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GRINDELIA ROBUSTA AND GRINDELIA SQUARROSA.

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From an inaugural essay.

Grindelia robusta being officinal, and no thorough investigation having been made, it was thought desirable to do so. An analysis was made in the chemical laboratory of the College, and under the direction of Professor Henry Trimble, to whom I am indebted for many valuable suggestions. An analysis of *Grindelia squarrosa* was also made at the same time, not only on account of its individual interest, but especially for purposes of comparison. The work, in general, was based on Dragendorff's Method of Plant Analysis.

DESCRIPTION OF THE DRUGS.

G. robusta and *G. squarrosa*, as found in the market, consist of the leaves and flowering tops of the herbs. They belong to the natural order Compositae, and are found west of the Rocky Mountains, especially in California.

There being some uncertainty as to the means of distinguishing the two species, a few of the more important points of difference may be of interest.

The drugs from which each analysis was made were personally selected in the crude state from the large stock of a reliable house, and may be relied upon as genuine.

1. *G. robusta* is, as its name implies, a robust grower, with large numerous leaves; while *G. squarrosa* is more attenuated, the leaves smaller, and branches and leaves less numerous.

2. The color of *G. robusta*, as seen in the market, is of a greenish brown; that of *G. squarrosa* is much lighter, the involucre and stems being of a straw color, the leaves pea-green.

3. The leaves of *G. robusta* are ovate, slightly serrate, sessile or clasping; those of *G. squarrosa* are lanceolate or obspatulate, more deeply serrate, and while the upper leaves may be sessile or clasping, those lower down are narrowed at the base to the midrib, which often extends half an inch or an inch from the stem before widening into the blade of the leaf.

4. The flower-heads of *G. robusta* are depressed globular, with the scales of the involucre closely appressed; those of *G. squarrosa* are nearly conical in shape, with

the scales of the involucre extended or squarrose, giving the head somewhat the appearance of a burr.

PROPERTIES.

G. robusta has the reputation of being almost a specific for certain forms of asthma, and externally in rhus poisoning. *G. squarrosa* has similar properties, but is less known and used.

HISTORY OF PREVIOUS INVESTIGATIONS.

In 1876, Dr. C. J. Rademaker made a chemical analysis of *Grindelia robusta* (New Remedies, July, 1876). He exhausted the drug with a hydro-alcoholic menstruum, obtaining from the evaporated residue, by treatment with ether, "an oleo-resin having the physical appearance of balsam of tolu and the odor of resin of turpentine." The oleo-resin was treated for alkaloid by treating with acidulated water filtering, rendering alkaline, and agitating with ether. An aqueous solution of the ethereal residue had "an alkaline reaction, and under the microscope showed well-formed prismatic crystals."

On treating for organic acids by acidulating the alkaline fluid from which the base and oleo-resin had been extracted, agitating with ether, and evaporating the ethereal layer, a residue was obtained, the aqueous solution of which had an "acid reaction, completely neutralized alkalies and formed salts. Under the microscope the acid showed well-formed acicular crystals."

Before my work was completed an analysis of *G. robusta* was made by G. Linwood Libby, an abstract of which is given in the Pharm. Era, January, 1888. He found an oleo-resin, an acid resin and a resin. He states that although he twice followed Dr. Rademaker's process carefully, he was unable to verify his results.

ANALYSIS.

For the quantitative analysis, 100 grams of each drug, in No. 80 powder, were used and subjected to the same treatment. The results were similar, hence the drugs will be considered together in the report. When not otherwise specified, the statements made apply to both. This is done to avoid repetition.

I. TREATMENT WITH PETROLEUM ETHER.

The drug was exhausted with petroleum ether (boiling point below 450) in successive portions. The amount soluble in this menstruum is *G. robusta*—8.87 per cent.: *G. squarrosa*—5.94 per cent. This residue was found to consist of vegetable wax and fixed and volatile oils in the following proportions:

<i>G. robusta</i> , wax,	0.41	per cent.;	fixed oil,	8.27	per cent.;	vol. oil,	0.19	per cent	
<i>G. squarrosa</i> ,	"	0.36	"	"	5.42	"	"	0.16	"

The wax was of a white color, solid at ordinary temperatures, melted at about 53° C.; did not saponify with an aqueous solution of soda, but did with an alcoholic solution of

soda. The addition of barium chloride formed a barium soap, insoluble in ether. The alcoholic filtrate from the soap was treated with ether and the ethereal solution evaporated, leaving a solid, white residue, melting at about 50°C., pointing to cetyl as a base.

The fixed oil was solid at ordinary temperatures, melting at 37°C., and was of a brown color. It gave a brown color on the addition of sulphuric acid. The oil was treated with a solution of caustic soda, sp. gr. 1.26. No saponification occurred, even on boiling. On diluting largely with water, however, it saponified readily, giving off the strong odor of the drug. Salt was added in excess and the soap collected. The residue was filtered, evaporated and tested by the flame test with the borax bead for glycerin, but with negative results. The soap was decomposed with hydrochloric acid and distilled with water. The distillate had oil globules floating on its surface, demonstrating the presence of a volatile fat-acid. Its odor was aromatic and somewhat valerian-like. The yield from the amount examined was too small to determine its composition by ultimate analysis.

The non-volatile fat-acids were separated by fractional precipitation with acetate of magnesium and found to consist of a mixture of palmitic, stearic and oleic acids.

Small quantities of the volatile oils were obtained by distilling each drug with water and shaking the distillate with petroleum ether. The oils resemble each other closely. They have an agreeable aromatic, pungent, somewhat mint-like odor and burning taste.

II. TREATMENT WITH ETHER.

The petroleum ether remaining in the drug was evaporated, and the drug exhausted with successive portions of ether. Proportion extracted by this solvent:

G. robusta,	4.02 per cent.,	of which	3.80 per cent.	is resin.
G. squarrosa,	6.92	“	“	4.01 “

The resin is soft (about the consistency of styrax), of a greenishblack color, having a smooth bland taste to the tongue, but after a short time having a very irritating effect on the fauces. It has the odor of the drug. It melts at about 40°C. On the addition of sulphuric acid the resin dissolves with a brown color and a rise in temperature. Nitric acid (sp. gr. 1.42) cold, gives a yellow-green color; on warming, effervescence takes place, with evolution of brown fumes of NO₂ and a peculiar smell.

The resin dissolves completely in a weak solution of the caustic alkalies, indicating that it is an acid-resin. On neutralizing the resin with caustic alkali, concentrating and allowing to stand, prismatic crystals were obtained, colorless, with a cooling saline taste, and insoluble in hot and cold alcohol, chloroform and ether. A portion of the resin was treated with 20 per cent. alcohol, the residue treated with 50 per cent. alcohol, and so on with 75 per cent. and 94 per cent. 75 per cent. alcohol dissolved the larger portion, very little remaining; showing that a 75° menstruum would exhaust the drugs of their resinous constituents. The different fractions obtained have the same melting point and give the same color-reactions as the original resin.

A portion of the ethereal extract was concentrated and precipitated in distilled water, the resin collected, dissolved in a little alcohol and reprecipitated in water containing one per cent. sulphuric acid. Each of these aqueous solutions of the ethereal extract were treated with petroleum ether, benzol, chloroform and ether, successively, for alkaloids, glucosides, or bitter principles. The aqueous solutions were then rendered alkaline and again agitated with the same solvents, with negative results in each case, except that the chloroform residue gave a slight reaction for a glucoside with Fehling's solution, being the same glucoside that was extracted more freely by alcohol and water.

III. TREATMENT WITH ALCOHOL.

The drugs, freed from ether, were exhausted with successive portions of absolute alcohol. Extracted from *G. robusta* 2.04 per cent. and *G. squarrosa* 2.67 percent. The dried residue was of a resinous or extractlike appearance, of a brown color, and acrid taste. Its aqueous solution was colored greenish black by ferric chloride, foamed on agitation, had an acid reaction and was precipitated by acetate of lead. The acidified aqueous solution gave marked alkaloidal reactions with the following reagents: potassio-mercuric iodide, tri-iodide of potassium, phosphomolybdic acid, tannin, potassio-bismuthic iodide, and picric acid. From this evidence it was assumed that an alkaloid was present. The acidified aqueous solution was agitated successively with the solvents previously used; then the solution rendered alkaline and again treated with solvents. A slight residue was obtained with each solvent—largest with chloroform—of a yellow color, soft and sticky, and of a burning, very acrid taste, especially affecting the palate. An aqueous solution of these residues was of neutral reaction : on adding the smallest portion of acid it was rendered permanently acid, and with the reagents did not give as heavy alkaloidal reactions as did the liquid which had been agitated with the solvents. No different results were obtained on testing a solution of the residues in acidulated water. One pound of each drug was then exhausted with strong alcohol, the alcohol evaporated, and the syrupy extract poured into water acidulated with one per cent. of sulphuric acid. After standing for twelve hours, with frequent stirring, the liquor was decanted, filtered, and agitated with solvents as before, both in acid and alkaline condition. The results were -the same as those of the previous trial. Five pounds of *G. robusta* were then exhausted with alcohol and given the same treatment, also adding to the list of solvents acetic ether, carbon disulphide and fusel oil. No alkaloid was obtained. A portion of the solution was neutralized, evaporated to dryness and the residue agitated with solvents, with still a negative result. Extraction from the drug by Prollius' fluid was tried, also without success. The methods used would undoubtedly have extracted an alkaloid had one been present, so it is safe to say that none exists in these plants. The uniform positive reactions with the accepted alkaloidal reactions are difficult to explain, but they are probably caused by some albuminous matter peculiar to these plants.

The substance extracted by the various solvents was free from glucose until after boiling with dilute acid, showing that a glucoside had been extracted.

IV. TREATMENT WITH WATER.

	G. robusta.		G. squarrosa.	
Total extract.....	12·16	per cent.	12·88	per cent.
Containing ash.....	2·80	“	2·51	“
<i>a.</i> Mucilage and carbohydrates precipitated				
by alcohol.....	2·17	“	1·93	“
Yielding ash.....	0·5	“	0·67	“
<i>b.</i> Glucose.....	1·26	“	1·90	“

Saccharose was not present.

(*c*) *Saponin*.—From the foamy, soapy-like character of the aqueous extract on agitation, as well as the taste of the resin and of the glucoside extracted, it was inferred that saponin or an allied body was present. A quantitative estimation by the method adopted by Christophsohn and Otten,¹ was made with the following results: *G. robusta*, 2 per cent.; *G. squarrosa*, 0.82 per cent. saponin.

As far as I have been able to learn, these are the first plants of the natural order compositae in which a saponin-like body has been found, and is therefore unique. It does not give the color-reaction of true saponin with sulphuric acid, but it possesses its attributes to a marked degree. It has its soapy character; acrid taste, affecting the fauces; is precipitated by baryta water; forms crystals with alkaline hydrates, and has a slight acid reaction. It is undoubtedly this that gives the acid reaction to the aqueous solutions of the various extracts. It was thought at first that this was due to the presence of organic acids; but on adding barium carbonate to the solution, it was not neutralized, even on boiling. Calcium carbonate also had no effect. Colorless, needle-shaped crystals of this saponin-like body were obtained by agitation with acetic ether (which had been freshly distilled over lime) evaporating, treating the residue with chloroform and evaporating in a dessicator over sulphuric acid. The principle in the two plants appears to be identical, and the name of *grindelin* is suggested for it. It is probable that the medical properties of the plants are due to this substance.

To a portion of the aqueous solution, sulphuric acid was added, and allowed to stand in a cool place for 48 hours. At the end of that time the liquid was observed to have a large number of minute acicular crystals floating in it. These were filtered of and dried, and on opening the filter, they separated in a thin, papery cone, glistening like benzoic acid. These crystals were thought to be the decomposition-product of *grindelin*, brought about by the action of the dilute acid in the cold, glucose being liberated.

To determine whether or not such was the case, a gravimetric estimation of the glucose in the liquid producing the crystals, and in the aqueous solution to which no acid had been added, was made. The supposition was verified, as the former yielded 0.26 per cent. more glucose than the latter. On boiling a solution with dilute acids, a white insoluble substance separates out, which on standing unites into a resin, having properties identical with that found in the drug. The theory is advanced that

¹ *Dragendorff's Plant Analysis*, page 68.

the resin found in the drug is wholly a decomposition product of grindelin, the greater part of the glucose set free being used by the plant as a necessary constituent to its growth and development.

(d) *Tannin*. A quantitative estimation of tannin was made with gelatin, in the presence of alum. An immediate precipitation took place in the solution of *G. robusta*. After 12 hours this was filtered off, washed, dried and weighed 50 per cent. of the dried residue was calculated as tannin, giving a yield of about 1½ per cent.

No tannin was found in *G. squarrosa*, no precipitate having formed at the end of 12 hours.

V. TREATMENT WITH DILUTE CAUSTIC SODA.

The drugs were exhausted with a dilute solution of caustic soda, and the substances soluble therein estimated as pectin, albuminoids, and allied bodies. *G. robusta* yielded 5.68 per cent; *G. squarrosa* 3.56 per cent.

VI. TREATMENT WITH DILUTE HYDROCHLORIC ACID.

No starch is present in either drug.

Total extracted by above solvent: *G. robusta* 2.17 per cent., of which 1.06 per cent. is calcium oxalate. *G. squarrosa* 4.94 per cent., of which 1.00 is calcium oxalate.

VII. DETERMINATION OF LIGNIN AND CELLULOSE.

The lignin was estimated by maceration with chlorine water. *G. robusta* 3.40 per cent., *G. squarrosa* 5.71 per cent.

The residue was macerated with nitric acid and potassium chlorate.

<i>G. robusta</i> , intercellular substance, &c.,	30.24%	sand, cellulose, &c.,	12.53%
<i>G. squarrosa</i> ,	25.44		15.02

VIII. ESTIMATION OF MOISTURE AND ASH.

<i>G. robusta</i> , moisture	11.12	per cent.,	ash	7.77	per cent.
<i>G. squarrosa</i> ,	11.7			5.22	

A qualitative analysis of the ash showed the presence of potassium, sodium, calcium, magnesium and iron as bases, and sulphuric, hydrochloric, carbonic and phosphoric acids.

Not having been able to verify Dr. Rademaker's results, I exhausted 1 lb. of *Grindelia robusta* with 75 per cent. alcohol and made a careful analysis according to his process', the results corresponding with my previous work. The substance which was

extracted for "alkaloid" when treated with distilled water gave a neutral reaction; on adding one drop of water acidulated with sulphuric acid (1:500) the solution was rendered permanently acid. It was then tested, before and after boiling, with dilute acid and found to be a glucoside. The substance which came out as "organic acid," was of acid reaction, did not neutralize barium carbonate, and also reduced Fehling's solution after boiling with dilute acid, corresponding to the properties of the saponinlike body before referred to, and evidently identical with it.

NOTE BY THE EDITOR.—*The Pharmaceutical Era*, June, contains an analysis of *Grindelia robusta* by John L. Fischer, the results of which, compared with those of Mr. Clark, are as follows:

	Clark.	Fischer.
Petroleum extract.....	8·87	8·50
Ether extract.....	4·02	10·05
Alcohol extract	2·04	6·00
Water extract.....	12·16	13·05
Dilute soda solution	5·68	—
Dilute acid solution.....	2·17	2·02
Lignin	3·40	
Intercellular substances	30·24	47·00
Cellulose	12·53	
Moisture	11·12	11·08
Ash.....	7·77	—

By dissolving the water extract in distilled water, rendering the solution alkaline, and agitating with ether, Fischer obtained a principle, grindeline, which had an alkaline reaction and neutralized acids, the sulphate crystallizing in groups of acicular prisms; it is described as being bitter, soluble in ether, alcohol and water, and precipitated by tannin, potassio-mercuric iodide, picric acid, potassium bichromate, iodine, and the chlorides of gold and platinum. Alkalinity excepted, these properties agree with those of the yellow sticky mass obtained by Mr. Clark from the alcohol-extract by a process similar to the foregoing.

NOTES ON THE ESSENTIAL OILS OF BAY, PIMENTA AND CLOVES.

By GEO. M. BERINGER, A. M., Ph. G.

The U. S. Pharmacopoeia describes oil of myrcia as "a brownish or dark brown liquid of an aromatic, somewhat clove-like odor, a pungent, spicy taste, and a slightly acid reaction. Sp. gr. about 1.040, soluble in an equal weight of alcohol. With an equal volume of a concentrated solution of potassa it forms a semi-solid mass."

This description is incorrect in at least one important point, namely, the specific gravity stated, and misleading, if not absolutely erroneous in its statement regarding the solubility. These errors have been copied into the dispensatories and various text

books without comment or correction.

The usual adulterants for this oil are the oils of cloves, pimenta and copaiba. The detection of these by color reactions or other chemical tests is difficult. The odor, specific gravity and solubility are the most important characteristics for recognizing adulteration, and so it is of the greatest importance, that our Pharmacopoeia should be correct in these statements.

In the AMERICAN JOURNAL OF PHARMACY, (1887, page 286), the writer called attention to the fact that two samples of oil of bay examined, showed a sp gr. of 0.975 and 0.9945. Recently Messrs. Dodge & Olcott have called attention to this error (*Drug. Circ.*, July, 1888), stating as the result of their extended experience in distilling this oil, that the correct sp. gr. is near 0.965 at 60°F.

The authority for the pharmacopoeial statement the writer has been unable to discover. Prof Markoe (*Proc. Amer. Phar. Assoc.*, 1877) gives the specific gravities of the various fractions of light and heavy oils obtained in the process of distillation; the fraction of the heavy oil having the highest gravity being only 1.037 ; the fraction of the light having the lightest gravity being 0.870. But singularly, he fails to give either the relative proportions of these two oils obtained in the process of distilling or the specific gravity of the finished oil.

Prof. J. M. Maisch, who was, perhaps, the first to record any examination of this oil, states (AMER. JOUR. PHAR., 1861) that the specific gravity must be near 0.930, as it floats in diluted alcohol, slowly rising to the surface.

The writer has carefully taken the specific gravity of a number of samples of oil of bay at 60° F., and using an accurate 10 grm. sp. gr. bottle; the following being those of fine odor, and believed from physical properties and comparative tests to be pure.

No. 1—0.970.	No. 3—0.9672.	No. 5—0.9765.	No. 7—0.9828
No. 2—0.9716.	No. 4—0.9696.	No. 6—0.9810.	

Nos. 1 and 3 are samples of Dodge & Olcott's distilling. No. 2 is a sample in the museum of the Philadelphia College of Pharmacy, received some time ago from A. H. Rüse. Judging from its fine bouquet and solubility it is likely distilled from the green leaf. No. 5 is a sample distilled in St. Thomas from green leaf.

Prof. Maisch, in his paper before referred to, states that, "with alcohol a clear solution cannot be obtained. If a single drop be added to half a fluidounce of 85 or 95 per cent. alcohol it sinks to the bottom, marking its passage down by a milky streak, and on agitation a white turbid fluid is obtained, which gradually deposits a white film leaving the supernatant liquid clear." The Pharmacopoeia says, "soluble in an equal weight of alcohol." Oil of bay is peculiar in its action with alcohol. While not yielding a clear solution in 95 or 85 per cent. alcohol there is no separation of oil globules.

The writer has examined a number of specimens of this oil and has never found one yielding a perfectly clear solution with alcohol or absolute alcohol.² It appears to me,

² The oil from the green leaf appears to yield a less turbid solution.

that the compilers of the last edition of the U. S. P. either had examined an adulterated sample of oil or did not consider it pertinent to tersely explain this important peculiarity of this oil.

Oil of pimenta and oil of cloves are correctly described in the U. S. P. as yielding solutions with an equal volume of alcohol.

Oil of pimenta makes a clear solution in absolute alcohol and in 95 or 85 per cent. alcohol in all proportions. It makes a clear solution with three volumes of 60 per cent. alcohol, which is not rendered cloudy on further addition of the alcohol. With five volumes of 50 per cent alcohol it makes a turbid, milky solution without separation of oil globules, the opalescence diminishing on increasing the alcohol, a clear solution being produced when thirty volumes of diluted alcohol have been added.

Oil of cloves is soluble in all proportions of absolute alcohol and 95 per cent. alcohol. Soluble in equal volume of 85 percent. alcohol, which is not rendered milky on further addition. Soluble in three volumes of 60 per cent. alcohol, the solution being rendered milky on further addition of alcohol.

A mixture of 80 per cent. oil of bay and 20 per cent. oil of pimenta is soluble with slight milkiness in equal volume of alcohol. A mixture of 50 per cent. of each gave but very slight milkiness, practically a clear solution, in equal volume of alcohol, but on adding more alcohol the milkiness becomes quite apparent. Mixtures of oil of bay with oil of cloves act similarly.

Oil of bay yields a clear solution in ether, but on diluting with 85 per cent. alcohol the solution is rendered cloudy, and on standing it gradually becomes clear, depositing a white film. Oil of bay yields a clear solution in benzin, chloroform and amylic alcohol; a milky solution in absolute alcohol, alcohol, methylic alcohol, turpentine, benzol, carbon bisulphide, glacial acetic acid, acetic ether and acetone.

Oil of pimenta yields a clear solution in ether, which remains clear on the addition of (85 per cent.) alcohol. It also yields a clear solution in benzin, benzol, chloroform, amylic alcohol, methylic alcohol, glacial acetic acid, acetic ether and acetone. Slightly milky in carbon bisulphide. A clear solution in equal volume of turpentine, but rendered milky on further addition.

Oil of cloves yields a clear solution in ether, not rendered milky on adding 85 per cent. alcohol. It yields a clear solution in chloroform, amylic alcohol, methylic alcohol, glacial acetic acid, acetic ether and acetone. Slightly milky with benzin; slightly milky with benzol, and not becoming clear by adding five times the volume of benzol; a milky solution in carbon bisulphide and turpentine.

I have found the following test of value in detecting the adulteration of oil of bay with pimenta or cloves where the quantity of adulterant was considerable. To three drops of oil of bay, in a small test tube, add three drops of pure sulphuric acid (1.84). Tightly cork the test tube and stand aside for half an hour until the reaction is complete and the oil is resinified, Add 60 minims of 50 per cent. alcohol and shake vigorously, gradually warm the mixture, agitating it continuously until the alcohol boils. With

pure oil of bay, the resin will form an insoluble mass, the alcohol remaining almost colorless or acquiring a pale, brownish yellow color, not red or purplish red.

Oil of pimenta, similarly treated, will yield a resinous mass considerable of which dissolves in the dilute alcohol, yielding a bright red or red-brown solution.

Oil of cloves similarly treated, yields a resinous mass, which almost entirely dissolves in the dilute alcohol, yielding a bright red solution, soon acquiring a purplish-red fluorescent color.

Oil of bay, adulterated with ten per cent. of pimenta, will, give a distinct red-brown solution, and five per cent. of oil of cloves can be easily detected by the purplish-red fluorescence.

Gmelin gives the specific gravity of oil of pimenta, as ascertained by Jahn, at 1.03. Gladstone (PHAR. JOUR., 1872, 687) states that the specific gravity at 10° C. (50° F.) is 1.0374. The U. S. Dispensatory (15th Edit., 1031), states the specific gravity at 1.021, but varies. No authority is given for this statement. The U. S. P. gives it as 1.040. Samples recently examined showed 1.0485 and 1.0525.

The German Pharmacopoeia states the specific gravity of oil of cloves at 1.041 to 1.060. The U. S. Pharmacopoeia says about 1.050. Samples examined showed the following, 1.0494, 1.0426, 1.0450 and 1.0596. The last sample was adulterated with the oil of cassia. A sample of oil of clove stalks showed a sp. gr. of 1.0672. The National Dispensatory states the sp. gr. of this oil to be 1.009. I am inclined to think this a mistake, as the odor is very similar and its behavior with solvents and chemical reactions are identical with oil of cloves. Its composition is likely similar if not identical.

“One drop of oil of cloves in 4 grams of alcohol is colored blue on the addition of one drop of a mixture of .1 part solution of ferric chloride and 20 parts water.” *Ph. G.*—Oil of bay similarly tested yields a pale yellowish green color. Oil of pimenta, a bright green. These colors soon fade and are immediately destroyed on the addition of hydrochloric acid.

The U. S. P. describes oil of cloves, as well as the oils of bay and pimenta, as slightly acid. The German Pharmacopoeia states, “oil of cloves does not redden litmus.” The following delicate reaction served to show the distinct acidity of these three oils. Ten drops of the oil was thoroughly shaken with half a fluidounce of boiling, distilled water, and when cold, filtered through a moistened filter. To one drachm of this filtrate was added, drop by drop, a small quantity of a very weak solution of phenolphthalein, made by adding 4 drops of one per cent. solution of phenolphthalein to a half fluidounce of water, and reddening by adding a couple of drops of liquor potassae. Each fluid drachm of the aqueous solution of the oil was found sufficient to decolorize from 3 to 6 drops of this reagent, the color being again produced on adding a drop or two of very dilute solution of potassium hydrate.

NOTES ON EAST INDIAN GUMS.

By J. G. PREBBLE, BOMBAY.

During the last few years large quantities of gums, the production of Indian trees, have been exported from Bombay. About threefourths of these exports go to the United Kingdom, and always I think to London, under the names of "ghátí," "amrad," "oomrawutty," etc. In a recent paper on these gums, published in this Journal,³ these names and the origin of the gums do not appear to be well understood. Hence some notes on these points may be of interest.

"Ghátí," an aboriginal or purely Indian word, has the primary meaning of a strait or pass through a mountain. Drugs or vegetables of country or local production are sometimes distinguished as "ghátí" from those which are imported from foreign ports or from a distance thus there is "ghátí-pitpapra" (*Justiciaprocumbens*), which is used as a substitute for the true pitpapra (*Fumaria officinalis*), imported from Persia, and "ghátí-mirchi" (*Capsicum annuum*), country-grown chillies, as distinguished from a variety resembling the West Indian and imported from Goa and known as "gowar-mirchi,"⁴ and lastly ghátí gum, gum collected on the ghats, and hills of the country and called "ghátí" in contradistinction to the variety imported from foreign ports.

The best picked "ghátí" gum as now exported from Bombay is entirely or almost entirely derived from *Anogeissus latifolia*.⁵ I think Dalzell is the first author who mentions this gum. He says, "the tree produces a very white, hard and valuable gum." The Bombay name is "daura" or "dabria." It is largely used throughout India for calico printing, for which it has a high reputation, and as has been shown by Mander it may with advantage be used in pharmacy in place of the high priced and scarce Kordofan gum. I have obtained the same reactions with this gum as was observed by Mander with a London sample of "ghátí" gum, hence I conclude that his sample was free from admixture with other gums.

"Oomrawuttee" gum derives its name from Oomrawuttee, or Amravti, the chief town of the Hyderabad assigned districts known as the Berars, the centre of a prosperous trade and officially described as "the very home of the cotton plant and the heart of the cotton trade in India." It gives its name to a variety of cotton staple, "the Oomrawutties," and such phrases as "good oomras," "good fine oomras," "oomra variety," are to be met with in the Bombay cotton market reports. Oomrawutti gum is considered by the native gum dealers in Bombay to be of two kinds, the "ghátí" and the "amrad;" the latter they consider to be derived from the babool tree (*Acacia arabica*). Babool gum is distinguished from all other gums that I have examined by being unaffected by either neutral or basic acetate of lead, and by being more or less darkened, but not gelatinized, by ferric chloride. Samples of babool gum that have hung long on the tree and are of a deep reddish-brown color give a very dark coloration, almost black, but the pale samples are less affected. The Oomrawuttee sample examined by Mander was evidently babool gum. With regard to the name

³ "Ghatti and other Indian Substitutes for Gum Arabic," *Pharm. Journ.*, April 14, 1888; AMER. JOUR. PHAR., June, p. 301.

⁴ Dymock, "Materia Medica of Western India."

⁵ I consulted Dr. Dymock on this point, and he is also of opinion that the gum now exported as ghatti is derived as stated.

“amrad,” I do not think it has any reference to “amra,” the native name for the gum derived from *Spondias mangifera*, as this gum has a character more nearly resembling tragacanth than arabic gum. Forty grains of it form a jelly with about two ounces of water. I thought it might be a corruption of “amravti,” but the gum dealers can give no satisfactory explanation of the meaning of the word further than that it is applied to all gums of a reddish tint. It is therefore probably a word imported into India, and as the name is principally applied to Barbary and Egyptian gums it may be a corruption of the Arabic word hamrâ, red, and this thought is supported by a statement I have recently seen that “amrad” is a corruption of “amhara,”⁶ a name applied to a gum derived from an acacia.

Gums are sent to Bombay from all parts of India, but the best come from Amravti. Other centres are Nagpur, Jubbnepur and Cawnpur, and a good deal is collected on the ghats, of the Bombay presidency. On arrival in Bombay they are sorted by Cooly women and children. Anogeissus gum, possessing well-marked physical characters, is easily separated, and is sent to the London market almost free from admixture, but the dark colored or amrad gums are generally mixtures of various gums, babool gum predominating. During the last financial year 20,895 cwts. of gum arabic of Indian production were exported from Bombay, valued at R7,93,934.⁷—*Phar. Jour. and Trans.* July 7, 1888.

NOTES ON SENNA.⁸

By CHARLES HEISCH, F.I.C.

Having had some samples of powdered senna brought to me by one of my inspectors, I was somewhat puzzled what to do with them. Not only was it possible that other leaves might be powdered with the senna, but that exhausted leaves might be also added. Many varieties of cassia appear to be sometimes found mixed with senna, and so long as you have the leaves you can mostly detect them, but when powdered you lose the characteristic appearances.

The principal adulterants of which I can find any account are *Cynanchum argel* and *Coriaria myrtifolia*, the latter being a poisonous plant used by dyers and tanners, sometimes called tanners' sumac.

How argel is to be detected in powdered senna, I cannot at present say; I have not yet got a specimen. Fortunately the worst adulterant—the *Coriaria myrtifolia* gives when infused precipitates with gelatin, bichloride of mercury, and antim. tart. which senna does not, and also a dark blue with salts of iron. The only bad case of adulteration which I have met with was with buchu leaves. These would have attracted the attention of anyone on the look out, by their different shape and peculiar odor, but in the case referred to did not attract the attention of the purchaser, who made his senna tea, and suffered accordingly. Had the sample been in powder, the mistake would have been almost unavoidable. As partially exhausted

⁶ *British and Colonial Druggist*, May, 19, p. 536.

⁷ “Annual Statement of the Trade and Navigation of the Port of Bombay,” 1886 and 1887.

⁸ Read at Meeting of Public Analysts, June, 1888. Reprinted from *The Analyst*, August.

leaves would, of course, give less ash and extract than the senna unexhausted, I made some examinations of undoubtedly pure senna leaves, both Alexandrian and Tinnevelly, and though the results show nothing very striking, I think they are of sufficient interest as a small contribution to our knowledge to be worth laying before you.

No.	Kind and Source.	Total.	Sol. in Water	Sol. in HCl.	Inso-luble.	Alkalinity as K ₂ O	Alcoholic Extract of Ash & Water-free.
1	Tinnevelly, Brown and Smart	11.48	2.4	8.86	.2	1.16	30.
2	Same powdered.....	11.22	2.31	8.77	.1	1.14	29.9
3	Tinnevelly, Apothecaries' Hall	11.34	2.35	8.72	.2	1.16	33.19
4	Same powdered.....	11.39	2.67	8.31	.4	1.06	31.78
5	Powdered Alexandrian, Brown and Smart.....	11.69	2.35	7.86	1.49	.84	33.3
6	Alexandrian Apothecaries' Hall	11.64	2.91	8.36	.37	1.06	29.04
7	Ditto in powder.....	11.35	2.66	7.98	.60	2.06	30.13
8	Alexandrian, Allen and Hanbury	12.36	2.96	9.02	.38	1.54	35.5
9	Same powdered.....	12.54	3.18	9.12	.24	1.76	35.41
10	Powder from Allen and Hanbury, believed to be mixed	13.98	1.22	11.91	.85	1.69	27.75
11	Powder No. 85, from Hampstead	19.01	3.01	12.86	3.14	1.22	29.55
	Ditto No. 88, ditto.....	12.89	2.48	9.05	1.36	1.25	30.00
12	Buchu leaves.....	6.06	2.73	3.25	0.07	1.47	17.49

On examining powdered senna under the microscope, one is struck by the fact that the white translucent hairs from the back of the leaf are quite unchanged by the powdering, so that if one is familiar with the appearance of undoubtedly genuine samples of powdered senna one can get an idea if any other samples contain about the right quantity of hair, which is some guide. I then took the ash in dried samples of the leaves; the amount soluble in water and its alkalinity; the amount sol. in HCl and the insoluble; and, finally, the amount of alcoholic extract calculated on the ash and water-free leaves. The results are contained in the accompanying table.⁹

⁹ It will be observed that several are done in duplicate, one on the leaf whole and the other on the powdered leaf. I thought it just possible the results might differ, as in the powder the proportion of veins from the leaves might be differently distributed. When bought powdered, the samples mostly contained more ash.

It will be observed that the samples obtained from Messrs. Allen and Hanbury contain considerably more ash than the others, and with one exception yield more extract. I have added the results obtained from the two District samples of powder, which in point of extract closely resemble the majority, but one of them differs largely in ash, I have also added the results obtained from buchu leaves, which give about half, both ash and extract.