STUDIES REGARDING THE ARNICA MONTANA MEADOWS FROM THE CENTRAL PART OF THE APUSENI MOUNTAINS

CERCETĂRI PRIVIND PAJIŞTILE CU ARNICA MONTANA DIN ZONA CENTRALĂ A MUNȚILOR APUSENI

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Abstract: *The constitution of mountain meadows vegetation is stricken by numerous factors, among them an important part played by the applied management. The A. montana meadows are the result of the application for a long time of an extensive traditional management. The absence of the maintenance works (especially the fertilization) and the exploitation only by grazing determine the powerful setting in of some species like: Vaccinium myrtillus, Vaccinium vitis-ideae, Luzula luzuloides, Deschampsia flexuoza etc. The application of the maintenance works and the exploitation by mowing or by a mixed system favours the extend of some species, like: : Agrostis capillaris, Festuca rubra, Trisetum flavescens, Trifolium pratense, Trifolium repens etc., and also of some species from other botanical families, like: Centaurea pseudophrygia, Euphrasia officinalis, Hieracium aurantiacum etc. The floristic biodiversity is being reduced in the case of the first system and it increases evidently in the case of the system with maintenance works and with a usage by mowing or mixed*

Rezumat*: Structura vegetaţiei pajiştilor montane este influenţată de numeroşi factori dintre care un rol important îl joacă managementul aplicat. Pajiştile cu A. montana sunt rezultatul aplicării timp îndelungat a unui management tradiţional de tip extensiv. Lipsa lucrărilor de îngrijire (mai ales a fertilizării) şi exploatarea numai prin păşunat determină instalarea puternică a unor specii, cum sunt: Vaccinium myrtillus, Vaccinium vitis-ideae, Luzula luzuloides, Deschampsia flexuoza etc. Aplicarea lucrărilor de îngrijire şi exploatarea prin cosit sau printr-un sistem mixt favorizează extinderea unor specii, cum sunt: Agrostis capillaris, Festuca rubra, Trisetum flavescens, Trifolium pratense, Trifolium repens etc., precum şi a unor specii din alte familii botanice cum ar fi: Centaurea pseudophrygia, Euphrasia officinalis, Gymnadenia conopsea, Hieracium aurantiacum etc. Biodiversitatea floristică se reduce în cazul primului sistem şi se lărgeşte evident în cazul sistemului cu lucrări de îngrijire şi cu o folosire prin cosit s-au mixtă. Populaţiile de Arnica montana din punct de vedere cantitativ sunt puţin influenţate de practicarea acestor două sisteme, aceste fiind prezente în ambele cazuri cu o acoperire însemnată.*

Key words: *mountain meadows, management, biodiversity*
Cuvinte cheie: *pajişti montane, management, biodiversitatea*

INTRODUCTION

Romania is one of the main source countries of dried *Arnica montana* flower heads processed in Central Europe (Kathe et al., 2004). *Arnica montana* occurs in *Nardus stricta* grasslands on siliceous soils in mountains areas. This habitat type (Code 6230) is listed in the EU-FFH- directive (92/43) and the species *Arnica Montana* is listed in Annex V (92/43) (Michler et al., 2005).

Agriculture formed traditional rural landscapes. Highly diverse and traditionally managed meadows can still be found in the Apuseni Mountains (Transylvania, Romania). The

habitats are species rich with a total of 143 species identified (Michler and Reif, 2003). The habitats are threatened by conversion to more intensive agriculture.

METHOD AND MATERIALS

Our studies have been carried out in the perimeter of Gârda de Sus village from the Apuseni Mountains, in the period 2005-2006. The research activity took place within the framework of the project called Conservation of Eastern Medicinal Plants: *Arnica montana* in Romania (www.arnica-montana.ro). In this work 10 polygons will be analysed regarding not only the applied management, but also the floristic composition. 5 polygons from the southern part and 5 polygons from the northern part have been taken into consideration, because the southern region is placed on siliceous substratum and the northern one is placed on calcareous substratum. The information regarding the management of meadows with *Arnica montana* have been obtained using a questionnaire with 79 questions. The questionnaire has been applied on 83 landowners that have meadows with arnica. For the determination of the floristic composition has been delimited a square with the web of 5 metres, where has been applied the Brown-Blanquet modified method and in the middle of the square it has been worked with the metric frame. It's been used this combined research method, because on 25 square metres it can be better determined the plant biodiversity, than on a square metre and the species coverage can be precisely caught using the metric frame.

RESULTS AND DISCUSSIONS

The management of the *Arnica montana* meadows differs pretty much from the northern zone to the southern zone of the commune. The maintenance works that are being applied on these meadows are: rock collecting, anthill destroying, wooden vegetation fighting, weed fighting and fertilisation (Păcurar and Rotar, 2007).

In the southern region of the commune, the maintenance works apply with an more reduced intensity, comparing to the northern part (Table 1). The most important maintenance work is the fertilisation, which is done only with manure. In the southern part, these meadows are not fertilised in the most cases and, in the northern part, the quantities are comprised between 3 and 20 t/ha, being applied in spring and in autumn.

In the southern region, generally, the meadows are exploited by a continuous grazing or a summer-autumn grazing. For change, in the north, the grazing is practiced only in autumn. The exploitation by mowing or by a mixed system is not practiced in the southern zone, meanwhile, in the north these two systems are frequent. Here, the mowing takes place at the end of July – the beginning of August.

The floristic composition is very much stricken by the applied management. *Agrostis capillaris* is less frequent in the south, comparing to the north, where it gets up to a coverage of 19%. *Alchemilla vulgaris* is not present in the southern part, but only in north, reaching 12,75%. The *Arnica montana* specie is found in both regions. *Cynosurus cristatus* appears only in the northern region. *Centaurea pseudophrygia* and *Cerastium holosteoides* are found only in case of organic fertilisers application. *Euphrasia officinalis* is present only in the northern part. The *Festuca rubra* specie has large spreading in the northern part. *Hieracium aurantiacum* is favoured by the application of larger quantities of manure. *Leucanthemum vulgare* behaves similar. *Lotus corniculatus* has a very small spreading in the southern part, comparing to the northern part. *Pimpinella major* and *Plantago lanceolata* behave likewise. *Polygala vulgaris* and *Prunella vulgaris* are present only in the north. The same presence is ascertained for the next species: *Rhinanthus glaber, Rh. minor* and *Ranunculus acris*. *Trifolium pratense* and *T. repens* are favoured by the usage way met in the northern region. *Vaccinium myrtillus* and

Table 1

Management and florist composition of *Arnica montana* meadows

Area	1m²	1m²	1m²	1m²	1m²	Constanta ($25m^2$)	1m²	1m²	1m²	1m²	1m²	Constanta ($25m^2$)
Numărul parcelei (cod propriu)	4004	4048	4057	4072	4073		11	26	30	45	52	
Zona	Zona sudică a comunei Gârda de Sus						Zona nordică a comunei Gârda de Sus					
Localitatea	Valea Bucinișului	Biharia	Biharia	Biharia	Biharia		Marocu	Marocu	Valea Garda Seaca	Ocoale	Ocoale	
Altitudinea (m)	1014	1200	1250	860	880				1216			
Expoziția	335	335	200				320	45	300	220	240	
Grosimea solului (cm)	12	9	8	7	5		20	10	15	<20	12	
Panta %	32	11	25	21	26		15	17	7	7	6	
Management												
Aplicarea lucrărilor de îngrijire	nu	da	da	da	nu		da	da	da	da	da	
Fertilizare gunoi - cantitativ	nu	redus	nu	redus	nu		5-6 t	3-5 t	12-16 t	16-17 t	16-20 t	
Fertilizarea – momentul aplicării	nu	primavara toamna	nu	primavara toamna	nu		p-t	p	p	p	p-t	
Păşunat	continuu	vara. toamna	vara	continuu	continuu		Sept.	toamna	toamna	nu	toamna	
Cosit	nu	nu	nu	nu	nu		Aug.	Aug.	Iul.	Iul.	Aug.	
Folosință Mixtă	nu	nu	nu	nu	nu		da	da	da	nu	da	
Recolta kg/m^2	520	469	371	279	487		364	552	642	361	790	
Specii												
Acer pseudoplantanus						0				0.20		1
Achillea distans					0.1	2			0.20	2.50	1.00	3
Achillea millefolium											4.50	1
Agrostis capillaris	0.25					2	2.00	10.00	19.00	7.00	8.25	5
Ajuga genevensis						0		0.75				3
Alchemilla vulgaris agg.						0		3.00	12.75		1.50	5
Anemone nemorosa		0.22				2	0.25	0.75				3
Antennaria dioica			2	0.2	1.25	3		0.10				1
Anthoxanthum odoratum		0.5	0.3	0.6	0.3	4	3.00	0.25	1.50	1.50		5
Anthyllis vulneraria						0	1.00					2
Aposeris foetida						0						2
Arnica montana	4	5.5	14	2	27	5	26.00	6.75		2.50	7.00	5
Astrantia major						0						1
Botrichum lunaria						0						1
Briza media						0	3.25					2
Campanula patula agg.						1	0.20					2
Campanula serrata	0.1			0.3		2						1
Cardaminopsis halleri						0	0.20	0.50				2
Carex pallescens			0.75	0.15	0.4	4			3.00	1.00		3
Carlina acaulis						2						0
Carum carvi						0						1

Centaurea mollis						0	2.50					1
Centaurea pseudophrygia						1			5.50	0.75	1.00	4
Cerastium holosteoides						0	0.50	1.00		0.20		5
Cirsium erisithales						0	2.25					1
Colchicum autumnale						0						3
Crocus vernus		0.75			0.2	3	5.00	1.00		0.20		3
Cynosurus cristatus						0			0.75		19.50	4
Dactilis glomerata						0						1
Dactylorhiza majalis						0	1.00			0.50		2
Danthonia decumbens						1				0.25		1
Deschampsia flexuosa.	7	5.5	10	2	0.75	5						0
Euphrasia officinalis						0	15.75	1.75	2.00		1.00	4
Festuca rubra		0.75		0.2		4	4.00	14.00	6.00	8.75	6.00	5
Galium album						0						2
Genistella sagittalis					1.25	3						0
Gentiana asclepiadea						0						1
Gentianella lutescens						0	1.25	0.75			0.50	3
Gnaphalium sylvaticum						0			0.20			4
Gymnadenia conopsea						0	0.75					3
Hieracium aurantiacum						0	0.50	0.50		0.50	0.75	5
Hieracium murorum	3					1				1.00		1
Hieracium pilosella			0.5			2		0.75		5.00		3
Homogyne alpina						1						0
Hypericum maculatum agg.	1				0.9	4		1.50	0.50		4.50	2
Juncus inflexus						0						1
Juniperus sibirica						1						0
Knautia dipsacifolia						0		2.25			6.00	4
Laserpitium krampfi				3.75		2						0
Leucanthemum vulgare						2	0.75	0.50	1.75	0.50		5
Linum catharticum						0	0.25	0.50				3
Lotus corniculatus agg.						1		11.00	3.00	0.20	5.00	5
Luzula campestris agg.						0	1.75	2.75	0.25	2.75	1.00	5
Luzula luzulina						0						1
Luzula luzuloides		0.4	2	0.5	0.1	4						1
Lycopodium clavatum	1					2						0
Lysimachia vulgaris						0						0
Melampyrum sylvaticum						1						0
Nardus stricta				0.4		2			0.75	2.50		2
Phleum alpinum						0						1
Picea abies				1.75	0.2	3				0.20		1
Pimpinella major						0	2.00	2.00	0.75		5.00	5
Plantago lanceolata						1		1.25	4.00		1.50	5
Plantago major						0						2
Plantago media						0						2

Populus tremula						1						0
Polygala amarela						0		2.00				2
Polygala vulgaris						3		1.50	1.50	0.50		4
Polygonum bistorta						0						1
Potentilla erecta	5	9.5	8	2.5	1.5	5		0.25	11.00	21.00	2.00	4
Primula veris						0	0.75					2
Prunella vulgaris						0		0.50	0.50	0.25		3
Pseudorchis albida	0.25					1		0.10			0.25	2
Ranunculus acris						0	0.50	1.00	0.50		4.00	4
Ranunculus auricomus						0						1
Rhinanthus glaber						0						1
Rhinanthus minor						0	1.50	1.00	0.50		7.00	4
Rumex acetosa						1	0.25	1.00				4
Rumex acetosela						1						0
Salix capreae						1					+	0
Scabiosa columbaria						0						1
Scorzonera rosea						1			1.25		0.50	2
Silene nutans						0						2
Silene vulgaris			0.2			1						0
Soldanella hungarica						0	1.50	0.20				3
Stellaria graminea			1			1	1.75		0.25		0.75	5
Thesium alpinum						1						0
Thymus pulegioides			3	0.1	0.2	4	12.00	3.25		3.50		5
Traunsteinera globosa						0	0.25					1
Trifolium campestre						0						1
Trifolium pratense						0	1.00	5.50	0.25		1.75	5
Trifolium repens						0		4.00	0.50	0.75	3.00	4
Trisetum flavescens						0		1.50			1.00	2
Trollius europaeus						0	9.00		2.50		0.20	4
Vaccinium myrtillus	30	21	10	35	23	5	1.00			2.50		2
Vaccinium vitis-idaea	6	12	7	1.5	5.25	5						0
Veratrum album						0	1.50	0.25	0.20	0.50		5
Verbascum nigrum						1						0
Veronica chamaedris						0		0.10			1.50	4
Veronica officinalis						3						1
Veromica serpyllifolia						0						1
Vicia cracca						0						1
Viola canina						0				0.75		1
Viola declinata						0	1.00	0.50			2.75	4
Nr. de specii (1 m^2)	11	10	13	15	15		35	39	28	28	30	
Nr. de specii (25 m^2)	14	16	20	30	26		52	53	39	46	47	
Strat.de Muşchi	80	45	10	65	40		65.00	20.00	55.00	30.00	5.00	
Acoperirea totală.	98	80	55	95	70		97.00	97.00	90.00	70.00	87.00	

V. vitis-idaea are present with a significant coverage in the southern part and in the northern part they have a very small coverage. *Veratrum album* and *Viola declinata* appear only in the northern region.

The number of species on one square meter ($1m^2$) is comprised between 10 and 15 in the southern part and clearly superior is the number in the northern part, where is situated in the range of 28-39. The same situation is registered when we refer to 25 m^2 , the number of species being comprised between 14 and 30 in the southern region and 39 to 53 in the northern part.

CONCLUSIONS

The application of a different management in Gârda de Sus commune determines important changes in the herbal carpet level.

The application of manure and the usage by mowing or by mixed system contribute to a high plant diversity, comparing to the usage system by continuous grazing and without fertilization.

The Arnica habitats have a high plant biodiversity.

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