

# New genera in the lichenized family Gomphillaceae (Ascomycota: Graphidales)

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## Research Article

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# Abstract

Previous molecular phylogenetic analysis in comparison with phenotype characters of *Gomphillaceae* resolved a total of 38 genus-level clades among the studied species, 17 of which in need to be recognized and formally established as new or reinstated genera. The four reinstated genus names, including one validation, are *Microxyphiomyces* Bat., Valle & Peres, *Psathyromyces* Bat. & Peres, *Spinomyces* Bat. & Peres ex Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*, and *Sporocybomyces* H. Maia. The remaining 13 are newly described: *Adelphomyces* Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*, *Aptrootidea* Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*, *Aulaxinella* Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*, *Batistomyces* Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*, *Bezerroplaca* Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*, *Caleniella* Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*, *Monocalenia* Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*, *Pseudocalenia* Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*, *Roselviria* Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*, *Santricharia* Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*, *Sipmanidea* Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*, *Verruciplaca* Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*, and *Vezdamyces* Xavier-Leite, M. Cáceres & Lücking, *gen. nov.* The following 53 new combinations are introduced for the species included in the new and reinstated genera: *Adelphomyces cochlearifer* (Lücking & Sérus.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *A. epithallina* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *A. parvula* (Hafellner & Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *Aptrootidea amapensis* (Bat. & Poroca) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *A. atrofusca* (R. Sant.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *A. atromuralis* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *A. marginata* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *A. triseptata* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *A. wilsoniorum* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *Aulaxinella corticola* (Kalb & Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *A. minuta* (R. Sant.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *A. multiseptata* (R. Sant.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *Basistomyces pallidus* (Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *B. hyalinus* (Kalb & Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *Bezerroplaca fusconitida* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *B. incrustatociliata* (Sérus.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *B. lucernifera* (Kalb & Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *B. pachyparaphysata* (R. Sant.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *B. streimannii* (Sérus.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *Caleniella maculans* (Vain.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *C. triseptata* (Zahlbr.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *Microxyphiomyces cuneatus* (L.I. Ferraro & Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *M. demoulinii* (Sérus.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *M. elegans* (Sérus.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *M. kashiwadani* (G. Thor, Lücking & Tat. Matsumoto) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *M. lancicarpus* (Kalb & Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *M. vainioi* (R. Sant.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* (syn.: *M. manaosensis* Bat., Valle & Peres.), *M. santessonianus* (Kalb & Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *M. santessonii* (D. Hawks.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *M. similis* (Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *M. variratae* (Lücking & Sipman) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *Monocalenia monospora* (Vězda) Xavier-Leite, M. Cáceres & Lücking,

*comb. nov.*, *Psathyromyces planus* (Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *P. heterellus* (Stirt.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *Pseudocalenia solorinoides* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *Roselviria lobulimarginata* (Sipman & Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *R. purulhensis* (Lücking, Sérus. & Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *Santricharia farinosa* (R. Sant.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *Sipmanidea neotropica* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. et stat. nov.*, *Spinomyces aggregatus* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. et stat. nov.*, *S. albostrigosus* (Lücking, Sérus. & Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *S. deslooveri* (Sérus.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *S. guatemalensis* (Lücking & Barillas) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *S. microcarpus* (Etayo & Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *S. verrucosus* (Sérus.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *Sporocybomyces leucomuralis* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *S. leucotrichoides* (Vain.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *S. macgregorii* (Vain.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *Verruciplaca calcarea* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. et stat. nov.*, *V. furcata* (Sérus.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *V. verrucifera* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*, *Vezdamyces albopruinosus* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. et stat. nov.*, and *V. vulgaris* (Müll. Arg.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.*

## Introduction

The family *Gomphillaceae* was originally based on the single, monospecific genus *Gomphillus* Nyl. (Watson, 1929), described by Nylander (1855). The bulk of the genera now included in this family had largely been classified in a separate family, *Asterothyriaceae*, also established by Watson (1929) but properly defined only later by Santesson (1952). The latter author recognized six genera in the *Asterothyriaceae*, namely *Asterothyrium* Müll. Arg., *Calenia* Müll. Arg., *Echinoplaca* Fée (including *Actinoplaca* Müll. Arg.), *Gyalectidium* Müll. Arg., *Psorotheciopsis* Rehm (including *Linhartia* Sacc. & P. Syd.), and *Tricharia* Fée. This group partly corresponded to *Ectolechiaceae* sensu Vainio (1896) and Zahlbruckner (1907), but the generic type of the latter family, *Sporopodium* Mont., was found to be unrelated to the above genera, belonging in *Lecanorales*, and so *Asterothyriaceae* was adopted by Santesson (1952) to accommodate the above genera. In addition, Santesson (1952) recognized a further genus later placed in *Gomphillaceae*, *Aulaxina* Fée, albeit in his monograph he placed it in a different family, *Graphidaceae*.

Even after Santesson's (1952) monograph, it took a long time to realize that *Gomphillus* and several genera placed in *Asterothyriaceae* shared a unique type of asexual anamorph, with the conidia formed externally on supporting structures as multiseptated, filamentous hyphal threads or moniliform chains. Müller (1891) first described these for *Actinoplaca* (= *Echinoplaca*) *strigulacea* Müll. Arg., as so-called 'sporodochia', whereas Santesson (1952) considered the squamiform anamorph formed by *Gyalectidium filicinum* Müll. Arg. a lichenicolous fungus, giving it the invalid name *Cristidium pallidum* R. Sant.

After Santesson's (1952) monograph, during a period of more than a decade starting in the late 50s, the Brazilian mycologist Augusto Chaves Batista and his collaborators described a larger number of new genera with characteristic anamorphs (Batista, 1961; Batista & Peres, 1964; Batista & Maia, 1967; Batista & Poroca, 1970). However, revisionary work (Lücking et al., 1998, 1999) considered these to represent synonyms of previously described genera: *Aciesia* Bat. (= *Tricharia*), *Actinoteichus* Cavalc. & Poroca (= *Asterothyrium*), *Aderkomyces* Bat. (= *Tricharia*), *Lochomyces* Bat. nom. inval. (= *Aulaxina*), *Microxyphiomyces* Bat., Valle & Peres (= *Tricharia*), *Phallomyces* Bat. & Valle (= *Echinoplaca*), *Psathyromyces* Bat. & Peres (= *Tricharia*), *Setomyces* Bat. & Peres nom. inval. (= *Tricharia*), *Spinomyces* Bat. & Peres nom. inval. (= *Echinoplaca* or *Tricharia* s.lat.), *Sporocybomyces* H. Maia (= *Echinoplaca*), *Tauromyces* Cavalc. & A. A. Silva (= *Gyalectidium*), and *Tegoa* Bat. & Peres nom. inval. (= *Asterothyrium*).

Up to that time, the genus *Gomphillus* and the family *Gomphillaceae* had not been connected to *Asterothyriaceae*. When describing a new species of *Gomphillus*, *G. americanus* Essl., Esslinger (1975) discussed the systematic position of the genus, which had variously been related to *Cladoniaceae* or *Lecideaceae* (Duby, 1830; Nylander, 1855, 1860; Zahlbruckner, 1905; Poelt, 1973; Henssen & Jahns, 1974). Esslinger (1975) concluded that *Gomphillus* had no close relatives in *Lecideaceae* and that placement in a family of its own remained warranted. The situation changed entirely when Vězda (1973) first recognized the true nature of the anamorphs of these lichen fungi, applying to them the newly coined term 'hyphophores'. Based on his findings, Vězda (1979) proposed that *Gomphillus* was closely related to the genera treated in *Asterothyriaceae* by Santesson (1952) and consequently included *Gomphillus* and the additional genera *Aulaxina*, *Gyalidea* Lettau ex Vězda, *Gyalideopsis* Vězda, *Linhartia*, and *Solorinella* Anzi in a broadly emended *Asterothyriaceae*, for the first time delimiting this group in its natural sense. Later, Vězda and Poelt (1987) proposed to reinstate *Gomphillaceae* for the genera producing hyphophores and with anastomosing paraphyses, whereas *Asterothyriaceae* was retained for genera lacking hyphophores and with unbranched paraphyses. Shortly thereafter, Vězda & Poelt (1990) separated *Gyalidea*, *Linhartia*, and *Solorinella* in their own family, *Solorinellaceae*, while *Asterothyrium* was stated to be related to *Thelotrema* (Vězda & Poelt 1987). However, *Asterothyriaceae* was accepted to include *Asterothyrium*, *Gyalidea* (= *Solorinella*), and *Psorotheciopsis* (= *Linhartia*) in most subsequent treatments (Lücking, 1997, 1999, 2008). Hafellner (1984) argued that *Asterothyrium* and *Gomphillus*, as the type genera of the two families in question, could not be related due to their supposedly profound morphological and anatomical differences, and later proposed to assign *Gomphillaceae* to its own order, *Gomphillales* (Hafellner, 1988).

The first molecular study on this group showed *Gomphillus* to be nested within *Asterothyriaceae* sensu Vězda (1979), forming a strongly supported clade sister to *Graphidaceae* in the order *Ostropales* s.lat. (Lücking et al., 2004). More recently, *Gomphillaceae* was even found nested within *Graphidaceae* and recognized as subfamily within the latter (Rivas Plata et al., 2012). However, in a broader analysis, it was again recovered as sister to *Graphidaceae* (Kraichak et al., 2018). In that study, the authors also suggested to split *Ostropales* s.lat. into several orders, *Gomphillaceae* to be including within *Graphidales*, a suggestion subsequently accepted (Lücking, 2019).

With respect to genus-level classification within *Gomphillaceae*, taxon sampling in the first molecular approach (Lücking et al., 2004) had been too limited to address this issue. Since the few genera in *Asterothyriaceae* appeared to be rather well defined (Lücking, 1999; Henssen & Lücking, 2002), Lücking et al. (2005) performed a broad-scale, phenotype-based cladistic study on all species assigned to *Gomphillaceae*, to test the genus concept applied at the time, including additional genera that had been established in the meanwhile. Besides the genera distinguished at the time of Santesson's monograph (1952), the subsequently established genera *Caleniopsis* Vězda & Poelt, *Gyalideopsis* (= *Epilithia* Nyl., *Microlychnus* A. Funk, *Microspatha* P. Karst.), *Hippocrepeida* Sérus., and *Paratricharia* Lücking, were included in this analysis. Lücking et al. (2005) further reinstated some older names, including some of those established by Batista and co-workers, namely *Actinoplaca*, *Aderkomyces* (= *Psathyromyces*), *Arthotheliopsis* Vain. (= *Phallomyces*), and *Diploschistella* Vain. In addition, five genera were newly described: *Aplanocalenia* Lücking, Sérus. & Vězda, *Ferraroa* Lücking, Sérus. & Vězda, *Jamesiella* Lücking, Sérus. & Vězda, *Lithogyalideopsis* Lücking, Sérus. & Vězda, and *Rubrotricha* Lücking, Sérus. & Vězda.

After further molecular studies supported the notion that *Asterothyriaceae* was nested within *Gomphillaceae* and the two families should therefore be merged, the number of lichenized genera raised to 24, with a total of 418 lichenized species accepted at the time (Lücking et al., 2017): *Actinoplaca* Müll. Arg., *Aderkomyces* Bat., *Aplanocalenia* Lücking, Sérus. & Vězda, *Arthotheliopsis* Vain., *Asterothyrium* Müll. Arg., *Aulaxina* Fée, *Calenia* Müll. Arg., *Caleniopsis* Vězda & Poelt, *Diploschistella* Vain., *Echinoplaca* Fée, *Ferraroa* Lücking, Sérus. & Vězda, *Gomphillus* Nyl., *Gyalectidium* Müll. Arg., *Gyalidea* Lettau ex Vězda, *Gyalideopsis*, *Hippocrepeida* Sérus., *Jamesiella* Lücking, Sérus. & Vězda, *Lithogyalideopsis* Lücking, Sérus. & Vězda, *Paratricharia* Lücking, *Phyllogyalidea* Lücking & Aptroot, *Psorotheciopsis* Rehm, *Rolueckia* Papong, Thammath. & Boonpr., *Rubrotricha* Lücking, Sérus. & Vězda, and *Tricharia* Fée. This was complemented by three lichenicolous genera including 12 species (*Corticifraga* D. Hawksw. & R. Sant., *Paragyalideopsis* Etayo, and *Taitaia* Suija, Kaasalainen, Kirika & Rikkinen) plus five lichenicolous species in *Gyalideopsis* (Diederich et al., 2018).

In a recently published, greatly expanded molecular phylogeny with a broad taxon sampling, focusing on foliicolous lineages and using two molecular markers (mtSSU and nuLSU), the authors found that several of these refined genera were still polyphyletic, particularly *Aderkomyces*, *Aulaxina*, *Calenia*, *Echinoplaca*, *Gyalideopsis*, and *Tricharia*, distinguishing at least an additional 19 lineages that correlated with apothecial and/or hyphophore features and deserved recognition at generic level (Xavier-Leite et al., 2022). Six of these have names available (one in need of validation), namely *Bullatina* Vězda & Poelt, *Linhartia* Sacc. & P. Syd. (both previously recognized in Vězda, 1979 and Vězda & Poelt, 1987), *Microxyphiomyces* Bat., Valle & Peres, *Psathyromyces* Bat. & Peres, *Spinomyces* Bat. & Peres ex Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*, and *Sporocybomyces* H. Maia. In addition to these, here we formally establish further 13 new genera for the remaining lineages: *Adelphomyces*, *Aptrootidea*, *Aulaxinella*, *Batistomyces*, *Bezerroplaca*, *Caleniella*, *Monocalenia*, *Pseudocalenia*, *Roselviria*, *Santricharia*, *Sipmanidea*, *Vezdamyces*, and *Verruciplaca*. We introduce the necessary combinations at species level, based on a phylogenetic binning approach (Xavier-Leite et al., 2023), and provide an updated, synoptical key table to the now 46 genera of *Gomphillaceae*.

# MATERIALS AND METHODS

The emended generic classification proposed here was based on our previously published two-loci phylogeny (Xavier-Leite et al., 2022). Since the topology for the entire family remained unresolved in some parts and data were missing for the bulk of non-foliicolous representatives of *Gyalideopsis* s.lat. and its relatives, we formally recognized new genera (or reinstated previous names) when the following three criteria were fulfilled: (1) including of the lineage in another genus would render that genus polyphyletic and potential monophyly with that genus could be rejected based on tests using topological constraints (SH test in RAxML 8.2.0; Stamatakis, 2014); (2) the lineage was monophyletic and supported with at least 70% bootstrap support, especially if there was lack of support for a close relationship with another lineage and/or the stem node(s) were comparatively long; and (3) there was correlation with diagnostic phenotype characters either in the apothecia or the hyphophores or both. To test the latter, in a separate study (Xavier-Leite et al., 2023) we employed phenotype-based phylogenetic binning to assign species with lack of molecular data to molecularly defined clades and then evaluated phenotype variation within each clade, while largely defining the clade based on its included sequenced species.

For each genus thus newly established below, we provide a brief diagnosis and a more detailed description, as well as images of representative species and features.

## RESULTS AND DISCUSSION

### The new and reinstated genera.

*Adelphomyces* Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*

Mycobank MB 000000

Fig. 1

**Type species:** *Adelphomyces epithallina* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [Mycobank MB 000000]. Basionym: *Gyalideopsis epithallina* Lücking. *Biblioth. Lichenol.* 65: 66 (1997).

**Diagnosis:** Lichenicolous; apothecia sessile, biatorine (*Gyalideopsis* type); ascospores very small, 1–3-septate; hyphophores (when known) setiform, black, apically widened (rostrate or spathulate); diahyphae moniliform.

**Etymology:** The generic name refers to the lichenicolous growth of two of the three species on thalli of species of the same family, *Gomphillaceae*; in adelphoparasites, the host is closely related to the parasite.

**Genus description:** Lichenicolous on species of *Gomphillaceae* (two species) or Pilocarpaceae (one species). Apothecia sessile, biatorine, with distinct margin. Excipulum hyphal but hyphae densely arranged. Hypothecium prosoplectenchymatous, pale. Epithecium indistinct. Ascospores very small, 1–3-septate. Hyphophores where known setiform, black, apically widened and either rostrate or spathulate.

Diahyphae inserted apically, branched throughout, moniliform, segments ellipsoid to drop-shaped, colorless.

**Discussion:** The species assigned to this new genus were previously included in *Gyalideopsis* s.lat., which based on cladistic and molecular phylogenetic analyses (Lücking et al., 2004, 2005; Xavier-Leite et al., 2022) is a highly polyphyletic assemblage. In a previous cladistic analysis, the clade including the three lichenicolous species was strongly supported (Lücking et al., 2005) and therefore, together with the placement of the type species separate from other representatives of *Gyalideopsis* in our molecular analysis (Xavier-Leite et al., 2022), we include the two non-sequenced taxa in this genus. Besides their lichenicolous growth habit, the species of this genus are recognized by their *Gyalideopsis*-type, sessile, yet very small apothecia in combination with their very small ascospores with few septa.

**Additional species included** (see Xavier-Leite et al., 2023):

*Adelphomyces cochlearifer* (Lücking & Sérus.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Gyalideopsis cochlearifera* Lücking & Sérus. [as '*cochlearifer*'], *Lichenologist* 30: 543 (1998).

*Adelphomyces parvula* (Hafellner & Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Gyalideopsis parvula* Hafellner & Vězda in Kalb & Vězda, *Biblioth. Lichenol.* 29: 43 (1988).

***Aptrootidea*** Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*

MycoBank MB 000000

Fig. 2 (A–F), Fig. 3 (A–D)

**Type species:** *Aptrootidea marginata* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Echinoplaca marginata* Lücking. *Biblioth. Lichenol.* 65: 57 (1997).

**Diagnosis:** Lichenized; often with sterile, short, dark setae on translucent prothallus; apothecia adnate to erumpent, thinly zeorine to emarginate (*Echinoplaca* type), brown to brown-black; ascospores variable; hyphophores unknown.

**Etymology:** This new genus is dedicated to our colleague and friend, André Aptroot, for his numerous contributions to tropical lichenology.

**Genus description:** Thallus foliicolous, continuous or dispersed, uneven to verrucose, lacking or with short, dark setae usually formed on a translucent prothallus. Apothecia adnate (to erumpent), spot-like; disc chocolate-brown to brown-black; proper margin absent, in the type species often with a thin thalline margin. Excipulum hyphal. Hypothecium prosoplectenchymatous, pale. Epithecium (dark) brown. Ascospores variably septate. Hyphophores unknown.

**Discussion:** The genus as here defined is likely heterogeneous, including the type species (the only sequenced species) and a group five further species supported to be closely related to the type based on phylogenetic binning (Xavier-Leite et al., 2023). *Echinoplaca marginata* was already recognized as distinct from other *Echinoplaca* species when it was described (Lücking, 1997), and therefore its separate placement based on molecular phylogeny (Xavier-Leite et al., 2022) did not come as a surprise. The other five species are included here provisionally based on the binning result; they were already recognized as a separate clade by Lücking et al. (2005) based on a cladistic analysis and they may represent an additional, separate genus, but none of the species has been sequenced yet. *Aptrootia triseptata* also exhibits some similarities with species now placed in the genus *Verruciplaca* (see below).

**Additional species included** (see Xavier-Leite et al., 2023):

*Aptrootidea amapensis* (Bat. & Poroca) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Echinoplaca amapensis* Bat. & Poroca, Publicações. Instituto de Micologia da Universidade de Pernambuco 635: 4 (1970).

*Aptrootidea atrofusca* (R. Sant.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Echinoplaca atrofusca* R. Sant., Symb. Bot. Upsal. 12(1): 371 (1952).

*Aptrootidea atromuralis* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Echinoplaca atromuralis* Lücking, Fl. Neotrop. Monogr. 103: 492 (2008).

*Aptrootidea triseptata* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Echinoplaca triseptata* Lücking, Biblioth. Lichenol. 65: 61 (1997).

*Aptrootidea wilsoniorum* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Echinoplaca wilsoniorum* Lücking, Fl. Neotrop. Monogr. 103: 491 (2008).

***Aulaxinella*** Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*

MycoBank MB 000000

Fig. 4 (A–F)

**Type species:** *Aulaxinella minuta* (R. Sant.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Aulaxina minuta* R. Sant., Symb. Bot. Upsal. 12(1): 298 (1952).

**Diagnosis:** Lichenized; thallus continuous, with dark brown prothallus; apothecia erumpent, zeorine with carbonized thalline margin lacking algae (*Aulaxina* type); ascospores variable; hyphophores setiform, black, formed in groups on algal-free thallus patches; diahyphae palmate.

**Etymology:** The generic name is derived from the closely related genus *Aulaxina*, in which the type species was previously placed, together with the notion that the thalli and apothecia in the type species are comparatively small.



**Genus description:** Thallus foliicolous, rarely corticolous, continuous, with dark brown prothallus, lacking sterile setae. Apothecia erumpent, zeorine, crater-like; disc brownish; proper margin indistinct, thalline margin distinct, strongly prominent, carbonized, lacking algae. Excipulum prosoplectenchymatous. Hypothecium prosoplectenchymatous, colorless. Epithecium indistinct. Ascospores variably septate. Hyphophores produced in groups on algal-free thallus patches, setiform with blunt apex, black. Diahypae inserted apically, palmate, in 3–5 separate bunches, emerging from thicker hypha, moniliform, segments ellipsoid, partly 1-septate.

**Discussion:** Due to the unique combination of thallus, apothecial and hyphophore features, *Aulaxina* was considered one of the most well-delimited genera in this group and its circumscription was never questioned (Santesson, 1952; Vězda, 1979; Vězda & Poelt, 1987; Lücking, 1997, 2008; Lücking et al., 2005). Our molecular phylogenetic analysis demonstrated the genus to be biphyletic, with *Caleniopsis* positioned inbetween the *Aulaxina minuta* aggregate and *Aulaxina* s.str. *Caleniopsis* differs from *Aulaxina* s.lat. in the uncarbonized apothecia with thicker, distinctly zeorine margin (*Calenia* type). Theoretically, *Caleniopsis* could be included in an emended *Aulaxina* to retain the *A. minuta* aggregate in that genus, but this solution would not reflect the molecular topology, since both the *A. minuta* aggregate and *Caleniopsis* form comparatively long branches, and while *Caleniopsis* is supported as sister to *Aulaxina* s.str., the placement of the *A. minuta* aggregate basal to this assemblage is not supported (Xavier-Leite et al., 2022). In addition, while this alternative solution would resolve the problem of separating the *A. minuta* aggregate from the similar *Aulaxina* s.str., it would generate the new problem of merging a morphologically distinct entity (*Caleniopsis*) with *Aulaxina*. Therefore, and since the *A. minuta* aggregate can be characterized by a phenotype character (continuous thallus with dark prothallus versus dispersed thallus with translucent prothallus in *Aulaxina* s.str.), we prefer to recognize this clade as a separate genus.

**Additional species included** (see Xavier-Leite et al. 2023):

*Aulaxinella corticola* (Kalb & Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Aulaxina corticola* Kalb & Vězda, *Biblioth. Lichenol.* 29: 15 (1988).

*Aulaxinella multiseptata* (R. Sant.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Aulaxina multiseptata* R. Sant., *Symb. Bot. Upsal.* 12(1): 302 (1952).

***Batistomyces*** Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*

MycoBank MB 000000

Fig. 5 (A–D)

**Type species:** *Batistomyces hyalinus* (Kalb & Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Tricharia hyalina* Kalb & Vězda. *Biblioth. Lichenol.* 29: 65 (1988).

**Diagnosis:** Lichenized; thallus continuous, with numerous, dense, short and stiff, black setae; apothecia sessile to substipitate, biatorine, translucent; ascospores variable; hyphophores setiform, black; diahyphae moniliform.

**Etymology:** This new genus is dedicated to the Brazilian mycologist Augusto Chaves Batista, for his pioneering contributions to the knowledge of tropical fungi and lichens in Brazil, especially in *Gomphillaceae*.

**Genus description:** Thallus foliicolous, continuous, with numerous, densely arranged, short, sterile black setae. Apothecia sessile to almost stipitate, biatorine, translucent; proper margin thin, prominent. Excipulum paraplectenchymatous, colorless. Hypothecium colorless. Epithecium indistinct. Ascospores muriform. Hyphophores setiform, black. Diahyphae inserted apically, moniliform, segments sausage-shaped.

**Discussion:** The genus *Tricharia* was considered by Lücking et al. (2005) to comprise two potentially distinct lineages, *Tricharia* s.str. with verrucose thalli and large and robust setae, and the *T. vainioi* group, with smooth thalli and more delicate setae. This distinction was supported by our molecular analysis (Xavier-Leite et al., 2022). However, while *T. hyalina* was previously considered to belong in the *T. vainioi* group, molecularly it resulted unrelated to that clade or *Tricharia* s.str., and a new genus is required to accommodate this topology. *Tricharia hyalina* was recognized to differ from *T. vainioi* and relatives by the very densely arranged, short and stiff setae (Lücking, 2008), and this character might provide a potential synapomorphy, but more taxa in the *T. vainioi* group need to be sequenced to test this assumption.

**Additional species included** (see Xavier-Leite et al., 2023):

*Batistomyces pallidus* (Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000].  
Basionym: *Tricharia pallida* Vězda, Folia Geobot. Phytotax. 14: 73 (1979).

***Bezerroplaca*** Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*

MycoBank MB 000000

Fig. 6 (A–F)

**Type species:** *Bezerroplaca lucernifera* (Kalb & Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Echinoplaca lucernifera* Kalb & Vězda, Biblioth. Lichenol. 29: 24 (1988).

**Diagnosis:** Lichenized; thallus continuous, verrucose, with scattered, white setae; apothecia adnate, emarginate (*Echinoplaca* type), brown-black; ascospores muriform; hyphophores setiform, white with darkened apex, with bell-shaped, ciliate diahyphal bunches; diahyphae filiform with spermatozoid terminal segments.

**Etymology:** This new genus is dedicated to our colleague and friend, Dr. José Luiz Bezerra, for his contributions to the knowledge of Brazilian foliicolous lichens.

**Genus description:** Thallus foliicolous, usually continuous, finely verrucose, with scattered, sterile white setae. Apothecia adnate and spot-like, emarginate; disc plane, brown-black. Excipulum hyphal, colorless. Hypothecium brown. Epithecium brown. Ascospores muriform. Hyphophores setiform, white but apically darkened. Diahyphae inserted apically, forming bell-shaped, superficially ciliate bunches, filiform but peripheral hyphae thickened and terminal segments narrowly spermatozoid.

**Discussion:** This new genus was previously recognized as a distinct group (Lücking, 1997; Lücking et al., 2005), predicting that *Echinoplaca* s.lat. was polyphyletic and demonstrating that a combination of thallus, apothecial, and hyphophore morphology would be diagnostic for genus-level lineages in the family. *Bezerroplaca* is characterized by the bell-shaped diahyphal bunches and the filiform diahyphae with spermatozoid end segments, but also the thallus and apothecial morphology is quite uniform in this group.

**Additional species included** (see Xavier-Leite *et al.* 2023):

*Bezerroplaca fusconitida* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [Mycobank MB 000000]. Basionym: *Echinoplaca fusconitida* Lücking, Biblioth. Lichenol. 65: 51 (1997).

*Bezerroplaca incrustatociliata* (Sérus.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [Mycobank MB 000000]. Basionym: *Echinoplaca incrustatociliata* Sérus. in Aptroot *et al.*, Biblioth. Lichenol. 64: 58 (1997).

*Bezerroplaca pachyparaphysata* (R. Sant.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [Mycobank MB 000000]. Basionym: *Echinoplaca pachyparaphysata* R. Sant., Symb. Bot. Upsal. 12(1): 373 (1952).

*Bezerroplaca streimannii* (Sérus.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [Mycobank MB 000000]. Basionym: *Echinoplaca streimannii* Sérus. in Aptroot *et al.*, Biblioth. Lichenol. 64: 59 (1997).

***Caleniella***Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*

Mycobank MB 000000

Fig. 7 (A–B)

**Type species:** *Caleniella triseptata* (Zahlbr.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [Mycobank MB 000000]. Basionym: *Calenia triseptata* Zahlbr., Denkschr. Kaiserl. Akad. Wiss. Wien Math.-Naturwiss. Kl. 83: 121 (1909).

**Diagnosis:** Lichenized; thallus continuous, verrucose, lacking setae; apothecia erumpent, zeorine (*Calenia* type); ascospores small, 3-septate; hyphophores unknown.

**Etymology:** The name is derived from the name *Calenia*, in which the type species was previously placed, together with the notion that the apothecia in the type species are comparatively small.

**Genus description:** Thallus foliicolous, continuous, lacking setae. Apothecia erumpent, zeorine; disc pale; proper margin indistinct, thalline margin distinct, strongly prominent, white. Excipulum prosoplectenchymatous, colorless. Hypothecium prosoplectenchymatous, colorless. Epithecium indistinct. Ascospores usually 8 per ascus, 3-septate. Hyphophores unknown.

**Discussion:** *Calenia* is one of the larger genera in *Gomphillaceae* that was suspected to be heterogeneous and polyphyletic (Lücking 1997; Lücking *et al.* 2005) and our molecular data confirmed this (Xavier-Leite *et al.*, 2022). *Calenia triseptata* was found to be related to *Caleniopsis* and *Aulaxina*, although it strongly differs in thallus and apothecial morphology and lacks hyphophores. Establishment of a new genus for this clade is therefore warranted. The main difference with *Calenia* s.str., which is not closely related, is found in the small, 3-septate ascospores.

**Additional species included** (see Xavier-Leite *et al.*, 2023):

*Caleniella maculans* (Vain.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000].  
Basionym: *Asterothyrium maculans* Vain., Ann. Acad. Sci. Fenn., Ser. A, 15(6): 170 (1921); *Calenia maculans* (Vain.) R. Sant., Symb. Bot. Upsal. 12(1): 343 (1952).

***Microxyphiomyces*** Bat., Valle & Peres

MycoBank MB 8944

Fig. 8 (A–F), Fig. 9 (A–D), Fig. 10 (A–D)

*Microxyphiomyces* Bat., Valle & Peres in Batista *et al.*, Publicações Inst. Micol. Recife 319: 8 (1961).  
Taxonomic synonym: *Setomyces* Bat. & Peres [nom. inval.] in Batista, Publicações, Instituto de Micologia da Universidade do Recife 320: 14 (1961).

**Type species:** *Microxyphiomyces manaosensis* Bat., Valle & Peres. = *Microxyphiomyces vainioi* (R. Sant.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Tricharia vainioi* R. Sant., Symb. Bot. Upsal. 12(1): 382 (1952).

**Diagnosis:** Lichenized; thallus continuous, smooth, with black setae; apothecia sessile, biatorine, rarely erumpent and chroodiscoid; ascospores transversely septate to muriform; hyphophores setiform, sometimes branched or hooked, black; diaphyphae filiform to moniliform.

**Discussion:** This genus is here resurrected to accommodate the *Tricharia vainioi* clade, which was already suspected to be distinct from *Tricharia* s.str. (Lücking *et al.*, 2005) and in our molecular analysis appears only distantly related to the latter (Xavier-Leite *et al.*, 2022). The main diagnostic features are the smooth thallus and the more delicate setae, compared to the verrucose thallus and robust setae in *Tricharia* s.str. It should be noted that the genus as defined here includes three morphodemes:

*Microxyphiomyces* s.str., with biatorine apothecia and unbranched hyphophores; the *T. lancicarpa* aggregate with chroodiscoid apothecia; and the *T. elegans* group with unique, branched-hooked hyphophores (Sérusiaux, 1984). Species of the latter have not yet been sequenced, so their inclusion in *Microxyphiomyces* is provisional. *Tricharia lancicarpa* differs from *Microxyphiomyces* s.str. in a similar way as *Roselviria* from *Spinomyces*, and in our phylogenetic analysis forms a supported sister clade (on a longer branch) to the latter, so the molecular evidence would allow to recognize this as a separate genus. We refrain from doing so until more species of the *T. vainioi* group have been sequenced.

**Additional species included** (see Xavier-Leite et al., 2023):

*Microxyphiomyces cuneatus* (L.I. Ferraro & Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Tricharia cuneata* L.I. Ferraro & Vězda, *Bonplandia* 6: 112 (1989).

*Microxyphiomyces demoulinii* (Sérus.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Tricharia demoulinii* Sérus., *Mycologia* 76: 109 (1984).

*Microxyphiomyces elegans* (Sérus.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Tricharia elegans* Sérus., *Mycologia* 76: 110 (1984).

*Microxyphiomyces kashiwadani* (G. Thor, Lücking & Tat. Matsumoto) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Tricharia kashiwadani* G. Thor, Lücking & Tat. Matsumoto, *Symb. Bot. Upsal.* 32(3): 62 (2000).

*Microxyphiomyces lancicarpus* (Kalb & Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Tricharia lancicarpa* Kalb & Vězda, *Biblioth. Lichenol.* 29: 67 (1988).

*Microxyphiomyces santessonianus* (Kalb & Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Tricharia santessoniana* Kalb & Vězda, *Biblioth. Lichenol.* 29: 70 (1988).

*Microxyphiomyces santessonii* (D. Hawksw.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Tricharia santessonii* D. Hawksw., *Lichenologist* 5: 321 (1972).

*Microxyphiomyces similis* (Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Tricharia similis* Vězda, *Folia Geobot. Phytotax.* 14: 75 (1979).

*Microxyphiomyces variratae* (Lücking & Sipman) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Tricharia variratae* Lücking & Sipman in Lücking et al., *Lichenologist* 37: 166 (2005).

***Monocalenia*** Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*

MycoBank MB 000000

Fig. 11 (A–B)

**Type species:** *Monocalenia monospora* (Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Calenia monospora* Vězda, Folia Geobot. Phytotax. 14: 56 (1979).

**Diagnosis:** Lichenized; thallus continuous, smooth, lacking setae; apothecia erumpent, zeorine (*Calenia* type), with epithelial algae; ascospores single, muriform; hyphophores unknown.

**Etymology:** The generic name is a combination of *Calenia* with part of the epithet of the type species, referring to the single-spored asci.

**Genus description:** Thallus foliicolous, continuous, lacking setae. Apothecia erumpent, zeorine; disc pruinose; proper margin indistinct, thalline margin distinct, not prominent. Excipulum prosoplectenchymatous, colorless. Hypothecium prosoplectenchymatous, colorless. Epithecium granular, with epithelial algae. Ascospores single, muriform. Hyphophores setiform, pale. Diahyphae inserted apically, moniliform, with fusiform segments.

**Discussion:** This new genus is established for a single species, *Calenia monospora*, which is unrelated to *Calenia* s.lat. and instead allied to *Asterothyrium* (Xavier-Leite et al., 2022). The lineage is characterized by a unique combination of smooth thallus, calenioid apothecia with pruinose disc and epithelial algae, and short hyphophores with fusiform diahyphal segments. Most similar is *Calenia lueckingii*, which agrees in the presence of epithelial algae and in the muriform ascospores, but its thallus is finely verrucose and the apothecia lack pruina, thus being more similar to *Calenia* s.str. and molecular data suggest a close relationship of that species with the latter and not with *C. monospora* (Xavier-Leite et al., 2022).

### ***Psathyromyces*** Bat. & Peres

MycoBank MB 9545

Fig. 12 (A–F)

*Psathyromyces* Bat. & Peres, Anais XIV Congr. Soc. Bot. Brasil: 95 (1964) [1963].

**Type species:** *Psathyromyces rosacearum* Bat. & Peres. = *Psathyromyces heterellus* (Stirt.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Arthonia heterella* Stirt., Proc. Roy. Phil. Soc. Glasgow 11: 106 (1879) [1878]; *Echinoplaca heterella* (Stirt.) R. Sant., Symb. Bot. Upsal. 12(1): 372 (1952); *Tricharia heterella* (Stirt.) Lücking, Biblioth. Lichenol. 65: 82 (1997); *Aderkomyces heterellus* (Stirt.) Lücking, Sérus. & Vězda, Lichenologist 37: 162 (2005).

**Diagnosis:** Lichenized; thallus continuous, smooth, with white setae; apothecia applanate, biatorine, orange; ascospores small muriform; hyphophores setiform, long, white, with arrow-like, blackened apex; diaphyphae moniliform.

**Discussion:** This genus is resurrected to accommodate the *Aderkomyces heterellus* aggregate, which is unrelated to *Aderkomyces* s.str. (Xavier-Leite et al., 2022) and differs from the latter in apothecial color and particularly in the very long, arrow-shaped hyphophores (Lücking et al., 2005). Apart from a second species included here, *A. planus*, the sequenced clade also indicates a further, yet undescribed species (Xavier-Leite et al., 2022).

**Additional species included** (see Xavier-Leite et al., 2023):

*Psathyromyces planus* (Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000].  
Basionym: *Tricharia plana* Vězda, Folia Geobot. Phytotax. 14: 74 (1979); *Aderkomyces planus* (Vězda) Lücking, Sérus. & Vězda, Lichenologist 37(2): 162 (2005).

***Pseudocalenia***Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*

MycoBank MB 000000

Fig. 11 (C–D)

**Type species:** *Pseudocalenia solorinoides* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000].  
Basionym: *Calenia solorinoides* Lücking, Nova Hedwigia 52: 292 (1991).

**Diagnosis:** Lichenized; thallus dispersed, bullate, lacking setae; apothecia immersed in the bullate thallus patches; ascospores single, muriform; hyphophores shortly setiform, white with blackened apex: diahyphae with terminal segments fusiform to clavate.

**Etymology:** The generic name refers to the notion that this species was previously included in *Calenia* but is not related to that genus.

**Genus description:** Thallus foliicolous, dispersed, lacking setae. Apothecia immersed in bullate thallus patches, lacking a proper margin and the 'thalline' margin formed by the surrounding thallus. Excipulum prosoplectenchymatous, colorless. Hypothecium prosoplectenchymatous, colorless. Epithecium indistinct. Ascospores single, muriform. Hyphophores marginal on the thallus patches, shortly setiform, white but apically blackened. Diahyphae inserted apically, terminal segments fusiform to clavate.

**Discussion:** *Pseudocalenia* is another segregate of *Calenia* s.lat., based on the morphologically unique *C. solorinoides*, which is unrelated to *Calenia* s.lat. and appears more closely allied to the morphologically quite distinct genera *Roselviria* and *Santricharia* (Xavier-Leite et al., 2022). The immersed, emarginate apothecia resembling those of *Solorinella* species may be the diagnostic apomorphy for this lineage; otherwise, the taxon is most similar to phylogenetically unrelated *C. bullatinoides* Lücking and *Bullatina aspidota* (Xavier-Leite et al., 2022), suggesting that the underlying thallus morphology evolved several times independently in the family.

***Roselviria***Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*

MycoBank MB 000000

Fig. 13 (A–D)

**Type species:** *Roselviria purulhensis* (Lücking, Sérus. & Vězda) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Tricharia purulhensis* Lücking & Barillas in Lücking, Biblioth. Lichenol. 65: 88 (1997); *Aderkomyces purulhensis* (Lücking & Barillas) Lücking, Sérus. & Vězda, Lichenologist 37: 162 (2005).

**Diagnosis:** Lichenized; thallus continuous, smooth, with white setae; apothecia erumpent, zeorine with triangular thalline lobules (*Chroodiscus* type); ascospores muriform; hyphophores setiform, white; diaphyphae moniliform.

**Etymology:** Dedicated to our colleague and friend, Roselvira Barillas, a pioneer in the study of foliicolous lichens in Guatemala.

**Genus description:** Thallus foliicolous, continuous, with sterile, white setae. Apothecia erumpent, zeorine ('pseudozeorine'); disc pale; proper margin distinct, prominent, thalline margin distinct, forming triangular lobules formed by algal-free corticiform layer. Excipulum hyphal, colorless. Hypothecium prosoplectenchymatous, colorless. Epithecium indistinct. Ascospores muriform. Hyphophores setiform, white. Diahyphae inserted apically, moniliform, segments ellipsoid to fusiform or to drop-shaped.

**Discussion:** This new genus appears unrelated to *Aderkomyces* s.str. in our molecular analysis (Xavier-Leite *et al.* 2022) and differs from typical members of that genus in the pale, chroodiscoid apothecia and the short, setiform hyphophores. Lücking *et al.* (2005) did not consider apothecial morphology in this case to be of systematic importance, but our molecular data not only demonstrate the opposite but also that the main feature connecting *Roselviria* with *Aderkomyces* s.str., the sterile white setae, evolved multiple times within the family.

**Additional species included** (see Xavier-Leite *et al.*, 2023):

*Roselviria lobulimarginata* (Sipman & Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Aderkomyces lobulimarginatus* Sipman & Lücking, Lichenologist 37: 162 (2005).

***Santricharia*** Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*

MycoBank MB 000000

Fig. 14 (A–F)

**Type species:** *Santricharia farinosa* (R. Sant.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Tricharia farinosa* R. Sant, Symb. Bot. Upsal. 12(1): 387 (1952).



**Diagnosis:** Lichenized; thallus continuous, coarsely verrucose, with black setae and dark brown prothallus; apothecia adnate to sessile, lecideine, with dark brown pruina; ascospores muriform; hyphophores setiform, black; diaphyphae moniliform.

**Etymology:** We are pleased to dedicate this new genus to the late Rolf Santesson for his groundbreaking monograph on foliicolous lichens published seven decades ago, laying the foundation for modern research in this fascinating group of organisms.

**Genus description:** Thallus foliicolous, continuous, coarsely verrucose, with numerous, sterile black setae; a dark brown prothallus usually present. Apothecia adnate to broadly sessile, lecideine; disc and proper margin covered by a thick, dark brown pruina. Excipulum prosoplectenchymatous, dark brown. Hypothecium prosoplectenchymatous, colorless. Epithecium dark brown, granulose. Ascospores single, muriform. Hyphophores setiform, black. Diaphyphae inserted apically, moniliform, segments sausage-shaped.

**Discussion:** This so far monospecific genus includes a species previously placed in *Tricharia* s.str. (Santesson, 1952; Lücking, 1997, 2008 Lücking et al., 2005) but apparently unrelated to the latter and instead closely related to the genus *Rubrotricha*, with which it shares almost no apomorphy (Xavier-Leite et al., 2022). The only consistent difference of the new genus from all species placed in *Tricharia* s.str. are the unique, lecideine apothecia with a thick, dark chocolate-brown pruina.

***Sipmanidea*** Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*

MycoBank MB 000000

Fig. 15 (A–F)

**Type species:** *Sipmanidea neotropica* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. et stat nov.* [MycoBank MB 000000]. Basionym: *Echinoplaca furcata* subsp. *neotropica* Lücking, Fl. Neotrop. Monogr. 103: 493 (2008).

**Diagnosis:** Lichenized; thallus continuous to dispersed, coarsely verrucose, usually whitish pruinose, with white, thinly branched setae usually formed on a translucent prothallus; apothecia erumpent to adnate, appearing zeorine to emarginate (*Calenia* or *Echinoplaca* type), orange; ascospores muriform; hyphophores setiform, yellowish; diaphyphae filiform with spermatozoid terminal segments.

**Etymology:** We dedicate this new genus to our esteemed colleague and friend, Harrie Sipman, one of the foremost tropical lichenologists and who has also worked on foliicolous lichens.

**Genus description:** Thallus foliicolous, continuous to dispersed, coarsely verrucose, often whitish pruinose, with numerous, sterile white setae with short, lateral branches, usually formed on translucent prothallus. Apothecia erumpent and zeorine (calenioid) to adnate and spot-like (echinoplacoid); disc orange but usually with white, marginal pruina produced by needle-shaped crystals. Excipulum hyphal,

colorless. Hypothecium prosoplectenchymatous, colorless. Epithecium yellowish brown, granular. Ascospores single, muriform. Hyphophores usually formed on the algiferous thallus, setiform, pale yellow. Diahyphae inserted subapically, composed of two types of filiform hyphae, either thick or thin, with the terminal segments of the thin hyphae strongly clavate to spermatozoid.

**Discussion:** This new genus corresponds to part of a group of species previously placed in *Echinoplaca* and considered unique due to their branched setae, unique thallus and apothecial pruina, and unique diahyphae (Lücking, 1997; Lücking et al., 2005). In our molecular phylogenetic analysis, the species previously assigned to this group (*E. furcata* including subspecies, *E. verrucifera* including forms) formed two distinct, somehow related but separate clades, differing in apothecial morphology (at least in the sequenced species) and ascospore size and number per ascus). The sequenced taxon here assigned to the genus *Sipmanidea*, *E. furcata* subsp. *neotropica*, differs from the nominal subspecies in the distinctly calenioid apothecia; *E. furcata* subsp. *furcata* Sérus. has more echinoplacoid apothecia with an only slightly raised thalline margin.

**Additional species included** (see Xavier-Leite et al., 2023):

*Sipmanidea furcata* (Sérus.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000].  
Basionym: *Echinoplaca furcata* Sérus., Mycotaxon 35: 238 (1989).

***Spinomyces*** Bat. & Peres ex Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*

MycoBank MB 000000

Fig. 16 (A–F)

**Type species:** *Spinomyces albostrigosus* (Lücking, Sérus. & Vězda) Xavier-Leite, Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Tricharia albostrigosa* R. Sant., Symb. Bot. Upsal. 12(1): 388 (1952); *Aderkomyces albostrigosus* (R. Sant.) Lücking, Sérus. & Vězda, Lichenologist 37: 161 (2005).

**Diagnosis:** Lichenized; thallus continuous, smooth, with white setae; apothecia sessile, biatorine; ascospores usually muriform; hyphophores setiform, white, often widened apically; diaphyphae moniliform.

**Etymology:** The name validated here likely refers to the sterile setae formed by these species.

**Genus description:** Thallus foliicolous, continuous, with sterile, white setae. Apothecia sessile, biatorine; disc variously coloured but usually yellowish to red-brown. Excipulum hyphal, colorless. Hypothecium prosoplectenchymatous, colorless. Epithecium indistinct. Ascospores mostly single, muriform. Hyphophores setiform with usually widened apex, white. Diahyphae inserted apically, moniliform, segments fusiform.

**Discussion:** The name *Spinomyces* was established without a description (Batista, 1961), with the original material of the invalid name *S. genipae* based on a mixture of sterile specimens of *Tricharia* cf.

*albostrigosa* and *Echinoplaca* sp. Since no name was available for the newly recognized clade centered around *Aderkomyces albostrigosus*, we decided to reinstate and validate the name *Spinomyces* for this clade based on a taxon representing the *T. albostrigosa* clade, rather than *Echinoplaca* as previously proposed (Lücking et al., 1998). The species referred to this new genus had previously been assigned to *Aderkomyces* (Lücking et al., 2005), which turned out to be polyphyletic based on molecular data (Xavier-Leite et al. 2022). *Aderkomyces* s.str. appears to differ from *Spinomyces* consistently by the applanate to adnate, more or less emarginate, dark greyish brown apothecia.

**Additional species included** (see Xavier-Leite et al., 2023):

*Spinomyces aggregatus* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. et stat. nov.* [MycoBank MB 000000]. Basionym: *Aderkomyces albostrigosus* f. *aggregatus* Lücking, Fl. Neotrop. Monogr. 103: 457 (2008).

*Spinomyces deslooveri* (Sérus.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Tricharia deslooveri* Sérus. in Aptroot *et al.*, Biblioth. Lichenol. 64: 200 (1997); *Aderkomyces deslooveri* (Sérus.) Lücking, Sérus. & Vězda, Lichenologist 37: 161 (2005).

*Spinomyces guatemalensis* (Lücking & Barillas) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Tricharia guatemalensis* Lücking & Barillas in Lücking, Biblioth. Lichenol. 65: 81 (1997); *Aderkomyces guatemalensis* (Lücking & Barillas) Lücking, Sérus. & Vězda, Lichenologist 37: 161 (2005).

*Spinomyces microcarpus* (Etayo & Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Tricharia microcarpa* Etayo & Lücking in Etayo, Flora y Fauna del Parque Nacional de Coiba (Panamá), Inventario Preliminar (Madrid): 217 (1997); *Aderkomyces microcarpus* (Etayo & Lücking) Lücking, Sérus. & Vězda, Lichenologist 37: 162 (2005).

*Spinomyces verrucosus* (Sérus.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Tricharia verrucosa* Sérus. in Aptroot *et al.*, Biblioth. Lichenol. 64: 204 (1997); *Aderkomyces verrucosus* (Sérus.) Lücking, Sérus. & Vězda, Lichenologist 37: 163 (2005).

***Sporocybomyces*** H. Maia

MycoBank MB 10031

Fig. 17 (A–F)

*Sporocybomyces* H. Maia in Batista & Maia, Atas Inst. Micol. Univ. Pernambuco 5: 60 (1967).

**Type species:** *Sporocybomyces pulcher* H. Maia. = *Sporocybomyces leucotrichoides* (Vain.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Calenia leucotrichoides* Vain., Ann. Acad. Sci. Fenn., Ser. A, 15(6): 166 (1921); *Echinoplaca leucotrichoides* (Vain.) R. Sant. in Thorold, J. Ecol. 40: 129 (1952).

**Diagnosis:** Lichenized; thallus continuous, finely verrucose, usually lacking sterile setae; apothecia adnate, spot-like (*Echinoplaca* type); ascospores large, transversely septate to muriform; hyphophores shortly setiform, blunt, white with darkened apices; diaphyphae filiform with clavate to sausage-shaped, multiseptate terminal segments.

**Discussion:** *Sporocybomyces* is another reinstated genus based on a name established by Batista and his co-workers (Batista & Maia, 1967), here used to accommodate the phylogenetically distinct *Echinoplaca leucotrichoides* clade (Xavier-Leite et al., 2022). While the apothecia in this group are echinoplacoid, the diahyphae produced on short, apically darkened hyphophores are unique in featuring multiseptate terminal segments (Lücking et al., 2005).

**Additional species included** (see Xavier-Leite et al., 2023):

*Sporocybomyces leucomuralis* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Echinoplaca leucomuralis* Lücking, Fl. Neotrop. Monogr. 103: 485 (2008).

*Sporocybomyces macgregorii* (Vain.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Arthonia macgregorii* Vain., Ann. Acad. Sci. Fenn., Ser. A, 15(6): 313 (1921); *Echinoplaca macgregorii* (Vain.) Lücking, Sérus. & Vězda, Lichenologist 37: 164 (2005).

***Verruciplaca*** Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*

MycoBank MB 000000

Fig. 18 (A–F)

**Type species:** *Verruciplaca verrucifera* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Echinoplaca verrucifera* Lücking, Biblioth. Lichenol. 65: 62 (1997).

**Diagnosis:** Lichenized; thallus continuous to dispersed, coarsely verrucose, usually whitish to bluish pruinose, with white, thinly branched setae usually formed on a translucent prothallus; apothecia adnate, emarginate (*Echinoplaca* type), orange; ascospores small muriform; hyphophores setiform, yellowish; diaphyphae filiform with spermatozoid terminal segments.

**Etymology:** The genus name refers to the large thallus verrucae typical of the new genus.

**Genus description:** Thallus foliicolous, continuous to dispersed, coarsely verrucose, usually whitish to bluish pruinose, with numerous, sterile white setae with short, lateral branches, usually formed on translucent prothallus. Apothecia adnate and spot-like (echinoplacoid); disc orange but often with white, marginal pruina produced by needle-shaped crystals. Excipulum hyphal, colorless. Hypothecium prosoplectenchymatous, colorless. Epithecium yellowish brown, granular. Ascospores usually 8 per ascus, muriform. Hyphophores formed on the algiferous thallus, setiform, pale yellow. Diahyphae inserted subapically, composed of two types of filiform hyphae, either thick or thin, with the terminal segments of the thin hyphae strongly clavate to spermatozoid.

**Discussion:** This new genus is similar to *Sipmanidea* in most aspects but forms a separate clade based on molecular evidence (Xavier-Leite et al., 2022). At present, ascospores are the main diagnostic feature, but sequence data for *Echinoplaca furcata* s.str. are needed to test this assumption. Lücking (2008) recognized only one species (with two forms) in the group forming the clade here named *Verruciplaca*, but our molecular data show that at least four distinct entities are involved (Xavier-Leite et al., 2022). Two correspond to the two forms of *E. verrucifera* (f. *verrucifera* and f. *calcarea*), and therefore we elevate f. *calcarea* to species level here. The two as yet unnamed lineages will be formally described in a separate paper.

**Additional species included** (see Xavier-Leite et al. 2023):

*Verruciplaca calcarea* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. et stat. nov.* [MycoBank MB 000000]. Basionym: *Echinoplaca verrucifera* f. *calcarea* Lücking, Fl. Neotrop. Monogr. 103: 493 (2008).

*Veزدamyces* Xavier-Leite, M. Cáceres & Lücking, *gen. nov.*

MycoBank MB 000000

Fig. 19 (A–F)

**Type species:** *Veزدamyces vulgaris* (Müll. Arg.) Xavier-Leite, M. Cáceres & Lücking, *comb. nov.* [MycoBank MB 000000]. Basionym: *Lopadium vulgare* Müll. Arg., Flora 64: 109 (1881); *Tricharia vulgaris* (Müll. Arg.) R. Sant., Symb. Bot. Upsal. 12(1): 389 (1952); *Actinoplaca vulgaris* (Müll. Arg.) Vězda & Poelt, Folia Geobot. Phytotax. 22: 184 (1987); *Gyalideopsis vulgaris* (Müll. Arg.) Lücking, Biblioth. Lichenol. 65: 75 (1997).

**Diagnosis:** Lichenized; thallus continuous, finely verrucose, lacking sterile setae; apothecia adnate to sessile, biatorine; excipulum paraplectenchymatous; ascospores single, muriform; hyphophores shortly setiform, white with incrustation of crystals: diahyphae moniliform with clavate to spermatozoid segments.

**Etymology:** The genus name honors the legacy of Antonín Vězda, one of the prominent lichen taxonomists of the twentieth century who substantially advanced our knowledge of foliicolous lichen taxonomy and particularly of *Gomphillaceae*.

**Genus description:** Thallus foliicolous, continuous, finely verrucose, lacking sterile setae. Apothecia adnate to sessile, biatorine; disc greenish yellow, proper margin distinct, yellow or white pruinose. Excipulum paraplectenchymatous, colorless. Hypothecium prosoplectenchymatous, colorless. Epithecium with epithelial algae. Ascospores single, muriform. Hyphophores shortly setiform with thickened apex, pure white, encrusted with crystals. Diahyphae inserted apically, moniliform, segments clavate to spermatozoid, with scattered algal cells in-between.

**Discussion:** The genus newly established here includes one of the most enigmatic species of *Gomphillaceae*, the systematic position of which has been a stumbling block prior to the results of our molecular phylogenetic analysis (Xavier-Leite et al., 2023). Originally described in *Lopadium* due to the biatorine apothecia and muriform ascospores (Müller, 1881), the genus was transferred to *Tricharia* by Santesson (1952), who mistook the hyphophores for sterile setae but noticed their difference to the sterile setae found in other *Tricharia* species. Vězda and Poelt (1987) then included the species in *Actinoplaca*, mainly due to the presence of algae in the diahyphal bunches. Lücking (1997) challenged this placement, arguing that other than the diahyphal algae, the species differed from *Actinoplaca strigulacea* in almost any possible way, including apothecial morphology and anatomy (echinoplacoid in *Actinoplaca* and lacking epithelial algae), ascospores (very small and 1-septate in *Actinoplaca*), and hyphophore and diahyphal type (sessile, globose diahyphal bunches with filiform diahyphae with only the terminal segments spermatozoid in *Actinoplaca*). The species was provisionally placed in *Gyalideopsis* based on apothecial morphology, but it was recognized that the paraplectenchymatous excipulum, epithelial algae, crystalline hyphophores and algiferous diaphyphal bunches strongly differed from all other species assigned to that genus (Lücking, 1997, 2008; Lücking et al., 2005). Much to our surprise, while the molecular phylogeny supports the placement of this taxon in its genus, it is indeed related to *Actinoplaca strigulacea*, another example of the sometimes visionary systematic concept that characterized the work of Antonín Vězda. Our molecular data also support the distinction of the form with white-pruinose apothecial margins as a separate species and suggest the existence of a further, yet undescribed species from Brazil (Xavier-Leite et al., 2022).

**Additional species included** (see Xavier-Leite et al., 2023):

*Vezdamyces albopruinosus* (Lücking) Xavier-Leite, M. Cáceres & Lücking, *comb. et stat. nov.* [MycoBank MB 000000]. Basionym: *Gyalideopsis vulgaris* f. *albopruinosa* Lücking, Fl. Neotrop. Monogr. 103: 431 (2008).

## Declarations

### Availability of data and material

All data used in this study are either directly cited (nomenclature) or are available through the cited references (underlying phylogeny and sequence data) or through the cited repositories (MycoBank registration numbers).

### Competing interests

The authors declare no competing interests.

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### Authors' contributions

ABXL, BTG, RL and MESC designed the study. ABXL provided draft descriptions of the new genera and ABXL and RL made the final descriptions. ABXL and RL assembled the new species combinations and the draft manuscript. All authors revised the manuscript and agreed on its final form.

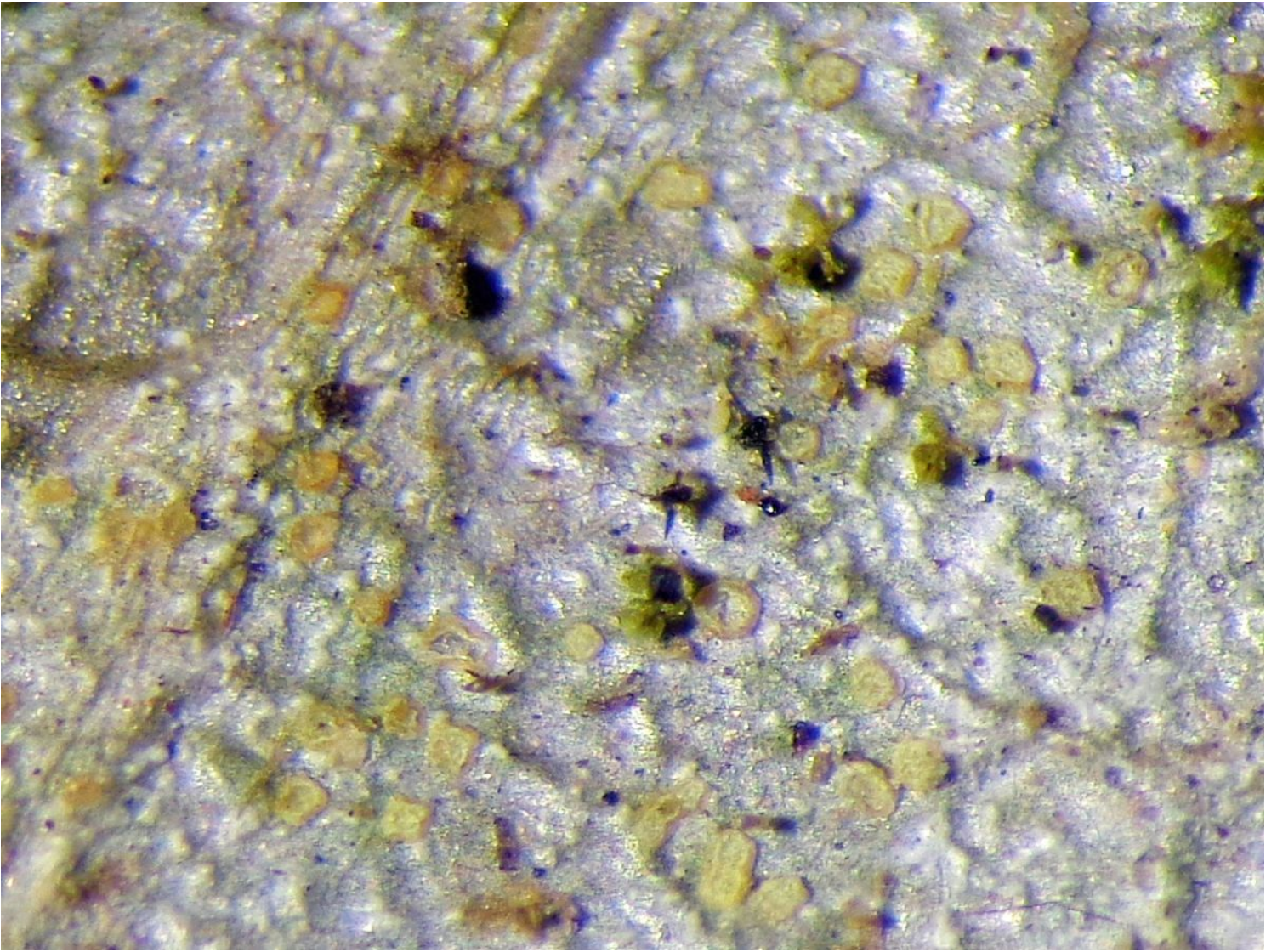
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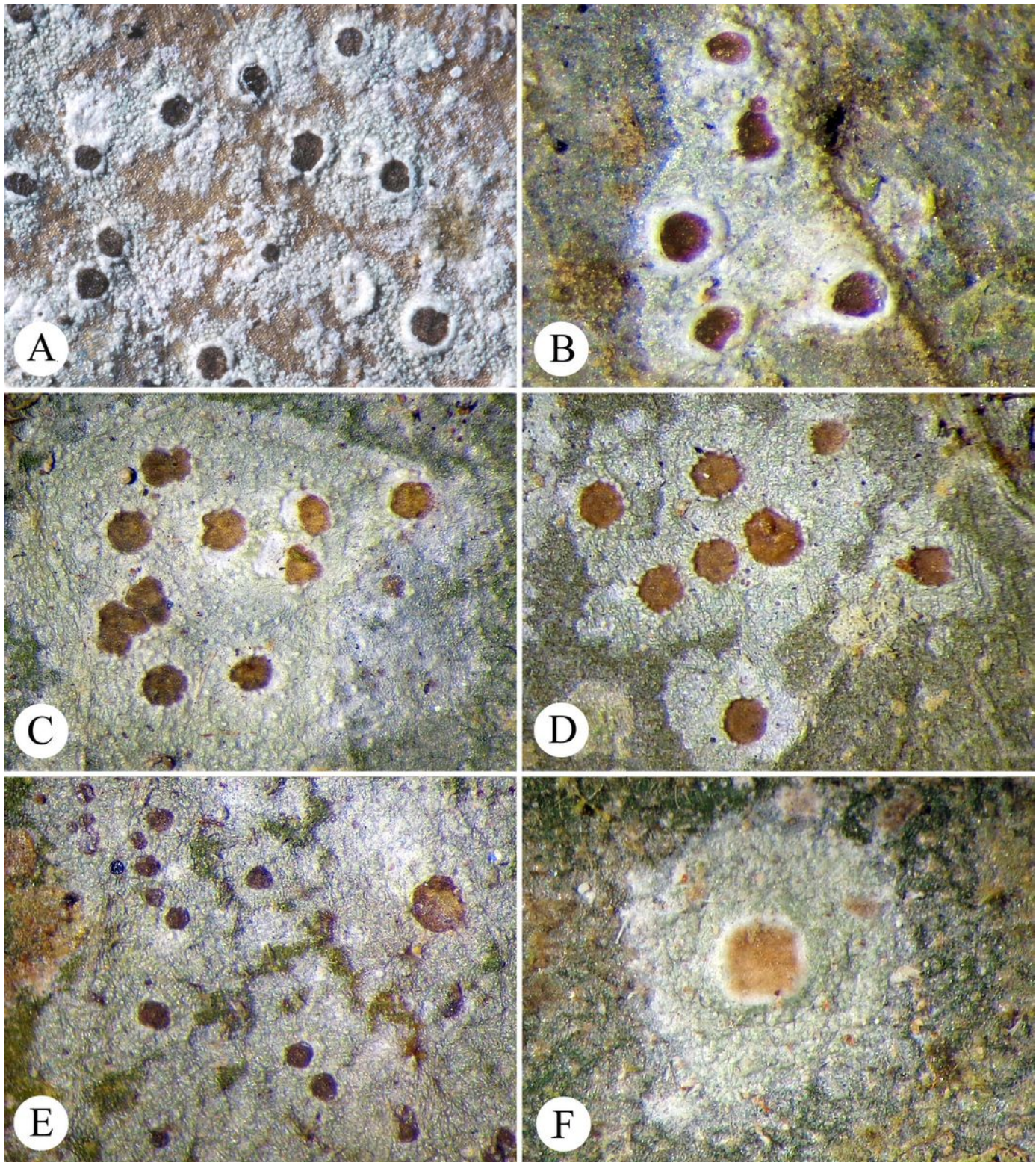
## Figures





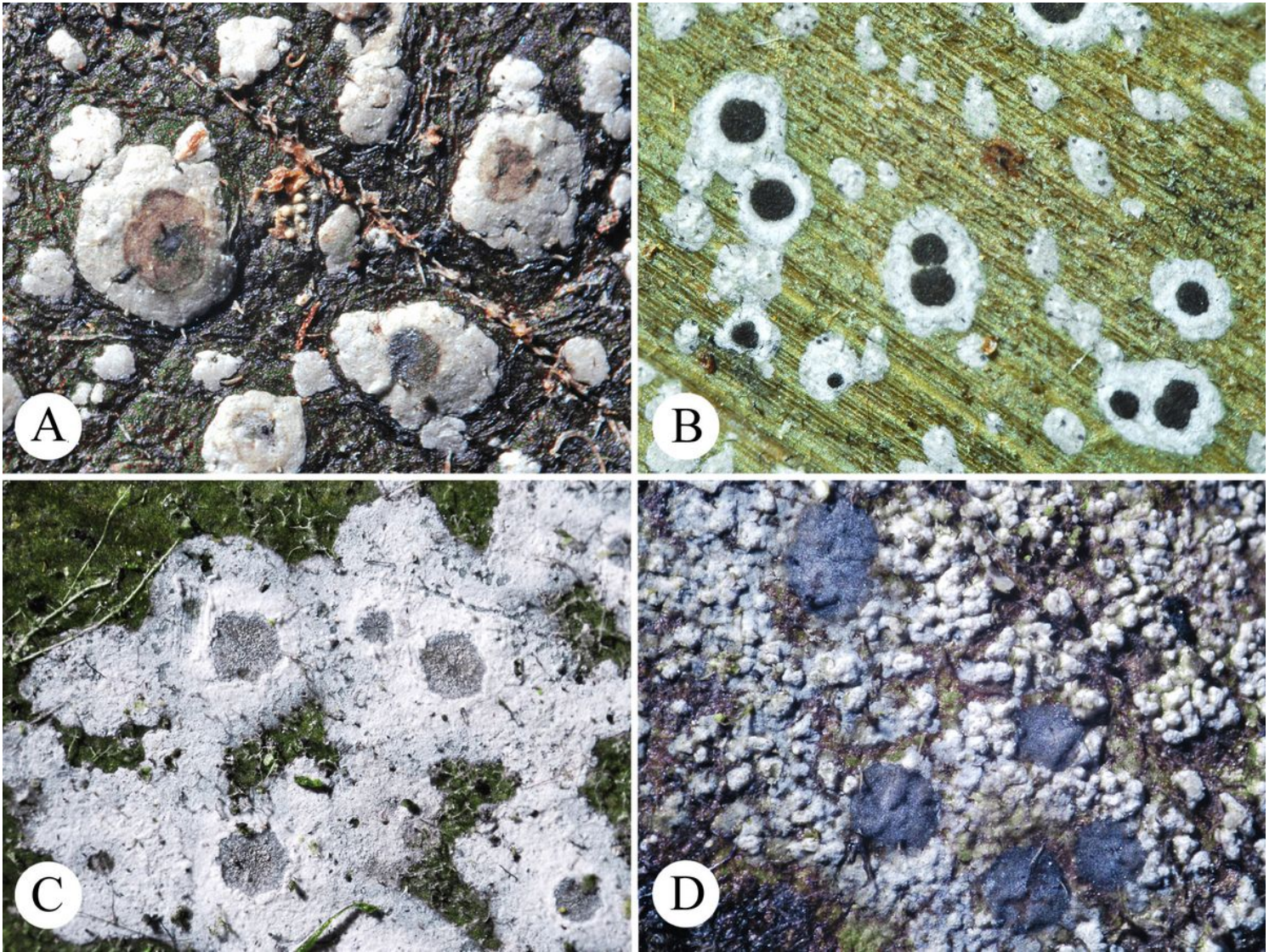
**Figure 1**

New genus *Adelphomyces*, sequenced specimen. *Adelphomyces epithallinus*, Brazil [23107], showing apothecia and hyphophores on thallus of *Vezdamyces vulgaris*.



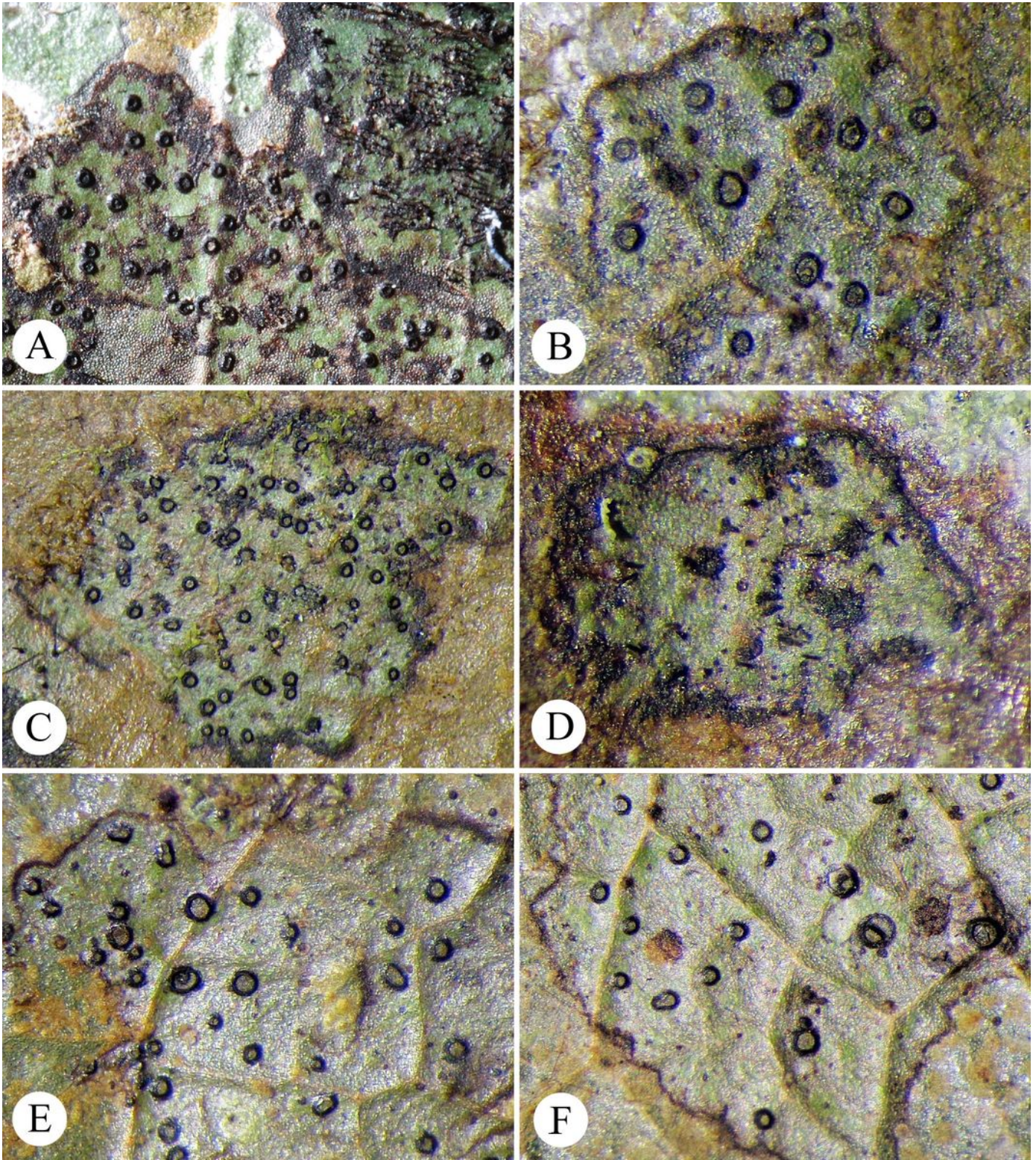
**Figure 2**

New genus *Aptrootidea*, including sequenced specimens. **A.** *Aptrootidea marginata*, Costa Rica. **B.** *A. marginata*, Brazil [23012]. **C.** *A. marginata*, Brazil [23114]. **D.** *A. marginata*, Brazil [23015]. **E.** *A. marginata*, Brazil [23013]. **F.** *Aptrootidea* sp. nov., Brazil [22024]. All showing thallus with apothecia.



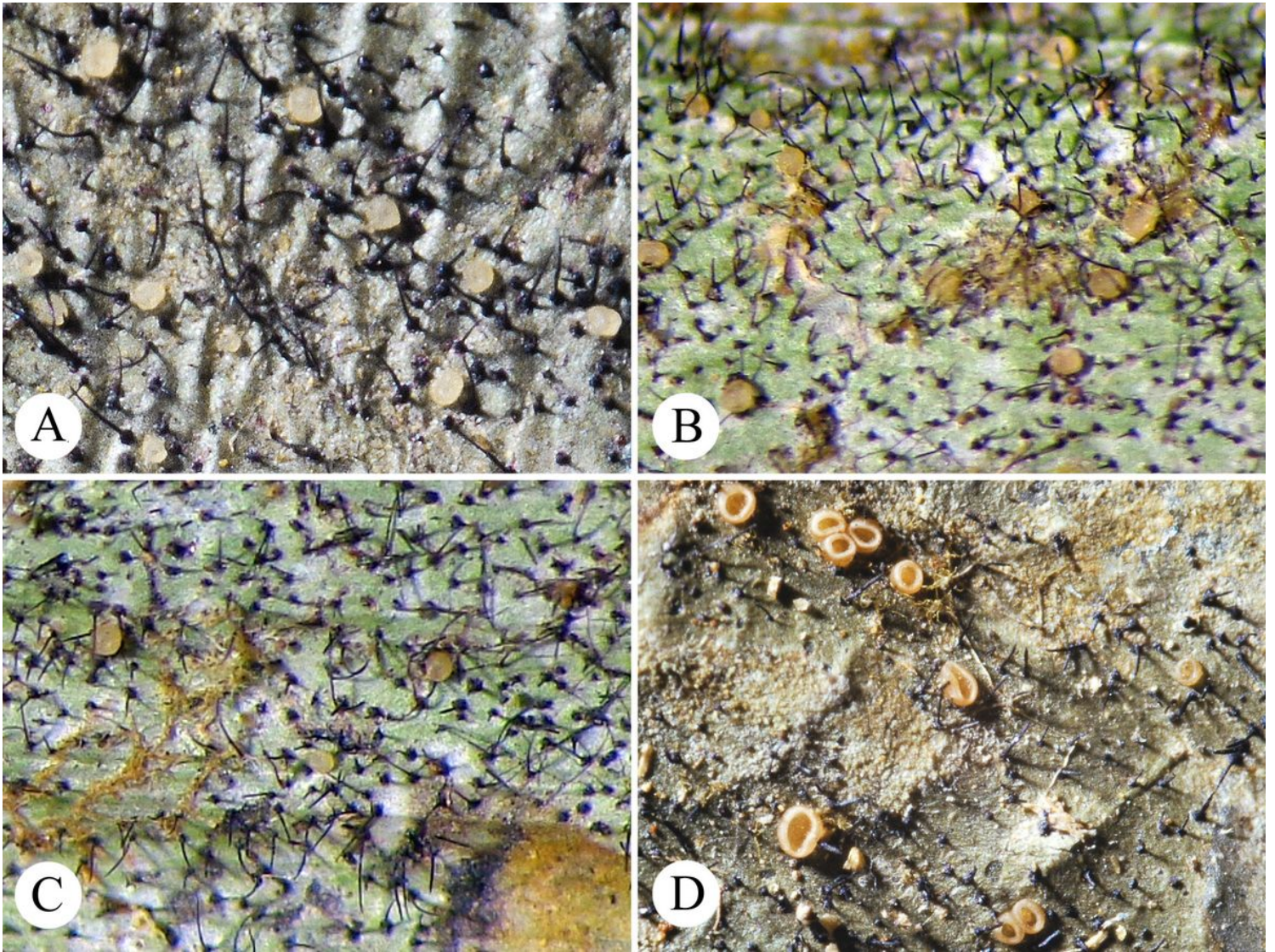
**Figure 3**

New genus *Aptrootidea*. **A.** *Aptrootidea amapensis*, Brazil. **B.** *A. atrofusca*. **C.** *A. atomuralis*, Costa Rica. **D.** *A. triseptata*, Costa Rica. All showing thallus with apothecia.



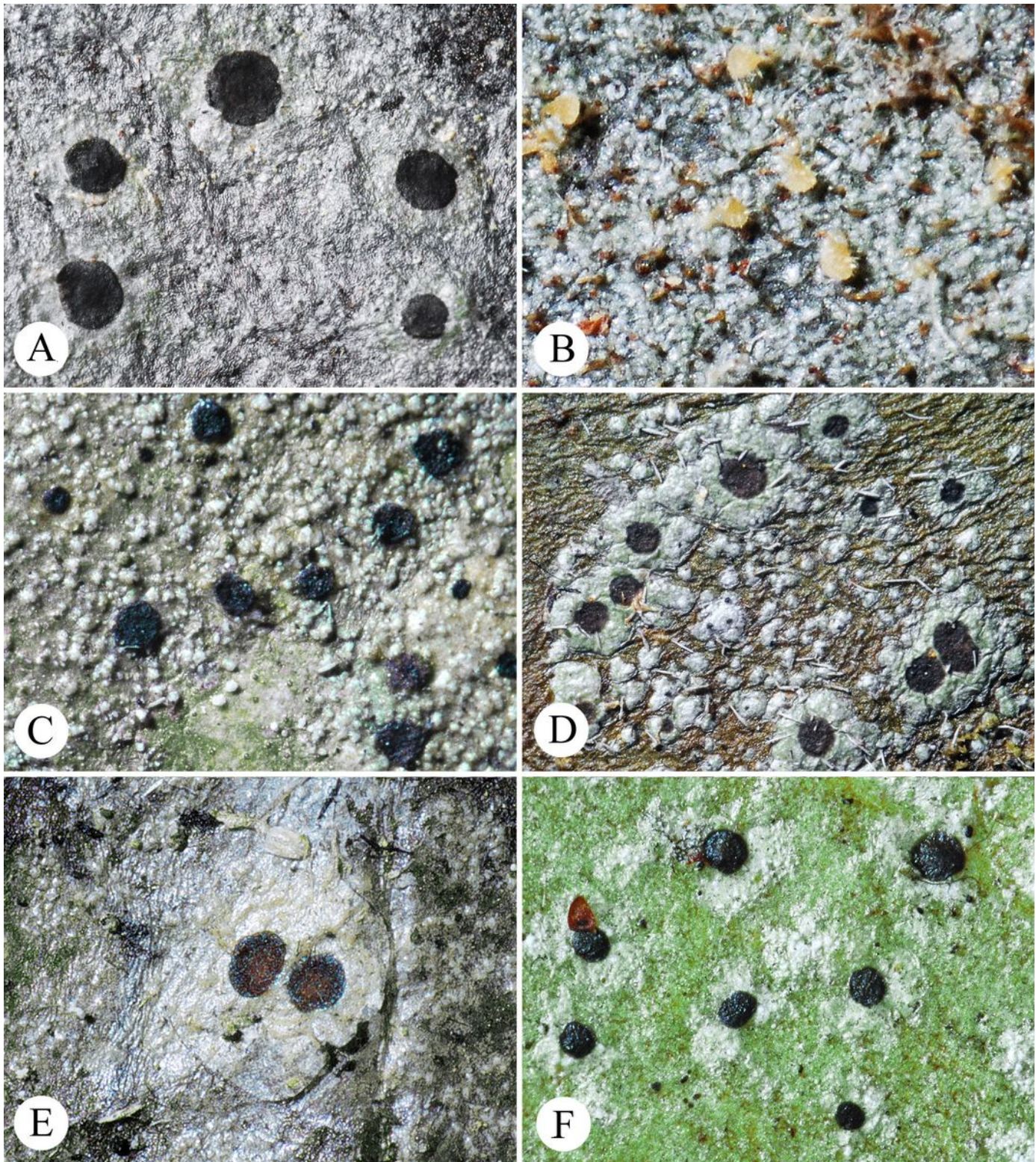
**Figure 4**

New genus *Aulaxinella*, including sequenced specimens. **A.** *Aulaxinella minuta*, Ecuador. **B.** *A. aff. minuta*, Brazil [23079]. **C.** *A. aff. minuta*, Brazil [23092]. **D.** *A. aff. minuta*, Brazil [22173]. **E.** *A. minuta*, Brazil [22186]. **F.** *A. minuta*, Brazil [22187]. All showing thallus with apothecia and (in part) hyphophores.



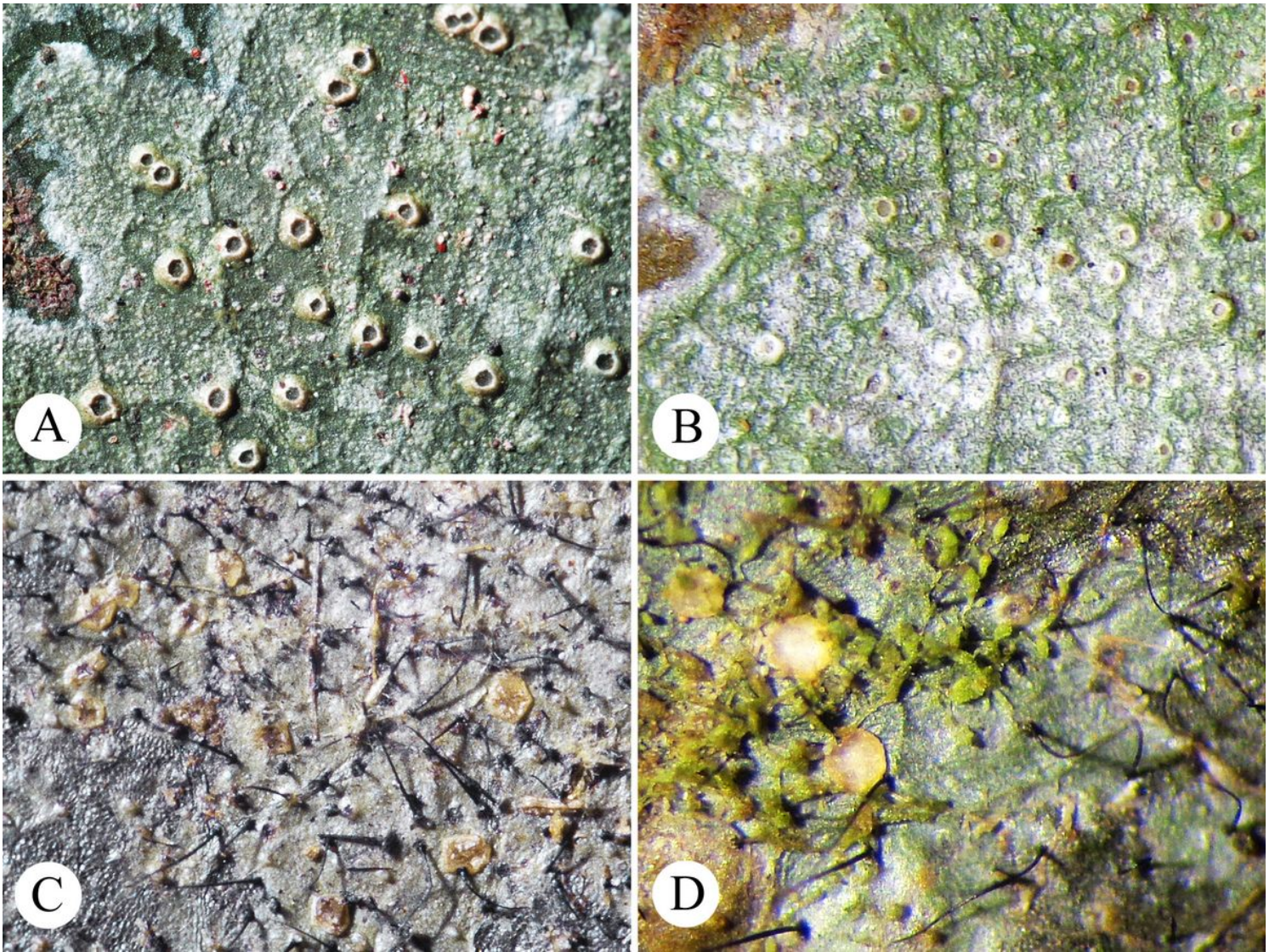
**Figure 5**

New genus *Batistomyces*, including sequenced specimens. **A.** *Batistomyces hyalinus*, French Guiana. **B.** *B. hyalinus*, Brazil [23154]. **C.** *B. hyalinus*, Brazil [23155]. **D.** *B. pallidus*, holotype. All showing thallus with apothecia and sterile setae.



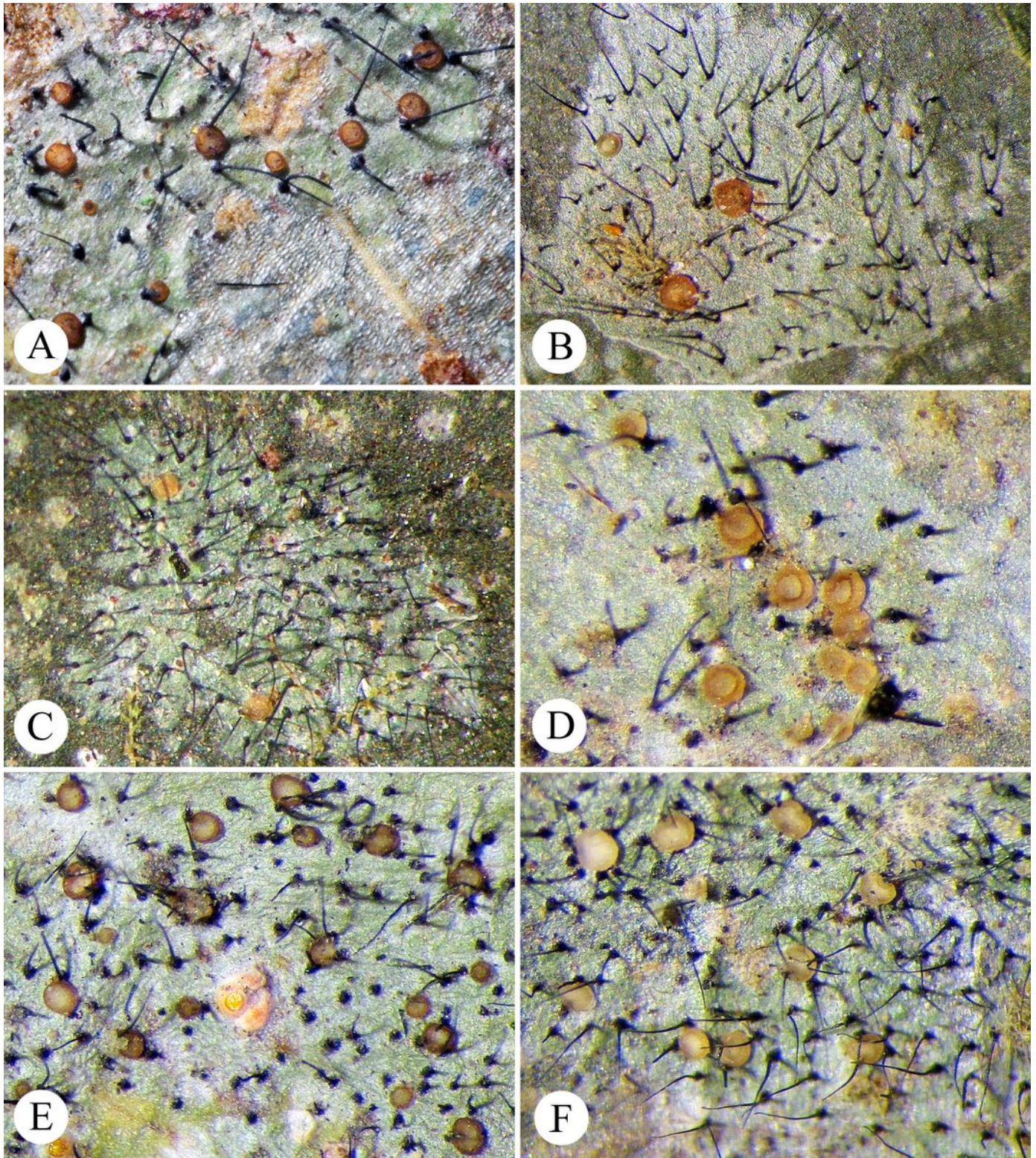
**Figure 6**

New genus *Bezerroplaca*. **A.** *Bezerroplaca lucernifera*, Ecuador. **B.** *B. lucernifera*, Costa Rica. **C.** *B. fusconitida*, Costa Rica. **D.** *B. incrustatociliata*, Papua New Guinea, **E.** *B. pachyparaphysata*, Brazil. **F.** *B. streimannii*, Australia. All showing thallus with apothecia and (in part) sterile setae and hyphophores.



**Figure 7**

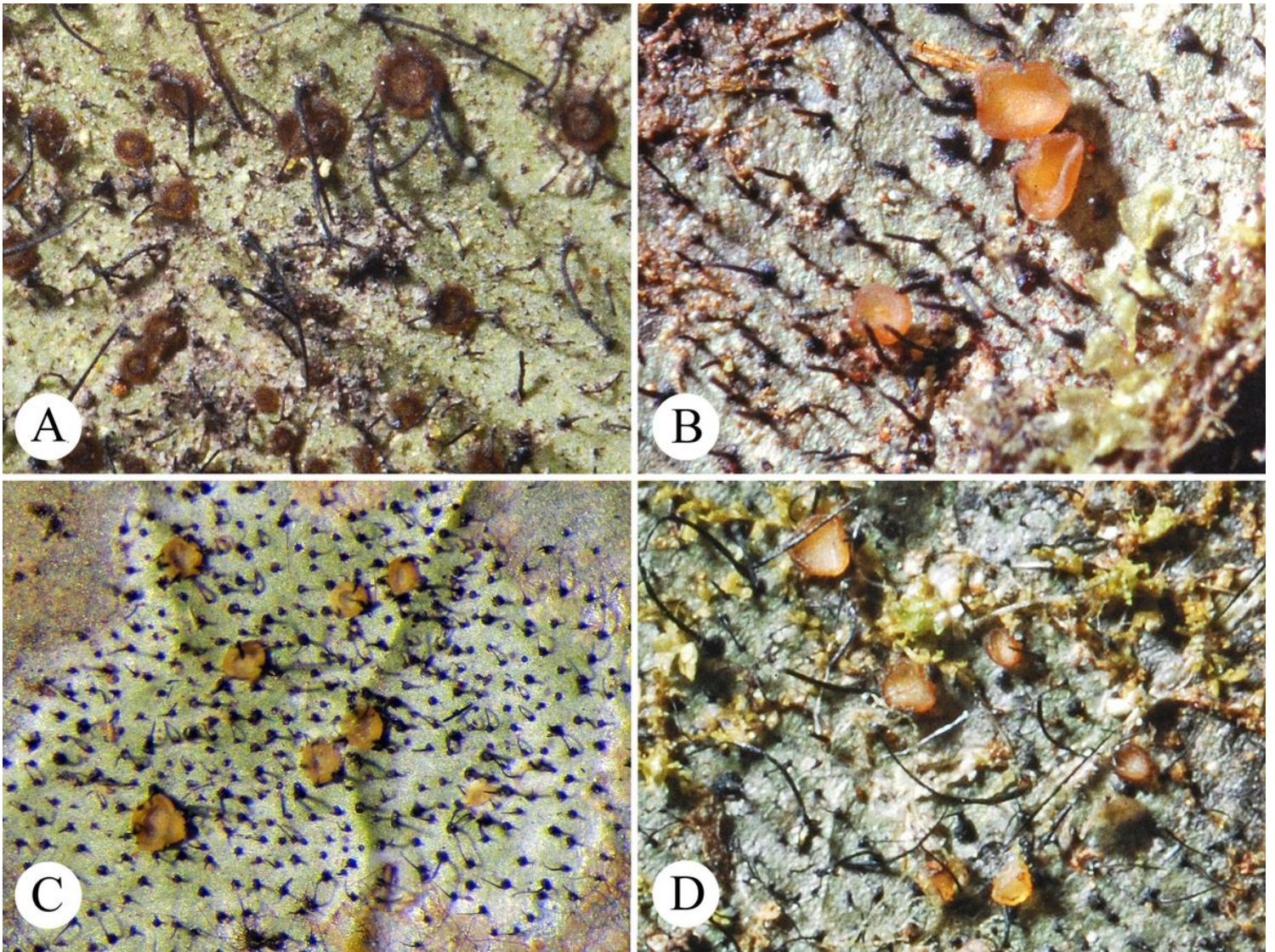
New genus *Caleniella* and reinstated genus *Microxyphiomyces*, including sequenced specimens. **A.** *Caleniella triseptata*, Costa Rica. **B.** *C. triseptata*, Brazil [23146]. **C.** *Microxyphiomyces lancicarpus*, French Guiana. **D.** *M. lancicarpus*, Brazil [22164]. All showing thallus with apothecia and (in part) sterile setae.



**Figure 8**

New genus *Microxyphiomyces*, including sequenced specimens. **A.** *Microxyphiomyces vainioi*, Costa Rica. **B.** *M. vainioi*, Brazil [22176]. **C.** *M. vainioi*, Brazil [22004]. **D.** *M. vainioi*, Brazil [23075]. **E.** *M. vainioi*, Brazil [23111]. **F.** *M. vainioi*, Brazil [23077]. All showing thallus with apothecia and sterile setae.





**Figure 9**

Reinstated genus *Microxyphiomyces*, including sequenced specimens. **A.** *Microxyphiomyces demoulinii*, Papua New Guinea. **B.** *M. similis*, holotype. **C.** *M. similis*, Brazil [22147]. **D.** *M. variratae*, holotype. All showing thallus with apothecia and sterile setae.

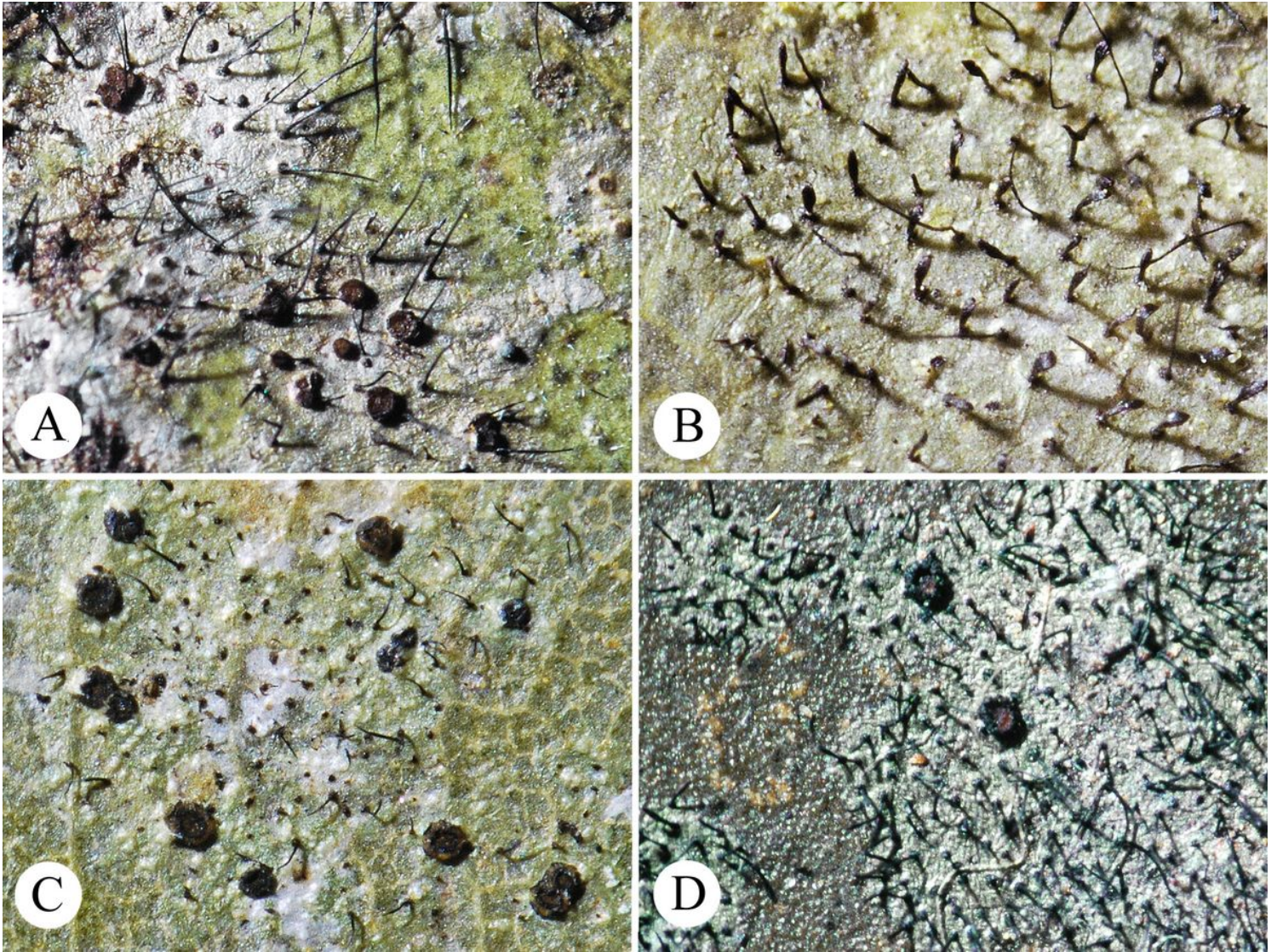
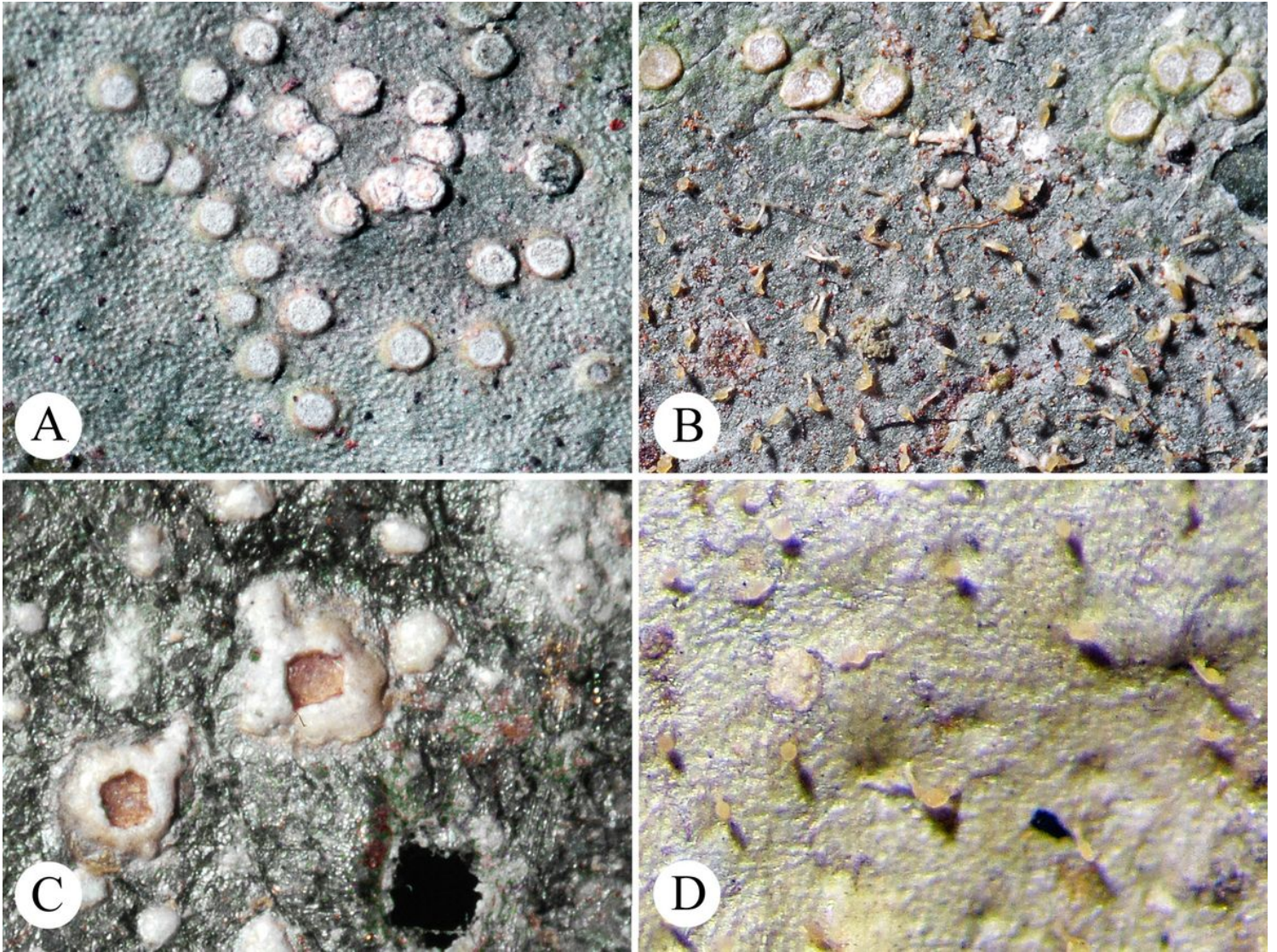


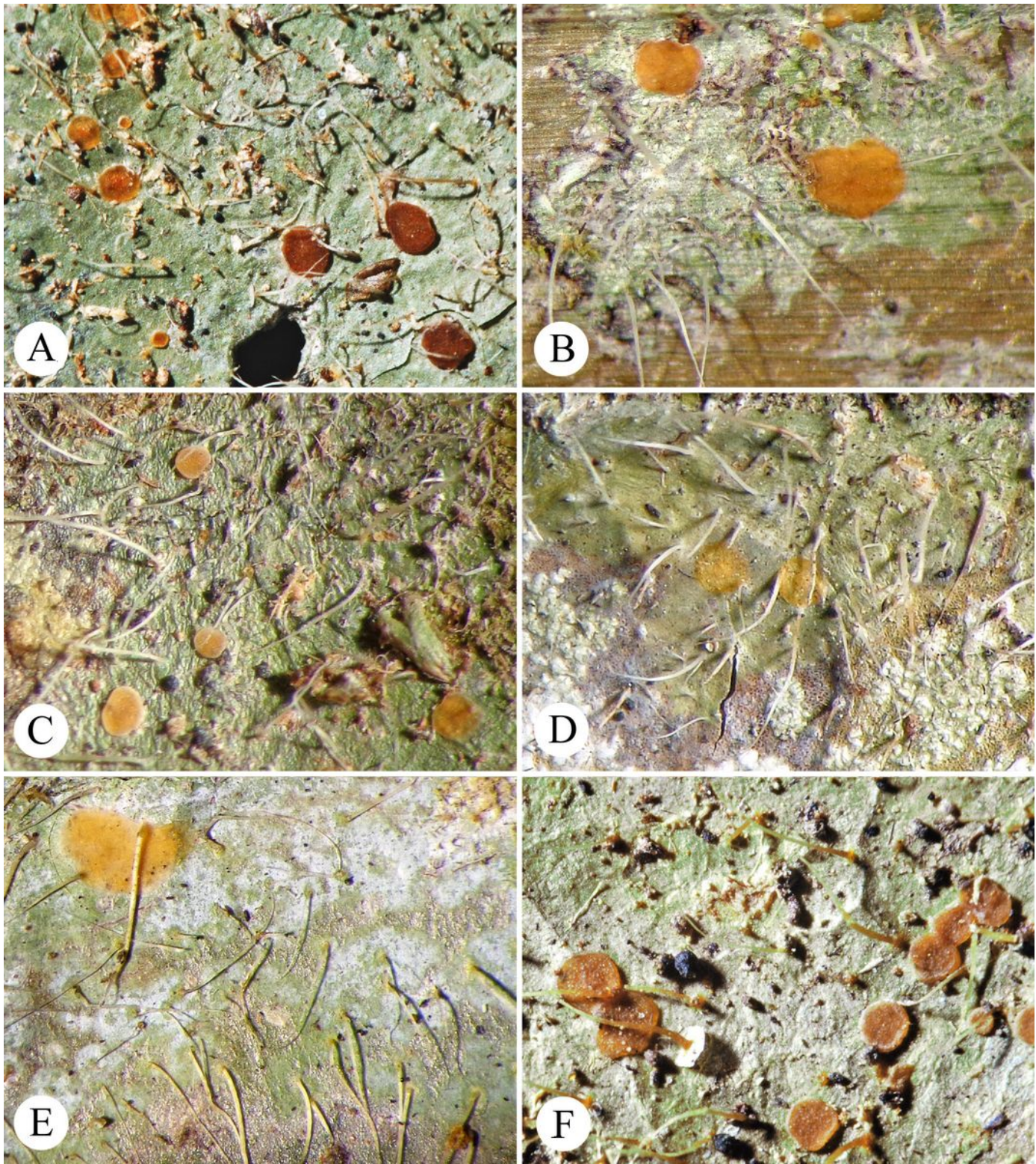
Figure 10

New genus *Microxyphiomyces*. **A.** *Microxyphiomyces cuneatus*, Paraguay. **B.** *M. cuneatus*, holotype. **C.** *M. kashiwadani*, Japan. **D.** *M. santessoni*, holotype. All showing thallus with apothecia and sterile setae.



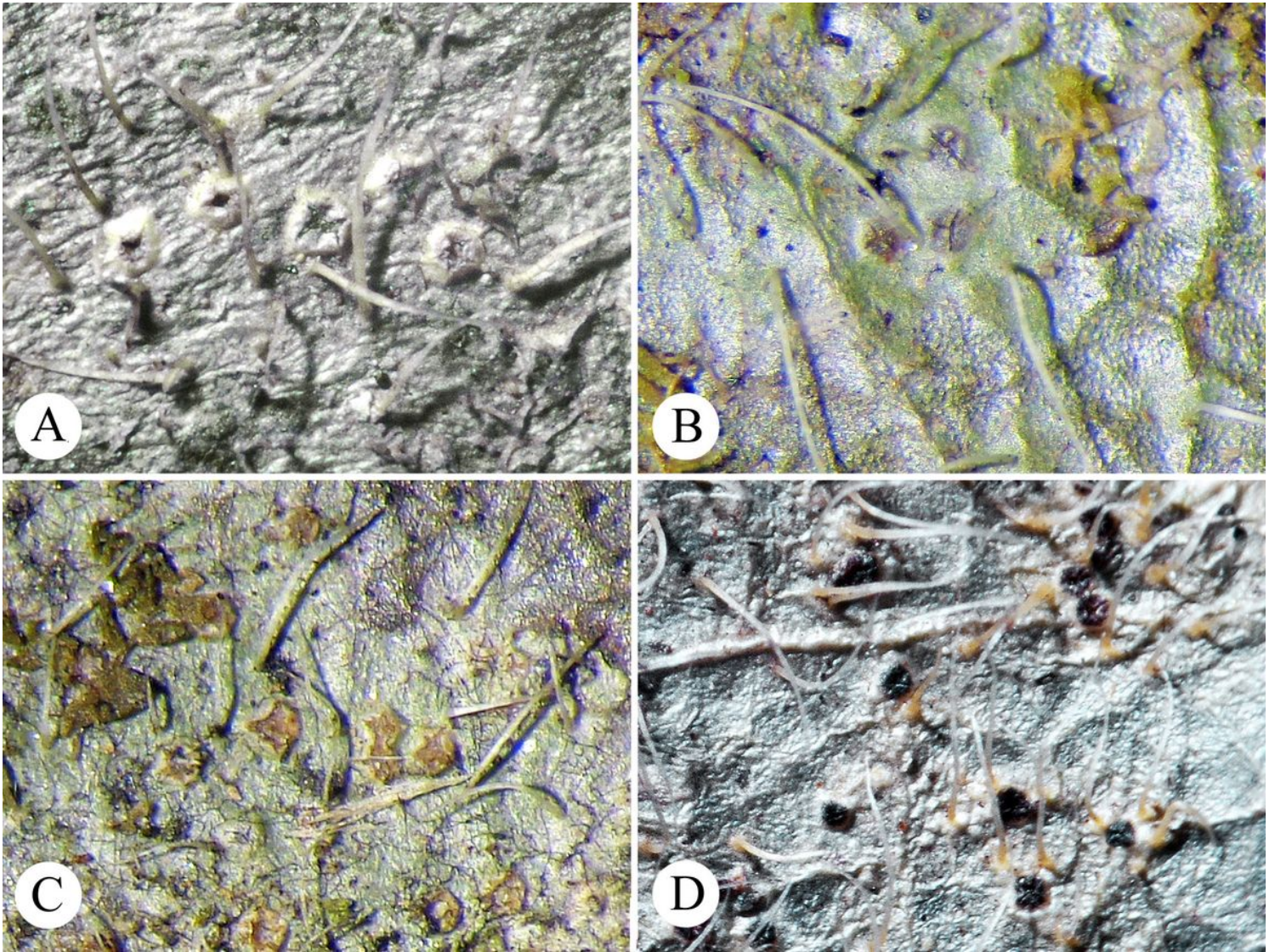
**Figure 11**

New genera *Monocalenia* and *Pseudocalenia*. **A.** *Monocalenia monospora*, Costa Rica. **B.** *M. monospora*, holotype. **C.** *Pseudocalenia solorinoides*, holotype. **D.** *Pseudocalenia* sp., Guatemala [22815]. All showing thallus with apothecia and/or hyphophores.



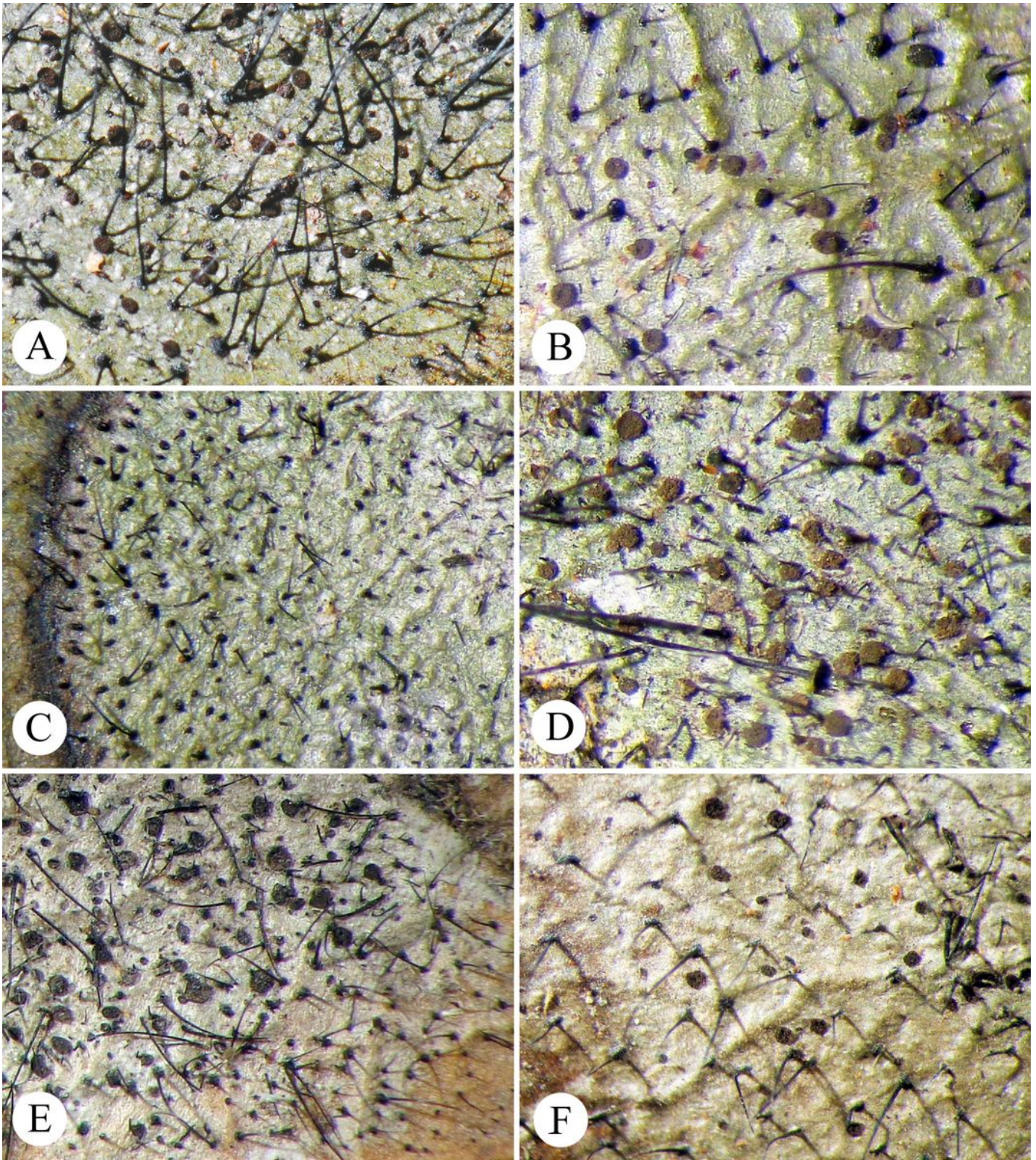
**Figure 12**

Reinstated genus *Psathyromyces*, including sequenced specimens. **A.** *Psathyromyces heterellus*, Guyana. **B.** *P. heterellus*, Brazil [22028]. **C.** *P. heterellus*, Brazil [22097]. **D.** *P. heterellus*, Brazil [22130]. **E.** *P.* aff. *heterellus*, Brazil [23163]. **F.** *P. planus* (Vězda) Xavier-Leite, M. Cáceres & Lüicking, holotype. All showing thallus with apothecia and sterile setae.



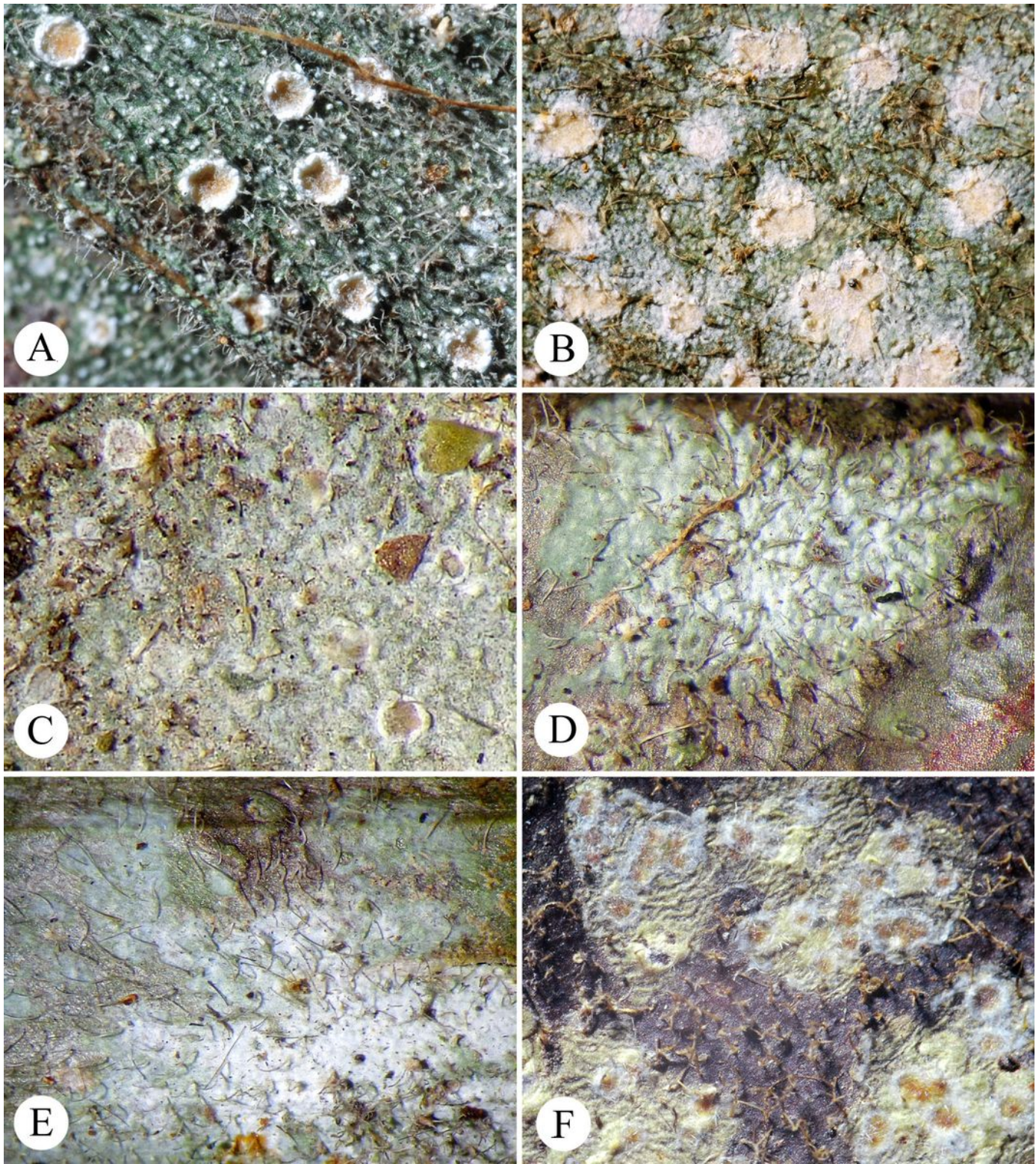
**Figure 13**

New genus *Roselviria*, including sequenced specimens. **A.** *Roselviria purulhensis*, Costa Rica. **B.** *R. purulhensis*, Brazil [22196]. **C.** *R. purulhensis*, Brazil [23104]. **D.** *R. lobulimarginata*, Malaysia (holotype). All showing thallus with apothecia and sterile setae.



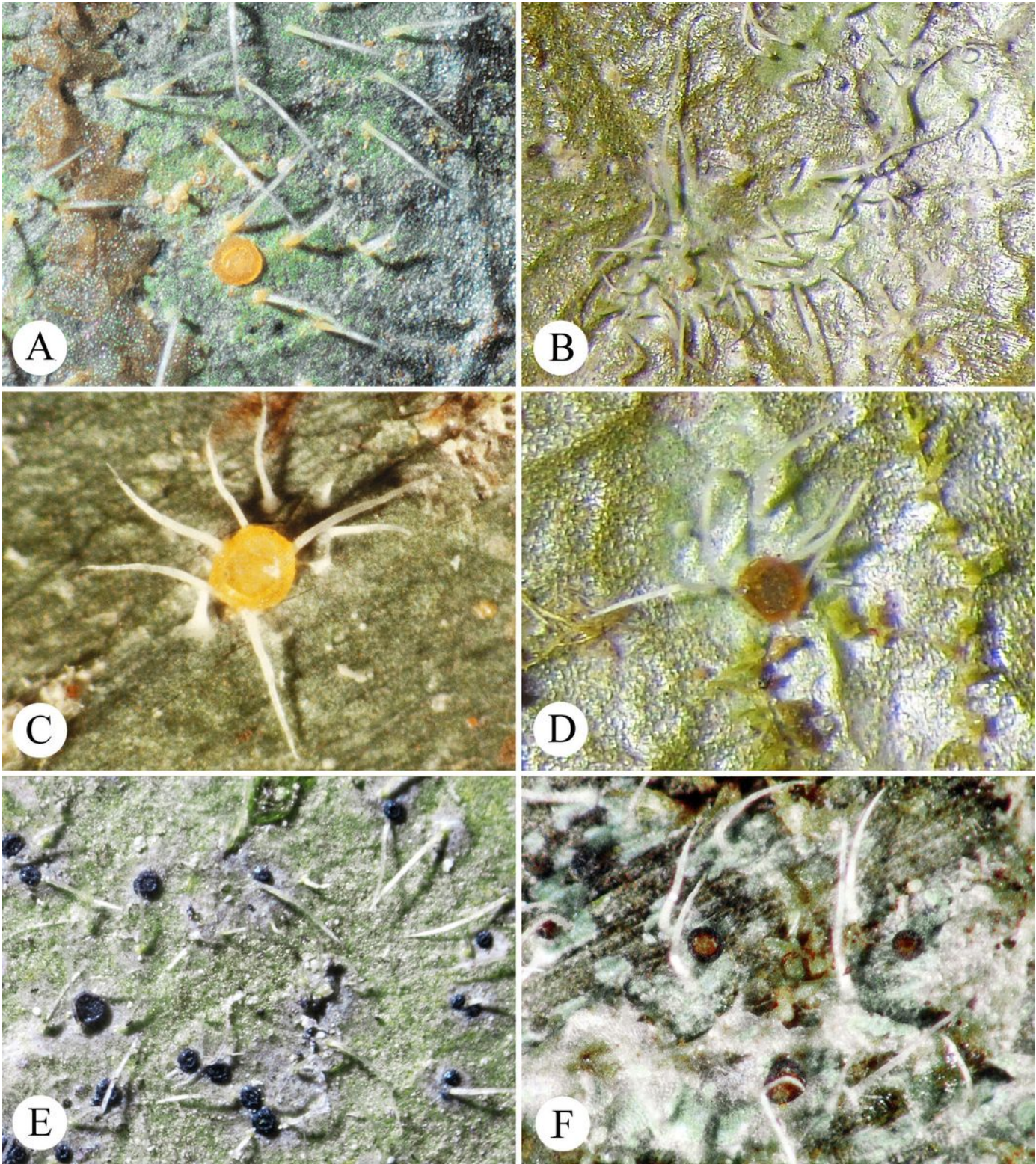
**Figure 14**

New genus *Santricharia*, including sequenced specimens. **A** *Santricharia farinosa*, Brazil. **B.** *S. farinosa*, Brazil [23062]. **C.** *S. farinosa*, Brazil [23063]. **D.** *S. farinosa*, Brazil [23065]. **E.** *S. aff. farinosa*, Guatemala [22801]. **F.** *S. aff. farinosa*, Guatemala [22809]. All showing thallus with apothecia and sterile setae.



**Figure 15**

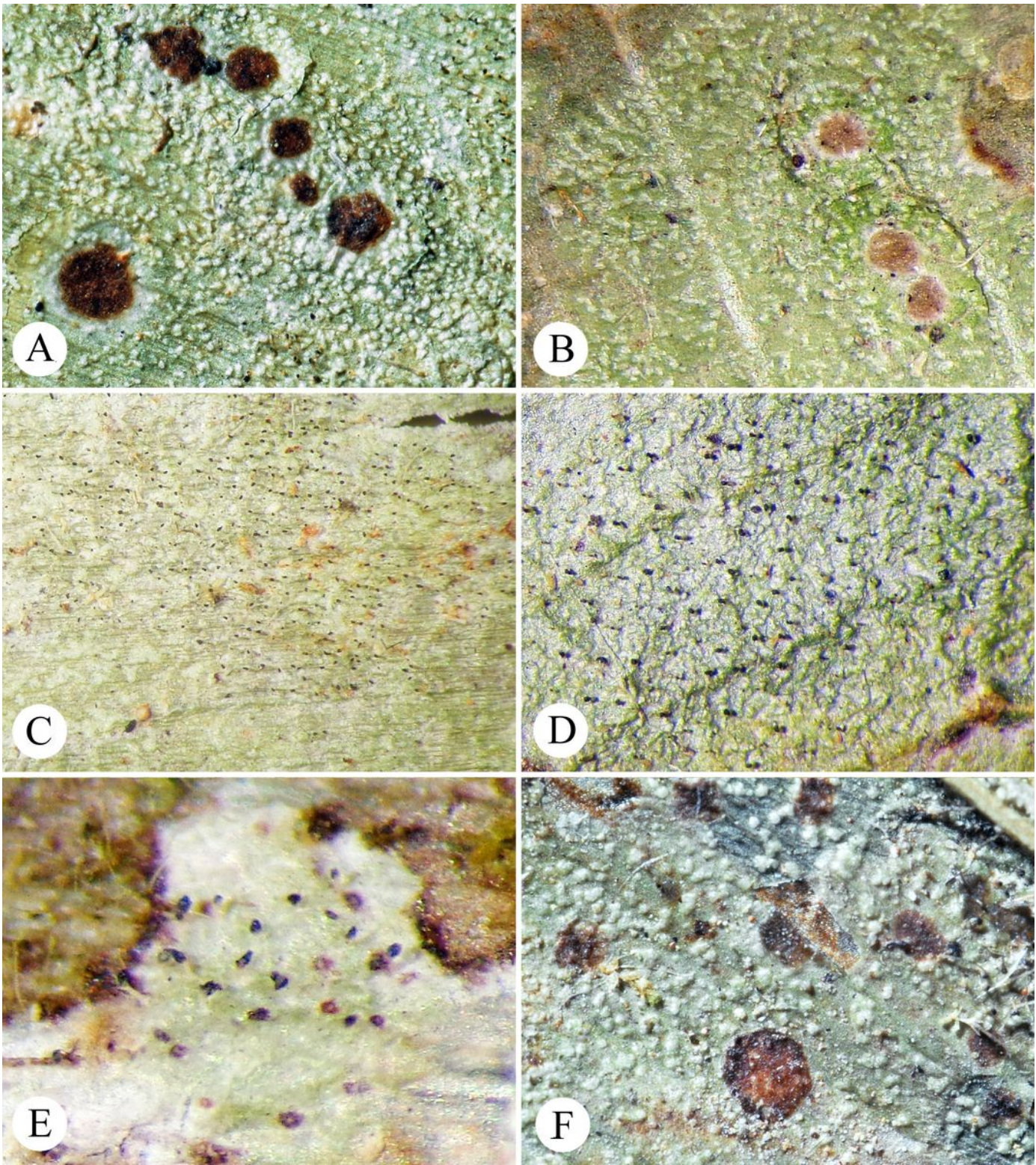
New genus *Sipmanidea*, including sequenced specimens. **A** *Sipmanidea neotropica*, Ecuador. **B.** *S. neotropica*, Ecuador. **C.** *S. neotropica*, Brazil [23016]. **D.** *S. neotropica*, Brazil [23143]. **E.** *S. neotropica*, Brazil [23144]. **F.** *S. furcata*, holotype. All showing thallus with apothecia and (in part) sterile setae and/or hyphophores.



**Figure 16**

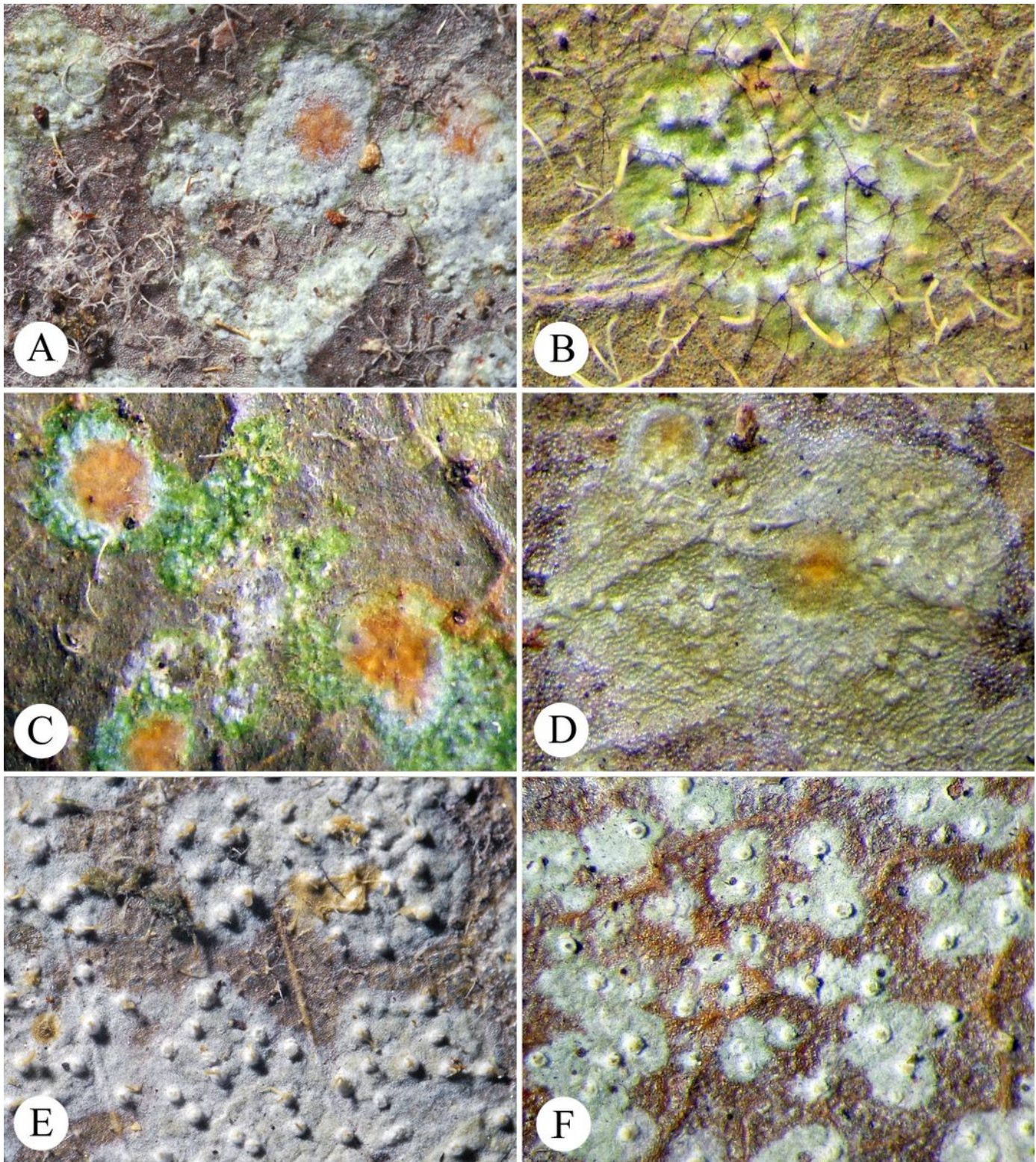
Reinstated and validated genus *Spinomyces*, including sequenced specimens. **A.** *Spinomyces albostrigosus*, Costa Rica. **B.** *S. albostrigosus*, Brazil [22194]. **C.** *S. aggregatus*, Guatemala. **D.** *S. aggregatus*, Brazil [22195]. **E.** *S. deslooveri*, holotype. **F.** *S. guatemalensis*, Guatemala. All showing thallus with apothecia and sterile setae.





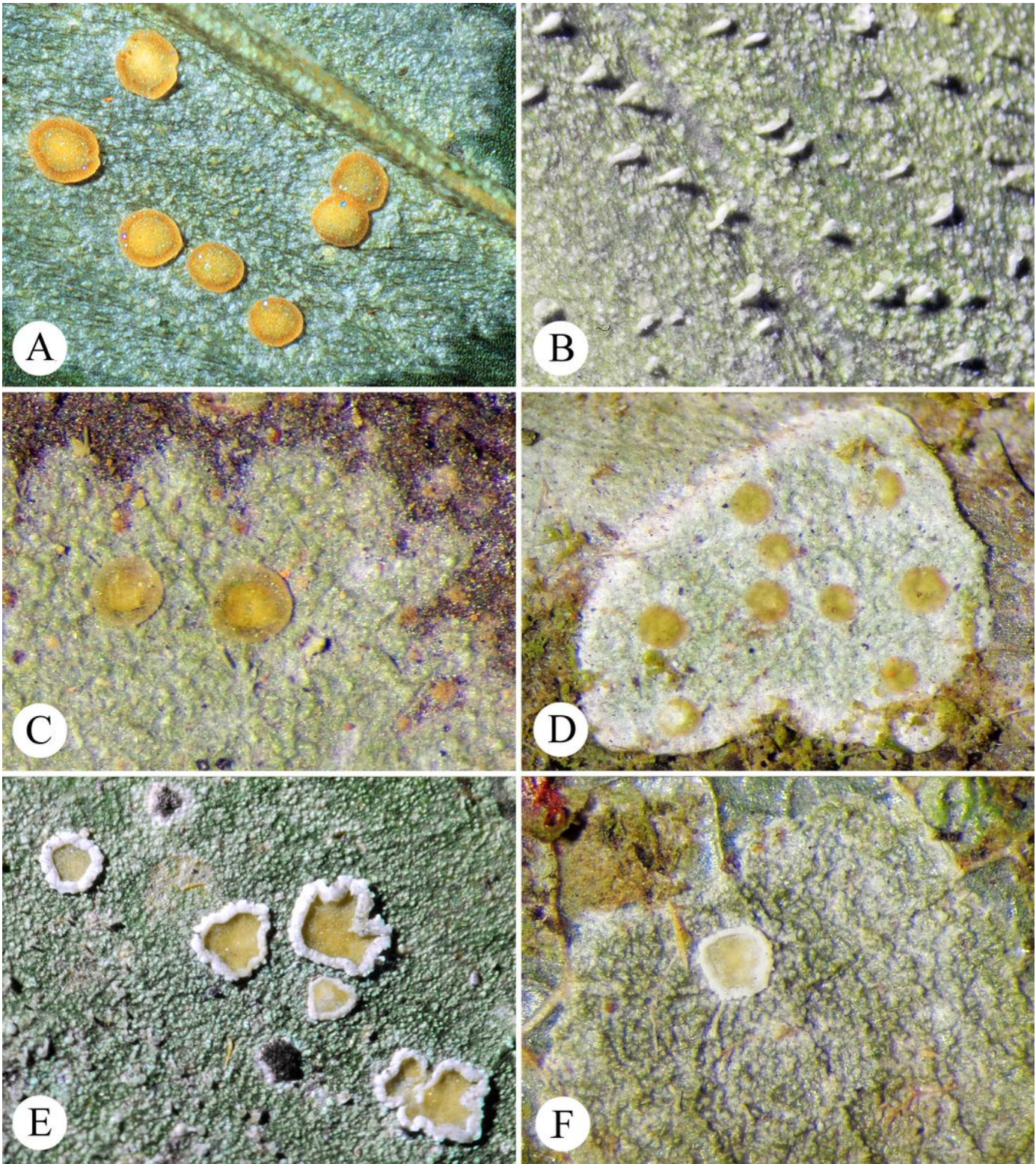
**Figure 17**

Reinstated genus *Sporocybomyces*, including sequenced specimens. **A** *Sporocybomyces leucotrichoides*, Costa Rica. **B**. *S. leucotrichoides*, Brazil [22046]. **C** *S. leucotrichoides*, Brazil [22030]. **D**. *S. leucotrichoides*, Brazil [23008]. **E**. *S. leucotrichoides*, Brazil [22013]. **F**. *S. leucomuralis*, Brazil. All showing thallus with apothecia and/or hyphophores.



**Figure 18**

New genus *Verruciplaca*, including sequenced specimens. **A.** *Verruciplaca verrucifera*, Costa Rica. **B.** *V. verrucifera*, Brazil [22069]. **C.** *V. verrucifera*, Brazil [22068] **D.** *Verruciplaca* sp., Panama [22893]. **E.** *V. calcarea*, Costa Rica. **F.** *V. calcarea*, Brazil [22198]. All showing thallus with apothecia and/or sterile setae or hyphophores.



**Figure 19**

New genus *Vezdamyces*, including sequenced specimens. **A.** *Vezdamyces vulgaris*, Costa Rica. **B.** *V. vulgaris*, Costa Rica (hyphophores). **C.** *V. vulgaris*, Brazil [22145]. **D.** *V. aff. vulgaris*, Brazil [23047]. **E.** *V. albopruinosus*, Ecuador. **F.** *V. vulgaris*, Brazil [23052]. All showing thallus with apothecia or hyphophores.