

## NOTE ON *CLADONIA* SPECIES (LICHENIZED ASCOMYCOTA) FROM ARDAHAN PROVINCE (TURKEY)

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### ABSTRACT

This paper is the first report on *Cladonia* species from Ardahan, a north-eastern province of Turkey. A circum-polar boreal-low arctic species, *Cladonia acuminata*, rarely reported from Asia, and the recently described *Cladonia monomorpha* are reported as new for Turkey. Their detailed descriptions and taxonomical remarks are provided. Localities of other ascertained *Cladonia* species in the province supplement the knowledge of their distribution patterns in the country. In addition, the typically corticolous/lignicolous species *Vulpicida pinastri* is mentioned as also growing on primary squamules and podetia of *C. pyxidata*.

KEY WORDS: lichens, *Cladonia*, biodiversity, geographical distribution.

### INTRODUCTION

Knowledge of the occurrence of lichens in Turkey is still insufficient, and this concerns both rare and even common species. Just recently lichen biota has been successively investigated in individual Turkish provinces and new species are still being added to the national list of lichens. At present, lichenological studies are being carried out in Ardahan Province (Yazici et al. 2010a, b). This study focuses on several *Cladonia* species which were ascertained in this region. Two of them, *C. acuminata* and *C. monomorpha*, are reported for the first time from Turkey.

Ardahan is a province of the Eastern Anatolia Region in the far north-east of Turkey where the country borders with Georgia (Fig. 1). According to the flora of Turkey (Davis 1965), the province is located in the grid square A9. It is a high mountain region where the continental climate is dominant, with a mild effect from the Black Sea. In Ardahan, Göle, and Hanak districts the climate is characterized by hot dry summers and cold snowy winters (mean annual temperature 6°C) and the mean annual rainfall is about 500-600 mm. In the collection area of Posof district, microclimatic conditions with moderately rainy winters and hot summers dominate (mean annual temperature 6.8°C) and mean annual rainfall is about 600 mm (Akman 1999).

### MATERIALS AND METHODS

Specimens were collected in 2008 and 2009 in Ardahan Province. The collection of *Cladonia* species originates from Ardahan, Göle, Hanak, and Posof districts and the localities are marked on the map – Figure 1. The materials

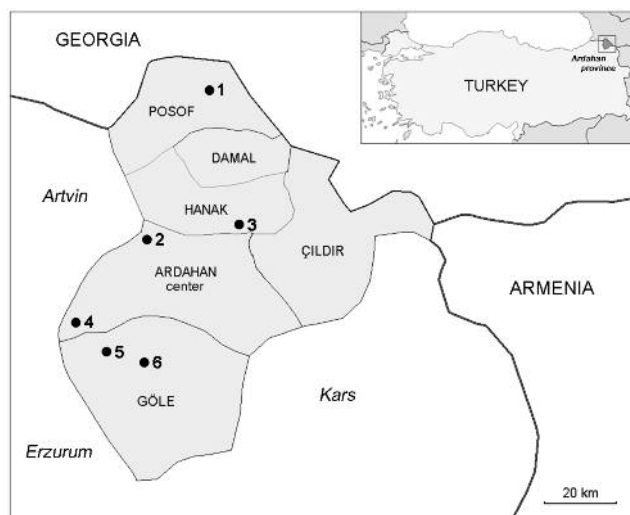


Fig. 1. Ardahan Province with localities of *Cladonia* under study.

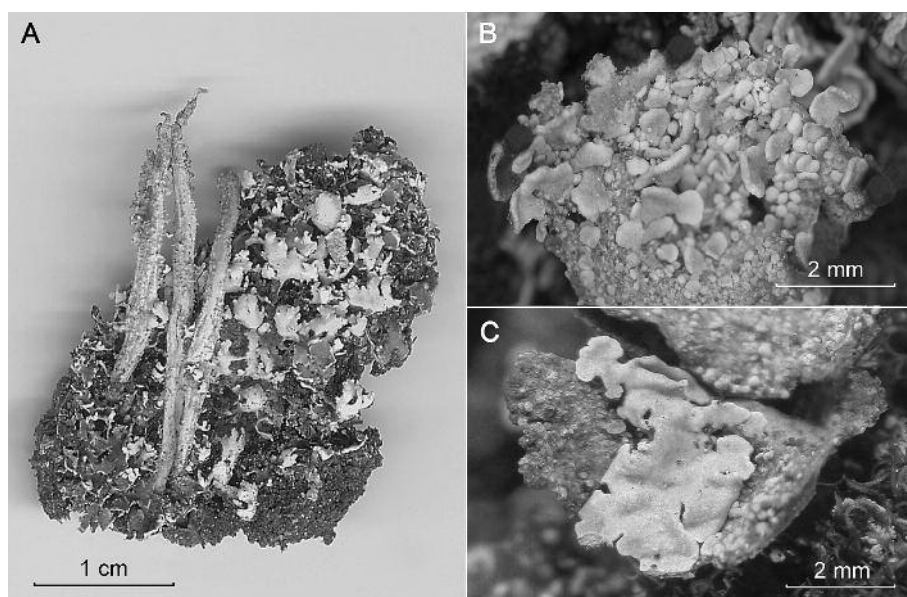


Fig. 2. Lichen specimens from Ardahan Province: **A** – *Cladonia acuminata* (Ach.) Norll., leg. K. Yazici, 07.12.2008 (KTUB 2024); **B** – *Cladonia monomorpha* Aptroot, Sipman & van Herk, inside of cup, leg. K. Yazici, 12.04.2009 (KTUB 2025); **C** – *Vulpicida pinastri* (Scop.) J.-E. Mattsson & M.J. Lai growing inside the cup of *Cladonia pyxidata* (L.) Hoffm., leg. K. Yazici, 12.04.2009 (KTUB 2028).

were examined using standard microscopic techniques supported by chemical analysis. Lichen substances were determined by thin layer chromatography (TLC, in solvents A and C) using the standard methods summarized by Orange et al. (2001). Descriptions of the species are based on original collections. Voucher specimens are deposited in the Herbarium of Karadeniz Technical University, Biology Department, Trabzon, Turkey (KTUB).

## RESULTS AND DISCUSSION

Ten species of the genus *Cladonia* were recognized in the material studied from Ardahan Province. The species reported as new for Turkey are characterized and discussed in details, other taxa are juxtaposed below with their localities in the region. *Cladonia symphycarpa* has been sporadically reported from Turkey – Bolu and Çorum Provinces (Çobanoğlu and Akdemir 2004), Trabzon Province (John and Breuss 2004); other lichens are rather well-known and common in the country (e.g. Yazici et al. 2007; Yazici et al. 2008; Kinalioğlu 2009). On primary squamules and inside the cup of podetium of *C. pyxidata*, a well developed thallus of *Vulpicida pinastri* (Scop.) J.-E. Mattsson & M.J. Lai was observed. This lichen is typically characterized by its corticolous/lignicolous habitat; it also occurs occasionally on siliceous rocks (e.g. Nimis 1993). It is an interesting fact that *Vulpicida pinastri* could also be lichenicolous.

### *Cladonia acuminata* (Ach.) Norll. (Fig. 2A)

**Morphological description.** Primary squamules persistent, numerous, small to medium-sized, up to 7 mm long, rather thin, usually ascending and sinuate, crenate to finely divided, grayish-green above and white below, esorediate; podetia up to 2.5 cm tall and 1-2 mm in diameter, cylindrical and slender, cupless and blunt, simple or somewhat branched in upper part; podetia partly verruculose-corticate, largely decorticate and with sparse coarse granular soredia in upper part, throughout covered by small and sparsely distributed squamules; apothecia small, brownish.

**Chemistry.** The specimen represents the chemotype with atranorin and norstictic acid as major substances, a trace

amount of connorstictic acid was also detected. Spot test: K+ yellow, P+ orange, C–, KC–, UV–. Chemically variable species (Stenroos and Ahti 1990; Ahti 2000), often including psoromic acid (e.g. Huovinen et al. 1989; Zhurbenko and Ahti 2005).

**Ecology.** The specimen was found on soil rich in humus, in an open situation in the vicinity of a coniferous forest.

**Notes.** *Cladonia acuminata* belongs to the section *Helopodium* and is related to *C. cariosa* and *C. symphycarpa* (Stenroos et al. 2002). All of these species may produce atranorin and norstictic acid (e.g. Huovinen et al. 1989; Smith et al. 2009). However, the podetia of *C. cariosa* are rather short and squat, not sorediate, distinctly fissured and crowned with usually large chocolate-brown apothecia. *C. symphycarpa* rarely forms short podetia and its thallus consists of large, well developed and densely growing basal squamules. Recently *C. cariosa* and *C. symphycarpa* have been reported from Turkey (Çobanoğlu and Akdemir 2004; John and Breuss 2004; Yazici et al. 2007) and the new locality of the second species is added here.

**World distribution.** Mainly a circumpolar-boreal species, it appears in montane to alpine belts in the Northern Hemisphere. Also reported from South America (e.g. Stenroos and Ahti 1990; Burgaz and Raggio 2007). Rarely reported from Asia (Ahti 1976; Kurokawa 2003; Wagner and Spribille 2005; Zhurbenko and Ahti 2005); it seems that the species is rare, but rather widespread in the boreal zone and the mountainous regions of the continent.

**Specimen examined.** TURKEY, Ardahan Province: [locality 1] center of Posof District, Control Tower Forests, 41°29'44.17"N/42° 44'03.88"E, 1430 m, 07.12.2008, leg. K. Yazici (KTUB 2024).

### *Cladonia monomorpha* Aptroot, Sipman & van Herk (Fig. 2B)

**Morphological description.** Primary squamules persistent, relatively large and thick, up to 5 mm long, densely growing but not coalescent, usually ascending, olive to brown above and white below, brownish at the base; podetia up to 1 cm tall with ± regular cups, scyphi c. 3-5 mm wide, gradually flaring, inside covered with distinctly cor-

ticulate bullate plates, outer surface mostly corticate-areolate and also with bullate plates, plates grade into squamules; apothecia small and brown.

**Chemistry.** It contains fumarprotocetraric acid (spot test: K–, P+ red, C–, KC–, UV–). According to Aptroot et al. (2001), unidentified accessory substances may occasionally be detected.

**Ecology.** The specimens were found on humous soil among mosses in a well-lit and open situation, a forest dominated by *Pinus sylvestris*.

**Notes.** The species has recently been distinguished and described from Europe (Aptroot et al. 2001) and it is related to *C. pocillum* (Ach.) Grognot and *C. pyxidata* (L.) Hoffm. The specimens from Turkey quoted here correspond exactly with the characteristics of the taxon provided by Aptroot et al. (2001). For detailed descriptions of *C. monomorpha* and its comparison with similar taxa see Aptroot et al. (2001), Kowalewska and Kukwa (2004), and Kowalewska et al. (2008). It is worth mentioning that the species is regarded by some authors as a taxon of uncertain status (e.g. Santesson et al. 2004; Smith et al. 2009) or even as a synonym of *C. pyxidata* (e.g. Nimis 2003). On the other hand, other lichenologists maintain that the species is very distinct and worth recognition at the specific level (e.g. Kowalewska et al. 2008; Diederich et al. 2009). It seems the status of *C. monomorpha* needs more attention and perhaps a resolution based on molecular studies.

**World distribution.** The species is known from Europe (Aptroot et al. 2001), North America (Greenland and the U.S.A.) and Asia (Mongolia) (Kowalewska et al. 2008).

**Specimens examined.** TURKEY, Ardahan Province: [locality 4] Bağdaşan village forests, 41°03'08"N/42°24'21"E, 2010 m, among mosses, 12.04.2009, leg. K. Yazici (KTUB 2025); [locality 5] Göle District, Yeniköy, Yeniköy forests, 40°58'00.27"N/42°29'01.83"E, among mosses, together with *Cladonia subulata*, 1960 m, 27.07.2008, leg. K. Yazici (KTUB 2033).

*Cladonia coniocraea* (Flörke) Spreng. – TURKEY, Ardahan Province: [locality 4] Bağdaşan village forests, 41°03'08"N/42°24'21"E, 2010 m, on humous soil among mosses, 12.04.2009, leg. K. Yazici (KTUB 2026).

*Cladonia fimbriata* (L.) Fr. – TURKEY, Ardahan Province: [locality 5] Göle District, Yeniköy, Yeniköy forests, 40°58'00.27"N/42°29'01.83"E, 1960 m, on humous soil among mosses, 27.07.2008, leg. K. Yazici (KTUB 2032).

*Cladonia foliacea* (Huds.) Willd. – TURKEY, Ardahan Province: [locality 3] Hanak District, Altaş village, 41°09'47.49"N/42°52'58.62"E, 1790-1850 m, on dead mosses, 28.07.2009, leg. K. Yazici (KTUB 2027).

*Cladonia furcata* (Huds.) Schrad. subsp. *furcata* – TURKEY, Ardahan Province: [locality 1] Posof District, center (Control Tower Forests), 41°29'44.17"N/42°44'03.88"E, 1430 m, on soil, 07.12.2008, leg. K. Yazici (KTUB 2031).

*Cladonia pyxidata* (L.) Hoffm. – TURKEY, Ardahan Province: [locality 4] Bağdaşan village forests, 41°03'08"N/42°24'21"E, 2010 m, on mosses, 12.04.2009, leg. K. Yazici (KTUB 2028) – primary squamules and the interior of the podetial cup are partly occupied by the thallus of *Vulpicida pinastri* (Fig. 2C).

*Cladonia pocillum* (Ach.) Grognot – TURKEY, Ardahan Province: [locality 2] Çamlıbel, 41°12'15.39 "N/42°

33'08.14" E, on mosses, 2302 m, 31.07.2009, leg. K. Yazici (KTUB 2034).

*Cladonia subulata* (L.) Weber ex F.H. Wigg. – TURKEY, Ardahan Province: [locality 5] Göle District, Yeniköy, Yeniköy forests, 40°58'00.27"N/42°29'01.83"E, on mosses, 1960 m, 27.07.2008, leg. K. Yazici (KTUB 2030).

*Cladonia symphycarpa* (Flörke) Fr. – TURKEY, Ardahan Province: [locality 6] Göle, Göle-Ardahan Mainroad side, about 20 km from Ardahan, 40°54'57.54"N/42°35'48.11"E, on mosses, c. 1980-2000 m, 26.07.2009, leg. K. Yazici (KTUB 2029).

#### Nomenclatural note:

The epithet "*symphycarpa*" instead of "*symphycarpia*" is used because the original spelling published by Flörke turned out to be correct (Ahti pers. comm., see also McCune et al. 2009).

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