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ALKALOIDS AND PHENOLICS OF *WURMBEA* AND *BURCHARDIA* SPECIES*

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Key Word Index—*Wurmbea*; *Burchardia*; Liliaceae; tropolone alkaloids; luteolin; aromatic acids; chemotaxonomy.

Abstract—The whole plants of four *Wurmbea* species and one *Burchardia* species were analysed. All *Wurmbea* species contained tropolone alkaloids, mainly colchicine, 2-demethylcolchicine, 3-demethylcolchicine and β-lumicolchicine. From all these species the flavone luteolin and 2-hydroxy-6-methoxybenzoic, vanillic and salicylic acids were isolated. *Burchardia multiflora* yielded one unidentified non-tropolone alkaloid, luteolin, and benzoic and salicylic acids. The chemotaxonomic significance of the substances isolated within the subfamily Wurmbaeoideae is discussed.

INTRODUCTION

Plants of the genus *Wurmbea*, comprising 18 species, grow wild in South and West Australia [1], and are also indigenous in East Africa [2]. Among Australian Liliaceae, the genus *Burchardia*, which is indigenous to that country, bears a superficial resemblance to *Wurmbea* [1]. Buxbaum [3] and Hutchinson [4] place the genera *Wurmbea* and *Burchardia* in the same subfamily, the Wurmbaeoideae. Phytochemical analysis within this subfamily has revealed that tropolone alkaloids constitute the major secondary metabolites [5]. Šantavý and co-workers [6] analysed three *Wurmbea* species from East Africa. They described the presence of colchicine and 3-demethylcolchicine. No information is available, however, on the phytochemistry of *Burchardia*.

We report our findings from the chemical investigation of *Wurmbea deserticola*, *W. dioica*, *W. inframediana*, *W. tenella* and *Burchardia multiflora* collected in Australia. We also discuss the significance of tropolone alkaloids as possible taxonomic markers for the genera *Wurmbea* and *Burchardia*.

RESULTS AND DISCUSSION

The alkaloids obtained by methanol extraction of the plant materials were purified by thin-layer chromatography and characterized by standard methods. The alkaloids isolated from the *Wurmbea* species studied are listed in Table 1. The results suggest that Australian and East African *Wurmbea* species [6] contain only neutral tropolone alkaloids. No alkaloids of the demecolcine type were found. The major alkaloid in all the *Wurmbea* species is colchicine. Other common alkaloids are its 2- and 3-*O*-demethylated derivatives and β-lumicolchicine. In *Burchardia multiflora*, no tropolone alkaloids were found. From the neutral chloroform fraction we isolated an unidentified alkaloid for which the molecular formula $C_{17}H_{21}NO_3$ was established.

It is also interesting to note that the genera *Wurmbea* and *Burchardia* differ in the qualitative composition of their aromatic acids. The characteristic acid of *Wurmbea* is a 2-hydroxy-6-methoxybenzoic acid, which is not present in *B. multiflora*. A flavone, luteolin, was present in plants of both genera.

The absence of tropolone alkaloids in *B. multiflora* is striking and suggests that this genus does not belong to the subfamily Wurmbaeoideae [7]. Australian and East African *Wurmbea* species are almost identical from the phytochemical point of view. This finding supports the presumption [5] that Australian *Wurmbea* species originated in East Africa, where plants of the subfamily Wurmbaeoideae are native.

EXPERIMENTAL

Plant material. The whole plants of *Wurmbea* and *Burchardia* were collected in flower in West Australia in the period June to September 1983 and identified by one of us (T.D.M.). Voucher specimens have been deposited in the Institute of Medical Chemistry, Olomouc.

Prep. TLC was on Merck silica gel 60 glass plates, 0.5 mm thick; analytical TLC was on Merck silica gel 60 F_{254} glass plates, 0.25 mm thick. Full details of TLC alkaloid detection are available in ref. [8] and those of aromatic acid detection in ref. [9]. All isolated pure compounds from *Wurmbea* species were identified by comparison with authentic samples (^{1}H NMR, ^{13}C NMR and IR spectra).

Extraction and isolation. Air-dried powdered plant material was extracted to exhaustion with MeOH in a Soxhlet apparatus. The dried MeOH extract was taken up in 0.1% H_2SO_4. The aq. soln was treated as described in ref. [8]. The yields of extracts (g/g dry wt) were as follows: *Wurmbea deserticola* 3.39 (ether extract, EE), 0.80 (neutral $CHCl_3$ extract, NCE), 0.036 (basic $CHCl_3$ extract, BCE); *W. dioica* (locality 1) 3.32 (EE); 0.92 (NCE), 0.097 (BCE); *W. dioica* (locality 2) 2.25 (EE), 0.16 (NCE), 0.023 (BCE); *W. dioica* (locality 3) 11.80 (EE), 0.56 (NCE), 0.026 (BCE);

*Dedicated to the memory of the late Dr. V. Preininger.

Table 1. Alkaloids of four *Wurmbea* species

Plant	Content of common alkaloids (mg/g dry wt)				Other alkaloids*
	Colchicine	2-Demethyl-colchicine	3-Demethyl-colchicine	β-Lumi-colchicine	
Wurmbea deserticola Macfarlane	1.7	tr	1.2	tr	Cornigerine, γ-lumicolchicine, 3-demethyl-β-lumicolchicine
Wurmbea dioica (R. Br.) F. Muell. subsp. *alba* Macfarlane	0.4	0.02	0.08	tr	*N*-Formyl-*N*-deacetylcolchicine
Wurmbea dioica (R. Br.) F. Muell. subsp. *alba* Macfarlane	0.1	0.2	tr	tr	Cornigerine, *N*-formyl-*N*-deacetylcolchicine
Wurmbea dioica (R. Br.) F. Muell. subsp. *alba* Macfarlane	1.2	0.9	tr	tr	Cornigerine, *N*-formyl-*N*-deacetylcolchicine, γ-lumicolchicine
Wurmbea inframediana Macfarlane	1.2	tr	0.87	tr	Cornigerine, *N*-formyl-*N*-deacetylcolchicine, γ-lumicolchicine
Wurmbea tenella (Endl.) Benth.	0.3	tr	0.2	tr	Cornigerine

*Alkaloids identified by R_f value and IR spectrum only.
tr traces.

W. inframediana 3.35 (EE), 0.41 (NCE), 0.033 (BCE); *W. tenella* 1.46 (EE), 0.20 (NCE), 0.015 (BCE); *Burchardia multiflora* (locality lat. 31°09'S, long. 116°19'E) 2.16 (EE), 0.16 (NCE), 0.030 (BCE). The EE composition of all *Wurmbea* plants was identical by TLC in EtOAc–2-butanone–HCOOH–H_2O (5:3:1:1). Crystallization of the combined extracts yielded luteolin (mp 334°, MeOH). After crystallization, mother liquors were separated by prep. TLC in C_6H_6–$CHCl_3$–MeOH (3:2:1) and yielded 2-hydroxy-6-methoxybenzoic (mp 134°, Et_2O, R_f 0.67), vanillic (mp 211°, Et_2O, R_f 0.38) and salicylic acids (mp 159°, Et_2O, R_f 0.68). In *B. multiflora* EE, TLC allowed the identification by direct comparison with authentic samples of luteolin (R_f 0.58) and benzoic (R_f 0.71) and salicylic acids (R_f 0.68).

NCEs of the *Wurmbea* plants were separated by prep. TLC in C_6H_6–EtOAc–$NHEt_2$–MeOH (5:4:1:0.4); yields are given in Table 1. In BCE, TLC in C_6H_6–EtOAc–$NHEt_2$ (7:2:1) showed that Dragendorff-positive substances of non-tropolone type were present in small amounts; they were not analysed further.

The composition of *B. multiflora* NCE and BCE was identical according to TLC in C_6H_6–EtOAc–$NHEt_2$ (7:2:1). Prep. TLC yielded an amorphous alkaloid, 3 mg, R_f 0.59, EIMS *m/z* (rel. int.): 287 $[M]^+$, $C_{17}H_{21}NO_3$ (75), 256 (100), 239 (75), 185 (50), 184 (88), 132 (78), 120 (38), 119 (19), 118 (31), 91 (25), 86 (44), 84 (63), 43 (16), 42 (25), 41 (31); IR ν_{max}^{KBr} cm^{-1}: 3410 (OH), 1706 (ester); UV λ_{max}^{EtOH} nm: 228 (sh), 284, 318, 372.

REFERENCES

1. Macfarlane, T. D. (1980) *Brunonia* **3**, 145.
2. Watt, J. M. and Breyer-Brandwijk, M. G. (1962) *Medicinal and Poisonous Plants of Southern and Eastern Africa*, 2nd edn. Livingstone, London.
3. Buxbaum, F. (1937) *Bot. Arch.* **38**, 213.
4. Hutchinson, J. (1960) *The Families of Flowering Plants*, p. 591. Clarendon Press, Oxford.
5. Šantavý, F. (1983) *Acta Univ. Palacki. Olomuc., Fac. Med.* **104**, 97.
6. Pijewska, L., Kaul, J. L., Joshi, R. K. and Šantavý, F. (1967) *Collect. Czech. Chem. Commun.* **32**, 158.
7. Šantavý, F. (1981) *Heterocycles* **15**, 1505.
8. Šantavý, F., Dvořáčková, S., Šimánek, V. and Potěšilová, H. (1983) *Acta Univ. Palacki. Olomuc., Fac. Med.* **105**, 63.
9. Potěšilová, H., Dolejš, L. and Šantavý, F. (1976) *Acta Univ. Palacki. Olomuc., Fac. Med.* **79**, 29.