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ALKALOIDS OF *ARGEMONE FRUTICOSA* AND *A. ECHINATA**

F. R. STERMITZ†, R. J. ITO†, S. M. WORKMAN† and W. M. KLEIN‡

Departments of Chemistry and Botany and Plant Pathology, Colorado State University, Fort Collins, CO 80521, U.S.A.

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Abstract—*Argemone fruticosa* Thurber ex Gray was analyzed and found to contain hunnemanine as the major alkaloid along with allocryptopine. *A. echinata* G. B. Ownb. was found to contain cryptopine and berberine as major alkaloids. These analyses indicate that these two species belong among the more specialized species of the genus.

THE MEXICAN species *Argemone fruticosa* Thurber ex Gray and *A. echinata* G. B. Ownb. were considered[1,2] to be possible sources of pavine-type alkaloids, although the morphological grounds on which this suggestion was based were somewhat ambiguous. Early descriptions of the genus incorporated *A. echinata* into either *A. hispida* or *A. platyceras*. The latter two are now considered by us to be more primitive species and contain the primitive marker pavine alkaloids as major constituents. On the other hand, the more recent authority[3] suggested an alliance of *A. echinata* with *A. squarrosa*, which we have placed[1] in alliance III (a more specialized group) of our division of the genus. The situation with respect to *A. fruticosa* was interesting in that Ownbey could find[3] no relation between it and other species of the *Argemone* and suggested that it was the only member which might conceivably be placed entirely outside the genus. This suggestion was, however, based upon herbarium studies only as Ownbey was unable to observe *A. fruticosa* in the field.

We were able to observe and collect *A. echinata* and *A. fruticosa* recently and wish to report here the alkaloid analyses of these two species.

RESULTS

Analysis of *A. fruticosa* showed that it contained 0·89% alkaloids (a very high figure for *Argemone* species), of which the major alkaloids were allocryptopine (about 60% of the total alkaloid content) and hunnemanine (about 20%). The sap of *A. fruticosa* was yellow or yellow–orange in color and we have previously found[1] that the sap color in *Argemone* species is usually due to the presence of berberine and/or sanguinarine. Neither was present

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† Department of Chemistry.

‡ Department of Botany and Plant Pathology.

[1] F. R. STERMITZ, D. E. NICODEM, C. C. WEI and K. D. MCMURTREY, *Phytochem.* **8**, 615 (1969).

[2] F. R. STERMITZ, S. M. WORKMAN and W. M. KLEIN, *Phytochem.* **10**, 675 (1971).

[3] G. B. OWNBEY, *Monograph of the Genus Argemone for North America and the West Indies, Memoirs of the Torrey Botanical Club*, Vol. 21, The Seeman Printery, Durham, North Carolina (1958).

in *A. fruticosa*. A trace amount of an impure orange alkaloid having a benzophenanthridine UV spectrum was indeed isolated, but insufficient pure material was available to complete identification.

Analysis of *A. echinata* showed that it contained 0·13% alkaloids, from which cryptopine (about 40% of the total) and berberine (about 30%) could be isolated. TLC showed traces of other alkaloids which could not be obtained pure.

These results show that neither of the species contains pavine-type alkaloids and hence probably belong to the more specialized alliances and we can tentatively place them in Alliance III[1] with *A. squarrosa*. Our observation of *A. fruticosa* in the field indicates some morphological resemblances to *A. squarrosa* as well. Further evidence for this will await the results of caryological studies presently underway.

EXPERIMENTAL

Plants of *A. echinata* were collected in June 1970, along Highway 57, 30 miles south of Saltillo, Mexico, and a voucher sample deposited at the Colorado State University herbarium under accession No. 49992. Plants of *A. fruticosa* were collected in June 1970, in Coahila, Mexico, about 15 miles south of the La Virgen settlement off Highway 40 and a voucher sample was deposited under No. 49993. We are particularly indebted to Senor Matias of the botanical garden in Parras de la Fuente for his assistance in guiding us to this rare species.

Isolation of the alkaloids was as described previously.[1,2] Cryptopine, allocryptopine, and berberine were compared with standard samples.[1] The isolation of hunnemanine was from the pH 9[1] alkaloid fraction and was compared with a standard sample obtained from Dr. R. H. F. Manske who had previously isolated[4] this alkaloid from *Hunnemannia fumariaefolia*.

[4] R. H. F. MANSKE, L. MARION and E. LEDINGHAM, *J. Am. Chem. Soc.* **64**, 1959 (1942).