



STEROL CONTENT AS A SIMILARITY MARKER OF DIFFERENT ORGANS OF TWO VARIETAS OF *CHRYSANTHEMUM PARTHENIUM*

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Key Word Index—*Chrysanthemum parthenium*; Compositae; feverfew; sterols; chemotaxonomy; numerical taxonomy.

Abstract—The major sterols from different organs (flowers, involucres, stems, leaves and roots) of two varieties of *Chrysanthemum parthenium* were determined by TLC and GLC. It was shown, using methods of numerical taxonomy, that the sterol overall similarity of the same organs of two varieties is much bigger than the similarity of different organs of one variety.

INTRODUCTION

Feverfew, *Chrysanthemum parthenium* (L.) [synonym = *Tanacetum parthenium* (L.) Schultz.-Bip.] (Compositae) has been used for many centuries as a folk medicine [1]. Leaves or infusions of feverfew have long been used as a popular remedy for fever, arthritis and migraine, and products derived are widely distributed in health food shops in many countries [2–4]. The history, botanical classification, chemical constituents, biological activity and clinical trials are recently well discussed [5]. Most reports on *Chrysanthemum parthenium* chemistry have been connected with sesquiterpenes lactones [6, 7] and flavonoids [8]. Very recently a new lipophilic flavonol, 6-hydroxykaempferol 3,7,4'-trimethyl ether, called tanetin, has been characterized in the leaves, flowers and seeds of feverfew. Pharmacological tests indicate that tanetin could contribute to the anti-inflammatory properties of feverfew [9].

Sterols of *C. parthenium* have not been extensively investigated. The aim of the present study is to determine the content of major sterols in different organs of *C. parthenium* and also compare overall sterol organ similarity using methods of numerical taxonomy.

RESULTS AND DISCUSSION

Sterols are present in all organs of plants. Flowering plants of both investigated varieties were collected and divided into the organs described in the Experimental. *C. parthenium* var. Schneeball has no tubular flowers. From each organ major sterols were isolated and determined. The sterol contents (% dry wt) are presented in Table 1.

Major sterols were determined by GLC after purifica-

tion by TLC and TLC with AgNO₃. The results are presented in Table 2.

The numerical analysis of data collected in the paper was performed in the convention of phenetic taxonomy [10, 11]. The aim of the phenetic analysis was to find in the set of 11 objects (organs of two varieties) the phenons—subsets linked by the overall similarity—and build up the hierarchical system of such phenons as a dendrogram (phenogram).

The starting point for the analysis was information on the set of 11 organs described by five features (sterol contents). The values of features were compiled in the data matrix.

The cluster analysis, which is the most commonly used tool of exploratory data analysis, was applied to the above data. In the present study the numerical taxonomy programs package TAXAL 2 was used [11]. Different combinations of preliminary data transformation and measures of dissimilarity with methods of

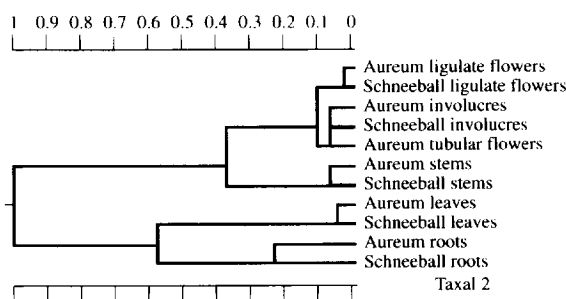
Table 1. Sterol content (% dry wt) in feverfew organs

Name of organ	Sample no.	Sterols (% dry wt)
<i>Chrysanthemum parthenium</i> var. Aureum		
Ligulate flowers	1	0.079
Involucre	2	0.073
Leaves	3	0.095
Stems	4	0.081
Roots	5	0.051
Tubular flowers	6	0.074
<i>C. parthenium</i> var. Schneeball		
Ligulate flowers	7	0.078
Involucre	8	0.074
Leaves	9	0.098
Stems	10	0.083
Roots	11	0.046

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Table 2. Content of major sterols (% of total sterols) in feverfew organs

Sample no.	Stanols	Campesterol and sitosterol	Stigmasterol	Fucosterol	Isofucosterol
<i>Chrysanthemum parthenium</i> var. Aureum.					
1	0.77	80.36	14.99	1.81	2.07
2	0.76	78.82	16.34	1.79	2.29
3	0.91	64.31	28.00	3.39	3.39
4	1.14	73.86	18.47	5.97	0.56
5	0.76	64.50	20.61	8.01	6.12
6	0.94	76.10	18.24	2.20	2.52
<i>C. parthenium</i> var. Schneeball					
7	0.78	80.82	14.73	2.06	1.81
8	0.53	77.98	17.24	2.39	1.86
9	0.94	64.26	29.16	2.19	3.45
10	0.92	75.07	16.42	6.38	1.21
11	2.08	55.73	28.12	8.33	5.24

Fig. 1. Dendrogram of organs of two varieties of *Chrysanthemum parthenium*. Relative scale used, 0 = minimal distance between clusters.

clustering provide results slightly differing in details, but absolutely invariant in the 'core' structure. The typical dendrogram is presented in Fig. 1.

The two main clusters contain flowers, involucre and stems in the first and leaves and roots in the second. In both clusters there are secondary subsets containing the same organs of two varieties. The only 'odd' organ, tubular flowers (Aureum), is located closer to involucre than to ligulate flowers. The results obtained by numerical taxonomy using sterol similarity showed that the same organs of two varieties are more similar than different organs of the same variety.

EXPERIMENTAL

Plant material. Two varieties of *Chrysanthemum parthenium* (*C. parthenium* var. Aureum and *C. parthenium* var. Schneeball) were cultivated in our department. Whole flowering plants were divided into ligulate and tubular flowers, involucre, stems, leaves and roots. Separated organs were dried at 40°.

Extraction and chromatography. Dry plant material was extracted with Et₂O. The extracts were evapd to dryness yielding the crude lipid fraction (CLF). The CLF from each organ was saponified. Sterols were purified by CC and TLC as usual, and GLC determination was carried out in typical condition [12].

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