

MONITORING AND ASSESSMENT OF *CLADINA* SUBGENUS IN ROMANIA UNDER ARTICLE 17 OF THE HABITATS DIRECTIVE 92/43/EEC

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The present study is based on the monitoring of *Cladina* subgenus in Romania and reporting under the Article 17 of the Habitats Directive, 1992. Within this study were identified four lichen species included in *Cladina* subgenus, namely: *Cladina arbuscula*, *Cladina ciliata*, *Cladina portentosa*, and *Cladina rangiferina*. The identified lichen species were monitoring and evaluated especially in the mountain areas from the alpine bioregion.

Keywords: *Cladina*, Habitats Directive 92/43/EEC, Romania.

INTRODUCTION

At the European level, the Habitats Directive (1992) promote the conservation of the lichen species included in the *Cladina* subgenus which are community interest. Also, Romanian legislative framework highlight the protection of species belonging to *Cladina* subgenus (GEO, 2007; Law no. 49/2011).

The Habitats Directive (1992) on the conservation of natural habitats and of wild fauna and flora aims to promote the maintenance of biodiversity and take into account the economic, social, cultural, and regional requirements. The Habitats Directive (1992) ensures the conservation of a wide range of rare, threatened or endemic animal and plant species. In this sense, *Cladina* subgenus which is included in Natura 2000 code 1378 in the Annex V animal and plant species of community interest whose wild nature and exploitation may be subject to management measures (Habitats Directive, 1992). Furthermore, *Cladina rangiferina* (L.) Web. has pharmaceutical importance therefore was used to treat various diseases of the human body (Zambare *et. al*, 2012).

The exploitation of lichen species included in the *Cladina* subgenus was an important reason for their inclusion in the Annex V of the Habitats Directive (1992).

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Natura 2000 network protect all species included in *Cladina* subgenus and their habitats with all characteristics (Martínez *et al.*, 2006; Gheza *et al.*, 2020).

At the European level, *Cladina* subgenus is represented by the following species: *Cladonia arbuscula*, *C. ciliata*, *C. portentosa*, *C. rangiferina*, *C. stellaris*, and *C. Stygia*; these species are widespread especially in boreal area in the following biogeographical regions: Alpine, Atlantic, Boreal, Continental, Macaronesian, Mediterranean, and Pannonian (Eionet Forum, 2016).

The mentioned above lichen species are frequently found in different types of forests from boreal area and are found in environments with a low content of nutrients (Eionet Forum, 2016). In the Black Sea and Steppic biogeographical regions were not reported any information on the occurrence of species included in *Cladina* subgenus; furthermore countries such as Bulgaria, Greece, Lithuania, Slovakia and Slovenia, have not reported the information on species included in the *Cladina* (Eionet Forum, 2016).

As regard the report during 2013–2018, European Environmental Agency summarized all informations received from member states on species and habitats conservation status (European Environment Agency, 2020).

MATERIALS AND METHODS

The conservation status of species included in *Cladina* subgenus was assessed using data that were acquired as a result of the first national monitoring of species and habitats.

Monitoring of the conservation status of the species and their habitats of community interest from each EU member State is an obligation arising from Article 11 and reporting under Article 17 of the Habitats Directive (1992). First Romanian monitoring was carried out during 2007–2012, following the mandatory requirements arising from Article 17 of the Habitats Directive (1992) for EU member states, to report the status of community interest species in 2013 (Fig. 1). The second monitoring was carried out during 2003–2018 and the status of community interest species was reported in 2019 (Fig. 2).

The coverage of lichen species was assessed using sampling units of 2×2 m (4 m^2) all included in 1×1 km grid cells. Within each sampling unit the coverage of lichen species was estimated as cover percentage.

All data were collected within Sites of Community Importance from Romania (ROSCI) as follow: ROSCI0019 Călimani-Gurghiu, ROSCI0024 Ceahlău, ROSCI0125 Munții Rodnei, ROSCI0128 Nordul Gorjului de Est, and ROSCI0217 Retezat. The investigated lichen species were identified within 29 sampling units in the studied areas (Table 1).

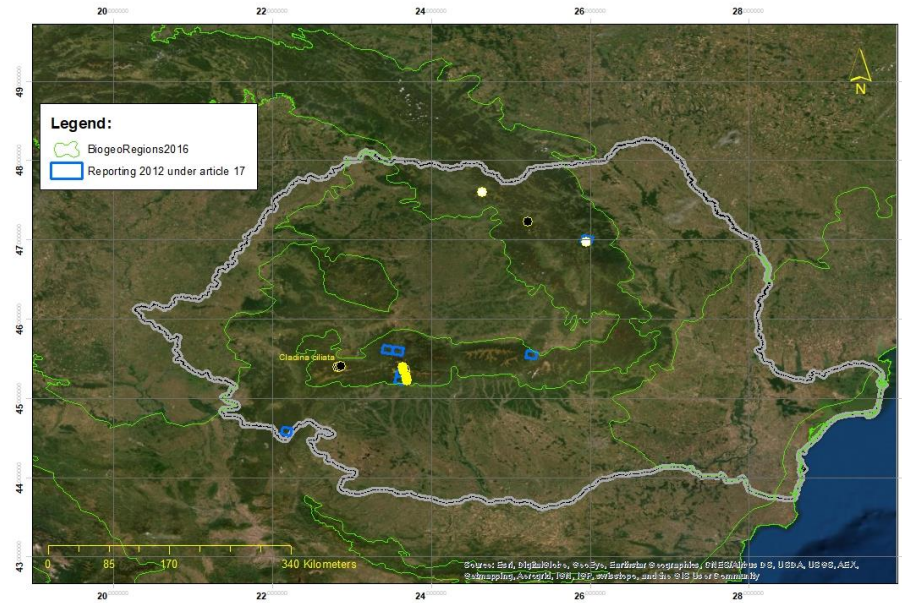


Fig. 1 The distribution of the *Cladina* subgenus in Romania reported in 2013

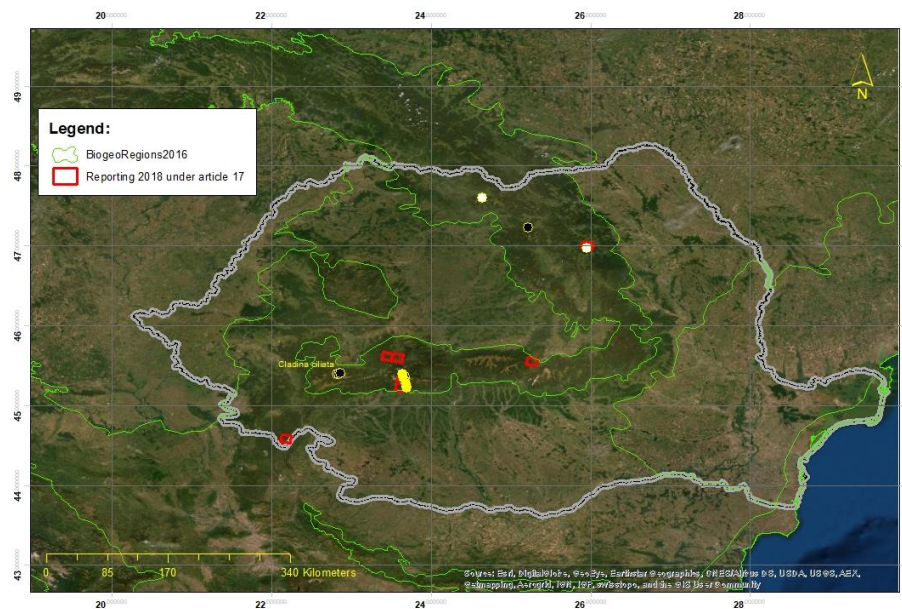


Fig. 2 The distribution of the *Cladina* subgenus in Romania reported in 2019

Table 1

Sites of Community Importance from Romania within lichen species of *Cladina* subgenus were identified and the associated number of sampling units

ROSCI	<i>Number of sampling units within the lichen species were identified</i>			
	<i>C. arbuscula</i>	<i>C. ciliata</i>	<i>C. portentosa</i>	<i>C. rangiferina</i>
ROSCI0019	2	-	1	-
ROSCI0024	1	-	-	-
ROSCI0125	1	-	-	-
ROSCI0128	6	-	5	4
ROSCI0217	3	1	5	-

Legend: ROSCI: Sites of Community Importance from Romania; - no available data

RESULTS AND DISCUSSIONS

During 2019 and 2020 we continued the surveillance and monitoring using the same method (complete survey or a statistically robust estimate) and data resulting from monitoring will be included in the next report to the EC in 2025. In this period, based on field activities, were identified four lichen species included in *Cladina* subgenus and under Natura 2000 code 1378, as follows: *Cladina arbuscula*, *Cladina ciliata*, *Cladina portentosa*, and *Cladina rangiferina* (Habitats Directive, 1992).

REPORTING THE CONSERVATION STATUS UNDER THE ARTICLE 17 OF THE HABITATS DIRECTIVE

The assessment of the effects of conservation policies and the progress performed with the implementation of Habitats Directive, the European Commission requires periodic assessments of the species and habitat types at national and biogeographical levels, followed by reporting every 6 years (Habitats Directive, 1992). According to the Habitats Directive (1992), the conservation status is based on the concept of "Favorable Conservation Status" and the degree of deviation from this status.

In 2007, lichen species were not mentioned in the Standard Forms for Natura 2000 sites in Romania and have not been updated in December 2020 (<http://www.mmediu.ro/>) despite the fact that the species of the *Cladina* subgenus were evaluated for reporting to the European Commission in 2013 (Mihăilescu *et al.* 2015) and 2019 (unpublished data). In the both reports, the conservation status assessment for the biogeographical regions ALP was established as favourable.

At the European level, the member states reported the main pressures and threats on species included in *Cladina* subgenus such as: atmospheric pollution, land use type, management practices on vegetation communities, different transport infrastructures, pastoral activities, buildings, collection of vegetal material, etc. (Eionet Forum, 2016). In Romania, the main threats on *Cladina* subgenus observed in the investigated habitats are building activities, exploitation of natural resources, pastoral activities, tourism, and vehicular traffic.

THE GEOGRAPHICAL DISTRIBUTION OF *CLADINA* SUBGENUS
IN ROMANIA BETWEEN 2019–2020

Cladina arbuscula (Wallr.) Rabenh.

Gorj County, ROSCI0128 Nordul Gorjului de Est, between Rânca and Novaci, alt. 980 m, lat. 45.21875°N, long. 23.69538°E, leg. Vicol Ioana, 17.10.2019, det. Vicol Ioana, 22.10.2019; alt. 1040 m, lat. 45.22115°N, long. 23.69744°E, leg. Vicol Ioana, 17.10.2019, det. Vicol Ioana, 23.10.2019; alt. 1265 m, lat. 45.23715°N, long. 23.69236°E, leg. Vicol Ioana, 17.10.2019, det. Vicol Ioana, 22.10.2019; alt. 1562 m, lat. 45.27158°N, long. 23.68675°E, leg. Vicol Ioana, 17.10.2019, det. Vicol Ioana, 23.10.2019; between Rânca and Obârșia Lotrului, towards Parângul Mare Peak, alt. 1999 m, lat. 45.35135°N, long. 23.65059°E, leg. Vicol Ioana, 16.10.2019, det. Vicol Ioana, 06.11.2019; alt. 2073 m, lat. 45.34113°N, long. 23.67009°E, leg. Vicol Ioana, 16.10.2019, det. Vicol Ioana, 22.10.2019; **Hunedoara County**, ROSCI0217 Retezat, towards Ștevia Lake, near Ștevia Stream, alt. 1855 m, lat. 45.39350°N, long. 22.84397°E, leg. Vicol Ioana, 28.08.2019, det. Vicol Ioana, 04.09.2019; Șaua Ciurila, alt. 1830 m, lat. 45.40384°N, long. 22.86372°E, leg. Vicol Ioana, 29.08.2019, det. Vicol Ioana, 05.09.2019; Creasta Preluce, alt. 1847 m, lat. 45.39296°N, long. 22.81991°E, leg. Vicol Ioana, 27.08.2019, det. Vicol Ioana, 05.09.2019; **Maramureș County**: ROSCI0125 Munții Rodnei, Pietrosul Rodnei, near Pietrosul Rodnei Peak, Curmătura Pietrosului, alt. 2236 m, lat. 47.59423°N, long. 24.63697°E, leg. Vicol Ioana, 26.06.2020, det. Vicol Ioana, 29.06.2020; **Neamț County**, ROSCI0024 Ceahlău, Lespezi Peak, alt. 1799 m, lat. 46.96730°N, long. 25.94802°E, leg. Vicol Ioana, 24.09.2019, det. Vicol Ioana, 01.10.2019; **Suceava County**, ROSCI0019 Călimani-Gurghiu, Doisprezece Apostoli Peak, leg. Vicol Ioana, 19.06.2019, det. Vicol Ioana, 24.06.2019; alt. 1594 m, lat. 47.21791°N, long. 25.22443°E, leg. Vicol Ioana, 26.09.2019, det. Vicol Ioana, 01.09.2019; alt. 1736 m, lat. 47.22127°N, long. 25.21273°E, leg. Vicol Ioana, 26.09.2019, det. Vicol Ioana, 01.10.2019. In Romania, *C. arbuscula* is distributed in the ALP biogeographical region, especially in the Oriental and Meridional Carpathians (Fig. 3).

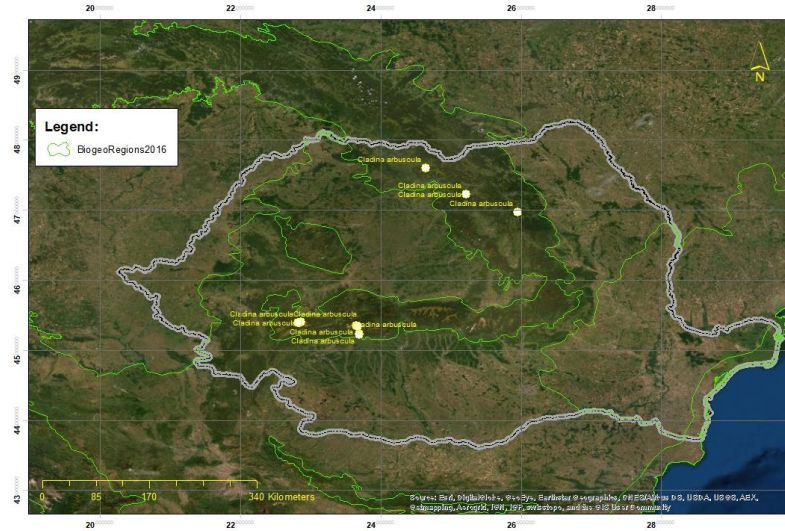


Fig. 3 The distribution of the *Cladina arbuscula* in Romania

***Cladina ciliata* Stirt.**

Hunedoara County: ROSCI0217 Retezat, towards Ștevia Lake, near Ștevia Stream, alt. 1855 m, lat. 45.39350°N, long. 22.84397°E, leg. Vicol Ioana, 28.08.2019, det. Vicol Ioana, 04.09.2019. In Romania, *Cladina ciliata* is distributed in the ALP biogeographical region, especially in Meridional Carpathians (Fig. 4).

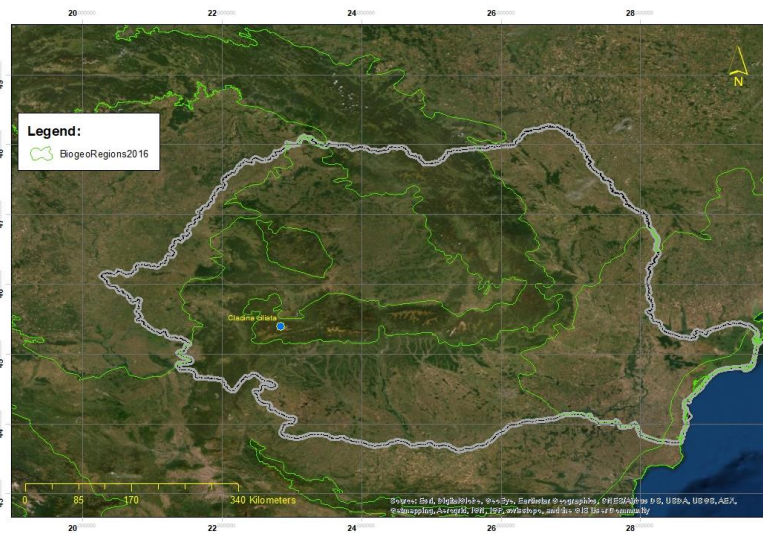


Fig. 4 The distribution of the *Cladina ciliata* in Romania

***Cladina portentosa* (Dufour.) Coem.**

Gorj County: ROSCI0128 Nordul Gorjului de Est, between Rânca and Novaci, alt. 980 m, lat. 45.21875°N, long. 23.69538°E, leg. Vicol Ioana, 17.10.2019, det. Vicol Ioana, 21.10.2019; alt. 1009 m, lat. 45.22014°N, long. 23.69600°E, leg. Vicol Ioana, 17.10.2019, det. Vicol Ioana, 21.10.2019; alt. 1265 m, lat. 45.23715°N, long. 23.69236°E, leg. Vicol Ioana, 17.10.2019, det. Vicol Ioana, 22.10.2019; between Rânca and Obârșia Lotrului, alt. 1720 m, lat. 45.38879°N, long. 23.64457°E, leg. Vicol Ioana, 17.10.2019, det. Vicol Ioana, 22.10.2019; alt. 2025 m, lat. 45.35876°N, long. 23.66776°E, leg. Vicol Ioana, 17.10.2019, det. Vicol Ioana, 22.10.2019; **Hunedoara County:** ROSCI0217 Retezat, towards Șaua Ciurila, alt. 1578 m, lat. 45.40909°N, long. 22.85538°E, leg. Vicol Ioana, 29.08.2019, det. Vicol Ioana, 04.09.2019; Șaua Ciurila, alt. 1830 m, lat. 45.40384°N, long. 22.86372°E, leg. Vicol Ioana, 29.08.2019, det. Vicol Ioana, 05.09.2019; Creasta Preluce, alt. 1836 m, lat. 45.39315°N, long. 22.81974°E, leg. Vicol Ioana, 27.08.2019, det. Vicol Ioana, 05.09.2019; towards Ștevia Lake, near Ștevia Stream, alt. 1855 m, lat. 45.39350°N, long. 22.84397°E, leg. Vicol Ioana, 28.08.2019, det. Vicol Ioana, 04.09.2019; Lolaia Peak, alt. 1971 m, lat. 45.40121°N, long. 22.86019°E, leg. Vicol Ioana, 29.08.2019, det. Vicol Ioana, 05.09.2019; **Suceava County:** ROSCI 0019 Călimani-Gurghiu, 12 Apostoli Peak, alt. 1736 m, lat. 47.22127°N, long. 25.21273°E, leg. Vicol Ioana, 26.09.2019, det. Vicol Ioana, 01.09.2019. In Romania, *Cladina portentosa* is distributed in the ALP biogeographical region, especially in the Oriental and Meridional Carpathians (Fig. 5).

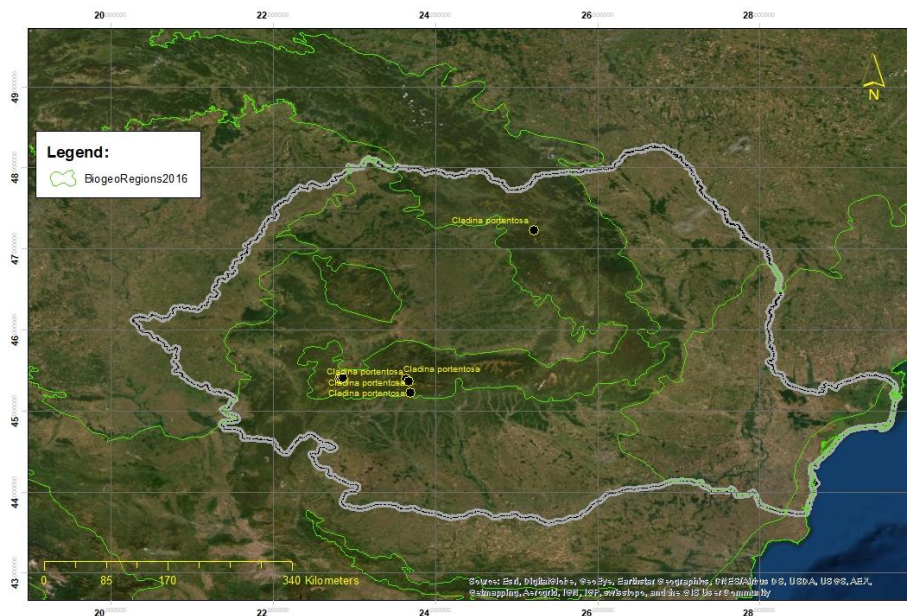


Fig. 5 The distribution of the *Cladina portentosa* in Romania

Cladina rangiferina (L.) Web.

Gorj County: ROSCI0128 Nordul Gorjului de Est, between Râncea and Novaci, alt. 1265 m, lat. 45.23715°N, long. 23.69236°E, leg. Vicol Ioana, 17.10.2019, det. Vicol Ioana, 22.10.2019; between Râncea and Obârșia Lotrului, alt. 1562 m, lat. 45.27158°N, long. 23.68675°E, leg. Vicol Ioana, 17.10.2019, det. Vicol Ioana, 23.10.2019; alt. 1720 m, lat. 45.38879°N, long. 23.64457°E, leg. Vicol Ioana, 17.10.2019, det. Vicol Ioana, 22.10.2019; towards Parângul Mare Peak, alt. 1999 m, lat. 45.35135°N, long. 23.65059°E, leg. Vicol Ioana, 16.10.2019, det. Vicol Ioana, 06.11.2019. In Romania, *Cladina rangiferina* is distributed in the ALP biogeographical region, especially in the Meridional Carpathians (Fig. 6).

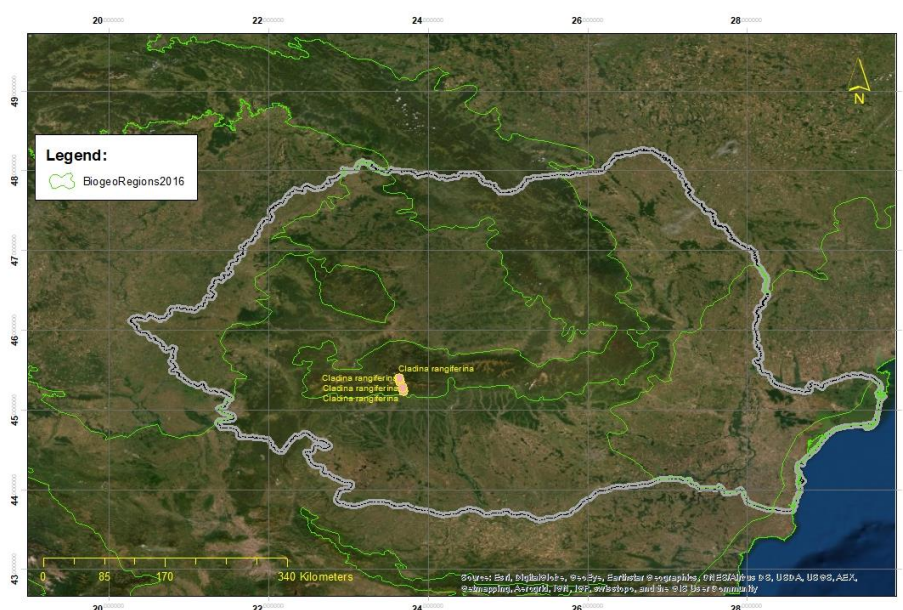


Fig. 6 The distribution of the *Cladina rangiferina* in Romania

CONCLUSIONS

In Romania, the presence of the species included in the *Cladina* subgenus was mentioned in the Carpathians, and their conservation status was favorable. Otherwise, at the European level, especially in alpine bioregion the report on the *Cladina* subgenus revealed for Romanian Carpathians a non-favorable conservation status (Eionet Forum, 2016). Because the Standard Forms of Natura 2000 sites were not updated in December 2020 (<http://www.mmediu.ro/>), consequently their management plans do not include conservation measures for protected species as lichens included in *Cladina* subgenus.

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