PERGAMON Biochemical Systematics and Ecology 28 (2000) 1023–1025

biochemical systematics and ecology

www.elsevier.com/locate/biochemsyseco

Occurrence of the antifeedant 14,15-dihydroajugapitin in the aerial parts of *Ajuga iva* from Algeria

M.L. Bondì[a], M.R.Y. Al-Hillo[b], K. Lamara[b], S. Ladjel[b], M. Bruno[c], F. Piozzi[a,c,*], M.S.J. Simmonds[d]

[a]*Istituto Chimica Tecnologia Prodotti Naturali, C.N.R. (associated with Istituto Nazionale Chimica Sistemi Biologici, C.N.R.), 153 La Malfa, 90146 Palermo, Italy*

[b]*Science Exact Institute, Chemistry Department, Oum El Bouaghi University, Oum El Bouaghi 04000, Algeria*

[c]*Dipartimento Chimica Organica, Università Palermo, Viale d.Scienze, 90128 Palermo, Italy*

[d]*Jodrell Laboratory, Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3AB, UK*

Received 31 March 1999; accepted 18 November 1999

Keywords: Ajuga iva; Lamiaceae; *Neo*-clerodanes; 14,15-dihydroajugapitin; Ivain IV; *Spodoptera frugiperda*; *Spodoptera littoralis*

1. Subject and source

Aerial parts of *Ajuga iva* (L.) Schreber were collected in June 1997 from Ain M'Lila near Oum El Bouaghi, Algeria. A voucher specimen (Ena El-Harrach, Algerie, AC-AG6) was deposited at the Herbarium of the Oum Bouaghi University.

The plant (local name "chendgoura") is used in traditional medicine in Algeria to treat diabetes, and is known to have antinflammatory, antifungal, antimicrobial, antifebrile, anthelmintic activity.

2. Previous work

The chemistry of *Ajuga* has been reviewed by Camps and Coll (1993). Four *neo*-clerodane diterpenoids (Ivain I–IV) were isolated from *A. iva* (aerial parts)

* Correspondence address: Dipartimento Chimica Organica, Università Palermo, Viale d.Scienze, 90128 Palermo, Italy. Tel.: + 39-091-596905; fax: + 39-091-596825.

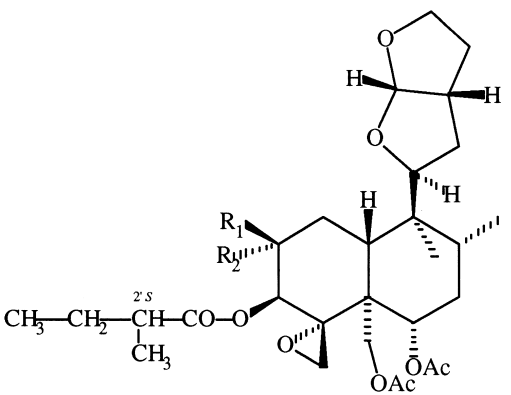
E-mail address: organica@unipa.it (F. Piozzi)

0305-1978/00/$ - see front matter
PII: S0305-1978(00)00012-0

collected in Israel (Camps et al., 1982); seven phytoecdysteroids were found in whole plants, including roots, harvested in Algerie (Wessner et al., 1992). Crude ethanol extracts of *A. iva* have been shown to have potent antifeedant activity against *Spodoptera frugiperda* and *S. littoralis* (Simmonds and Blaney, 1992). The activity against *S. littoralis* could be explained by one or more of the ivain diterpenoids, which deter *S. littoralis* from feeding (Belles et al., 1985).

3. Present study

Of the previously reported *neo*-clerodanes in *A. iva*, only small amounts of ivain IV (**1**) were found; no phytoecdysteroids were isolated; on the contrary, the main component was 14,15-dihydroajugapitin (**2**), the C-2 epimer of (**1**) which occurrs in *A. chamaepitys* (Hernandez et al., 1982; Boneva et al., 1990), and in *A. pseudoiva* (Camps et al., 1984). It is the first time that the two epimers (**1**) and (**2**) have been found together in the same species.



	R_1	R_2	
1	OH	H	ivain IV
2	H	OH	14,15-dihydroajugapitin

14,15-Dihydroajugapitin (**2**), formed colourless crystals (from Et_2O-hexane), m.p. 212°, $[\alpha]_D = -39°$ ($CHCl_3$). MS, ^{1}H-NMR, ^{13}C-NMR were in agreement with the previously reported data.

14,15-Dihydroajugapitin and ivain IV were reported to show antifeedant activity against *Spodoptera littoralis* when tested on plant material (Belles et al., 1985). We compare the effect of these compounds against larvae of both *Spodoptera frugiperda* and *S. littoralis*.

Table 1
Effect of compounds on the feeding behaviour of *Spodoptera frugiperda* and *Spodoptera littoralis*

	Compounds[b]	Feeding index[a] Mean (sem)	
		S. frugiperda	*S. littoralis*
(**1**)	14,15-dihydroajugapityn	61 (4.1)[c]	48 (5.7)[c]
(**2**)	Ivain IV	74 (11.4)[c]	76 (4.4)[c]

[a]Feeding index = $((C - T)/(C + T))\%$, C = amount of control discs, T = amount of treatment discs eaten after 18 h; + ve Index indicates an antifeedant.
[b]Compounds were applied to discs at 100 ppm. $n = 15$–20.
[c]Significant activity, $P < 0.01$, Wilcoxon matched pairs test.

4. Biological activity

A binary choice feeding bioassay using sucrose-treated glass-fibre discs was used to evaluate the activity of the compounds against final stadium larvae of *Spodoptera frugiperda* and *S. littoralis* (Simmonds et al., 1992). 14,15-Dihydroajugapitin and ivain IV showed significant levels of antifeedant activity against both species (Table 1).

References

Belles, X., Camps, F., Coll, J., Piulachs, M.D., 1985. J. Chem. Ecol. 11, 1439.
Boneva, I.M., Mikhova, B.P., Malakov, P.Y., Papanov, G.Y., Duddeck, H., Spassov, S.L., 1990. Phytochemistry 29, 2931.
Camps, F., Coll, J., Cortel, A., 1982. Chem. Lett, 1053.
Camps, F., Coll, J., Dargallo, O., 1984. Phytochemistry 23, 387.
Camps, F., Coll, J., 1993. Phytochemistry 32, 1361.
Hernandez, A., Pascual, C., Sanz, J., Rodriguez, B., 1982. Phytochemistry 21, 2909.
Simmonds, M.S.J., Blaney, W.M., Schoonhoven, L.M., 1992. J. Insect Physiol. 38, 249.
Simmonds, M.S.J., Blaney, W.M., 1992. Harley, R.M., Reynolds, T. (Eds.), Advances in Labiatae Science, 375.
Wessner, M., Champion, B., Girault, J.P., Kaouadji, N., Saidi, B., Lafont, R., 1992. Phytochemistry 31, 3785.