

Sesquiterpene lactones. XXXI. New guaianolides in *Centaurea bella* Trautv. and *Centaurea adjarica* Alb.

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Abstract

Nine new guaianolides, 3 of which are chlorinated, were isolated from the dried, above-ground parts of *Centaurea bella* Trautv. They are: cebellin A, B, C, D, E, F, G, H and I. The known guaianolides centaurepensin and repdiolide were also found. The occurrence of repin, acroptillin and janerin was confirmed. Cebellin F, G, I and repin, acroptillin and janerin were chromatographically shown to occur in *Centaurea adjarica* Alb.

Key words: *Centaurea bella*, new guaianolides, *Hyalinella*, *Compositae*

INTRODUCTION

As a part of studies on the occurrence of sesquiterpene lactones in species from the genus *Centaurea* L. of the *Compositae* family, attempts were undertaken to isolate these compounds from representatives of the subgenus *Hyalinella* (Tzvel.) Tzvel. It was assumed that the demonstration of new sesquiterpene lactones would give further information on the relationships of plants classified as belonging to the genus *Centaurea* L., which is still an object of interest for taxonomists. On the other hand, the discovery in *Centaurea bella* Trautv. from the subgenus *Hyalinella* (Tzvel.) Tzvel. of acroptillin (I) (Geppert et al. 1983), a chlorinated guaianolide which has a very high biological activity (Gonzales et al. 1980), chlorine being extremely rarely found in natural compounds, could indicate the occurrence here of other lactones of this type.

MATERIAL AND METHODS

Two species of the subgenus *Hyalinella* (Tzvel.) Tzvel were studied, *Centaurea bella* Trautv. and *Centaurea adjarica* Alb. These plants were grown in the garden belonging to the Chair of Medicinal Plants of the Poznań Medical Academy (Poland) and identified on the basis of Flora USSR (1961).

The "lactone fractions" were isolated by the method of Drożdż and Piotrowski (1973) from dried, crushed above-ground plant parts. Chromatography was done on silica gel plates. The compounds were isolated by column chromatography. Chemically uniform substances were identified or their structure determined by $^1\text{H-NMR}$ 200 MHz, MS, CD and IR spectra. The presence of chlorine was determined on the basis of MS spectra chemically after incineration. The details of the structure of the new sesquiterpene lactones are presented in a separate paper (Buděšínský et al. 1986).

From 1550 g of dried *Centaurea bella* Trautv. parts, gathered during blooming, 5.6 g of the "lactone fraction" in the form of a chloroform extract, were obtained. This was applied to a column of silica gel (220 g) suspended in chloroform. The compounds were eluted with a mixture of chloroform-ethyl acetate 7:1 (v/v) gradually increasing the polarity of the system. The eluates were checked by TLC on silica gel plates. Twentythree fractions were obtained, from which four (6, 10, 12, 18) were chosen for rechromatography on silica gel 200-300 mesh (Serva).

Isolation of centaurepensin (II). Fraction no. 3 already began to crystallize in the eluent after concentration. The crystalline substance was rinsed with chloroform. The compound (63 mg) so obtained had a melting point of 216-218°C and was identified as centaurepensin (II).

Isolation of cebellin A (III) and cebellin B (IV). Fraction no. 6 gave two spots upon control chromatography. They were separated on a silica gel (18 g) column by eluting the mixture from the adsorbent with ethyl ether. Two amorphous, new guaianolides were obtained, called cebellin A (54 mg) (III) and cebellin B (IV) (43 mg) (Fig. 1).

Isolation of cebellin C (V), cebellin D (VI) and cebellin F (VII). Fraction no. 10, which had given 3 spots, was rechromatographed on a column with silica gel (25 g) suspended in chloroform. The compounds were eluted with hexane-chloroform-ethyl acetate 1:1:1 (v/v/v) and 3 new guaianolides were obtained. The first one, cebellin C (V) (21 mg), which crystallized in a chloroform-ethyl ether mixture and had a m.p. of 181-183°C, contained chlorine in its molecule. The second also contained chlorine (57 mg) was amorphous and was labelled cebellin D (VI). The third (43 mg), amorphous, guaianolide from fraction 10 was called cebellin F (VII).

Isolation of cebellin E (VIII), cebellin G (IX) and cebellin H (X). These compounds composed fraction 12. They were separated on a column of silica gel (20 g) with hexane-chloroform-ethyl acetate 1:1:2 (v/v/v) as the eluent. A further 3 new guaianolides were isolated this way. One of them, (48 mg), which was amorphous and contained chlorine, was called

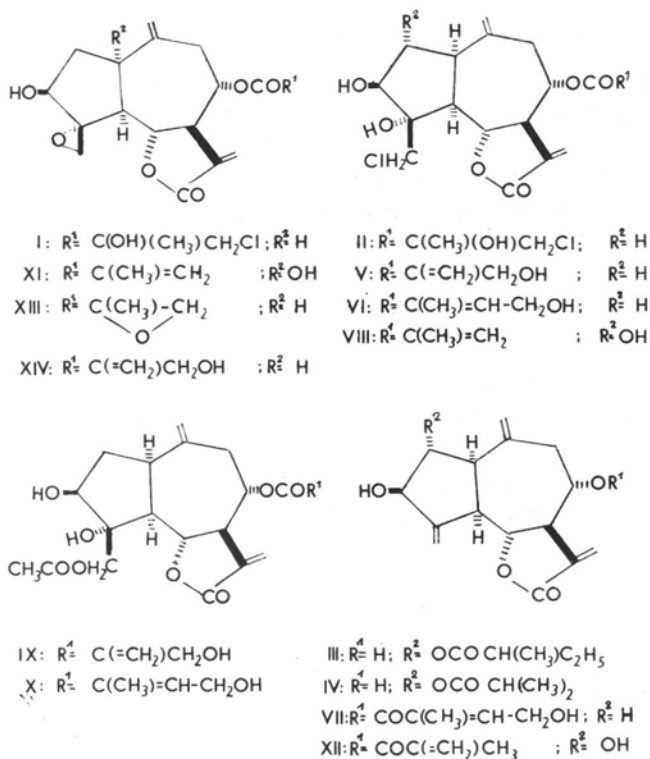


Fig. 1. Sesquiterpene lactones isolated from *C. bella*: I — acroptillin, II — centaurepsin, III — cebellin A, IV — cebellin B, V — cebellin C, VI — cebellin D, VII — cebellin F, VIII — cebellin E, IX — cebellin G, X — cebellin H, XI — cebellin I, XII — repdiolide, XIII — repin, XIV — janerin

cebellin E (VIII). The remaining 2 lactones from this fraction crystallized from a mixture of chloroform-ethyl ether. These were cebellin G (IX) (14 mg) with a m.p. of 144°C and cebellin H (X) (10 mg) with a m.p. of 160-161°C.

Isolation of cebellin I (XI) and repdiolide (XII). Fraction 18 was rechromatographed in a system of hexane-chloroform-ethyl acetate 1:1:2 (v/v/v) on silica gel (18 g). One of the compounds separated in this way was shown to be a new crystalline guaianolide (17 mg) chloroform-ethyl ether) with a m.p. of 137-139°C. It is proposed that the new lactone should be called

cebellin I (XI). The second compound (54 mg) obtained through this rechromatography was a guaianolide with a structure corresponding to that of repdiolide (XII).

RESULTS AND DISCUSSION

In this study, the occurrence of repin (XIII), acroptillin (I) and janerin (XIV) (Geppert et al. 1983) in the "lactone fraction" of *Centaurea bella* Trautv. was confirmed. The isolation of 9 new sesquiterpene lactones and 2 known ones: centaurepensin (II) first isolated from *Centaurea repens* L. (Gonzales et al. 1977) and repdiolide (XII) recently obtained from the same plant (Stevens 1982) was presented.

A different species from the subgenus *Hyalinella* (Tzvel.) Tzvel., *Centaurea adjarica* Alb., is also rich in sesquiterpene lactones. The following compounds were found in this species by means of thin-layer chromatography: repin (XIII), acroptillin (I), janerin (XIV), cebellin F (VII), G (IX) and I (XI) as well as others, not found in *Centaurea bella* (Fig. 2).

The four guaianolides containing chlorine in their molecule, isolated from *C. bella*, are noteworthy. They are: centaurepensin (II) and new lactones — cebellins C (V), D (VI) and E (VIII).

Studies are continuing on plants classified in subgenus *Hyainella*. This includes *C. adjarica* as well as *C. bella*, from which we expect to obtain further sesquiterpene lactones.

Acknowledgement

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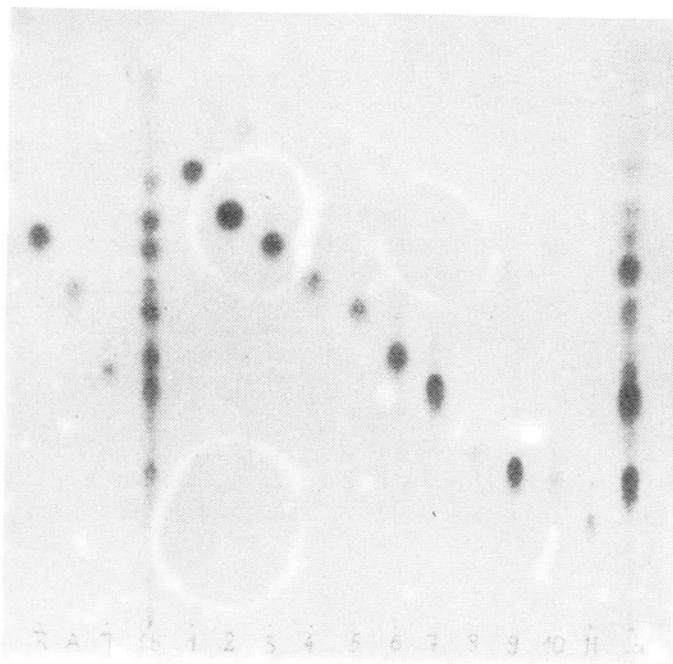


Fig. 2. Control chromatography of lactone fractions from *C. bella* and *C. adjarica* compared with lactones isolated from *C. bella*. R — repin, A — acroptillin, J — janerin, Cb — lactone fraction from *C. bella*, 1 — centaurepensin, 2 — cebellin A, 3 — cebellin B, 4 — cebellin C, 5 — cebellin D, 6 — cebellin F, 7 — cebellin E, 8 — cebellin G, 9 — repdiolide, 10 — cebellin H, 11 — cebellin I, Ca — lactone fractions from *C. adjarica*

*Laktony seskwiterpenowe. XXXI. Nowe gwajanolidy w Centaurea bella Trautv.
i Centaurea adjarica Alb.*

Streszczenie

Z wysuszonych części nadziemnych *Centaurea bella* Trautv. wyizolowano 9 nowych gwajanolidów w tym 3 z chlorem w cząsteczce. Są to cebelliny: A, B, C, D, E, F, G, H i I. Znaleziono tu także znane gwajanolidy, centaurepensynę i repdiolid, oraz potwierdzono występowanie repiny, akroptyliny i janeryny. Na drodze chromatograficznej stwierdzono obecność w *Centaurea adjarica* Alb. cebelliny F, G, I oraz repiny, akroptyliny i janeryny.