The presence and chorology of *Evonymus nanus* Bieb. in the Călugăreni Forest.

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1.Introduction

The dwarf spindle tree (*Evonymus nanus* Bieb.) is to be found in various sites such as: alder, weeping willows, ash, oak, hornbeam and even spruce forests, on alluvial soils, on calcareous stone, on dolomitic rocks and serpentines, but fragmentarily. The general area where the species can be found covers Central Asia and reaches the south-east of Europe. In Romania it is rather scarce, appearing only in: Voşlobeni (the „După Luncă" reserve), Lazărea on the banks of the brooke Român, Tuşnad Băi in a place named „Băile cu stuh", Miercurea Ciuc along the brooke Cibo, Bicsad next to the CFR railaway station on the riverside of Olt, Topliţa, Corbu – the county of Hargita; Grajduri, Bârnova, the brooke Stavnic, Mânzăteşti, Mogoşeşti, Mirceşti – the county of Iaşi; Bălteni – the county of Vaslui; Schitu Tarcău – the county of Neamţ; Rogojeşti, Zăiuşi, Mihăileni, Baisa – the county of Botoşani; Poiana Uzului, Sălătruc, Slănic, Colbu – the county of Bacău (Săvulescu et al. 1958, Mohan 2001, Dobrescu 1968, Chifu et al. 2006). In the county of Suceava the species is mentioned in Zamostea –the Zamostea-Luncă reserve, Bahna –the brooke Racovăţ – Fălticeni, Mountain Dămăcuşa – Moldoviţa, the brooke Lefe – Fundu Moldovei and Cheile Barnarului (Seghedin et al. 1977, Săvulescu et al. 1958, Mititelu & Monah 1993).

By means of the field studies undertaken between 2007 – 2009, this species was identified in the forest of Călugăreni (111 ha), vigorously represented by numerous individuals in a compact population. This forest is situated on the national road Suceava –Dorohoi (km 17).

From an administrative point of view, the forest under study comprises the compartments 22, 23, 24, 64, 65, 66, 67, 72, 73, from the management unit VII Zvoriştea, the forest district of Adâncata, the County Forest Administration of Suceava.

The population of *Evonymus nanus* is to be found in depression areas, with alluvial soil, partially flooded in spring and winter. The phytocoenological research carried out on this forest led to the identification of the associations *Corylo avellanae-Carpinetum* Chifu 1997 şi *Evonymo nanae-Carpinetum* Seghedin et al. 1977.

2.Materials and methods

All along the period 2007–2009 we made regular observations, from the prevernal period until autumn, both on the identification and the spreading of the species in the forest of Călugăreni, and for the sake of phytocoenological research.

For the study of the chorology of the species in Romania we analysed a specialised bibliography. For the study of the vegetation we used the methodology of the Phytocoenological School of Zurich-Montpellier.

The phytocoenoses studied in field trips belong to the associations *Corylo avellanae-Carpinetum* Chifu 1997 and *Evonymo nanae-Carpinetum* Seghedin et al. 1977. The synthetic tables of the associations were drawn up on the basis of phytocoenological surveys.

The nomenclature of the species was realized in keeping with the works unanimously accepted (Ciocârlan 2000). The ecological indices were taken from „Indicator values of vascular plants in Central Europe" (Ellenberg H., 1974).

3.Results and discussion

The coenosystem we opted for is the following one: the class *Querco-Fagetea* Br.-Bl. et Vlieger in Vlieger 1937, the order *Fagetalia sylvaticae* Pawlowski in Pawlowski et al. 1928, the alliance *Lathyro hallersteinii-Carpinion* Boşcaiu 1974, the suballiance *Galio schultesii-Carpinenion* Täuber 1992, the associations: *Evonymo nanae-Carpinetum* Seghedin et al. 1977, *Corylo avellanae-Carpinetum* Chifu 1997.

Phytocoenological Table of as. *Evonymo nanae-Carpinetum* Seghedin et al. 1977 (1-5) and as. *Corylo avellanae-Carpinetum* Chifu 1997 (6-10)

Number of survey	1	2	3	4	5		6	7	8	9	10	
Altitude (m)	300	300	300	300	300		310	310	320	320	320	
Exposition	-	-	S	-	S		-	V	SV	NV	N	
Slopes (degrees)	0	0	2	0	2	K	0	3	3	2	2	K
Coverage of the arborescent layer (%)	90	100	100	85	80		80	70	85	40	90	
Coverage of shrubs + sapling layer (%)	10	5	5	10	15		15	20	10	90	45	
Coverage of the herbaceous (%)	30	40	15	20	30		30	50	20	10	70	
Surface (m^2)	1000	1000	1000	1000	1000		1000	1000	1000	1000	1000	
Number of species	57	61	56	50	46		40	41	45	25	28	
Ass. charact.												
Carpinus betulus	1	3	2	1	2	V	+	+	-	-	-	V
Carpinus betulus juv.	-	+	+	-	1		+	-	+	1	+	
Quercus robur	-	+	+	+	+	V	3	2	3	3	5	V
Quercus robur juv.	+	+	+	-	-		-	+	-	-	-	
Corylus avellana	2	1	1	1	+	V	+	1	+	-	-	III
Evonymus nanus	1	+	-	+	1	IV	-	-	-	-	-	-
Galio schultesii-Carpinenion												
Cerasus avium	-	-	+	+	+	IV	-	-	1	+	-	V
Cerasus avium juv.	+	-	+	-	+		+	+	-	+	+	
Tilia cordata	3	1	+	2	1	V	1	1	1	-	-	IV
Tilia cordata juv.	-	-	-	+	+		+	+	-	+	-	

Campanula trachelium	-	-	-	-	-	-	-	+	-	-	-	I
Carex pilosa	+	+	-	+	1	IV	2	1	-	-	-	II
Dactylis polygama	-	-	-	-	-	-	+	+	-	-	-	II
Galium schultesii	-	-	-	-	+	I	+	+	-	-	-	II
Glechoma hirsuta	+	+	+	-	+	IV	+	+	1	-	-	III
Scilla bifolia	+	+	-	+	+	IV	-	-	-	-	-	-
Stellaria holostea	+	+	-	+	-	III	1	+	+	-	-	III
Lathyro hallersteinii-Carpinion												
Crocus vernus	+	+	+	1	1	V	1	1	-	+	-	III
Ranunculus auricomus	+	-	+	+	+	IV	-	+	-	+	-	II
Aposeris foetida	-	-	+	+	+	III	+	+	-	-	-	II
Melampyrum bihariense	+	+	-	-	-	II	-	-	+	-	-	I
Tilio platyphyllae-Acerion pseudoplatani												
Acer platanoides	-	-	+	+	-	IV	-	-	+	-	-	III
Acer platanoides juv.	-	+	-	-	+		+	-	-	+	-	
Geranium robertianum	+	-	-	-	+	II	-	+	-	-	-	I
Symphyto-Fagion												
Campanula persicifolia	-	-	+	-	-	I	-	-	-	-	-	-
Symphytum cordatum	-	+	+	+	+	IV	-	-	-	-	-	-
Veronica officinalis	-	-	-	-	-	-	+	+	-	-	-	II
Fagetalia sylvaticae												
Anemone ranunculoides	+	+	+	-	+	IV	-	+	+	+	-	III
Allium ursinum	+	1	1	1	+	V	-	-	+	-	-	I
Asarum europaeum	2	1	+	-	-	III	+	1	-	+	-	III
Campanula rapunculoides	-	-	-	-	-	-	+	+	-	-	-	II
Carex sylvatica	-	-	-	-	+	I	-	-	+	-	-	I
Corydalis cava	-	-	-	-	-	-	+	-	+	+	-	III
Corydalis solida	+	+	+	+	-	IV	+	+	-	-	-	II
Euphorbia amygdaloides	-	+	-	-	+	II	+	+	-	-	-	II
Galanthus nivalis	+	+	+	+	+	V	+	+	-	-	-	II
Galium odoratum	+	-	+	+	-	III	+	+	-	1	1	IV
Isopyrum thalictroides	+	+	+	-	+	IV	-	+	-	-	-	I
Lamium galeobdolon ssp. galeobdolon	+	+	-	+	-	III	-	-	1	+	-	II
Lathyrus vernus	+	+	-	-	-	II	+	-	-	-	-	I
Mercurialis perennis	+	+	+	-	+	IV	+	+	-	-	-	II
Platanthera bifolia	-	+	-	+	-	II	-	-	-	-	-	-
Pulmonaria obscura	-	-	-	+	-	I	-	-	+	-	-	I
Pulmonaria officinalis	+	1	+	+	-	IV	-	1	+	-	-	II
Rubus hirtus ssp. hirtus	-	-	-	-	-	-	+	-	-	-	-	I
Salvia glutinosa	+	+	-	+	+	IV	-	-	+	-	1	II
Sanicula europaea	-	-	+	+	-	II	-	-	+	1	-	II
Scrophularia nodosa	-	-	-	-	-	-	-	-	+	-	-	I
Vicia sylvatica	-	+	-	-	-	I	-	-	-	-	-	-
Viola miriabilis	-	-	-	-	-	-	+	-	-	-	-	I
Alnion incanae et Alno-Fraxinetalia												
Alnus glutinosa	-	-	+	+	1	III	-	-	-	-	-	-
Fraxinus excelsior	+	-	1	-	1	IV	+	+	-	-	-	II
Fraxinus excelsior juv.	-	-	+	+	+		-	+	-	-	-	
Padus avium	-	+	+	+	-	III	-	-	-	-	-	-
Malus sylvestris	-	-	+	-	+	II	-	-	-	-	-	-
Pyrus pyraster		+	+	-	-	II	-	-	-	-	-	-
Ulmus minor	+	-	1	2	-	III	-	+	-	-	-	I
Viburnum opulus	+	+	+	-	+	IV	-	-	+	-	-	I
Sambucus nigra	-	-	+	-	+	II	-	-	-	+	+	II

Rubus caesius	+	+	+	-	-	III	-	-	-	-	-	-
Geranium phaeum	+	+	+	+	-	IV	-	+	-	-	-	I
Circaea lutetiana	-	-	-	+	+	II	+	-	-	-	+	II
Gagea lutea	+	-	+	+	-	III	-	-	-	-	-	-
Rumex sanguineus	-	+	-	-	-	I	-	-	-	-	-	-
Stachys sylvatica	+	+	+	-	-	III	-	-	-	-	+	I
Querco-Fagetea												
Acer campestre	1	2	1	+	1	V	+	-	+	-	-	V
Acer campestre juv.	-	-	-	+	-		-	+	+	+	+	
Ajuga reptans	-	-	+	-	-	I	-	-	+	-	+	II
Anemone nemorosa ssp. nemorosa	+	+	-	+	+	IV	+	+	-	-	-	II
Athyrium felix-femina	-	-	+	-	-	I	-	-	+	-	-	I
Brachypodium sylvaticum	1	1	+	+	2	V	-	-	+	-	-	I
Convallaria majalis	+	+	-	-	+	III	-	+	-	-	-	I
Evonymus europaeus	+	+	+	-	-	III	+	-	-	+	-	II
Geum urbanum	+	+	+	+	-	IV	-	+	+	-	-	II
Hepatica nobilis	+	-	+	+	-	III	+	-	-	+	-	II
Lathyrus niger	-	-	-	-	-	-	+	-	+	-	-	II
Lathyrus venetus	-	-	-	-	-	-	-	+	-	-	-	I
Mycelis muralis	-	-	-	-	+	I	+	-	+	-	+	III
Poa nemoralis	+	+	-	-	-	II	-	-	+	-	1	II
Polygonatum latifolium	+	1	+	+	-	IV	+	-	-	-	-	I
Ranunculus ficaria	1	+	+	+	+	V	-	-	-	-	-	-
Viola reichenbachiana	+	+	+	+	+	V	+	-	1	+	2	IV
Rhamno-Prunetea s.l.												
Cornus sanguinea	+	1	+	+	-	IV	+	+	+	1	1	V
Crataegus monogyna ssp. monogyna	+	+	+	-	-	III	-	-	-	+	2	II
Rosa canina	+	-	-	-	+	II	-	-	+	-	1	II
Viburnum lantana	-	-	-	-	+	I	-	+	+	+	-	III
Populus tremula	-	-	-	-	-	I	-	+	-	-	-	I
Populus tremula juv.	-	-	+	-	-		-	-	-	-	-	
Rubus idaeus	-	-	-	-	-	-	-	-	-	-	+	I
Galeopsis speciosa	-	-	-	+	-	I	-	-	+	-	-	I
Fragaria vesca	-	-	-	+	-	I	-	-	-	-	2	I
Urtica dioica ssp. dioica	+	+	+	+	-	IV	-	-	+	-	+	II
Trifolio-Geranietea s.l.												
Agrimonia eupatoria	-	+	-	-	-	I	-	-	-	-	-	-
Astragalus glycyphyllos	-	-	-	-	-	-	+	-	+	-	+	III
Clinopodium vulgare	-	-	-	-	-	-	-	-	+	-	1	II
Lapsana communis ssp. communis	-	+	-	-	-	I	+	-	-	-	-	I
Veronica chamaedrys ssp. chamaedrys	-	-	-	-	-	-	-	-	+	+	-	II
Vicia sepium	-	-	-	-	-	-	-	-	+	-	+	II
Galio-Urticetea s.l.												
Aegopodium podagraria	+	1	1	+	-	IV	+	+	-	-	-	II
Alliaria petiolata	+	+	+	-	-	III	-	+	-	-	-	I
Galium aparine	-	-	-	+	-	I	+	-	-	+	-	II
Rumex obtusifolius	+	-	-	-	+	II	-	-	-	-	-	-
Sambucus ebulus	+	-	-	-	-	I	-	-	-	-	-	-
Molinio-Arrhenatheretea s.l.												
Ranunculus repens	+	-	+	+	-	III	-	-	-	-	+	I
Equisetum telmateia	+	+	-	-	-	II	-	-	-	-	-	-
Stachys palustris	-	+	+	-	-	II	-	-	-	-	-	-
Taraxacum officinale	-	-	-	+	+	II	-	-	+	-	-	I
Geranium palustre	-	+	-	-	-	I	-	-	-	-	-	-

Geranium pratense	-	+	-	-	-	I	-	-	-	-	-	-
Lysimachia nummularia	+	-	-	-	-	I	-	-	-	-	+	I
Lythrum salicaria	-	+	-	-	-	I	-	-	-	-	-	-
Campanula patula	-	-	-	-	-	-	-	-	+	-	-	I
Prunella vulgaris	-	-	-	-	-	-	-	+	+	-	-	II
Variae syntaxa												
Acer tataricum juv.	+	-	-	-	-	I	-	-	-	-	-	-
Cornus mas	-	-	-	-	-	-	-	-	-	+	+	II
Robinia pseudoacacia juv.	-	-	-	-	-	-	-	-	-	-	+	I
Anthriscus sylvestris	-	+	-	-	-	I	-	-	+	-	+	II
Arctium lappa	-	-	-	-	-	-	-	-	-	-	+	I
Arctium tomentosum	-	-	-	-	-	-	-	-	+	-	-	I
Conium maculatum	-	+	-	-	+	II	-	-	-	-	-	-
Erigeron annuus	+	-	-	+	-	II	-	-	-	-	-	-
Galium mollugo	-	-	-	-	-	-	-	-	+	-	-	I
Malva sylvestris	-	+	-	-	-	I	-	-	-	-	-	-

Place and date of surveys: 1-3, 9, 10 – Călugăreni (26.07.2009), 4, 5 – Călugăreni (24.05.2008), 6-8 – Călugăreni (15.05.2007).

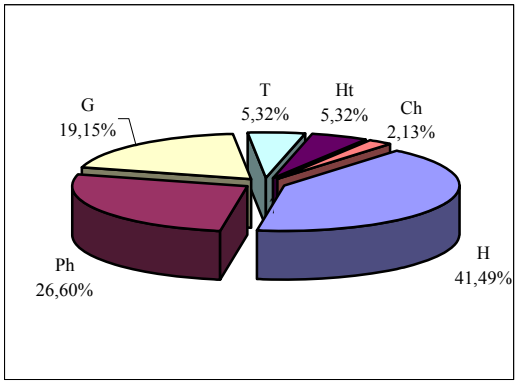

Figure 1 The spectre of the bioforms for the association Evonymo nanae-Carpinetum Seghedin et al. 1977

The phytocoenoses studied of the *Evonymo nanae-Carpinetum* Seghedin et al. 1977 association occupy significant surfaces the studied area, on flat land, with faesiom fluvic soil type, with high troficity, temporarily flooded. The spectre of bioforms is numerically dominated by the hemicryptophyte species (41,49%), followed by the phanerophyte species (26,60%). Geophyte species (19,15%) are represented by numerous vernal and estival species.

One can notice in the analysis of the distribution of the floristic elements (graph. 2) the dominance of the elements with a nothern character: the Euroasian elements (35,11%), the European elements (26,60%) and the Central-European elements (14,89%), resulting 76,60% of the total of species. Relatively well represented are the circumpolar elements (11,70%).

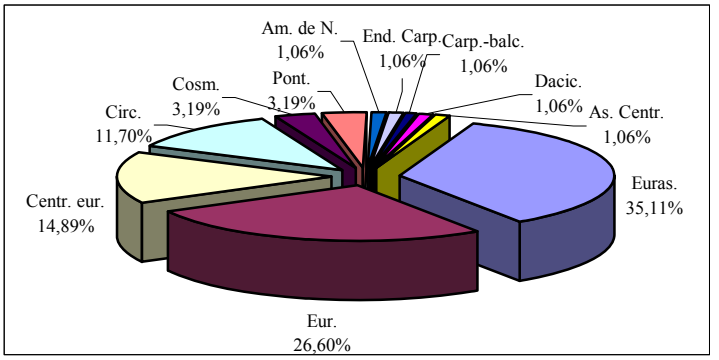

Figure 2 The spectre of the floristic elements for association Evonymo nanae-Carpinetum Seghedin et al. 1977

The analysis of the distribution of species according to the six ecological indices (H. Ellenberg 1974), emphasized general features of the spectre of the vegetal species from the surveys under study, as well as different ecological land corrological characteristics of the entire association, irrespective of the preferences of the species for different factors. The averages of the ecological indices express the ecological characteristics of the stations where the phytocoenoses under study develop. The average of the light index (L=5,19) indicates the presence of the intermediary category between the semiombrophile species and the sciaphile species. The greatest proportion of the mezothermic species and the eurithermic species is reflected by average of the temperature index (T=5,38).

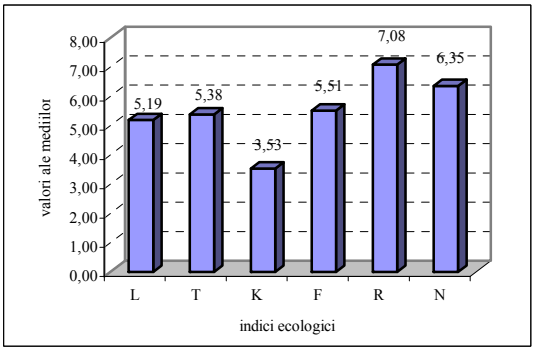

Figure 3 Values of the averages of the ecological indices for association Evonymo nanae-Carpinetum Seghedin et al. 1977

As far as the continentalism of the species is concerned (K), the greatest proportion belongs to the intermediary category between the species preferring the oceanic climate and those from suboceanic areas, as well as the species from areas with suboceanic climate. Regarding the moisture content (F), the greatest proportion belongs to the category of mezoxerophile species, this is reflected in the value of 5,51.

From the distribution of the species according to their reaction to the soil (R), we deduce that the majority is made up of neutrophile species, followed by

the euriacide species. Regarding the distribution of the species in relation to the amount of nitrogen avaible in the soil (N), the category of the nitrophile species has the greatest proportion, followed by the mezonitrophile species and the intermediary between the two.

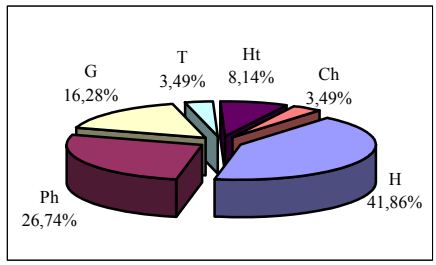

Figure 4 The spectre of the bioforms for the association Corylo avellanae-Carpinetum Chifu 1997

Corylo avellanae-Carpinetum Chifu 1997 - This association occupies land with low slope, with brown soils, sometimes slightly acidic, with mull humus type. The tree layer has a good coverage, consisting of edifying and dominant species *Quercus robur* and *Carpinus betulus*, with whom may occur *Tilia cordata, Fagus sylvatica, Cerasu avium, Fraxinus excelsior*.

The bioform spectrum is similar to the one of the previous association, emphasizing the high proportion of hemicryptophyte species (41,86%), followed by the phanerophyte species (26,76%) and geophyte species (16.28%).

And the spectre of the floristic elements is similar, the large proportion of Eurasian elements being outstanding (34,52%), followed by those of European elements (26,19%) and Central European elements (16,67%).

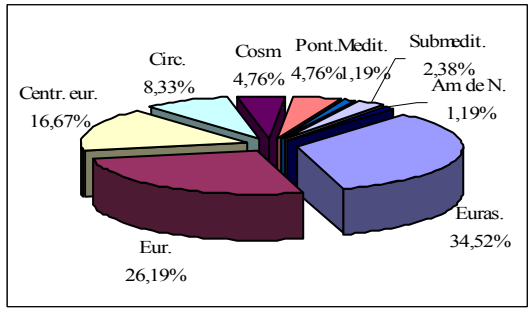

Figure 5 The spectre of the floristic elements for the association Corylo avellanae-Carpinetum Chifu 1997

The spectrum of ecological indices presents the average values of indices close to those of previous association, but slightly different.

The average light index is higher than that of the previous association (L=5,51), and it indicates the presence of the intermediary category betwen the semiombrophile species and the sciaphile species.

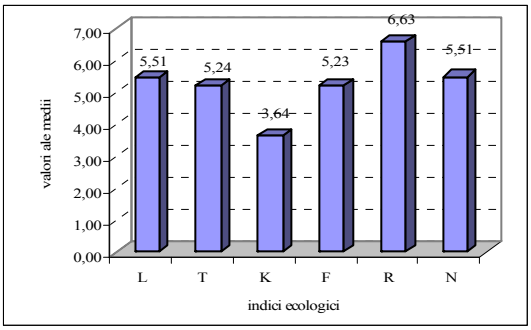

Figure 6 Values of the averages of the ecological indices for the association Corylo avellanae-Carpinetum Chifu 1997

Regarding the temperature index (T=5,24), this index is reflected in the same greatest proportion of the mezothermic species and the eurithermic species. The average of the moisture of soil indices is lower as compared to the previous association (5,23), fact reflected in the floristic composition. Regarding the distribution of the species in relation to their reaction to the soil, the majority is made up of neutrophile species, followed by the euriacide species, the average of whose index is less than that of the previous association (6,63). From the distribution of the species according to the amount of nitrogen avaible in the soil, we distinguish the presence of more mezonitrophile species (5,51).

4. Conclusions

Figure 7 General appearance of Evonymus nanus Bieb. in vernal period

The presence of *Euonymus nanus* Bieb. in this forest shows that even small bodies of forest may offer surprises about the biodiversity of cormoflora. This species is rare in Romania, but it seems to be much more widespread than it was believed to be. Given the status of the new location for this species in Romania, the forest must receive special protection status for the future.

The phytocoenoses of the two associations (E*vonymo nanae-Carpinetum* Seghedin et al. 1977 and *Corylo avellanae-Carpinetum* Chifu 1997) are similar to other phytocoenoses studied by various authors, in terms of ecological aspects, floristic compositions, bioform spectrum and coenotaxonomic characteristics (Chifu et al. 1996)

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Abstract

The presence and chorology of *Evonymus nanus* Bieb. in the Călugăreni Forest.

The research carried out in the Călugăreni forest between 2007 and 2009 brought to light the presence in this area of the species *Evonymus nanus* Bieb, represented by a vigorous population.

Evonymus nanus Bieb. has a fragmentary habitat, being extremely rare in Romania and Europe. The species is included on the red list and requires special protection. In the county of Suceava as well as in Romania on the whole, this species appears only insularly being scarce or represented by isolated individuals. In the specialised literature, the species has been signalled in 5 places in the county of Suceava so far. Phytocoenological research carried out in 1997 (Chifu) and

1977 (Seghedin at al.) undertook analysis of phytocoenoses belonging to the associations *Corylo avellanae-Carpinetum* and *Evonymo nanae-Carpinetum*. Due to its small size and the fact that the colour of the leafage very often resembles palanquin, the species is often difficult to notice, even when its presence is acknowledged in a certain area. As a result, research carried out in spring, in the prevernal period, is more often than not essential when it comes to detecting and studying the populations of this plant. The scientific value as well as the phytogeographical significance of this species asks for a better management of the forest of Călugăreni, even if we are dealing with a private property. The present paper presents a detailed analysis of the coenotic ambiance which hosts this species.

Keywords: *Evonymus nanus, Corylo avellanae-Carpinetum, Evonymo nanae-Carpinetum*, red list.

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