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β-PHENETHYLAMINES FROM THE CACTUS GENUS *OPUNTIA**

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Unidentified alkaloids have previously been detected in Argentinian *Opuntia* species [1]. Hordenine was detected in three Uruguayan species [2] and *N*-methyltyramine has been obtained from *O. clavata* [3]. Mescaline was detected in *O. spinosior* by mass-analysed ion kinetic energy spectrometry [4], and mescaline, tyramine, and 3-methoxytyramine have been crystallized and 3,4-dimethoxy-β-phenethyl amine detected in this species [5].

In the present work, routine alkaloid screening [6] revealed the presence of alkaloids in several species of the genus *Opuntia*. Alkaloids were crystallized as their hydrochloride salts from the screening extract of *O. stanlyi* var. *kunzei* and from a large-scale extraction and PLC [7] of *O. schottii*. Non-crystalline alkaloids were identified by TLC [8, 9] (cochromatography in five solvents on SGG).

Known β-phenethylamines were identified in eleven species of the subgenus *Cylindropuntia* (cholla) (Table 1). Alkaloids, including primary and secondary amines of undetermined chemical class, were detected in five of the six investigated species of the subgenus *Opuntia* (prickly pear); none could be identified by TLC comparison with a series of reference cactus alkaloids, and this subgenus clearly lacked any of the β-phenethylamines identified in the subgenus *Cylindropuntia*.

All the known alkaloids have been previously isolated from other cacti [10], but this is the first report of crystalline hordenine from *Opuntia*. The observed differences between the alkaloid compositions of the two subgenera correlate with their taxonomic di-

* Part 43 in the series "Cactus Alkaloids". For part 42, see Mata, R. and McLaughlin, J. L. (1979) *J. Pharm. Sci.* (accepted for publication).

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Table 1. Alkaloids identified in the genus *Opuntia*

Plant species	Alkaloids identified	Criteria for identification in addition to TLC	Source
Subgenus *Cylindropuntia*			
O. acanthocarpa Engelm. & Bigelow	unknown alkaloids (trace)	—	1
O. fulgida Engelm.	unknown alkaloids	—	1
O. imbricata Haw.	tyramine	MS	1
	3-methoxytyramine	MS	1
	mescaline	MS	
	3,4-dimethoxy-β-phenethylamine	MS	
	unknown alkaloid	—	
O. invicta	tyramine	—	1
Brandeqee	*N*-methyltyramine	—	
	hordenine	—	
O. kleiniae DC.	tyramine	—	
	N-methyltyramine	—	
O. leptocaulis DC.	unknown alkaloids (trace)	—	1
O. schottii Engelm.	tyramine	MS	2
	N-methyltyramine*	MS, IR, mp	
	hordenine†	MS, IR, mp	
O. stanlyi Engelm.	tyramine	—	1
var. *kunzei* (Rose) L. Benson	*N*-methyltyramine‡	MS, IR, mp, mmp	
O. stanlyi	tyramine	—	1
var. *stanlyi* Engelm.	*N*-methyltyramine	—	
O. subulata	3-methoxytyramine	—	3
(Mühlenpfordt) Engelm.	unknown alkaloid	—	

Table 1 (*Continued*)

Plant species	Alkaloid identified	Criteria for identification in addition to TLC	Source
O. versicolor Engelm.	tyramine	—	
	N-methyltyramine	—	
	hordenine	—	
	unknown alkaloids	—	
O. whipplei Engelm. & Bigelow	3,4-dimethoxy-β-phenethylamine	—	5
	unknown alkaloids		
Subgenus *Opuntia*			
O. erinacea Engelm. & Bigelow var. *hystricina* (Engelm. & Bigelow) L. Benson	unknown alkaloids	—	6
O. humifusa Raf.	no detectable alkaloids	—	7
O. lindheimeri Engelm.	unknown alkaloids	—	5
O. phaeacantha Engelm.	unknown alkaloids	—	5
O. stricta (Haw.) Haw. var. *dillenii* (Ker-Gawler) L. Benson	unknown alkaloids	—	6
O. stricta (Haw.) Haw. var.?	unknown alkaloids	—	5
O. violacea Engelm. var. *macrocentra* (Engelm.) L. Benson	unknown alkaloids	—	5

Key to Sources: 1. Rodney Engard, Desert Botanical Garden of Arizona, Pheonix, Arizona; 2. William and Emery Lehnert, U.S. National Park Service, Del Rio, Texas; 3. Abbey Garden, Carpinteria, California; Niall McCarten, Department of Geosciences, University of Arizona, Tucson, Arizona; 5. G. K. Arp, Lockheed Electronics Co., Houston, Texas; 6. E. Clover, University of Michigan Botanical Gardens, Ann Arbor, Michigan; W. N. McKnight, Department of Botany, Eastern Illinois University, Charleston, Illinois.

* Yield: 0.018%; † yield: 0.049%; ‡ yield: 0.05.

vergence. The identification of *O*-methylated alkaloids, such as mescaline and 3,4-dimethoxy-β-phenethylamine, in the three species *O. spinosior* [5], *O. imbricata*, and *O. whipplei* supports their classification in a single taxonomic series [11].

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