

**THE ECOLOGY AND COENOLOGY OF *HYPERICUM*
PERFORATUM AND *H. MACULATUM* FROM THE MUREȘ
COUNTY FLORA**

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Abstract: This study synthesizes some ecological and coenological observations on two species of *Hypericum* genus: *H. perforatum* and *H. maculatum* from Mures county flora. 43 plant associations from 11 classes of vegetation, in which the two species occurrence, were analyzed. The two species are not evenly distributed at class and plant associations levels, showing a relatively wide range of eco-coenotical range. The two species were generally recorded with different AD values: *H. perforatum* ranges from "+" to "2", whereas the other species occurs with a constant "+".

A relation between site conditions and the quality and quantity of active principles contained (hypericin and flavonoids) has been observed. Their biosynthesis seems to be enhanced on habitat conditions.

Introduction

This study attempts to observe the ecology and coenology of two species belonging to *Hypericum* genus, *H. perforatum* and *H. maculatum*, based on field-work data and bibliographical sources.

Methodology

The principle used in accomplishing this study has been identification of classes and plant associations which contain the two *Hypericum* species, data synthesizing and their comparative analysis.

Vegetation research methods are those elaborated by Braun – Blanquet, adapted to specific features of the vegetation in our country. Survey assessment technique and that of qualitative and quantitative assessment has been achieved observing the recommendation of the following authors: Borza and Boșcaiu (1965), Ivan (1978), Cristea (1993). As coenotaxonomic units has been used the plant association as described by Central-European Phytosociological School.

In this study have been analysed 11 classes with 43 plant associations.

Brief characterization of the vegetation in the studied areas

The general aspect of today's vegetation in Mureș Defile is the reflection of physical-geographical conditions, of the origin of different floristic elements, of changes made by anthropo-zoogens factors which have induced profound modifications in vegetation structure by forest and hydrotechnical planning, by changing the land destination, culture, laying out roads etc. In Mureș Defile vegetation is characteristic of mountain level and stretches from 500 m to 1700 m altitude. The two *Hypericum* species can be found in the following classes:

- on inferior mountain level: *Molinio–Arrhenatheretea*, *Festuco–Brometea*, *Artemisietea*, *Galio–Urticetea*, *Epilobietea angustifolii*, *Asplenietea trichomanis*.
- on middle mountain level: *Mulgedio–Aconitetea*.

In Gurghiu Valley the vegetation is displayed on two levels: hill (between 337 m and 550 – 600 m altitude) and mountain (between 600 – 1600 m altitude). Today's vegetation in Gurghiu Valley presents itself as a continuous layer with predominating forests, shrubberies but also zonal secondary grassy vegetation installed after forest and shrubby clearing. The two *Hypericum* species have been identified in the following classes :

- on hills level in *Quercus-Fagetum*, *Rhamno-Prunetum*, *Alnetum glutinosae*, *Festuco-Brometum*, *Molinio-Arrhenatheretum*,
- on inferior mountain level in *Quercus-Fagetum*, *Molinio-Arrhenatheretum*,
- on middle mountain level in *Quercus-Fagetum*, *Epilobietum angustifolii*, *Galio-Urticetum*,
- on superior mountain level in *Vaccinio-Piceetum*, *Mulgedio-Aconitetum*.

The hills surrounding Herghelia village are distributed biogeographically to the region known in toponymy as „ Transilvania Plain” and have an average altitude of 350 m. Common oak, evergreen oak and hornbeam forests clearing in Transilvania led to the installation of xeromezophill and xerophill phytocoenosis. These phytocoenosis have a significant steppe feature, a large number of *Festucion rupicolae* and *Festucetalia valesiacae* characteristic species being part of their composition. Plant associations and species characteristic for *Festuco – Brometum* are well represented also.

„ Peonies Field” botanical reservation can be found 455 m altitude in Transilvania Plain. „Peonies Field” is a hay-field with steppe peony which lays on a 2,5 ha surface.

Table 1: The presence and AD values of *Hypericum perforatum* and *H. maculatum* species in the classes and associations analysed:

Plant associations and classes	AD values		Total no. of species
	<i>Hypericum perforatum</i>	<i>Hypericum maculatum</i>	
CL. VACCINIO-PICEETEA Br.-Bl.in Br.-Bl. et al. 1939			
1. <i>Hieracio rotundati-Piceetum</i> Pawlowski et Br.-Bl. 1939	-	+	143
CL. QUERCO-FAGETEA Br.-Bl.et Vlieger 1937			
2. <i>Telekio speciosae-Alnetum incanae</i> Coldea (1986) 1990	-	+	182
3. <i>Pulmonario rubrae-Fagetum</i> (Soó 1964) Täuber 1987	-	+	149
4. <i>Stellario nemori-Alnetum glutinosae</i> Lohmeyer 1957	-	+	123
5. <i>Quercus petraeae-Carpinetum</i> Zólyomi et Pócs 1957	-	+	152
6. <i>Quercus robori-Carpinetum</i> Soó et Pócs (1931)1957	+	+	159
CL. ALNETEA GLUTINOSAE Br.-Bl. et R. Tx ex Westhoff et al. 1946			
7. <i>Calamagrostio-Salicetum cinereae</i> Soó et Zólyomi in Zólyomi 1955	-	+	67
8. <i>Salicetum cinereae</i> Zólyomi 1931	+	-	87
CL. RHAMNO-PRUNETEA Goday et Berja Carbonell 1961			
9. <i>Pruno spinosae-Crataegetum</i> Soó (1927) 1931	+	-	145
CL. MOLINIO-ARRHENATHERETEA R.Tx. 1937 em. R. Tx. 1970			
10. <i>Filipendulo vulgaris-Arrhenatheretum</i> Hundt et Hübl 1983	+	-	145
11. <i>Festuco rubrae-Agrostietum capillaris</i> Horv. 1951 <i>tipicum nardetosum strictae</i> Oroian 1998	+	-	106
	-	+	58
12. <i>Rumici crispi-Agrostietum stoloniferae</i> Moor 1958	+	-	124
13. <i>Junco-Molinietum</i> Preising in Tx. et Preising ex Klapp 1954	+	+	121
14. <i>Cirsietum rivularis</i> Nowinski 1928	-	+	82
15. <i>Scirpetum sylvatici</i> Ralski 1931	-	+	95
16. <i>Filipendulo-Geranium palustris</i> Koch 1926	-	+	94
17. <i>Deschampsietum caespitosae</i> Horvatić1930	-	+ - 1	128
18. <i>Cirsio cani-Festucetum pratensis</i> Majovski ex Ruyickova 1975	+	-	117
19. <i>Chaerophyllo hirsuti-Filipenduletum</i> Niemann et al. 1973	-	1	79
20. <i>Mentha aquatica-Juncetum effusi</i> Aichinger 1963	-	+	46
21. <i>Agrostietum stoloniferae</i> (Ujvárosi 1941) Burduja et al. 1956	+	+	123
22. <i>Poo-Trisetum</i> Knapp ex Oberd 1957	-	+	96
CL. CALLUNO-ULICETEA Br.-Bl.et R.Tx. ex. Klika et Hadač 1944			

23. <i>Polygalo–Nardetum</i> (Preising 1953) Oberd. 1957	-	+	48
CL. FESTUCO–BROMETEA Br.-Bl. et R.Tx. ex Klika et Hadač 1944			
24. <i>Thymo comosi–Festucetum rupicole</i> (Csűrös 1959) Pop et Hodișan 1985	+	-	80
25. <i>Thymo pannonicici–Stipetum stenophyllae</i> Sanda et al 1998	+	-	63
26. <i>Agrostio–Festucetum valesiacae</i> Borisavljevič et al. 1955	+	-	73
27. <i>Polygalo majoris–Brachypodietum pinnati</i> Wagner 1941	+	-	113
28. <i>Medicagini minimae–Festucetum valesiacae</i> Wagner 1941	+	-	105
29. <i>Salvio (nutantis)–Paeonietum tenuifolii</i> Mititelu 1990	+	-	135
CL. ARTEMISIETEA VULGARIS Lohmeyer et al. in R. Tx. 1950			
30. <i>Tanaceto–Artemisietum vulgaris</i> Sissingh 1950	+	-	51
31. <i>Tussilaginetum farfarae</i> Oberd. 1949	-	+	47
32. <i>Hyosciamo–Conietum maculati</i> Slavnić 1951	+	-	58
CL. GALIO–URTICETEA Passarge ex Kopecký 1969			
33. <i>Arunco–Petasitetum albi</i> Br.-Bl. et Sutter 1977	-	+	56
34. <i>Telekio–Petasitetum hybridi tipicum</i> (Morariu 1967) Resm. et Rațiu 1974	+	+	84
<i>aruncetosum dioici</i> Oroian 1998	-	+	152
35. <i>Urtico–Aegopodietum</i> (R. Tx. 1963) Oberd. 1964	+	1	68
CL. EPILOBIETEA ANGUSTIFOLII R. Tx. et Preising in R. Tx. 1950			
36. <i>Rubetum idaei</i> Gams 1927	-	+	39
37. <i>Eupatorietum cannabini</i> R. Tx. 1950	+	-	49
38. <i>Telekietum speciosae</i> Treg 1941	-	+ - 1	60
CL. ASPLENIETEA TRICHOMANIS (Br.-Bl. in Meier et Br.-Bl. 1934) Oberd. 1977			
39. <i>Sempervivetum heuffelii</i> Schneider – Binder 1969	+	-	37
40. <i>Asplenio trichomanis–Poëtum nemoralis</i> N. Boșcaiu 1971	+	-	120
CL. MULGEDIO–ACONITETEA Hadač et Klika in Klika et Hadač 1944			
41. <i>Polemonio caerulei–Carduetum personatae</i> Sămărghițan 2001	-	1 - 2	64
42. <i>Hyperico grisebachii–Calamagrostietum villosae</i> Pawlowski et. Wal. 1949	-	+	31
43. <i>Rumicetum alpini</i> Beger 1922	-	+	17

Results and Discussions

After data synthesis it was noticed that the two species are not uniformly spread in classes and vegetal associations. Both species appear in only 3 vegetal associations: *Quercrobori–Carpinetum*, *Junco–Molinietum* and *Agrostietum stoloniferae*. *H. perforatum* only appear in the phytocoenosis of 20 plant associations and *H. maculatum* occur in the phytocoenosis of 23 plant associations. *H. maculatum* has AD value „ +” to „2” in the following plant associations: *Polemonio caerulei–Carduetum personatae*, *Telekietum speciosae*, *Urtico–Aegopodietum* and *Deschampsietum caespitosae*. *H. perforatum* has only „ +” value in all investigated associations.

On vegetation class level it was noticed that both species are present in 5 classes: *Quercro–Fagetea*, *Alnetea glutinosae*, *Molinio–Arrhenatheretea*, *Artemisitea vulgaris*, *Galio–Urticetea*. In *Quercro–Fagetea* out of 5 studied associations, *H. maculatum* is present in 4, both species being present in the 5-th. In *Molinio–Arrhenatheretea*, *H. maculatum* also dominate in 8 out of 12 studied associations. It also happens in *Epilobietea angustifolii*. In *Artemisitea vulgaris* and *Alnetea glutinosae* the two species are present in one of the two studied associations. *H. perforatum* only is present in 3 of a total of 11 classes: *Rhamno–Prunetea*, *Festuco–Brometea*, *Asplenetea trichomanis*. *H. maculatum* only appears in 3 other classes: *Vaccinio–Piceetea*, *Calluno–Ulicetea*, *Mulgedio–Aconitetea*.

At habitats level we observed that *H. perforatum* is more frequently seen in habitats formed of semi-natural dry grasslands but also in shrubberies developed on calcareous substrate (*Festuco–Brometea*). This habitat is formed by steppic or sub-continental grasslands (*Festucetalia valesiacae*) and by grasslands of sub-mediterranean and oceanic origin. *H.*

maculatum is present on semi-natural tall herb humid meadows developed on neutro - alkaline to calcareous soils (*Eu-molinion*) and on more acid soils (*Junco-Molinietum*).

The correlation of the phytochemical aspects with the ecology of *H. perforatum* and *H. maculatum* species

H. perforatum is one of the oldest species used in therapeutics. The other species of the genus are not admitted in therapeutics. On biochemical aspects the two species differs in quality and quantity of the active principles contained. The most important active principles of drug are hypericin and flavonoids. This two drugs biosynthesis is closely related to environmental factors. This has been shown by analysing through specific methods samples taken from spontaneous flora, with stationary conditions as different as possible. Through phytochemical analyses it was established that hypericin biosynthesis is favoured by solar radiaton exposure and low humidity. The largest quantity was found in *H. perforatum* samples (0.2243% and 0.1923%) taken from sunny stations with low soil humidity. In *H. maculatum* samples hypericin quantity is much lower (0.0961%).

The biosynthesis of flavonoids is inhibited by increased soil humidity. The lowest flavonoids content was identified in *H. maculatum* (2.27%) and *H. perforatum* (3.76%) samples originating from humid stations; compared to other populations of *H. perforatum* (3.76%) taken from low humidity stations. Flavonoids has chemotaxonomical value for *Hypericum* species in general and particularly for *H. perforatum* populations.

Conclusions

This study attempts to emphasise the classes and vegetal associations in which the two *Hypericum* species are best represented and where they therefore encounter optim ecology. Thus *H. perforatum* is best represented in classes' associations: *Festuco-Brometea*, *Artemisietea vulgaris* and *Asplenietea trichomanis*. *H. maculatum* is pre-eminently present in classes' associations: *Molinio-Arrhenatheretea*, *Mulgedio-Aconitetea* and *Quercu-Fagetea* where it can reach AD values of 2. Also no correlation has been noticed between the presence or absence of the species, AD values and the specific abundance of studied vegetal associations.

As a result of the specific phytochemical analysis it has been noticed that there are significant qualitative and quantitative differences between the two species on active principles level, this different phytochemical characters being found within the same species.

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**ECOLOGIA ȘI CENOLOGIA SPECIILOR DE *HYPERICUM PERFORATUM* ȘI
H. MACULATUM DIN JUDEȚUL MUREȘ**

(Rezumat)

În acest studiu s-a încercat prezentarea ecologiei și cenologiei la două specii din genul *Hypericum* (*H. perforatum* și *H. maculatum*) din flora spontană a județului Mureș. S-au luat în lucru 11 clase cu 43 de asociații vegetale și 2 subasociații în care au fost identificate cele două specii (Tab. 1). Cele 11 clase au fost astfel selectate încât să acopere o suprafață cât mai mare și să cuprindă zone cât mai variate din județ: defileul Mureșului, Valea Gurghiului, zone din Câmpia Transilvaniei.

Prezența sau absența speciilor în unitățile cenotaxonomice studiate considerăm că este determinată în primul rând de exigențele lor ecologice și de condiționarea cenotică generată de ansamblul factorilor de mediu. *Hypericum perforatum* (H, Eua, 2n = 32, P, U3, T3, R0) este frecventă în locuri destul de uscate, pe soluri calcaroase sau silicioase, în fânețe, marginea drumurilor și a pădurilor, pe pârloage. *Hypericum maculatum* (H, Eua, 2n=32, D, U4, T3, R2) preferă locurile ± umede din păduri, tufișuri, în poieni montane, fânețe umede, mlăștinoase din regiunea montană, pe soluri dezvoltate pe șisturi, granite, andezite sau gresii.

S-a constatat că cele două specii nu sunt răspândite uniform la nivelul claselor, asociațiilor vegetale sau subasociațiilor prezentând o largă amplitudine eco-cenotică. Astfel, din totalul de 45 de asociații în 3 cazuri apar ambele specii, în 20 de asociații apare doar *H. perforatum*, iar în 23 de asociații apare *H. maculatum*.

Valoarea de AD a celor două specii este diferită, *H. perforatum* prezentând valori cuprinse între „+ - 2”, pe când cealaltă specie prezintă constant valoarea „+”. La nivelul claselor se observă că ambele specii sunt prezente în 5 dintre ele, dar și în cadrul acestui grup domină ca prezență *H. maculatum* în 3 cazuri, în celelalte 2 clase speciile fiind reprezentate egal. În cazul celorlalte clase luate în studiu repartiția celor două specii este egală, ele apărând în câte 3 din totalul de 11 clase.

Un alt aspect pe care am încercat să-l subliniem este corelația dintre condițiile staționare unde vegetează cele două specii și cantitatea, respectiv calitatea principiilor active conținute (hipericina și flavonele), constatându-se că biosinteza acestora este influențată de insolație și de condițiile xerice.