A REMARKABLE CLADONIACEAE FLORA AT SUBANDEAN REGION IN CHÁMEZA (CASANARE, COLOMBIA)

Flora de Cladoniaceae muy especial en la región subandina en Chámeza (Casanare, Colombia)

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ABSTRACT
A remarkable Cladoniaceae flora was discovered in the subandean region of Chámeza, (Casanare, Colombia) at 1200 meters above sea level. Four species of the genus Cladonia (Cladoniaceae, Lichenized Fungi) are new records for Colombia: Cladonia macilentoides, C. scabriuscula, C. sipmanii and C. subdelicatula. This shows the importance of increasing diversity studies at mid elevations where suitable habitats for species of Cladonia occur.

Key words. Cladonia, subandean forest, plant richness, lichenized fungi.

INTRODUCTION
The cosmopolitan family Cladoniaceae (lichenized fungi) is one of the most collected lichen groups because its members are conspicuous and they can be found in many different ecosystems. Nevertheless the taxonomy and distribution of this family are not well studied in most parts of the world, including Colombia.
The first specialized publication on Cladoniaceae in Colombia (Sipman & Cleef 1978) treats morphology, chemistry, and ecological and spatial distribution of 6 species of the family Cladoniaceae. Afterwards a Flora Neotropica Monograph (Ahti 2000) revised and summarized all knowledge on the family for the Neotropics, including Colombia. Patterns of species richness of the Cladoniaceae in the Neotropics were analysed by Edier Soto Medina (2013). In the same year Ahti & Sipman (2013) in a Cladoniaceae volume for the Flora of the Guianas made clear that the diversity of Cladoniaceae has been underestimated.

This study aims to contribute to the knowledge of the Colombian lichen biota, considering that Colombia has a high percentage of endemism and that lichens are an important component of many ecosystems.

**METHODOLOGY**

**Sampling**

The material used in this work was collected on two farms in Chámeza-Casanare on various different substrates (rock, soil and wood), on 24-31 January 2012, at elevations of about 1400 m, 1450 m and 1500 m, in grazing areas and secondary forest. The specimens were air-dried and subsequently placed in the freezer at -25°C for 24 hours in order to kill any noxious insects. Then the specimens were transferred to herbarium packets and provided with labels containing all collection data.

**Determination of the material**

Subsequently the specimens were analyzed in the laboratory using stereomicroscope and transmission microscope. For the identification the literature available in the library and the collections of Neotropical Cladoniaceae in the herbarium of B were consulted. The main publications used were Ahti (2000), Ahti & Sipman (2013) and Sipman & Ahti (2013).

**Technique of thin layer chromatography (TLC)**

The chemistry of the samples reported below was analysed by the TLC method, using solvents A, B and C (Orange et. al. 2001). As standard a mixture of the control substances atranorin, norstictic and fumarprotocetraric acid was used. They were obtained from the lichens *Cladonia symphyacarpa* (Flörke) Fr. and *Cladonia rangiferina* (L.) Weber ex F.H. Wigg.

**RESULTS**


Four species were recognized which had not been published from Colombia before (Ahti 2000, Sipman et al. 2008; unpublished checklist). Descriptions and notes are presented here.

*Cladonia macilentoides* Ahti & Fleig

Fig. 1.


**Description (after Ahti 2000):** Primary thallus persistent, consisting of crenulate esorediate squamules, 1-2 mm wide. Podetia 0.5-2 cm tall, 0.1-0.2 mm thick towards
the base, 0.05 mm thick toward the tips, very slender, greenish or whitish gray, with basal parts sometimes partly blackening; unbranched to usually somewhat branched by dichotomy, ascophyte; tips often bifurcate, narrow. Surface mostly decorticate, with soredioid granules present. Podetial wall 80-120 µm; cortex 20-30 µm; medulla 0-20 µm; stereome 80-100 µm. Conidiomata on primary squamules (not seen). Apothecia rare, red (not seen).

Chemistry. P + yellow, K + yellow; thamnolic acid.

Remarks: Cladonia macilentoides is difficult to recognize when hymenial discs are absent. Then it resembles most the young podetia of C. didyma (Fée) Vain. by the acuminate, mostly unbranched, largely decorticated podetia. They differ by the presence of fine soredia, usually rather scarce and best found near the tips or the base, and the stereome is thinner, not turning translucent and brownish. Similar species with decorticate, acuminate podetia and thamnolic acid chemistry occur in section Perviae, like C. condrotyla Vain., C. granulosa (Vain.) Ahti, C. palmicola Ahti & Fleig and C. subdelicatula Vain. ex Asahina. They lack the yellow-orange spots at the base of the basal squamules, and the surface of the podetia is less denudated or with different disposition of the propagules.

Selected specimen: Chámeza-Casanare. Vda. Centro Sur, Finca el paraiso. 5°11’45”N 72°54’04”W. Herrera Vargas J. and Vargas Mendoza L. 795a (Fig. 1).

Cladonia scabriuscula (Delise) Nyl. Fig. 2.

Description (after Ahti 2000): Primary thallus evanescent, consisting of small squamules 2 x 3 mm. Podetia 1-3 cm tall, 1-3 mm thick, brownish to grayish, with white patches, not melanotic at base, slightly to moderately branched; branching type anisotomic dichotomy; axils open to closed; tips subulate, ascphyse. Surface of podetia areolate corticate, with cortex smooth, thin, scaling off to form podetial squamules, often finally becoming largely decorticate, usually moderately to richly squamulose (squamules to 2 x 2-3 mm); distal parts incompletely corticate, scabrose, micro-squamulose to granulose. Podetial wall 140-215 µm; cortex 15-20 µm; medulla 20-35 µm; stereome 170-180 µm, translucent to opaque, very hard, distinctly delimited from medulla; surface of central canal slightly uneven. Conidiomata common, at tips of podetia. Apothecia brown (not seen).

Chemistry. P + red, K -; fumarprotocetraric and protocetraric (trace) acids.

Remarks: Cladonia scabriuscula is very closely related to Cladonia furcata (Huds.) Schrad., which lacks granulose tips, is less squamulose, and is generally more robust.

Selected specimen: Chámeza-Casanare. Vda. Mundo Viejo, finca El Triunfo. 5°11’45”N 72°54’04”W. Herrera Vargas J. and Vargas Mendoza L. 92 (Fig. 2).

Cladonia sipmanii Ahti Fig. 3.


Description (after Ahti 2000): Primary thallus evanescent. Podetia slender to fairly robust, 5-7 cm tall, 0.5-1 mm thick, pale glaucous-
white, with necrotic base darkening at surface, often cyanescent in part, moderately branched; branching type anisotomic dichotomy or trichotomy, with distinct main axes and short side branchlets; axils perforated but usually closed near the young tips and frequently also lower down, to 0.1-3 mm broad, funnels small but sometimes widely gaping in lower part of aged podetia; tips erect or slightly divericate, furcate. Surface of podetia smooth, continuous in upper parts, areolate in lower parts; often slightly squamulose. Podetial wall 240-275 µm; cortex 25 µm; medulla 75-100 µm; stereome 125-150 µm, sharply delimited; central canal grooved. Conidiomata at tips of podetia, containing red slime (not seen). Apothecia brown (not seen).

**Remarks:** *Cladonia hians* Ahti is similar by its thamnolic acid chemistry and open axils, and differs because most of its upper axils are open and it produces numerous regular scyphoid funnels in well-illuminated habitats, though in shade the funnels are narrow and less regularly developed. The original Guayan material of *C. sipmanii* is more robust than the Colombian specimen, which looks juvenile, with strongly branched, slender podetia without conidiomata or apothecia.

**Selected specimen:** Chámeza-Casanare. Vda. Mundo viejo, finca El Triunfo. 5°11’45”N 72°54’04”W. Herrera Vargas J. and Vargas Mendoza L. 92 (Fig. 3).

*Cladonia subdelicatula* (Vain.) Sandst. 1963. Fig. 4.


Figure 1. Cladonia macilentoides.

Figure 2. Cladonia scabriuscula.
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Figure 3. *Cladonia sipmanii*.

Figure 4. *Cladonia subdelicatula*.
DISCUSSION

The lichen family Cladoniaceae is in Colombia by far the best represented in the páramos, from where 39 species were reported by Sipman et al. (2000). Certainly the harsh climate at high elevations, unfavorable for luxuriant phanerogam vegetation, increases the chances for poor competitors like soil lichens. Another speciose Cladoniaceae flora was found at low elevation on the sandstone table lands around Araracuara, where the extremely poor sandstone rocks prevent a luxuriant phanerogam vegetation. Sipman (1997) reported 17 species, almost all different from those occurring in the páramos. The landscape at intermediate elevations is usually forest-covered, at least in virgin condition, and leaves few opportunities for Cladoniaceae. However, the lichens reported here from Chámeza-Casanare show that suitable habitats for Cladoniaceae may occur also at intermediate elevations.

As table 1 shows, 8 out of the 16 species of Cladoniaceae observed in Chámeza-Casanare are not known from the páramos or the sandstone area of Araracuara. This indicates that a considerable number of the species found at intermediate elevations do not show up in the páramos or the lowlands, and appear restricted to intermediate elevations. This indicates that the rare natural habitats suitable for Cladoniaceae in such elevations are of particular interest for the exploration of the Cladoniaceae flora of Colombia.

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LITERATURE CITED

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