THE ALKALOIDS OF ARGEMONE ÁLBA LESTIB.*

BY P. A. FOOTE.

The plants of the Papaveraceæ will no doubt interest the pharmacist for many generations to come. According to Small[1] two species of the genus Argemone in the Poppy family grow in Florida: they are Argemone álba and Argemone Mexicana. The latter species was investigated by Schlotterbeck[2] who found berberine and protopine.

Fig. 1.—*Argemone álba* Lestib.

Argemone álba, White Prickly Poppy,[3] grows in waste places in dry or sandy soil from Missouri to Florida and Texas.[1] It blooms in the spring and summer, presenting a beautiful white corolla.

A preliminary investigation showed that the dried overground portion of the flowering plant, collected in April, contained approximately 2.63 p. c. of alkaloids, determined gravimetrically. The stems contained 3.25 p. c. of alkaloids. It therefore seemed most worthy of further study.

The collection, drying, comminution, extraction and analysis were used to demonstrate these important processes to the writer's classes; hence, the different methods of isolation as given below. Frequently, the students, assisted as they were, continually kept in touch with the work, which was carried on at intervals over a period of two years. This practical demonstration proved of such value that the writer hopes to continue the practice, especially since Florida abounds in plants of pharmaceutical interest.

EXPERIMENTAL.

Collection and Preparation.—The material was collected during the third week of April 1929. It was found largely along the railroad tracks in the outskirts of Gainesville. Most of the plants were in bloom but still had unripe capsules. They were pulled up to get the roots so that the entire plant might be investigated. The roots were chopped from the overground portion for separate investigation. After air drying the drug was comminuted to No. 60 mesh.

INVESTIGATION OF THE ROOTS.

Eight hundred and forty-five Gm. of the ground dried root were moistened

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[1] "Flora of the Southeastern United States," 2nd ed., N. Y., 1913, page 462.

[2] *Pharm. Rev.*, 19 (1901), 458.

[3] Britton and Brown, "Illustrated Flora of the United States and Canada," 1st Edition, Phila. (1901), page 575.

with dilute ammonia water for the purpose of liberating the alkaloids from their combinations with acids.

The powder was dried at room temperature by spreading out in thin layers in a room having a good circulation of air. The drug was extracted with warm chloroform in a modified Soxhlet apparatus. The percolate was a deep orange color. Most of the solvent was distilled off. The last portion was allowed to evaporate spontaneously. It left behind a reddish brown residue. A 14X hand lens showed tiny needles grouped in many balls. The residue gave positive powerful tests for berberine including the chlorine water and nitric acid tests. The hydrochloride, hydriodide and chromate were prepared. All of these substantiated the evidence that the major alkaloid in the root was berberine. By the microscope no other crystals were apparent. Nevertheless, the chloroform extract was repeatedly extracted with warm water to separate the berberine from any other alkaloids that might be present, for berberine is soluble in water and most alkaloids are not. When this aqueous extract was evaporated to dryness, it was found to consist only of berberine. The remaining chloroform extract appeared resinous in nature. It was mixed with sand and extracted with dilute acetic acid. No more alkaloids were found.

INVESTIGATION OF THE OVERGROUND PORTION.

Four thousand five hundred and seventy-five Gm. of the ground dried overground portion were moistened with dilute ammonia and dried at room temperature. Part of it was extracted with chloroform and the remainder by 95 p. c. alcohol.

Chloroform Extraction.—3135 Gm. of the drug were extracted by warm chloroform in a continuous extraction apparatus. The extract was concentrated to a small volume and shaken out with dilute hydrochloric acid until all the alkaloids were extracted. The acid solution was concentrated to half its volume. On cooling berberine hydrochloride crystallized out in golden-yellow needles. The melting point was indefinite, turning black to dark brown above 110° C., undergoing decomposition. The following tests were positive for berberine: chlorine water, sulphonic acid, Froehde's reagent and the quinone test.

The filtrate was divided into four equal portions, namely, A, B, C and D. These were treated as follows:

A. This portion was precipitated by Sonnenschein's reagent, filtered, dried at low temperature and mixed with an equal volume of moist Na_2CO_3. It was then exhaustively extracted with chloroform and then with ether. When allowed to evaporate spontaneously the chloroform left a deposit of berberine and the ether nothing.

B. This portion was precipitated by Mayer's reagent, collected on a filter, and then suspended in distilled water. Hydrogen sulphide was then passed in until the solution was saturated and allowed to stand for forty-eight hours. The insoluble mercuric sulphide was filtered off and the filtrate evaporated to dryness in vacuum. An ether extract of the residue gave no alkaloid. This was followed by chloroform and acetone extractions which gave only berberine.

C. Precipitation of this portion was obtained by placing sticks of caustic soda in the solution until it became alkaline. They were removed. A dark brown precipitate settled out. It was collected on a filter paper and washed with water until neutral to litmus. After drying, successive extractions with ether, chloroform

and water gave only berberine in the chloroform and aqueous extracts. The ether extract yielded nothing.

D. A solution of picric acid (Hager's reagent) was added to the last portion. It was concentrated and added to twice its volume of acetone. In thirty minutes there crystallized a substance in irregular white plates, m. p. 232–235° C. This picrate was soluble in water but insoluble in chloroform and acetone. It was precipitated from its aqueous solution by ammonium hydroxide. Alkaloidal reagents, such as Wagner's, Sonnenschein's or Froehde's failed to precipitate it. Further investigation was impossible due to the small quantity isolated.

Alcohol Extraction.—1440 Gm. of the drug were extracted by warm 95 p. c. alcohol in a Sando extractor.[1] The alcohol was distilled off and the residue extracted with ether. The ether solution was shaken out with dilute acid and that made alkaline and shaken out with ether. The only base found was berberine. The alcoholic extract contained some crystals of potassium nitrate.

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SUMMARY.

The dry overground portion of *Argemone alba* Lestib. contains 2.64 p. c. of alkaloids. This is practically all berberine.

A minute quantity of an alkaloid was isolated, the picrate of which melted at 232–235° C.

Berberine was the only alkaloid found in the root.

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ERGOT IMPORTS FROM RUSSIA AND SPAIN LARGER IN 1931.

Imports of ergot for consumption in the United States during 1931 amounted to 287,000 pounds as compared with 291,300 pounds in 1930 and 228,000 pounds in 1929. Assuming that supplies from Germany represent transshipments of Russian ergot, purchases thereof totaled 210,300 pounds in 1931 as against 121,000 in 1930. Imports from Soviet Russia direct totaled 8700 pounds in 1930 and 106,100 in 1931. Arrivals from Spain amounted to 70,200 pounds in 1931, as compared with 61,300 in the preceding year. Small quantities were recorded from Portugal and Belgium.

NUX VOMICA FROM FRENCH INDO-CHINA.

Nux vomica exported from French Indo-China finds a leading consuming outlet in the United States, the above country having surpassed India in the quantity shipped to the United States last year. Imports of nux vomica into the United States totaled approximately 1,924,600 pounds valued at $58,500 in 1931, as compared with 2,197,500 pounds worth $56,400 during 1930. French Indo-China in 1931 supplied 1,264,400 pounds while 617,800 pounds came from India. Small quantities were recorded as entering from Syria and Canada, presumably transshipments.

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[1] *Ind. Eng. Chem.*, 16 (1924), 1125.