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NOTE

FREE FLAVONOID AGLYCONES FROM *INULA MONTANA*

Joël Reynaud and Monique Lussignol

Laboratoire de Botanique, ISPB Faculté de Pharmacie, Lyon, France

ABSTRACT

Inula montana *L.* (*Asteraceae*) *is sometimes used in folk medicine in France in place of* Arnica montana *L. (and improperly called "Arnica"). A preliminary study on the flavonoid chemistry* of Inula montana *showed the occurrence of four major flavonoid aglycones: luteolin (5,7,3',4'-hydroxyflavone), hispidulin (5,7,4'-hydroxy-6-methoxyflavone), nepetin (5,7,3'-hydroxy-6-methoxyflavone) and cirsimaritin (5,4'-hydroxy-6,7-dimethoxyflavone). This species contains less free flavonoid aglycones (only 5 compounds detected) than* Arnica montana *(nearly 20 free aglycones isolated and identified).*

INTRODUCTION

Inula montana L. (Asteraceae) is a 10–40 cm perennial herb with solitary capitula (5–8 cm diameter) with yellow florets, growing in South Europe (France, Spain and Italy) and in North Africa. It is sometimes called "arnica" in France and used in folk medicine for its vulnerary activity, in place of *Arnica montana* L.

The chemistry of several species of the genus *Inula* has already been studied, e.g. *I. helenium, I. graveolens, I. japonica, I. viscosa,* etc. They have been reported to be rich in sesquiterpene lactones, terpenoids and methylated flavonoids (Grande et al., 1985; Vajs et al., 1989; Wollenweber et al., 1991). Some of them, such as *I. salicina, I. conyza, I. britannica, I. viscosa,* and especially *I. helenium,* have medicinal properties (tonic, diuretic, bactericidal and antiseptic) (Beckstrom-Sternberg & Duke, 1997). However, no reports could be found in the literature on the chemistry of *Inula montana* L.

Keywords: Flavonoids, Cirsimaritin, Hispidulin, Nepetin, *Inula montana* L., Asteraceae.

Address correspondence to: Dr. J Reynaud, Laboratoire de Botanique, ISPB Faculté de Pharmacie, 8 Avenue Rockefeller, 69373 Lyon Cedex 08, France.

MATERIALS AND METHODS

Inula montana was collected in France (Drôme) in 1996, and a voucher specimen was deposited in our laboratory. Powdered aerial parts (40 g) were extracted with MeOH/H_2O (7/3) at room temperature for 24 h. After elimination of chlorophyls, free flavonoid aglycones were extracted with $(C_2H_5)_2CO$. After evaporation, the dry residue was partitioned by thin-layer chromatography (TLC) on polyamid (DC6 Macherey-Nagel) using toluene/ethylmethylketone/acetylacetone (4/3/3, v/v/v) as eluting solvent. Among five compounds detected, four were purified and identified using classical methods: UV and mass spectra (Markham, 1982).

RESULTS AND DISCUSSION

The lower chromatographic band at Rf 0.17 corresponded to luteolin (5,7,3',4'-hydroxyflavone). Above, at Rf 0.34, we identified nepetin (5,7,3',4'-hydroxy-6-methoxyflavone), UV (max (MeOH) 253, 271, 344 (+$AlCl_3$) 274, 422, (+$AlCl_3$/HCl) 262, 279, 365. ms: 316 [M^+, 43%], 315 [M-1, 5%], 301 [M-15, 29%], 298 [M-18, 19%], 273 [M-43, 23%].

The third band at Rf 0.53 was hispidulin (5,7,4'-hydroxy-6-methoxyflavone), UV (max (MeOH) 273, 334, (+$AlCl_3$) 282, 301, 359, (+$AlCl_3$/HCl) 287, 298,

354. ms: 300 [M^+, 32%], 299 [M-1, 5%], 285 [M-15, 13%], 282 [M-18, 12%], 257 [M-43, 11%]. The upper band at Rf 0.72 was cirsimaritin (5,4'-hydroxy-6,7-dimethoxyflavone), UV(max (MeOH) 274, 334, (+$AICI_3$) 274, (300), 362, (+$AICI_3$/HCI) 278, (300), 357. ms: 313 [M^+, 11%], 312 [M-1, 9%], 284 [M-29, 13%], 256 [M-57, 55%].

To our knowledge, this present paper is the first published on the flavonoid chemistry of *Inula montana* L. We can notice that its free aglycone flavonoid content is very poor compared to that of *Inula viscosa* in which 13 exudate flavones and flavonols were previously reported (Wollenweber et al., 1991). As reported for other species of *Inula* (Grande et al., 1985), and as with numerous Asteraceae (Harborne, 1994), *Inula montana* L. yields methylated flavonoids. Hispidulin and nepetin have already been reported as leaf exudates of *Inula viscosa* (Wollenweber et al., 1991) and of various other species of Asteraceae or Lamiaceae (Harborne, 1994). These methylated flavonoids are known to have cancer preventive and/or antitumor activities (Beckstrom-Sternberg & Duke, 1997). Although *Inula montana* L. is used in place of *Arnica montana* L., its flavonoid content is different and very poor in comparison with that of the latter (Merfort, 1984; Ebert et al., 1988). Moreover, the methylated flavonoids it contains are not mentioned as vulnerary. Therefore, its medicinal use for the same activity, is probably due to the presence of other chemical compounds.

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