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ALKALOIDS FROM THE AERIAL PARTS OF *Consolida anthoroidea* AND *Delphinium linearilobum*

S. Suzgec,[1] L. Bitis,[2] U. Sozer,[1] H. Ozcelik,[3] J. Zapp,[4]
A. K. Kiemer,[4] F. Mericli,[1*] and A. H. Mericli[1*]

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Aconitum, Delphinium, and *Consolida* species (Ranunculaceae) are toxic plants due to the diterpenoid alkaloids they contain. These alkaloids are neurotoxic agents, causing bradycardia, muscle system spasms, hypotension, and death by arrest of respiration. *Aconitum* preparations have been used as cardiotonics, febrifuges, sedatives, and anodynes. *Delphinium* and *Consolida* were formerly known as *Delphinium*, and their extracts have been employed in analgesic balms and also as sedatives, emetics, and anthelmintics. They are also known to possess insecticidal and growth-inhibiting activities [1, 2].

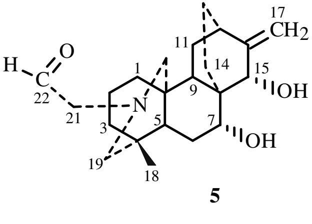
In continuation of our investigations on Turkish *Aconitum*, *Delphinium*, and *Consolida* species for their diterpenoid alkaloid content [3–6], we have now studied *Consolida anthoroidea* and *Delphinium linearilobum*.

From the aerial parts of *Consolida anthoroidea* six diterpenoid alkaloids, ajaconine (**1**), hetisine (**2**), 13-*O*-acetylhetisine (**3**), α-atisine (**4**), spiratine A (**5**), and septentriosine (**6**), and two norditerpenoid alkaloids, 1-demethylwinkleridine (**7**), and senbusine B (**8**), have been isolated and identified. This plant has not been chemically studied before.

From the aerial parts of *Delphinium linearilobum* two diterpenoid alkaloids, hetisine (**2**) and acochlearine (**9**), and five norditerpenoid alkaloids, isotalatizidine (**10**), cammaconine (**11**), winkleridine (**12**), deltatsine (**13**), and condelphine (**14**), have been isolated and identified. From the aerial parts of *Delphinium linearilobum* (Syn. *D. crispulum*) collected from a different region of Turkey and from the roots of the plant some diterpenoid alkaloids have been isolated earlier [7, 8]. In this study we report the occurence of winkleridine, condelphine, and acochlearine for the first time in this plant.

Among the alkaloids isolated from both plants, especially spiratine A (**5**) [9] and acochlearine (**9**) [3] are very rare compounds; these two alkaloids have been isolated only once before from other plants. This is also the first report for the occurrence of spiratine A in Ranunculaceae. ^{13}C NMR data of these two compounds are shown in Table 1.

NMR spectra were recorded on a Bruker, 500 MHz spectrometer. MS were determined on a Finnigan MAT 90 spectrometer. VLC was carried out with Merck Al_2O_3 (EM 1085) and SiO_2 60 G (7731). Chromatographic separations on a Chromatotron were carried out on rotors coated with a 1 mm thick layer of Merck Al_2O_3 60 GF-254 (1092) or SiO_2 PF-254 (7749). Thin layer chromatograms were run using the solvent system toluene–EtOAc–DEA (7:4:1 or 7:2:1) and $CHCl_3$–MeOH–NH_4OH (90:10:5 or 80:20:2).



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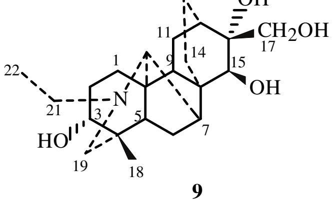

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1) Istanbul University, Faculty of Pharmacy, Department of Pharmacognosy, 34116 Beyazyt-Istanbul-Turkey, e-mail: alimer@istanbul.edu.tr; fmericli@istanbul.edu.tr; 2) Marmara University, Faculty of Pharmacy, Department of Pharmacognosy, 34668 Haydarpasa-Istanbul-Turkey; 3) Suleyman Demirel University, Faculty of Science and Literature, Department of Botany, Isparta-Turkey; 4) Saarland University, Institute of Pharmaceutical Biology, P.O.151150, 66041 Saarbrucken-Germany. Published in Khimiya Prirodnykh Soedinenii, No. 2, pp. 242–243, March–April, 2009. Original article submitted September 21, 2007.

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TABLE 1. ^{13}C NMR Data of **5** and **9** in $CDCl_3$

C atom	**5**	**9**	C atom	**5**	**9**
1	35.2 t	38.0 t	12	36.5 d	42.6 d
2	20.2 t	30.9 t	13	26.1 t	23.5 t
3	41.5 t	70.0 d	14	24.8 t	26.9 t
4	34.0 s	33.9 s	15	80.3 d	86.7 d
5	43.5 d	40.8 d	16	154.5 s	78.8 s
6	28.6 t	23.7 t	17	110.2 t	67.8 t
7	77.3 d	36.5 d	18	24.8 q	24.1 q
8	41.9 s	42.2 s	19	60.3 t	56.9 t
9	45.6 d	52.3 d	20	58.4 t	66.8 d
10	47.0 s	51.5 s	21	65.2 t	51.7 t
11	28.2 t	21.3 t	22	182.0 d	12.4 q

Plant Material. *Consolida anthoroidea* (Boiss.) Schrod. (Ranunculaceae) was collected from Akdamar Island on Van Lake Gevas-Van-Turkey and *Delphinium linearilobum* (Trautv.) Busch (Ranunculaceae) was collected from Tendurek Pass between Van and Agri – Turkey both in August 2000 by one of us (H.O.). A voucher specimen from both plants is deposited in the Herbarium of Science and Literature Faculty of Suleyman Demirel University (Ozcelik 6306 and 8645).

Extraction and Isolation. Dried and powdered aerial parts of the plants were extracted with 90% EtOH by percolation at room temparature, and the extracts obtained were evaporated to dryness *in vacuo.* The residues were treated with 0.5 N H_2SO_4 and extracted with $CHCl_3$. NaOH (5%) was then added to the aqueous solutions (cooled in ice) to bring them to pH 10. The solutions were again extracted with $CHCl_3$. The $CHCl_3$ extracts were evaporated to dryness, yielding crude alkaloid mixtures.

The crude alkaloid extract (4.65 g) obtained from 2.0 kg aerial parts of *Consolida anthoroidea* was first separated by VLC on a basic Al_2O_3 column with petroleum ether–$CHCl_3$–MeOH mixtures. VLC fractions 11–17 (petroleum ether–$CHCl_3$ 10:90 to 0:100, 450 mg) were combined and chromatographed on a SiO_2 rotor with petroleum ether–$CHCl_3$–MeOH mixtures to give spiratine A (**5**, 26 mg). VLC fractions 18–20 ($CHCl_3$–MeOH 98:2 to 95:5) (850 mg) were combined and chromatographed on a SiO_2 rotor with petroleum ether–$CHCl_3$–MeOH mixtures to give senbusine B (**8**, 9 mg) ajaconine (**1**, 21 mg), and septentriosine (**6**, 10 mg). VLC fractions 21–24 ($CHCl_3$–MeOH 92-8 to 70:30) (850 mg) were combined and chromatographed on a Al_2O_3 rotor with petroleum ether–$CHCl_3$–MeOH mixtures to give 1-demethylwinkleridine (**7**, 39 mg), 13-*O*-acetylhetisine (**3**, 11 mg), α-atisine (18 mg), and hetisine (**2**, 13 mg).

The crude alkaloid extract (4.02 g) obtained from 2.3 kg aerial parts of *Delphinium linearilobum* was first separated by VLC on a basic Al_2O_3 column with petroleum ether–$CHCl_3$–MeOH mixtures. VLC fractions 11–13 (petroleum ether–$CHCl_3$ 50:50 to 30:70) (282 mg) were combined and chromatographed on a SiO_2 rotor with petroleum ether–$CHCl_3$–MeOH mixtures to give deltatsine (**13**, 10 mg) and condelphine (**14**, 22 mg). VLC fractions 14–16 (petroleum ether–$CHCl_3$ 20:80 to 0:100) (188 mg) were combined and chromatographed on a SiO_2 rotor with petroleum ether–$CHCl_3$–MeOH mixtures to give winkleridine (10 mg). VLC fractions 18–19 ($CHCl_3$–MeOH 98:2 to 96:4) (221 mg) were combined and chromatographed on a SiO_2 rotor with petroleum ether–$CHCl_3$–MeOH mixtures to give isotalatizidine (**10**, 43 mg) and cammaconine (**11**, 10 mg). VLC fractions 21–22 ($CHCl_3$–MeOH 92:8 to 90:10) (377 mg) were combined and chromatographed on a Al_2O_3 rotor with petroleum ether–$CHCl_3$–MeOH mixtures to give acochlearine (**9**, 14 mg). VLC fractions 23–25 ($CHCl_3$–MeOH 80:20 to 60:40) (515 mg) were combined and chromatographed on a Al_2O_3 rotor with petroleum ether–$CHCl_3$–MeOH mixtures to give hetisine (**2**, 13 mg).

All the alkaloids were identified by comparison of their ^{1}H and ^{13}C, DEPT NMR data [10–21] and by Co-TLC behavior with those of authentic samples for **1**, **2**, **3**, **9**, **10**, and **13**.

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REFERENCES

1. M. H. Benn and J. M. Jacino, *Alkaloids, Chemical and Biological Perspectives,* Vol. **1**, S.W. Pelletier (Ed.), Wiley Interscience, New York, 1, 155 (1983).
2. N. G. Bisset, *J. Ethnopharmacol.,* **4**, 247 (1981).
3. A. H. Mericli, S. Suzgec, L. Bitis, F. Mericli, H. Ozcelik, J. Zapp, and H. Becker, *Pharmazie*, **61**, 483 (2006).
4. A. H. Mericli, S. Pirildar, SiSuzgec, L. Bitis, F. Mericli, H. Ozcelik, J. Zapp, and H. Becker, *Helv. Chim. Acta*, **89**, 210 (2006).
5. L. Bitis, S. Suzgec, F. Mericli, H. Ozcelik, J. Zapp, H. Becker, and A. H. Mericli, *Pharm. Biol.*, **44**, 244 (2006).
6. S. Suzgec, L. Bitis, S. Pirildar, H. Ozcelik, J. Zapp, H. Becker, F. Mericli, and A. H. Mericli, *Chem. Nat. Comp.,* **42**,75 (2006).
7. A. Ulubelen, A. H. Mericli, F. Mericli, U. Kolak, R. Ilarslan, and W. Voelter, *Phytochemistry*, **50**, 513 (1999).
8. U. Kolak, M. Ozturk, F. Ozgokce, and A. Ulubelen, *Phytochemistry*, **67**, 2170 (2006).
9. H. P. He, Y. M. Shen, J. X. Zhang, G. Y. Zuo, and X. J. Hao, *J. Nat. Prod.,* **64**, 379 (2001).
10. W. Deng and W. L. Sung, *Heterocycles*, **24**, 869 (1986).
11. P. Kulanthaivel, S. W. Pelletier, and J. D. Olsen, *Heterocycles*, **27**, 339 (1988).
12. J. A. Glinski, B. S. Joshi, Q. P. Jiang, and S. W. Pelletier, *Heterocycles*, **27**, 185 (1988).
13. S. W. Pelletier, N. V. Mody, J. Finer-Moore, H. K. Desai, and H. S. Puri, *Tetrahedron Lett.*, **22**, 313 (1981).
14. B. S. Joshi, H. K. Desai, S. W. Pelletier, E. M. Holt, and A. J. Aasen, *J. Nat. Prod.*, 51, 265 (1988).
15. G. Almanza, J. Bastida, C. Codina, and G. de la Fuente, *Phytochemistry*, **45**, 1079 (1997).
16. C. Konno, M. Shirasaka, and H. Hikino, *J. Nat. Prod.*, **45**, 128 (1982).
17. S. W. Pelletier, and Z. Djarmati, *J. Am. Chem. Soc.*, **98**, 2626 (1976).
18. S. W. Pelletier, S. K. Srivastava, B. S. Joshi, and J. D. Olsen, *Heterocycles*, **23**, 331 (1985).
19. Y. Z. Chen and A. Wu, *Phytochemistry*, **29**, 1016 (1990).
20. B. S. Joshi, J. A. Glinski, H. P. Ghokski, S. Y. Chen, S. K. Srivastava, and S. W. Pelletier, *Heterocycles*, **22**, 2037 (1984).
21. V. N. Aiyar, P. Kulanthaivel, and M. Benn, *Phytochemistry*, **25**, 973 (1986).