

THE LICHEN FLORA OF THE COMANA NATURAL PARK

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Abstract. The forestry continuity and the occurrence of red-listed lichens are critical criteria needed for the designation of protected areas. This study highlights the occurrence in time of red-listed lichen species within the Comana Natural Park. 31 lichens were identified within the study area, of which one is designated as national red-listed lichen such as *Ramalina obtusata* and the other one is designated as global red-listed lichen by IUCN, for instant *Flavoparmelia caperata*. An important aspect is represented by the occurrence of *F. caperata* on old oaks both in the Padina Tătarului Peony Reserve and in the Oloaga-Grădinari Butcher's broom Reserve. The forest habitats of the Comana Natural Park are mainly represented by old-growth forests and therefore is important to reduce the anthropogenic impact on these habitats needed for the long-term conservation of lichen species.

Keywords: Comana Natural Park, habitat conservation, IUCN, old-growth forests, red-listed lichen.

Rezumat. Flora lichenilor din Parcul Natural Comana. Continuitatea forestieră și prezența lichenilor în listele roșii sunt criterii critice necesare pentru desemnarea ariilor protejate. Acest studiu evidențiază prezența de-a lungul timpului a speciilor de licheni incluși în listele roșii din Parcul Natural Comana. În cadrul ariei studiate au fost identificate 31 de specii de licheni dintre care o specie este desemnată în Lista Roșie Națională a lichenilor, de exemplu *Ramalina obtusata* și o altă specie este desemnată în Lista Roșie Globală a lichenilor, de exemplu *Flavoparmelia caperata*. Un aspect important este reprezentat de prezența speciei *F. caperata* pe stejari seculari atât în Rezervația de bujori Padina Tătarului cât și în Rezervația de ghimpe Oloaga Grădinari. Habitatele forestiere din Parcul Natural Comana sunt reprezentate de păduri seculare și de aceea este important să se reducă impactul antropogen asupra acestor habitate necesar pentru conservarea speciilor de licheni.

Cuvinte cheie: Parcul Natural Comana, conservarea habitatelor, IUCN, păduri seculare, licheni incluși în listele roșii.

INTRODUCTION

The Comana Natural Park is one of the protected areas included in category V of IUCN and therefore is important for species and habitats conservation due to suitable management associated with traditional human activities (DUDLEY, 2008).

The Comana Natural Park is situated near Bucharest and therefore is strongly subjected to a significant anthropogenic pressure highlighted especially by deforestation (SÂRBU et al., 2007); therefore, legislative tools must be implemented for the sustainable development of species and their habitats (SANCHEZ et al., 2021). Also, cultural and traditional anthropogenic activities play an important role in stopping biodiversity deterioration and balance the relationships between environment and humans (CAO et al., 2021; TUPALA et al., 2022). Within the Comana Natural Park, the first researches on lichen species were performed during 1933-1943 (CRETZOIU, 1933; ERICHSEN, 1934; SERVIT et al., 1934; CRETZOIU, 1935; 1937a; b; ERICHSEN, 1938; CRETZOIU, 1943) and later, much later, in 2022, research activities were performed on lichen species within a scientific research project RO1567-IBB04/2022 of the Institute of Biology of the Romanian Academy (Bucharest, Romania).

The aim of this study is to highlight the lichen flora of the Comana Natural Park across time and reveal the red-listed lichen species designated at national and global level. The main concern of this study is based on the occurrence of red-listed lichen species within the Comana Natural Park.

MATERIALS AND METHODS

The Comana Natural Park is situated in the Southern part of Romania, in the Giurgiu County, within continental biogeographical region at 44°09' lat. and 26°07' long. with altitudes between 37-65 m (SÂRBU et al., 2007). The climate is temperate-continental with southern influences (SÂRBU et al., 2007). The Comana Natural Park is represented by South-east European subtermophile forests subjected to uncontrolled deforestation (SÂRBU et al., 2007). Both epiphytic lichen species and lignicolous lichen species were collected in the Comana Natural Park. In the case of host trees for epiphytic lichens, the tree girth was measured at a height of 1 m above the ground.

The nomenclature of lichen species is based on the Index Fungorum (***. <http://www.indexfungorum.org/>) and MYCOBANK Database (ROBERT et al., 2005). The Nomenclature of host trees of lichens was updated according to IPNI (2023). The following abbreviations were used in this study: alt. (altitude), BUCM L (Bucharest, Mycology Herbarium, Lichen Collection), lat. (latitude), leg. (researcher who collected the specimen), long. (longitude), det. (researcher who identified the specimen), and LRE (Lichenes Romaniae Exsiccati).

A great part of data presented in this study were collected from the field as original data and the other were gathered from herbarium (BUCM L) and from literature. The collected lichen species from the field were identified according to CIURCHEA (2004) and PURVIS et al. (1994). The collected specimens were determined using chemical reagents such as calcium chloride, chlorine, iodine-potassium iodide and potassium hydroxide.

RESULTS AND DISCUSSIONS

A total of 31 lichen species were identified across time within the Comana Natural Park, of which a large part is represented by epiphytic lichens followed by lignicolous and terricolous lichen species. Of all identified species one is included in the Red List of Lichens from Romania for instant *Ramalina obtusata* (Arnold) Bitter (VICOL & MIHĂILESCU, 2022) and the other one is included in the Red List of IUCN for instant *F. caperata* (ALLEN et al., 2020).

Data regarding the lichen species included in Red List of Lichens from Romania (VICOL & MIHĂILESCU, 2022) and in Red List of IUCN, with a significant zoological importance (ALLEN et al. 2020), are presented in this paper. As regards the Red List of Lichens from Romania, only *R. obtusata* was identified within the Comana Natural Park for the first time in 1935 and almost 90 years have passed since then, but this species has not been retrieved within this protected area (VICOL, 2022). *Flavoparmelia caperata* is one of the lichen species included in the IUCN Red List which has appeared in the Comana Natural Park in different locations, such as Gligore's Cross (CRETZOIU, 1937a), the Padina Tătarului Peony Reserve and the Oloaga-Grădinari Oloaga-Grădinari Butcher's broom Reserve (VICOL, 2022 personal communication).

Flavoparmelia caperata is worldwide spread in temperate forests and is listed according to IUCN criteria as being of Least Concern (ALLEN et al. 2020).

The list of lichens identified within the Comana Natural Park is as follows:

Anaptychia ciliaris (L.) Flot.

Comana Forest (CRETZOIU, 1933; MORUZI et al., 1967).

Acrocordia gemmata (Ach.) A. Massal.

Comana Natural Park, Oloaga-Grădinari Butcher's broom Reserve, on *Carpinus betulus* L., leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 22.07.2022, lat. 44.1500609°N, long. 26.1227743°E, alt. 147 m [BUCM L3514].

Arthothelium spectabile A. Massal.

Comana Forest, Walnut Fountain (CRETZOIU, 1943; MORUZI et al., 1967).

Bacidia rubella (Hoffm.) A. Massal.

Comana Natural Park, Padina Tătarului Peony Reserve, on *Fraxinus* sp., leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 21.07.2022, lat. 44.1346366°N, long. 26.1466715°E, alt. 134 m [BUCM L3501].

Evernia prunastri (L.) Ach.

Comana Forest, Walnut Fountain (CRETZOIU, 1933; MORUZI et al., 1967), Comana Natural Park, Padina Tătarului Peony Reserve, on *Quercus* sp., leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 21.07.2022 [BUCM L3508; BUCM L3519; BUCM L3520; BUCM L3521; BUCM L3522], on lignicolous substrata, leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 21.07.2022, lat. 44.1346366°N, long. 26.1466715°E, alt. 134 m [BUCM L3525].

Flavoparmelia caperata (L.) Hale

Comana Forest, Gligore's Cross, on corticolous substrata, leg. Cretzoiu P., 24.02.1937 [BUCM L0766; LRE 66], CRETZOIU (1933); CRETZOIU (1937a); MORUZI et al. (1967); VICOL (2022), Comana Natural Park, Padina Tătarului Peony Reserve, on *Quercus* sp., leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 16.06.2022, Oloaga-Grădinari Butcher's broom Reserve, on *Quercus* sp., leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 16.06.2022, lat. 44.1500609°N, long. 26.1227743°E, alt. 147 m.

Glaucomaria carpinea (L.) S.Y. Kondr., Lökös & Farkas

Comana Natural Park, Oloaga-Grădinari Butcher's broom Reserve, on lignicolous substrata, leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 22.07.2022, lat. 44.1500609°N, long. 26.1227743°E, alt. 147 m [BUCM L3511].

Graphis scripta (L.) Ach.

Comana Natural Park, Padina Tătarului Peony Reserve, on *Quercus* sp., leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 16.06.2022, Oloaga-Grădinari Butcher's broom Reserve, on *Fraxinus* sp., leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 16.06.2022, on *Tilia* sp., leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 22.07.2022, [BUCM L3504], on *Carpinus betulus* L., leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 16.06.2022, lat. 44.1500609°N, long. 26.1227743°E, alt. 147 m.

Hypogymnia tubulosa (Schaer.) Hav.

Comana Natural Park, Oloaga-Grădinari Butcher's broom Reserve, on lignicolous substrata, leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 21.07.2022, lat. 44.1500609°N, long. 26.1227743°E, alt. 147 m [BUCM L3515].

Lecanora albella (Pers.) Ach.

Comana Forest, Walnut Fountain (CRETZOIU, 1943; MORUZI et al., 1967).

Lepra albescens (Huds.) Hafellner

Comana Forest, near Comana Lake, Walnut Fountain (CRETZOIU, 1937b; CRETZOIU, 1943; ERICHSEN, 1934; MORUZI et al., 1967; SERVIT et al., 1934).

Lepra multipuncta (Turner) Hafellner

Comana Forest, Walnut Fountain (CRETZOIU, 1937b; CRETZOIU, 1943; ERICHSEN, 1938; MORUZI et al., 1967).

Melanelixia glabrata (Lamy ex Nyl.) Sandler & Arup

Comana Natural Park, Padina Tătarului Peony Reserve, on *Quercus* sp., leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 22.07.2022, lat. 44.1346366°N, long. 26.1466715°E, alt. 134 m [BUCM L3500].

Xanthoparmelia verruculifera (Nyl.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch

Comana Forest, Walnut Fountain (CRETZOIU, 1935; MORUZI et al., 1967).

Parmelia sulcata Taylor

Comana Forest (SERVIT et al., 1934), Comana Natural Park, Padina Tătarului Peony Reserve, on *Quercus* sp., leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 16.06.2022, lat. 44.1346366°N, long. 26.1466715°E, alt. 134 m, Oloaga-Grădinari Butcher's broom Reserve, on *Quercus* sp., leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 16.07.2022, lat. 44.1500609°N, long. 26.1227743°E, alt. 147 m.

Peltigera didactyla (With.) J.R. Laundon

Comana Forest (CRETZOIU, 1943; CRETZOIU & KLEMENT, 1935; MORUZI et al., 1967).

Peltigera malacea (Ach.) Funck

Comana Forest, terricol, leg. Klement O., 04.1935, det. Cretzoiu P. [BUCM L1158; LRE 5], CRETZOIU (1936); CRETZOIU (1943); CRETZOIU & KLEMENT (1935); MORUZI et al. (1967); VICOL (2022).

Pertusaria leioplaca (Ach.) DC.

Comana Forest, Walnut Fountain (CRETZOIU, 1937b; CRETZOIU, 1943; MORUZI et al., 1967).

Phaeophyscia orbicularis (Neck.) Moberg

Comana Natural Park, Padina Tătarului Peony Reserve, on *Fraxinus* sp., leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 21.07.2022, lat. 44.1346366°N, long. 26.1466715°E, alt. 134 m, [BUCM L3523], Oloaga-Grădinari Butcher's broom Reserve, on *Fraxinus* sp., leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 21.07.2022, [BUCM L3524], on *Tilia* sp., leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 21.07.2022, [BUCM L3518], on lignicolous substrata, leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 21.07.2022, [BUCM L3507], lat. 44.1500609°N, long. 26.1227743°E, alt. 147 m.

Physcia adscendens H. Olivier

Comana Natural Park, Oloaga-Grădinari Butcher's broom Reserve, on lignicolous substrata, leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 21.07.2022, lat. 44.1500609°N, long. 26.1227743°E, alt. 147 m [BUCM L3506; BUCM L3530].

Physcia aipolia (Ehrh. ex Humb.) Fűrnr.

Comana Forest, on corticolous substrata, leg. Cretzoiu P., 16.05.1940 [BUCM L1094; LRE 128], Vicol (2022), Comana Natural Park, Oloaga-Grădinari Butcher's broom Reserve, on lignicolous substrata, leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 21.07.2022, [BUCM L3516; BUCM L3517], leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 22.07.2022, lat. 44.1500609°N, long. 26.1227743°E, alt. 147 m [BUCM L3531].

Physcia stellaris (L.) Nyl.

Comana Natural Park, Oloaga-Grădinari Butcher's broom Reserve, on lignicolous substrata, leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 21.07.2022, lat. 44.1500609°N, long. 26.1227743°E, alt. 147 m [BUCM L3527].

Physcia tenella (Scop.) DC.

Comana Forest (CRETZOIU, 1933; MORUZI et al., 1967).

Pseudevernia furfuracea (L.) Zopf

Comana Natural Park, Padina Tătarului Peony Reserve, on lignicolous substrata, leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 21.07.2022, lat. 44.1346366°N, long. 26.1466715°E, alt. 134 m [BUCM L3526].

Ramalina fastigiata (Pers.) Ach.

Comana Forest (CRETZOIU, 1933; MORUZI et al., 1967).

Ramalina obtusata (Arnold) Bitter

Comana Forest, Walnut Fountain, on corticolous substrata, leg. Cretzoiu P., Klement O., 11.1935 [BUCM L1210; LRE 34], CRETZOIU (1937c); MORUZI et al. (1967); VICOL (2022).

Ramalina pollinaria (Westr.) Ach.

Comana Forest (CRETZOIU, 1937b; MORUZI et al., 1967).

Schaereria fuscocinerea (Nyl.) Clauzade & Cl. Roux

Comana Natural Park, Oloaga-Grădinari Butcher's broom Reserve, on lignicolous substrata, leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 22.07.2022, lat. 44.1500609°N, long. 26.1227743°E, alt. 147 m [BUCM L3486].

Varicellaria hemisphaerica (Flörke) I. Schmitt & Lumbsch

Comana Natural Park, Oloaga-Grădinari Butcher's broom Reserve, on *Tilia* sp., leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 22.07.2022, lat. 44.1500609°N, long. 26.1227743°E, alt. 147 m [BUCM L3529; BUCM L3505].

Xanthoria parietina (L.) Th. Fr.

Comana Forest (CRETZOIU, 1933), Comana Natural Park, Padina Tătarului Peony Reserve, on lignicolous substrata, leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 21.07.2022, lat. 44.1346366°N, long. 26.1466715°E, alt. 134 m, [BUCM L3502], Oloaga-Grădinari Butcher's broom Reserve, on lignicolous substrata, leg. Vicol Ioana, 16.06.2022, det. Vicol Ioana, 16.06.2022, lat. 44.1500609°N, long. 26.1227743°E, alt. 147 m [BUCM L3528].

Xylographa parallela (Ach.) Fr.

Comana Forest, Walnut Fountain (CRETZOIU, 1943).

A great part of lichen species were identified on old trees which denotes forest continuity conserved during time within the Comana Natural Park (Table 1). Forest continuity is an important criterion as regards the designation of protected areas and species and their habitats conservation (FRITZ et al., 2008; MÖLDER et al., 2021; RANIUS et al., 2023).

Table 1. The circumferences of host trees on which lichen species have been identified within the Comana Natural Park (only original data are included in the table).

Species	Host tree	Tree girth (m)	Collection date
<i>Acrocordia gemmata</i>	<i>Carpinus betulus</i>	0,95	16.06.2022
<i>Evernia prunastri</i>	<i>Quercus</i> sp.	0,72	16.06.2022
<i>Evernia prunastri</i>	<i>Quercus</i> sp.	0,79	16.06.2022
<i>Evernia prunastri</i>	<i>Quercus</i> sp.	0,89	16.06.2022
<i>Evernia prunastri</i>	<i>Quercus</i> sp.	0,93	16.06.2022
<i>Evernia prunastri</i>	<i>Quercus</i> sp.	1,00	16.06.2022
<i>Flavoparmelia caperata</i>	<i>Quercus</i> sp.	0,98	16.06.2022
<i>Flavoparmelia caperata</i>	<i>Quercus</i> sp.	1,00	16.06.2022
<i>Flavoparmelia caperata</i>	<i>Quercus</i> sp.	1,20	16.06.2022
<i>Flavoparmelia caperata</i>	<i>Quercus</i> sp.	1,24	16.06.2022
<i>Flavoparmelia caperata</i>	<i>Quercus</i> sp.	1,43	16.06.2022
<i>Flavoparmelia caperata</i>	<i>Quercus</i> sp.	1,80	16.06.2022
<i>Graphis scripta</i>	<i>Carpinus betulus</i>	0,71	16.06.2022
<i>Graphis scripta</i>	<i>Carpinus betulus</i>	0,75	16.06.2022
<i>Graphis scripta</i>	<i>Carpinus betulus</i>	0,80	16.06.2022
<i>Graphis scripta</i>	<i>Carpinus betulus</i>	0,93	16.06.2022
<i>Graphis scripta</i>	<i>Carpinus betulus</i>	0,95	16.06.2022
<i>Graphis scripta</i>	<i>Fraxinus</i> sp.	0,96	16.06.2022
<i>Graphis scripta</i>	<i>Fraxinus</i> sp.	1,25	16.06.2022
<i>Graphis scripta</i>	<i>Quercus</i> sp.	0,79	16.06.2022
<i>Graphis scripta</i>	<i>Tilia</i> sp.	0,97	16.06.2022
<i>Melanelixia glabratula</i>	<i>Quercus</i> sp.	0,89	16.06.2022
<i>Parmelia sulcata</i>	<i>Quercus</i> sp.	0,85	16.06.2022
<i>Parmelia sulcata</i>	<i>Quercus</i> sp.	0,98	16.06.2022
<i>Parmelia sulcata</i>	<i>Quercus</i> sp.	1,00	16.06.2022
<i>Parmelia sulcata</i>	<i>Quercus</i> sp.	1,20	16.06.2022
<i>Phaeophyscia orbicularis</i>	<i>Tilia</i> sp.	0,97	16.06.2022
<i>Phaeophyscia orbicularis</i>	<i>Fraxinus</i> sp.	1,25	16.06.2022
<i>Varicellaria hemisphaerica</i>	<i>Tilia</i> sp.	0,97	16.06.2022
<i>Varicellaria hemisphaerica</i>	<i>Tilia</i> sp.	1,55	16.06.2022

The long-term conservation of protected habitats with a significant continuity and suitable forest management are important for red listed lichen species and their survival in a continuous anthropogenic pressure on natural environments (DUDLEY, 2008; MÖLDER et al., 2021; VICOL & MIHĂILESCU, 2022).

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