

Foliicolous lichens and their lichenicolous fungi collected during the Smithsonian International Cryptogamic Expedition to Guyana 1996

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Abstract: A total of 233 foliicolous lichen species and 18 lichenicolous fungi are reported from Guyana as a result of the Smithsonian „International Cryptogamic Expedition to Guyana“ 1996. Three lichens and two lichenicolous fungi are new to science: *Arthonia grubei* sp.n., *Badimia subelegans* sp.n., *Calopadia pauciseptata* sp.n., *Opegrapha matzeri* sp.n. (lichenicolous on *Amazonomyces sprucei*), and *Pyrenidium santessonii* sp.n. (lichenicolous on *Bacidia psychotriae*). The new combination *Strigula janeirensis* (Bas.: *Phylloporina janeirensis*; syn.: *Raciborskiella janeirensis*) is proposed. Apart from *Amazonomyces sprucei* and *Bacidia psychotriae*, *Arthonia lecythidicola* (with the lichenicolous *A. pseudopegraphina*) and *Byssolecania deplanata* (with the lichenicolous *Opegrapha* cf. *kalbii*) are reported as new hosts for lichenicolous fungi. *Arthonia pseudopegraphina* growing on *A. lecythidicola* is the first known case of adelphoparasitism at generic level in foliicolous *Arthonia*. *Arthonia flavoverrucosa*, *Badimia polillensis*, and *Byssoloma vezdanum* are new records for the Neotropics, and 115 species are new for Guyana, resulting in a total of c. 280 genuine foliicolous species reported for that country, while *Porina applanata* and *P. verruculosa* are excluded from its flora. The foliicolous lichen flora of Guyana is representative for the Guianas (Guyana, Suriname, French Guiana) and has great affinities with the Amazon region, while the degree of endemism is low. A characteristic species for this area is *Amazonomyces sprucei*. Species composition is typical of Neotropical lowland to submontane humid forests, with a dominance of the genera *Porina*, *Strigula*, and *Mazosia*. The table mountain vegetation supports elements of the upper montane forest, such as *Echinoplaca fusconitida* and *Logilvia gilva*. Follicolous lichen diversity is highest in undisturbed lowland to submontane humid forest, much lower in the table mountain vegetation and drastically decreased in semi-open secondary vegetation and the coastal savanna. Species composition in semi-open, disturbed vegetation is similar to that found in the undisturbed forest canopy. Site preferences of foliicolous lichens follow those established by studies in other Neotropical regions like Costa Rica.

Introduction

The Guayana Shield, covering the Guianas (Guyana, Suriname and French Guiana), Venezuelan Guayana and parts of Colombia and Brazil, forms a distinct geographical region in northern South America, characterized by geologically old rock formations with poor soils and hilly terrain with emerging table mountains (Mori & Prance 1987). Four main vegetation types can be distinguished in Guyana (Daniels 1984; Ek 1990; Sipman 1991): (1) Humid savanna intermingled with light forests on white sand along the coast and in the northeast; (2) lowland to submontane humid forest, with a distinct dry season, on sandstone and granite in the northwest and interior; (3) cloud forest and rocky savanna on the table mountains, particularly in the Guayana Highland extending from Venezuela into Guyana and reaching 2800 m on Mt. Roraima (Pakaraima Mts. in the west of Guyana); (4) extensive dry savanna in the south (Rupunini). The lowland to submontane humid forests have a clear affinity with those of the Amazon but appear to be poorer in tree species especially in Guyana due to the poor soils and the more distinct dry season (Lindeman & Mori 1989).

Of particular interest is the vegetation of the table mountains, especially in the western part of the Guayana Shield. Even those mountains not exceeding 400 m altitude show an altitudinal zonation from lowland to submontane rain forest at the bottom to cloud forest intermingled with rocky savanna at the top (Sipman & Aptroot 1992). The „Massenerhebungseffekt“ (Grubb & Whitmore 1966) induces the formation of cloud forest with *Clusia* spp. as typical elements even at low elevations because of the low condensation zone around the isolated table mountains. The table mountains are also known for their high endemism in higher plants. A striking example is the genus *Brocchinia*, a strange group of terrestrial bromeliads partly forming stems up to 8 m high, which is restricted to the Guayana Highlands (Smith & Downs 1974).

The lichen flora of the Guianas, in particular Guyana, has only recently been explored in detail. A checklist of Hekking & Sipman (1988) summarizes the records made before 1987. Only

16 species of foliicolous lichens are listed for Guyana in the world monograph of Santesson (1952), mainly collected by Richards in 1929 near the Essequibo River. Except for *Coccocarpia tenuissima* Müll. Arg., all are common and widely distributed taxa. Many new records were added on the basis of recent collections studied by Santesson & Tibell (1988), Sipman (1991, 1992, 1997), Sipman & Aptroot (1992), Aptroot & Sipman (1993a), and Matzer (1996), resulting in a total of about 150 species of typically foliicolous lichens and eight lichenicolous fungi reported for the Guyanan flora. Only one new species, *Byssoloma farkasii* Sipman, was described (Sipman & Aptroot 1992).

The floristic diversity of the Guiana is currently explored by the „Smithsonian Biological Diversity of the Guianas Program“ of the Smithsonian Institution (U.S. National Museum, Washington, D.C.), including field expeditions to various areas in Guyana. One of several expeditions in 1996, in which the author participated, visited four different regions: the coastal savanna near Georgetown, the submontane humid forest and table mountain vegetation at Kaieteur Falls, the submontane moist forest near Paramakatoi, and the dry savanna and grasslands near Kato. In this paper, the results of this expedition concerning foliicolous lichens and their lichenicolous fungi are presented. Apart from the taxonomic account, a general survey of the foliicolous lichen flora of Guyana is provided, and the study sites are compared in terms of diversity and species composition.

Study sites

Collections were gathered from the following localities (Fig. 1):

- A: Timehri (Demerara/Mahaica Distr.); 6°35' N, 58°12' W, sea level; coastal savanna near Timehri, 5-7 km E of road from Georgetown to Timehri; semi-open to open savanna vegetation on white sand, partly burned, dominated by xerophytic shrubs and trees (*Annona*, *Curatella*, *Solanum*, *Xylopia*); foliicolous in undergrowth; II, 1996, leg. R. Lücking.
- B: Timehri; 6°35' N, 58°12' W, sea level; coastal savanna near Timehri, 7 km E of main road

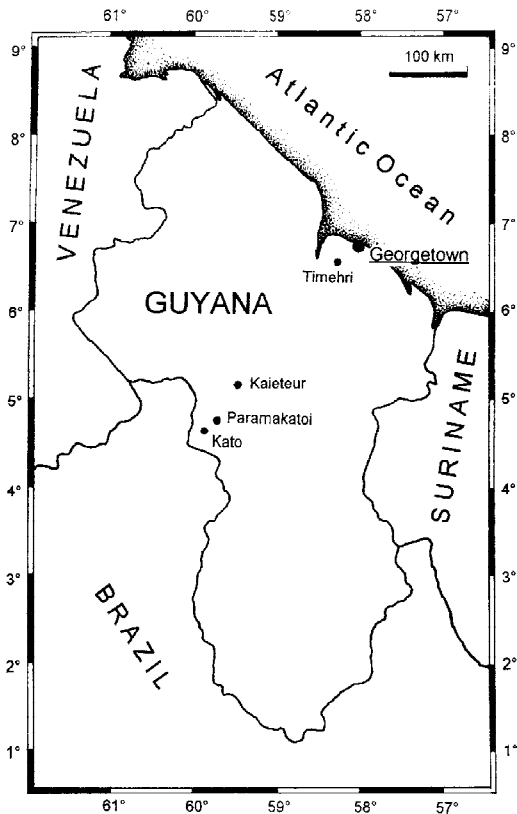


Fig. 1. Geographic situation of Guyana and the study sites.

from Georgetown to Timehri; transition to evergreen dry forest mixed with secondary vegetation, dominated by large-leaved trees; foliicolous in undergrowth; II. 1996, leg. R. Lücking.

- C: Kaieteur Falls National Park (Potaro/Siparuni Distr.); 5°05' N, 59°23' W, 400 m; trail from guesthouse to Johnson's Point; submontane rain forest with transition to cloud forest, mixed with rocky savanna dominated by *Clusia*, *Brocchinia*, Ericaceae, with species rich understorey; foliicolous in undergrowth; II. 1996, leg. R. Lücking.
- D: Kaieteur Falls National Park; 5°05' N, 59°23' W, 400 m; trail from guesthouse along edge of Potaro River above falls, submontane, dark moist forest with loose understorey dominated by large-leaved trees and shrubs; foliicolous in undergrowth; II. 1996, leg. R. Lücking.
- E: Kaieteur Falls National Park; 5°05' N, 59°23' W, 400 m; trail from guesthouse along edge of Potaro River above falls, mesic submontane,

dark rain forest with loose understorey dominated by large-leaved trees and shrubs; foliicolous in subcanopy; II. 1996, leg. R. Lücking.

- F: Kaieteur Falls National Park; 5°05' N, 59°23' W, 100-400 m; trail from guesthouse to Tukeit on W edge of lower part of Potaro River; lowland to submontane, dark moist forest; foliicolous in undergrowth; II. 1996, leg. R. Lücking & A. Lücking.
- G: Kaieteur Falls National Park; 5°05' N, 59°23' W, 400 m; foliicolous on exposed *Citrus* tree at trail N of guesthouse towards Menzies Landing; II. 1996, leg. R. Lücking.
- H: Paramakatoi (Potaro/Siparuni Distr.); 4°42' N, 59°43' W, 900-1200 m; trail SW of village upon forest ridge, mesic to humid submontane rain forest with transition to humid lower montane forest, primary and secondary forest in lower part, foliicolous in undergrowth; II. 1996, leg. R. Lücking.
- I: Paramakatoi; 4°42' N, 59°43' W, 500-800 m; trail NW of village towards Kato, humid lowland to submontane rain forest dominated by large-leaved trees and shrubs (*Apeiba*, *Cordia*), with sparse epiphyte cover; foliicolous in undergrowth; II. 1996, leg. R. Lücking.
- K: Paramakatoi; 4°42' N, 59°43' W, 500-800 m; semi-open and open secondary vegetation along trails towards river SE of village; foliicolous on shrubs and trees, e.g. *Citrus*; II. 1996, leg. T. Ahti & A. Lücking.
- L: Paramakatoi; 4°39' N, 59°45' W, 500-800 m; trail NW of village towards Kato, humid lowland to submontane rain forest dominated by large-leaved trees and shrubs (*Apeiba*, *Cordia*), with sparse epiphyte cover; foliicolous in canopy; II. 1996, leg. R. Lücking.

Material and methods

Species were identified using the keys of Santesson (1952) and Lücking (1992, 1997a), as well as further references (survey in Farkas & Sipman 1997). All observations concerning anatomical details were made in tap water, Lugol's solution (I) and KOH solution. Measurements refer to observations made in tap water. Using the light indices proposed by Lücking (1997b), the collection sites were assigned to five different light regimes which simultaneously give information on the degree of disturbance: Shady forest understorey or closed vegetation [Index 1]: sites D, F, H, I; transition to light gaps or semi-open vegetation [Index 2]: site B; light gaps or semi-open vegetation [Index 3]: site C; transition to canopy or open vegetation

[Index 4]: sites A, E, G, K; canopy or open vegetation [Index 5]: site L. Site C takes a particular position since in addition to the light regime it is characterized by its montane character.

At all sites, sampling of foliicolous lichens was made along transect as proposed by Lücking & Lücking (1996), and samples were made in regular distances of c. 10 m. For the ecological analysis, only those parts of a transect were taken into consideration which could be considered homogeneous, i.e. without marked changes of vegetation between the beginning and the end of the transect and within. Due to some small spots of table mountain or secondary vegetation included in the study, it was impossible to avoid that the transects had different dimensions. This was, however, compensated in that the abundance of foliicolous lichen species was estimated by the number of leaves on which a species occurred, relative to the total number of leaves collected. Three categories were hereby distinguished: [1] rare (on less than 5 % of the collected leaves), [2] moderately common (on 5-20 %), [3] abundant (on more than 20 %). Based on species composition, the sites were ordinated by multi-dimensional scaling and classified by a cluster analysis, using Sørensen's (1948) coefficient of affinity as distance measure and Ward's Method as clustering algorithm. Foliiicolous lichen species were ordinated by means of a correspondence analysis (CA) using reciprocal averaging and the above defined light indices as site scores to calculate the species scores (Jongman et al. 1995): $S_n = (\text{abundance}_{n,i} \times I_i) / (\text{abundance}_{n,i})$, with S_n = score of species n, $\text{abundance}_{n,i}$ = abundance of species n at site i, and I_i = light index at site i.

All statistical calculations were made with the program package STATISTICA 5.0.

Taxonomic account

Genera and species are listed in alphabetical order. Species new to science are marked with three asterisks***, while new records for the Neotropics are marked with two** and new records for Guyana with one*. The localities are indicated by letters. Nomenclature follows Farkas & Sipman (1997), if not otherwise indicated. Specimens are deposited in the herbarium of the University of Georgetown, Guyana (BRG), in the U.S. National Herbarium (US), and in the private collection of the author (hb. Lücking).

***Actinoplaca strigulacea* Müll. Arg.** — Selected specimens examined: A: 96-3002 (BRG). D: 96-3542 (BRG). F: 96-3448 (US). E: 96-3202 (US). H: 96-3645 (BRG). I: 96-3811 (BRG).

***Amazonomyces sprucei* (R. Sant.) Lücking, Sérus. & Thor** (Lücking et al. 1998a) — Bas.: *Stirtonia sprucei* R. Sant. — Selected specimens examined: D: 96-3131 (BRG), 96-3560 (US). F: 96-3281 (BRG), 96-3428 (US). H: 96-3741 (BRG, US). I: 96-4006 (US), 96-4178 (BRG). — *Notes*: Some specimens (e.g. I: 96-4178) were found with two types of pycnidia on the same thallus, the typical large, bisymmetrical type producing filiform conidia, and small, rounded pycnidia producing simple, fusiform conidia $3 \times 0.7 \mu\text{m}$ in size. The occurrence of macro- and microconidia in Arthoniaceae was already assumed by Lücking (1995a), but this is the first definite report in a taxon carrying ascocarps as well. Microconidia were also found in *Eremothecella calamicola* (see below).

***Anisomeridium foliicola* R. Sant. & Tibell** — Selected specimens examined: D: 96-3565 (US). F: 96-3463 (BRG). H: 96-3659 (US). I: 96-3841 (US).

****Anisomeridium musaesporoides* Etayo & Lücking** (Etayo & Lücking 1998) (Fig. 2A) — Selected specimens examined: D: 96-3566 (hb. Lücking). I: 96-3847 (BRG, holotypus). — *Notes*: This new species is known from Panama and Guyana. It is easily distinguished from other foliicolous species by its applanate perithecia with apical ostiole and a broad whitish, lateral zone, and its rather large ascospores with distinctly submedian septum. Judging from the taxonomic account provided by Harris (1995), it has no close relative among corticolous taxa.

***Arthonia accolens* Stirt.** — Selected specimens examined: I: 96-4077 (BRG), 96-4187 (US).

***Arthonia aciniformis* Stirt.** — Selected specimens examined: D: 96-3592 (BRG, US), 96-3588 (hb. Lücking). I: 96-4084 (US). — *Notes*: Several specimens (e.g. D: 96-3588) carry the campylidia described for

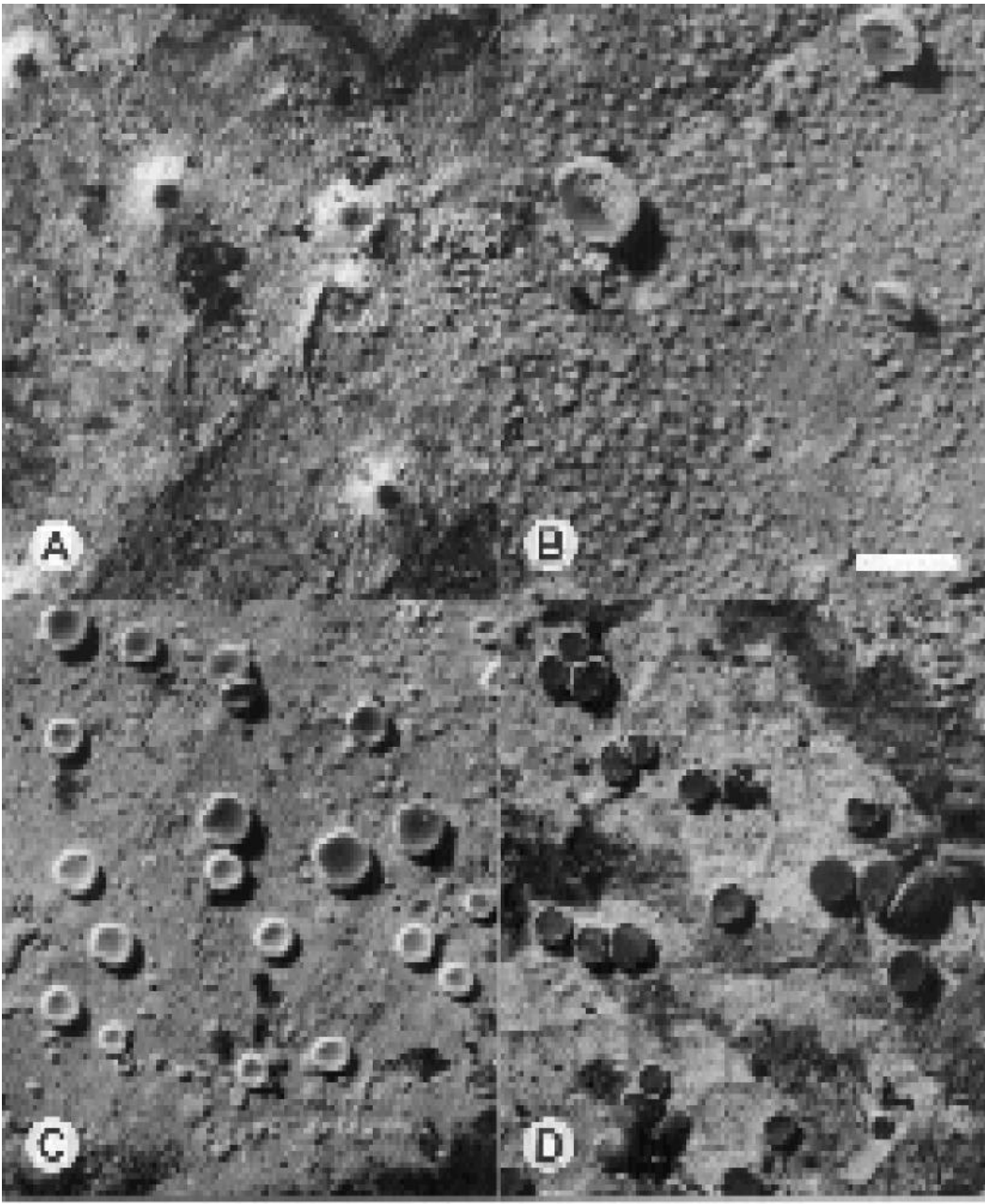


Fig. 2. (A) *Anisomeridium musaesporoides* [an isotype]. (B) *Badimia polillensis* [96-3759, with campylidia]. (C) *B. dimidiata* [96-3775]. (D) *B. subelegans* [an isotype]. General appearance. Scale = 1 mm.

that species by Lücking (1995a).

**Arthonia atropunctata* Vain. (lichenicolous; Matzer 1996) — Specimen examined: I: 96-4190 (hb. Lücking). — Observed host lichen: *Tricharia* cf. *urceolata*. — Notes: First record for continental South America.

Arthonia cyanea Müll. Arg. — Selected specimens examined: B: 96-3076 (BRG). C: 96-3506 (US). H: 96-3734 (BRG).

***Arthonia flavoverrucosa* U. Becker & Lücking — Selected specimens examined: D: 96-3594 (hb. Lücking), 96-3151 (hb. Lücking). F: 96-3313 (BRG). — Notes: The specimens are scanty but typical. New for the Neotropics.

****Arthonia grubei* Lücking sp.n. (Figs 3A, 4A) — A *Arthonia accolente* apotheciis in marginibus pruinosis ascosporis parietibus crassis et thallo cellulis algarum irregulariter constitutis instructo differt. — Typus: GUYANA. Paramakatoi, 04° 42' N, 59° 43' W, 900-1200 m, submontane moist forest, foliicolous in undergrowth, II. 1996, Lücking 96-3723 (BRG, holotypus). — Thallus continuous, smooth, pale yellowish to greenish grey, 5-10 mm across; ascocarps numerous, plane, not raised above thallus level, angular-rounded, dark purplish brown, with a very thin marginal pruina, K+ slightly sordid greenish, 0.4-0.8 mm diam.; hypothecoid layer brownish, c. 5 µm thick; ascigerous layer 20-25 µm high, pale brownish; epithecoid layer brownish, c. 5 µm thick; interascal hyphae densely branched and anastomosing; asci ovoid to almost globose, 18-22 × 15-20 µm; ascospores 8 per ascus, 2-septate, macrocephalic, with rather thick walls (c. 1 µm) and slightly rounded lumina, very slightly constricted at the septa, 13-15 × 5.5-6.5 µm; phycobiont a species of *Phycopeltis*, cells angular-rounded, irregularly arranged, 8-12 × 4-6 µm. — Dedicated to Dr. Martin Grube for his systematic studies on the genus *Arthonia*. — Notes: This new species is only known from the type collection but is rather characteristic due to the combination of 2-septate, macrocephalic ascospores with thick walls, marginally thinly pruinose

ascocarps, and irregularly arranged phycobiont cells. Brownish apothecia and 2-septate, macrocephalic ascospores are also known from *A. accolens* and *A. lividula* Vain. (where *A. grubei* would key out following Ferraro & Lücking 1997). However, in these species the ascospores are thin-walled and the phycobiont cells are rectangular and form distinctly radiating rows. Judging from the external appearance and anatomical details (thin marginal pruina, K+ sordid greenish reaction), *A. grubei* might be related to *A. obesa* (Müll. Arg.) R. Sant., which differs by its 3-septate, microcephalic ascospores. The thick-walled ascospores of *A. grubei* are unique among foliicolous *Arthoniae*; only *A. aciniformis* has similarly thick-walled, but 1-septate ascospores.

**Arthonia intermedia* Matzer (lichenicolous; Matzer 1996) — Selected specimens examined: H: 96-3710 (BRG). I: 96-4049 (US). — Observed host lichens: *Porina mirabilis*, *Phyllophiale alba*.

**Arthonia lecythidicola* (Bat. & H. Maia) Lücking & Sérus. (Lücking et al. 1998a) — Bas.: *Ameropeltomyces lecythidicola* Bat. & H. Maia. — Selected specimens examined: H: 96-3731 (BRG). I: 96-4086 (BRG, US). — Notes: The characteristic applanate pycnidia of that species are very abundant in the present material. The *Arthonia* aff. *palmulacea* reported by Sipman (1997) probably belongs to this species.

Arthonia leptosperma (Müll. Arg.) R. Sant. — Specimen examined: I: 96-4081 (BRG).

**Arthonia mira* R. Sant. — Selected specimens examined: H: 96-3713 (hb. Lücking), 96-3730 (BRG). I: 96-4079 (hb. Lücking).

Arthonia palmulacea (Müll. Arg.) R. Sant. — Selected specimens examined: F: 96-3311 (BRG), 96-3312 (US). I: 96-4078 (BRG, US).

Arthonia pseudopegraphina Matzer (lichenicolous; Matzer 1996) — Selected specimens examined: I: 96-4048 (BRG), 96-4046 (hb. Lücking). — Observed host lichens: *Arthonia lecythidicola* (on I: 96-4046), *Mazosia rubropunctata*. — Notes:

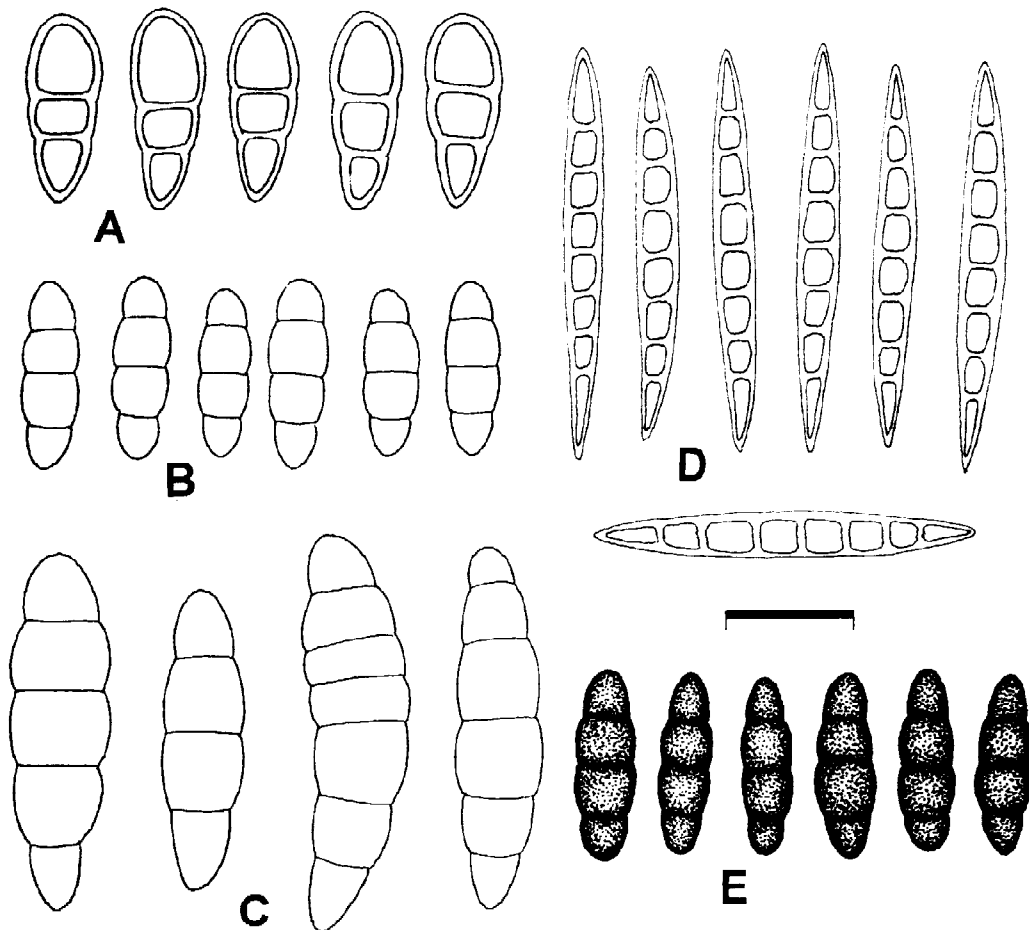


Fig. 3. (A) *Arthonia grubei* [holotype]. (B) *Badimia subelegans* [an isotype]. (C) *Calopadia pauciseptata* [holotype]. (D) *Opegrapha matzeri* [holotype]. (E) *Pyrenidium santessonii* [holotype]. Ascospores. Scale = 10 μ m.

This species has so far only been reported from *Mazosia* species and is most commonly found on *M. rubropunctata*. The ascocarps on the new host *Arthonia lecythidicola* are typical in all parts, in particular the I+ bluish reaction of the hypothecioid layer (Matzer 1996). In addition to the report of a new host species for this taxon, this is the first known case of an adelpho-parasymbiotic relationship at generic level in foliicolous representatives of the genus *Arthonia* and the first record

of a foliicolous *Arthonia* species as host for a lichenicolous fungus (see Matzer 1996).

***Arthonia trilocularis* Müll. Arg.** B: 96-3075 (BRG). D: 96-3208 (US).

***Aspidothelium fugiens* (Müll. Arg.) R. Sant.** — Selected specimens examined: B: 96-3093 (BRG). C: 96-3486 (US). D: 96-3137 (US), 96-3573 (hb. Lücking). F: 96-3261 (US). H: 96-3657 (BRG). I: 96-3840 (BRG). — *Notes:* The genus *Aspidothelium* was synonymized with *Thelenella* by Harris (1995), which was adopted in the most

recent checklist of foliicolous lichens by Farkas & Sipman (1997). Harris (1995) gives no detailed reasons for his treatment except that „... the similarities are fundamental, the differences unimportant ...“ (loc. cit.: 162). Those similarities listed by him are „... oddly staining ascus, fleshy ascomata with periphysoids, chlorococcalean phycobiont...“, characters which are certainly universal rather than synapomorphic, except for the „... oddly staining ascus ...“ for which, however, no further details are provided. In fact, Eriksson (1981) describes the asci of *Aspidothelium* and *Thelenella* (as *Microglaena*) as different from each other. Santesson (1952) also discussed the relationships of *Aspidothelium*, stating that *Clathroporina* (supposed by him to be close to *Aspidothelium*) and *Microglaena* (= *Thelenella*) „... are clearly distinguished by their mycological characters – the different types of paraphyses and spores are especially striking.“ (loc. cit.: 281). *Clathroporina* is actually not related to *Aspidothelium*, but the differences hold for the latter as well. While *Aspidothelium* has simple to very slightly branched paraphyses, they are branched and apically anastomosing in *Thelenella* (Mayrhofer 1987; specimen of *T. modesta* (Nyl.) Nyl. from GZU checked by me). Further, the perithecia of *Aspidothelium* are sessile and exposed from the thallus, whereas in *Thelenella* they are immersed in thalline verrucae. The most striking feature of *Aspidothelium* is, however, the ascospore type: the ascospores, e.g. in *A. fugiens*, have a high number of transverse septa which, together with the fusiform shape, gives them a very characteristic appearance (Santesson 1952; Lücking 1992). The same septation can be observed in the young stages of species with muriform ascospores, such as *A. cinerascens* Vain., while the ascospores of *Thelenella* belong to a more universal type (Mayrhofer 1987). I therefore see no reason to synonymize *Aspidothelium* with *Thelenella*, even if more detailed studies may demonstrate that the ascus types are

similar as suggested by Harris (1995).

- ****Aspidothelium* sp.n. ined.** — Specimen examined: D: 96-3564 (hb. Lücking). — *Notes*: This new species, about to be described from Costa Rica, has the same ascospore type as *Aspidothelium fugiens* but differs in the perithecia provided with very long *Trichothelium*-type setae, similar to those of *A. trichothelioides* Sérus. & Vezda.
- ****Asterothyrium leptosporum* Müll. Arg.** — Specimen examined: L: 96-4218 (hb. Lücking).
- ****Asterothyrium leucophthalmum* (Müll. Arg.) R. Sant.** — Specimen examined: K: 96-4210 (BRG).
- ****Asterothyrium* aff. *monosporum* Müll. Arg.** — Specimen examined: A: 96-3045 (BRG, US). — *Notes*: This taxon is related to *Asterothyrium monosporum* with which it shares the ascospore type, but differs in the apothecial margin being composed of recurved, triangular lobes, and the exciple consisting of free hyphae.
- Aulaxina* aff. *epiphylla* (Zahlbr.) R. Sant.** — Specimen examined: D: 96-3545 (hb. Lücking). — *Notes*: The specimens are characterized by partly elongate apothecia and ascospores with 5-7 transverse and 0-1 longitudinal septa, 17-20 × 4-6 µm in size. These characters point to *Aulaxina epiphylla* which, however, has much larger ascospores and is only known from the Paleotropics (Santesson 1952; Farkas & Sipman 1997). It cannot be excluded that the present collection is an aberrant form of *A. quadrangula*, although distinctly elongate apothecia are unknown in that species.
- ****Aulaxina intermedia* Lücking** (Lücking 1997a) — Selected specimens examined: F: 96-3422 (hb. Lücking). I: 96-3830 (BRG).
- Aulaxina microphana* (Vain.) R. Sant.** — Specimen examined: I: 96-3829 (BRG).
- Aulaxina minuta* R. Sant.** — Selected specimens examined: D: 96-3537 (hb. Lücking). F: 96-3257 (BRG). H: 96-3640 (US). I: 96-4113 (BRG).
- ****Aulaxina opegraphina* Fée** — Selected specimens examined: A: 96-3054 (BRG). D: 96-3544 (US).

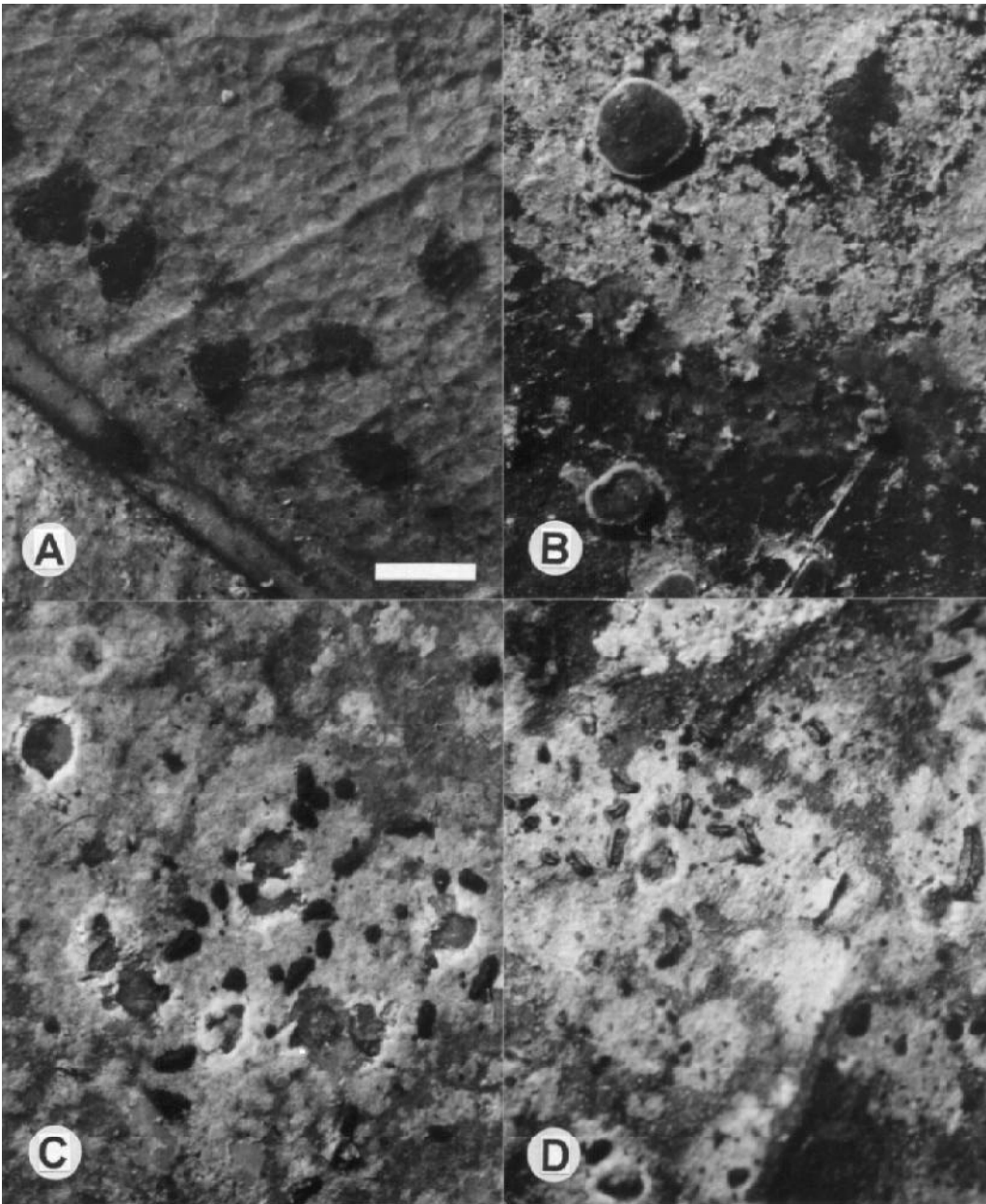


Fig. 4. (A) *Arthonia grubei* [holotype; note the marginal pruina of the ascocarps]. (B) *Calopadia pauciseptata* [holotype]. (C-D) *Opegrapha matzeri* on *Amazonomyces sprucei* [an isotype; note the pruinose ascocarps in (D)]. General appearance. Scale = 1 mm.

- Aulaxina quadrangula* (Stirt.) R. Sant.** — Selected specimens examined: A: 96-3034 (BRG). B: 96-3069 (US). C: 96-3466 (BRG). D: 96-3543 (US). F: 96-3425 (BRG). H: 96-3641 (US).
- Bacidia brasiliensis* (Müll. Arg.) Zahlbr.** — Selected specimens examined: D: 96-3135 (BRG), 96-3165 (US). F: 96-3412 (hb. Lücking). H: 96-3632 (US), 96-3633 (US). I: 96-3766 (BRG).
- **Bacidia* cf. *corallifera* Lücking** — Specimen examined: A: 96-3059 (hb. Lücking). — *Notes:* The specimens lack the pycnidia characteristic of that species (Lücking & Lücking 1995) but otherwise coincide with the type material. They can be distinguished from the externally similar *Byssoloma wettsteinii* by the greyish thallus with irregular surface, the greyish black (not dark brown) apothecial disc and the irregular, greyish (not chamois-coloured) margin.
- Bacidia psychotriae* (Müll. Arg.) Zahlbr.** — Specimen examined: I: 96-3744 (hb. Lücking).
- Bacidina apiahica* (Müll. Arg.) Vezda.** — Specimen examined: D: 96-3533 (BRG). — *Notes:* Sérusiaux (1995, 1996) pointed out that the generic names *Bacidina* Vezda and *Woessia* D. Hawksw. & Poelt comprise the same taxon, known as the *Bacidia phycodes* group. A further name established in the same paper as *Woessia*, viz. *Lichingoldia* D. Hawksw. & Poelt, is also synonymous (Ekman 1996a). Both *Woessia* and *Lichingoldia* antedate and thus have priority over *Bacidina*, but Ekman (1996a, b) suggested to conserve *Bacidina* since it has been in wider use and covers a number of species known by their sexual form, while *Woessia* and *Lichingoldia* were established on single species with conidiomata. Since both names were only recently established, conservation of *Bacidina* seems unlikely. However, I have not adopted the recently established combinations of *Bacidina* species into *Woessia* (Sérusiaux 1996; Farkas & Sipman 1997), since a decision on the formal proposal by Ekman (1996a) is still pending and should be awaited before making and accepting taxonomic alterations which could either influence that decision or later prove to be superfluous.
- **Bacidina* aff. *apiatica* (Müll. Arg.) Vezda.** — Selected specimens examined: F: 96-3277 (hb. Lücking). I: 96-3794 (hb. Lücking). — *Notes:* This is probably a new species which needs further study. It grows regularly hypophyllous and differs from *Bacidina apiahica* in the smaller ascospores (17-22 µm long) and the much reduced thallus. The taxon is known to me from several collections in the Neotropics and has also been reported from Papua New Guinea (Aptroot & Sipman 1993b).
- Bacidina mirabilis* (Vezda) Vezda** — Selected specimens examined: F: 96-3273 (hb. Lücking). I: 96-3784 (BRG, US).
- Badimia dimidiata* (C. Bab. ex Leight.) Vezda** (Fig. 2C) — Selected specimens examined: D: 96-3128 (BRG), 96-3515 (hb. Lücking). F: 96-3253 (BRG). I: 96-3775 (US).
- Badimia galbinea* (Kremp.) Vezda** — Selected specimens examined: I: 96-3779 (BRG), 96-3781 (US).
- ***Badimia polillensis* (Vain.) Vezda** (Fig. 2B) — Selected specimens examined: I: 96-3758 (BRG, US), 96-3759 (hb. Lücking). — *Notes:* The species of the *Badimia pallidula* group (Lücking et al. 1994), with slightly translucent, flesh-coloured apothecia lacking excipular crystals, are most common in the Paleotropics. Only *B. pallidula* was known from the Neotropics, including Guyana, though only by thalli with apothecia (Sipman 1997; Lücking, unpubl. observ.). This is the first collection of campylidia of a species of that group reported from the Neotropics, but on account on the thallus morphology (small, dense verrucae), the specimens must be assigned to another species, *B. polillensis*. Indeed, they are completely identical with campylidial collections of that species from tropical Asia.
- ****Badimia subelegans* Sipman & Lücking sp.n.** (Figs 2D, 3B) — A *Badimia dimidiata* apotheciis obscurioribus excipulo crystallis flavescenter-fuscis K+ purpureo-flavis instructo differt. — Typus: GUYANA.

Trail from Paramakatoi to Kato, 04° 42' N, 59° 43' W, 500 m, lowland to submontane moist forest, foliicolous in undergrowth, II. 1996, Lücking 96-4120 (BRG, holotypus; hb. Lücking, isotypus). — Additional specimens examined: D: 96-3161 (hb. Lücking). F: 96-3113, 96-3117 (BRG). I: 96-3777 (hb. Lücking). Kuyuwini River, Sipman 18541 f (B). — Thallus dispersed, often lacinate, smooth or with an irregular surface, pale bluish to whitish grey, up to 50 mm across and often covering large areas of the leaf, thallus patches often connected by a matt, thin, whitish-translucent prothallus; apothecia numerous, rounded or slightly irregular when old, sessile, 0.45-0.8 mm diam.; disc ochraceous yellow to orange brown or sometimes dark purplish brown, young apothecia often paler yellowish; margin well-developed, slightly prominent, in old apothecia often somewhat irregular, pale grey, the zone between the margin and the disc usually dark grey to almost black; exciple well developed, paraplectenchymatous but encrusted with a large cluster of yellowish brown crystals, K+ purplish, then yellowish; hypothecium colourless to pale yellowish, 30-40 µm high; epithecium c. 3 µm thick, especially developed in the lateral parts of the disc and consisting of yellowish brown granules; hymenium 40-50 µm high, colourless, IKI+ blue; paraphyses simple, with slightly clavate apices; asci clavate, of the *Badimia*-type, 35-45 × 9-12 µm; ascospores 3-septate, oblong-ellipsoid, colourless, with slight constrictions at the septa, 13-16 × 4-4.5 µm; campylidia and conidia as in *B. dimidiata* but campylidia greyish brown and encrusted with the same crystals as found in the exciple; phycobiont a species of Chlorococcaceae, cells rounded, 5-8 µm diam. — *Notes*: This new species was mentioned in Sipman (1997) as *Badimia* sp. Externally it resembles *B. dimidiata* in the ochraceous yellow to orange brown apothecia, but differs in the yellowish brown, K+ purplish crystals in the exciple and in the very large, dispersed to lacinate

thallus. Moreover, the apothecia are usually darker than in *B. dimidiata*, which can be easily seen when both species grow side by side on the same leaf. Anatomically, the new species comes close to *B. elegans* (Vain.) Zahlbr., which has more yellowish-orange apothecia, a yellowish apothecial margin, and the excipular crystals are yellow and do not react K+ purplish. *B. subelegans* is known to me from eastern Colombia to French Guiana (Lücking, unpubl. observ.); it seems to be restricted to northern South America.

**Bapalmuia* cf. *marginalis* (Vain.) R. Sant. — Specimen examined: I: 96-3789 (hb. Lücking). — *Notes*: The specimens have only a few apothecia which are probably young, and the ascospores are difficult to observe. However, the hymenium is extremely high (up to 350 µm), and the only known species having such apothecia is *Bapalmuia marginalis*, a species only known from tropical Asia (Santesson 1952; Farkas & Sipman 1997).

Bapalmuia palmularis (Müll. Arg.) Sérus. — Selected specimens examined: F: 96-3252 (BRG). I: 96-3761 (BRG, US, hb. Lücking).

**Bapalmuia verrucosa* Sérus. & Lücking (Lücking et al. 1998a) — Specimen examined: I: 96-3790 (hb. Lücking). — *Notes*: The specimens agree in all details with the type collection from Brazil, in particular the coarsely verrucose thallus and the high hymenium (here 170 µm) with very long ascospores.

**Bapalmuia* sp.n. ined. — Specimen examined: I: 96-3760 (BRG). — *Notes*: This new species will be described from Costa Rica. It is characterized by very distinct radiating thallus ridges, otherwise unknown in the genus.

Byssolecania deplanata (Müll. Arg.) R. Sant. — Selected specimens examined: B: 96-3109 (hb. Lücking). D: 96-3522 (BRG). F: 96-3414 (US).

Byssolecania fumosonigrans (Müll. Arg.) R. Sant. — Selected specimens examined: H: 96-3631 (BRG). I: 96-3834 (hb. Lücking). — *Notes*: The names *Byssolecania*

fumosonigrans and *B. deplanata* are used in a preliminary sense; a revision of the genus is still under way by Vezda (pers. comm. 1995). *B. fumosonigrans* here covers specimens with dark grey, slightly raised apothecia and rather narrow (2-3 µm), 3-septate ascospores, while *B. deplanata* includes collections with light brown, completely plane apothecia with pale marginal zone and broad (4-5 µm) and also 3-septate ascospores. The taxa are mentioned as *Byssolecania* sp. A and B in other papers (Lücking 1994; Lücking et al. 1998b).

- **Byssolecania* aff. *fumosonigrans* (Müll. Arg.) R. Sant. — Selected specimens examined: D: 96-3194 (BRG, hb. Lücking). — Notes: Probably a previously unrecognized species, differing from *B. fumosonigrans* by the larger, constantly 5-septate ascospores.
- **Byssoloma absconditum* Farkas & Vezda — Specimen examined: D: 96-3525 (BRG).
- Byssoloma amazonicum* Kalb & Vezda — Selected specimens examined: I: 96-3749 (BRG, hb. Lücking).
- **Byssoloma anomalum* Kalb & Vezda — Specimen examined: D: 96-3246 (hb. Lücking).
- **Byssoloma chlorinum* (Vain.) Zahlbr. — Selected specimens examined: A: 96-3014 (BRG, US). B: 96-3104 (US). D: 96-3163 (hb. Lücking). F: 96-3406 (BRG).
- **Byssoloma discordans* (Vain.) Zahlbr. — Selected specimens examined: H: 96-3618 (BRG). I: 96-4063 (US).
- Byssoloma guttiferae* (Bat. & Peres) Lücking & Sérus. (Lücking et al. 1998a) — Syn.: *Byssoloma aeruginescens* Vezda (Lücking et al. 1998a). — Selected specimens examined: D: 96-3130 (BRG, US). F: 96-3255 (BRG), 96-3408 (US).
- Byssoloma leucoblepharum* (Nyl.) Vain. — Selected specimens examined: D: 96-3237 (BRG), 96-3517 (US). F: 96-3254 (BRG). H: 96-3613 (BRG). I: 96-4066 (BRG), 96-4067 (US).
- **Byssoloma lueckingii* Sérus. — Selected specimens examined: A: 96-3005 (BRG). G: 96-3217 (US).

Byssoloma minutissimum Kalb & Vezda — Specimen examined: I: 96-3799 (BRG).

Byssoloma subdiscordans (Nyl.) P. James — Selected specimens examined: A: 96-3040 (BRG), 96-3053 (US). B: 96-3067 (BRG). C: 96-3491 (BRG, hb. Lücking). D: 96-3516 (BRG). F: 96-3443 (US). H: 96-3621 (BRG). I: 96-3751 (BRG). L: 96-4232 (US).

Byssoloma tricholomum (Mont.) Zahlbr. — Selected specimens examined: D: 96-3142 (BRG). I: 96-3786 (BRG, US).

***Byssoloma vezdanum* Sérus. — Selected specimens examined: D: 96-3511 (BRG, US, hb. Lücking). F: 96-3444 (BRG), 96-3416 (hb. Lücking). — Notes: The specimens fit the original description in all details (large, plane apothecia; 5-septate ascospores) except that the thallus is often provided with a thin woolly cover of colourless hyphae, similar to the prothallus in *Lasioloma arachnoideum*. Such specimens are also known from Africa [e.g. CONGO, Lambinon 72/18 (LG)], from where this taxon was first described (Sérusiaux 1978). Thus, I have seen no reason to consider them as taxonomically different.

Byssoloma wettsteinii (Zahlbr.) Zahlbr. — Selected specimens examined: D: 96-3149 (BRG), 96-3164 (US, hb. Lücking). I: 96-3803 (BRG).

Calenia conspersa (Stirt.) R. Sant. — Selected specimens examined: F: 96-3427 (hb. Lücking). I: 96-3816 (BRG, US).

**Calenia depressa* Müll. Arg. — Selected specimens examined: C: 96-3469 (BRG). H: 96-3638 (US).

**Calenia graphidea* Vain. — Selected specimens examined: C: 96-4198 (BRG). D: 96-3243 (US).

**Calenia lobulata* Lücking (Lücking 1997a) — Specimen examined: A: 96-3060 (BRG).

Calenia phyllogena (Müll. Arg.) R. Sant. — Selected specimens examined: B: 96-3073 (BRG). D: 96-4130 (US). I: 96-3814 (BRG).

**Calenia submuralis* Lücking (Lücking 1997a) — Specimen examined: H: 96-3666 (BRG).

**Calenia thelotremella* Vain. — Selected

specimens examined: C: 96-3477 (BRG).
F: 96-3423 (US).

***Calenia triseptata* Zahlbr.** (Lücking 1997a) —
Syn.: *Calenia submaculans* R. Sant.
(Lücking 1997a) — Selected specimens
examined: C: 96-3227 (US), 96-4202
(BRG). D: 96-3138 (BRG, hb. Lücking).
I: 96-3822 (US).

***Caleniopsis laevigata* (Müll. Arg.) Vezda &
Poelt** — Specimen examined: C: 96-3226
(BRG).

***Calopadia fusca* (Müll. Arg.) Vezda** — Selected
specimens examined: A: 96-3004 (BRG).
D: 96-3214 (US).

******Calopadia pauciseptata* Lücking sp.n.** (Figs
3C, 4B) — A *Calopadia puiggarii*
ascosporis 3-7-septatis minoribusque differt.
— Typus: GUYANA. Timehri, 06° 3' N,
58° 12' W, sea level, coastal savanna, II.
1996, Lücking 96-3032 (BRG, holotypus).
— Thallus marginally dispersed into
rounded patches, smooth, pale grey, 15 mm
across, thallus patches connected by a thinly
woolly prothallus; apothecia rounded,
sessile, 0.5-0.9 mm diam.; disc dark brown;
margin pale chamois-coloured to greyish
white, not prominent; exciple distinctly
paraplectenchymatous, composed of rather
large cells, colourless, up to 70 µm thick;
hypotheecium dark brown, 35-50 µm high;
apothecial base dark aeruginous; hymenium
80-90 µm high, colourless, IKI+ blue;
paraphyses distinct, slightly branched; asci
clavate, 75-85 × 15-18 µm, with a distinct
tholus and a IKI+ darker blue tubular
structure; ascospores 8 per ascus (rarely
fewer), 3-7-septate, ellipsoid, colourless,
25-30 × 6-9 µm. — Notes: I have not
hesitated in describing this new species,
although it is known only from a single
collection, since it provides important new
systematic information on ascospore
variation in the genus. The species clearly
belongs to *Calopadia* because of its thallus
structure (the *Lasioloma* like prothallus is
also known from specimens of *Calopadia*
puiggarii) and the apothecial anatomy, with
a large-celled exciple, an aeruginous
apothecial base, distinct, slightly branched
paraphyses, and comparatively large

ascospores. It would in fact have been
assigned to *C. puiggarii* if I hadn't checked
the ascospores in order to exclude the
possibility that it represents *C. phyllogena*!
The situation is comparable to *Fellhanera*
dictyospora Lücking (1997c), which has
muriform ascospores (like most *Calopadia*
species) but on account on its thallus
morphology and apothecial anatomy belongs
to *Fellhanera*. *Calopadia pauciseptata*
provides important systematic information
since it completes a series of ascospore types
already indicated by species such as *C.*
nymanii (R. Sant.) Vezda (several
submuriform ascospores), *C. phyllogena* (2-
4 muriform ascospores), and *C. puiggarii*
(single, muriform ascospores). The
ascospore variation is thus similar to that
of the related genus *Tapellaria* (Santesson
1952).

****Calopadia phyllogena* (Müll. Arg.) Vezda** —
Selected specimens examined: D: 96-3519
(BRG). F: 96-3411 (US).

****Calopadia puiggarii* (Müll. Arg.) Vezda** —
Selected specimens examined: C: 96-4216
(US). D: 96-3187 (BRG). F: 96-3417
(BRG).

****Calopadia subcoerulescens* (Zahlbr.) Vezda**
— Selected specimens examined: H: 96-
305 (BRG). 96-3606 (hb. Lücking).

****Caprettia amazonensis* Bat. & H. Maia** —
Selected specimens examined: A: 96-3043
(hb. Lücking). B: 96-3094 (hb. Lücking).
D: 96-3125 (hb. Lücking). I: 96-4109 (hb.
Lücking). L: 96-4231 (hb. Lücking).

****Caprettia* sp.n.** — Specimen examined: I: 96-
4012 (BRG). — Notes: A new, lichenized
species which will be described by
Sérusiaux (pers. comm. 1997), differing
from *Caprettia amazonensis* by the distinct
algiferous thallus.

***Chroodiscus australiensis* Lumbsch & Vezda**
— Selected specimens examined: F: 96-
3259 (BRG). I: 96-3804 (US).

***Chroodiscus coccineus* (Leight.) Müll. Arg** —
Selected specimens examined: D: 96-3558
(BRG). F: 96-3452 (US). H: 96-3644 (US).
I: 96-3805 (BRG), 96-3808 (hb. Lücking).
— Notes: Some specimens growing
intermingled with typical *C. coccineus*

deviate by their distinctly lobate to stellate, graphidoid ascocarps (e.g. 96-3808). Since the ascospores are identical in both forms, I have not seen any possibility to separate the graphidoid specimens from the typical forms, although their general appearance is very different.

- Chroodiscus* aff. *mirificus* (Kremp.) R. Sant.** — Specimen examined: D: 96-3193 (hb. Lücking). — *Notes*: The present material resembles the African populations usually referred to that species, characterized by a verrucose thallus and the absence of disc-like isidia (Kalb & Vezda 1992). This taxon is probably not conspecific with *Chroodiscus mirificus* s.str. The other Neotropical collections reported so far (Sipman & Aptroot 1992; Lücking & Lücking 1995) also belong here, while typical *C. mirificus*, with a smooth thallus and abundant disc-like isidia, is restricted to Australasia.
- ****Coccocarpia domingensis* Vain.** — Specimen examined: D: 96-3553 (BRG).
- ****Coccocarpia palmicola* (Spreng.) L. Arvidss. & D. Gall.** — Specimen examined: D: 96-3559 (hb. Lücking).
- ****Coccocarpia pellita* (Ach.) Müll. Arg.** — Specimen examined: C: 96-3221 (BRG).
- Coenogonium interpositum* Nyl.** — Selected specimens examined: D: 96-3556 (BRG), 96-3153 (BRG). — *Notes*: One collection (96-3153) has 1-septate ascospores. Morphologically identical species of *Coenogonium* are usually separated by simple vs. 1-septate ascospores, but the appearance of the simple ascospores indicates that, at least in some cases, they merely represent immature stages of the 1-septate condition. Reported as *Coenogonium* sp. by Sipman (1997).
- Coenogonium linkii* Ehrenb.** — Specimen examined: H: 96-3607 (BRG).
- Cryptothecia candida* (Kremp.) Müll. Arg.** — Selected specimens examined: F: 96-3426 (BRG), I: 96-4052 (BRG), 96-4051 (US).
- Dictyonema phyllogenum* (Müll. Arg.) Zahlbr.** — Selected specimens examined: D: 96-3555 (BRG), I: 96-4152 (hb. Lücking).
- ****Dimerella epiphylla* (Müll. Arg.) Malme** — Selected specimens examined: A: 96-3062

(BRG), D: 96-3561 (US), K: 96-4204 (BRG).

- Dimerella fallaciosa* (Müll. Arg.) Vezda** — Selected specimens examined: F: 96-3276 (hb. Lücking), H: 96-3647 (hb. Lücking).
- Dimerella flavicans* Vezda & Farkas** — Selected specimens examined: B: 96-3085 (BRG, US, hb. Lücking), H: 96-3648 (hb. Lücking), I: 96-4045 (US).
- Dimerella hypophylla* Vezda** — Selected specimens examined: I: 96-4042 (BRG, US).
- ****Dimerella isidiifera* Lücking** (Lücking, in press) — Specimen examined: I: 96-4044 (hb. Lücking). — *Notes*: Distinguished from all other species of the genus by the formation of disc-like isidia.
- Dimerella* aff. *pilifera* Vezda** — Selected specimens examined: D: 96-3557 (BRG), F: 96-3256 (US), H: 96-3637 (hb. Lücking). — *Notes*: A rather characteristic, undescribed species with pilose thallus, similar to *Dimerella pilifera* Vezda (1994) from Papua New Guinea, with which it was previously confused (Sipman 1997). The Neotropical species differs by its irregular, branched hairs and the apothecia which are marginally hypophyllous; it is rather common in the Amazon region.
- ****Dimerella zonata* (Müll. Arg.) R. Sant.** — Specimen examined: K: 96-4206 (hb. Lücking).
- Echinoplaca diffluens* (Müll. Arg.) R. Sant.** — Specimen examined: I: 96-3823 (hb. Lücking).
- Echinoplaca epiphylla* Fée** — Selected specimens examined: A: 96-3023 (BRG, US, hb. Lücking), C: 96-4075 (BRG), I: 96-4116 (US).
- Echinoplaca furcata* Sérus.** — Selected specimens examined: C: 96-3473 (BRG), D: 96-3529 (US), F: 96-3453 (BRG), I: 96-3813 (US).
- ****Echinoplaca fusconitida* Lücking** (Lücking 1997a) — Selected specimens examined: C: 96-3484 (BRG, US, hb. Lücking), D: 96-3541 (US), E: 96-4096 (BRG). — *Notes*: The species is given as *Echinoplaca* aff. *similis* Kalb & Vezda in Sipman (1997).
- ****Echinoplaca* aff. *fusconitida* Lücking** (Lücking

1997a) — Selected specimens examined: C: 96-3481 (hb. Lücking). — *Notes*: The specimens are similar to *Echinoplaca fusconitida* but differ in the light brown apothecia with a marginal zone composed of rather large, plane, crystalline verrucae which give the apothecia a rather characteristic appearance. Probably a new species which cannot be formally described because of the scanty material.

**Echinoplaca hymenocarpoides* (Vain.) Lücking (Lücking 1997a) — Selected specimens examined: E: 96-4095 (BRG, hb. Lücking). I: 96-4135 (US).

**Echinoplaca* aff. *incrustatociliata* Sérus. (Aptroot et al. 1997) — Specimen examined: C: 96-3480 (hb. Lücking). — *Notes*: The specimens resemble the recently described *Echinoplaca incrustatociliata* (Aptroot et al. 1997) by its hyphophores being heavily encrusted with crystals. However, the ascospores are 2-8 per ascus, submuriform and smaller (17-25 × 7-10 µm). The collections cannot be identified with any other species at present, and further material must be awaited to clarify its taxonomic relationships.

Echinoplaca leucotrichoides (Vain.) R. Sant. — Selected specimens examined: B: 96-3071 (BRG). C: 96-3476 (US). F: 96-3258 (BRG). H: 96-3651 (US). I: 96-3817 (BRG). L: 96-4223 (BRG).

**Echinoplaca marginata* Lücking (Lücking 1997a) — Specimen examined: B: 96-3072 (BRG).

Echinoplaca pellicula (Müll. Arg.) R. Sant. — Selected specimens examined: D: 96-3183 (BRG). I: 96-3818 (US).

**Echinoplaca serusiauxii* Lücking (Lücking 1997a) — Specimen examined: D: 96-3540 (BRG). — *Notes*: The specimens are not well developed but agree with *Echinoplaca serusiauxii* in all respects except that the hyphophores are narrower.

**Echinoplaca tricharioides* Kalb & Vezda — Selected specimens examined: A: 96-3030 (hb. Lücking). L: 96-4233 (BRG). — *Notes*: The apothecia in the present specimens are rather pale brown, contrary to typical forms with dark brown to almost black apothecia.

**Echinoplaca verrucifera* Lücking (Lücking 1997a) — Selected specimens examined: A: 96-3039 (BRG). D: 96-3158 (US).

Eremothecella calamicola Syd. — Selected specimens examined: D: 96-3593 (BRG, US, hb. Lücking). F: 96-3120 (BRG). H: 96-3725 (US, hb. Lücking), 96-3726 (hb. Lücking). I: 96-4085 (US). — *Notes*: On one specimen (96-3726), the typical pycnidia with filiform, multiseptate conidia (up to 180 µm long), together with small, circular pycnidia (0.15-0.2 mm diam.) with central opening and with small, simple, 3-4 µm long conidia were found. This confirms the earlier assumption that the different conidial types found in the Arthoniaceae may represent macro- and microconidia (Lücking 1995a).

**Fellhanera angustispora* Lücking (Lücking 1997c) — Selected specimens examined: B: 96-3110 (hb. Lücking). I: 96-3797 (BRG).

**Fellhanera badimioides* Lücking, Lumbsch & Elix — Selected specimens examined: I: 96-3793 (hb. Lücking), 97-4128 (BRG).

**Fellhanera bouteillei* (Desm.) Vezda — Selected specimens examined: C: 96-3485 (BRG). D: 96-3514 (hb. Lücking).

**Fellhanera* cf. *dispersa* Lücking (Lücking 1997c) — Specimen examined: D: 96-3215 (hb. Lücking). — *Notes*: The apothecial disc in the present specimens is more brownish than in the material reported from Costa Rica (Lücking 1997c).

**Fellhanera emarginata* Lücking (Lücking 1997c) — Specimen examined: I: 96-4165 (BRG).

Fellhanera fuscata (Müll. Arg.) Vezda — Syn.: *Fellhanera dominicana* (Vain.) Vezda (Lücking 1997c). — Selected specimens examined: B: 96-3083 (BRG). F: 96-3407 (US). I: 96-3802 (BRG).

**Fellhanera lisowskii* (Vezda) Vezda — Selected specimens examined: H: 96-3600 (BRG). I: 96-3791 (BRG, US, hb. Lücking).

**Fellhanera rhapsidophylli* (Rehm) Vezda — Specimen examined: B: 96-3082 (hb. Lücking).

**Fellhanera santessonii* Barillas & Lücking — Selected specimens examined: A: 96-3026

- (BRG). B: 96-3065 (US), 96-3100 (US). D: 96-3530 (BRG). F: 96-3409 (US). H: 96-3611 (BRG), 96-3610 (hb. Lücking).
- Fellhanera stanhopeae* (Müll. Arg.) Lücking, Lumbsch & Elix** — Selected specimens examined: I: 96-3795 (BRG, hb. Lücking), 96-4137 (US).
- ****Fellhanera* aff. *stanhopeae* (Müll. Arg.) Lücking, Lumbsch & Elix** — Specimen examined: H: 96-3619 (hb. Lücking). — *Notes*: An undescribed species, distinguished from *Fellhanera stanhopeae* by the smaller apothecia and smaller, 1-septate ascospores.
- ****Fellhanera subfuscatula* Lücking** (Lücking 1997c) — Specimen examined: I: 96-3800 (hb. Lücking).
- ****Fellhanera sublecanorina* (Nyl.) Vezda** — Specimen examined: I: 96-3796 (BRG).
- ****Fellhanera verrucifera* Lücking** (Lücking 1997c) — Selected specimens examined: B: 96-3105 (BRG, hb. Lücking). D: 96-3148 (US). F: 96-3405 (BRG).
- Flavobathelium epiphyllum* Lücking, Aptroot & Thor** (Lücking et al. 1997) — Selected specimens examined: H: 96-3660 (BRG). I: 96-3838 (US), 96-4110 (BRG, US).
- Gyalectidium filicinum* Müll. Arg.** — Selected specimens examined: B: 96-3091 (BRG). C: 96-3468 (hb. Lücking). D: 96-3523 (US). F: 96-3418 (BRG). H: 96-3649 (US). I: 96-3819 (BRG).
- ****Gyalectidium imperfectum* Vezda** — Selected specimens examined: A: 96-3001 (BRG).
- ****Gyalideopsis cochlearifera* Lücking & Sérusiaux** (lichenicolous; Lücking & Sérusiaux 1998) — Selected specimens examined: C: 96-3472 (hb. Lücking). D: 96-3539 (BRG). I: 96-3825 (US). L: 96-4222 (BRG). — Observed host lichen: *Calenia phyllogena*. — *Notes*: A widely distributed new parasymbiont on thalli of Gomphillaceae, easily recognized by its spatulate hyphophores and small, blackish apothecia (see Lücking 1997a, as *Aulaxina* sp. and *Gyalideopsis* sp. B; Lücking & Sérusiaux 1998).
- ****Gyalideopsis* aff. *intermedia* Lücking** (Lücking 1997a) — Selected specimens examined: D: 96-3538 (BRG). E: 96-4098 (hb. Lücking).
- *Notes*: This species is mentioned as *Gyalideopsis* sp. A in Lücking (1997a) and characterized by orange brown apothecia, single, muriform ascospores and a smooth thallus with abundant hyphophores.
- ****Gyalideopsis rubescens* Vezda** — Specimen examined: I: 96-4136 (BRG).
- ****Gyalideopsis vulgaris* (Müll. Arg.) Lücking** (Lücking 1997a) — Selected specimens examined: F: 96-3424 (BRG, US).
- ****Hemigrapha* cf. *phaeospora* Matzer & Lücking** (lichenicolous; Matzer 1996) — Specimen examined: 96-9999 (hb. Lücking). — Observed host lichens: not identified. — *Notes*: The species has been described from *Strigula phyllogena* (Müll. Arg.) R.C. Harris. The present host could not be determined since it is sterile.
- ****Keratosphaera batistae* H. B. P. Upadhyay** (lichenicolous; Matzer 1996) — Specimen examined: I: 96-4192 (hb. Lücking). — Observed host lichen: *Mazosia praemorsa*.
- Lasioloma arachnoideum* (Kremp.) R. Sant.** — Selected specimens examined: A: 96-3003 (BRG). B: 96-3103 (US). C: 96-3503 (BRG, US, hb. Lücking). D: 96-3521 (BRG, US). H: 96-3624 (hb. Lücking). I: 96-3747 (US).
- Lichenopeltella epiphylla* R. Sant.** (lichenicolous; Matzer 1996) — Selected specimens examined: F: 96-3309 (BRG). I: 96-4053 (US). — Observed host lichens: *Porina epiphylla*, *P. mirabilis*.
- Loflammia flammae* (Müll. Arg.) Vezda** — Selected specimens examined: D: 96-3513 (BRG). I: 96-3748 (US).
- Loflammia gabrielis* (Müll. Arg.) Vezda** — Selected specimens examined: B: 96-3068 (BRG, hb. Lücking).
- ***Genus et sp.n. aff. *Loflammia* ined.** — Selected specimens examined: D: 96-3236 (hb. Lücking). — *Notes*: This taxon is about to be described from Brazil. It differs from other Ectolechiaceae by the dark greyish brown, half-moon shaped campylidia with simple conidia, and the greyish brown apothecia with 3-septate ascospores.
- Logilvia gilva* (Müll. Arg.) Vezda** — Selected specimens examined: C: 96-3500 (BRG), 96-4213 (US).

- Mazosia bambusae* Vain.** — Selected specimens examined: B: 96-3096 (BRG). I: 96-3998 (US).
- Mazosia dispersa* (Hedr.) R. Sant.** — Selected specimens examined: B: 96-3077 (BRG). D: 96-3172 (BRG, US, hb. Lücking). F: 96-3121 (BRG). H: 96-3721 (US). I: 96-4076 (hb. Lücking).
- **Mazosia longispora* Lücking & Matzer** (Lücking & Matzer 1996) — Selected specimens examined: D: 96-3598 (hb. Lücking). H: 96-3716 (hb. Lücking).
- Mazosia melanophthalma* (Müll. Arg.) R. Sant.** — Selected specimens examined: B: 96-3081 (BRG), 96-3107 (BRG, US). C: 96-3249 (US). D: 96-3597 (BRG, hb. Lücking). F: 96-3315 (BRG). H: 96-3717 (US). I: 96-4070 (BRG).
- **Mazosia paupercula* (Müll. Arg.) R. Sant.** — Specimen examined: H: 96-3718 (BRG).
- Mazosia phyllosema* (Nyl.) Zahlbr.** — Selected specimens examined: A: 96-3027 (BRG). B: 96-3097 (US). F: 96-3316 (hb. Lücking). I: 96-4176 (BRG).
- Mazosia pilosa* Kalb & Vezda** — Selected specimens examined: B: 96-3095 (BRG). C: 96-3219 (US). D: 96-3587 (US). F: 96-3119 (BRG). H: 96-3715 (US). I: 96-3999 (BRG).
- Mazosia praemorsa* (Stirt.) R. Sant.** — Selected specimens examined: B: 96-3080 (BRG). C: 96-4199 (hb. Lücking). D: 96-3585 (US). F: 96-3114 (BRG). H: 96-3719 (US, hb. Lücking). I: 96-4072 (US).
- Mazosia pseudobambusae* Kalb & Vezda** — Selected specimens examined: D: 96-3170 (US). F: 96-3285 (BRG).
- Mazosia rotula* (Mont.) Massal.** — Selected specimens examined: B: 96-3078 (BRG). D: 96-3586 (US). F: 96-3282 (BRG). H: 96-3724 (BRG). I: 96-4071 (BRG, US). K: 96-4205 (hb. Lücking).
- Mazosia rubropunctata* R. Sant.** — Selected specimens examined: H: 96-3728 (BRG), 96-3727 (US). I: 96-4069 (BRG).
- **Mazosia tenuissima* Lücking & Matzer** (Lücking & Matzer 1996) — Selected specimens examined: F: 96-3290 (BRG, hb. Lücking). I: 96-4059 (BRG, US, hb. Lücking).
- Mazosia tumidula* (Stirt.) R. Sant.** — Selected specimens examined: I: 96-3997 (BRG, US, hb. Lücking).
- Microtheliopsis uleana* Müll. Arg.** — Selected specimens examined: A: 96-3006 (BRG). F: 96-3279 (hb. Lücking). H: 96-3661 (US). I: 96-3887 (BRG, hb. Lücking).
- Musaespora kalbii* Lücking & Sérus.** (Lücking & Sérusiaux 1997) — Selected specimens examined: C: 96-3493 (BRG, US, hb. Lücking). D: 96-3569 (hb. Lücking). F: 96-3431 (US). H: 96-3656 (hb. Lücking). I: 96-3835 (BRG).
- Opegrapha epiporina* Matzer** (lichenicolous; Matzer 1996) — Selected specimens examined: C: 96-4217 (US), 96-3498 (hb. Lücking). F: 96-3310 (BRG). H: 96-3712 (hb. Lücking). I: 96-4061 (BRG, US, hb. Lücking). — Observed host lichen: *Porina mirabilis*.
- Opegrapha filicina* Mont.** — Selected specimens examined: F: 96-3289 (BRG, US, hb. Lücking). H: 96-3737 (BRG). I: 96-4003 (BRG), 96-4004 (US).
- **Opegrapha* cf. *kalbii* Matzer** (lichenicolous; Matzer 1996) — Specimen examined: 96-9999 (hb. Lücking). — Observed host lichen: *Byssolecania deplanata*. — Notes: The specimens are close to *Opegrapha kalbii* but differ in some details (e.g. ascocarp and ascospore dimensions) which are impossible to evaluate at present due to the scanty material. The species is known from *Byssoloma polychromum* (Müll. Arg.) Zahlbr.; *Byssolecania* represents a new host genus for lichenicolous fungi.
- Opegrapha lambinonii* Sérus.** — Selected specimens examined: I: 96-4056 (BRG, US), 96-4055 (hb. Lücking).
- ****Opegrapha matzeri* Lücking sp.n.** (lichenicolous) (Figs 3D, 4C-D) — A *Opegrapha duckei* ascocarpiis maioribus lichenicola in *Amazonomyce sprucei* differt. — Typus: GUYANA. Kaieteur Falls, 05° 05' N, 59° 23' W, 400 m, submontane moist forest, foliicolous in undergrowth, II. 1996, Lücking 96-3562 (BRG, holotypus; hb. Lücking, isotypus). — Additional specimens examined: F: 96-3280 (hb. Lücking). I: 96-4195 (BRG). — Thallus not

developed, ascocarps growing on thalli of *Amazonomyces sprucei*. Ascocarps usually numerous on parts of the host thallus (including its ascocarps and pycnidia), distinctly elongate but usually simple, 0.4–1.0 mm long and 0.15–0.25 mm broad, pure black or covered with a thin greyish or yellowish pruina; disc not exposed, visible as a thin, longitudinal slit; excipuloid tissue laterally developed, brownish black, 20–50 µm broad; hypothecoid layer usually brownish, 10–15 µm thick; ascigerous layer 40–50 µm high, colourless or pale yellowish; interascal hyphae richly branched and anastomosing; asci broadly clavate, 33–40 × 17–20 µm; ascospores 8 per ascus, in a regular bundle, 7(–9)-septate, narrowly fusiform, with slightly thickened walls and not constricted at the septa, 27–32 × 3.5–4 µm, with a thin gelatinous sheath. — *Notes*: This new species is dedicated to Dr. Mario Matzer for his outstanding contributions to our knowledge of lichenicolous fungi on foliicolous lichens. Its characteristic traits are the rather large, partly pruinose ascocarps, the 8-spored asci and the large, 7(–9)-septate ascospores, together with its occurrence on *Amazonomyces sprucei*. The members of this genus, formerly included in *Stirtonia* and *Cryptothecia* (Lücking et al. 1998a), were not known so far as hosts for lichenicolous fungi. *Opegrapha matzeri* does not seem to be related to any of the known lichenicolous taxa (Matzer 1996) but comes close to two lichenized species: *Opegrapha duckei* Bat., J. L. Bez. & Cavalc. ex Lücking & Sérus. and a still undescribed species known from Costa Rica (Lücking & Matzer 1996; Lücking et al. 1998a). All have essentially the same ascocarp anatomy and ascospores, but *O. matzeri* differs in the lichenicolous growth habit and from *O. duckei* in the larger ascocarps. With the latter it shares the formation of a thin yellowish pruina. *O. matzeri* seems to be an aggressive parasite as the attacked parts of the host thallus become necrotic.

**Opegrapha porinicola* Matzer (lichenicolous; Matzer 1996) — Specimen examined: 96-

9999 (hb. Lücking). — Observed host lichen: *Porina mirabilis*.

Opegrapha sipmanii Matzer (lichenicolous; Matzer 1996) — Specimen examined: I: 96-4194 (BRG). — Observed host lichen: *Porina mirabilis*.

**Opegrapha strigulae* R. Sant. ex Matzer & R. Sant. (lichenicolous; Matzer 1996) — Selected specimens examined: D: 96-3576 (hb. Lücking). I: 96-4062 (hb. Lücking). — Observed host lichens: *Strigula smaragdula*, *S. subtilissima*.

**Opegrapha uniseptata* Matzer (lichenicolous; Matzer 1996) — Specimen examined: L: 96-4225 (BRG). — Observed host lichen: *Porina atropunctata*.

**Opegrapha velata* (Müll. Arg.) Vain. (lichenicolous; Matzer 1996) — Specimen examined: 96-9999 (hb. Lücking). — Observed host lichen: *Tricharia heterella*.

Parmeliella sp. A. — Specimen examined: D: 96-3212 (hb. Lücking).

Parmeliella sp. B. — Specimen examined: C: 96-3220 (hb. Lücking). — *Notes*: Two species of *Parmeliella* were distinguished in the present collections. Both have the characteristic dark tomentum. *Parmeliella* sp. A is closely adnate to the substrate and has linear lobes provided with cylindrical to coralloid isidia, while *Parmeliella* sp. B has broader lobes which are only loosely attached to the substrate. So far I have not been able to name the two specimens, but it seems that some species of that genus occur regularly on leaves, like in the externally similar genus *Coccocarpia*.

Phyllobathelium epiphyllum (Müll. Arg.) Müll. Arg. — Selected specimens examined: D: 96-3568 (BRG, US, hb. Lücking). F: 96-3433 (US). H: 96-3665 (BRG). I: 96-3842 (BRG).

Phyllobathelium leguminosae (Cavalc. & A. Silva) Lücking & Sérus. (Lücking et al. 1998a) — Bas.: *Septoriomyces leguminosae* Cavalc. & A. A. Silva. — Specimen examined: I: 96-3837 (BRG). — *Notes*: This name covers the specimens from Guyana formerly identified as *Phyllobathelium nigrum* R. Sant. & Tibell (Sipman 1997).

- **Phyllobathelium thaxteri* (Vain.) Zahlbr. — Selected specimens examined: C: 96-3507 (hb. Lücking). D: 96-3567 (BRG). H: 96-3662 (US). I: 96-3836 (BRG).
- **Phyllobathelium* sp.n. ined. — Specimen examined: I: 96-3844 (BRG). — *Notes*: A new species about to be described from Costa Rica, distinguished by its smooth thallus and muriform macroconidia.
- Phyllophiale alba* R. Sant. — Selected specimens examined: A: 96-3007 (BRG). C: 96-3487 (US). H: 96-3669 (BRG). I: 96-3873 (US). — *Notes*: The species of *Phyllophiale* are here maintained as an autonomous taxa although there are strong indications that they represent vegetative states of *Porina* species. However, since the evidence for their biological status is contradictory in some points (Lücking & Vezda 1998), I have adopted a conservative position in this case.
- **Phyllophiale* aff. *alba* R. Sant. — Selected specimens examined: A: 96-3063 (BRG). D: 96-3173 (hb. Lücking). — *Notes*: This taxon is usually identified as *Phyllophiale alba*, but differs in the smaller, more greenish, often densely arranged isidia and the thin thallus without crystals. Moreover, it occurs on an undescribed species of *Porina* (see below *P.* aff. *mirabilis*), while isidia of *Phyllophiale alba* are found on thalli of *Porina mirabilis* (Lücking & Vezda 1998).
- **Phyllophiale fusca* R. Sant. — Selected specimens examined: C: 96-3222 (BRG). D: 96-3571 (BRG). F: 96-3458 (US).
- **Porina andreana* Lücking & Vezda (Lücking & Vezda 1998) — Selected specimens examined: H: 96-3675 (BRG), Lücking). I: 96-4040 (hb. Lücking).
- **Porina atriceps* Vain. (Lücking & Vezda 1998) — Specimen examined: I: 96-3884 (hb. Lücking).
- **Porina atrocoerulea* Müll. Arg. — Selected specimens examined: H: 96-3679 (BRG). K: 96-4208 (US).
- **Porina atropunctata* Lücking & Vezda (Lücking & Vezda 1998) — Selected specimens examined: F: 96-3292 (hb. Lücking). H: 96-3685 (BRG), 96-3686 (US), 96-3687 (hb. Lücking). I: 96-3885 (hb. Lücking). K: 96-4209 (hb. Lücking).
- **Porina curtula* Malme (Lücking & Vezda 1998) — Specimen examined: I: 96-4147 (BRG). — *Notes*: The collections from Guyana were formerly identified as *Porina tetracerae* (Afz.) Müll. Arg. (Sipman 1997).
- Porina distans* Vezda & Vivant (Lücking & Vezda 1998) — Selected specimens examined: H: 96-3668 (BRG). I: 96-3882 (US). — *Notes*: Since various species of *Porina* are capable of forming isidia of a type described for *P. distans* (of which perithecia are unknown), it has been suggested to use this name as a label for sterile collections until the isidiate forms can be studied in more detail using molecular methods, and their status can be clarified (Lücking & Vezda 1998).
- Porina epilucida* Aptroot & Sipman (lichenicolous) — Selected specimens examined: D: 96-3570 (hb. Lücking). F: 96-3440 (BRG). H: 96-3683 (US). I: 96-3877 (hb. Lücking). — Observed host lichen: *Porina mirabilis*.
- Porina epiphylla* (Fée) Fée. — Selected specimens examined: F: 96-3299 (BRG), 96-3298 (US). I: 96-4020 (BRG, US).
- Porina fulvella* Müll. Arg. — Selected specimens examined: D: 96-3572 (US). F: 96-3304 (BRG).
- Porina fusca* Lücking — Selected specimens examined: F: 96-3307 (BRG). I: 96-4140 (US), 96-3879 (hb. Lücking). — *Notes*: Some specimens (e.g. 96-3879) carry isidia of the *Phyllophiale fusca* type.
- Porina guianensis* Lücking & Vezda (Lücking & Vezda 1998) — Selected specimens examined: H: 96-3673 (BRG), 96-3672 (hb. Lücking). I: 96-3869 (BRG, US). — *Notes*: The collections from Guyana were formerly identified as *Porina verruculosa* Müll. Arg. (Sipman 1997). The latter is not known from Guyana (Lücking & Vezda 1998).
- Porina imitatrix* Müll. Arg. — Selected specimens examined: F: 96-3291 (BRG). H: 96-3667 (BRG). I: 96-3880 (US).
- Porina leptosperma* Müll. Arg. — Specimen examined: H: 96-3671 (BRG).

- Porina leptospermoides* Müll. Arg.** — Specimen examined: C: 96-3489 (BRG). F: 96-3437 (US). — *Notes*: Formerly reported as *Porina limbulata* (Aptroot & Sipman 1993a; see Lücking 1996).
- Porina limbulata* (Kremp.) Vain.** — Selected specimens examined: D: 96-3176 (BRG). F: 96-3303 (BRG), 96-3302 (hb. Lücking). H: 96-3689 (BRG, hb. Lücking). I: 96-3870 (US). — *Notes*: Formerly reported as *Porina rufula* (Aptroot & Sipman 1993a: fig. 14; see Lücking 1996).
- ****Porina lucida* R. Sant.** — Selected specimens examined: F: 96-3298 (BRG), 96-3297 (hb. Lücking). H: 96-3677 (US). I: 96-3876 (BRG, US, hb. Lücking). — *Notes*: The earlier reports made by Aptroot & Sipman (1993a) and Sipman (1997) refer to *Porina mirabilis* (see Lücking & Vezda 1998).
- Porina mirabilis* Lücking & Vezda** — Selected specimens examined: B: 96-3089 (BRG). D: 96-3179 (US). F: 96-3297 (BRG). I: 96-3875 (BRG), 96-3874 (hb. Lücking). — *Notes*: Some specimens (e.g. 96-3089, 96-3179) carry isidia of the *Phyllophiale alba* type.
- ****Porina* aff. *mirabilis* Vain.** — Selected specimens examined: A: 96-3017 (hb. Lücking). I: 96-4146 (hb. Lücking). — *Notes*: This species has been confused with *Porina applanata* (Aptroot & Sipman 1993a; Sipman 1997). It is actually a new species, related to *P. mirabilis* but lacking the crystals typical of the latter; it therefore resembles *P. applanata* or a member of the *P. rufula* group (Hafellner & Kalb 1995). All hitherto collections of this new taxon carry isidia of a type slightly different from *Phyllophiale alba*. *Porina applanata* does not occur in the Neotropics (Lücking et al. 1998).
- ****Porina nitidula* Müll. Arg.** — Selected specimens examined: A: 96-3008 (BRG). B: 96-3090 (BRG). C: 96-3488 (US). F: 96-3293 (BRG). I: 96-3866 (US).
- ****Porina nucula* Ach.** — Specimen examined: I: 96-4025 (hb. Lücking).
- ****Porina octomera* (Müll. Arg.) F. Schill.** — Specimen examined: I: 96-4018 (BRG).
- ****Porina papillifera* (Stirt.) F. Schill.** — Specimen examined: K: 96-4207 (BRG).
- Porina radiata* Kalb, Lücking & Vezda** (Lücking & Vezda 1998) — Syn.: *Porina rugosa* Kalb & Vezda nom. illeg., non *P. rugosa* Ach. (Lücking & Vezda 1998). — Selected specimens examined: I: 96-3867 (BRG, US, hb. Lücking).
- ****Porina rubentior* (Stirt.) Müll. Arg.** — Selected specimens examined: F: 96-3294 (BRG), 96-3295 (US). H: 96-3690 (BRG). I: 96-3871 (US).
- Porina rufula* (Kremp.) Vain.** — Selected specimens examined: D: 96-3154 (BRG). F: 96-3301 (BRG). H: 96-3681 (US). — *Notes*: Formerly reported as *Porina pseudofulvella* Sérus. by Aptroot & Sipman (1993a; see Lücking 1996).
- ****Porina subepiphylla* Lücking & Vezda** (Lücking & Vezda 1998) — Selected specimens examined: F: 96-3314 (BRG). I: 96-4022 (BRG), 96-4021 (US).
- ****Porina tetramera* (Malme) R. Sant.** — Selected specimens examined: A: 96-3019 (BRG). I: 96-4015 (US). L: 96-4228 (hb. Lücking).
- ****Porina vezdae* Lücking** — Selected specimens examined: I: 96-4017 (BRG, US).
- ****Pseudocalopadia mira* Lücking** (Lücking 1998a) — Selected specimens examined: A: 96-3057 (BRG). C: 96-3502 (US). E: 96-4101 (BRG). — *Notes*: Characterized by a farinose thallus, small apothecia with 3-septate ascospores, and campylidia of the *Calopadia* type.
- ******Pyrenidium santessonii* Lücking, sp.n.** (lichenicolous) (Fig. 3E) — A *Pyrenidium cryptotheciae* ascosporis maioribus angustioribusque et peritheciis lichenicola in thallo *Bacidiae* differt. — Typus: GUYANA. Paramakatoi, 4° 42' N, 59° 43' W, 500-800 m, submontane moist forest, foliicolous in undergrowth, II. 1996, Lücking 96-4047 (BRG, holotypus). — Thallus not developed, perithecia growing on thalli of *Bacidia psychotriae*; perithecia aggregate in gall-like malformations of the host thallus, their upper part dark and exposed; galls 0.3-0.7 mm diam., single perithecia 0.05-0.1 mm diam., rounded; perithecial wall composed of several layers

of brown, elongate cells; interascal hyphae not very numerous, branched and anastomosing, in the upper part with an aeruginous pigment; asci fissitunicate, 50-60 × 10-13 µm; ascospores 3-septate, oblong, with slightly constricted septa, (dark) brown, 13-15 × 4-4.5 µm, 3.3 times as long as broad; vegetative hyphae usually well-developed around the perithecia, septate, dark brown, 2.5-5 µm thick. — *Notes:* This new species is intermediate between the three already known species which attack foliicolous lichens. With *Pyrenidium cryptotheciae* Matzer and *P. zamiae*, it shares the 8-spored asci, but the ascospores in the former are shorter and broader (2.1 times as long as broad), while in the latter they are distinctly larger. In addition, both species occur on hosts with a trentepohlioid phycobiont, while *P. santessonii* has been found on a host with a chlorococcoid phycobiont. The other species known from such a host, i.e. *P. sporopodiorum* Matzer growing on *Sporopodium citrinum*, differs mainly by its 4-spored asci. I am therefore convinced that *Pyrenidium santessonii* is a good species, although its variational amplitude must be studied further with more collections.

***Pyrenidium zamiae* (Müll. Arg.) Matzer** (lichenicolous; Matzer 1996) — Selected specimens examined: H: 96-3708 (BRG). I: 96-4050 (hb. Lücking). — Observed host lichen: *Porina lucida*.

***Sporopodium antonianum* Elix, Lumbsch & Lücking** — Selected specimens examined: C: 96-3501 (BRG). F: 96-3442 (US). H: 96-3627 (BRG, hb. Lücking). I: 96-3756 (BRG, US).

****Sporopodium citrinum* (Zahlbr.) Elix, Lumbsch & Lücking** — Selected specimens examined: B: 96-3101 (BRG). D: 96-3136 (US). H: 96-3629 (BRG). I: 96-3753 (US).

***Sporopodium leprieurii* Mont.** — Selected specimens examined: D: 96-3520 (BRG). I: 96-3754 (US).

****Sporopodium phyllocharis* (Mont.) Massal.** — Selected specimens examined: D: 96-3512

(BRG). H: 96-3628 (US). I: 96-3826 (BRG). L: 96-4230 (US).

***Sporopodium xantholeucum* (Müll. Arg.) Zahlbr.** — Specimen examined: H: 96-3630 (BRG).

***Strigula antillarum* (Fée) Müll. Arg.** — Selected specimens examined: A: 96-3009 (BRG). E: 96-4100 (US). F: 96-3434 (BRG).

***Strigula concreta* (Fée) R. Sant.** — Selected specimens examined: A: 96-3048 (BRG, US, hb. Lücking). D: 96-3189 (hb. Lücking). F: 96-3450 (US). H: 96-3705 (BRG, hb. Lücking). I: 96-3865 (hb. Lücking).

***Strigula janeirensis* (Müll. Arg.) Lücking comb. nov.** — Bas.: *Phylloporina janeirensis* Müll. Arg., Flora 73: 198 (1890). Syn.: *Raciborskiella janeirensis* (Müll. Arg.) R. Sant., Symb. Bot. Ups. 12(1): 196 (1952). Type: BRAZIL. Rio de Janeiro: Rio de Janeiro, Glaziou s.n. (G, holotype). — Selected specimens examined: F: 96-3265 (BRG). H: 96-3693 (US). I: 96-3853 (BRG). — *Notes:* This new combination is introduced following Harris (1995). Having a number of non-foliicolous taxa recently assigned to *Strigula*, I now agree that there is no point in separating *Raciborskiella* and *Phylloporis* from that genus.

****Strigula macrocarpa* Vain.** — Specimen examined: I: 96-4013 (BRG).

***Strigula maculata* (Cooke & Masee) R. Sant.** — Selected specimens examined: H: 96-3698 (BRG). I: 96-3891 (US).

***Strigula melanobapha* (Kremp.) R. Sant.** — Selected specimens examined: A: 96-3020 (BRG, US, hb. Lücking). B: 96-3088 (hb. Lücking). D: 96-3577 (US, hb. Lücking). H: 96-3703 (hb. Lücking).

****Strigula microspora* Lücking** — Specimen examined: I: 96-3857 (BRG).

***Strigula multipunctata* (G. Merr. ex R. Sant.) R. C. Harris** — Selected specimens examined: I: 96-3862 (BRG, hb. Lücking).

***Strigula nemathora* Mont.** — Selected specimens examined: D: 96-3579 (BRG). H: 96-3700 (US). I: 96-3854 (hb. Lücking).

****Strigula nitidula* Mont.** — Selected specimens examined: A: 96-3022 (BRG, US, hb.

- Lücking). B: 96-3086 (BRG). C: 96-3496 (US). D: 96-3581 (BRG). H: 96-3704 (BRG, hb. Lücking). I: 96-3863 (hb. Lücking).
- Strigula obducta* (Müll. Arg.) R. C. Harris** — Selected specimens examined: F: 96-3264 (BRG). H: 96-3692 (US). I: 96-3860 (hb. Lücking).
- Strigula phyllogena* (Müll. Arg.) R. C. Harris** — Selected specimens examined: F: 96-3115 (BRG). H: 96-3697 (US).
- Strigula platypoda* (Müll. Arg.) R. C. Harris** — Selected specimens examined: D: 96-3123 (BRG), F: 96-3266 (US). H: 96-3696 (BRG, hb. Lücking). I: 96-3861 (US).
- ****Strigula prasina* Müll. Arg.** — Selected specimens examined: I: 96-3852 (BRG, US, hb. Lücking).
- ****Strigula schizospora* R. Sant.** — Selected specimens examined: A: 96-3047 (hb. Lücking). B: 96-3112 (BRG, US, hb. Lücking). C: 96-3497 (BRG). D: 96-3185 (US). H: 96-3695 (BRG), 96-3694 (hb. Lücking). I: 96-3856 (BRG). K: 96-4093 (US).
- Strigula smaragdula* Fr.** — Selected specimens examined: A: 96-3010 (BRG). B: 96-3087 (US). C: 96-3495 (BRG). F: 96-3435 (US). H: 96-3706 (BRG). I: 96-3858 (BRG). K: 96-4092 (US).
- Strigula subtilissima* (Fée) Müll. Arg.** — Selected specimens examined: D: 96-3578 (BRG). F: 96-3269 (US). H: 96-3699 (BRG, hb. Lücking). I: 96-3993 (BRG).
- ****Strigula viridis* (Lücking) R. C. Harris** — Selected specimens examined: D: 96-3580 (US). F: 96-3272 (BRG, hb. Lücking).
- Tapellaria epiphylla* (Müll. Arg.) R. Sant.** — Selected specimens examined: A: 96-3061 (BRG, US). D: 96-3528 (US). F: 96-3415 (BRG).
- ****Tapellaria maior* (Lücking) Lücking** (Lücking 1998a) — Selected specimens examined: C: 96-3504 (BRG). D: 96-3192 (US, hb. Lücking). E: 96-4097 (hb. Lücking).
- ****Tapellaria nana* (Fée) R. Sant.** — Selected specimens examined: A: 96-3024 (BRG). B: 96-3064 (BRG). H: 96-3602 (US).
- Tapellaria puiggarii* (Müll. Arg.) R. Sant.** — Specimen examined: I: 96-3742 (hb. Lücking).
- Tricharia albostrigosa* R. Sant.** — Specimen examined: D: 96-3526 (BRG).
- ****Tricharia amazonum* Zahlbr.** — Selected specimens examined: I: 96-3827 (BRG, US).
- Tricharia couepiae* (Bat.) Lücking & Sérus.** (Lücking 1997a; Lücking et al. 1998a) — Specimen examined: D: 96-3213 (BRG). — *Notes*: The species was earlier reported as *Tricharia dilatata* Vezda and *T. subdilatata* nom. nud. (Sipman & Aptroot 1992; Sipman 1997; see Lücking 1997a).
- Tricharia farinosa* R. Sant.** — Selected specimens examined: C: 96-3483 (hb. Lücking). D: 96-3145 (BRG). F: 96-3455 (US). H: 96-3642 (BRG).
- Tricharia helminthospora* R. Sant.** — Selected specimens examined: C: 96-3223 (US). D: 96-3527 (BRG).
- Tricharia heterella* (Stirt.) Lücking** (Lücking 1997a) — Syn.: *Tricharia membranula* (Müll. Arg.) Lücking; *Echinoplaca affinis* Kalb & Vezda (Lücking 1997a). — Selected specimens examined: A: 96-3028 (BRG). B: 96-3070 (hb. Lücking). C: 96-3471 (hb. Lücking). D: 96-3548 (US, hb. Lücking). F: 96-3419 (US). H: 96-3654 (US, hb. Lücking). I: 96-3832 (BRG).
- ****Tricharia hyalina* Kalb & Vezda** — Specimen examined: A: 96-3029 (hb. Lücking).
- ****Tricharia lancicarpa* Kalb & Vezda** — Specimen examined: C: 96-3482 (hb. Lücking).
- ****Tricharia planicarpa* Lücking** (Lücking 1997a) — Selected specimens examined: C: 96-3470 (BRG), 96-3228 (US). D: 96-3166 (BRG), 96-3547 (hb. Lücking). F: 96-3420 (hb. Lücking). I: 96-3831 (US).
- ****Tricharia pseudosantessonii* Lücking** (Lücking 1997a) — Selected specimens examined: D: 96-3244 (hb. Lücking). — *Notes*: Based on the treatment of foliicolous lichens from Costa Rica by Lücking (1992), collections from Guyana were formerly identified as *Tricharia santessonii* Hawksworth (Sipman 1997).
- Tricharia urceolata* (Müll. Arg.) R. Sant.** — Selected specimens examined: C: 96-3509 (hb. Lücking). D: 96-3524 (BRG). F: 96-

3118 (US). H: 96-3650 (hb. Lücking). I: 96-3828 (hb. Lücking), 96-4114 (BRG). — *Notes:* *Tricharia urceolata* is probably still a collective species, since two different forms are involved. *T. urceolata* s.str. has rather small, brownish apothecia with a strongly prominent, irregular margin of the same colour as the disc. A second form (96-3650, 96-3828) has larger, almost stalked apothecia with a paler margin. This form is akin towards *T. longispora* Kalb & Vezda but differs in the paler apothecia and shorter ascospores.

***Tricharia vainioi* R. Sant.** — Selected specimens examined: C: 96-4200 (BRG). D: 96-3535 (US), 96-3534 (US). F: 96-3447 (US). H: 96-3652 (BRG). I: 96-4134 (BRG).

****Trichothelium alboatrum* Vain.** — Selected specimens examined: H: 96-3688 (hb. Lücking). I: 96-4029 (BRG, hb. Lücking). — *Notes:* All specimens belong to the „*aspleni*“ form as defined by Lücking (1998b).

***Trichothelium annulatum* (Karst.) R. Sant.** — Selected specimens examined: D: 96-3198 (BRG), 96-3574 (hb. Lücking). F: 96-3320 (US), 96-3321 (US). H: 96-3684 (BRG). I: 96-4035 (US).

****Trichothelium argenteum* Lücking & Ferraro** (Lücking & Ferraro 1997) — Selected specimens examined: I: 96-4032 (hb. Lücking).

***Trichothelium bipindense* F. Schill.** (Lücking 1998b) — Selected specimens examined: F: 96-3319 (BRG). I: 96-4038 (US).

***Trichothelium epiphyllum* Müll. Arg.** — Selected specimens examined: H: 96-3678 (hb. Lücking). I: 96-4031 (BRG), 96-4037 (hb. Lücking). — *Notes:* One specimen (96-3678) belongs to the „*montanum*“ form, and another (96-4037) resembles the „*ulei*“ form (Lücking 1998b).

***Trichothelium juruense* (P. Henn.) F. Schill.** (Lücking 1998b) — Selected specimens examined: I: 96-4033 (BRG), 96-4034 (hb. Lücking).

****Trichothelium minutum* (Lücking) Lücking** (Lücking 1998b) — Selected specimens examined: F: 96-3308 (BRG). I: 96-4028 (BRG, US, hb. Lücking).

****Trichothelium mirum* Lücking** (Lücking 1998b) — Specimen examined: D: 96-3575 (BRG).

****Trichothelium pallescens* (Müll. Arg.) F. Schill.** (Lücking 1998b) — Specimen examined: I: 96-4030 (BRG).

****Trichothelium sipmanii* Lücking** (Lücking 1998b) — Selected specimens examined: F: 96-3318 (BRG). I: 96-4027 (US).

***Woessia pseudohyphophorifera* Lücking & Sérus.** — Selected specimens examined: D: 96-3554 (BRG). H: 96-3601 (US). I: 96-3771 (BRG, US).

Floristic observations

On the basis of collections from four representative localities, a total of 233 foliicolous lichens and 18 lichenicolous fungi are reported from Guyana in the present paper. Three lichens and two lichenicolous fungi are newly described. Three species are new to the Neotropics, while 85 lichens and nine lichenicolous fungi are new records for Guyana. Excluding the facultatively foliicolous taxa such as *Dichosporidium*, *Malcolmiella* (the *Lecidea piperis* group; see Vezda 1997), *Megalospora*, or *Parmeliella* (Sipman 1997; this paper), the foliicolous lichen flora so far known from Guyana comprises about 260 lichens and c. 20 lichenicolous fungi. This figure is lower than that of Costa Rica with c. 335 species (Lücking 1995b) but appears to be the second highest reported for any country in the world.

With the low variation of vegetation types present in Guyana and the large number of collections from various localities treated in recent papers, it can be assumed that our knowledge of its foliicolous lichen flora is rather complete. This seems to be confirmed by the low percentage (2 %) of newly described species. For comparison: of the more than 300 species found in Costa Rica, about 30 % have been new to science (Lücking 1991, 1995a, 1997a, c, 1998a, b, and in prep.; Lücking & Matzer 1996). One could of course expect that due to the wide distribution of many foliicolous lichens, the percentage of new taxa automatically decreases when new areas are surveyed. However, in a recently examined

collection from Ecuador (Lücking, in prep.), still 5 % of the species are to be described as new. A preliminary comparison of different sites in northern South America, from eastern Colombia, Ecuador, and Peru to the Guianas and the south-eastern region of the Amazon, is remarkably homogeneous (Lücking 1997d, in prep.). Most species are widely distributed throughout this area, whereas the degree of endemism is low. This pattern is also true for non-foliicolous lichens, perhaps with the exception of terricolous or saxicolous groups like the Cladoniaceae which show some restricted patterns of species endemism in the Guayana Highland (Sipman 1991). A characteristic foliicolous lichen for the Amazon region seems to be *Amazonomyces sprucei*, which is abundant at lowland rain forest sites in Ecuador, Guyana, French Guiana, and Brazil (Lücking 1997d, and unpubl.), but does not occur outside this region. Other typical element of this area are *Bacidia psychotriae* and *Malcolmiella trailiana* (Müll. Arg.) Vezda. It might be assumed that most humid forest site within this region are representative for the area, and the total foliicolous lichen diversity of the Amazon region is probably not much higher than within a single region like Guyana. On the other hand, areas in Colombia, Venezuela, Ecuador or Peru which include the Andes and have isolated rain forest areas on the Pacific coast, like the Chocó, may shelter more species than the whole Amazon region.

Ecological observations

The highest foliicolous lichen diversity was found in the undisturbed submontane humid forest sites, with 91-158 species per site and 216 species if all four sites are combined (Fig. 5), not considering the lichenicolous fungi. With 158 species, site I at Paramakatoi shelters the second highest site diversity ever recorded, after the „Botarrama“ trail in Costa Rica with 217 species (Lücking 1998c). The table mountain forest (site C) and the evergreen dry forest (site B) support a rather low diversity, with 39-46 species, while at the semi-open to open sites and in the forest canopy, the diversity drastically decreases, with 2-35 species per site and 50 species if all sites are combined. Diversity is

thus negatively correlated with the light regime and the degree of disturbance (Spearman rank correlation; $r = -0.87$, $p < 0.001$).

Sipman (1991) studied the foliicolous lichen site diversity in Guyana and found distinctly lower values ranging from 12 to 69 species. This is probably due to the less intensive concentration of foliicolous lichens in the collections made by him. However, the general diversity patterns were essentially the same, with the highest diversity found in tall virgin riverain forests and the lowest values in low, semi-open forests with transition to savanna. In another study, Sipman (1997) reported 155 foliicolous taxa for a single site in Guyana, including the forest (sub)canopy, with about 135 genuine foliicolous lichens. This figure is rather similar to those found in the present paper.

On the basis of their foliicolous lichen species composition and abundance, the investigated sites can be separated into two clusters: one is formed by sites D, F, H, and I, while the other is composed of sites A-C and K-L (Fig. 6). Cluster A thus includes the undisturbed submontane humid forest sites with light index 1 and high foliicolous lichen diversity, while cluster B combines all semi-open to open, low diversity sites with higher light intensity or anthropogenic disturbance, including the forest canopy.

Of particular interest is the table mountain site C, not only because of its low diversity in spite of being a primary vegetation, but also because of its species composition. Due to its partly open vegetation mixed with rocky savanna, the site is intermediate between the closed and the semi-open vegetation, and in addition shelters exclusive species only found here, such as *Caleniopsis laevigata*, *Coccocarpia pellita*, *Echinoplaca fusconitida*, *E. aff. incrustatociliata*, *Logilvia gilva*, and *Tricharia lancicarpa*. Of these, the abundant *Echinoplaca fusconitida* and *Logilvia gilva* are typical montane taxa (Lücking 1997b), and the latter was reported by Sipman (1991) from the mossy forest of Mt. Roraima. This coincides with the particular character of table mountain vegetation. Due to their exposition, the precipitation regime is similar to that of an upper montane rain forest even if the absolute altitude at the present site was only 400 m. The influence of this „Massenerhebungs-

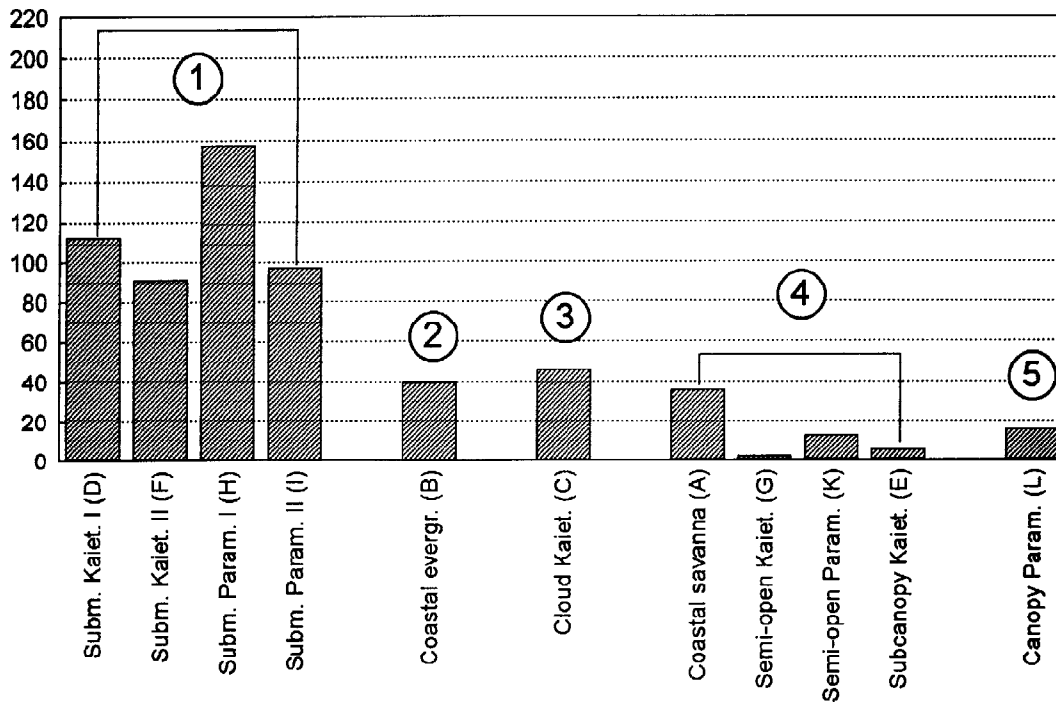


Fig. 5. Follicolous lichen diversity (excluding lichenicolous fungi) at the study sites. The numbers in circles indicate the corresponding light / disturbance indices: (1) = shady forest understorey or closed vegetation; (2) = transition to light gaps or semi-open vegetation; (3) = light gaps or semi-open vegetation; (4) = transition to canopy or open vegetation; (5) = canopy or open vegetation.

effekt“ (Grubb & Whitmore 1966) on foliicolous lichen distribution was already demonstrated in a study of Cocos Island (Lücking & Lücking 1995).

The intermediate position of montane forests between undisturbed shady understorey and disturbed semi-open vegetation is a well-known phenomenon and can be explained by the fact that foliicolous lichens react primarily to the light regime in their local distribution (Lücking 1997b). Sipman & Aptroot (1992) noted in their analysis of the Guyanan lichen flora that lichens found in the forest canopy, in different savanna types, and in the table mountain vegetation, are mainly identical with those found in cultivated areas.

According to their average abundance values (Table 1), the most common species are *Byssoloma subdiscordans*, *Tricharia heterella*,

Strigula nitidula, *Amazonomyces sprucei*, *Lasioloma arachnoideum*, *Mazosia praemorsa*, *Strigula melanobapha*, *S. schizospora*, *Arthonia cyanea*, *Bacidia brasiliensis*, and *Byssoloma leucoblepharum*. Compared with the lowland rain forest in Costa Rica, the abundant species are shared between the two areas, except for *Amazonomyces sprucei* and *Strigula melanobapha* which are not found in Costa Rica, and *Bacidia brasiliensis* and *Mazosia praemorsa*, which are less common in the latter area. These species are otherwise abundant in the Amazon region.

Based on their CA scores, the foliicolous lichen species can be divided into four groups (Table 1). Group 1 is the largest one and comprised species with scores = 1.00 which are exclusively found at the undisturbed submontane humid forest sites D, F, H, or I (cluster A). This group

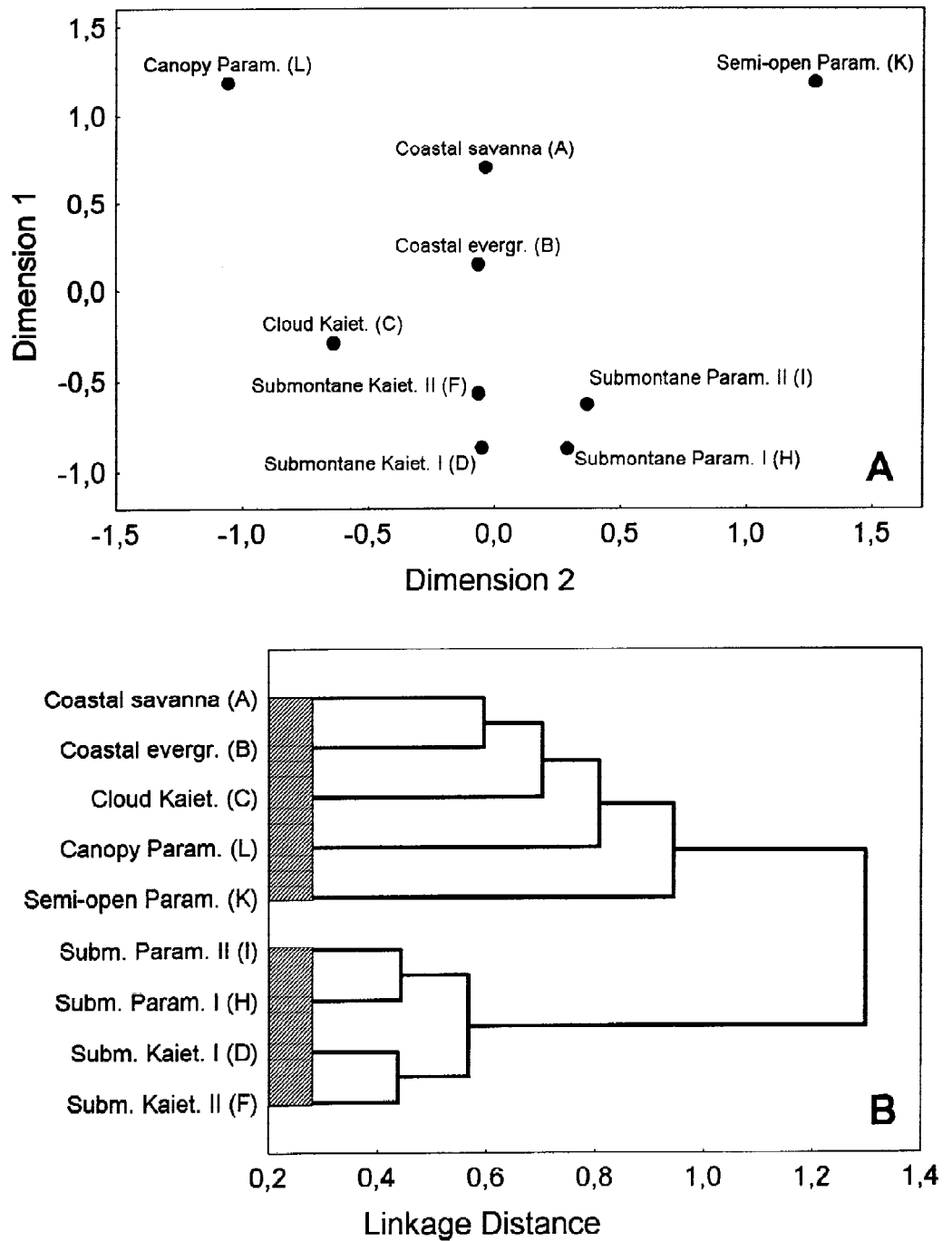


Fig. 6. Multidimensional scaling (A) and cluster analysis (B) of the study sites on the basis of their foliicolous lichen species composition, using Sørensen's (1948) coefficient of similarity and Ward's method as clustering algorithm. Sites E and G are excluded because of their low diversity.

is dominated by the genera *Arthonia*, *Byssoloma*, *Fellhanera*, *Mazosia*, and *Porina*, as well as species of *Strigula* with thin or supracuticular thalli. The most characteristic species with high abundance values are *Amazonomyces sprucei*, *Bacidia brasiliensis*, *Chroodiscus coccineus*, *Strigula subtilissima*, *Phyllobathelium epiphyllum*, *Badimia subelegans*, *Opegrapha filicina*, *Trichothelium annulatum*, *Strigula platypoda*, and *Porina rubentior*. A second group, with species having scores between 1.14 and 1.80, includes species which are most abundant in the undisturbed submontane humid forest sites but extend into secondary and semi-open vegetation. The generic composition is the same as in the first group. Abundant taxa belonging to this type are *Mazosia praemorsa*, *Byssoloma leucoblepharum*, *Aspidothelium fugiens*, *Actinoplaca strigulacea*, and *Tricharia heterella*.

The third and fourth group have distinctly less species. Group 3 is formed by species with scores between 2.00 and 2.83 which seem to have a broad ecological amplitude and are found over a great range of site types (Lücking 1997b). This group is dominated by the genus *Strigula*, and characteristic species are *S. nitidula*, *S. melanobapha*, *S. nemathora*, *Gyalectidium filicinum*, *Arthonia cyanea*, *Lasioloma arachnoideum*, *Aulaxina quadrangula*, *Porina nitidula*, and *Byssoloma subdiscordans*. The last group comprises a few species, with scores between 3.00 and 5.00, which are mostly found outside the closed forest in the forest canopy and accordingly abound in semi-open to open secondary vegetation. The most typical genus is *Asterothyrium*, with three species, accompanied by *Echinoplaca hymenocarpoides*, *Tapellaria nana*, *Strigula antillarum*, *Aulaxina opegraphina*, *Pseudocalopadia mira*, and *Byssoloma lueckingii*.

The division of the species into four groups according to their CA scores agrees rather well with the results of Sipman's (1991) preliminary studies and with their preferences towards undisturbed or disturbed vegetation (Lücking 1997b), although the latter data are principally based on investigations made in Costa Rica. Apparently, the ecology of widely distributed species is rather homogeneous within their

distribution range, and results of ecological studies made at a particular locality can therefore be generalized. The CA scores as presented here do not exactly correspond to the light indices given by Lücking (1997b), since they do not consider the fact that the undisturbed forest understorey also includes small light gaps where species preferring semi-open conditions can occur. The scores should therefore be interpreted as combined light regime / disturbance scores.

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