THE ESSENTIAL OIL OF *Ajuga bombycina* FROM TURKEY*

K. H. C. Baser, M. Kurkcuoglu, and F. Z. Erdemgil UDC 547.913+543.51

Water-distilled essential oil from Ajuga bombycina, *endemic in Turkey, was analyzed by GC/MS. Fifty-four compounds were characterized representing 96.2 % of the oil with* β*-pinene (28.2%),* α*-pinene (18.5%), germacrene D (8.5%), and* β*-phellandrene + limonene (6.9%) as the major constituents.*

Key words: *Ajuga bombycina*, Lamiaceae, *essential oil*, GC/MS.

The genus *Ajuga* is represented in Turkey by 12 species and 22 taxa. *Ajuga* is a perennial herb with slender woody root. Stems are prostrate or procumbent, 3-15 cm. Basal leaves are obovate to obovate-oblong, crenate-dentate. Inflorescence is dense, 3-15 cm. Verticillasters 2-flowered, corolla is yellow, 12-16 mm, shape as in *A. chamaepitys*. It grows on limestone rocks and rocky slopes at 50-1350 m in South, South-West, and Central Anatolia. It is an endemic species in Turkey [1, 2].

A. bombycina Boiss. has not been investigated previously for its essential oil. No data exist on the ethnomedical use and biological activity of *A. bombycina* in the scientific literature. Previous data on the essential oils of *Ajuga* species occurring in Turkey are presented in Table 1. β-Pinene and germacrene D were found as the main constituents in two varieties of *Ajuga chamaepitys* subsp. *chia* growing in Turkey: 20.8%, 12.6% and 14.0%, 14.6% respectively [5].

The water-distilled oil of *Ajuga bombycina* obtained in 0.1% yield was analyzed for the first time. Fifty-four compounds were characterized with β-pinene (28.2 %), α-pinene (18.5 %), germacrene D (8.5 %), β-phellandrene, and limonene (6.9 %) as the main constituents.

EXPERIMENTAL

The oil was analyzed by GC/MS using a Shimadzu GC-MS QP5050A system. CPSil5CB column (25m × 0.25 mm i. d., 0.4 mm film thickness) was used with helium as a carrier gas. GC oven temperature was kept at 60°C and programmed to 260°C for at a rate of 5°C/min, and then kept constant at 260°C for 40 min. The split flow was adjusted at 50 mL/min. The injector temperature was at 250°C. MS were taken at 70 eV. Mass range was between *m/z* 30 to 425. A library search was carried out using the Wiley GC-MS Library and in-house TBAM Library of Essential Oil Constituents. The MS were also compared with those of reference compounds and confirmed with the aid of retention indices from published sources. Relative percentage amounts of the separated compounds were calculated from total ion chromatograms by a computerized integrator.

Ajuga bombycina was collected from Denizli: Olukbasi, Geyran Road in July 1999 in Turkey. Voucher specimens are kept at the Herbarium of the Faculty of Pharmacy of Anadolu University (ESSE 12857).

Dried aerial parts were subjected to hydrodistillation using a Clevenger–type apparatus to produce oil in 0.1% yield (Table 2).

*Presented at the 4th International Symposium on the Chemistry of Natural Compound (SCNC), 6-8 June 2001, Isparta, Turkey.

Medicinal and Aromatic Plant and Drug Research Centre (TBAM), 26470, Eskisehir, Turkey. Published in Khimiya Prirodnykh Soedinenii, No. 3, pp. 207-208, May-June, 2001. Original article submitted June 19, 2001.

 0009-3130/01/3703-0242$25.00

TABLE 1. Previous Data on the Essential Oils of *Ajuga* Species Occurring in Turkey

A. chamaepitys	Part	Yield, %	Main component	Ref.
A. chamaepitys	Herb	Tr.	-	3
subsp. *cuneatifolia*	Herb	0.1-0.4	-	3
subsp. *laevigata*	Herb	0.1-0.4	-	3
subsp. *mesogitana*	Herb	0.1-0.4	-	3
subsp. *chia* var. *chia*	Aerial parts	0.3	β-Caryophyllene (24.4 %)	4
subsp. *chia* var. *chia*	Herb	0.046	β-Pinene (20.8%), Germacrene D (12.6%)	5
subsp. *chia* var. *ciliata*	Herb	0.086	Germacrene D (14.6%), β-Pinene (14.0%)	5

TABLE 2. Chemical Composition of the Oil of *Ajuga bombycina* Growing in Turkey

Compound	[a]RI	%	Compound	[a]RI	%
trans-2-Hexenal	823	0.1	Myrtenol	1174	0.1
α-Thujene	924	3.9	Verbenone	1176	0.3
α-Pinene	934	18.5	Decanal	1178	0.1
Camphene	943	0.4	Dodecane	1194	0.1
Verbenene	946	0.1	Thymol	1262	2.3
Sabinene	965	0.9	Carvacrol	1272	5.8
β-Pinene	973	28.2	Tridecane	1300	0.1
2-Amylfuran	976	0.2	α-Copaene	1371	0.5
Myrcene	978	0.7	β-Bourbonene	1379	1.7
α-Phellandrene	993	0.3	β-Cubebene	1381	0.5
p-Cymene	1008	0.3	β-Caryophyllene	1412	0.5
β-Phellandrene + Limonene	1018	6.9	(*E*)-Geranyl acetone	1422	0.3
(*Z*)-β-Ocimene	1021	Tr.	α-Guaiene	1430	0.1
(*E*)-β-Ocimene	1032	0.1	α-Humulene	1445	0.1
γ-Terpinene	1044	0.1	γ-Muurolene	1466	0.1
Terpinolene	1047	0.1	Germacrene D	1473	8.5
Nonanal + Linalool	1078	0.7	Bicyclogermacrene	1487	1.4
β-Thujone	1092	0.1	β-Bisabolene + γ-Cadinene	1500	0.1
α-Campholene aldehyde	1099	0.6	δ-Cadinene	1508	0.2
cis-Limonene oxide	1111	0.1	Germacrene B	1546	0.9
trans-Limonene oxide	1115	0.1	Germacrene D-4-ol	1559	1.1
trans-Pinocarveol	1119	1.5	Caryophyllene oxide	1564	0.4
trans-Verbenol	1123	1.1	α-Cedrol	1584	0.2
Pinocarvone	1134	2.6	Hexahydrofarnesyl acetone	1825	1.0
Terpinen-4-ol	1156	Tr.	Hexadecanoic acid	1935	0.1
Myrtenol	1164	2.1			

[a]RI: Retention index on nonpolar column. Tr.: trace ($\leq$0.1%).

REFERENCES

1. K. H. C. Baser, *Acta Horticulturae*, **333**, 217 (1993).
2. P. H. Davis, *Flora of Turkey and the East Aegean Islands*, Edinburgh University Press, Edinburgh,. **7**, 52 (1982).
3. N. Tanker, F. Ilisulu, M. Koyuncu, and M. Coskun, *Int. J. Crude Drug Res*., **24,** No. 4, 177 (1986).
4. F. Mericli, A. H. Mericli, Y. Korkmaz-Alp, and F. Yilmaz, *Acta Pharm. Turcica*, **36**, No. 1, 177 (1994).
5. K. H. C. Baser, Z. Erdemgil, T. Ozek, and B. Demirci, *J. Essent. Oil Res*., **11**, 203 (1999).