Phytochemistry, 1977, Vol 16, pp 782–783. Pergamon Press. Printed in England.

CARPESIOLIN FROM *CARPESIUM ABROTANOIDES*

MASAO MARUYAMA and SONOE OMURA
Department of Chemistry, Miyagi University of Education, Sendai, Japan

(*Received* 18 *November* 1976)

Key Word Index—*Carpesium abrotanoides*; Compositae; carpesiolin; carabrone; sesquiterpene lactone.

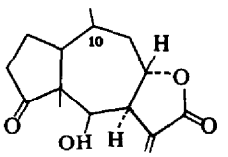
Abstract—Carpesiolin and carabrone were obtained from *Carpesium abrotanoides* as antifungal and antibacterial components, respectively, and the structure of carpesiolin was elucidated.

In the course of a continuing search for antifungal and antibacterial material of plant origin, alcoholic extracts of *Carpesium abrotanoides* L. showed significent inhibitory activity against *Cochliobolus miyabeanus* (Ito et Kurib.) Drechsl. and *Xanthomonas oryzae* (Ueda et Ishiyama) Dowson [1]. Our earlier paper [1, 2] described the isolation and stereochemistry of granilin and isolation of ivalin. This paper reports on the isolation and structure elucidation of a new pseudoguaianolide carpesiolin from this plant in addition to carabrone [3] formerly isolated from seed of this plant.

One of the active fractions of the chromatography of the active extract afforded an antibacterial crystalline substance, carpesiolin (**1**). (**1**), mp 122–123°, $[\alpha]_D$ + 115.3°, $C_{15}H_{20}O_4$ (Anal. and ^{13}C-NMR) has one tertiary and one secondary methyl groups (δ 1.04 (*s*) and 1.09 ppm (*d*, *J* 6 Hz), one hydroxyl group (ν_{max} 3580 cm^{-1}; δ 3.08 ppm (*d*), D_2O exchangeable; formation of monoacetate (**2**), mp 184.5–185°, $C_{17}H_{22}O_5$, on acetylation), one ketone group (ν_{max} 1724 cm^{-1}; δ 223.20 ppm in ^{13}C-NMR) and an α-methylene-γ-lactone group (ν_{max} 1770 cm^{-1}; λ_{max} 210 nm (ε 5100); δ 5.98 (*d*, *J* 3 Hz) and 6.10 ppm (*d*, *J* 3.5 Hz). The NMR signal at 4.38 ppm (*ddd*, *J* 11.5, 10 and 3 Hz) is due to a proton α to the ether oxygen of the γ-lactone and its chemical shift value suggests that this γ-lactone ring is fused *trans* to a seven membered ring [4]. This result and analysis of the NMR spectra of **1** and its acetate established the main features of the structure shown for carpesiolin. In the spectrum of **1**, one doublet of a set at 4.01 ppm (*J* 9 and 3 Hz) is due to a carbinyl proton of a secondary hydroxyl group since it collapsed to a doublet (*J* 9 Hz) on addition of D_2O, and moved to 5.5 ppm (*d*, *J* 8 Hz) on acetylation. Furthermore, in the spectrum of the deuterated compound, on irradiation the multiplet at 2.9 ppm, a signal of the β-methine proton of the lactone, collapsed so that two methylene doublets at 5.98 and 6.10 ppm gave two singlets, a doublet at 4.38 ppm gave a broad doublet and a doublet at 4.01 ppm changed to a singlet.

The fact that the carbonyl frequency of **1** at 1724 cm^{-1} shifted to 1743 cm^{-1} on acetylation shows that this ketone is on a five membered ring and is hydrogen bonded to the hydroxyl group, and this relation of the two groups allows the cyclopentanone ring to be fused next to the hydroxyl group.

One methyl group which appears at 1.04 ppm as a singlet is located on a carbon between the hydroxyl and the carbonyl groups since this carbon is quaternary and this methyl signal shifted downfield by 0.72 ppm on addition of 1/4 mol of Eu(dpm)$_3$. Another methyl group which appears at 1.09 ppm as a doublet is located at C-10 position from biogenetic point of view resulting in structure **1** for carpesiolin. This structure is also in accord with ^{13}C-NMR data.



Carpesiolin **1**

The planar structure of **1** is same as that of allodesacetylconfertiflorin [5], and their NMR spectra [6] are very similar, but these two compounds are not identical; therefore **1** is one of its diastereoisomers.

Another active fraction of the plant afforded an antifungal crystalline substance, mp 88–90°, which was characterized as carabrone by comparison of its mp and spectral data with those of an authentic sample and by formation of the 2,4-dinitrophenylhydrazone.

EXPERIMENTAL

Mps are uncorrected. NMR were measured with TMS as internal standard at 100 MHz. Biological assays were carried out by the paper disk method on incubated agar surfaces.

Carpesiolin (**1**). The fraction D (1.17 g) obtained from the Si gel column chromatography of the partitioned extract [1] was repeatedly chromatographed with Si gel in C_6H_6–AcOEt (5:1) to give a crystalline fraction (0.20 g), which was recrystallized from $CHCl_3$–*n*-hexane to give carpesiolin (**1**) (0.10 g) as colourless prisms, mp 122–123°; $[\alpha]_D^{18}$ + 115.3° *c* = 1.0, $CHCl_3$): Found C, 68.38; H, 7.87. Calc. for $C_{15}H_{20}O_4$: C, 68.16; H, 7.63%; ν_{max}^{KBr} cm^{-1}: 3580, 1770, 1724, 1665; λ_{max}^{MeOH} 210 nm (ε 5100); NMR ($CDCl_3$): δ 1.04 (3H, *s*, C-5 Me), 1.09 (3H, *d*, *J* 6Hz, C-10 Me), 2.9 (1H, *m*, C-7), 3.08 (1H, *d*, *J* 3Hz, C-6 OH, D_2O exchangeable), 4.01 (1H, *dd*, *J* 9 and 3 Hz, C-6; *d*, *J* 9 Hz on

D_2O addition), 4.38 (1H *ddd*, *J* 11.5, 10 and 3 Hz, C-8), 5.98 (1H, *d*, *J* 3 Hz, C-13), 6.10 (1H, *d*, *J* 3.5 Hz, C-13); NMR ($CDCl_3$) (with 1/4 mol $Eu(dpm)_3$): δ 1.31 (3H, *d*, *J* 6 Hz, C-10 Me), 1.76 (3H, *s*, C-5 Me); ^{13}C-NMR ($CDCl_3$): δ 18.99 (Me), 20.02 (Me), 24.57 (CH_2), 30.21 (CH), 37.79 (CH_2), 44.28 (CH_2), 45.32 (CH) 52.35 (CH), 57.63 (C), 75.35 (CH—O), 76.14 (CH—O), 121.28 (=CH_2), 13936 (=C), 169.51 (O—C=O), 223.20 (C=O). Assignments were verified by an off-resonance experiment. The acetate crystallized from EtOH as colourless needless (19 mg), mp 184.5–185°; Found: C, 66.39; H, 7.42. Calc. for $C_{17}H_{22}O_5$: C, 66.65: H, 7.24%: ν_{max}^{KBr} cm^{-1}: 1768, 1743, 1670: NMR ($CDCl_3$): δ 1.98 (3H, *s*, OAc), 5.50 (1H, *d*, *J* 8 Hz, C-6).

Carabrone The fraction B (1.35 g) from the same Si gel column chromatography as above was rechromatographed with Si gel in C_6H_6–AcOEt (5:1) to give a crystalline fraction (0.55 g), which was recrystallized from Et_2O–*n*-hexane to give carabrone (0.22 g) as colourless prisms, mp 88–90°, $[\alpha]_D^{18}$ + 104.1° (c = 1.0, $CHCl_3$), NMR ($CDCl_3$): δ 0.5 (2H, *m*), 1.08 (3H, *s*), 2.13 (3H, *s*), 3.1 (1H, *m*), 4.77 (1H, *ddd*, *J* 11, 9 and 6 Hz), 5.53 (1H, *d*, *J* 2.5 Hz), 6.18 (1H, *d* *J* 3 Hz). 2,4-Dinitrophenylhydrazone, mp 185.5–187.5°.

Acknowledgements—I am grateful to Mitsui Toatsu Chemicals, Inc. for biological assays and financial support. A part of the work was also supported by a Scientific Research Grant from the Ministry of Education, Japan. I also thank Mr. J. Ishiyama and Mrs. R. Tanaka of Tohoku University for NMR measurements, Microanalysis Laboratory of Tohoku University for elemental analysis, and Mr. T. Koizumi for technical assistance.

REFERENCES

1. Maruyama, M. and Shibata, F. (1975) *Phytochemistry* **14**, 2247.
2. Maruyama, M. and Karube, A. *Phytochemistry* in press.
3. Minato, H., Nosaka, S. and Horibe, I. (1964) *J. Chem. Soc.* 5503.
4. Herz, W. and Lick, L. A. (1963) *J. Org. Chem.* **28**, 2970. idem (1964) *ibid* **29**, 613.
5. Fischer, N. H. and Mabry, T. J. (1967) *Tetrahedron* **23**, 2529.
6. Yoshioka, H., Mabry, T. J. and Timmermann, B. N. (1973) *Sesquiterpene Lactones* pp 298. University of Tokyo Press.

Phytochemistry, 1977, Vol. 16. pp 783–784. Pergamon Press. Printed in England.

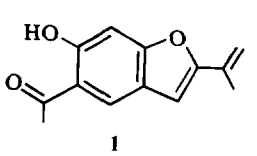
EIN NEUES EUPARIN-DERIVAT AUS *LIATRIS SQUARROSA*

FERDINAND BOHLMANN und ANTOINETTE SUWITA
Institut für Organische Chemie der Technischen Universität Berlin, Straße des 17. Juni 135, D-1000 Berlin 12, Germany

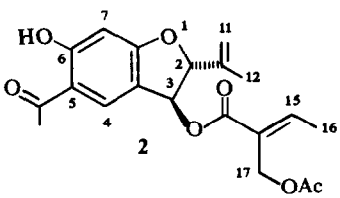
(*Received* 14 *January* 1977)

Key Word Index—*Liatris squarrosa*; Compositae; new euparine derivative.

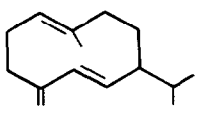
Aus der Gattung *Liatris* sind schon mehrere Vertreter eingehend untersucht. Man findet hier vor allem Germacrolide [1] und andere Sesquiterpene [2] sowie Flavone [3]. Neben dem weitverbreiteten Pentainen [4] kommt in zwei Arten auch eine Thiophenacetylenverbindung vor [5]. *Liatris squarrosa* (L.) Michx. ist bisher noch nicht untersucht worden. Weder aus den Wurzeln noch aus den oberirdischen Teilen konnten Sesquiterpenlactone isoliert werden. Die Wurzeln enthalten neben Euparin (**1**) einen Ester des Dihydroeuparins, dem aufgrund der spektroskopischen Daten die Konstitution (**2**) zukommen muß. Ähnliche Verbindungen sind schon aus anderen Compositen, insbesondere aus Vertretern der Tribus Eupatorieae isoliert worden [6]. Euparin kommt auch in *L. pycnostachya* vor [7]. Die oberirdischen Teile ergeben ebenfalls **1** und **2** sowie Germacren D (**3**) und als Hauptinhaltsstoff Lupeol (**4**).



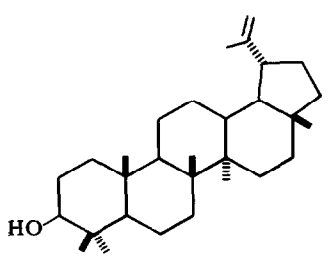
1



2



3



4

EXPERIMENTELLES

IR, Beckman IR 9, CCl_4; *NMR*. Varian HA 100, CCl_4; *MS*. Varian MAT 711. Die lufttrockenen Pflanzenteile (Dr. R. King, Washington, Herbar-N. 4939) extrahierte man mit Et_2O–petrol (1:2) und trennte die erhaltenen Extrakte zunächst grob durch

Tabelle 1. NMR-Signale von **2** ($CDCl_3$, δ-Werte bezogen auf TMS als innerem Standard)

2-H	*d(br)* 5·97	15-H	*q* 7.18
3-H	*d* 6.11	16-H	*d* 1.95
4-H	*s* 7.90	17-H	*s* 4.90
7-H	*s* 6.46	OAc	*s* 2.01
11-H	*s(br)* 4.97	COMe	*s* 2.55
11-H	*s(br)* 5.08	OH	*s* 13.02
12-H	*s(br)* 1.76		

J(Hz): 2,3 = 2.5; 15,16 = 7.