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FIRST REPORT OF OCCURRENCE OF SCRUB COMMUNITIES OF *PRUNO SPINOSAE-RUBION RADULAE* IN ROMANIA

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Abstract: We report, for the first time, the presence in Romania of scrub communities dominated by *Rubus praecox* and *R. radula*, which are assignable to the alliance *Pruno-Rubion radulae*. By comparing the identified phytoceonoses with those described in central Europe, we point out that the scrub communities from north-western Romania host a lower species richness and are characterised by a scarce number of (sub)oceanic species.

Key words: bioclimate, floristic composition, phytocoenological relevés, distribution range, *Rubus praecox*, *Rubus radula*, scrub, sub(oceanic) species

Introduction

Rubus (*Rosaceae*) is one the most diverse genera of flowering plants, with more than 800 species, present in all continents, except Antarctica [10]. In Europe, 763 species of *Rubus* are recognized [11]. This genus has a complex evolutionary history shaped by hybridization, polyploidy and apomictic processes [5, 10, 11, 28, 31, 32, 33, 34, 35]. As a consequence, the species ascribed to this genus display a tremendous morphological variability, which has led to more than 15000 taxa being described [23]. This has posed a lot of trouble to traditional taxonomy [37] and has been a major drawback for the study of scrub dominated by different *Rubus* species (brambles, blackberries).

In his monographic works on the scrub vegetation in Germany [36, 39], pointed out the pronounced diversity of scrublands dominated by different species of *Rubus* and clarified the nomenclature, syntaxonomy and synecology of the alliance *Pruno spinosae-Rubion radulae* Weber 1974. To date, this syntaxon includes bramble scrub on neutral and base-rich soils of western and central Europe [14]. Phytocoenoses assignable to *Pruno-Rubion radulae* were reported in Germany [2, 21, 36, 38], France [25], Spain and Portugal [24], Austria [40], Slovenia [29] and Croatia [30]. According to Preislerová et al (2022) [22], the scrub communities of *Pruno-Rubion radulae* are distributed only in the central-western part of the European continent, being absent from its eastern part.

Rubus praecox Bertol. (syn. *R. procerus* P. J. Müll ex Boulay; *R. discolor* Wheihe & Nees) belongs to the subgen. *Rubus*, series *Discolores* (P. J. Müll.) Focke with stems high-arching, prickles uniform, without stalked glands, leaves and sepals grey-white felted beneath [9, 41]. The

species distribution range covers the south, west and central part of Europe, including Romania [9, 41].

Rubus radula Weihe ex Boenn belongs to the same subgenus, series *Radulae* Focke, with stems low- to high-arching with large, more or less uniform prickles and numerous stalked glands, with intermediates between them, absent or few. The leaves are usually greyish, stellate-hairy beneath [9, 41]. The distribution range encompasses most of the European continent, including Romania [9, 41].

Both species are considered to be quite frequent in the Romanian Flora [20, 27]. Although both were frequently reported as present in different regions of Romania [1, 7, 15, 17, 20, 26], phytocoenological data including the occurrence of these species have been rarely published [6, 12].

In Romania, due to the difficult determination of *Rubus* species, scrub dominated by different brambles and blackberry species has been neglected in vegetation surveys, with only one exception [12]. Therefore, our main objectives were to: a) report the presence, geographical location and habitat conditions of *Rubus*-dominated scrub ascribable to the alliance *Pruno-Rubion radulae* in north-western Romania; b) describe and compare the species compositions (floristic structure) of these scrub with their counterparts from western-central Europe.

Material and Methods

We surveyed areas from the north-western part of Romania (Sălaj and Maramureș counties) in the search for scrub communities dominated by different blackberry species. The determination of *Rubus* species was carried out based on *Flora Europaea* [9]. With the exception of *Rubus caesius*, for all the other recorded *Rubus* species, voucher specimens were collected and deposited at the *CL Herbarium* (Cluj-Napoca)[46]. Relevés were carried out according to Braun-Blaquet's approach (1964)[4]. The taxonomic nomenclature, used for the species recorded in the phytosociological table (Table 1), follows *Flora Europaea* (https://ww2.bgbm.org/EuroPlusMed/query.asp. 2025) [44].

The species indicator values for continentality (*K*) were retrieved from Ellenberg (1992)[8] and Borhidi (1995)[3]. The relative proportion of (sub)oceanic species ($K<4$) at relevé level was calculated based on species number. To characterise the main bioclimatic features of the studied area, the following bioclimatic indicators were used [16]: annual precipitation (derived by averaging, along the whole period, the annual sum of daily precipitation amounts in millimeters), precipitation seasonality (expressed in %, as the ratio between the standard deviation and the mean of 12 values representing the monthly average precipitation within the considered period), temperature seasonality (expressed in °C as the standard deviation of the daily mean temperature calculated across among the 12 months) and modified Kira warmth index (expressed in °C as the monthly average temperature for those months with a long-term average of daily temperature higher than 5°C). All these indicators were retrieved as multiannual means corresponding to the interval 1960–1999 at 0.5° by 0.5° spatial resolution [16].

QGIS v3.28 software [https://docs.qgis.org][45] was used for mapping the location of the relevés and the class of bioclimatic indices within each 0.5° grid cell.

Results and Discussion

Our investigations have led to the identification, for the first time in Romania, of scrub dominated by *Rubus praecox* and *R. radula* (Table 1, Fig. 1). We highlight, for the first time, the floristic structure of this bramble scrub at the eastern limit of their distribution range (Table 1). Taking into account the coverage and phytocoenotic affinities of the recorded species [18, 36] we assigned these phytocoenoses to the association *Pruno-Rubetum praecocis* Weber 1986. These secondary phytocoenoses have developed within the pedoclimatic niches of the former primary forest vegetation, that is the regional syntaxa *Melampyro bihariense-Carpinetum* (Borza 1941) Soó 1964 and *Carpino-Fagetum* Paucă 1941.

Table 1: Analytic phytosociological table including eight relevés of *Pruno – Rubetum praecocis* Weber 1986 recorded in north-western Romania (*K* – species indicator value for continentality; *F* – species frequency).

Relevé ID	***K***	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	***F* (%)**
Altitude (m a.s.l.)		340	250	380	160	530	470	210	200	
Terrain aspect		-	-	N	-	-	V	-	-	
Area (m^2)		200	200	200	200	100	200	100	150	
Diagnostic for association										
Rubus praecox	2	3	4	4	5	3	3	1	4	100
Clematis vitalba	3	+	1	1	1	1	1			75
Pruno-Rubion radulae										
Rubus radula	2			+			1	5	1	50
Rubus caesius	3	1	1			2	1			50
Pteridium aquilinum	x						+			12.5
Prunetalia et Crataego-Prunetea										
Rosa canina	3	2		2	1	1	2	1	1	87.5
Carex divulsa subsp. *leersii*	3	+	+	+		1			+	62.5
Humulus lupulus	3		1		+	1	+		2	62.5
Agrimonia eupatoria	4	+	+	1			+		+	62.5
Cornus sanguinea	4	+	+	+	+			+		62.5
Pyrus communis subsp. *pyraster*	5	+		+						25
Prunus spinosa	5	+		+			2			37.5
Crataegus monogyna	3			+						12.5
Companions										
Carex hirta	3	1	1	1		1			+	62.5

Galium aparine	3	+	+	1	+				+	62.5
Galium mollugo	3	+	+	1		+	+		+	75
Dactylis glomerata	3	+	+	1		+			+	62.5
Urtica dioica	x		+	+	+	1			+	62.5
Cirsium arvense	x	+		+			+	+	+	62.5
Erigeron annuus	x	+		+		+	+		+	62.5
Arrhenatherum elatius	3				+	+	+		+	50
Poa pratensis	x	1	+	+					+	50
Robinia pseudacacia (juv.)	4		+	+	+	+				50
Achillea millefolium	x	+		+		1			+	50
Artemisia vulgaris	x					+	+	+	+	50
Reynoutria japonica	2		+	+	+					37.5
Dipsacus fullonum	3	+				+			+	37.5
Elymus caninus	3			+					+	25
Potentilla reptans	3	1		+					+	37.5
Torilis arvensis	3	+		+					+	37.5
Geranium dissectum	3	+			+					25
Holcus lanatus	3		+			+				25
Rumex crispus	3	+		+					+	37.5
Dipsacus laciniatus	x		+	+		+				37.5
Mentha longifolia	4	+		+						25
Convolvulus arvensis	x	+		+					+	37.5
Silene latifolia subsp. *alba*	x			+	+					25
Filipendula vulgaris	5	1		+						25
Frangula alnus	5						+	+		25
Daucus carota	5	+							+	25
Pastinaca sativa	5			+		+	+			37.5
Geum urbanum	5			+			+			25
Hypericum perforatum	5					+	+			25
Picris hiracioides	5					+	+			25
Trisetum flavescens	5	+		+						25
Vicia tetrasperma	5		+		+		+			37.5
Vicia sepium	5	+		+						25
Equisetum arvense	x		+	+			+			37.5
Lathyrus tuberosus	6		+		+	+				37.5
Calamagrostis epigejos	7					+			+	25

Plantago altissima	7	+							+	25
Lactuca serriola	7		+				+			25
Agrostis capillaris	3	+								12.5
Bromus hordeaceus	3	+								12.5
Ranunculus acris	3	+								12.5
Myosoton aquaticum	3		+							12.5
Lotus corniculatus	3			+						12.5
Sambucus ebulus	3			+						12.5
Glechoma hederacea	3			+						12.5
Echium vulgare	3			+						12.5
Scrophularia nodosa	3						+			12.5
Leucanthemum vulgare	3						+			12.5
Eupatorium cannabinum	3							+		12.5
Cirsium vulgare	3								+	12.5
Verbena officinalis	3							+		12.5
Lolium multiflorum	3							+		12.5
Fallopia convolvulus	x			+						12.5
Potentilla anserina	x					+				12.5
Anisantha sterilis	4	+								12.5
Dianthus carthusianorum	4	+								12.5
Bromus arvensis	4		+							12.5
Galium verum	x	+								12.5
Festuca arundinacea	x	+								12.5
Jacobea vulgaris	x			+						12.5
Capsella bursa-pastoris	x							+		12.5
Lathyrus pratensis	x								+	12.5
Vicia cracca	x					+				12.5
Allium scorodoprasum	5	+								12.5
Alopecurus pratensis	5				+					12.5
Ballota nigra	5			+						12.5
Calystegia sepium	5				+					12.5
Cruciata laevipes	5			+						12.5
Fragaria vesca	5	+								12.5
Equisetum hyemale	5		+							12.5
Lythrum salicaria	5								+	12.5
Ranunculus polyanthemos	5			+						12.5
Vicia hirsuta	5		+							12.5

Agrostis stolonifera	x		+							12.5
Rumex patientia	x				+					12.5
Melilotus officinalis	6					+				12.5
Euphorbia salicifolia	x	+								12.5
Arctium tomentosum	7			+						12.5
Elytrigia repens	7							+		12.5
Festuca rupicola	7	+								12.5
Medicago falcata	7	+								12.5
Bromus squarrosus	x			+						12.5
Centaurea phrygia	x			+						12.5
Amorpha fruticosa	x								1	12.5

Localities of relevés: 1 - Perii Vadului; **2** - Buciumi; **3** - Mesteacăn; **4** – Cicârlău; **5** - Bocicoel; 6 - Văleni; **7-8** - Baia Mare.

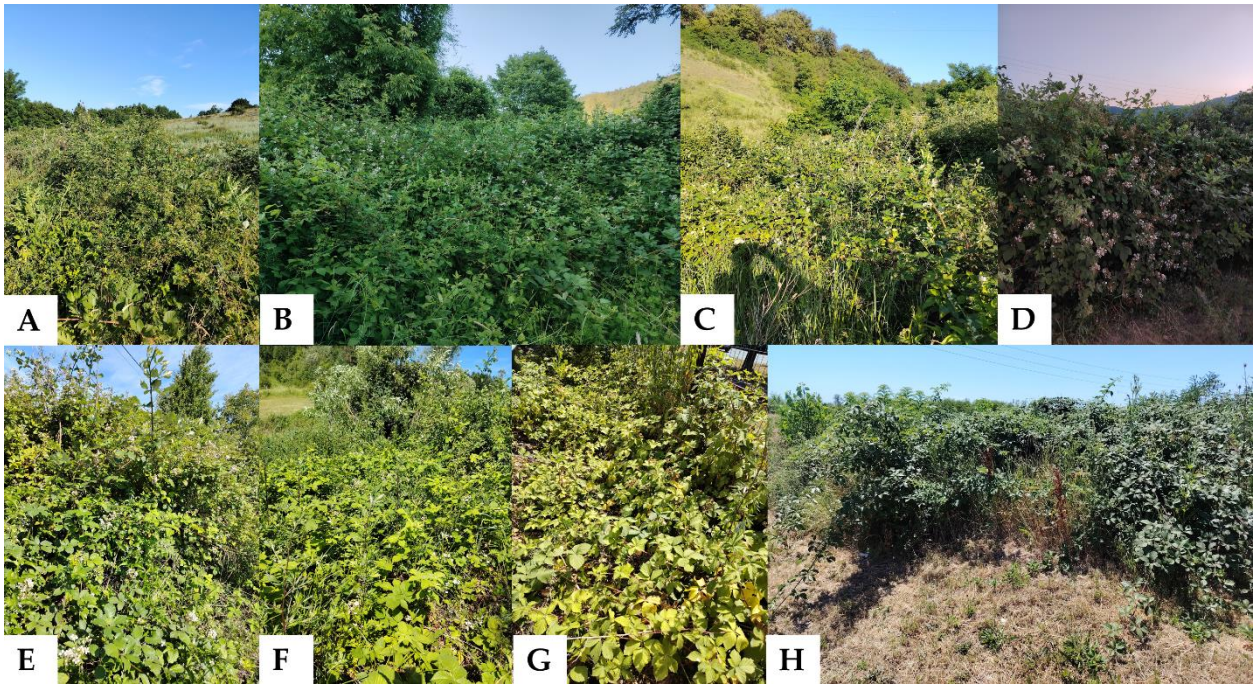

Fig. 1: Physiognomy of scrub dominated by *Rubus praecox* and *Rubus radula.* Localities: A – Perii Vadului, **B** – Buciumi, **C** – Mesteacăm, **D** – Cicârlău, **E** – Văleni, **F** – Bocicoel, **G** and **H** – Baia Mare.

Compared with similar phytocoenoses described in Germany [36, 39], those found in north-western Romania display lower species richness and, especially, a lack of Atlantic and nemoral species. The absence of the oceanic species *Lonicera periclymenum* and *Ilex aquifolium* from this scrub occurring in Romania is due to the more continental climate, with only slight sub-Atlantic influences in the north-western part of the country (Fig. 2). The lack of nemoral species, such as *Lonicera xylosteum*, *Arum maculatum*, *Poa nemoralis*, *Lamium galeobdolon*, *Coryllus avelana*, *Carpinus betulus*, *Hedera helix* and *Viola reichenbachiana*, can be explained

by the massive successive deforestations that have occurred in the region over the last two centuries. Some meso-xerophilous species, like *Picris hieracioides*, *Filipendula vulgaris*, *Festuca rupicola*, *Dianthus carthusianorum*, *Allium scorodoprasum*, *Medicago falcata*, are also present in the floristic composition of this bramble scrub. Their presence may be related to the calcareous substrate and the warmer summers, as compared with western-central Europe.

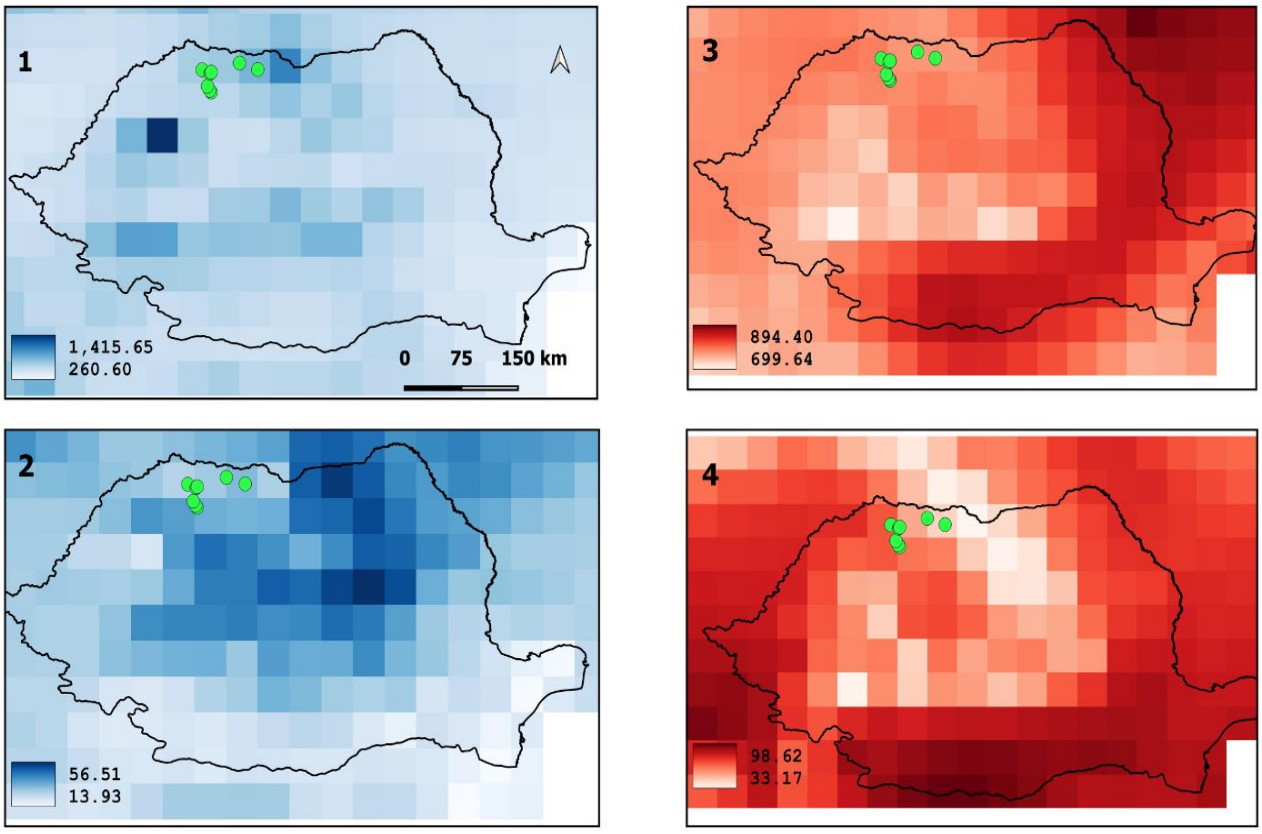

Fig. 2: Geographical variation of some bioclimatic indicators by value class across 0.5 degree-grid cells and, distribution of the studied scrub (green dots) in north-western Romania: 1 – annual sum of daily precipitation amounts (mm), **2** – precipitation seasonality, **3** – temperature seasonality, **4** - modified Kira warmth index.

Both bramble species, *R. radula* and *R. praecox*, are considered oceanic species [3, 8]. Also, the phytocoenoses assigned to the alliance *Pruno-Rubion radulae* have been considered oceanic/sub-oceanic communities [36, 39], with natural distribution ranges confined to western and central Europe, and so absent from eastern Europe [14, 22] (Fig. 3). In the north-western part of Romania the bioclimate is characterised by slight sub-Atlantic influences and by lower values of precipitation and temperature seasonality compared with the eastern part of the country (Fig. 2). Also, the studied region is characterised by slightly higher values of annual precipitation and modified Kira warmth index (Fig. 2). About 60% of the total number of plant taxa recorded in the scrub communities investigated are oceanic or sub-oceanic species. Moreover, the oceanic and suboceanic species are more frequent (13 %) compared with the subcontinental and continental species (3-5 %).

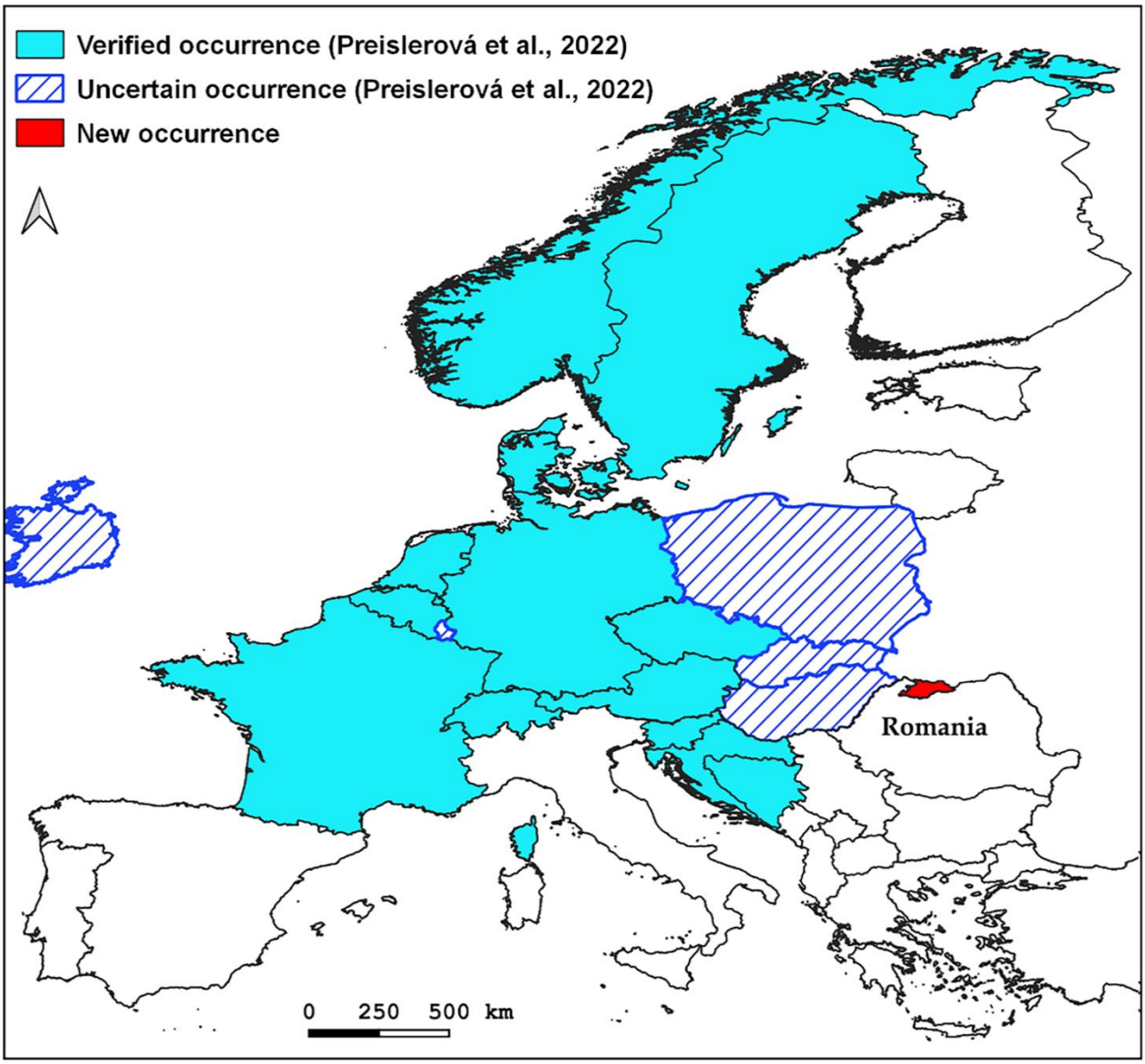

Fig. 3: Updated natural distribution range of *Pruno spinosae-Rubion radulae* scrub throughout Europe.

Conclusions

We here report, for the first time, the presence in Romania of scrub communities dominated by *Rubus radula* and *R. praecox*, which are assignable to the alliance *Pruno-Rubion radulae*, according to the latest European coenotaxonomic system, as follows:

Class *Crataego-Prunetea* Tx. 1962

Ord. *Prunetalia* Tx. 1952

All. *Pruno spinosae-Rubion radulae* Weber 1974

Ass. *Pruno-Rubetum praecocis* Weber 1986.

In conclusion, we consider that the occurrence of these sub-oceanic scrub communities in north-western Romania can be explained by the bioclimatic particularities of the region. Being

present at the eastern limit of their natural distribution range, where the bioclimate is more continental, these bramble scrub communities host a lower number of species and are characterised by the scarcity of other (sub)oceanic species.

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PRIMA MENȚIONARE A TUFĂRIȘURILOR APARȚINÂND ALIANȚEI *PRUNO-RUBION RADULAE* ÎN ROMÂNIA

(**Rezumat**)

Datorită istoriei evolutive complexe a genului *Rubus* (hibridare, poliploidie și apomixie) speciile acestui gen manifestă o variabilitate morfologică foarte pronunțată. Aceasta a constituit un impediment în studiile fitocenotice ale tufărișurilor edificate de diverse specii de *Rubus*.

Pe baza cerectărilor proprii, efectuate în regiunea nord-vestică a țării, evidențiem pentru prima dată prezența în România a comunităților edificate de *Rubus praecox* Bertol. și *Rubus radula* Weihe ex Boenn. De asemenea, este detaliată structura floristică a fitocenozelor investigate.

În comparație cu cele descrise în Germania, putem afirma că fitocenozele din România prezintă o bogăție specifică mai redusă și sunt mai sărace în specii (sub)oceanice, deoarece aceste tufărișuri se dezvoltă la extremitatea estică a arealului natural al sintaxonului *Pruno-Rubion radulae*. Bioclimatul din regiunea nord-vestică a României, care este caracterizat prin influențe subatlantice mai pronunțate comparativ cu alte regiuni ale țării, explică prezența acestor tufărișurilor (sub)-atlantice în vegetația României.

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