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FAUNISTIC STUDY ON SOME TERRESTRIAL INVERTEBRATES WITH CONSERVATIVE VALUE FROM COMMUNITY GALBENA AND VEMEŞOAIA, FĂGĂRAŞ MOUNTAINS - ROMANIA

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Abstract

In 2020, a faunistic study on invertebrate fauna from Galbena and Vemeşoaia Community and its adjacent area, from Făgăraş Mountains was accomplished. Galbena and Vemeşoaia Community are spreading on 893 hectares (which represents 0.15% from the Făgăraş Mountains). Even if this property is spread over a small area, five Natura 2000 invertebrates were identified: Rosalia alpina (Linnaeus, 1758); Carabus (Hydrocarabus) variolosus Fabricius, 1787; Pholidoptera transsylvanica (Fischer,1853); Lycaena dispar (Haworth, 1802); Callimorpha (Euplagia) quadripunctata (Poda, 1761), protected under the Habitats Directive 92/43 / EEC. Another endemic species for Romania was identified: Carabus (Megodontus) planicollis Küster, 1827. The numerical abundance of each species was recorded and their areas of distribution were established. In the same time the species threats and pressures were evaluated. The main conservation measures were defined. The present study wants to highlight that even small unstudied area could represents an important conservation point for invertebrate fauna directly and indirectly on their habitats. -

Key words*: conservation, distribution, invertebrates, habitat, pressure, threats.*

INTRODUCTION

In Romanian legislation, community ("obşte") is a form of human organization, whose origin goes back to the beginning of the medieval era. According to this organization, forests and pastures are indivisible property of the entire community. Another characteristic of this form of property is the forbidding of selling to the foreign person, being inherited only by legal successors, from one generation to the next. But this form of property protection is good or not, in terms of Natura 2000 species conservation? The Galbena and Vemeşoaia Community are situated in the South-West part of Făgăraş Mountains, part of ROSCI0122 Făgăraş Mountains. This means that this community is included in European ecological network Natura 2000 (a functional network of protected sites and define appropriate management measures to ensure the restoration or maintenance of species and habitats at a favorable conservation status) (Habitat Directive, 92/43/EEC, 1992; Romanian Official Monitor 2007; 2011). According to the Natura 2000 policy, a selection of some invertebrates' species of community interest was made. In this selection, the following species were included: *Rosalia alpina* (Linnaeus, 1758); *Carabus* (*Hydrocarabus*) *variolosus* Fabricius, 1787; *Pholidoptera transsylvanica* (Fischer, 1853)*; Lycaena dispar* (Haworth, 1802); *Callimorpha* (*Euplagia*) *quadripunctata* (Poda, 1761). We also considered *Carabus* (*Megodontus*) *planicollis* Küster, 1827, an endemic species for Romania (especially Southern Carpathians) (Barloy & Prunar, 2012).

According to management plan of ROSCI0122 Făgăraş Mountains with an area of 198620.5 ha, represents one of the largest sites of community importance at the national level, being located in the central part of Romania, in the administrative area of 4 counties: Sibiu, Braşov, Vâlcea and Argeş. It was designated for the conservation of 27 habitats of interest community (of which 5 are priority) and for 13 invertebrate species (Management Plan of

ROSCI0122 Făgăraș Mountains, 2016). From all invertebrate species with conservative value, four are similar with those signaled in Galbena and Vemeşoaia Community and its adjacent area: *Rosalia alpina, Pholidoptera transsylvanica, Lycaena dispar* and *Callimorpha* (*Euplagia*) *quadripunctata*.

European studies discovered that different management strategies could influence the effectiveness of Natura 2000 network (Rouveyrol & Prima, 2024). Romania shares many conservation concerns with other Eastern and Central European countries. Over 80% of the species of European conservation concern were included in at least one protected area, but plants and invertebrates were underrepresented (Iojă et al., 2010). Cazzolla Gatti et al., 2023 declared that in Romania, the Steppic and the Continental biogeographic regions offer very limited protection to biodiversity and rare species.

If we consider only saproxylic beetles (as: *Rosalia alpina*), the current Natura 2000 network from Romania covers only a small part of their distributions (Mirea et al., 2024). Selective logging and removal of deadwood and old-growth trees, that degraded the forest structure, were frequent negative practices in the Carpathians few decades ago, which lead to a decreasing of abundance of the protected species. In the past, Romanian forest managers oftenly considered them as pest species and applying eradication methods to lower their populations. More actually, these saproxylic beetles are protected, as threatened and endangered species per the EU environmental mandates (Mirea et al., 2024). As a result, forest managers have neither the incentives nor technical information on the saproxylic beetle community to promote concrete conservation actions. Thus, the most important tool in protecting these species was the inclusion of their habitats in the Natura 2000 network (Mirea et al., 2024).

In Romania, the national distributions of those six invertebrates, which constitute the subject of this research were described, from a local level to the national level (Barloy & Prunar, 2012; Iorgu et al., 2015; Lotrean & Manu, 2015; Manu et al., 2014; 2016; 2017; Bărbuceanu, 2017; Iorgu, 2021; Nitzu, 2021, Rákósy & Goia, 2021; Bărbuceanu & Truţă, 2021). In the same time, we identified other studies that revealed their conservation status at national level (Mihăilescu et al., 2015; Iorgu, 2021; Nitzu, 2021; Rákósy, 2021).

The current surface of strictly protected areas from all European countries is unbalanced across biogeographical regions. It does not comply with the 10% target of strict protection, according to the EU 2030 Biodiversity Strategy. In the present only 3% of land is under strict protection. This means that a significant amount of work needs to be done to achieve these conservation goals, considering all geographic and ecological conditions (Cazzolla Gatti et al., 2023).

In this context, any new and original information on the distribution, threats, pressures and conservation measures of invertebrates with conservative value are valuable for protected areas management.

MATERIALS AND METHODS

The study was accomplished in July-August 2020, in Galbena and Vemeşoia Community (GVO), located at South-West of Făgăraș Mountains (Galbena Mountain- N: 45°32'47.5"; E: 024°27'14.0" and Vemeşoaia Mountain- N: 45°32'47.3"; E: 024°26'28.6" E) and its adjacent area (Figure 1). This community is located in Vâlcea County, Romania, on an area of 393 hectares, which represent 0.15% of the Făgăraș Mountains surface. From this area, 328.6 hectares represent the forest ecosystems and the rest are grasslands and riparian zones (Prosilva Geotop SRL., 2015; Manu et al., 2024).

For the inventory of invertebrates' fauna, three methods were used in the field:

- Transect method, using visual searching for adults along transects. Considering the habitat topography, the length of transect was between 100 and 500 m; the width between 10 and 20 m. Transects were carried out in a zigzag pattern to cover all researched areas as best as possible. In the case of small habitats, transects can be shorter and if the species has a very low density, they can be longer. The fauna collection was done by hand or with tweezers, directly on the substrate: soil, rocks, logs, herbaceous vegetation, shrubs and bark of trees. For saproxylic Coleoptera species, in

areas with dead wood (fallen or standing trees, wood stacks), there were investigated the adequate micro-refuges, through removing the bark on the trunks of dry trees and on logs. This method was used for: Orthoptera and Coleoptera species (Iorgu et al., 2015; Lotrean & Manu, 2015; Campanaro et al., 2017).

- Transect method - collection with the entomological net. Transects were established with length by 100 m and the width by 1-1.5 m. This method was used for: Orthoptera, Coleoptera and Lepidoptera species (van Chris et al., 2012; Iorgu et al., 2015; Campanaro et al., 2017).
- Pitfall traps (five traps in each location). Method was used for Coleoptera species (Iorgu et al., 2015; Campanaro et al., 2017).

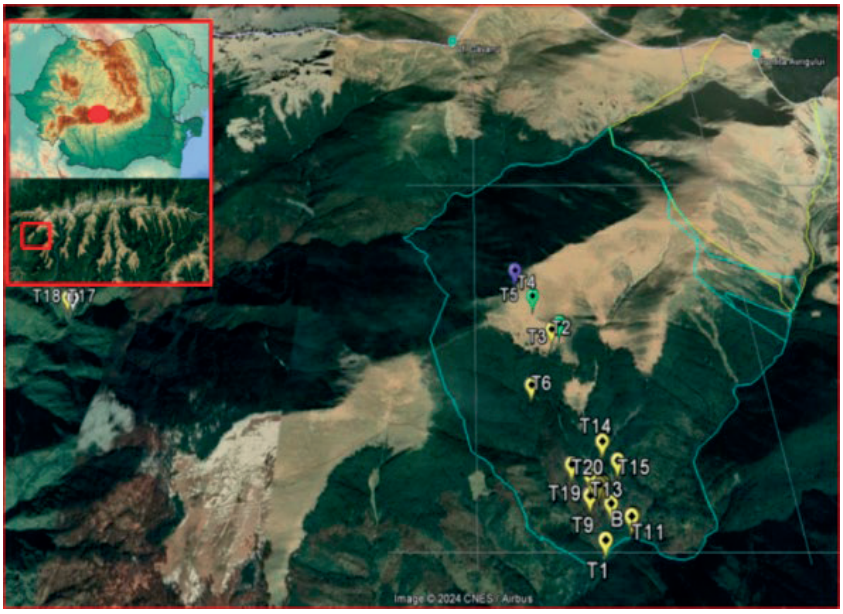

Figure 1. The geographical location of the Galbena and Vemeşoaia Community (blue line), South-West Făgăraş Mountains - Romania (original)

In total twenty two transects were established and two locations with pitfall traps. Transects from Vemeşoaia Mountain recorded an East exposures (Figure 1; Table 1). For taxonomical identification of species, we used an actual key (Panin, 1955; Knechtel & Popovici, 1959; Panin & Săvulescu, 1961; Tolman & Lewington, 2009). Habitats classification was made after Doniţă et al., 2005.

For each protected species, threats and pressures were evaluated (in degree of intensity), using the actual legislation codification: high (for the impacts that have a significantly high negative impact, in the investigated habitat were the species were identified), medium (for the impacts that have a significantly medium negative impact) and low (for the impacts that have a significantly low negative impact) (Habitat Directive, 92/43/EEC, 1992; Romanian Official Monitor, 2018; 2023). In order to differentiate the pressure from threat, we used "the standard lexicon for biodiversity conservation: unified classifications of threats and actions" (Salafsky et al., 2008). According to this lexicon, pressures (stresses) are currently acting and threats are expected in near future. Stresses are attributes of a conservation target's ecology that are impaired directly or indirectly by human activities. Threats can be past (historical), ongoing, and/or likely to occur in the future. Natural phenomena are also regarded as direct threats in some situations.

Table 1. The location of investigated transects and pitfall traps in Galbena and Vemeşoaia Community and its adjacent area from Făgăraş Mountain

Toponym	Habitat Natura 2000	Transect	Altitude
Boia Mare Valley	6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels + 91V0 Dacian Beech forests (*Symphyto-Fagion*)	T1, T11	1033-1066
	6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	T7, T8	1047-1069
Boia Mică Valley	6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels + 91V0 Dacian Beech forests (*Symphyto-Fagion*)	T17	812
	6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	T18	798
Vemeşoaia Mountain	4060 Siliceous alpine and boreal grasslands	T2, T3, T4, T5	1772-2007
	9410 Acidophilous Picea forests of the montane to alpine levels (*Vaccinio-Piceetea*)	T6	1502
	91V0 Dacian Beech forests (*Symphyto-Fagion*)	T9, T10, T12	1201-1235
	9410 Acidophilous Picea forests of the montane to alpine levels (*Vaccinio-Piceetea*) - forest edge	T13, T14	1273-1387
	91V0 Dacian Beech forests (*Symphyto-Fagion*) - forest edge	T15, T16, T19, T20	1109-1138
Vemeşoaia Mountain	91V0 Dacian Beech forests (*Symphyto-Fagion*)	Pitfall traps	1226
	9410 Acidophilous Picea forests of the montane to alpine levels (*Vaccinio-Piceetea*)	Pitfall traps	1150
Sterminoasa Valley	91V0 Dacian Beech forests (*Symphyto-Fagion*) + 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	T21	989
Galbena Mountain	6230* Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and sub-mountain areas, in Continental Europe)	T22	1751

RESULTS AND DISCUSSIONS

In Galbena and Vemeşoaia Community (GVO) and on its adjacent area, six species with conservative value were identified (five Natura 2000 species and one endemic). From taxonomical point of view, they were grouped as following: Coleoptera order (*Rosalia alpina, Carabus variolosus, Carabus planicollis*), Lepidoptera order (*Lycaena dispar, Callimoprha quadripunctaria*) and Orthoptera order (*Pholidoptera transsylvanica*) (Figure 2). These species are legaly protected and their conservation status were described at international, national and regional level) (Habitat Directive, 92/43/EEC, 1992; Romanian Official Monitor 2007, 2011; Management Plan of ROSCI0122 Făgăraş Mountains and ROSPA0098 Piemontul Făgăraş, 2016; Murariu & Maican, 2021; IUCN, 2024).

From 22 investigated transects, 13 of them contain favorable Natura 2000 habitats for these invertebrates, as: 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels; 91V0 Dacian Beech forests (*Symphyto-Fagion*); 9410 – Acidophilous Picea forests of the montane to alpine levels (*Vaccinio-Piceetea*); 4060 – Siliceous alpine and boreal grasslands., 6230* – Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and sub-mountain areas, in Continental Europe) (Figures 2, 3).

According to Doniţă et al., 2005, habitat 91V0 Dacian Beech forests (*Symphyto-Fagion*) is growing on slopes with medium inclinations and different aspects, plateaus, summits. The bedrock is mainly flish, conglomerates and crystalline schist. The soils are eutricambosol, luvosol from middle-deep to deep and weakly skeletal, moderate poorly acid, humid. The trees layer covers 90-100% and is formed by spruce (*Picea abies*), beech (*Fagus sylvatica*), fir (*Abies alba*), mixed with individuals of sycamore maple (*Acer pseudoplatanus*), elm (*Ulmus glabra*). The shrubs layer is underdeveloped, with rare individuals of *Sambucus racemosa, Daphne mezereum, Rosa* sp. The herbaceous layer varies according with the light touching the ground: *Dentaria*

glandulosa, Galium odoratum, Rubus hirtus, Calamagrostis arundinacea, Luzula luzuloides, etc.

Habitat 9410 – Acidophilous Picea forests of the montane to alpine levels (*Vaccinio-Piceetea*) is growing on very steep slopes with different aspects, peaks, ridges. The bedrock is siliceous and calcareous. The soils are prepodzol, podzol, cryptopodzole, andosol, superficial-middle deep, very acidic, oligobasic, humid. At lower altitude, the trees layer may have 100% coverage, being formed exclusively by spruce (*Picea abies*), or comprising a few individuals of mountain ash (*Sorbus aucuparia*). In the alpine areas, the tree layer covers 60-80%, being formed by 100 years old and 15-20 m height bushes of stone pine (*Pinus mugo*) sau juniper (*Juniperus communis*). The shurbs layer is not present or is underdeveloped: *Sorbus aucuparia, Lonicera nigra, Rubus idaeus*, etc. The herbaceous and undergrowth layer is dominated by *Oxalis acetosella* and *Vaccinium* sp. (Doniţă et al., 2005).

Siliceous alpine and boreal grasslands- 4060 develops on windy areas, slopes and cliffs with N and NE aspects and medium-large inclinations. The bedrock is silica, but also conglomerates with limestones. The soils are superficial, skeletal, lithosol, rankers and cryptopodzoles, humosiosols (under phytocenoses installed secondary), with soil reaction from strong acid to acid (pH = 4.7-5.0). The subshrubs (undergrowth) layer has 20-40 cm height, 80-100% coverage and is dominated by *Rhododendron myrtifolium* (*Rh. kotschy*), *Vaccinium myrtillus, Vaccinium vitis-idaea, Vaccinium gaultherioides*. The herbaceous layer is not distinct. It is intertwined with that of the subshrubs with the following dominant species: *Agrostis capillaris, Festuca rubra, Nardus stricta, Anthoxanthum odoratum, Luzula luzuloides, Potentilla ternata, Homogyne alpina, Loiseleuria procumbens, Geum montanum* (Doniţă et al., 2005).

Habitat 6230* – Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and sub-mountain areas, in Continental Europe) is developed on plateaus, slopes, valleys and peaks with gently to moderate slopes, with acidic substrate. Soils are short-profile, spodisoles poor in bases (5-10%), weak aerated and acidic (pH = 3.6-4.5). The trees layer is very scattered, in the grasslands being present sub-shrubs as: *Vaccinium myrtillus, Vaccinium vitis-idaea*. The herbaceous layer is formed by: *Viola declinata, Nardus stricta* (sometimes covering 95% only itself, with a very small number of neighboring species), *Festuca nigrescens*, etc. (Doniţă et al., 2005).

Habitat 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine level is vegetating on steep valleys, shaded gutters and chimneys, sometimes at the edge of the streams. The bedrock is variable. The soil is wet colluvial, rich in fixed gravel and boulder. The arbustive layer is scarce: *Alnus viridis, Salix silesiaca.* The herbaceous layer is dominant, most frequent being *Doronicum austriacum*; there are also present: *Heracleum carpaticum, Heracleum sphondylium, Petasites* sp., *Poa delyii, Phyteuma vagneri, Achillea distans, etc.* (Doniţă et al., 2005).

The Coleoptera species *Rosalia alpina* (Linnaeus, 1758) is protected at national and European level (Romanian Official Monitor, 2007 - annexes III, IVa; Habitat Directive, 92/43/EEC - annexes IIa, IVa). It was declared vulnerable species at international and national level (Nitzu, 2021; IUCN, 2024). According to report under the Article 17 of the Habitats Directive (2013-2018), the overall assesment status of *Rosalia alpina* for Romania, from alpine bioregion is unfavorable-inadequate (European Commison, 2020), as well as at regional level (Management Plan of ROSCI0122 Făgăraş Mountains, 2016). In adjacent area of GVO, this saproxylic species was identified in two locations (T16 and T21), with four individuals (Figures 1, 2). The characteristic habitat of this species is – 91V0 Dacian Beech forests (*Symphyto-Fagion*) - forest edge (Figure 3A). For this species 3 preassures were identified and two threats, with different level of intensity (Table 2).

Species *Carabus variolosus*, Fabricius, 1787 is also protected at national level (Romanian Official Monitor, 2007 - annexes III, IVa) and European level (Habitat Directive, 92/43/EEC - annexes IIa, IVa). In Romania, this species is vulnerable (Nitzu, 2021). The overall assesment of *Carabus variolosus* for Romania,

from alpine bioregion, is favorable (European Commision, 2020). In adjacent area of Galbena and Vemeşoaia Community, this species was identified in a single location, Boia Mică Valley (T18), with one individual (Figures 1, 2). According to Natura 2000, the preffered habitat is 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (Figure 3B). The presence of forest roads and intensive sheeping grazing are the main pressures for this species. Soil erosion could constitute a threath for this invertebrate (Table 2).

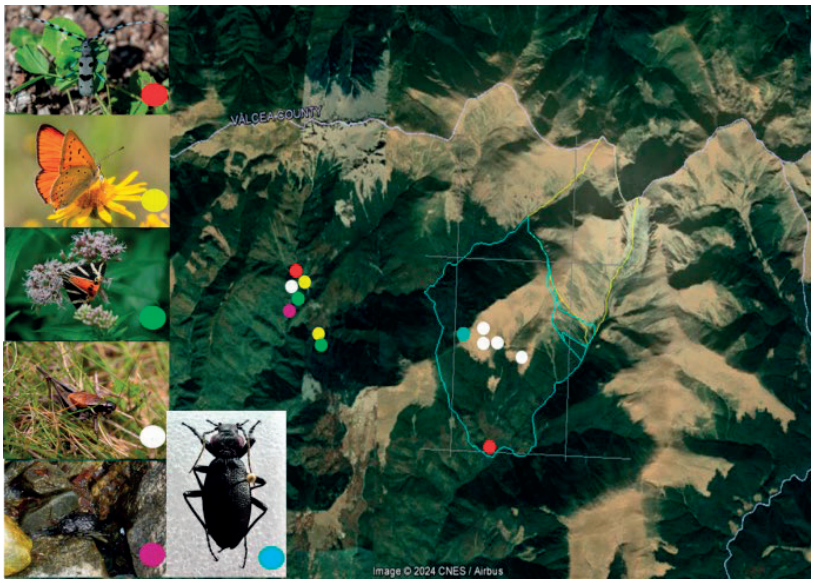

Figure 2. The biogeographically distribution of the Natura 2000 protected invertebrates from Galbena and Vemeşoaia Community and its adjacent area, from Făgăraş Mountain, Romania (red circle = *Rosalia alpina*; purple circle = *Carabus variolosus*; blue circle = *Carabus planicollis*; yellow circle = *Lycaena dispar*; green circle = *Callimoprha quadripunctaria*; white circle = *Pholidoptera transsylvanica*) (original photos: Manu Minodora and Lotrean Nicolae)

Species *Carabus planicollis* Küster, 1827 is an endemic invertebrate for Romania (Southern Carphatians). It lives in the mountain coniferous forests, even in alpine lands (stony alpine meadows), from 1900 to 2000 meters altitude (Barloy & Prunar, 2012; Nitzu, 2021). In Romania, it is endangered species (Nitzu, 2021). In GVO, this species was recorded on Vemeşoaia Mountain (T5), with one individ (Figures 1, 2). The habitat where it was signaled is classify as 4060 – Siliceous alpine and boreal grasslands (Figure 3C). The intensive sheep grazing and soil erosion are the pressure and respectivelly threat for this invertebrate species (Table 2).

In GVO, forest roads are used mainly in summer, in the period when adults of these protected species are active. The presence of access roads causes disturbance to the adjacent habitats, determining a reduction or a fragmenting of the habitat area, pollution and erosion, vegetation destruction, changing of the terrain configuration. These forest roads facilitate the access of people, domestic animals and vehicles. Another pressure observed in the riparian areas 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine level) is the modification of the vegetation structure as a result of the "resining" process (as a method of forest artificial regeneration). This process will determine an increasing of soil acidity and a disappearance of carabids species, which are adapted to the specifical ecological conditions, characteristical for beech forest and for mountain riparian areas. Intensive sheep grazing will disturb flora and fauna, modify the microrelief and will alter the soil quality by compaction.

The butterfly species *Lycaena dispar* (Haworth, 1802) has also an international and national conservation status (Habitat Directive, 92/43/EEC - annexes IIa, IVa; Romanian Official Monitor, 2007 - annexes III, IVa). According to the Article 17 of the Habitats Directive, the overall assesment status of this butterfly species for alpine bioregion from Romania is favorable (European Commison, 2020). This status is in concordance with that given by Rákósy in 2021 at national lavel or that from IUCN (least concern species) (IUCN, 2024; Rákósy, 2021). In Gablena and Vemeşoaia Community, four individuals were identified at Boia Mică Valley (T17) and Sterminoasa Valley (T21) (Figures 1, 2). The characteristic habitat for this species in this small community is a mixture between 6430 Hydrophilous tall herb fringe communities of plains, montane to alpine levels and 91V0 Dacian Beech forests (Symphyto-Fagion) (Figure 3D).

The main pressures for this species are the forest roads and logging without replanting or natural regeneration, which exercise with high and respectively medium intensities. The extensions of these forest roads, construction of forestry ramps and intensive sheep grazing constitute threats for *Lycaena dispar* (Table 2).

Another Natura 2000 protected butterfly species was identified, in the same locations from GVO (T17 and T21): *Callimorpha* (*Euplagia*) *quadripunctata* (Poda 1761), with three individuals (Figure 2). On European level and national it is considered species of community interest whose conservation requires the designation of special areas of conservation (Habitat Directive, 92/43/EEC – annex IIa; Romanian Official Monitor, 2007 - annex III). It conservation status is favorable, for alpine bioregion from Romania, as well as for regional level (Management Plan of ROSCI0122 Făgăraş Mountains, 2016; European Commision, 2020). According to Rákósy, 2021, it is a least concern species. In GVO, the habitats where the species was found were 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels; 91V0 Dacian Beech forests (*Symphyto-Fagion*) (Figure 3E). Forest roads and logging without replanting or natural regeneration are medium intensity pressures for this species. Extensions of these activities represent the main threats (Table 2).

Orthoptera species *Pholidoptera transsylvanica* (Fischer 1853), was identified in five locations from GVO: Vemeşoaia Mountain (T2, T3, T4), Sterminoasa Valley (T21) and Galbena Mountain (T22) (Figures 1, 2). In total, 11 individuals were recorded, in the following habitats: 4060 – Siliceous alpine and boreal grasslands; 91V0 Dacian Beech forests (*Symphyto-Fagion*); 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels; 6230* – Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and sub-mountain areas, in Continental Europe) (Figure 3F). It is protected at national and European level (Romanian Official Monitor, 2007- annexes III, IV a; Habitat Directive, 92/43/EEC – annexes IIa, IVa). For alpine bioregion from Romania, this species recorded a favorable conservation status, similar with those obtain at regional level, according to the Management Plan of ROSCI0122 Făgăraş Mountains, in 2016 (European Commision, 2020). Intensive sheep grazing, soil erosion and forest roads are the main pressures for *Pholidoptera transsylvanica* and their extensions, other forestry activities (as construction of forestry ramps), droughts and low rainfall represent the main threats (Table 2).

For the proposed conservation measures, we must consider the pressures and threats listed above for each protected species. Sometimes, these are similar, but they manifest with different intensities (Table 2). For *Rosalia alpina*, we propose that the forest cutting and the wood extraction to be forbidden in the forest area where the species was identified and its neighbor (at least 1 ha) (Campanaro et al., 2017). Forest cuttings will be carried out only in exceptional cases, under strict control, focusing on natural regeneration. Keeping old and dead trees in the forest provides favorable habitat for this species. The removal of dead wood or veteran trees causes a decrease in dead wood availability and negatively affects the survival of *Rosalia alpina*. The access to the forest road will be restricted. Due to the fact that this road is degraded (soil erosion), we propose its stabilization by weeding or by planting beech trees. The construction of new

roads will be avoided (will be accepted when there is no other option and when the new road has a vital importance).

The conservation measures for *Carabus variolosus, Carabus planicollis* and *Pholidoptera transsylvanica* are quite similar, considering the intensive sheep grazing and their transit. This activity must be limited, in the areas where these species were identified. Grazing should be done by rotation, allowing the restoration of the vegetation layer from entire meadow, preventing the appearance and expansion of areas without vegetation, which leads to desertification. We recommend annual sowing of the pasture, with local plant species. In this way the phenomenon of soil erosion will be reduced. Sheeping grazing must be done, considering the support capacity of the meadow, allowing the vegetation recovering (Onete et al., 2021). Pastures from Galbena Mountain recorded a grazing capacity by 2.5 UVM/ha for a period of 85 days/year. Meadows from Vemeşoaia Mountain recorded a grazing capacity by 5 UVM/ha for a period of 70 days/year and those from Sterminoasa Mountain has a grazing capacity of 0.5-2.3 UVM /ha for 85 days/year (Onete et al., 2021).

Table 2: Pressures and threats identified for invertebrates with conservative value, from Galbena and Vemeşoaia Community and its adjacent area, 2020 (pressures and threats codes according to M.O. 304/2018; M.O. 901/2023)

Pressure	**Code**	**Species**	**Pressure intensity for each species**
Roads, paths and railways	D01	*Rosalia alpina* *Carabus variolosus* *Lycaena dispar* *Callimorpha (Euplagia) quadripunctaria* *Pholidoptera transsylvanica*	Medium Medium High Medium Medium
Logging without replanting or natural regeneration	B03	*Rosalia alpina* *Lycaena dispar* *Callimorpha (Euplagia) quadripunctaria*	Medium Medium Medium
Forest cleaning	B 02.02	*Rosalia alpina*	High
Intensive sheep grazing	A 04.01.02	*Carabus variolosus* *Carabus planicollis* *Pholidoptera transsylvanica*	High High High
Soil erosion	K 01.01	*Pholidoptera transsylvanica*	Low
Threat	**Code**	**Species**	**Threat intensity for each species**
Forest road extension	D01	*Rosalia alpina* *Lycaena dispar* *Callimorpha (Euplagia) quadripunctaria* *Pholidoptera transsylvanica*	Medium High High Medium
Logging extension	B03	*Rosalia alpina* *Callimorpha (Euplagia) quadripunctaria* *Pholidoptera transsylvanica*	High Medium Medium
Soil erosion	K01.01	*Carabus variolosus* *Carabus planicollis* *Pholidoptera transsylvanica*	Low Low Low
Other forestry activities (construction of forestry ramps)	BO7	*Lycaena dispar* *Callimorpha (Euplagia) quadripunctaria* *Pholidoptera transsylvanica*	High High Medium
Intensive sheep grazing	A 04.01.02	*Lycaena dispar*	Low
Droughts and low rainfall	M 01.02	*Pholidoptera transsylvanica*	High

In GVO, *Lycaena dispar*, *Callimopha quadripunctaria* and *Pholidoptera transsylvanica* were often identified in riparian areas near to the forest edges or near to forest roads. The conservation of these habitats is essential for species survival and involves limitation of the logging. The forest ramps and the forest exploatation must be placed at one km distance from the habitats of these species. The storage time and the quantity of wood material from forest ramps must be reduced. The lifting of the wooden material should be

done with minimal impact on the adjacent habitats (without soil degradation), with well-maintained equipment. Forest machinery maneuvers (turning, loading, etc.) should be done only on the existing forest roads. The over-dimensioning of forest machinery must be forbidden, so that these maneuvers can be easily carried out in the specially arranged perimeter (the existing forest road), without damaging the neighboring habitats.

A

91V0 Dacian Beech forests (*Symphyto-Fagion*)- forest edge- Vemeşoaia

B

6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels- Boia Mică Valley

C

4060 – Siliceous alpine and boreal grasslands- Vemeşoaia

D

6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels + 91V0 Dacian Beech forests (*Symphyto-Fagion*) – Sterminoasa Valley

E

6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels + 91V0 Dacian Beech forests (*Symphyto-Fagion*) – Boia Mică Valley

F

6230* – Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and sub-mountain areas, in Continental Europe)- Galbena

Figure 3. Characteristic Natura 2000 habitats for invertebrate fauna from Galbena and Vemeşoaia Community and its adjacent area (A - *Rosalia alpina*, B - *Carabus variolosus*, C - *Carabus planicollis*, D - *Lycaena dispar*, E - *Callimoprha quadripunctaria*, F- *Pholidoptera trassylvanica*) (original photos: Manu Minodora, Lotrean Nicolae, Nicoară Roxana)

The existing forest roads must be preserved and their extension (in number or dimension) must be forbidden. Roads extension could determine a fragmentation of the characteristically habitats of these invertebrates and soil deterioration. Repairing and maintenance of the forest roads will be carried out with maximum caution, in order to not damage the species' habitats.

For *Lycaena dispar* conservation, the extensive grazing and traditional mowing of the wet areas are two measures for the protection of its habitat. In the period May-October, the grazing will be restricted. The tall hydrophilic grasses and sedges must be protected for the adults mating. This means that the intensive mowing or grazing near to the water courses and in hygrophilous meadows is forbidden.

Schrubs conservation, especially those with *Eupatorium cannabinum* located near to the water courses or in hygrophilous meadows, is another protection method for *Callimoprha quadripunctaria*. Extensive grazing and traditional mowing must be realised, in order to prevent afforestation. These traditional actions will keep the mosaic aspect of the vegetation (areas covered by bushes alternating with areas covered by grassy vegetation). In the same time, the traditional extensive grazing keeps the habitat's heterogenity, alternance between meadows with open areas and shiny rocky places.

Pholidoptera transsylvanica is another species which prefferes riparian areas. Protection of the flowing waters banks, prohibition of waste storage and maintenance of the water quality are essential measures for this species conservation. An adequate grazing management in mountain grasslands, as we mentioned above, will favour the developing of these invertebrates with conservative value.

CONCLUSIONS

In Galbena and Vemeşoaia Community, wich represent 0.15% of the Făgăraş Mountains surface, were identidied six invertebrates with conservative value (five Natura 2000 and one endemic species). If we consider the conservation status at the alpine bioregion of Romania, four invertebrates recorded a favourable conservation status and only one is unfavorable-inadequate. Identification of these protected species demonstrated the presence of favorable, characteristically habitats, as: old, mature deciduous forests with intact forest edges, mountain grasslands, riparian areas with rich hygrophilous vegetation, rivers with flowing water, characterized by a relatively low flow speed and marshy areas in natural forests.

In the same time the five pressures and six threats were evaluated, indicating their intensity. The main preassures were: forest logging, overgrazing, forest roads and soil erosion. The main threats were: the extension of access forest roads, of forest exploitation, builging of new temporaly forest ramps, intensive grazing/overgrazing and desertification. Conservation of these invertebrates implies a decrease in the intensity and/or the disappearance of these pressures and threats, through target protection measures. Application of these conservation measures protects invertebrates on long term as viable biological components of their natural habitats, maintain their distribution areas and provide a favorable characteristically habitats, large enough to keep their populations on long term.

The present study highlighted that even small unstudied area could represents an important conservation hotspot for invertebrate fauna, directly, and indirectly for their habitats.

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