

**The constituents of the seeds of *Gynocardia odorata*, R. Br / by Frederick B. Power and Marmaduke Barrowcliff.**

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THE CONSTITUENTS OF THE SEEDS  
OF  
GYNOCARDIA ODORATA, *R.Br.*

BY

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AND

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(From the Transactions of the Chemical Society, 1905)



THE WELLCOME CHEMICAL RESEARCH LABORATORIES

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10. THE COMPOSITION AND DETERMINATION OF CERIUM OXALATE
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16. THE CHEMISTRY OF THE JABORANDI ALKALOIDS
17. A NEW ADMIXTURE OF COMMERCIAL STROPHANTHUS SEED
18. RESEARCHES ON MORPHINE—Part II.
19. THE CONSTITUTION OF PILOCARPINE—Part II.
20. THE CHEMISTRY OF THE BARK OF ROBINIA PSEUD-ACACIA, *Linn.*
21. THE ANATOMY OF THE BARK OF ROBINIA PSEUD-ACACIA, *Linn.*
22. A SOLUBLE MANGANESE CITRATE AND COMPOUNDS OF MANGANESE WITH IRON
23. THE CHEMICAL CHARACTERS OF SO-CALLED IODO-TANNIN COMPOUNDS
24. THE CONSTITUTION OF PILOCARPINE—Part III.
25. A NEW SYNTHESIS OF  $\alpha$ -ETHYLTRICARBALLYLIC ACID
26. THE CONSTITUENTS OF THE ESSENTIAL OIL OF ASARUM CANADENSE
27. DERIVATIVES OF GALLIC ACID
28. THE OCCURRENCE OF SALICIN IN DIFFERENT WILLOW AND POPLAR BARKS

(Continued on page 3 of cover)



XCII.—*The Constituents of the Seeds of Gynocardia Odorata.*

By FREDERICK BELDING POWER and MARMADUKE BARROWCLIFF.

PRIOR to the year 1900 it was generally believed that the "chaulmoogra oil" of commerce was obtained from the seeds of *Gynocardia odorata* (R. Br.). More recently, however, it has been recorded by Mr. E. M. Holmes (*Pharm. J.*, 1900, 64, 522; 1901, 66, 596), on the authority of Dr. Prain, Director of the Botanic Survey of India, that chaulmoogra oil is afforded by the seeds of *Taraktogenos Kurzii* (King), these seeds having evidently been wrongly referred to the genus *Gynocardia*. The results obtained by one of us and Mr. F. H. Gornall (*Trans.*, 1904, 85, 838) in an investigation of the oil from authentic seeds of *Taraktogenos Kurzii* are in accordance with the above observation, for it was proved that the latter oil is identical



in its physical characters and in composition with the chaulmoogra oil of commerce.

We are now, moreover, in a position to state conclusively that the oil which has long been known in European commerce as "chaulmoogra oil," and sometimes described under the synonym of "gynocardia oil," has never been obtained from the seeds of *Gynocardia odorata*, for whereas chaulmoogra oil at the ordinary temperature is a solid (m. p. 22—23°), the oil from the seeds of *Gynocardia odorata* is a liquid. Furthermore, chaulmoogra oil is optically active and consists chiefly of the glyceryl esters of members of the chaulmoogric acid series, whereas the oil from gynocardia seeds is optically inactive and contains neither chaulmoogric acid nor its homologues.

The present investigation has shown that gynocardia oil consists of the glyceryl esters of the following acids: (1) linolic acid, or isomerides of the same series, constituting the largest proportion of the oil; (2) palmitic acid, in considerable amount; (3) linolenic and isolinolenic acids, the latter preponderating; and (4) oleic acid, in relatively small amount.

In addition to the fatty oil, gynocardia seeds contain, as has previously been shown (Power and Lees, this vol., p. 349), 5 per cent. of a crystalline glucoside, gynocardin,  $C_{18}H_{19}O_9N, 1\frac{1}{2}H_2O$ , and a hydrolytic enzyme, gynocardase.

#### EXPERIMENTAL.

The seeds of *Gynocardia odorata* are not collected for commercial purposes, and some difficulty was experienced in obtaining them. Through the kindness, however, of Mr. David Hooper, Curator of the Indian Museum, Calcutta, it has been possible for us to procure a quantity of these seeds sufficient for a complete investigation of their constituents.

According to a private communication from Mr. Hooper, the recognised habitats of *Gynocardia odorata* are Sikkim, Assam, and Chittagong in Bengal, and he also informs us that in Assam the oil is sometimes expressed from the seeds by the natives.

The seeds employed in this investigation were collected in Sylhet, Assam, and their genuineness confirmed by Surgeon-Major Prain, Director of the Botanic Survey of India, by the Reporter on Economic Products to the Government of India, and also by Mr. E. M. Holmes, F.L.S., of London.

On divesting the seeds of their shells it was found that the latter represented 37 per cent. of their weight. The kernels, when subjected to hydraulic pressure, afforded an amount of fatty oil and of a "press-cake" equivalent, respectively, to 19.5 and 40 per cent. of the



weight of the entire seed. By extracting the total powdered seed with ether, 27.2 per cent. of oil was obtained.

#### *The Fatty Oil.*

The fatty oil from the seeds of *Gynocardia odorata* is, at the ordinary temperature, a light yellow liquid, having an odour resembling that of linseed oil. It is optically inactive. The expressed oil, and that extracted from the seeds by ether, gave the following values respectively :

	Expressed oil.	Oil extracted by ether.
Specific gravity .....	0.925 at 25°	0.927 at 25°
Acid value .....	4.9	5.0
Saponification value.....	197.0	199.6
Iodine value .....	152.8	152.0

#### *Hydrolysis of the Fatty Oil.*

One hundred grams of the fatty oil were hydrolysed with alcoholic sodium hydroxide, the alcohol removed, and the residue mixed with sand, dried, and extracted with light petroleum. The latter removed a very small amount of a substance which, after crystallisation from alcohol, melted at 133°, and proved to be phytosterol.

#### *The Fatty Acids.*

The sodium salts obtained by the above hydrolysis were dissolved in water, the liquid acidified with sulphuric acid, and the liberated fatty acids taken up by ether. The ethereal solution was then washed, dried, and the ether removed, the last traces of the latter being eliminated by heating the residual oil for some time at 100°. The total mixed fatty acids thus obtained, which partially solidified on standing at the ordinary temperature, gave an acid value of 199.8, and an iodine value of 162.6.

In order to investigate the mixture of fatty acids, 500 grams of the fatty oil were hydrolysed, the acids liberated, and the portion volatile in steam removed. The latter consisted of very small amounts of formic and acetic acids. The non-volatile acids were separated from the aqueous liquid and allowed to stand, when a considerable amount of a crystalline substance was deposited. The latter, which was collected at the pump, amounted to 60 grams; it was dissolved in alcohol and converted into its lithium salt in three successive fractions, each of which, after precipitation, was redissolved by heat, allowed to crystallise, the acid regenerated, and then crystallised from alcohol. The first fraction of acid melted at 60—61°, the second at



59—60°, and the third at 59—61°. On further crystallisation of the first fraction it melted at 62°, and gave on analysis the following figures:

0.1086 gave 0.2991 CO<sub>2</sub> and 0.1220 H<sub>2</sub>O. C = 75.1; H = 12.5.

C<sub>16</sub>H<sub>32</sub>O<sub>2</sub> requires C = 75.0; H = 12.5 per cent.

The solid acid which separated from the total fatty acids was thus shown to be palmitic acid.

The high iodine-absorption value (162.6) of the total fatty acids indicated the presence of linolic acid or acids of the same series, and, taking into consideration the large amount of palmitic acid isolated, also of acids of the linolenic series. For the identification of these acids the method was employed which depends on oxidation with permanganate, and the separation of the corresponding hydroxy-acids (compare Lewkowitsch's *Chemical Technology and Analysis of Oils, Fats, and Waxes*, vol. i, pp. 360—363).

Sixty grams of the oily acids, from which the large amount of palmitic acid had been removed as described above, were therefore oxidised with potassium permanganate, and the following products isolated:

(1) A crystalline acid, melting at 133°.

0.0747 gave 0.1862 CO<sub>2</sub> and 0.0773 H<sub>2</sub>O. C = 68.0; H = 11.5.

C<sub>18</sub>H<sub>36</sub>O<sub>4</sub> requires C = 68.3; H = 11.4 per cent.

This product was thus identified as dihydroxystearic acid, and its formation proved the presence of oleic acid in the fatty oil.

(2) A crystalline mixture, melting at 156—159°.

0.1158 gave 0.2624 CO<sub>2</sub> and 0.1077 H<sub>2</sub>O. C = 61.8; H = 10.3.

C<sub>18</sub>H<sub>36</sub>O<sub>6</sub> requires C = 62.1; H = 10.3 per cent.

This evidently consisted of isomeric tetrahydroxystearic acids, which could not be readily separated. They represented the chief product of the oxidation, and their formation would appear to prove the presence in the fatty oil of isomeric acids of the linolic series.

(3) A crystalline acid melting at 171°.

0.1010 gave 0.2100 CO<sub>2</sub> and 0.0866 H<sub>2</sub>O. C = 56.7; H = 9.5.

C<sub>18</sub>H<sub>36</sub>O<sub>8</sub> requires C = 56.8; H = 9.5 per cent.

This acid was therefore *isolinusic* acid, a hexahydroxystearic acid, and its formation proved the occurrence of *isolinolenic* acid in the fatty oil.

(4) A very small amount of a mixture of acids melting considerably higher than *isolinusic* acid. This, in all probability, contained *linusic* acid (m. p. 203—205°), the hexahydroxystearic acid derived from

linolenic acid. The presence of the latter acid in the fatty oil was, however, definitely established by the formation of its crystalline hexabromide, which melted at 180—181°.

Our thanks are due to Mr. Frederic H. Lees for his assistance in connection with this investigation.

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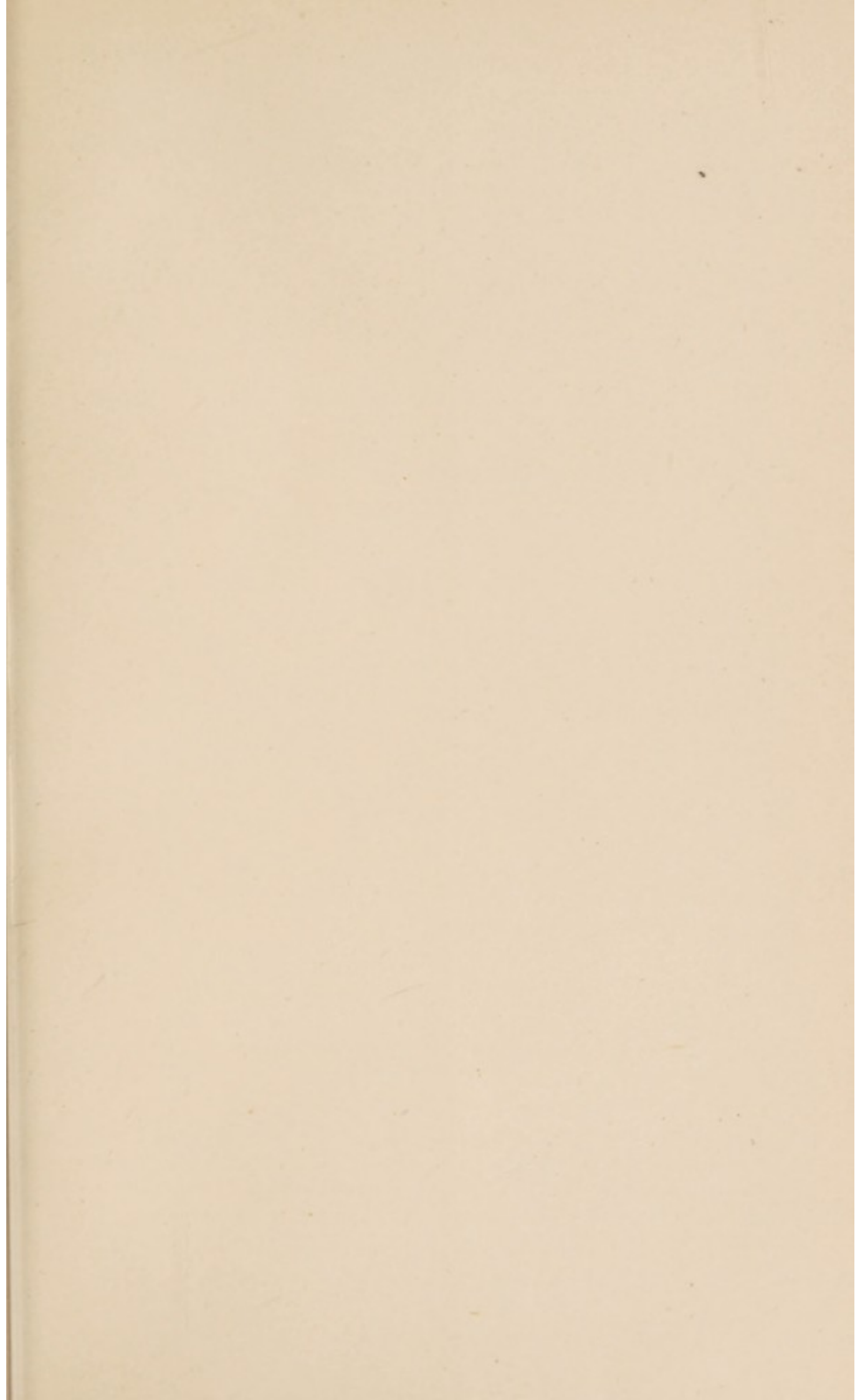
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30. THE CONSTITUENTS OF AN ESSENTIAL OIL OF RUE
31. METHYL  $\beta$ -METHYLHEXYL KETONE
32. INTERACTION OF KETONES AND ALDEHYDES WITH ACID CHLORIDES
33. THE ANATOMY OF THE STEM OF DERRIS ULIGINOSA, *Benth.*
34. THE CHEMISTRY OF THE STEM OF DERRIS ULIGINOSA, *Benth.*
35. THE CONSTITUTION OF PILOCARPINE—Part IV.
36. PREPARATION AND PROPERTIES OF DIMETHYLGLYOXALINE AND DIMETHYLPYRAZOLE
37. THE ELECTROLYTIC REDUCTION OF PHENO- AND NAPHTHOMORPHOLONES
38. CHEMICAL EXAMINATION OF KÓ-SAM SEEDS (*BRUCEA SUMATRANA*, *Roxb.*)
39. COMPARATIVE ANATOMY OF THE BARKS OF THE SALICACEÆ—Part I.
40. THE CONSTITUTION OF CHRYSOPHANIC ACID AND OF EMODIN
41. THE CONSTITUTION OF EPINEPHRINE
42. A LÆVO-ROTATORY MODIFICATION OF QUERCITOL
43. THE CONSTITUENTS OF THE ESSENTIAL OIL OF CALIFORNIAN LAUREL
44. SOME DERIVATIVES OF UMBELLULONE
45. THE CONSTITUENTS OF CHAULMOOGRA SEEDS
46. THE CONSTITUTION OF CHAULMOOGRIC ACID—Part I.
47. CHEMICAL EXAMINATION OF CASCARA BARK
48. CHEMICAL EXAMINATION OF GYMNEMA LEAVES
49. THE RELATION BETWEEN NATURAL AND SYNTHETICAL GLYCERYLPHOSPHORIC ACIDS
50. GYNOCARDIN, A CYANOGENETIC GLUCOSIDE
51. PREPARATION AND PROPERTIES OF 1:4:5-TRIMETHYLGLYOXALINE
52. THE CONSTITUTION OF PILOCARPINE—Part V.
53. THE CONSTITUTION OF BARBALOIN—Part I.
54. THE CONSTITUENTS OF THE SEEDS OF *HYDNOCARPUS WIGHTIANA*, *Blume*, AND OF *HYDNOCARPUS ANTHELMINTICA*, *Pierre*
55. THE CONSTITUENTS OF THE SEEDS OF *GYNOCARDIA ODORATA*, *R.Br.*
56. THE SYNTHESIS OF SUBSTANCES ALLIED TO EPINEPHRINE



