A more palatable preparation may also be prepared by first extracting the cascara with alcohol, acetone, etc. But in this case there is some loss of activity. A still more palatable and active preparation can be obtained by salting out of the bitter principle by sodium sulphate. The bitterness may be thus removed without markedly impairing the therapeutic activity of the cascara.

The color-producing principle is found almost entirely in the bitter resinous substance.

Further work is being done with other salts to determine their effect on fluidextract of cascara.

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THE SEED OF EUPHORBIA MARGINATA PURSH.*

BY LOYD E. HARRIS AND MARGARET C. GALLAGHER.[1]

An investigation of the literature on plants of the Euphorbiaceæ revealed the fact that the seeds of this family yield a comparatively large amount of a fixed oil (1) which has a decided medicinal value (2). Since *Euphorbia marginata* Pursh. grows in such abundance in this section of the country a determination of the quantity and properties of the oil yielded by this species appeared to be of exceptional value and it was with this purpose in view that the present investigation was undertaken.

It was the medicinal use of these plants which occasioned the name of the family, it being named after King Juba's physician, Euphorbium, who had cured Augustus Ceasar with the gum (3). Its therapeutic use at the time was in dropsy and distemper. Since then it has been applied in a number of different diseases (4), but its use has become obsolete. The oil of several species, however, has remained as a purgative.

Of the many species of Euphorbia which have been examined, *Euphorbia lathyris* has perhaps received the greatest attention. Various analyses (5) of this plant have yielded amounts of fixed oil varying from 35 per cent to 42 per cent. This oil resembles croton oil in physiological action (6). Some other species which have been examined are *E. helioscopia* (7), *E. pillulifera* (8), *E. drummondi* (9), *E. Cyparissias* (10), *E. platyphylla* (11) and *E. resinifera* (12). The oil content of these is sometimes as low as 14 per cent and the maximum amount is rarely above 40 per cent. They nearly all yield products which act powerfully as emetics and cathartics, and in overdoses occasion dangerous if not fatal pros-

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tration, with symptoms of inflammation of the gastro-intestinal mucous membrane (13).

The abundant literature on this family does not yield many references to *E. marginata* except that the milky acrid juice has been mentioned (14), and it has been suggested that the seeds were worthy of investigation (15).

EXPERIMENTAL.

The seeds were collected from September 22 to October 5, 1928, from plants which grew along ravines southeast of Norman, Oklahoma. They were dried in the sun, separated from seed pods and ground to moderate fineness.

Moisture determination made by the oven method gave the following percentages:

Weight of sample.	Percentage of moisture.
15.1165	6.1
6.3615	6.0
77.4246	6.3
5.4169	6.4
	Average 6.2

Ash determinations gave the following results:

Weight of sample.	Per cent of soluble ash.	Per cent of insoluble ash.	Total ash.
5.4169	0.48	3.71	4.19
7.4246	0.46	..	..
5.0012	0.56	3.40	4.00
5.0355	0.59	3.40	3.99

The first two samples were used in the moisture determinations.

Preliminary Analysis.—Two samples of 100 Gm. each were analyzed according to the method of Dragendorff (16) to ascertain in a general way the nature of the constituents extracted by each solvent and an indication of the amounts present. The samples were placed in a Soxhlet extractor and extraction with petroleum ether was continued until the percolate became colorless. The extract was oily in appearance, had a peculiar acrid, unpleasant odor, and an amber yellow color. It had a very low viscosity and a specific gravity of 0.914.

The ether extract was greenish yellow in color and as the solvent evaporated a white solid settled out, but it failed to show any definite structure when examined under the microscope.

The alcohol extract was a brown gummy substance which contained whitish, rosette crystals.

The drug residue was transferred to a conical percolator and extracted with distilled water. The extract was a dark brown, brittle solid, after the water had been evaporated, and had a very disagreeable odor.

The extraction was continued with a 2 per cent sodium hydroxide solution. The percolate did not have an alkaline reaction until approximately four liters of solvent had been added. When completely dry the extract was brown with white acicular crystals throughout.

The final extraction was made with a 2 per cent solution of hydrochloric acid but the amount extracted was almost negligible. It was dark brown in color and had no definite distinguishing characteristics.

The residue of the drug was removed from the percolator and dried. It was grayish brown and very light.

The amounts of the extracts are shown in the accompanying table:

Solvent.	Sample I.	Sample II.
Petroleum ether	30.4585	31.6605
Ether	0.6800	0.6248
Absolute alcohol	1.7092	1.9311
Water	2.3425	3.4290
Dil. NaOH (2%)	29.6850	29.0200
Dil. HCl (2%)	0.6000	0.6000
Unextracted residue	33.6000	35.3350

THE FIXED OIL.

The remainder of the ground seed (2110 Gm.), was placed in three conical percolators and extracted with petroleum ether as in the first extraction. By this process, 671 Gm. of oil were obtained, which was filtered through cotton to remove a slight sediment. The petroleum ether was removed by heating under reduced pressure. The specific gravity of the oil thus obtained was 0.909.

Physical Properties.—Fifty cc. of the oil were transferred to a distilling flask and steam distilled. Two cc. or 4 per cent of a water-insoluble liquid was present in the distillate. On account of its odor and boiling point (40–50° C.) this liquid was considered to be petroleum ether.

The remainder of the oil was then subjected to steam distillation, a heavy emulsion forming during the process. The distillate weighed 30.5767 Gm. and consisted chiefly of petroleum ether. There was, however, a small residue (2 cc.) of a yellow oil, which was not further investigated.

The emulsion was separated from the oil by decantation and washed with alcohol which "broke" it completely. The oil which separated was much clearer than the other oil and it was thought advisable to wash the total amount in a similar manner. The alcoholic layer, which was separated from the oil, had a very bright yellow color. After the recovery of the alcohol, 25 cc. of a yellow oil remained.

The small amount of alcohol left in the oil after washing was removed by distillation under reduced pressure. The following constants of the oil were determined: Sp. Gr. 0.9222; A. V. 7.76; S. V. 186; and I. V. 135.66.

The oxygen absorption of the oil was studied to determine whether it was a drying or non-drying oil. 0.1387 Gm. of the oil was weighed and placed in a protected place on Feb. 17th and weighed each day to determine its drying properties. Until March 1st no gain was noticed. After this time a gradual gain in weight occurred until March 13th at which time it weighed 0.1523 Gm. This represented an increase of 0.0136 Gm. It was weighed for several weeks after this but no loss or gain was noted.

Saponification.—203.5 Gm. of the oil were saponified with 130 cc. of a 25 per cent solution of sodium hydroxide in an autoclave for 1 hour at 15 lbs. (17). The soap was dissolved in water and extracted with ether to obtain the phytosterol, if any was present. 0.522 Gm. was obtained from the ether extract from which no crystalline substance, to indicate phytosterol, was obtained.

The acids were then liberated with dilute hydrochloric acid (1:1) and 185 Gm. were obtained. The I. V. was 139.51.

A second sample of 200 Gm. was saponified in the same manner. The acids obtained had an iodine value of 137.

THE FATTY ACIDS.

The first portion of the fatty acids was neutralized with alcoholic potassium hydroxide and precipitated with an aqueous solution of lead acetate. The solution was allowed to stand over night on ice. The lead soap was recovered and refluxed with ether for two hours and allowed to stand over night on ice. The ether-soluble portion was separated from the solid lead salts by decantation and each portion treated with dilute hydrochloric acid (1:1) to liberate the acids.

The ether was removed by distillation under reduced pressure from the ether-soluble portion which had an I. V. of 139 and the solid portion had an I. V. of 129. The second portion of acids was treated in the same manner. The I. V. for the liquid acids was 135 and for the solid acids, 69.

Identification of Liquid Fatty Acids.—Bromination Products. The bromination products were prepared according to the method given by Lewkowitsch (18). A precipitate of 4.7 Gm. formed, which after recrystallization from alcohol gave a melting point of 176–177° C. The ethereal filtrate was washed with a saturated solution of sodium thiosulphate to remove the excess bromine and the ether recovered by distillation. The residue was taken up with boiling petroleum ether, except a small amount which did not dissolve. This was separated and the liquid left at 5° C. for two hours. The residue gave a melting point of 176–177° and was considered to be the same as the first obtained. No further residue was obtained at the end of two hours.

THE OXIDATION PRODUCTS.

The oxidation products of the liquid fatty acids were prepared according to the method of Hazura and Grussner (19). There was a very slight precipitate which indicated the formation of dihydroxy-stearic or sativic acid in very small amounts.

The acid filtrate was neutralized with potassium hydroxide and boiled down to about half its original volume and acidulated with sulphuric acid. The precipitate, consisting of a brown flocculent mass, was dried by exposure to air and treated with ether, which dissolved out probably azelaic acid (20) and other secondary acidic products of oxidation.

The ethereal solution was evaporated and then recrystallized twice from water. Long, flat, needle-shaped crystals were obtained.

The ether-insoluble portion was crystallized from alcohol and then from water. The ether-soluble portion was extracted with alcohol and evaporated and tested for iso-linusic acid but no indication of its presence was found. The ether-insoluble portion, after extraction with alcohol, was extracted with water. The aqueous extract was evaporated and recrystallized twice. The crystals were rhombic plates which melted at 197° C., which indicated linusic acid, melting point 203° C. (21).

SEPARATION AND IDENTIFICATION OF THE SOLID ACIDS.

The methyl esters were prepared by the method of Read and Feng (22), 200 Gm. of the acids were refluxed with methyl alcohol (300 cc.) and 10 cc. of sulphuric acid for 10 hours.

The esters were fractionated at the following temperatures and pressures:

Temperature.	Pressure.	1st Fraction.	2nd Fraction.	3rd Fraction.
160–185	6 mm.	9.1 Gm.	.....	.....
185–189	2 mm.	.....	25.5 Gm.	.....
169–179	0.5 mm.	.....	.....	35.3 Gm.

The esters had a pale yellow color and the residue was a black, oily mass.

The second portion of the esters was redistilled, and collected at the following temperatures and at 0.5-mm. pressure.

Temperature.	Melting point.
140–178	35° C.
178–185	29–30° C.
185–189	Liquid

The esters were saponified by refluxing for fifteen minutes with alcoholic potassium hydroxide and the acids liberated from the soap by the addition of dilute hydrochloric acid (1:1).

The magnesium salt of the first fraction of the acids obtained from the redistilled esters was prepared by adding in succession, $^1/_{10}$ of the calculated amount of a neutral aqueous solution of magnesium acetate to the acids. The amount of magnesium acetate was calculated on the basis of pure stearic acid. Only four precipitates were collected and dried separately. The acids were liberated from the first two portions and the melting points determined as follows: No. 1, 56° C. and No. 2, 54° C. The last two portions were too small for further investigation.

The residue from the distillation of the esters was saponified with alcoholic potassium hydroxide and the solution neutralized with acetic acid and the lead soap formed by adding neutral lead acetate solution. The lead soap was extracted with ether. A very small amount of a fatty substance was obtained which appeared to be free unsaturated fatty acids.

The fatty acids were liberated from the lead soap with dilute hydrochloric acid (1:1) and the acids recovered and boiled with alcohol. The alcoholic solution which was dark brown in color was poured off and allowed to cool over night. A solid layer of acids formed on top of the solution and, after purification by recrystallization from alcohol, gave a melting point of 83° C.

SUMMARY.

Chemical analysis of the seed showed that they contained approximately 30 per cent of a drying oil in which the following acids were found: Linolenic, linolic, stearic, palmitic and a trace of oleic acid.

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