the latter for partitions and walls of houses, which, when properly constructed, are very neat-looking and durable. The top shoot makes an excellent vegetable, while the trunk, when split in two longitudinally, and the pith scooped out, is used as a boat to transport the raw sago which has been extracted from it. The bark, when taken off, makes excellent fuel, and an enterprising Chinaman, who employs an engine for rasping sago logs, uses this as a substitute for firewood. The sago trade between Mempakul and Labuan is carried on by native schooners of about forty tons, which ply regularly, and in fair weather are able to make a trip every two days.

The following are the figures recorded in the returns at Mempakul of the sago shipped to Labuan since January, 1890:

	Sago Flour.	*Raw Sago.*
1890	$23,483.72	$10,350.32
1891	24,826.67	18,560.20
1892	101,327.06	25,304.59
1893	119,092.70	25,034.24

The latter portion of the year is generally the busiest, as the rains assist in the transport of the raw material from streams which may have become too shallow during the dry weather.

The present price of sago flour at Singapore is $2.55 per pikul. The Chinese traders buy the raw material at from $1 to $1.20 per pikul, according to the market price at Singapore, and, after allowing for the cleaning of the raw sago and washing it in the factories, there remains a profit of at least 50 cents per pikul to the Chinese manufacturers. The freight from Labuan to Singapore at present is 22 cents per bag of 115 catties = 150 lbs. A royalty of 6 cents per pikul is charged on sago flour exported from Province Dent to Labuan, when the Singapore price is below $2.50, and 8 cents when above that sum. On raw sago a royalty of 8 cents is charged to protect the sago factories. The sago trade is increasing rapidly on the Borneo Coast, and at the present time over three-fourths of the flour and raw sago exported from and imported into Labuan comes from British North Borneo ports. .

(Signed), J. G. G. WHEATLEY,

Magistrate, Province Dent.