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ARNICA MONTANA L. IN THE NATURA 2000 ROSCI0047 SITE NEMIRA PEAK

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Key words: *Arnica montana L., Natura 2000, Nemira Peak*

INTRODUCTION

According to the Standard Form, the Natura 2000 ROSCI 0047 site the Nemira Peak has the following geographic coordinates (Photo 1):
N 46° 13' 17"
E 26° 20' 22"
The entire area of this site is 3509 hectares.
The highest region reaches 1646 m, and the lowest site area does not exceed 699 m. The average altitude of the Nemira Peak site is 1260 m.

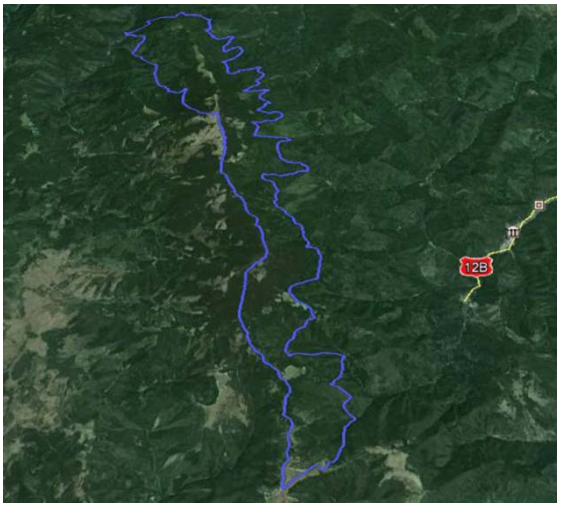

Photo 1. ROSCI 0047 site the Nemira Peak
(source: Natura 2000 Viewer)

Scientific name of the species: *Arnica montana L* (Ord. *Asterales*, Fam. *Asteraceae*).
Folk names: arnica, wolf's bane, leopard's bane, mountain tobacco, mountain arnica.
[2, 3, 5, 8, 9, 10, 11, 12]
Preservation status

According to the IUCN, *Arnica montana* is listed on Annex V of the Habitats Directive and on Annex D of the Council Regulation (EC) No 338/97 of 9 December 1996 on the protection of species of wild fauna and flora by regulating trade therein. There are protection measures in place for some European countries and it features in some national red lists:

- In Bosnia-Herzegovina and Croatia it is classed as Vulnerable on the national red lists.
- Czech Republic: protected by national Law and included in national parks and protected landscape areas.
- France: protected in several regions (Aquitaine, Centre, Bourgogne) and more than five departements, included in several protected areas.
- Germany: Classed as Vulnerable (level 3) on the German Red List (Ludwig and Schnittler 1996).
- Hungary: classed as Extinct in the Wild on the national red list
- Italy: not on the national red list but some populations are in regional parks and prevents regional collection by law.
- Lithuania: classed as Vulnerable, protected according to national and regional law.
- Luxembourg: classed as Critically Endangered on the national red list.
- Slovenia: classed as Vulnerable on the 2002 red list, protected by law which it prevents from being collected. Several localities are in protected areas such as Natura 2000 sites, national parks, regional parks.
- Sweden: classed as Near Threatened on the Swedish red list 2010.
- Switzerland: classed as Least Concern on Swiss Red List (Moser *et al.* 2002) but regionally found in protected areas. Collections are accepted but there are rules about the amount.
- Ukraine: included in the 1996 Red Data Book of Ukraine, but not included in the 2009 edition of this book. It is protected in the Carpathian biosphere reserve, in the Tapichirkiskij, Urochychcze Zatinky, Teresjanka, Chorkyj Dil, Stebnyk protected areas, and in the nature monument Verchnje Ozerychere.

Future recommended actions include to manage the mowing of meadows, provide land owners with financial support to graze, and control the change of agricultural practices. In general, in face of the threats the species is facing it should be monitored. In Luxembourg, site management to encourage seedling establishment is needed, [IUCN, 2,3].

The description of the species

Arnica montana (the mountain arnica) is a perennial species with a cylindrical underground thick rhyzome, of which fibrous roots sprout, exclusively in the wild flora.

The stem is errect, simple, rarely bearing secondary branches, of 20 to 50 cm in height, and short hairs; it bears an inflorescence at its superior end. There are rarely 3 to 5 inflorescences, an axial one, and the others near the leaf petiole.

The basal leaves are large, ovate-lanceolate, rough, hairy, rosette-arranged, and the stem leaves are opsed and small, compared to the basal ones. The flowers are yellow, disposed in a calatidium; the ligulate outer ones are large, 4-8 cm, and the inner ones are tubulous, numerous, and protected by an involucre with 2 rows of bractei. The fruits are hairy achenes, with a rough black pappus, [5, 6, 7, 8, 9, 10, 11, 12].

The habitat: It is frequent from the beech level up to the alpine level, within meadows and bushes.

– 6230 – species in the meadows of *Nardus stricta*, on a siliceous substrate - HdR: 3608 – southeast carpathian meadows of *Scorzonera rosea* and *Festuca nigrescens*; - 3609 - southeast carpathian meadows of *Nardus stricta* and *Viola declinata* (corresponding to ass. *Violo declinatae - Nardetum*).

– 4030 European dry heaths

– 4060 Alpine and boreal heaths [2,3].

Ecology: Arnica is a species that prefers acidic, very fertile and humid, sandy soils rich in humus.

Spread in Europe - Native: Andorra; Austria; Belarus; Belgium; Bosnia and Herzegovina; Croatia; Czech Republic; Denmark; Estonia; France (France (mainland)); Germany; Italy (Italy (mainland)); Liechtenstein; Lithuania; Luxembourg; Montenegro; Netherlands; Norway; Poland; Portugal (Portugal (mainland)); Romania; Russian Federation (Kaliningrad); Slovenia; Spain (Spain (mainland)); Sweden; Switzerland; Ukraine (Ukraine (main part))

Regionally extinct:Hungary

It is encountered within the entire Carpathian mountain chain, from 600 m in altitude up to 2800 m. Arnica grows in various counties of our country: Alba, Bistrița-Năsăud, Cluj, Argeș, Hunedoara, Suceava etc. It is abundant in its wid form in the Apuseni Mountains and Northern Moldavia. The species may be found on the next mountains: Surul, Parâng, Neagoiul, Bucegi, Postăvarul etc.

(1-12, IUCN).

MATERIAL AND METHODS

- GPS, compass
- photo camera
- field guide and work sheets
- field maps comprising the site limits

The field identification and the assessment of the preservation status was made for *Arnica montana* in the Nemira Peak ROSCI 0047 site. Transects were searched in order to identify the mountain arnica, within the specific habitats, along which visual observations were recorded. The populations of the researched species were located by means of GPS, as well its favourable habitats. The field measurements and GPS recordings followed a data structure that allowed their automatic upload in the GIS database. There were accomplished botanical surveys in the regions in which the species was spotted, that provided tha data to make estimates on the population size, and on the preservation status for *Arnica montana* L (regarding the accompanying species, as well).

RESULTS AND DISCUSSIONS

The field research was done from the North part of the Nemira Peak site to the South.

The meadows and bushes from the ridges of Farcu Mic, Farcu Mare, Nemira Mică, Țiganca, Nemira Mare, the meadows in between the Șandru peak, Culmea Slănic and the Romeo brook, the Cenghea pasture, the meadows surrounding the Ghepar peak, in the Nardus and *Calluna* meadows from the Mereni commons. It grows in all the pastures and bushes from the natural reserve.

There are seldom found more than 3-5 individuals/100 m^2 due to the trotting destruction caused by intensive pasturage.

The observation specific zones in which arnica was registered are described as it follows:

Observation field place no. 1

- **Habitat 6230** – mountain meadow with *Nardus*, with many plant species, and silicious ground. Situated in the north area of the Nemira Peak site
- Altitude -1345 m,
- Exposure – North - East
- Identified species during the 2013 pasturage: *Agrostis capilaris* (even distribution on 60-80% of the meadow surface), *Festuca rubra* (more than 5% of the surface), *Nardus stricta*, *Achillea colina, A, distans,* (almost 5% of the entire surface), *Thymus pulegioides, Veronica chamaedrys, Poa pratensis, Alchemilla xanthochlora, Prunella grandiflora, Trifolium alpeste, Cruciata pedemontana, Cerastium sylvaticum, Leontodon autumnalis, Arnica montana* L (very rare), *Viola declinata***.**
- unwanted species - *Rumex alpinus* (10 - 20%), *Deschampsia caespitosa, Urtica dioica.*
- Threats - placement of sheep yards on new grounds, covered by poaceae species
- Preservation regulations: we recommend a moderate pasturage for future.

Observation field place no. 2

Habitat 6230 – mountain meadow with *Nardus*, with many plant species, on a silicious substrate.

The same vegetation type was encountered next to a scree between Farcul Mare and Nemira Mică (coordinates: N 53°30' 66" and E 26°12' 54"). *Arnica montana* L is very rare, there were found some individuals near the tourist path by the forest.

Observation field place no. 3
Situated on the northern peak of Nemira Mică, at 1503 m altitude, on the coordinates N 53°14' 50" and E 26°01' 562", the Nardus meadow lies on a surface of 4-5 ha.
The identified species were: *Nardus stricta* (covering more than 80%), *Agrostis capillaris*, *Juniperus nana*, *Festuca rubra*, *Potentilla erecta*, *Deschampsia caespitosa*, *Vaccinium myrtillus* (covering more than 10%), *Thymus pulegioides. Arnica montana* L. is very rare, we only identified 2 individuals.

Observation field place no. 4
Habitat 6230 (*Nardus* meadows on a silicious substrate) N 53°11' 04" and E 26°01' 932",
The young spruce trees cover 90 % of the meadow.
The identified species were: *Viola declinata, Nardus stricta, Juniperus sibirica, Scorzonera rosea,Thymus pulegioides,Festuca rubra,Festuca nigrescens, Hieracium pilosella, Alchemilla xanthochlora, Taraxacum officinalis.*
Threats: intensive pasturage. *Arnica montana* L. is very rare, almost extinct.

Observation field place no. 5
Location: from the Mereni common up to the Ghepar mountain peak, N 46°07' 11" and E 26°20' 23".
Habitat 4030 with European short dry bushes, from the *Calluna* meadow type.
The identified species were: *Calluna vulgaris* (20%), *Vaccinium mirtyllus* (more than 20%*), V. vitis - idaea, Nardus stricta* (almost 50%), *Festuca nigrescens* (5%), *Potentilla montana*, *P. erecta*, *Arnica montana L* extremely rare (a few individuals/ha, trotted by the animals).
There were no invasive plant species. Threats: the intensive pasturage caused a lack of growth for the vegetation (15- 20 cm in height).

Observation field place no. 6
Habitat 4030 - European dry bushes
Mereni commons, nearby the Ghepar Peak. The coordinates were N 46°08' 03" and E 26°20' 41". The dominant species was *Calluna vulgaris.*
Other identified species were: *Potentilla erecta, Festuca nigrescens, F. rubra, Hieracium pilosella, Vaccinium mirtyllus, V. vitis idaea, Nardus stricta, Arnica montana* L. – extremely rare. The invasive species were absent. The vegetation height was quite low (10-30 cm) due to the intensive pasturage.

Observation field place no. 7
Habitat 4030 – European dry bushes
The identified species were: *Calluna vulgaris, Nardus stricta, Vaccinium myrtillus, V. vitis- idaea, Campanula serrata, Festuca rubra, Potentilla erecta, Thymus pulegioides, Festuca nigrescens, Agrostis capillaris.*
Arnica montana L. was present in this observation field place, though very scarce. There was noticed an intensive pasturage in the entire area.

Observation field place no. 8
Habitat 4030 – dry European bushes
The location was the meadow between the Ghepar and Cenghiu peaks, the coordinates being
N 46°08' 50" and E 26°20' 44".
The altitude for this observation place is 1305 m.
The identified species were: *Calluna vulgaris* (covering 70 - 80% of the entire surface), *Juniperus nana* (20-30%), *Vaccinium mirtyllus, V. gaultheroides, Genista tinctoria, Festuca nigrescens, Arnica montana* L. is very rare, there were only a few identified individuals for each hectare; *Hieracium sp., Potentilla erecta, Pinus sylvestris.*
The shrubs cover almost 90% of the entire surface and grow up to 30- 50 cm in height.
Regarding the unwanted species, we have found a reduced number of bushes of *Deschampsia caespitosa*. *Arnica montana* L. was encountered scarcely.

Observation field place no. 9
The location was the Cenghiu meadow, the coordinates being N 46°09' 58" and E 26°20' 49".
The altitude for this observation place is 1390 m.
Arnica montana L. is very rare in this area. The other plant species are scarce (*Festuca rubra, Agrostis capillaris, Picea abies, Juniperus sibirica* and *Nardus stricta*).
One may not frame this observation place into a prioritary habitat because the biomass is made of invasive species.

Observation field place no. 10
The identified habitat was 6230 (*Nardus* meadows with numerous plant species on silicious substrates).
The location was the ridge between Țiganca and Nemira Mare.
Forest edge and deforested meadow with *Nardus* and *Vaccinium.*
The altitude for this observation place is 1470 m, the coordinates being N 46°14'22" and E 26°19'29".
Only 3 individuals of *Arnica montana* L. were determined.
The dominant species are: *Vaccinium sp*. (30%), *Nardus stricta* (50%), *Agrostis capillaris* and *Festuca rubra* (about 15%).
The pasturage is present in average limits. Of all the unwanted species, *Deschampsia caespitosa* was found very rarely.The vegetation's height is up to 30 cm.

Observation field place no. 11
The location was nearby Şaua (Poarta) Nemirei (between Ţiganca and Nemira Mare).
The identified habitat was 6230 (*Nardus* alpine meadows with numerous plant species on silicious substrates). The coordinates were N 46°14'49" and E 26°19'25".
The dominant species were: *Nardus stricta*, *Festuca rubra*, and *Agrostis capillaris*.
Arnica montana L. is scarce in this searched area.
Of all the allochtonous species, we only found *Deschampsia caespitosa*. The *Vaccinium* shrubs only lie on 1-5% of this area.

Observation field place no. 12
The identified habitat was 4060 – alpine and boreal shrubs. The location was Şaua Nemirei, the geographic coordinates being N 46°14'57" and E 26°19'28". There were 10 vascular species that we identified in this region.
The dominant species were: *Vaccinum mirtyllus* (70-90% in the outskirts and 50% on the pasture), *Vaccinium vitis idaea* 1-5%, *Nardus stricta* 5-10%. *Arnica montana* L. was rarely found (2 individuals).

Observation field place no. 13
Shrubs of *Vaccinium* sp. and *Juniperus nana* within the habitat 4060 – alpine and boreal shrubs. The location was Nemira Mare. The geographic coordinates were N 46°15'24" and E 26°19'25". There were 12 identified plant species.
The dominant species were: *Vaccinium gaultherioides* - 10%, *V. myrtillus* 70%, *Juniperus nana* 10%, bryophytes 5%. Only 5 individuals of *Arnica montana* L. were found in this observation place.

The threats for arnica are represented by: 1 – the excessive pasturage; 2 – the invasive species; 3 - climate changes and environmental alterations; 4 – pollution;

The proposed regulations in order to keep the mountain arnica in a favourable state are**:**
- pasturage/excessive pasturage

The pasturage areas and the maximum number of sheep/surface unit should be established depending on each pasture and its degree of degradation. the pasturage should be forbidden in the regions with floristically degraded pastures, comprising invasive plant species, until the habitat is reestablished. An analysis for each pasture should be made before use. This is a way to establish the sustainability for each pasture.

Locating the areas to which the regulations will be applied:
This regulation should be imposed in all the pasturage regions within the boundaries of the Nemira Peak Natura 2000 site. According to the field research, the most damaged pastures are those from Farcu, Nemira, Ţiganca, and Şandru.

- terrestrial plants' harvesting

Plant harvesting together with the underground parts causes the extinction of many plant individuals from that area. This fact should be restricted and fines should be enforced in case of non-compliance. Plant collection with their underground parts should be done only with the curator's acceptance and just for those individuals in stable populations with a favourable preservation status. This aspect should be vulgarized by means of info pannels, brochures, flyers, info campaigns, and volunteers.

The info pannels, brochures, flyers, maps of tourist paths, info campains, and volunteers should be located at the site entrance, all along the tourist paths, in the resting zones, info points, chalets, guesthouses within the site and surrounding it.
- outdoor sports and leisure activities

The tourist paths and camping areas should be permanently maintained, so that the tourists won't miss the right track. The tourists should be informed about what is allowed and what is forbidden (by means of info boards, flyers, brochures, maps of the tourist tracks), and about the regulations and fines in case of non-compliance.

Soil pollution and solid waste; H05.01 – litter and solid waste.

Regarding the solid waste, the most appropriate solution is to inform the tourists to gather their waste into garbage bags and deposit them at the nearest dumpster. In order to avoid the gathering of litter from tourist visits, we recommend the start of „Garbage-Free" strategy, that is successfull in the parks and reserves from Western Europe and Northern America, where the tourists are informed that there are no litter dumpsters within the site, and that implies their obligation to collect and carry their our food leftovers and wrappings.

Environmental alterations: J01 – fire and fire control

Lighting fire should be forbidden within the site boundaries. The tourists should be informed on this matter and on the regulations enforced in case of non-compliance.

The info pannels, brochures, flyers, maps of tourist paths, info campains, and volunteers should be located at the site entrance, all along the tourist paths, in the resting zones.

CONCLUSIONS

Regarding arnica's habitat, the species is frequent from the beech level up to the alpine level, within meadows and bushes.
Arnica montana is an endemic species in Europe, widely spread in hundreds of sites. The populations of arnica are stable in some countries and endangered in others.

The arnica's preservation status is a favourable one in Romania due to its abundance. The threats for

this species is the decline of its habitats in some areas and the wrong harvesting of the arnica plants (underground plants included).

The threats for this species are: intensive pasturage, advanced growth of the young spruce trees, plant harvest for medicinal purposes, climate changes, tourism, fire, trotting the plants to their destruction.

Several regulations to diminish the impact were recommended, so that arnica should keep its favourable preservation status for a long time. The info pannels, brochures, flyers, maps of tourist paths, info campains, and volunteers should be located at the site entrance, all along the tourist paths, in the resting zones, info points, chalets, guesthouses within the site and surrounding it.

ABSTRACT

Arnica montana is an endemic species in Europe, widely spread in hundreds of sites. The populations of arnica are stable in some countries and endangered in others. The reasons of this decline are represented by its harvesting for medicinal purposes and, to some extent, by the habitat diminishing. The species is keen to the alpine and subalpine meadows, and to the acidic soils rich in nutrients. The arnica's preservation status is a favourable one in Romania due to its abundance. Nevertheless, in the near future its status should be thoroughly monitored as the specific habitats will begin their decline.

The purpose of this scientific paper is to analyze the distribution area of this species within the investigated site, the types of habitats in which the species were identified, the relation between arnica and the environment, the identification of the possible menaces, and the new management regulations for a sustainable preservation.

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