Diterpenoid Alkaloids from *Consolida regalis* S. F.Gray subsp. *paniculata* (Host) Soo var. *paniculata*

Filiz MERICLI,¹,² Ali H. MERICLI,¹,² Haridutt K. DESAI,² Ayhan ULUBELEN¹ and S. William PELLETIER²,³

¹Faculty of Pharmacy, University of Istanbul, 34452 Istanbul, TURKEY
²Institute for Natural Products Research, ³Department of Chemistry, The University of Georgia, Athens, GA 30602-2556 USA

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**Abstract**

Seven diterpenoid alkaloids: delcosine(1), delsoline(2), gigactonine(3), lycoctonine(4), takaosamine(5), atisine(6) and hetisinone(7) have been isolated from the aerial parts of *Consolida regalis* subsp. *paniculata* var. *paniculata*. The presence of compounds 1, 2, 5, 6 and 7 in this plant has not been previously reported.

**Introduction**

*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* (formerly known as *Delphinium*) extracts have been employed in analgesic balms and also as sedatives, emetics and anthelmintics. They are also known to possess insecticidal and growth-inhibiting activities¹⁴. Testing of pure diterpenoid alkaloids and their derivatives for the cardiovascular (bradycardic and hypotensive) action has also been conducted.⁵⁶ In continuation of our investigations of Turkish *Aconitum*, *Delphinium* and *Consolida* species for their diterpenoid alkaloid content,⁷¹² we have now studied *Consolida regalis* subsp. *paniculata* var. *paniculata*. The plant is widespread in Turkey and in the one
previous investigation the presence of lycoctonine, delcorine, deoxydelcorine, dehyrodelcorine, delcoridine, bicolorine, regaline, paniculatine, paniculine and corepanine were reported\textsuperscript{13}.

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|}
\hline
\textbf{R}^1 & \textbf{R}^2 & \textbf{R}^3 & \textbf{Alkaloid} \\
\hline
1 & H & Me & H & DELCOSINE \\
2 & H & Me & Me & DELSOLINE \\
3 & H & H & Me & GIGACTONINE \\
4 & Me & H & Me & LYCOCTONINE \\
5 & H & H & H & TAKAOSAMINE \\
\hline
\end{tabular}
\end{table}

\textbf{Results and Discussion}

From the aerial parts of \textit{Consolida regalis} subsp.\textit{paniculata} var.\textit{paniculata} seven diterpenoid alkaloids: delcosine(1), delsoline(2), gigactonine(3), lycoctonine(4), takaosamine(5), atisine(6) and hetisinone(7) have been isolated. The alkaloids are quite different from those reported in the previous study on this plant\textsuperscript{13}; only lycoctonine and gigactonine (named as paniculine in the previous study) were found in this study, but other common compounds were not obtained. In the first study the plant was collected around
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Konya-in Middle Anatolia, Turkey; but in this study the plant was collected in the European part of Turkey around Enez, Edime, near the border of Greece. The plant is also not very rich in alkaloids; but like other *Consolda* species it contains toxic diterpenoid alkaloids.

**Experimental**

*General*: 'H and 13C NMR spectra including DEPT were recorded on a Bruker AC-300 spectrometer. ESIMS were recorded on a Perkin Elmer SCIEX API-1 mass spectrometer. Chromatographic separations on a Chromatotron were carried out on rotors coated with 1 mm thick layers of *Merck Al2O3* 60 PF 254, 360 (EM 1104) or SiO2 (EM 7749).

*Plant material.* *Consolda regalis* S.F.Gray subsp. *paniculata* (Host) Soo var. *paniculata* was collected from the European part of Turkey near Enez, Edime at an altitude 30 m in July 1997 and indentified by two of us (F.M., A.H.M.). A voucher specimen is deposited in the Herbarium of the Faculty of Pharmacy of Istanbul University, Nr. ISTE 63049.

*Extraction and isolation.* Dried and powdered aerial parts of the plant (5.250 kg) were extracted with 90% EtOH by percolation at room temperature and the extract obtained evaporated to dryness in vacuo. The residue was treated with 0.5 N H2SO4 and extracted with CHCl3. NaOH(5%) was then added to the aqueous solution (cooled in ice) to bring it to pH 10. The solution was again extracted with CHCl3. The CHCl3 extract was evaporated to dryness, yielding 1.980 g of crude alkaloidal mixture. This was first separated by VLC (vacuum liquid chromatography) on a basic alumina column with hexane-CHCl3-MeOH mixtures. VLC fraction 13 (collected with CHCl3-MeOH 99.5 : 0.5) gave gigactonine (40 mg). VLC fraction 20 (CHCl3-MeOH 80 : 20) gave takaosamine (48 mg). VLC fractions 14-17 (CHCl3-MeOH 99 : 1 to 96 : 4) were combined (142 mg) and chromatographed on a SiO2 rotor of a Chromatotron with hexane-CHCl3-MeOH mixtures to give gigactonine (27 mg), delcosine (9 mg) and lycoctonine (7 mg). VLC fractions 18-19 (CHCl3-MeOH 95 : 5 to 90 : 10) were combined (132 mg) and chromatographed on a SiO2 rotor with hexane-CHCl3-MeOH.
mixtures to afford delsoline (7 mg) and hetisinone (6 mg). VLC fractions 21-22 (CHCl₃-MeOH 60:40 to 40:60) were combined (183 mg) and chromatographed on an Al₂O₃ rotor with hexane-CHCl₃-MeOH mixtures to give a mixture of 20 α- and 20 β - atisine (25 mg). All these compounds were identified by comparison of their ¹H and ¹³C, DEPT NMR data and CO-TLC behavior with those of authentic samples.

The ¹H and ¹³C NMR data of takaosamine, which is relatively rare in Aconitum, Delphinium and Consolida species, are given below.

**Takaosamine (5)**

¹H NMR (CDCl₃) δ: 4.12 (1H, t, J=5.0 Hz, H-14), 4.00 (1H, br s, H-6), 3.40 and 3.37 (each 3H, s, 2XOCH₃) and 1.10 (3H, t, J=7.0 Hz, NCH₂CH₃). ¹³C NMR (CDCl₃) δ: 90.1 (C-6, d), 87.8 (C-7, s), 81.9 (C-16, d), 78.0 (C-8, s), 75.7 (C-14, d), 72.6 (C-1, d), 66.8 (C-18, t), 66.3 (C-17, d), 57.8 (OCH₃-6, q), 57.0 (C-19, t), 56.3 (OCH₃-16, q), 50.4 (NCH₂CH₃, t), 48.8 (C-11, s), 45.2 (C-10, d), 44.8 (C-5, d), 43.9 (C-9, d), 39.3 (C-13, d), 38.2 (C-4, s), 34.4 (C-15, t), 29.3 (C-3, t), 26.9 (C-12 and C-2, t) and 13.7 NCH₂CH₃, q.

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**References**


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