



Monitoring the protected entomofauna of Rarău – Giumalău Mountains with notes regarding the distribution and habitat of some rare species (preliminary studies)

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Abstract. The present study brings a modest contribution to the knowledge of the protected entomofauna of Rarău – Giumalău Mountains, adding new data regarding the distribution, habitat and population size of a few protected species belonging to different taxonomic groups. The main investigated species are: *Carabus variolosus*, *Pholidoptera transsylvanica* and *Rosalia alpina*, this species were observed and collected with various methods (field observations, pitfall traps, pan traps, sticky traps, sweep net etc.) from different locations. We also refer to the distribution and habitat of some rare species, as an example: *Omyomymar andriescui*, species discovered few years ago in the Rarău and Ceahlău Mountains. Also we discuss the negative impact of the human activities on these mountains. In conclusion, the state of the entomofauna showed that an appropriate management plan is needed for the conservation of the rare species of the region.

Key Words: insect fauna, records, habitats, anthropic impact.

Introduction. It is well known that some areas of Rarău-Giumalău Mountains are part of the Natura 2000 European ecological network. These mountains are famous because of the rare flora and fauna species which are mentioned in international conventions and red lists. On these sites, have been identified three rare and protected insect species of interest: *Pholidoptera transsylvanica*, *Carabus variolosus* and *Rosalia alpina*. One year ago, was described from Rarău Mountains also *Omyomymar andriescui*, an apparently a rare species present only in the Carpathian Mountains.

Taking into account the conservation importance of these mountains, the surface and habitat diversity of these areas, and also the insufficient data we can assert that this entomofauna is poorly studied. We search to add new data to the knowledge of these protected insect species. In this study our aim was to identify these three protected species in Rarău-Giumalău Mountains, to identify species habitat and to approximate the population size. Noteworthy references: Cenușă (2009), Donita et al (2005), Peiu & Nemeș (1970), Nemeș & Peiu (1971), Seghedin (1983), Stoiculescu (2004), IUCN Red List of Threatened Species (2010), www.faunaeur.org and www.carpati.org.

A part of this paper was presented as a poster at the “EPE” Symposium Meeting in 2015 organized at “V. Alecsandri” University from Bacău, but the data was not published (Pricop et al 2015).

Material and Method. Most species have been observed and collected with the entomological sweep-net and with some pitfall traps from forest and grass-land vegetation. The material was observed and/or collected from some areas of Rarău-

Giurnală Mountains (Romania), starting at an elevation of 900 up to 1,600 m. The examined specimens were photographed and released back in to the wild (Figure 1).

We have illustrated the habitus of some specimens utilizing photographs obtained with a digital camera. We have illustrated the species habitat and distribution maps were also added. For accurate data we used a GPS unit. The maps were made using ArcView GIS 3.1 software. All photographs and representations are original.



Figure 1. Aspects regarding few materials and methods used for the present study and the anthropogenic impact on Rarău Mountains (original).

Our areas of investigation were broad, from Chiril village area at 700 m elevation, continuing with the southern slope to the top of Rarău at 1,600 m altitude. We continued on the mountain plateau until reached the area called "Popii Rarăului"; continued also until we reached "old Todirescu hayfields" and "Slătioara" old growth forest. The species have been identified by the first author.

Results and Discussion

The protected insect species of Rarău-Giumalău Mountains (Table 1)

1. *Pholidoptera transsylvanica* (Fischer, 1853); Species Code - 4054, known as the Carpathian bush-cricket, belongs to *Orthoptera*: Family *Tettigoniidae*. Diagnosis: This endemic bush-cricket has a dark brown to grey color body, creamy colored belly; the forehead or frons with a broad white to light grey transversal stripe; the pronotum with a white stripe on the posterior border. The wings are small and reduced, usually brownish to red in color; the ovipositor is evidently straight with a brown to grey color, 19-29 mm in length. This species is endemic to the Carpathian Mountains. Habitat: inhabits grasslands (meadows), bushes and forest edges of mountains from June to early October, adults are present from early July to late August and is an omnivorous species (Figure 2). For the protection, the typical habitats for this species – the mountains meadows must be conserved.

Distribution: From Eastern Slovakia to Hungary, Croatia and Yugoslavia to the central area of distribution in the Romanian Carpathians. *P. transsylvanica* - important references: Cenușă (2009), Iorgu & Iorgu (2008), Iorgu & Pisciă (2008), Jordán et al (2003), Kis (1980), Krištín & Kaňuch (2013), Tatole et al (2009), Tatole (2010), IUCN (2010) and Fauna Europaea (2015).

Material: we have been able to collect and observed total of 7♂ and 4♀ of *P. transsylvanica* on the 25-26 of July 2015 but also on the 8-9 august 2015, the material was collected from four different sites (Figure 2) from mountain meadows edified by *Festuca spp.* and *Agrostis sp.* but also from some area with *Juncus spp.* (*Juncus glomeratus*) and other plant species belonging to the Gramineae family.

P. transsylvanica was identified on the "Popii Rarăului" area, in a small number of specimens in habitat type R3607 South-Eastern Carpathian grasslands with *Dianthus tenuifolius* and *Festuca amethystina* (Nature 2000: 6170 Alpine and subalpine calcareous grasslands) (Donita et al 2005).

Most specimens were identified in a habitat type R3608 South-Eastern Carpathian grasslands with *Scorzonera rosea* and *Festuca nigrescens* (Nature 2000: 6230 Species-rich *Nardus* grasslands, on siliceous substrates in Mountain Areas (Donita et al 2005) and R3609 South-Eastern Carpathian grasslands of *Nardus stricta* with *Viola declinata* (Nature 2000: 6230 * Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas [and submontan areas, in Continental Europe]), (Donita et al 2005) habitat located on a medium inclined slope with natural alpine meadows at 1170-1270 meters altitude near Chiril creek sources.

Observations: *P. transsylvanica* is the most common protected species in Giumalău-Rarău Mountains, and it is prevalent especially in meadows, from 900 to 1,650 m (Rarău) elevation and it occurs solely in the Carpathian region. It occupies bushes, meadows and forest edges in mountain areas; adults may be found from June until late August. The main threats are the habitat loss due to overgrazing.

Table 1

The protected insect species of Rarău-Giumalău Mountains

No.	Protected species	Habitat and distribution records in Rarău Mountains	Major threats
1	<i>Carabus variolosus</i>	mountainous river banks from 800 to 1,000 m altitude	habitat destruction due to human impact, mainly road construction and deforestation
2	<i>Pholidoptera transsylvanica</i>	mountain meadows from 1,100 to 1,500 m altitude	habitat loss due to overgrazing and other human activities
3	<i>Rosalia alpina</i>	mostly beech forests at an elevation of 700 to 1,100 m	deforestation, habitat loss due to forest management/ extraction of deadwood

The very first site where we have collected the biological material was at 1,200 m altitude, on the border of the central reservation (GPS: N47026.246', E025033.584'). At this point we found few males and fewer females. The second site was at 1,300 m alt. also on the border of the reservation (GPS: N47026'256'', E025033'224''). The third site is situated at 1,500 m alt. near "Popii Rarăului" pastures (GPS: N47026'560'', E025035.375''). The fourth site is at 1,400 m elevation, in "old hayfields Todirescu" reserve area (Coordonate GPS: N47026'349'', E025036'347'').



Two males of *Pholidoptera transsylvanica* in a meadow dominated by *Festuca sp.* and *Agrostis capillaris* at 1,200 and 1,300 m alt. (1, 2)

Female of *P. transsylvanica* from "Popii Rarăului" (3)



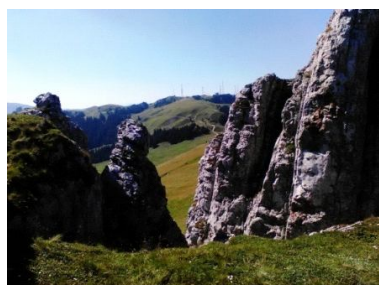
Female of *P. transsylvanica* from 1200 m alt.



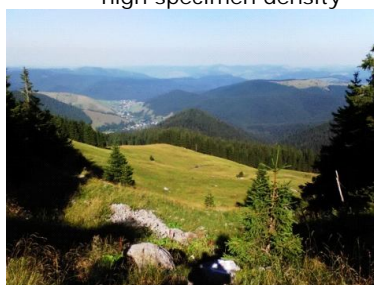
Habitat of *P. transsylvanica* at 1,200 m alt., a site with a high specimen density



Collecting in the upper part of "old hayfields Todirescu" - Rarău



The upper area of "Popii Rarăului"



Upper area of "Todirescu Hayfields"



Distribution records of Carpathian bush-cricket

Figure 2. The protected insect species *Pholidoptera transsylvanica* in Rarău Mountains (original).

The meadows with the highest density of adults of this species are situated at 1,200-1,300 m altitude on the southern slope of Rarău. A single female was observed near "Popii Rarăului" pastures and a single male was collected in the upper part in the meadows called "old hayfields Todirescu". In Figures 1 and 2 are presented the species habitat; the species habitats and maps with the distribution of these sites. It appears that the males are more abundant than the females. Only 3 males were observed in the vegetation, the rest were collected with the sweep net. As density we have collected a maximum of 3 adult specimens/100 m² (2♂ and 1♀). In late spring to early June the nymphs of *P. transsylvanica* are more abundant than the adults in late July or August.

Note: The "protected" Orthoptera species displayed on: <http://www.ocolul-pojorata.ro/rezervatii/specii/protejate.php>, does not belong to the taxon named: *P. transsylvanica*!

2. *Carabus (Hygrocarabus) variolosus* Fabricius 1787 (ssp. *variolosus*); Species Code – 4014, popular the amphibious carabid beetle belongs to *Coleoptera*: Family *Carabidae* and is frequent, especially in low mountainous and hilly zones and it is a predatory species that feeds on small invertebrates (Figure 3).

Diagnosis: *C. variolosus* is easy to identify because of its dark color and the unique elytral sculpture consisting in numerous small pits or dimples longitudinally arranged (Figure 2), about 33 mm in length (average), inhabiting in Romania broad leaf forests (*Fagus sylvatica* forests associated with *Alnus spp.* near small streams) from hills and mountainous areas with high humidity levels, near streams and small ponds (Matern et al 2008).

C. variolosus - important references: Barloy & Prunar (2012), Cenușă (2009), Müller–Kroehling (2006), Panin (1955), Tatole et al (2009), Tatole (2010), IUCN (2010) and Fauna Europaea (2015).

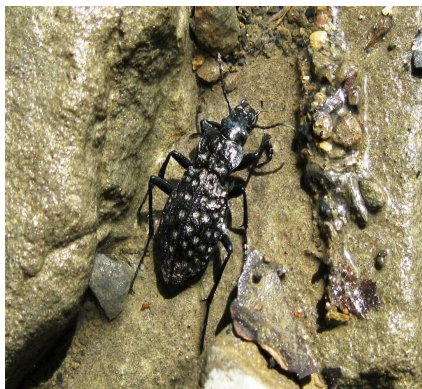
Distribution: from France to the Ukraine, *C. variolosus* was recorded in many European countries, mostly from Central Europe.

Observations: *C. variolosus* appears to be rare in these mountains, we found few males belonging to this species near a small stream (Ciurgăului creek near Rarău Monastery at 930 m altitude), the preferred habitats are mountainous river banks. The main threats are the habitat destruction due to human activity in this area. It appears that this species is not a high altitude species. In this area was not found higher than 1,000 m altitude.

As a protection measure of this species the habitat must be conserved. The main disturbance factors are forest exploitation and road constructions. Also chemical pollution of streams and creeks with household used waters can be a liability of this species. *C. variolosus* is a very clean fresh water indicator in its natural habitats.

Carabus (Hygrocarabus) variolosus it was also identified in the vicinity of creeks and swamps in several areas but especially in habitat type R5406 South-Eastern Carpathian springs and brooks with *Carex flava* and *Blysmus compressus* (NATURE 2000: 7230 Alkaline fens), in Slătioara forest along Ion creek and Gemenea creek (Donita et al 2005); R5411 South-Eastern Carpathian springs and brooks with *Carex nigra* ssp. *nigra*, *Juncus glaucus* and *Juncus effusus* (Nature 2000 - non existent), (Donita et al 2005) along Chiril creek, Izvorul Malului and Ursului creek.

Most specimens were identified in a habitat type R5421 South-Eastern Carpathian springs and brooks with *Chrysosplenium alternifolium* and *Cardamine amara* (Nature 2000 - non existent), (Donita et al 2005) Colbu creek and Giumalău creek.



Habitus of *Carabus variolosus* - specimen observed at 900 m alt.



Adult of *Rosalia alpina* found dead in old growth Slătioara forest reserve in a beech trunk



Figure 3. The tow protected Coleoptera species found in Rarău-Giumalău Mountains (original).

3. *Rosalia alpina* Linnaeus, 1758; Species code – 1087, the Alpine Longhorn belonging to *Coleoptera*: Family *Cerambycidae*. Diagnosis: *R. alpina* is easy to identify from the long antennae, much longer than the rest of the body, almost twice as the length of the body. Both elytra are flat, blue to gray, with few black spots, including one spot on the pronotum. Antennae and legs colored as the rest of the body. Body length = 20–40 mm

long. The beetle is nocturnal and the coloration serves as good camouflage within their preferred habitat of Beech forest. In Romania is known from different forest habitats, especially *Fagus sylvatica* at 700–1,100 m alt. This species prefer old trees from low altitudes of the mountains (Figure 3).

R. alpina is also rare and was found in old growth Slătioara forest at 1,000 m elevation (their preferred habitat is mostly beech forest), the main threats are the habitat loss due to deforestation.

R. alpina - important references: Cenușă (2009), Cizek et al (2009), Nicollet & Lempérière (2002), Tatole et al (2009), Tatole (2010), IUCN (2010) and Fauna Europaea (2015).

Distribution: *R. alpina* it is prevalent From Eastern Spain to the European Russia, not present in the UK and northern countries.

Note: *R. alpina* is spread increasingly less so as a species and population.

Typically the larvae are developing in beech wood but also in other broad leaf forests as *Salix sp.*, *Carpinus betulus*, *Quercus sp.*, *Alnus sp.* etc. Adult are found from June until July and they feed on pollen. To protect this species we must sustain the old trees in these forests and also to eliminate the use of different pesticides.

R. alpina was identified in the beech mixed forests of the following habitats: R4101- South-Eastern Carpathian spruce forests (*Picea abies*) with beech (*Fagus sylvatica*) and silver fir (*Abies alba*) with *Pulmonaria rubra* (Nature 2000: 91V0 Dacian beech forest [*Symphylo-Fagion*]), (Donita et al 2005), Izvorul Alb creek valley and Munceii Rarăului; R4102 - South-Eastern Carpathian *P. abies* forests with *F. sylvatica* and silver fir (*Abies alba*) with *Hieracium rotundatum*, (Nature 2000: 9110 *Luzulo-Fagetum F. sylvatica* forest), (Donita et al 2005), on the slopes of Chiril creek valley and old growth forest Slătioara, and Munceii Rarăului. It develops in good condition in and through beech dead wood which is abundant in Slătioara old growth forest; R4109 - South-Eastern Carpathian *F. sylvatica* forests with *Symphytum cordatum* (Nature 2000: 91V0 Dacian *F. sylvatica* forests [*Symphyto – Fagion*]), [Donita et al 2005] on the slopes of Izvorul Malului creek valley).

The noteworthy entomofauna. On the basis of our field observations, we provide below additional informations on a few particular species and why they are noteworthy indicating which species are rare or unique, endangered or biogeographically important, including field data. We give some few examples of species and habitats. A part of the identified species is presented in Figures 4 & 5.

Beside the three protected species from above we found also *Lucanus cervus* in Chiril village, a very rare species in these areas. Linked with the broad leaf forests but also a thermophile species, about 700 m alt. The nearest site from Suceava county, where this species was recorded was Râșca-Slătioara (Stan 2013). The main threat is the large area deforestation due to faulty forest management.

We also mention the endemic subspecies: *Miramella ebneri carpathica* (Cejchan 1958), this *Orthoptera* subspecies is abundant in Rarău grassland vegetation mostly from 1,300 to 1,600 m elevation. We observed this species on *Carduus sp.* and *Cirsium sp.* from the south face of Rarău Mountains, to the top of Rarău Mountains at 1,600 m alt. and also in "old hayfields Todirescu" at 1,400 m altitude. The area with the highest abundance was at 1,400-1,500 m altitude under the peak of Rarău. At 1,400 m elevation in the spruce forest habitat, on *Luzula sp.* near "Hotel Rarău", we found a few specimens of *Isophys sp.* – *Orthoptera*. It is known that some species belonging to genus *Isophys* are endemic to the Carpathians. We mention also the specie *Decticus verucivorus*, *Tettigonia spp.* common on Rarău Mountains and *Barbitistes constrictus* from Giumalău Mountains.

Beside *C. variolosus* we have identified also the species *Carabus auronitens* in the spruce forest at 1,450 m altitude near "Hotel Rarău". *Carabus auronitens* it is usually found in beech forests. In the plateau area (alpine pasture) of Rarău at 1,500 m elevation, in the ruderalised areas (area with *Rumex alpinus*, *Capsella bursa-pastoris*, *Urtica dioica* and *Cirsium spp.* and *Carduus sp.*). *Decticus verucivorus*, *Geotrupes spp.* are very common.



Miramella ebneri carpathica



Isophya sp.



Decticus verucivorus



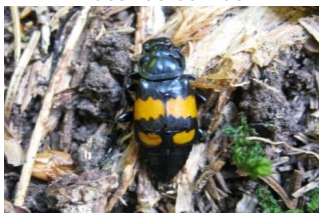
Lucanus cervus



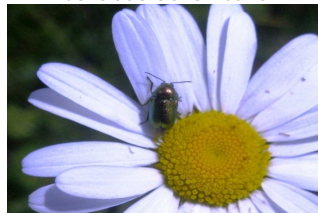
Carabus auronitens



Geotrupes sp.



Necrophorus vespilloides



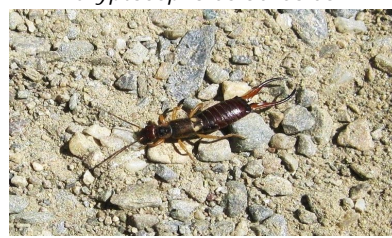
Cryptocephalus aureolus



Chrysopa pallens Ramb.



Panorpa sp.



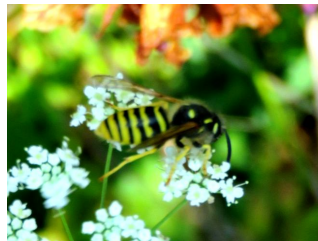
Forficula auricularia



Bombus spp.



Eristalis sp.



Vespa sp.



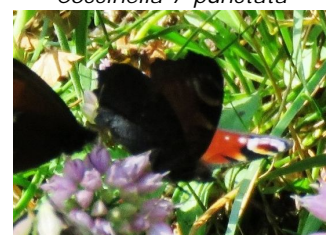
Coccinella 7-punctata



Tettigonia cantans



Xanthorhoe sp.



Inachis io

Figure 4. Some noteworthy entomofauna recorded from Rarău Mountains (original).

Necrophorus vespilloides – a specific burying beetle (Fam. Silphidae) that feeds on dead animals, observed by us at 1,400 m altitude in the spruce forest.

We also mention *Cryptocephalus aureolus* a beetle observed at 1,000-1,300 m alt. on Rarău that feeds on pollen and nectar mainly on the *Asteraceae* plants. We observed this species on *Leucanthemum* sp., *Tanacetum* sp., *Hieracium* sp. and *Arnica montana* but also on *Ranunculus* sp.

Chrysopa pallens Rambur – a common predator species in this area observed in the spruce forest at 900-1,000 m altitude near “Rarău Monastery”.

Panorpa spp. (*P. communis*) – species found in beech forests and bushes at 700-1,200 m altitude, near some streams.

Forficula auricularia L. (male) was observed at 1,070 m altitude, near “Rarău Monastery”.



Lasiommata maera



Gonepteryx rhamni



Limenitis sp.



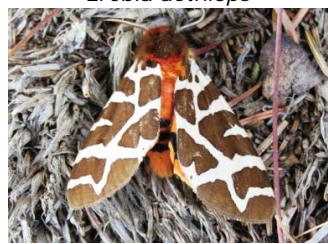
Erebia aethiops



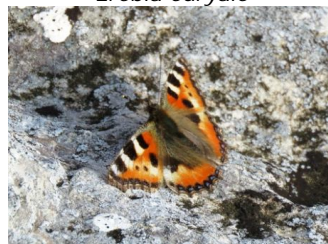
Erebia euryale



Erebia ligea



Arctia caja



Aglais urticae



Vanessa atalanta



Melanargia galathea



Zygaena sp. on Cirsium sp.



Argynnis aglaja



Araschnia levana



Muschampia sp. near tessellum



Hesperia comma



Polyommatus sp.



Noctuidae larva from 1,600 m elev near Meteo Station - Rarău

Figure 5. Noteworthy Lepidoptera fauna recorded from Rarău Mountains (original).

The *Lepidoptera* fauna (Figure 5) of Rarău Mountains and Moldova region is very rich (Peiu & Nemeş 1970; Nemeş & Peiu 1971; Rakosy et al 2003; Chimişliu & Goga 2005). Although *Parnassius apollo* was last seen and recorded from Rarău only in the last century (searched by us but not found). We have been able to identify other species:

Lasiommata maera (L.) at 1,200 m altitude on a meadow on South face of Rarău at 1,200 m altitude and also in "La Cotet" area. *L. maera* is present in the mountainous areas of Moldova, hill area and also in fields, at low altitude this species had disappeared, the main cause is the aggressive agriculture;

Gonepteryx rhamni (L.) was observed on *Dianthus* sp. at 1,500 m alt. on rocky areas; *Limenitis* sp., species of this genus are vulnerable. The main threat is due to systematic extraction of deadwood linked to forest management;

Arctia caja (L.) – common species observed at 1,300 m South slope of Rarău;

Polyommatus sp. – rare species observed at 1,200 m altitude in a meadow on the south side of Rarău feeding on some plants belonging to *Lamiun* sp. plant genus;

Inachis io (L.) is common, we found it at high altitude at "La Cotet" area – 1,500m elev. We recorded also the geometrid moth *Xanthorhoe* sp associated with the spruce forest;

Xylena exsoleta, a noctuidae larva observed at 1,600 m elev. near Rarău-Meteo Station- Rarău peak;

Erebia aethiops (Esper) was recorded in a meadow at 1,200 m altitude near the spruce forest;

Erebia euryale (Esper) – this species colonize areas ruderalised and deforested areas of this massif, commonly observed by us from 1,200 to 1,500 m altitude;

Erebia ligea (L.) – endangered species because of the overgrazing, few specimens were observed by us at 1,200 m and 1,400 m altitude, in semi-natural meadows including "old hayfields Todirescu" reserve;

Zygaena spp.: *Z. filipendulae* - observed at 1,200 m elevation;

Aglais urticae – common in this area from 900-1500 m alt;

Vanessa atalanta – observed below "Rarău Monastery" at 800 m altitude.

Melanargia galathea (L.) – also a common species in Rarău, abundant at 1,200 m altitude, species present from 800 to 1,400 m altitude in meadows;

Argynnis aglaja (L.) – a common species that is resistant to the human impact in this area, recorded by us from few meadows near "Rarău Monastery" (1,100 m) to 1,300 m altitude;

Araschnia levana (L.) – species in decline, recorded by us in Chiril creek valley area (700-800 m altitude) on *Eupatorium cannabinum* near the main stream;

Hesperia comma (L.) – very common species, feeding on *Scabiosa* sp., *Centaurea* sp. and *Cirsium* sp. from 900 to 1,200 m altitude at the border of the spruce forest near "Rarău Monastery";

Muschampia sp. few specimens were observed in Rarău, feeding on *Dianthus* sp.

The *Hymenoptera* species are very diverse, worth to mention are the species more abundant belonging to *Bombus* spp.: *B. terrestris*, *B. lapidarius* found feeding at altitude on *Cirsium* sp. and *Carduus* sp. and *Polistes dominulus*, *Vespa* spp.: *V. germanica*, *V. crabro*, and *Anthophora* sp. etc.

In Rarău are present also some rare microhymenoptera species: *Dicopus minutissimus* Enock a rare fairy fly recorded from this area (Pricop 2012; Pricop & Andriescu 2011), associated with *P. abies* forests from 800 to 1,400 m altitude and *Omyomymar andriescui* Pricop, species recently described from Rarău and Ceahlău Mountains, considered to be endemic from the Carpathian Mountains associated with calcareous habitats from 1,400 to 1,800 m alt (Figure 6). *O. andriescui* is considered to be valid as a species and is cited and included also in Universal Chalcidoidea Database – collected from spruce forests and sub alpine areas (Pricop 2012, 2014; Pricop & Andriescu 2011; Noyes 2015).

Due to the phenomenon of human intervention appear more often on the alpine plateau of both Giumalău and Rarău Mountains numerous habitats of type R8707 South-Eastern Carpathian communities with *Poa supina* (Donita et al 2005), with edifying species like *Rumex alpinus*, *Poa supina*, *Veratrum album*, on various substrates, types of

rock debris, boulders but always on nitric soils, wet and fertile, rich in organic substances. These habitats can be found on large areas mainly near "Meteo cabin" to the top of the plateau, and in areas with visible overgrazing; even in the immediate vicinity of „Pietrele Doamnei” scientific reserve.



Dicopus minutissimus



Omyomymar andriescui (map - 1, 2)



Distribution of *O. andriescui*

Figure 6. Some rare microhymenoptera species found in Rarău Mountain (original).

Conclusions. In Rarău-Giumalău Mountains we have identified three rare and protected insect species mentioned from this reservations: *P. transsylvanica*, *C. variolosus* and *R. alpina*, but the conservation status for this endangered entomofauna is low due to the anthropic impact over this areas, as: road construction, overgrazing, deforestation and uncontrolled tourism.

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