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Sticta viviana (lichenized Ascomycota: *Peltigerales*: *Lobariaceae*), a new species from Colombian paramos

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Abstract: The new species *Sticta viviana* A. Suárez & Lücking is described from Colombian paramos. It superficially resembles *S. fuliginosa* s. str. but differs by the small lobes with a shiny surface, the strongly branched, corymbose isidia, the dark lower tomentum, the smaller, usually sessile and urceolate cyphellae with one papilla-like outgrowth per cell of the basal membrane, and the K+ orange-yellow medulla. In contrast, *Sticta fuliginosa* s. str., as represented by the type material, a sequenced topotype, and specimens from North America and Colombia falling into the same clade, is defined by an uneven lobe surface, simple to branched but not corymbose isidia, a pale lower tomentum, larger, immersed to erumpent cyphellae, with each cell of the basal membrane having 2–4 papillae, and a K− medulla. The new species is not closely related to *S. fuliginosa* s. str. but falls within a clade of several, as yet undescribed, species with *S. fuliginosa* gross morphology.

Key words: Bogotá, Cundinamarca, Guasca, Marilandia, lichen, *Sticta fuliginosa*

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Introduction

The lichen genus *Sticta* is one of the larger genera of foliose macrolichens. Kirk *et al.* (2008) mention 114 species, and three further species were described recently (Aptroot 2008; Øvstedal & Gremmen 2010; Lumbsch *et al.* 2011). However, this figure seriously underestimates the real diversity in the genus, as indicated by Moncada *et al.* (2012), whose preliminary ITS data suggest that *Sticta* might contain as many as 500 species worldwide. *Sticta* is recognized by its cyphellae on the lower side, pores delimited by a distinct, prominent margin and with a membrane separating the medulla from the outside. It is a subcosmopolitan genus, with a number of species occurring in temperate rainforests of the Northern and Southern Hemispheres (Galloway 1994, 1997, 1998*a*, 2001, 2007; Goward *et al.* 1994; Galloway *et al.* 1995; Brodo *et al.* 2001; Takahashi & Deguchi 2004; Smith *et al.* 2009; Singh & Sinha 2010). However, the majority of the species are found in tropical montane and andine regions (Joshi & Awasthi 1982; Chen *et al.* 1994; Galloway 1998*b*; Büdel *et al.* 2000; Aptroot *et al.* 2002; Farkas 2003; Aptroot 2008; Lumbsch *et al.* 2011).

The most common and widespread species of the genus are currently recognized as *S. fuliginosa*, *S. limbata* and *S. weigelii*. Following the aforementioned taxonomic treatments, *S. fuliginosa* in its traditional sense comprises specimens with broad, rounded, sparsely branched lobes and isidia formed predominantly laminally (i.e. on the upper lobe surface). The underside is more or less pale with scattered, rather large, often irregular to angular pseudocyphellae. However, a few critical revisions and molecular studies suggest that species of *Sticta* defined by their gross morphology, such as *S. weigelii*, actually form species complexes (Harris 1984; McDonald *et al.* 2003). Studying samples from the Neotropics, it was realized that the

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Sticta fuliginosa, *S. limbata* and *S. weigelii* morphodemes represent collective assemblages of partially unrelated lineages that evolved similar morphodemes in parallel (Moncada *et al.* 2012). Revision of type material revealed that most of these lineages are without names, even though many species of *Sticta* were historically described from Colombia and adjacent areas (e.g. Nylander 1863*a*, *b*). In anticipation of a larger phylogenetic treatment that will be published separately and requires all included names to be validly published, here we proceed to describe the first of a number of new species in *Sticta*.

Sticta viviana A. Suárez & Lücking sp. nov.

MycoBank No.: MB802891

Differing from *Sticta fuliginosa* s. str. in the smaller thallus lobes with shiny, scrobiculate faveolate surface, the corymbose isidia, the dark lower tomentum, the smaller, usually sessile and urceolate cyphellae with one papilla-like outgrowth per cell of the basal membrane, and the K− medulla.

Type: Colombia, Cundinamarca, Guasca, Páramo de Guasca near Bogotá, 3350 m, on branches of paramo shrubs, 18 August 2011, *Moncada* 4756 (UDBC—holotype; F—isotype).

(Fig. 1)

Thallus foliose, orbicular to irregular, up to 5 cm diam., very sparsely branched and if branched, polytomous (not distinctly bifurcating). *Stipe* absent. *Primary photobiont* cyanobacterial (*Nostoc*). *Lobes* suborbicular, horizontal to subpendulous, imbricate to adjacent or with narrow interspaces, with involute to undulate margins and irregular, revolute and often crenate apices, 5–10 mm long and 7–15 mm wide, subcoriaceous, fragile. *Upper surface* scrobiculate to faveolate towards the apices, dark brown, shiny, glabrous and lacking papillae and pruina, but with indistinct, cream-coloured maculae; marginal cilia absent. *Laminal isidia* abundant, cylindrical to coralloid with basal stipe and becoming corymbose (i.e. cauliflower-like), up to 1 mm long including the stipe, dark brown to blackish brown, shiny. *Lower surface* rugose to undulate, cream-coloured; primary tomentum dense and thick except towards the margin, fasciculate to spongiose, soft, brown, consisting of hairs 340–430 μm long, clustered in fascicles of 12–20 branched hyphae with free, moniliform apices; secondary tomentum (i.e. diminutive tomentum developed between the hairs of the primary tomentum) thinly arachnoid, cream-coloured to beige, formed by hyphae 7–23 μm long, solitary with free, septate apices; rhizines absent. *Cyphellae* sparse, 1–10 per cm^2 towards the centre and 1–20 per cm^2 towards the margin, dispersed, irregular to angular in outline, cupuliform to urceolate with wide pore (0·3–0·7 mm diam.), sessile to suprasessile (i.e. with the basal membrane at or above the level of the lower cortex and the cyphellae margin basally constricted), but below the tomentum level, with erect to slightly involute, cream-coloured to golden brown margins lacking tomentum; basal membrane of cyphellae (the cell layer covering the medulla) white. *Medulla* lax, white.

Apothecia not observed.

Pycnidia not observed.

Anatomy. *Upper cortex* paraplectenchymatous, 17–33 μm thick, consisting of 3–4 cell layers. *Photobiont layer* 35–60 μm thick, with the photobiont cells 10–15 μm diam. *Medulla* 55–165 μm thick, with the hyphae 2·5 μm wide, lacking crystals. *Lower cortex* paraplectenchymatous, 12–18 μm thick, consisting of 1–2 cell layers. Cavity of the cyphellae 60–100 μm deep; cells of the basal membrane with one external, papilla-like outgrowth per cell.

Chemistry. Medulla K+ orange-yellow, C−, KC+ pale yellow, P−. Cyphellae K+ yellow, C−, KC−, P−. No substances detected by TLC (the K+ yellow reaction of the medulla and cyphellae seems to be caused by tiny crystals deposited on the cell walls but no spots are detectable by TLC).

Etymology. *Sticta viviana* is dedicated to the Colombian lichenologist Bibiana Moncada who, with her thesis on the systematics and phylogeny of *Sticta* in Colombia, has provided the basis for a thorough global revision of the genus. The epithet *viviana*, which is the original form of the name Bibiana, comes

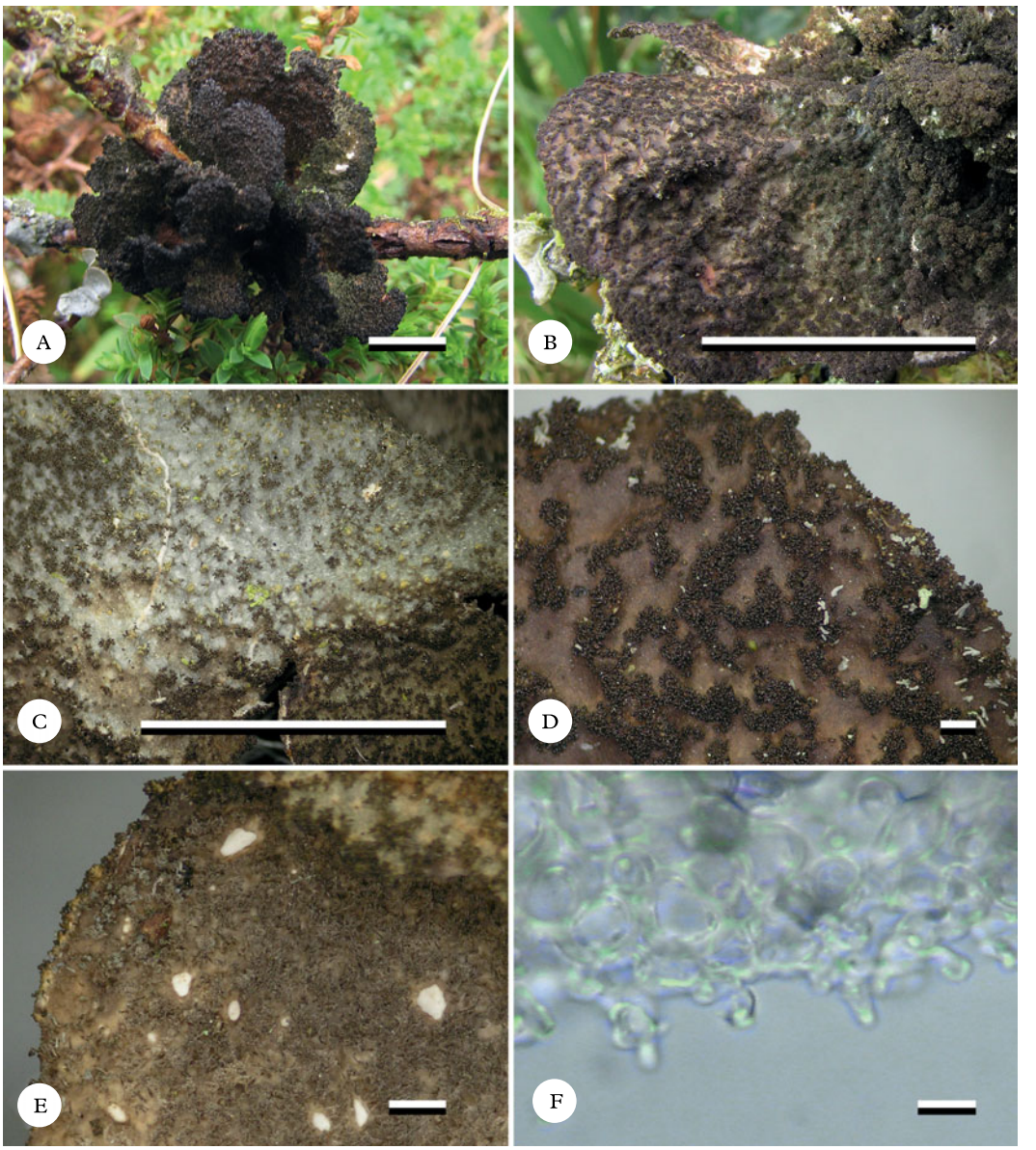

FIG. 1. *Sticta viviana*. A & B, specimens in the field (A, holotype; B, *Lücking* 33311); C, lobe surface; D, lobe surface detail with isidia; E, lobe undersurface showing tomentum and cyphellae; F, cyphella membrane showing papillae (C–E, *Lücking* 33311; F, holotype). Scales: A–C = 10 mm; D & E = 1 mm; F = 10 µm. In colour online.

from the Latin 'vivianus' and means living, alive.

Ecology. Epiphytic on branches and twigs of paramo shrubs and treelets, usually rather exposed to light.

Notes. Detailed morphological, anatomical and chemical studies, combined with molecular analyses, have shown that morphologically defined taxa such as *Sticta weigelii* and *S. fuliginosa* represent a large number of partly unrelated species (McDonald *et al.*

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2003; Moncada *et al.* 2012). Many of these have not been named, even considering the high number of several hundred epithets described in the genus. *Sticta viviana* is one of more than 15 species that conform to the gross morphology of *S. fuliginosa* (broad, rounded lobes with laminal isidia) and would be included in that species using traditional keys (e.g. Goward *et al.* 1994; Galloway *et al.* 1995; Brodo *et al.* 2001; Galloway 2001, 2007; Smith *et al.* 2009). Molecular data, however, demonstrate that the new species is not even closely related to *S. fuliginosa* s. str. (for which a topotype from Wales was sequenced), but belongs in a clade of several distinct, undescribed species with *S. fuliginosa* gross morphology (Moncada *et al.* 2012).

In addition to molecular data, all these species can be distinguished using morphological, anatomical, and chemical features, such as the upper surface structure (even vs scrobiculate-faveolate and glabrous versus tomentose or hirsute), the nature of the vegetative propagules (shape and branching patterns), the nature of the lower tomentum (pale vs dark, simple versus double with primary and secondary tomentum), the type of cyphellae (size and shape, presence of papillae on the basal membrane), and the medullary K-reaction. Many of these characters have been considered infraspecific variation, such as the shape of the isidia (e.g., Galloway 1994, 1997, 1998*a*). However, in the absence of independent evidence such as molecular data, the assessment of variation is circular in conclusion, since that way variation is not 'detected' but rather 'generated' by assuming that a set of specimens belongs to the same species. The molecular ITS data show that specimens clustering in supported, monophyletic clades have a very narrow range of variation, each taxon having very uniform isidia, except for ontogenetic, directed variation (Moncada *et al.* 2012). Thus, *Sticta fuliginosa* s. str., as represented by the type material, the sequenced topotype, and specimens from North America and Colombia falling into the same clade, is defined by the following characters: the lobe surface is uneven (not scrobiculate-faveolate) and glabrous; the isidia are simple to branched (not corymbose); the lower tomentum is white and a secondary tomentum is present, the hairs of both being comparatively short (up to 100 and 15 μm, respectively); the cyphellae are medium-sized (up to 1·2 mm diam.), rounded to irregular, immersed to erumpent, and each cell of the basal membrane has 2–4 papillae; the white medulla is K−.

While most neotropical specimens initially assigned by us to *Sticta fuliginosa* do not represent that species (Moncada *et al.* 2012), it was also found that several ITS sequences available from GenBank from Canada (DQ419943), Finland (AY124095), Japan (AB239345), and New Zealand (AF350310) labelled *Sticta fuliginosa* do not cluster phylogenetically with *S. fuliginosa*, but form three separate clades, possibly representing undescribed taxa as well. The presence of unrecognized species of this morphodeme in Northern Hemisphere temperate regions is remarkable, as is the fact that virtually no taxonomic synonyms seem to have been listed for *Sticta fuliginosa* in its traditional sense (Zahlbruckner 1925; Galloway 2007).

Additional specimens examined (paratypes). **Colombia**: *Cundinamarca*: Guasca, Páramo de Guasca near Bogotá, 3350 m, 2011, *Moncada* 4739, 4748, 4752 (UDBC); Chipaque, Vereda Marilandia vía Santuario, near Bogotá, 2400 m, 2011, *Moncada* 4800, 4801, 4808 (UDBC), *Lücking* 33311 (UDBC, F).

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