

Isolation of Batatasin I from *Dioscorea dumetorum* Rhizomes

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Batatasin I was shown to occur in the fresh rhizomes of poisonous yam (*Dioscorea dumetorum* Pax.). It was isolated by column chromatography and identified by chromatographic and spectral evidence. Two other unknown phenanthrenes were shown to occur by thin-layer chromatography.

Naturally occurring phenanthrenes have been shown so far to occur in only three plant families: Dioscoreaceae [1, 2], Combretaceae [3], and Papaveraceae [4]. Within the family Dioscoreaceae, only *Dioscorea opposita* Thunb. (= *D. batatas* Decne) [1] and *Tamus communis* [2] were reported to contain phenanthrene derivatives. *D. batatas* contains the phenanthrene batatasin I, together with the related bibenzyl derivatives batatasins III, IV and V [1, 5]. These various batatasins were shown to be responsible for inducing dormancy in the aerial bulbils of *D. batatas* [1, 5–6]. Dihydrophenanthrenes within the family Dioscoreaceae were shown to occur in two *Dioscorea* spp., namely *D. prazeri* [7] and *D. decipiens* [8].

These phenanthrenes and the related dihydrophenanthrenes and bibenzyl derivatives thus appear to be possible chemotaxonomic markers of certain species of the family Dioscoreaceae. Therefore we have undertaken a systematic investigation of a number of *Dioscorea* spp. regarding the occurrence of phenanthrenes and related compounds.

We wish to report on the isolation of batatasin I (**1**) from the fresh rhizomes of the poisonous yam *Dioscorea dumetorum* Pax. It was isolated by column chromatography and identified by chromatographic and spectral evidence. Two other phenanthrenes were shown to occur by TLC. Their isolation and structural elucidation is still under investigation.

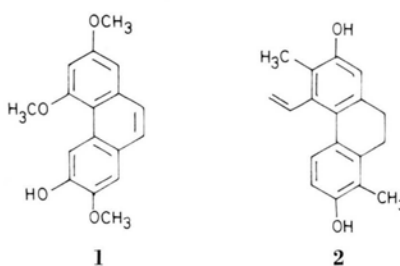
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Results and Discussion

Poisonous yam has been reported to be used as an ingredient of arrow poisons in Africa [9]. It is reported to have caused deaths in famine in East Sudan. The ingredients implicated for such poisonous effects have been shown to be the alkaloids dioscorine and dihydrosioscorine [10]. In South Africa, poisonous yam rhizomes are used for the local relief of pain [9], a use somewhat similar to the use of *Tamus communis* rhizomes in Europe as a local antirheumatic [11]. *Tamus communis* rhizomes have yielded several phenanthrene derivatives [2]. It is intriguing that poisonous yam contains also a number of phenanthrenes, one of which is being identified as batatasin I. The exact physiological function of these phenanthrenes in animals and humans has not been delineated. It may be possible that such phenanthrenes may contribute to the poisonous effects of poisonous yam rhizomes or to the pain relieving effect of *Tamus communis* and of poisonous yam rhizomes. The isolation of a C-substituted dihydrophenanthrene (**2**) from *Juncus roemerianus* with antitumor effect [12, 13], points to the importance of studying these phenanthrenes and related compounds regarding their pharmacological and biological effects.



Experimental

Detection of batatasin I. — Fresh rhizomes of *D. dumetorum* (50 g) was minced in a mortar containing cold acetone (200 ml) and ground thoroughly. It was then extracted exhaustively in a percolator with 500 ml of acetone. The acetone extract was evaporated to dryness *in vacuo*. The extract was tested on TLC using system I (Silica gel/benzene-ethyl acetate 4 : 1) to show the presence of a violet-fluorescent spot under UV (R_F 0.40) corresponding to batatasin I. When tested on TLC



system II (Silica gel/chloroform-methanol 93 : 7), the extract showed a violet-fluorescent spot corresponding to batatasin I (R_F 0.60). Upon spraying the plates with 10% H_2SO_4 and heating at 110 °C for 10 min, this batatasin I band as well as authentic batatasin I gave a yellow colour changing to pinkish-violet upon cooling.

Two other violet-fluorescent spots were detected in both TLC systems:

Compound A, R_F 0.45 (System I) & R_F 0.67 (System II); pink colour with 10% H_2SO_4 spray.

Compound B, R_F 0.21 (System I) & R_F 0.37 (System II); light-violet colour with 10% H_2SO_4 spray.

Isolation of batatasin I. — The acetone extract (150 mg) was subjected to fractionation on column chromatography on 50 g silica gel (35–70 mesh) using benzene containing increasing amounts of ethyl acetate from 0–10%. Fractions were screened by TLC System I and the fractions containing the band corresponding to batatasin I were combined

and rechromatographed on a smaller silica gel column. The fractions containing batatasin I were combined and evaporated to dryness. The residue was recrystallized from benzene-petroleum ether to yield batatasin I (~2 mg), m.p. 144–146 °C (reported 148.5–149.5 °C [6], and 145–147 °C [14]); mixed m.p. with authentic batatasin I undepressed; U.V. λ_{max}^{EtOH} (log ϵ) 355 (log ϵ 4.0), 344 (3.82), 328 (3.65), 305 (3.97), 294 (4.0) 283 (4.23), 261 (4.96) and 254 nm (4.75); I.R. ν_{max}^{KBr} 3490, 2910, 1620, 1610, 1575 and 1510 cm^{-1} ; IR superimposable with that of authentic batatasin I.

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