The flavonoid chemosystematics of Egyptian Verbena species

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1. Subject and source

The genus Verbena L. (Verbenaceae) comprises 250 species mainly in tropical and temperate America. It is represented in Egypt by two species viz. Verbena officinalis L. and V. supina L. (Taeckholm, 1974). Verbena officinalis is widely distributed mainly in the northern hemisphere while V. supina is of Mediterranean, West Irano–Turanian and East Saharo-Arabian distribution (Fienbrun-Dothan, 1978). In Egypt both species are distributed in the Mediterranean coastal area, Nile Valley and Oases.

Aerial parts of Verbena officinalis L. was collected at the flowering stage from (1) Kafr El-Dwaar, Behiera 19.3.1993 (El-Garf); (2) Kom Hammada, El- Behiera in March 1998, (El-Garf, 600) and Verbena supina L. was collected from (1) Wadi Halazeen, 40 km West Mersa Matrouh 25.4. 1996 (El-Garf 1010). (2*)14 km on the way from Mersa Matrouh 22.5.1963, Taeckholm. (3*) Assiut University, 12.5.-1962, Taeckholm. Voucher specimens are present in the Herbarium of Cairo University (CAI) and National Research Center (CAIRC).

2. Previous work

In previous studies Verbena species have been found to contain naringenin, eriodictyol (Stotz et al., 1984), 4’-methoxyluteolin-7-glucoside, 4’-methoxyluteolin-7-glucuronoide,
4’-methoxyluteolin-7-neohesperidoside, Chrysoeriol-7-glucoside, Chrysoeriol-7-rutinoside, 3’-methoxyluteolin-7-(2”,6”-dirhamnosyl-glucoside) and 3’-methoxy luteolin -7- neohesperidoside (Michael et al., 1996).

3. Present study

The dried plant material of each species was extracted with 70% EtOH. Concentrated extracts were fractionated on polyamide columns using water as eluent then decreasing the polarity by increasing the concentration of EtOH. The isolated flavonoids were further purified by using elution techniques on Whatman No. 3MM paper and finally purified on a Sephadex LH-20 column.

The structure elucidation of the isolated flavonoids was achieved using standard methods (Harborne, 1967, 1984; Mabry et al., 1970; Markham, 1982). The isolated flavonoids were identified as: apigenin-7-glucoside, luteolin-7-glucoside, luteolin-7-galactoside luteolin-7-neohesperidoside, diosmetin-7-glucoside, diosmetin-7-galactoside, diosmetin-7-neohesperidoside and chrysoeriol-7-galactoside.

The structure of the isolated flavonoid compounds were confirmed through complete acid hydrolysis, mild acid hydrolysis, enzymatic hydrolysis, co-chromatography with authentic samples and UV spectroscopy. Also the structures of the intermediates, aglycones and sugars obtained were identified through co-chromatography with authentic samples.

The structure of the two uncommon flavonoids (Luteolin-7-neohesperidoside and diosmetin-7-neohesperidoside) were further confirmed through H¹-NMR spectra. (data available on request).

<table>
<thead>
<tr>
<th>Species</th>
<th>Sample</th>
<th>AP</th>
<th>Lut</th>
<th>Lut</th>
<th>Lut</th>
<th>Di</th>
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<th>Di</th>
<th>Chr</th>
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<tbody>
<tr>
<td>Verbena officinalis</td>
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<td>Verbena officinalis</td>
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<td>Verbena supina</td>
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<td>Verbena supina</td>
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<td>Verbena supina</td>
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</tr>
</tbody>
</table>

Notes: + + + = major; + + = strong; + = present; t = trace; – = absent; Ap = Apigenin; Lut = Luteolin; Chr = Chrysoeriol; Di = Diosmetin, G = Glucoside; Gal = Galactoside; Neo = Neohesperidoside

ᵃFresh samples.
ᵇHerbarium samples.
4. Chemotaxonomic significance

*Verbena officinalis* and *Verbena supina* can be differentiated by characters of habit, leaves, flowers.

The flavonoid profile indicated that luteolin-7-neohesperidoside and diosmetin-7-neohesperidoside are major components in *Verbena officinalis* while *Verbena supina* contains diosmetin-7-glucoside as its major component. Luteolin-7-glucoside, luteolin-7-galactoside and diosmetin-7-galactoside were present in both species. Both species also contained apigenin-7-glucoside and chrysoeriol-7-galactoside in smaller amounts (Table 1).

The occurrence of the flavonoid compounds in the two species, support their classifications as distinct species. Little quantitative differences are present between the fresh and herbarium samples.

References


