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Phenanthroindolizidine alkaloids from *Vincetoxicum pumilum*

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1. Subject and source

Vincetoxicum pumilum Decne. [syn. *Alexitoxicon pumilum* (Decne.) Pobed., *Antitoxicum pumilum* (Decne.) Pobed., *Cynanchum pumilum* (Decne.) Bornm.] (Apocynaceae–Asclepiadoideae) is a perennial herb endemic to Central Asia (Jalili and Jamzad, 1999). The plant (roots and aerial parts) was collected in Deh-Ghaibi near Mashhad, Iran. A voucher specimen (accession number 35007) was deposited in herbarium FUMH (Ferdowsi University Mashhad Herbarium).

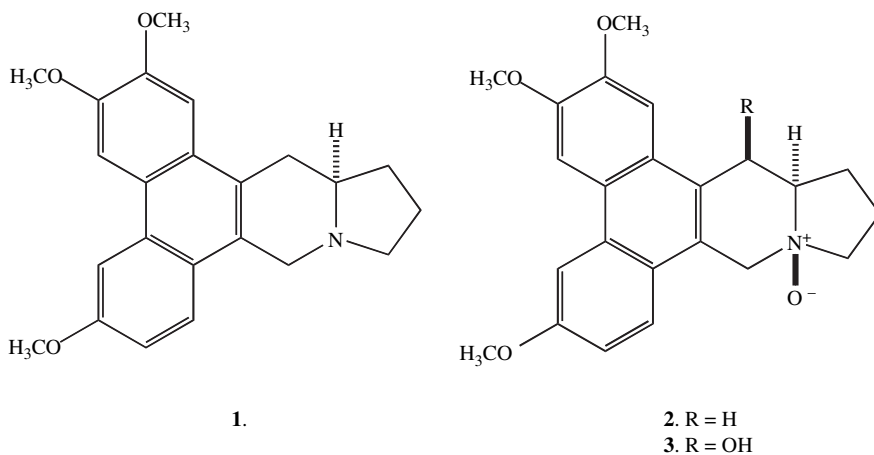
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2. Previous work

There are no literature reports of phytochemical investigations of *V. pumilum*.

3. Present study

Dried and milled roots (310 g) and aerial parts (568 g) were repeatedly extracted with a 1:1 mixture of methanol and dichloromethane. The extracts were evaporated and the residues (27 g from the roots and 59 g from the aerial parts) were suspended in water at pH 2–3, extracted with diethyl ether, the solutions alkalized with aqueous ammonia, and re-extracted with diethyl ether. The resulting alkaloid fraction of the root extract (560 mg) was fractionated by LC [75 × 2 cm column of Matrex silica gel 60A (35–70 μm), CH₂Cl₂–CH₃OH–28% aqueous NH₃ (93:6:1 followed by 90:10:1)] and HPLC [25 × 2.1 cm column of LiChrosorb Si60 (5 μm), CH₂Cl₂–saturated methanolic NH₃ (97:3) and CH₂Cl₂–CH₃OH–28% aqueous NH₃ (92.5:6.5:1)] to give 70 mg of (–)-13α-antofine (**1**), 2 mg of (–)-10β,13α-antofine *N*-oxide (**2**) and 3 mg of (–)-14β-hydroxy-10β,13α-antofine *N*-oxide (**3**). Similarly, fractionation of the alkaloid fraction from the aerial parts (800 mg) by HPLC as above gave 7 mg of **1**, 3 mg of **2**, and 2 mg of **3**.



The compounds were identified by comparison of their ¹H and ¹³C NMR spectra with literature data (Stærk et al., 2000, 2002). Compound **1**: [α]_D²⁵ –118° (*c* 0.3, CHCl₃), lit. –124° (Stærk et al., 2002); compound **2**: [α]_D²⁵ –56° (*c* 0.3, CHCl₃), lit. –37° (Stærk et al., 2000); compound **3**: CD spectrum (CH₃OH) showed positive Cotton effects at 211 nm and 233 nm and a negative Cotton effect at 268 nm, in agreement with the literature (Stærk et al., 2000).

4. Chemotaxonomic significance

The genus *Vincetoxicum* Wolf [*Cynanchum* sect. *Vincetoxicum* (Wolf) Tsiang & P. T. Li] has traditionally been classified within the cosmopolitan family Asclepiadaceae. However, the traditionally defined Asclepiadaceae have long been regarded as an apomorphic derivative of the Apocynaceae. Recently, a unified classification of Apocynaceae s. l. has been provided on the basis of extensive morphological studies as well as cladistic interpretation of molecular data (Endress and Bruyns, 2000; Endress and Stevens, 2001; Potgieter and Albert, 2001). Apocynaceae s. l. thus include Asclepiadaceae and Periplocaceae, reduced to a subfamily status (Endress and Bruyns, 2000). Most recent studies focus on subtribal classification within the Asclepiadoideae (Liede, 1999; Liede and Kunze, 2002; Liede and Meve, 2001, 2002; Liede and Täuber, 2002; Rapini et al., 2003). Although taxonomic interpretations of *Vincetoxicum* Wolf and *Cynanchum* L. and their relationships are complex, the former genus appears to be more related to *Tylophora* R. Br. rather than to the latter (Liede, 1996; Liede and Kunze, 2002; Yamashiro et al., 2004). *Vincetoxicum* and *Tylophora* produce phenanthroindolizidine alkaloids (Govindachari, 1967; Bick and Sinchai, 1981; Ali and Bhutani, 1989; Capo and Saa, 1989; Li et al., 1989; Lavault et al., 1994; Abe et al., 1995, 1998; Stärk et al., 2000, 2002; Huang et al., 2002; Zhen et al., 2002), absent from the Old World *Cynanchum* s. s. (sections *Cynanchum* and *Rhodostegiella*). The presence of phenanthroindolizidine alkaloids in *V. pumilum* is thus consistent with the most recent views (Liede, 1996; Yamashiro et al., 2004) on taxonomy of the phylogenetically complex Asclepiadeae. The phenanthroindolizidine alkaloids such as antofine are also of interest, because they exhibit potent antitumor activity by a mode of action different from known antitumor drugs (Gao et al., 2004).

References

- Abe, F., Iwase, Y., Yamauchi, T., Honda, K., Hayashi, N., 1995. *Phytochemistry* 39, 695.
- Abe, F., Hirokawa, M., Yamauchi, T., Honda, K., Hayashi, N., Ishii, M., Imagawa, S., Iwahana, M., 1998. *Chem. Pharm. Bull.* 46, 767.
- Ali, M., Bhutani, K.K., 1989. *Phytochemistry* 28, 3513.
- Bick, I.R.C., Sinchai, W., 1981. *Alkaloids*, vol. 19. Academic Press, 193 pp.
- Capo, M., Saa, J.M., 1989. *J. Nat. Prod.* 52, 389.
- Endress, M.E., Bruyns, P.V., 2000. *Bot. Rev.* 66, 1.
- Endress, M.E., Stevens, W.D., 2001. *Ann. MO Bot. Gard* 88, 517.
- Gao, W., Lam, W., Zhong, S., Kaczmarek, C., Baker, D.C., Cheng, Y.-C., 2004. *Cancer Res.* 64, 678.
- Govindachari, T.R., 1967. *Alkaloids*, vol. 9. Academic Press, 517 pp.
- Huang, X.S., Yu, S.S., Liang, X.T., 2002. *Chin. Chem. Lett.* 13, 61.
- Jalili, A., Jamzad, Z., 1999. *Red Data Book of Iran*. Research Institute of Forests and Rangelands, Tehran, 22 pp.
- Lavault, M., Richomme, P., Bruneton, J., 1994. *Pharm. Acta Helv.* 68, 225.
- Li, X., Peng, J., Onda, M., Konda, Y., Iguchi, M., Harigaya, Y., 1989. *Heterocycles* 29, 1797.
- Liede, S., 1996. *Taxon* 45, 193.
- Liede, S., 1999. *Blumea* 44, 471.
- Liede, S., Meve, U., 2001. *Novon* 11, 171.

- Liede, S., Meve, U., 2002. *Nord. J. Bot.* 22, 579.
- Liede, S., Kunze, H., 2002. *Org. Divers. Evol.* 2, 239.
- Liede, S., Täuber, A., 2002. *Syst. Bot.* 27, 789.
- Potgieter, K., Albert, V.A., 2001. *Ann. MO Bot. Gard.* 88, 523.
- Rapini, A., Chase, M.W., Goyder, D.J., Griffiths, J., 2003. *Taxon* 52, 33.
- Stærk, D., Christensen, J., Lemmich, E., Duus, J.Ø., Olsen, C.E., Jaroszewski, J.W., 2000. *J. Nat. Prod.* 63, 1584.
- Stærk, D., Lykkeberg, A., Christensen, J., Budnik, B., Abe, F., Jaroszewski, J.W., 2002. *J. Nat. Prod.* 65, 1299.
- Yamashiro, T., Fukuda, T., Yokoyama, J., Maki, M., 2004. *Mol. Phylogenet. Evol.* 31, 689.
- Zhen, Y., Huang, X., Yu, D., Yu, S., 2002. *Zhiwu Xuebao* 44, 349.