

Scientific Edition

JOURNAL OF THE AMERICAN PHARMACEUTICAL ASSOCIATION

JUSTIN L. POWERS, EDITOR, WASHINGTON, D. C.

VOLUME XXXI

JULY, 1942

NUMBER 7
CONSECUTIVE No. 13

Chemical Examination of the Seeds of *Barringtonia acutangula* Gaertn.*

By J. K. Lahiri and S. Ghosh

Barringtonia acutangula Gaertn. (*Myrtaceæ*) is one of the most widely distributed trees in Bengal and is known in Bengali as "Hijjal." The fruit is known as "nurse fruit" and is one of the best-known domestic remedies. When children suffer from cold in the chest, the seed is rubbed down with water on a stone and applied over the sternum. A few grains, administered internally, seldom fails to induce vomiting which results in expulsion of mucus from the air passages. The seed is also used to reduce enlarged abdomens in children (1).

The seeds, leaves and roots are stated to act as a fish poison.

No chemical or pharmacological investigation appears to have been made of the constituents of the seeds of *B. acutangula* growing so widely in Bengal. The present investigation consists of an attempt to elucidate the chemical composition of the seeds.

Greshoff (2) and Weil (3) have reported the presence of saponin-like glycosides in *B. insignis*, *B. vriesei* and *B. racemosa*. Van den Driessen-Mareeuw (4) has isolated a saponin, barringtonin, from the seeds of *B. spinosa* and Nozoe (5) has also isolated a

saponin, barrinin, from the seeds of *B. asiatica*.

The fresh fruits of *B. acutangula* were collected from the Dacca district during the season when they were fully grown. The seeds obtained from them were air dried and powdered.

EXPERIMENTAL

Preliminary Examination.—The ash content of the air-dried and powdered seeds was found to be 4.85%. A hot water infusion gave a filtrate acid to litmus. The infusion gave on shaking the characteristic honeycomb froth indicating the presence of saponins. Steam distillation did not indicate volatile constituents. Extraction with Prollius' fluid and with weak hydrochloric acid gave negative results with the usual alkaloidal reagents (6).

Extraction with Selective Solvents.—Air-dried and powdered seeds were extracted in a Soxhlet extractor with selective solvents. Petroleum ether (b. p., 40–60° C.) extracted 2.0%, ether 5.5% and rectified spirit 4.1%. The petroleum ether extract showed the presence of an oil and traces of a sterol. The ether extract showed the presence of a substance which gave a blue-black precipitate with ferric chloride. The rectified spirit extract showed the presence of a bitter saponin. The marc left after extracting with the above solvents was extracted several times with 45% alcohol. The combined aqueous alcoholic extracts were concentrated and treated with lead acetate. The lead acetate precipitate also showed the presence of saponins.

* From the Department of Chemistry, School of Tropical Medicine, Calcutta, India.

Isolation of the Saponin.—Air-dried and powdered seeds (200 Gm.) were refluxed four times with 45% alcohol. The combined extracts were concentrated to a small bulk, filtered and treated with an aqueous solution of lead acetate. The precipitate obtained was suspended in 75% alcohol and the lead was removed by a current of hydrogen sulfide. The filtrate was concentrated and a little alcohol added. The precipitate formed, consisting of starchy matter, was filtered off and rejected. Further amounts of alcohol were added and the first lot of crude saponin (0.81 Gm.) precipitated was filtered off. Ether was added to the alcoholic filtrate and the second crop of the crude saponin (0.75 Gm.) was obtained. On drying over concentrated sulfuric acid in vacuum the saponin was obtained as a yellow powder (yield 0.78%). The crude saponin was purified by dissolving it in the smallest quantity of water and precipitating it with alcohol. The flocculent precipitate formed was collected and dried over concentrated sulfuric acid and was obtained as a white amorphous powder. Addition of ether to the alcoholic filtrate gave a precipitate which on drying formed a yellow amorphous powder. The white and the yellow powders gave all the tests for saponin. The white powder was further purified by dissolving it in smallest quantity of water and precipitation by alcohol. The saponin was thus obtained as a white amorphous powder which decomposed at 148° C.

The filtrate obtained after removing the lead acetate precipitate was treated with lead subacetate but nothing of interest could be obtained either from the lead subacetate precipitate or the filtrate.

The Saponin.—The white amorphous saponin, acid in nature, was very soluble in water and insoluble in petroleum ether, ether, chloroform and alcohol. On hydrolysis the saponin gave sugars. Alcoholic cholesterol and baryta water gave a white precipitate with the saponin.

*Pharmacological Action.*¹—The saponin possessed strong hæmolytic action and was found to kill fish. *Macrones vittatus* were experimented with and the opercular movement of the fish, kept under water, was recorded on a kymograph before and after the addition of the saponin.

SUMMARY

The toxic principle of the seeds of *Barbingtonia acutangula* is an amorphous acid saponin. Other substances such as starch, fatty oil and sugars are present. The poisonous action of the seeds on fish could be accounted for by the presence of the saponin.

¹ The authors desire to express their thanks to Dr. N. N. Das for carrying out the pharmacological experiments.

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Interrelated Vitamin Requirements

The Influence of Thiamin, Riboflavin, Pantothenic Acid and Vitamin B₆ on Liver Glycogen Reserves*

By G. C. Supplee, R. C. Bender and Z. M. Hanford

The degree and rate of glycogen formation and hydrolysis in the liver are influenced by many factors, including dietary components, energy demands of the organism, state of metabolism and the degree of normality of glandular secretions. As yet, only fragmentary and incidental data concerning the influence of vitamin entities are available, notwithstanding much evidence of an inferential character indicating

that important reactions involving these factors are largely localized in the liver. Although glycogenesis and glycogenolysis are recognized as liver functions, the chemical reactions involved are only generally known to be of an oxidative or reducing character, and it has not been determined to what degree individual vitamin entities may be directly or indirectly concerned. The investigations reported herein were designed to determine the interrelationship and effect of each of four entities of the vitamin B complex on glycogen formation

* From the Borden Company Biological and Chemical Research Laboratories, Bainbridge, N. Y.