Foliicolous lichens and their lichenicolous fungi from Ecuador, with a comparison of lowland and montane rain forest

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Foliicolous lichens and their lichenicolous fungi from Ecuador, with a comparison of lowland and montane rain forest

Abstract

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A rich collection of foliicolous lichens from Ecuador gathered at the Biological Stations Jatun Satcha and Guajalito, two representative localities in the lowland and the montane rain forest, yielded a total of 297 species, including 15 facultatively foliicolous taxa and 11 lichenicolous fungi. Twelve species are described as new: *Aspidothelium mirabile*, *A. ornatum, A. scutellicarpum* [= *Aspidopyrenium insigne* var. *dispersum*], *Asterothyrium gigantosporum, A. longisporum, Dimerella vezdana, Gyalideopsis albopruinosa, Porina napensis, P. pichinchensis, Psorotheciopsis guajalitensis, Tapellaria marcellae* and *Tricharia verrucifera.* Furthermore, the new combination *Porina repanda* [≡ *Verrucaria repanda*] is made. Species diversity is the second highest known in the world, after Costa Rica with approximately 380 species. Species composition is remarkably similar to that of Costa Rica, which exhibits a similar landscape physiognomy. However, the lowland rain forest of Ecuador still remains undercollected. The lowland and the montane rain forest sites differ markedly in their foliicolous lichen flora. *Arthonia*, *Aspidothelium*, *Echinoplaca*, *Mazosia* and *Gyalideopsis* are the most discriminative genera between the two forest types with respect to diversity and species composition.

1. Introduction

Ecuador is one of the regions with the highest biodiversity in the world. Vascular plant diversity (trees, lianas, epiphytes, and herbs) was found to be up to 842 species in a one-hectare plot in Amazonian Ecuador (Valencia & al. 1994), and the number of species for the whole country is estimated to 16 500-20 000 (Balslev & Renner 1989). Reasons for this high diversity are the extreme topography, with mountains reaching 6300 m, in combination with high precipitation and the proximity to the equator (Gentry 1982, 1988), as well as the palaeogeographical history (Behrensmeyer & al. 1992) and mechanisms governing the diversity at the small scale (Kubitzki 1985).

It would be expected that these factors result in high lichen diversity as well. However, as in most tropical countries (Galloway 1992), the lichen flora of Ecuador is too insufficiently known to give reliable estimates on species richness. It was not until the early 1970s that the "Lichen

flora of Ecuador" was initialized by Arvidsson (1986), but thus far only macrolichens have been treated in detail (Galloway & Arvidsson 1990, Arvidsson 1991, Yoshimura & Arvidsson 1994). Crustose lichens, which account for most of the diversity in the lowland forest (Sipman & Harris 1989, Aptroot & Sipman 1997), are mostly undercollected. With regard to foliicolous lichens, the lack of knowledge is demonstrated by the low number of 30 species listed for Ecuador in the world monograph of Santesson (1952), most of them sampled by E. Asplund in 1939 and 1940. Nevertheless, two new species, viz. *Echinoplaca atrofusca* R. Sant. and *Trichothelium asplundii* R. Sant., were based on Ecuadorian material. Recent foliicolous lichen collections gathered in the frame of the "Lichen flora of Ecuador" are currently under study, and some new findings have been published (Sérusiaux 1995), e.g. the campylidia-bearing *Woessia arvidssonii* Sérus. Arvidsson (1986) estimated the total number of lichen species present in the hitherto made collections to about 2000. This coincides with estimations based on studies in other areas (Sipman 1991, 1995, Lücking 1995a, Aptroot 1997, Aptroot & Sipman 1997) that lichen diversity in tropical countries may amount to 2000-3000 species and hence contribute significantly to the overall vegetative diversity.

The present paper further contributes to the knowledge of lichen diversity in Ecuador, focusing on foliicolous lichens and their lichenicolous fungi. It is based on a collection made during an expedition to Ecuador together with M. Matzer in May 1996. Four areas were visited (including the Páramo region), of which two sheltered foliicolous lichens. These are the "Jatun Satcha" Biological Station in the lowland to submontane rain forest in Amazonian Ecuador, and the "Guajalito" Biological Station in the montane rain forest on the western flanks of the Cordillera Occidental. This paper describes twelve new species and lists all species encountered in the collections. A floristic and biogeographical analysis is made in comparison with the well-known foliicolous lichen floras of Costa Rica and Guyana, and the lowland and montane forest sites are compared in terms of diversity and taxonomic composition.

2. Study area

Ecuador is a tropical Andean country situated on the equator and bordered to the north by Colombia, to the southeast by Peru and to the west by the Pacific Ocean. It covers a surface of about 283 500 km^2. The Andean Cordilleras, with the Cordillera Occidental in the west and the Cordillera Oriental in the east, traverse Ecuador from north to south and divide it into the Pacific coastal plain (La Costa) and the eastern lowland (El Oriente) facing the Amazon basin (Harling 1979). Except for the northern parts, most of the coastal plain is covered by semi-deciduous forest and savanna, habitats not well-suitable for foliicolous lichen growth (Sérusiaux & de Sloover 1986, Lücking 1992a, b). The eastern lowlands are dominated by lowland rain forest, while the Andean plateaus shelter different types of Páramo and shrub vegetation. At the flanks of the Cordilleras, two narrow strips of upper montane rain or cloud forest are found (Harling 1979).

The foliicolous lichen material treated in this paper was collected at two different localities situated in the eastern lowland rain forest area near Tena ("Jatun Satcha") and in the Pacific slope upper montane rain forest near the capital Quito ("Guajalito"). Both are protected areas provided with biological stations, being administrated by the Fundación Jatun Satcha (associated to the National Herbarium QCNE) and the Biological Science Department and Herbarium QCA of the Universidad Católica del Ecuador, respectively. The exact collecting data are as follows:

(1) Jatun Satcha Biological Station: Napo Province, 25 km E of Tena at S side of the Río Napo, 01°04'S, 77°35'W, 450 m alt., tropical lowland to submontane rain forest, 5.1996, *R. Lücking* (together with M. Matzer).
(2) Guajalito Biological Station: Pichincha Province, 45 km W of Quito on the W slope of the Cordillera Occidental (km 59 on old road towards Sto. Domingo de los Colorados), 00°09'S, 78°39'W, 1800 m alt., tropical montane rain forest, 5.1996, *R. Lücking* (together with M. Matzer).

3. Taxonomic account

The encountered foliicolous lichens and lichenicolous fungi are presented in three parts. The first part deals with new and remarkable taxa, the second and third parts briefly report the other foliicolous lichens and lichenicolous fungi, respectively. All taxa are listed in alphabetical order. The nomenclature follows Farkas & Sipman (1997) unless otherwise indicated. For convenience, the bibliographic reference is given in case of most recently described taxa. The localities are only quoted as "Jatun Satcha" and "Guajalito", respectively, followed by the author's collection number. Representative sets of specimens, including the type material of names of new taxa, are deposited in the National Herbarium (QCNE) and the Herbarium of the Universidad Católica del Ecuador (QCA).

3.1. New and remarkable taxa

Aspidothelium aff. ***fugiens*** (Müll. Arg.) R. Sant.
This population differs from typical *Aspidothelium fugiens* in the large hemispherical perithecia, which are basally expanded when young. The collections resemble *Phylloporina macrospora* Müll. Arg., considered as taxonomic synonym of *A. fugiens* (Santesson 1952).

Selected specimens examined: Jatun Satcha: *96-81* (QCA, hb. Lücking), *96-884* (QCNE, hb. Lücking).

Aspidothelium mirabile Lücking, **sp. nova** – Fig. 1A, 2A
Holotypus: Ecuador, Pichincha, Guajalito Biological Station, 00°09'S, 78°39'W, 1800 m, montane rain forest, on leaves of *Ericaceae*, 5.1996, *Lücking 96-316* (QCA).

Ab *Aspidothelio cinerascente* ascosporibus cellula media grandi indivisa instructis differt.

Description: Thallus epiphyllous, crustose, continuous but with gaps and marginally dispersed, smooth, pale greenish grey, c. 10 mm diam.; phycobiont a species of *Chlorococcaceae*. Perithecia sessile, applanately cylindrical, their top with a disc-like or ring-shaped expansion with an entire or slightly irregular margin (Fig. 1A), together with that expansion 0.2-0.3 mm diam., whitish grey (in the type collection partly damaged by water and thus translucent). Perithecial wall, paraphyses, periphyses and asci as in *Aspidothelium cinerascens*; asci 80-100 × 24-27 µm. Ascospores 6-8 per ascus, fusiform, muriform but with a large central cell up to 10 µm long which remains completely undivided (Fig. 2A), hyaline, 45-55 × 14-17 µm.

Notes: This new species is only known from the type collection. However, I found the ascospores so characteristic and remarkable that I decided to describe this species formally. The ascospore type, muriform with a large cell in the middle, is very rare among lichens and has hitherto mainly been reported from the *Arthoniaceae*, e.g. *Eremothecella cingulata* (R. Sant.) Ferraro & Lücking (Santesson 1952, as *Arthothelium cingulatum*) and *Amazonomyces farkasiae* (Lücking) Lücking, Sérus. & Thor (Lücking 1995b, as *Cryptothecia farkasiae*). The restricted occurrence of such ascospores and their constant formation in the taxa in question confirms the assumption that also in the present case they deserve taxonomic recognition on specific level and do not represent an aberrant form of a species with normal muriform ascospores. Except for the deviating ascospores, the new species is most similar and most closely related to *Aspidothelium cinerascens* Vain., which has similar but larger perithecia and typically muriform ascospores. The latter was found at the same locality and partly intermingled with *A. mirabile*, so that ecological reasons for the formation of muriform ascospores with a large median cell can be ruled out.

Aspidothelium ornatum Lücking, **sp. nova** – Fig. 1B, 2B, D
Holotypus: Ecuador, Pichincha, Guajalito Biological Station, 00°09'S, 78°39'W, 1800 m, montane rain forest, on leaves of free standing tree near station, 5.1996, *Lücking 96-330* (QCA; isotypes to be distributed in Lücking, Lich. Fol. Exs.).

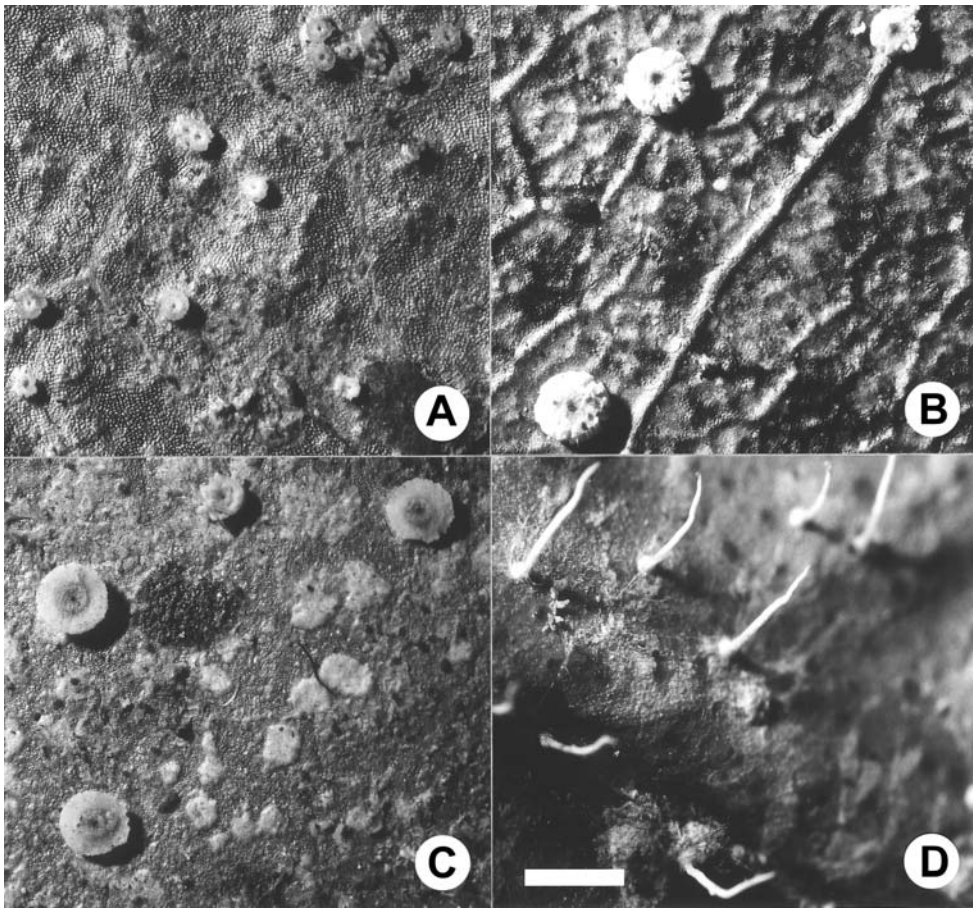

Fig. 1. A: *Aspidothelium mirabile* Lücking, thallus with perithecia; B: *A. ornatum* Lücking, thallus with perithecia; C: *A. scutellicarpum* Lücking, thallus with perithecia; D: *Dimerella vezdana* Lücking, thallus with pycnidia. – Scale = 1 mm.

Ab *Aspidothelio fugiente* peritheciis maioribus subglobosis strato spongioso ornatis parietibus paraplectenchymatisque et ascosporibus majoribus differt.

Description: Thallus epiphyllous, crustose, continuous but with gaps and marginally dispersed, algiferous patches connected by a thin, translucent prothallus, smooth, greyish green, up to 20 mm diam.; phycobiont a species of *Chlorococcaceae*. Perithecia sessile, subglobose and basally constricted, their whole surface except for a small portion around the ostiole covered by a spongiose layer formed by outgrowths of the perithecial wall, which are indistinctly arranged in 7-10 longitudinal rows (Fig. 1B), 0.5-0.8 mm diam., whitish except for the ostiole indicated by a narrow, brownish grey spot. Outer perithecial wall paraplectenchymatous, laterally up to 100 µm thick, externally with abundant, irregular appendages (Fig. 2D) formed by agglutinate hyphae, which give the perithecial surface a spongiose appearance; inner wall prosoplectenchymatous; paraphyses, periphyses and asci as in *Aspidothelium fugiens*; asci 180-215 × 40-50 µm. Ascospores usually 8 per ascus, rarely less, fusiform, transversely septate with c. 20-35 septa (Fig. 2B), hyaline, 110-140 × 15-20 µm.

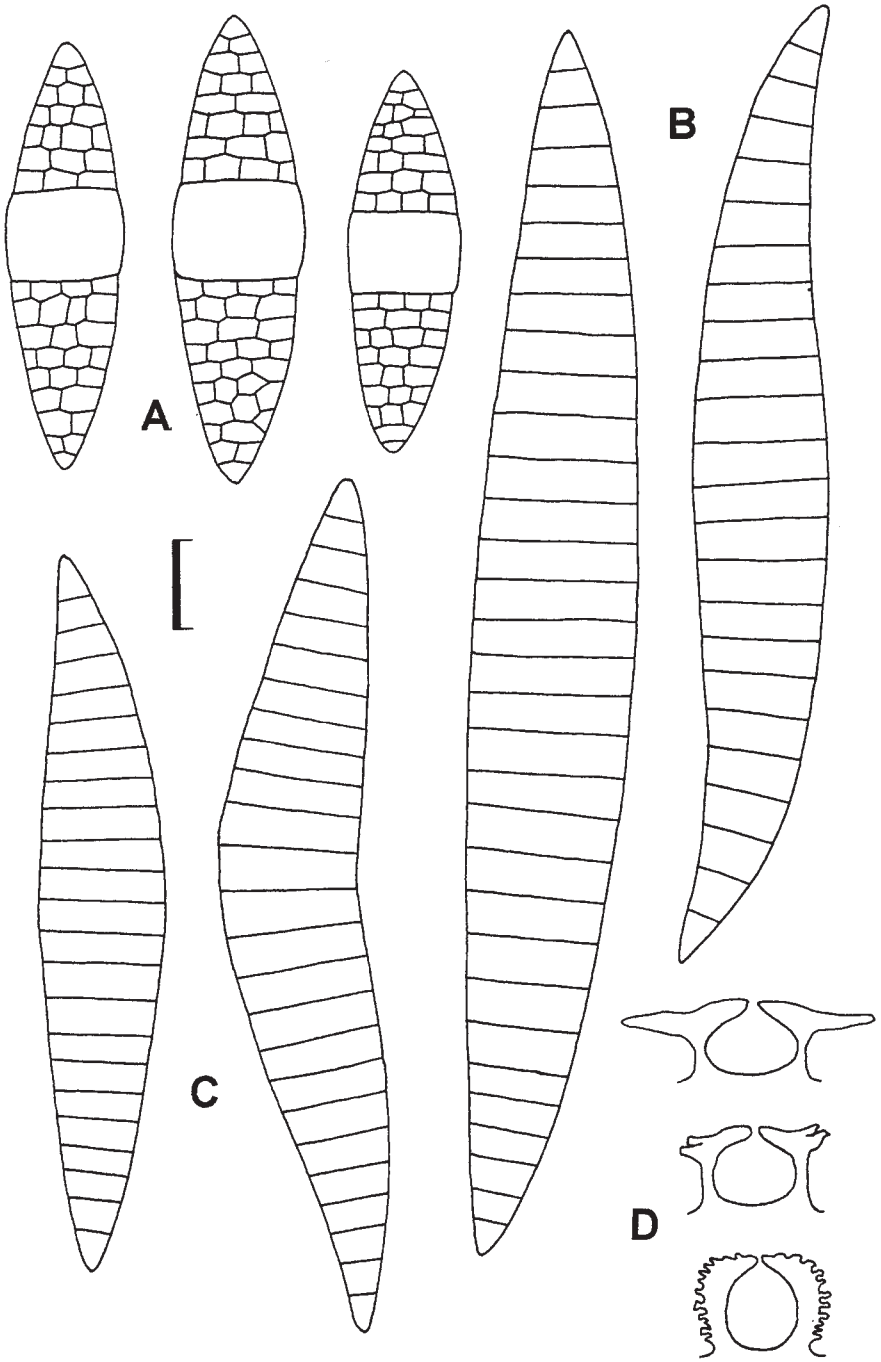

Fig. 2. A: *Aspidothelium mirabile* Lücking, ascospores; B: *A. ornatum* Lücking, ascospores; C: *A. scutellicarpum* Lücking, ascospores; D: schematic section through perithecia in *A. scutellicarpum* (above), *A. fugiens* (Müll. Arg.) R. Sant. (middle) and *A. ornatum* (below). – Scale = 10 µm for ascospores and 200 µm for perithecial sections.

Notes: I first regarded this material as an aberrant form of *Aspidothelium fugiens* (Müll. Arg.) R. Sant., since it exhibits the same ascospore type, and *A. fugiens* is usually considered as being variable with regard to perithecial morphology (Santesson 1952). A closer examination finally convinced me that this form has to be separated from *A. fugiens* on the species level. Not only is the importance of perithecial morphology in the *A. fugiens* complex underestimated, but also is the present form unknown in other collections usually referred to *A. fugiens*. The appendages, which give the perithecial surface a spongiose appearance, are very characteristic and unmistakable. In specimens usually referred to *A. fugiens*, the perithecia are either completely smooth, or their top is provided with small warts, setae or a disc-like expansion, but never is the whole perithecial surface covered with such appendages. Moreover, the ascospores in *A. ornatum* are distinctly larger than in *A. fugiens*. Another particular feature is the paraplectenchymatous outer perithecial wall in *A. ornatum*. Usually, the outer perithecial wall in *Aspidothelium* is formed by densely intricate hyphae, which only distantly resemble a paraplectenchyma (Santesson 1952).

I have not studied the specimen from Ecuador *Asplund 194r*, cited and illustrated in Santesson (1952: 283) among *Aspidothelium fugiens*, but according to the illustration it might represent *A. ornatum*.

Additional specimens examined: Guajalito: *96-315* (QCNE), *96-335* (QCA, filed under *A. fugiens*).

Aspidothelium scutellicarpum Lücking, **sp. nova** – Fig. 1C, 2D
Holotypus: Ecuador, Pichincha, Guajalito Biological Station, 00°09'S, 78°39'W, 1800 m, montane rain forest, on leaves of *Ericaceae* and *Araceae*, 5.1996, *Lücking 96-331* (QCA; isotypes to be distributed in Lücking, Lich. Fol. Exs.).
= *Aspidopyrenium insigne* var. *dispersa* Vain. in Ann. Acad. Sci. Fenn., ser. A, 15: 320. 1921. – Lectotypus: Philippines, *Robinson s.n.* (TUR-Vainio 30876!).

Ab *Aspidothelio fugiente* peritheciis apicibus disciformibus differt. Perithecia *A. cinerascente* similia sed ascosporae transverse septatae.

Description: Thallus epiphyllous, crustose, dispersed into rounded to irregular patches connected by a thin, translucent prothallus, smooth, whitish with a slight pale greenish grey, 10-15 mm diam.; phycobiont a species of *Chlorococcaceae*. Perithecia sessile, applanately cylindrical, their top with a distinct disc-like or ring-shaped expansion with an entire to slightly irregular or minutely dentate margin (Fig. 1C, 2D), together with that expansion 0.3-0.9 mm diam., whitish with a slight pinkish tinge but often around the ostiole or the whole upper, disc-like part of the perithecia light to dark grey. Perithecial wall, paraphyses, periphyses and asci as in *Aspidothelium cinerascens*; asci 130-160 × 30-45 µm. Ascospores 6-8 per ascus, more rarely 2-4, fusiform, transversely septate with c. 19-25 septa (Fig. 2C), hyaline, 70-100(-130) × 12-18 µm.

Notes: Santesson (1952) describes the perithecia of *Aspidothelium fugiens* as either provided with a disc-like expansion or with warts. Since then, the perithecial morphology of the *A. fugiens* complex has been regarded as variable, including practically all specimens with transversely septate ascospores (except *A. geminiparum* (Malme) R. Saut.). However, the different perithecial types found in this complex are usually very distinct, especially when found growing side by side on the same leaf, and only rarely intermediate forms are found. The value of this character is further demonstrated by the constant perithecial morphology found in other species, such as *A. cinerascens*.

Since I suspected that the taxonomic synonyms of *Aspidothelium fugiens* listed in Santesson (1952) would cover both the forms with warts and disc-like expansions, I investigated the types of all names in question. As a matter of fact, three names seem to represent the more common form with wart-like expansions or short lobes around the ostiolar region: *Lecania fugiens* Müll. Arg., *Phylloporina platyspora* Müll. Arg., and *Aspidopyrenium insigne* Vain. All collections are either damaged by water or contain only very few perithecia. The type of *Phylloporina*

macrospora Müll. Arg. is also not well developed and by its smooth, basally expanded perithecia it closely resembles a form listed as *Aspidothelium* aff. *fugiens* above. Actually, the type of *Aspidopyrenium insigne* var. *dispersa* Vain. is a very well developed and typical representative of the form with a disc-like expansion. However, I have preferred to describe this taxon under a new name since the binomial based on the varietal epithet *dispersa* (referring to the dispersed thallus) would be inappropriate in *Aspidothelium* when the morphological characteristics of this species are taken into consideration. Thus, the name *A. fugiens* is here considered to cover the specimens with wart-like expansions or short lobes around the ostiole, while *A. scutellicarpum* refers to the form with a disc-like expansion (see Fig. 2D).

While *Aspidothelium scutellicarpum* externally resembles *A. cinerascens* (and is impossible to distinguish without microscopical examination), its ascospore type is the same as in *A. fugiens*, even with regard to size ranges and number of ascospores per ascus. Its ecology is similar to that of *A. cinerascens*, being more common at higher altitudes, while *A. fugiens* seems to be more abundant at lower altitudes.

Additional specimens examined: Jatun Satcha: *96-880* (hb. Lücking), *96-881* (QCA); Guajalito: *96-318* (QCNE, hb. Lücking).

***Aspidothelium* sp. nova A**
A new species to be described from Costa Rica with setiform perithecial appendages and transversely septate ascospores.

Specimen examined: Jatun Satcha: *96-882* (QCA).

***Aspidothelium* sp. nova B**
A new species to be described from Costa Rica with papilliform perithecia and rather long ascospores.

Specimen examined: Jatun Satcha: *96-872* (QCA).

Asterothyrium gigantosporum Lücking, **sp. nova** – Fig. 3B
Holotypus: Ecuador, Pichincha, Guajalito Biological Station, 00°09'S, 78°39'W, 1800 m, montane rain forest, on leaves of *Lauraceae*, 5.1996, *Lücking 96-337* (QCNE; isotypus: hb. Lücking).

Ab *Asterothyrio pittieri* apotheciis planioribus discis hyalinis instructus et ascis 4-sporis differt. Apothecia ad *A. leucophthalmum* similia sed maiores.

Description: Thallus morphology and anatomy as in *Asterothyrium leucophthalmum* (Müll. Arg.) R. Sant. but thallus patches larger, up to 2 mm diam., partly confluent, greenish but with their marginal zone free of algae and silvery grey; cortex formed by distinctly radiate rows of rectangular, dead cells. Phycobiont a species of *Chlorococcaceae*. Apothecia usually singly in the centre of the thallus patches, 0.35-0.5 mm diam., morphologically and anatomically as in *A. leucophthalmum*, very applanate; disc pale yellowish brown, translucent, margin formed by 5-10 triangular or rectangular, greyish black lobes. Exciple indistinctly paraplectenchymatous, hyaline, 15-20 µm thick, laterally covered with a corticate, dark brown thallus tissue without algae. Paraphyses and asci as in *A. leucophthalmum*; asci c. 100 × 40 µm. Ascospores (3-)4 per ascus, ovoid-ellipsoid, 1-septate, with c. 2 µm thick outer walls (Fig. 3B), hyaline, 58-75 × 17-25 µm.

Notes: *Asterothyrium gigantosporum* is externally similar to *A. leucophthalmum* and *A. longisporum* Lücking (see below), but differs by its larger apothecia and the different ascospore type. Well developed specimens with confluent thallus closely resemble *A. anomalum* Kalb & Vězda, but this taxon has single, muriform ascospores. The ascospore type is the same as found in *A.*

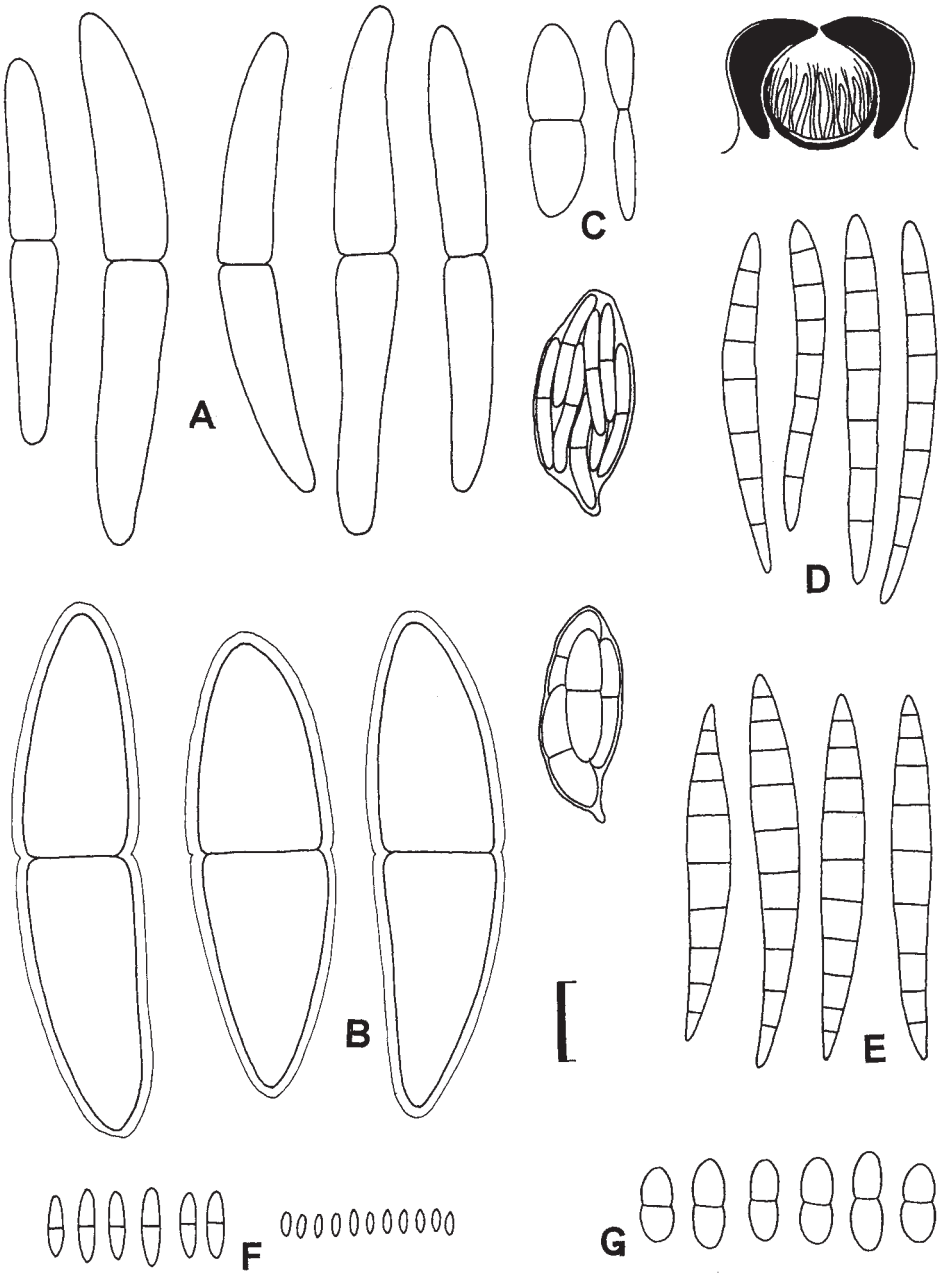

Fig. 3. A: *Asterothyrium longisporum* Lücking, ascospores and ascus; B: *A. gigantosporum* Lücking, ascospores and ascus; C: ascospores of *A. argenteum* Müll. Arg. (left) and *A. leucophthalmum* (Müll. Arg.) R. Sant. (right) for comparison; D: *Porina napensis* Lücking, section through perithecium, and ascospores; E: *P. pichinchensis* Lücking, ascospores; F: *Dimerella vezdana* Lücking, ascospores (left) and conidia (right); G: *Psorotheciopsis guajalitensis* Lücking, ascospores. – Scale = 10 µm for ascospores, 40 µm for asci, and 100 µm for perithecial section.

pittieri Müll. Arg., which differs by its smaller, more prominent apothecia with reddish brown to black discs and by its 2-spored asci.

Asterothyrium longisporum Lücking, **sp. nova**
Holotypus: Ecuador, Pichincha, Guajalito Biological Station, 00°09'S, 78°39'W, 1800 m, montane rain forest, on leaves of undetermined dicot, 5.1996, *Lücking 96-303* (QCNE; isotypus: hb. Lücking).

Ab *Asterothyrio leucophthalmo* et *A. argenteo* ascosporibus majoribus differt.

Description: Thallus morphologically and anatomically as in *Asterothyrium leucophthalmum* but thallus patches larger, up to 2 mm diam., and their inner part often whitish; cortex formed by distinctly radiate rows of rectangular, dead cells. Phycobiont a species of *Chlorococcaceae*. Apothecia 1-5 in the centre of the thallus patches, 0.2-0.3 mm diam., morphologically and anatomically as in *A. leucophthalmum*, applanate; disc pale yellowish brown, translucent, margin formed by 5-10 triangular or rectangular, greyish black lobes. Exciple indistinctly paraplectenchymatous, hyaline, 10-15 µm thick, laterally covered with a corticate, dark brown thallus tissue without algae. Paraphyses and asci as in *A. leucophthalmum*; asci 70-80 × 30-40 µm. Ascospores usually 8 per ascus, very rarely less, oblong-cylindrical, 1-septate, with a constriction at the septum (Fig. 3A), hyaline, 50-70 × 7-11 µm.

Notes: This new species appears as a giant-spored counterpart of *Asterothyrium leucophthalmum*, since it agrees in all details with that species except for the much larger ascospores. Even considering the enormous variation in ascospore size, shape and septation in *Asterothyrium*, the elongate ascospores of *A. longisporum* are very characteristic and unmistakable. The species is somewhat intermediate between *A. leucophthalmum*, which has equally elongate but much smaller ascospores, and *A. argenteum* Müll. Arg., in which the ascospores are only slightly narrower but much shorter and ellipsoid in shape (Fig. 3C).

Additional specimens examined: Guajalito: *96-266* (QCA, hb. Lücking); *96-341* (hb. Lücking).

Aulaxina microphana (Vain.) R. Sant.
Santesson (1952: 300) finds it "remarkable that Vainio referred to *Bilimbia* this very typical *Aulaxina* sp.". *Bilimbia* (= *Mycobilimbia*) is characterized by sessile, lecideine apothecia while those of *Aulaxina* are erumpent from the thallus and laterally covered by a carbonaceous margin. However, I have repeatedly observed that in old apothecia of *A. microphana* the marginal lobes are recurved, completely exposing the hymenium, very much like in old specimens of *Calenia phyllogena* (Müll. Arg.) R. Sant. In these cases, a dark pigment is developed in the hymenium, and then the basally constricted apothecia can indeed be mistaken as lecideoid. Another feature, found in the collection *96-913*, is the development of a central, columella-like tissue in old apothecia, which goes along with the formation of the dark pigment. I have studied the hymenia in several of such apothecia and found them completely healthy and provided with mature ascospores. These apothecia, which occur together with otherwise typical apothecia on the same thallus, resemble those of *Paratricharia paradoxa* (Lücking) Lücking and seem to confirm the assumption that the latter is related to *Aulaxina*. In the present collections of *A. microphana*, also a large variation in ascospore size was observed, ranging from 10 × 3 µm to 22 × 7 µm (see Lücking 1997a).

Selected specimens examined: Jatun Satcha: *96-913* (QCA, hb. Lücking); Guajalito: *96-1107* (QCNE).

Bacidia corallifera Lücking
The present collections agree in most respects with *B. corallifera*, including the abundant erect pycnidia. The pycnidia are, however, somewhat smaller and never branched as in the type collection.

Specimen examined: Jatun Satcha: *96-557* (to be distributed in Lücking, Lich. Fol. Exs.).

Bacidina apiahica (Müll. Arg.) Vězda
The collection *96-228* carries abundant pycnidia. They are not flask-shaped as described by Santesson (1952) but rather cylindrical with tapering top, being 140 µm high and up to 40 µm broad at their base. The numerous conidia are filiform and 85 × 1 µm in size. Thalli of *Bacidina apiahica* mostly lack pycnidia but I have observed pycnidia of the same type in a few collections from the Neotropics.

Selected specimens examined: Jatun Satcha: *96-362* (QCA); Guajalito: *96-228* (hb. Lücking), *96-1012* (QCNE).

Bacidina pallidocarnea (Müll. Arg.) Vězda
The specimen *96-264* carries abundant pycnidia. They are hemispherical to almost subglobose, with thin walls covered by thallus tissue, and produce huge amounts of filiform, 35-45 × 0.5-0.7 µm large conidia. As far as I know, pycnidia have not previously been described for that species. The conidia are of the same type as found in other species of *Bacidina* (= *Woessia*; proposed for conservation against the latter; see Ekman 1996), while the conidiomata exhibit a large variation, ranging from hemispherical or flask-shaped pycnidia to the stalked pycnidia in *Woessia pseudohyphophorifera* Lücking & Sérus. and the campylidia in *W. arvidssonii* Sérus.

Selected specimens examined: Jatun Satcha: *96-117* (QCA); Guajalito: *96-205* (QCNE, hb. Lücking).

***Bacidina* sp.**
This species resembles *Bacidina apiahica* externally but deviates by its broader ascospores (35 × 3.5 µm) with mostly 7 septa; it is probably a facultatively foliicolous taxon.

Specimen examined: Guajalito: *96-225* (hb. Lücking).

Bapalmuia aff. ***palmularis*** (Müll. Arg.) Sérus.
This taxon is the same as that named *Bacidia costaricensis* nom. nud. by Lücking (1992c). It differs from *B. palmularis* by the shorter and broader ascospores and the prominent apothecial margin with an indistinctly paraplectenchymatous exciple.

Specimen examined: Jatun Satcha: *96-576* (hb. Lücking).

Bapalmuia cf. ***verrucosa*** Sérus. & Lücking
The specimen is sterile but agrees in the coarsely verrucose thallus and maculate soralia perfectly with the type collection.

Specimen examined: Jatun Satcha: *96-984* (hb. Lücking).

***Bapalmuia* sp. nova**
A new species to be described from Costa Rica, characterized by radiate lines on the thallus surface. The apothecia and ascospores are identical with those of *Bapalmuia palmularis*.

Selected specimens examined: Jatun Satcha: *96-505* (QCA), *96-800* (QCNE).

Byssolecania variabilis Vězda, Kalb & Lücking in Bot. Jahrb. Syst. (in press)
This newly described species is characterized by 5-7-septate ascospores and differs from the anatomically similar *Byssolecania deplanata* (Müll. Arg.) R. Sant. by the larger, paler and completely applanate apothecia and the ascospore dimensions.

Selected specimens examined: Jatun Satcha: *96-119* (hb. Lücking), *96-822* (hb. Lücking).

Byssoloma deplanata (Müll. Arg.) R. Sant.
Differing from *Byssolecania fumosonigricans* (Müll. Arg.) R. Sant. s.str. by the 5-7-septate ascospores and from *B. variabilis* by the smaller ascospores and darker apothecia.

Selected specimens examined: Jatun Satcha: *96-552* (QCA), *96-823* (QCNE), *96-824* (hb. Lücking).

Byssoloma ortizii Lücking
This is the second record of this taxon after its description from Costa Rica (Lücking 1991). The ascospores in the present collection confirm *B. ortizii* as an autonomous species besides *B. wettsteinii* (Zahlbr.) Zahlbr. and not as a genetic modification of the latter; they have 5-7 septa and are 24-27 µm long, thus distinctly longer than in *B. wettsteinii*. Both taxa seem to be ecologically separated as well: *B. wettsteinii* is abundant in the lowland rain forest, while *B. ortizii* has only been found at higher altitudes.

Specimen examined: Guajalito: *96-1003* (hb. Lücking).

***Calenia* sp.**
A probably new species known from a single small specimen. It resembles *Calenia lobulata* Lücking in the applanate apothecia laterally covered by thin lobes, which are the remnants of the tissue originally covering the disc, and in the single, muriform ascospores. In contrast to the latter, the apothecia in this taxon are flesh-coloured and covered by a thin whitish pruina.

Specimen examined: Guajalito: *96-1083* (hb. Lücking).

Coccocarpia cf. ***filiformis*** L. Arvidss.
The sparse material is sterile but without doubt belongs to *Coccocarpia*. Since *C. filiformis* is the only species within that genus with a dwarf-fruticose thallus, I have tentatively identified the material with that species.

Specimen examined: Guajalito: *96-1098* (hb. Lücking, filed under *Gyalideopsis* aff. *verruculosa*).

Cryptothecia effusa (Müll. Arg.) R. Sant.
This species is mostly corticolous but occasionally found on leaves. It is characterized by the radially elongate fertile thallus parts; otherwise, it seems to be closely related to *Cryptothecia candida* (Krempelh.) R. Sant.

Selected specimens examined: Jatun Satcha: *96-459* (hb. Lücking), *96-460* (hb. Lücking).

Cryptothecia subnidulans Stirt.
A facultatively foliicolous species, which differs from the externally similar *Cryptothecia candida* by the single-spored asci.

Selected specimens examined: Guajalito: *96-249* (hb. Lücking), *96-1160* (hb. Lücking).

Dimerella vezdana Lücking, **sp. nova** – Fig. 1D, 3F
Holotypus: Ecuador, Napo, Jatun Satcha Biological Station, 01°04'S, 77°35'W, 450 m, lowland rain forest, on leaves of *Brunfelsia grandiflora*, 5.1996, *Lücking s.n.* (QCA; isotypes to be distributed in Lücking, Lich. Fol. Exs.).
[– *Bacidia vezdana* Lücking, nom. nud., in Beih. Nova Hedwigia 104: 132. 1992].

A *Dimerella flava* pycnidiis parte basali inflatis sine massis conidiorum apicalis differt.

Description: Thallus epiphyllous, continuous or marginally laciniate, greyish green, very slightly nitidous, up to 20 mm diam.; phycobiont a species of *Trentepohlia (Trentepohliaceae)*. Apothecia not common, usually marginally hypophyllous on a mycelium free from algae, rarely epiphyllous, rounded, 0.5-0.8 mm diam. and 0.2 mm high, disc persistently plane, pale yellow, margin chamois-coloured; exciple paraplectenchymatous, with rather large, thick-walled cells, laterally and basally up to 70 µm broad; hypothecium hyaline, 20-30 µm high; hymenium hyaline, 50-60 µm high. Paraphyses simple, straight, 1-1.5 µm thick, apically distinctly clavate and up to 4 µm thick; asci cylindrical, 50-55 × 5-6 µm. Ascospores 8 per ascus, uniseriate or slightly irregularly arranged, ellipsoid, 1-septate (Fig. 3F), hyaline, 8-10 × 2.5-3 µm. Pycnidia common, usually on the epiphyllous thallus or projecting horizontally from the leaf margin, whitish to chamois-coloured, with a very pronounced beak up to 2 mm long and 50-70 µm broad (Fig. 1D), their base slightly inflated and 0.2-0.25 mm broad; pycnidial wall ± prosoplectenchymatous along the beak and indistinctly paraplectenchymatous in the basal part. Conidia formed and stored in the inflated basal portion of the pycnidia, ellipsoid-ovoid, simple (Fig. 3F), hyaline, 3-3.5 × 1.2-1.5 µm.

Notes: This new species was first identified by Lücking (1992c) as a *Bacidia*, due to the similarity of the beaked pycnidia with those of *B. africana* Vězda. A closer examination then revealed that the associated phycobiont belongs to *Trentepohlia*, which suggested *Dimerella* as the possible home for this species. This was confirmed by the description of *D. flava* Malcolm & Vězda (1995) from New Zealand, which has very similar pycnidia, and by the subsequent discovery of apothecia associated with the pycnidia of the present species.

Dimerella vezdana and *D. flava* are indeed closely related. Both exhibit identical apothecial morphology and anatomy and can only be separated by the slightly different pycnidia, which are basally inflated in *D. vezdana*, while those of *D. flava* are tubular and carry the pycnidial mass as a yellow drop on the top of the pycnidia. The possibility that both species represent different developmental stages of the same taxon has been taken into consideration. However, the conidia produced in *D. vezdana* and stored in the basal part of the pycnidia are certainly mature and easily extruded when wet, without any tendency to accumulate at the apex. Also, the yellowish colour in the pycnidia and conidial mass typical of *D. flava* has never been observed in *D. vezdana*. The separation of both species seemed also to be supported by their different distribution, since *D. vezdana* is only known from the Neotropics. However, a very typical collection of *D. flava* has recently been found near Recife in Brazil (Cáceres & Lücking, unpubl. data).

Additional specimen examined: Jatun Satcha: *96-829* (QCA).

***Dimerella* sp. A**

This collection is characterized by orange apothecia and very large ascospores (15-18 × 3.5-4 µm) and cannot be identified with any known foliicolous species of the genus so far. The only other taxon with such large ascospores, *D. hypophylla* Vězda, has paler apothecia provided with a slightly dentate margin and grows regularly hypophyllous. The collection *96-289* bears pycnidia; the conidia are simple and 3 × 0.7 µm large. The general aspect of this species is very similar to *D. epiphylla* (Müll. Arg.) Malme, but here the conidia are much larger and 1-septate. A species externally similar to *D. epiphylla* but with small conidia (3 × 0.8 µm) is *D. usambarensis* Vězda & Farkas, which comes very close to the present collections but has smaller ascospores (9-12 × 2.5-3 µm).

Specimens examined: Jatun Satcha: *96-289* (hb. Lücking), *96-826* (hb. Lücking).

Echinoplaca aff. ***atrofusca*** R. Sant.

This is certainly a new species but left undescribed due to the sparse material (a single specimen; Fig. 4A). Externally the taxon resembles *E. atrofusca* but has a single large, muriform ascospore

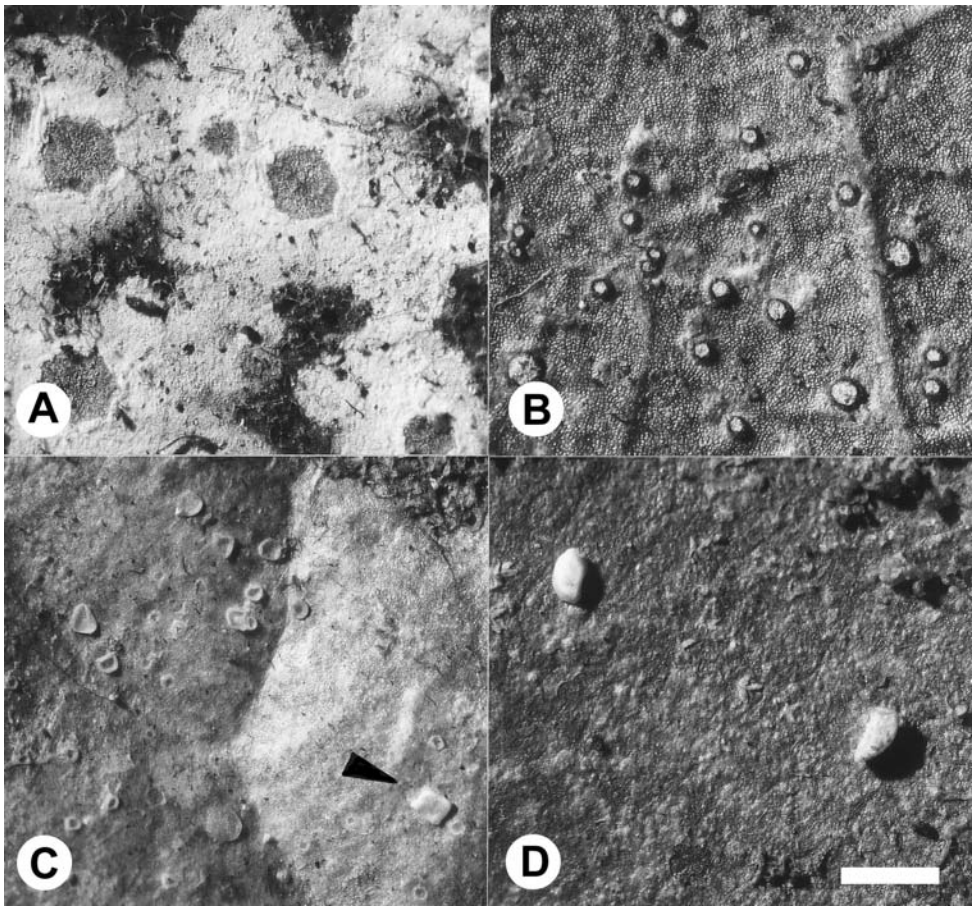

Fig. 4. A: *Echinoplaca* aff. *atrofusca* R. Sant., thallus with apothecia; B: *Gyalideopsis albopruinosa* Lücking, thallus with apothecia; C-D: *Gyalideopsis hyalina* Lücking, thallus with apothecia and campylidioid hyphophores (arrow). – Scale = 1 mm.

instead of eight small, submuriform ones. The taxon thus forms an extreme in the series *E. triseptata* Lücking and *E. atrofusca*, with all having the same characteristic thallus morphology but different ascospores (3-septate vs. submuriform vs. large and muriform). Besides *E. hispid*a Sipman, *E. handelii* (Zahlbr.) Lücking and *E. epiphylla* on one hand, and *E. verrucifera* Lücking and *E. furcata* Sérus. on the other hand, this is another transitional series within *Echinoplaca* s.str. from transversely septate to muriform ascospores.

Specimen examined: Jatun Satcha: *96-431* (hb. Lücking).

Echinoplaca furcata Sérus.
Most specimens have a rather well developed apothecial margin and are thus akin to *Calenia* (see Lücking 1997a).

Selected specimens examined: Jatun Satcha: *96-433* (QCA), *96-713* (QCNE), *96-714* (hb. Lücking).

Echinoplaca cf. ***melanotrix*** Lücking in Bibl. Lichenol. 65: 58. 1997
The specimen agrees in thallus and apothecial morphology with *E. melanotrix* but hyphophores, which are necessary for a definite identification, are absent.

Specimen examined: Jatun Satcha: *96-708* (hb. Lücking).

Fellhanera bouteillei (Desm.) Vězda
The specimens from Jatun Satcha mostly deviate by their greenish instead of bluish thalli.

Selected specimens examined: Jatun Satcha: *96-139* (QCA, hb. Lücking), *96-142* (QCNE, hb. Lücking); Guajalito: *96-248* (QCNE, hb. Lücking), *96-1017* (QCA, hb. Lücking).

Graphis **sp. A**
This and the following species are facultatively foliicolous, and similar specimens have been found in occasionally made corticolous collections (Lücking, unpubl. obs.). Based on apothecial morphology, at least four taxa can be distinguished. The present one differs by its orange-red apothecia and is probably identical with a common corticolous species. Ascospores were not found in the foliicolous material.

Specimen examined: Jatun Satcha: *96-786* (hb. Lücking).

Graphis **sp. B**
In this taxon, the apothecial margins are covered by a whitish grey thallus layer, and the apothecia are comparatively large. No ascospores were found.

Specimens examined: Jatun Satcha: *96-787* (hb. Lücking); Guajalito: *96-253* (hb. Lücking), *96-320* (hb. Lücking).

Graphis **sp. C**
This species differs from the preceding one in that only the lateral parts of the apothecia are covered by a thalline layer, while the upper parts are pure black. The ascospores are oblong-ellipsoid, 8-9-septate and very slightly constricted at the septa.

Specimens examined: Guajalito: *96-255* (hb. Lücking), *96-322* (hb. Lücking).

Graphis **sp. D**
Besides *Graphis* sp. A, this is the most characteristic among the species distinguished here. Its pure black apothecia are very prominent and slightly constricted basally. The comparatively narrow apothecia give the species a very elegant appearance. The ascospores are oblong-ellipsoid and taper towards the proximal end, 9-11-septate, and at the proximal end the lowermost cell forms a short tail-like appendage. Both ends are provided with gelatinous caps.

Specimens examined: Guajalito: *96-319* (hb. Lücking), *96-321* (hb. Lücking), *96-325* (hb. Lücking).

Gyalideopsis albopruinosa Lücking, **sp. nova** – Fig. 4B
Holotypus: Ecuador, Pichincha, Guajalito Biological Station, 00°09'S, 78°39'W, 1800 m, montane rain forest, on leaves of undetermined dicot., 5.1996, *Lücking 96-1084* (QCNE).

A ceteris specieibus *Gyalideopsis* apotheciis albo-pruinosis differt. Ascosporae muriformes, singulae in ascis.

Description: Thallus epiphyllous, dispersed, up to 15 mm diam., the algiferous thallus patches smooth or with a slightly irregular surface, their inner parts silvery grey, provided with large areoles of colourless crystals, their periphery thin, greenish; phycobiont a species of *Chlorococcaceae*; the thallus patches connected by a thin, translucent prothallus, which in some

specimens bears numerous hyphophores. Hyphophores very small, 0.07-0.08 mm high, setiform but with the upper part distinctly broadened and almost forming a disc-like expansion; the stalk pale, 0.015 mm broad, the upper expansion dark brown, up to 0.05 mm broad; diahyphae not found. Apothecia numerous, broadly sessile and hardly constricted basally, 0.25-0.4 mm diam., disc provided with a very thick, pure white pruina, margin distinct, slightly prominent, reddish brown (Fig. 4B); lateral exciple 30-50 µm broad, the basal part formed by parallel hyphae, pale yellowish, the upper part prosoplectenchymatous, reddish brown; hypothecium 5-10 µm high, pale yellowish; hymenium 55-70 µm high, hyaline, covered by a very thick (15-25 µm) and well developed layer of colourless crystals. Paraphyses 0.7-1 µm thick, richly branched and anastomosing; asci broadly clavate, 55-66 × 18-25 µm. Ascospores single per ascus, ellipsoid to ovoid, richly muriform, hyaline, 50-60 × 15-20 µm.

Notes: This new species is very characteristic due to its apothecia provided with a thick, pure white pruina. The apothecial disc thus strongly contrasts with the reddish brown margin. Pruinose apothecia are known from *G. vainioi* Kalb & Vězda, but this species differs in numerous details (thallus morphology, hyphophores) and is certainly not closely related to *G. albopruinosa*. The latter, on the other hand, seems to be related to *G. intermedia* Lücking and *Gyalideopsis* sp. A (see Lücking 1997a). As in *Gyalideopsis* sp. A, the hyphophores grow on an algal-free, translucent prothallus, and the apothecial anatomy is, except for the pruina, similar in all three species. The hyphophores of *G. albopruinosa* resemble those of *Echinoplaca leucotrichoides* (Vain.) R. Sant.

Additional specimen examined: Guajalito: *96-268* (hb. Lücking).

Gyalideopsis hyalina Lücking in Bibl. Lichenol. 65: 67. 1997

In collections from various regions in the Neotropics I have repeatedly found thalli bearing white, campylidia-like conidiomata, which did not seem to belong to *Lecanorales* but showed some similarities with *Aspidothelium*. In the present material, I have found a number of thalli with both "campylidia" and ascocarps, and these ascocarps are actually the apothecia of an already described species, *Gyalideopsis hyalina* (Fig. 4C-D). A closer investigation of the conidiomata revealed that they are not genuine campylidia but represent a very particular type of hyphophores. The sterile part of these hyphophores is developed into a broad, white scale, which totally covers the fertile part and, when seen from above, closely resembles a campylidium of the *Pyrenotrichum splitgerberi* type. However, the fertile part reveals the differences: instead of a conidiogeneous layer at the base, the scales bear a hyaline bunch of diahyphae in their upper part. The diahyphae are not constricted as in most other *Gomphillaceae* but are filiform and 70-80 × 0.7-1 µm large. Thus, a squash mount might be easily confused with a campylidium. This type of hyphophores seems to be unique among the *Gomphillaceae*. The most similar hyphophores are found in *Gyalideopsis haliotidiformis* Kalb & Vězda, which differs in a number of other characters, while non-constricted, filiform diahyphae have been described from *G. robusta* Kalb & Vězda. This new type of hyphophores underlines the great variety of conidiomata found in the genus *Gyalideopsis*. The following collections of *G. hyalina* bear hyphophores: *96-1046, 96-1047, 96-1048, 96-1049*.

Selected specimens examined: Guajalito: *96-218* (QCA, hb. Lücking), *96-1046* (hb. Lücking), *96-1047* (QCNE, hb. Lücking), *96-1048* (hb. Lücking), *96-1049* (hb. Lücking).

Gyalideopsis aff. ***verruculosa*** Hafellner & Vězda

These collections differ from *Gyalideopsis verruculosa* by the larger, applanate, pale flesh-coloured apothecia. They somewhat resemble *G. vulgaris* but lack apothecial algae, and the exciple is not paraplectenchymatous.

Specimens examined: Guajalito: *96-258* (hb. Lücking), *96-1098* (hb. Lücking).

***Gyalideopsis* sp.**
A probably new species, which is characterized by single, muriform ascospores, light brownish apothecia and an irregularly verrucose thallus. The apothecia are, even in the fully mature condition, laterally covered by the thin thalline lobes that originally covered the disc. Such apothecia are known from several species in *Gyalideopsis* and *Tricharia* (Lücking 1997a), but none can be identified with the present material, which resembles *G. verruculosa* except for the apothecial margin.

Specimens examined: Guajalito: *96-233* (hb. Lücking), *96-1111* (hb. Lücking).

Lyromma ornata Lücking, Kalb & Sérus. in Bot. Jahrb. Syst. (in press)
This new species is known from several collections in the Neotropics. The perithecia and pycnidia are provided with a crown of short triangular lobes, which make the impression of a black star when seen from above.

Specimens examined: Jatun Satcha: *96-883* (hb. Lücking), *96-983* (hb. Lücking).

Malcolmiella psychotrioides Kalb & Lücking in Bot. Jahrb. Syst. (in press)
Several members of the *Lecidea piperis* Nyl. group have recently been re-accommodated in the genus *Malcolmiella* (Vězda 1997, Lücking & Kalb 1999). Most of these taxa are widely distributed and abundant in lowland rain forests where they are found on smooth bark, thin twigs and occasionally on leaves. The present species externally resembles *Bacidia psychotriae* (Müll. Arg.) Zahlbr., from which it differs mainly by its simple ascospores.

Specimen examined: Jatun Satcha: *96-559* (hb. Lücking), *96-796* (hb. Lücking).

***Malcolmiella* sp.**
A probably undescribed species with orange apothecial disc, which closely resembles a *Badimia*.

Specimen examined: Jatun Satcha: *96-561* (hb. Lücking).

Opegrapha cf. ***lambinonii*** Sérus.
The specimens lack ascocarps but have the goniocystangia and thallus morphology typical for this species.

Selected specimens examined: Jatun Satcha: *96-758* (QCA), *96-946* (QCNE, hb. Lücking).

Opegrapha uniseptata Matzer in Mycol. Pap. 171: 87. 1996
This lichenicolous species has been identified because of its 1-septate ascospores and the host genus *Strigula*. The collection is remarkable due to the growth of the ascomata on the perithecial primordia of the host. Therefore, the mature *Opegrapha* ascomata are surrounded by a broad black area which resembles the expanded *Strigula* perithecia. Normally developed perithecia are found intermingled with these infected ones.

Specimen examined: Jatun Satcha: *96-480* (hb. Lücking, on *Strigula phyllogena*).

***Opegrapha* sp.**
A facultatively foliicolous taxon with widely open discs, which externally resembles a *Phaeographis*. The ascospores are fusiform, 3-5 septate with angular lumina, and provided with a thin lateral halo.

Specimen examined: Jatun Satcha: *96-477* (hb. Lücking).

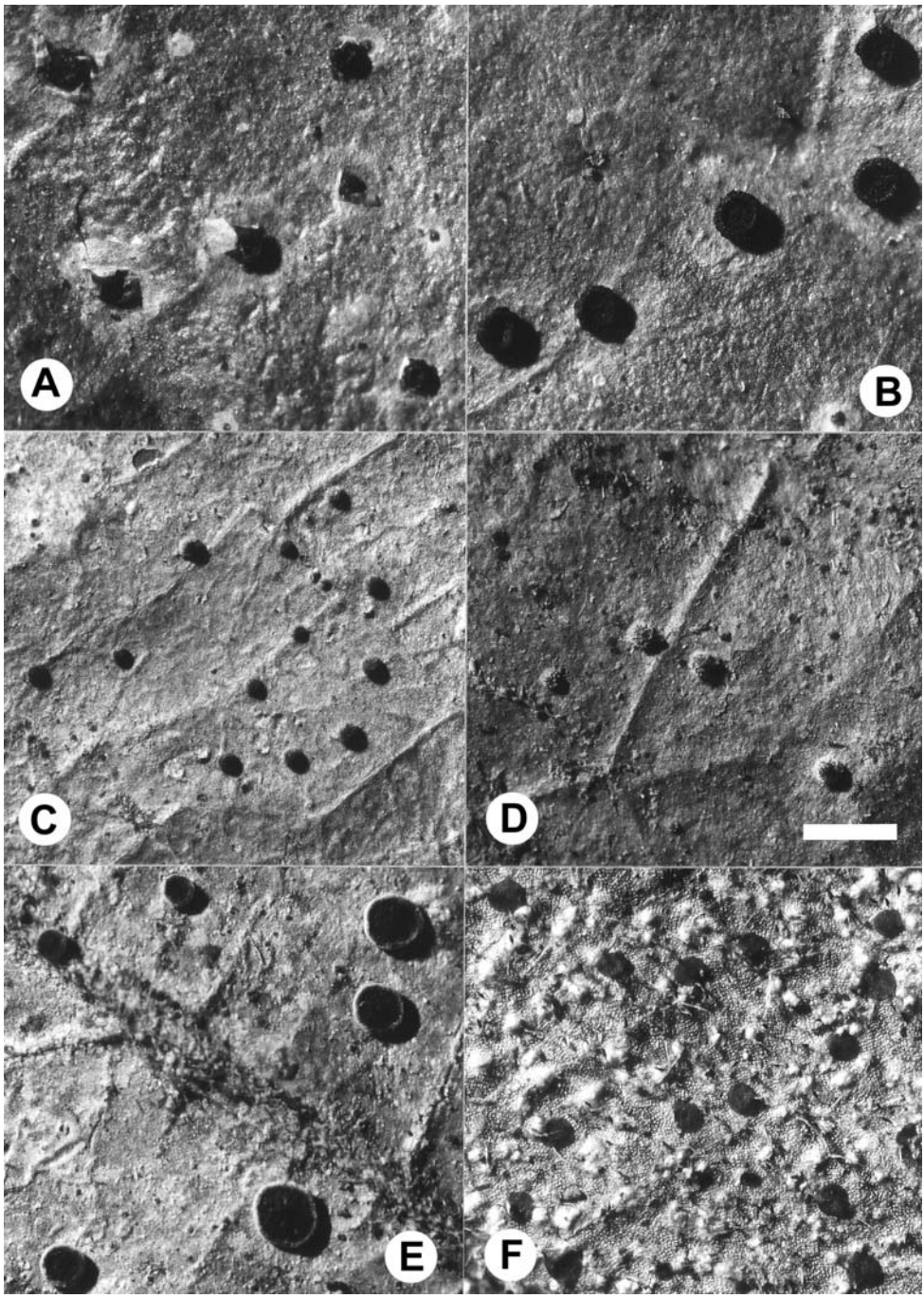

Fig. 5. A-B: *Psorotheciopsis guajalitensis* Lücking, thallus with apothecia; note the thallus tissue partly covering the margin of younger apothecia in (A); C: *Porina napensis* Lücking, thallus with perithecia; D: *Porina pichinchensis* Lücking, thallus with perithecia; E: *Tapellaria marcellae* Lücking, thallus with apothecia; note the whitish apothecial margin; F: *Tricharia verrucifera* Lücking, thallus with apothecia. – Scale = 1 mm.

***Phaeographis* sp. A**
This facultatively foliicolous collection is characterized by small apothecia and small (15-17 × 5-6 µm), 5-septate ascospores. The thallus is provided with numerous thin, black setae, which seem to belong to the lichen.

Specimen examined: Guajalito: *96-323a* (hb. Lücking).

***Phaeographis* sp. B**
This taxon is distinguished from the preceding one by the larger apothecia with a greyish pruinose disc, the irregular thallus surface, and the larger (25 × 7 µm) ascospores with 5-7 septa.

Specimens examined: Guajalito: *96-323b* (hb. Lücking), *96-327* (hb. Lücking).

***Phaeographis* sp. C**
A taxon with an effuse, *Cryptothecia*-like thallus and large apothecia with large (35 × 8 µm), 7-septate ascospores.

Specimen examined: Guajalito: *96-224* (hb. Lücking).

***Phyllobathelium* sp. nova**
A new species to be described from Costa Rica, which differs from other species of the genus by its smooth thallus and the large muriform conidia.

Selected specimens examined: Jatun Satcha: *96-591* (QCA), *96-878* (QCNE), *96-1154* (hb. Lücking); Guajalito: *96-311* (QCA, hb. Lücking), *96-313* (QCNE, hb. Lücking).

***Porina napensis* Lücking, sp. nova –** Fig. 3D, 5C
Holotypus: Ecuador, Napo, Jatun Satcha Biological Station, 01°04'S, 77°35'W, 450 m, lowland rain forest, on leaves of *Moraceae*, 5.1996, *Lücking 96-975* (QCA; isotypus: hb. Lücking).

A *Porina atrocoerulea* peritheciis globosis et ascosporis majoribus differt.

Description: Thallus continuous, smooth, pale greyish green, 5-10 mm diam.; phycobiont a species of *Phycopeltis (Trentepohliaceae)*, cells rectangular, in radiate rows. Perithecia 0.2-0.25 mm diam., distinctly constricted at the base and almost globose but with the top often slightly applanate, greyish black, smooth, laterally covered by a very thin thallus layer (Fig. 5C); perithecial walls in the upper part completely confluent, very thick (up to 50 µm), black with a slight bluish tinge, the outer wall not reaching the perithecial base, the inner wall entire, in the lower part prosoplectenchymatous, 10-15 µm thick, black. Paraphyses simple, 0.7 µm thick; asci narrowly obclavate, 80-100 × 15-18 µm. Ascospores 8 per ascus, irregularly arranged, oblong-cylindrical and tapering towards the proximal end, or sometimes narrowly fusiform, 7-septate (Fig. 3D), hyaline, 45-50 × 4-4.5 µm.

Notes: This new species is closely related to *Porina atrocoerulea* Müll. Arg.. It differs by the much larger ascospores, which are by far outside the variation of the latter species. Also the perithecia are more constricted basally and have a more differentiated wall.

Additional specimen examined: Jatun Satcha: *96-855* (hb. Lücking).

***Porina pichinchensis* Lücking, sp. nova** – Fig. 3E, 5D
Holotypus: Ecuador, Pichincha, Guajalito Biological Station, 00°09'S, 78°39'W, 1800 m, montane rain forest, on leaves of undetermined dicot, 5.1996, *Lücking 96-1178* (QCA).

A *Porina nitidula* peritheciis majoribus et ascosporis majoribus 9-11-septatis differt.

Description: Thallus continuous, smooth, pale greyish, 5-10 mm diam.; phycobiont a species of *Phycopeltis (Trentepohliaceae)*, cells angular-rounded, irregularly arranged. Perithecia 0.25-0.35 mm diam., subglobose, pure black and then smooth or in the upper lateral parts covered by a grey thalline layer with small papillae (Fig. 5D); perithecial wall, paraphyses and asci as in *Porina nitidula*; asci 120-140 × 15-20 µm. Ascospores 8 per ascus, irregularly arranged, fusiform, sometimes the proximal end prolonged into a short tail, 9-11-septate (Fig. 3E), hyaline, 45-60 × 6-9 µm.

Notes: *Porina pichinchensis* externally resembles a luxuriant form of *P. nitidula* Müll. Arg.. It agrees in all morphological details, particularly the black perithecia, which are laterally covered with a papillose grey thalline layer leaving the black area around the ostiole. The species is clearly distinguished, however, by the much larger ascospores with more numerous septa. A species of the *P. nitidula* group with subglobose perithecia and rather similar ascospores is *P. palniensis* Awashti & Singh, but here an algal layer is developed between the inner and outer perithecial wall, which is not the case in most other species of this group.

Additional specimens examined: Guajalito: *96-262* (hb. Lücking), *96-263* (hb. Lücking).

Porina repanda (Stirt.) Lücking & R. Sant., **comb. nova**
≡ *Verrucaria repanda* Stirt. in Proc. Philos. Soc. Glasgow 11: 108. 1878. – Holotypus: Brazil, *Trail* (BM!).
= *Porina laticarpa* Lücking

Notes: *Verrucaria repanda* was listed by Santesson (1952) as a doubtful name, and the type from Stirton's original herbarium was believed to be lost. I had the opportunity to study the type material, now housed in BM, and found it to be identical with a species subsequently described as *Porina laticarpa* Lücking (1991). The type carries annotations made by Santesson after the publication of his monograph, indicating that he re-studied the specimen and intended to place it into *Porina*, which was, however, never published.

Selected specimens examined: Jatun Satcha: *96-392* (QCA), *96-660* (QCNE), *96-665* (QCA, hb. Lücking).

Porina tetracerae (Afz.) Müll. Arg.
The collection *96-860* bears numerous cylindrical isidia. The formation of such isidia is regarded a non-specific character by McCarthy (1993), who includes such specimens in *P. tetracerae*. The ascospores of both collections are typical, being 45-48 × 4-5 µm in size.

Specimens examined: Jatun Satcha: *96-860* (hb. Lücking), *96-879* (hb. Lücking).

***Porina* sp. nova**
This new species will be described from Costa Rica. It is characterized by white perithecia and 3-septate ascospores.

Specimen examined: Jatun Satcha: *96-987* (hb. Lücking).

***Porina* sp.**
This collection is characterized by very long (70-75 × 3.5-4 µm), filiform-tapering ascospores with c. 19 septa. The perithecia are applanately conical, and the thallus is provided with a whitish prothallus. It is not quite clear whether this material is facultatively foliicolous or represents a new foliicolous species. Among corticolous taxa, it comes close to *Porina exasperatula* Vain, which has very similar but larger ascospores with more numerous septa, and a dark prothallus.

Specimen examined: Jatun Satcha: *96-642* (hb. Lücking).

Psorotheciopsis guajalitensis Lücking**, sp. nova –** Fig. 3G, 5A-B
Holotypus: Ecuador, Pichincha, Guajalito Biological Station, 00°09'S, 78°39'W, 1800 m, montane rain forest, on leaves of free standing tree, 5.1996, *Lücking 96-181* (QCNE; isotypes to be distributed in Lücking, Lich. Fol. Exs.).

A *Psorotheciopsis albomaculante* apotheciis majoribus et ascosporibus septo tenue differt.

Description: Thallus dispersed into rounded, partly confluent patches of 2-3 mm diam., the whole thallus sometimes covering large areas of the leaf, with a cellular cortex as in other species of *Psorotheciopsis*, composed of dead, rectangular cells arranged in radiate rows; phycobiont a species of *Chlorococcaceae*. Apothecia abundant, usually single on the thallus patches, 0.4-0.7 mm diam., at first immersed below the corticate thallus but soon erumpent and then the thallus visible as irregular lobes around the very prominent margin; mature apothecia sessile, without remnants of the thallus, disc and margin pure black, margin distinct, slightly prominent and with an irregular surface (Fig. 5A-B); exciple very well developed and with a complicate anatomy: upper and outer parts black, without visible structure, inner part below the hypothecium brownish, between the inner and outer part an aeruginous "tissue" of parallel, simple or slightly branched hyphae; epithecium black, 15 µm thick; hymenium hyaline, 85-100 µm high. Paraphyses simple, 1 µm thick; asci cylindrical, 80-90 × 6-8 µm. Ascospores broadly ellipsoid, 1-septate with thin septum (Fig. 3G), hyaline, 9-12 × 4-6 µm.

Notes: Due to its very large, pure black apothecia, this new species is the most conspicuous in the genus. In other species of *Psorotheciopsis* the apothecia are much smaller (0.2-0.4 mm). *Psorotheciopsis patellarioides* (Rehm) R. Sant., *P. varieseptata* (Vězda) Henssen & Lücking and *P. philippinensis* (Rehm) Lücking (= *Linhartia vezdana*) further differ by their translucent apothecial disc. Pure black apothecia are found in *P. albomaculans* (Rehm) R. Sant. and *P. premneella* (Rehm) R. Sant., but here the ascospores are either provided with a very thick septum or are extremely large. A particular feature of *P. guajalitensis* is that young apothecia are laterally covered by remnants of the thallus. This reminds one of the related genus *Asterothyrium* in which, however, the thallus tissue is invariably connected with the proper exciple and persistent even in mature apothecia.

Additional specimens examined: Guajalito: *96-283* (QCA, filed under *L. patellarioides*), *96-284* (QCNE, filed under *L. albomaculans*).

Strigula **sp.**
A very strange collection, which resembles *Strigula smaragdula* Fr. but is provided with numerous large, black, elongate-conical and beaked pycnidia. The conidia are ellipsoid, 1-septate and 7 × 2.5 µm in size.

Specimen examined: Guajalito: *96-193* (hb. Lücking).

Tapellaria marcellae Lücking, **sp. nova –** Fig. 5E
Holotypus: Ecuador, Napo, Jatun Satcha Biological Station, 01°04'S, 77°35'W, 450 m, lowland rain forest, on leaves of undetermined dicot, 5.1996, *Lücking 96-556* (QCNE; B, LG, hb. Lücking, isotypi).

A *Tapellaria phyllophila* margine apothecii albo-pruinosa differt.

Description: Thallus continuous or marginally dispersed, or composed of confluent thallus patches, smooth, pale grey; phycobiont a species of *Chlorococcaceae*. Apothecia rounded, sessile, basally constricted, 0.5-0.8 mm diam. and 0.25-0.3 mm high; disc black, margin persistent, covered with a distinct greyish white pruina (Fig, 5E); exciple well developed, paraplectenchymatous, greyish brown with a purplish tinge, laterally up to 50 µm broad; hypothecium dark reddish brown, K+ purplish; epithecium well developed, blackish, 10-15 µm thick;

hymenium 120-140 µm high, hyaline. Paraphyses richly branched and anastomosing, forming dense nets around the asci; asci clavate, 110-130 × 20-28 µm. Ascospores 2-4 per ascus, oblong-cylindrical, muriform, 70-115 × 10-15 µm.

Notes: Due to the grey apothecial margin and the general appearance, this new species was first mistaken for *Calopadia subcoerulescens* (Zahlbr.) Vězda. Only a microscopical examination revealed that the material actually belongs to *Tapellaria*. Within that genus, the species are separated by their ascospore septation and by the absence or presence of a marginal pruina. This pruina seems to be a good specific character, as demonstrated by *T. puiggarii* (Müll. Arg.) R. Sant. and another, undescribed species, which have very distinctive ascospores. In one case, two species with identical ascospores, viz. *T. epiphylla* (Müll. Arg.) R. Sant. and *T. nana* (Feé) R. Sant., are separated by the marginal pruina. The present collection forms the pruinose counterpart of *T. phyllophila* (Stirt.) R. Sant., a species that also has 2-4 muriform ascospores per ascus. *T. marcellae* thus differs from *T. nana* in the same way as *T. phyllophila* from *T. epiphylla* or *Calopadia phyllogena* (Müll. Arg.) R. Sant. from *C. puiggarii* (Müll. Arg.) Vězda (i.e. pruinose vs. non-pruinose apothecia), but in *Tapellaria marcellae* the marginal pruina is less well developed than in *T. nana* or *T. puiggarii*. When compared to the non-pruinose *T. phyllophila*, *T. marcellae* also has larger and higher apothecia on average.

Tricharia verrucifera Lücking, **sp. nova** – Fig. 5F
Holotypus: Ecuador, Pichincha, Guajalito Biological Station, 00°09'S, 78°39'W, 1800 m, montane rain forest, on leaves of undetermined dicot, 5.1996, *Lücking 96-1074* (QCNE; isotypes to be distributed in Lücking, Lich. Fol. Exs.).

A *Tricharia couepiae* thallo verrucoso apotheciis rubro-fuscis et hyphophoris angustioribus differt.

Description: Thallus continuous, coarsely verrucose, verrucae 0.15-0.2 diam., filled with colourless crystals, whitish, thallus between the verrucae pale greenish or thin and translucent, up to 25 mm diam.; sterile setae whitish, 0.4-0.6 mm high and 15-20 µm broad; phycobiont a species of *Chlorococcaceae*. Hyphophores abundant, 0.2 mm high, the basal part setiform, whitish, 20-25 µm broad, the upper part distinctly broadened, lanceolate, dark brown, 80-100 µm long and up to 60 µm broad; diahyphae not observed. Apothecia rounded, applanate, broadly sessile on the thallus, 0.35-0.6 mm broad and 0.1 mm high, dark brown when young and orange to reddish brown when mature, margin indistinct, of the same colour as the disc (Fig. 5F); exciple well developed, 30-50 µm broad, composed of simple or branched, radiating hyphae embedded in a gelatinous mass, hyaline but externally covered by a layer of yellowish brown crystals; hypothecium pale yellowish, 10-15 µm high; hymenium hyaline, 60-70 µm high, apically covered by a 10 µm thick layer of yellowish brown crystals. Paraphyses richly branched and anastomosing, 0.7-1 µm thick; asci broadly clavate, 50-55 × 15-20 µm. Ascospores single, oval, muriform, 35-45 × 15-18 µm, sometimes disintegrating and producing numerous, simple conidia within the ascus.

Notes: This new species belongs in the group centred around *Tricharia heterella* (Stirt.) Lücking, *T. couepiae* (Bat.) Lücking & Sérus., and *T. dilatata* Vězda, characterized by pale thallus setae, applanate apothecia and hyphophores with a dark, broad upper part (Lücking 1997a). Within this group, *T. verrucifera* is easily distinguished by its coarsely verrucose thallus, together with the combination of reddish brown apothecia, single muriform ascospores, and comparatively small hyphophores without appendages. As in the other species, the very applanate apothecia sometimes resemble those of an *Echinoplaca* species, but a section reveals the well developed exciple, which does not spread over the thallus. *Tricharia verrucifera* closely resembles a species from Guatemala named *Tricharia* sp. D (Barillas & Lücking 1992), which has an identical thallus and apothecial morphology but 4-spored asci.

Additional specimens examined: Guajalito: *96-1072* (QCA), *96-1073* (hb. Lücking).

3.2. Further foliicolous lichens found at "Jatun Satcha" and "Guajalito" Biological Stations in Ecuador

Actinoplaca strigulacea Müll. Arg. – Jatun Satcha: *96-79* (QCA), *96-893* (QCNE); Guajalito: *96-259* (QCA), *96-1052* (QCNE).

Amazonomyces sprucei (R. Sant.) Lücking, Sérus. & Thor in Lichenologist 30: 134. 1998 [≡ *Stirtonia sprucei* R. Sant.] – Jatun Satcha: *96-935* (QCA), *96-457* (QCNE).

Anisomeridium foliicola R. Sant. & Tibell. – Jatun Satcha: *96-875* (QCA, QCNE, hb. Lücking).

A. musaesporoides Etayo & Lücking in Lichenologist 31: 145. 1999 – Jatun Satcha: *96-869* (hb. Lücking), *96-885* (QCA).

Arthonia accolens Stirt. – Jatun Satcha: *96-81* (QCA, hb. Lücking), *96-761* (QCNE).

A. aciniformis Stirt. – Jatun Satcha: *96-941* (QCA).

A. cyanea Müll. Arg. – Jatun Satcha: *96-465* (QCA, QCNE, hb. Lücking).

A. leptosperma (Müll. Arg.) R. Sant. – Jatun Satcha: *96-754* (QCA), *96-938* (QCNE).

A. orbygniae (H. B. P. Upadhyay) Matzer in Mycol. Pap. 171: 175. 1996 [= *Arthonia opegraphina* Lücking, nom. illeg. – Jatun Satcha: *96-485* (hb. Lücking), *96-928* (QCA).

A. palmulacea (Müll. Arg.) R. Sant. – Jatun Satcha: *96-942* (QCA), *96-943* (QCNE).

A. trilocularis Müll. Arg. – Jatun Satcha: *96-940* (QCA); Guajalito: *96-1169* (QCNE).

Aspidothelium cinerascens Vain. – Guajalito: *96-257* (QCA, hb. Lücking).

A. fugiens (Müll. Arg.) R. Sant. – Jatun Satcha: *96-110* (QCA, hb. Lücking), *96-493* (QCNE); Guajalito: *96-335* (QCA).

A. trichothelioides Sérus. & Vězda – Guajalito: *96-1095* (QCA).

Asterothyrium argenteum Müll. Arg. – Jatun Satcha: *96-1207* (QCA); Guajalito: *96-241* (QCNE).

A. aulaxinoides Lücking in Cryptog. Mycol. 20 (in press) – Guajalito: *96-242* (hb. Lücking).

A. leucophthalmum (Müll. Arg.) R. Sant. – Guajalito: *96-214* (QCA, hb. Lücking).

A. cf. *microsporum* R. Sant. (pycnidia) – Jatun Satcha: *96-111* (QCA), *96-1216* (QCNE); Guajalito: *96-300* (QCA, hb. Lücking).

A. monosporum Müll. Arg. – Jatun Satcha: *96-112* (QCA), *96-666* (QCNE).

A. pittieri Müll. Arg. – Jatun Satcha: *96-113* (QCA), *96-1142* (QCNE); Guajalito: *96-216* (QCA).

A. rondoniense Bat. & H. Maia ex Lücking & Henssen in Cryptog. Mycol. 20 (in press) – Jatun Satcha: *96-1203* (hb. Lücking); Guajalito: *96-302* (QCA, hb. Lücking).

A. rotuliforme (Müll. Arg.) Sérus. – Guajalito: *96-240* (QCA).

A. tetrasporum Lücking in Cryptog. Mycol. 20 (in press) – Jatun Satcha: *96-427* (hb. Lücking).

A. umbilicatum (Müll. Arg.) Müll. Arg. – Guajalito: *96-338* (hb. Lücking).

A. uniseptatum Lücking in Cryptog. Mycol. 20 (in press) – Jatun Satcha: *96-1203* (hb. Lücking, filed under *A. rondoniense*).

Aulaxina intermedia Lücking in Bibl. Lichenol. 65: 27. 1997 – Jatun Satcha: *96-909* (QCA).

A. minuta R. Sant. – Jatun Satcha: *96-424* (QCA), *96-678* (QCNE, hb. Lücking).

A. opegraphina Fée – Jatun Satcha: *96-115* (QCA, hb. Lücking), *96-423* (QCNE); Guajalito: *96-221* (QCA), *96-1115* (QCNE).

A. quadrangula (Stirt.) R. Sant. – Jatun Satcha: *96-80* (QCA, hb. Lücking), *96-116* (QCNE); Guajalito: *96-213* (QCA), *96-1103* (QCNE).

A. submuralis Kalb & Vězda – Jatun Satcha: *96-1185* (QCA, hb. Lücking); Guajalito: *96-219* (QCA, hb. Lücking), *96-1101* (QCNE).

Bacidia psychotriae (Müll. Arg.) Zahlbr. – Jatun Satcha: *96-560* (hb. Lücking), *96-820* (QCA, hb. Lücking).

Bacidina defecta Vězda – Jatun Satcha: *96-526* (QCA).

B. mirabilis (Vězda) Vězda – Jatun Satcha: *96-527* (QCA), *96-993* (QCNE, hb. Lücking).

B. scutellifera (Vězda) Vězda – Jatun Satcha: *96-377* (QCA, QCNE, hb. Lücking).

Badimia dimidiata (C. Bab. ex Leight.) Vězda – Jatun Satcha: *96-370* (QCA), *96-372* (QCNE, hb. Lücking), *96-571* (QCA, QCNE, hb. Lücking).
B. pallidula (Krempelh.) Vězda – Jatun Satcha: *96-363* (QCA), *96-558* (QCNE, hb. Lücking).
Bapalmuia palmularis (Müll. Arg.) Sérus. – Jatun Satcha: *96-572* (QCA), *96-573* (QCNE).
Barubria fuscorubra (Vězda) Vězda – Guajalito: *96-192* (QCA, hb. Lücking), *96-1011* (QCNE).
Byssolecania deplanata (Müll. Arg.) R. Sant. – Jatun Satcha: *96-378* (QCA, QCNE, hb. Lücking).
Byssoloma amazonicum Kalb & Vězda – Jatun Satcha: *96-508* (QCA, QCNE, hb. Lücking).
B. aurantiacum Kalb & Vězda – Jatun Satcha: *96-819* (QCA).
B. chlorinum (Vain.) Zahlbr. – Jatun Satcha: *96-375* (QCA), *96-504* (QCNE); Guajalito: *96-997* (hb. Lücking), *96-1016* (QCNE).
B. fadenii Vězda – Jatun Satcha: *96-352* (QCA).
B. fumosonigricans (Müll. Arg.) R. Sant. – Jatun Satcha: *96-554* (QCA), *96-555* (QCNE).
B. guttiferae (Bat. & Peres) Lücking & Sérus. in Lichenologist 30: 138. 1998 [= *Byssoloma aeruginescens* Vězda] – Jatun Satcha: *96-816* (QCA, QCNE, hb. Lücking).
B. leucoblepharum (Nyl.) Vain. – Jatun Satcha: *96-1132* (QCA, QCNE, hb. Lücking); Guajalito: 96-247 (QCNE), 96-1015 (hb. Lücking).
B. minutissimum Kalb & Vězda – Jatun Satcha: *96-355* (QCA), *96-809* (QCNE, hb. Lücking); Guajalito: *96-999* (QCNE).
B. subdiscordans (Nyl.) P. James – Jatun Satcha: *96-366* (QCA, QCNE, hb. Lücking); Guajalito: *96-250* (QCA), *96-1018* (QCNE, hb. Lücking).
B. tricholomum (Mont.) Zahlbr. – Jatun Satcha: *96-506* (QCA), *96-795* (QCNE).
B. wettsteinii (Zahlbr.) Zahlbr. sensu Lücking in Abstr. Bot. 21(1): 96. 1997 – Jatun Satcha: *96-347* (QCA), *96-348* (QCNE, hb. Lücking).
Calenia conspersa (Stirt.) R. Sant. – Jatun Satcha: *96-685* (hb. Lücking), *96-903* (QCA).
C. depressa Müll. Arg. – Jatun Satcha: *96-126* (QCA), *96-669* (QCNE); Guajalito: *96-1106* (QCA, QCNE, hb. Lücking).
C. graphidea Vain. – Jatun Satcha: *96-430* (QCA), *96-449* (hb. Lücking), *96-731* (QCNE).
C. lobulata Lücking in Bibl. Lichenol. 65: 37. 1997 – Guajalito: *96-212* (QCA, hb. Lücking), *96-1071* (QCNE).
C. lueckingii Hartmann in Mycotaxon 59: 484. 1996 – Jatun Satcha: *96-1150* (QCA), *96-1214* (QCNE); Guajalito: *96-201* (QCA, hb. Lücking), *96-1053* (QCNE).
C. monospora Vězda – Jatun Satcha: *96-128* (QCA, hb. Lücking).
C. phyllogena (Müll. Arg.) R. Sant. – Jatun Satcha: *96-84* (QCA), *96-996* (QCNE, hb. Lücking); Guajalito: *96-1054* (QCA).
C. solorinoides Lücking – Jatun Satcha: *96-1193* (hb. Lücking); Guajalito: *96-1091* (QCA).
C. thelotremella Vain. – Jatun Satcha: *96-85* (QCA, hb. Lücking).
C. triseptata Zahlbr. [= *Calenia submaculans* R. Sant.] – Jatun Satcha: *96-667* (QCA, hb. Lücking), *96-912* (QCA, QCNE, hb. Lücking).
Calopadia foliicola (Fée) Vězda – Jatun Satcha: *96-132* (QCA, hb. Lücking), *96-374* (QCNE); Guajalito: *96-1038* (QCA), *96-1045* (QCNE).
C. fusca (Müll. Arg.) Vězda – Jatun Satcha: *96-133* (QCA, hb. Lücking), *96-379* (QCNE); Guajalito: 96-197 (QCA), 96-1042 (QCNE).
C. phyllogena (Müll. Arg.) Vězda – Jatun Satcha: *96-130* (QCA), *96-799* (hb. Lücking); Guajalito: 96-196 (QCNE), 96-1039 (QCA).
C. puiggarii (Müll. Arg.) Vězda – Jatun Satcha: *96-131* (QCA), *96-1135* (QCNE, hb. Lücking); Guajalito: *96-195* (QCA), *96-1041* (QCNE).
Chroodiscus australiensis Lumbsch & Vězda – Jatun Satcha: *96-696* (QCA, hb. Lücking), *96-894* (QCNE).
Ch. coccineus (Leight.) Müll. Arg. – Jatun Satcha: *96-86* (QCA, hb. Lücking), *96-129* (QCNE); Guajalito: *96-1001* (QCA, QCNE, hb. Lücking).

Coccocarpia domingensis Vain. – Jatun Satcha: *96-87* (QCA, hb. Lücking), *96-358* (QCNE); Guajalito: *96-291* (QCNE), *96-1057* (QCA).
C. erythroxyli (Spreng.) Swinsc. & Krog – Jatun Satcha: *96-368* (QCA, QCNE, hb. Lücking).
C. palmicola (Spreng.) L. Arvidss. & D. Gall. – Jatun Satcha: *96-578* (QCA).
C. pellita (Ach.) Müll. Arg. – Jatun Satcha: *96-836* (hb. Lücking).
C. stellata Tuck. – Jatun Satcha: *96-88* (QCA, hb. Lücking); Guajalito: *96-293* (QCNE, hb. Lücking).
Coenogonium ciliatum Kalb & Lücking in Bot. Jahrb. Syst. (in press) – Jatun Satcha: *96-585* (QCA), *96-979* (hb. Lücking).
C. interpositum Nyl. – Jatun Satcha: *96-835* (to be distributed in Lücking, Lich. Fol. Exs.).
C. linkii Ehrenb. – Jatun Satcha: *96-579* (QCA), *96-827* (QCNE).
Cryptothecia candida (Krempelh.) R. Sant. – Jatun Satcha: *96-134* (QCA, hb. Lücking), *96-766* (QCNE).
Dictyonema phyllogenum (Müll. Arg.) Zahlbr. – Jatun Satcha: *96-578* (QCA, filed under *Coccocarpia palmicola*); Guajalito: *96-29* (hb. Lücking).
Dimerella dilucida (Krempelh.) R. Sant. – Jatun Satcha: *96-584* (QCA), *96-978* (QCNE).
D. epiphylla (Müll. Arg.) Malme – Jatun Satcha: *96-90* (QCA), *96-448* (QCNE); Guajalito: 96-237 (QCNE).
D. flavicans Vězda & Farkas – Jatun Satcha: *96-447* (QCA), *96-828* (QCNE); Guajalito: *96-328* (QCA).
D. hypophylla Vězda – Jatun Satcha: *96-589* (QCA), *96-590* (QCNE, hb. Lücking).
D. isidiifera Lücking in Lichenologist 31: 367. 1999 – Jatun Satcha: *96-125* (QCA), *96-587* (QCNE, hb. Lücking).
D. lisowskii Vězda – Jatun Satcha: *96-831* (QCA).
D. lutea (Dicks.) Trevis. – Guajalito: *96-272* (hb. Lücking).
D. siquirrensis Lücking in Lichenologist 31: 370. 1999 – Jatun Satcha: *96-834* (QCA).
D. subzonata Lücking in Lichenologist 31: 371. 1999 – Guajalito: *96-184* (to be distributed in Lücking, Lich. Fol. Exs.).
Echinoplaca atrofusca R. Sant. – Guajalito: *96-1089* (QCA, QCNE, hb. Lücking).
E. diffluens (Müll. Arg.) R. Sant. – Jatun Satcha: *96-429* (hb. Lücking), 96-896 (QCA).
E. epiphylla Fée – Jatun Satcha: *96-135* (QCA, hb. Lücking), *96-706* (QCNE); Guajalito: *96-1100* (QCA, QCNE, hb. Lücking).
E. fusconitida Lücking in Bibl. Lichenol. 65: 51. 1997 – Jatun Satcha: *96-432* (QCA), *96-1181* (QCNE, hb. Lücking); Guajalito: *96-1122* (QCA), *96-1123* (QCNE).
E. intercedens Vězda – Jatun Satcha: *96-72* (QCA), *96-75* (QCNE, hb. Lücking).
E. leucotrichoides (Vain.) R. Sant. – Jatun Satcha: *96-74* (QCA, hb. Lücking), *96-91* (QCNE, hb. Lücking); Guajalito: *96-200* (QCNE).
E. lucernifera Kalb & Vězda – Guajalito: *96-1129* (QCA), *96-1130* (QCNE, hb. Lücking).
E. marginata Lücking in Bibl. Lichenol. 65: 57. 1997 – Jatun Satcha: *96-422* (QCA), *96-1138* (QCNE); Guajalito: *96-1050* (QCA).
E. pellicula (Müll. Arg.) R. Sant. – Jatun Satcha: *96-434* (QCA, QCNE); Guajalito: *96-1051* (QCA).
E. serusiauxii Lücking in Bibl. Lichenol. 65: 60. 1997 – Guajalito: *96-1085* (to be distributed in Lücking, Lich. Fol. Exs.).
E. similis Kalb & Vězda – Guajalito: *96-1118* (hb. Lücking).
E. trichariodes Kalb & Vězda – Guajalito: *96-285* (hb. Lücking), *96-1082* (QCA).
E. verrucifera Lücking in Bibl. Lichenol. 65: 62. 1997 – Guajalito: *96-1058* (QCA).
Eremothecella calamicola Syd. – Jatun Satcha: 96-462 (hb. Lücking), *96-757* (QCA), *96-937* (QCNE).
Fellhanera emarginata Lücking in Trop. Bryol. 13: 148. 1997 – Guajalito: *96-206* (QCA, hb. Lücking), *96-1010* (QCNE).

F. fuscatula (Müll. Arg.) Vězda sensu Lücking in Trop. Bryol. 13: 149. 1997 [= *F. dominicana* (Vain.) Vězda] – Jatun Satcha: *96-94* (QCA), *96-137* (QCNE), *96-549* (hb. Lücking); Guajalito: *96-208* (QCA, hb. Lücking).

F. lisowskii (Vězda) Vězda – Jatun Satcha: *96-808* (QCA, hb. Lücking).

F. longispora Lücking in Trop. Bryol. 13: 153. 1997 – Guajalito: *96-226* (hb. Lücking).

F. misionensis Ferraro & Lücking in Mycotaxon (in press) – Jatun Satcha: *96-136* (QCA); Guajalito: *96-204* (QCNE, hb. Lücking).

F. muhlei Lücking in Trop. Bryol. 13: 155. 1997 – Jatun Satcha: *96-356* (hb. Lücking).

F. paradoxa (Vězda) Vězda – Jatun Satcha: *96-365* (hb. Lücking), *96-516* (QCA), *96-546* (QCNE); Guajalito: *96-1007* (QCA).

F. rhapidophylli (Rehm) Vězda – Jatun Satcha: *96-141* (QCA, hb. Lücking), *96-525* (QCNE); Guajalito: *96-1006* (hb. Lücking).

F. rubida (Müll. Arg.) Lücking in Trop. Bryol. 13: 160. 1997 – Jatun Satcha: *96-287* (hb. Lücking), *96-818* (QCA), *96-1143* (QCNE).

F. semecarpi (Vain.) Vězda – Jatun Satcha: *96-346* (QCA); Guajalito: *96-1002* (QCNE).

F. stanhopeae (Müll. Arg.) Lücking, Lumbsch & Elix – Jatun Satcha: *96-140* (QCA), *96-1151* (QCNE, hb. Lücking); Guajalito: *96-274* (QCA), *96-1014* (QCNE).

F. subfuscatula Lücking in Trop. Bryol. 13: 162. 1997 – Jatun Satcha: *96-530* (QCA); Guajalito: *96-207* (hb. Lücking).

F. sublecanorina (Nyl.) Vězda – Jatun Satcha: *96-361* (hb. Lücking), *96-524* (QCA).

F. subternella (Nyl.) Vězda – Jatun Satcha: *96-76* (QCA), *96-351* (QCNE); Guajalito: *96-246* (QCNE), *96-1004* (QCA).

Flavobathelium epiphyllum Lücking, Aptroot & Thor in Lichenologist 29: 221. 1997 – Jatun Satcha: *96-600* (QCA), *96-601* (QCNE), *96-602* (hb. Lücking).

Gyalectidium catenulatum (Cavalc. & A. A. Silva) Ferraro, Lücking & Sérus. comb. ined. [≡ *Tauromyces catenulatus* Cavalc. & A. A. Silva] – Jatun Satcha: *96-143* (hb. Lücking).

G. filicinum Müll. Arg. – Jatun Satcha: *96-95* (QCA), *96-144* (QCNE, hb. Lücking); Guajalito: *96-199* (QCA), *96-1094* (QCNE).

G. imperfectum Vězda – Jatun Satcha: *96-450* (hb. Lücking); Guajalito: *96-211* (QCA, hb. Lücking), 96-1092 (QCNE).

Gyalidea epiphylla Vězda – Jatun Satcha: *96-436* (QCA).

Gyalideopsis intermedia Lücking in Bibl. Lichenol. 65: 69. 1997 – Jatun Satcha: *96-439* (hb. Lücking).

G. montana Lücking in Bibl. Lichenol. 65: 71. 1997 – Guajalito: *96-603* (hb. Lücking).

G. rubescens Vězda – Jatun Satcha: *96-686* (QCA), *96-981* (hb. Lücking), *96-1201* (QCNE); Guajalito: *96-1113* (QCA).

G. rubra Lücking in Bibl. Lichenol. 65: 73. 1997 – Guajalito: *96-1109* (QCA), *96-1110* (hb. Lücking).

G. verruculosa Haf. & Vězda – Guajalito: *96-1067* (QCA), *96-1068* (hb. Lücking), *96-1069* (QCNE).

G. vulgaris (Müll. Arg.) Lücking in Bibl. Lichenol. 65: 75 (1997) – Jatun Satcha: *96-438* (QCA), *96-711* (QCNE); Guajalito: *96-1060* (QCA), *96-1062* (QCNE).

G. sp. A in Bibl. Lichenol. 65: 76. 1997 – Guajalito: *96-220* (hb. Lücking), *96-1075* (QCA).

Heterodermia sp. – Guajalito: *96-239* (hb. Lücking).

Hypotrachyna sp. – Guajalito: *96-296* (hb. Lücking).

Lasioloma arachnoideum (Krempelh.) R. Sant. – Jatun Satcha: *96-97* (QCA), *96-147* (QCNE, hb. Lücking); Guajalito: *96-244* (QCNE), *96-1021* (QCA).

Leptogium sp. A – Jatun Satcha: *96-833* (hb. Lücking).

L. sp. B – Jatun Satcha: *96-580* (hb. Lücking).

Loflammia epiphylla (Fée) Lücking & Vězda in Phyton (Horn) 39 (in press) [= *L. flammea*

(Müll. Arg.) Vězda] – Jatun Satcha: *96-96* (QCA, hb. Lücking), *96-148* (QCNE, hb. Lücking); Guajalito: *96-1027* (QCA, hb. Lücking).

L. gabrielis (Müll. Arg.) Vězda – Jatun Satcha: *96-353* (QCA), *96-804* (QCNE).

Logilvia gilva (Müll. Arg.) Vězda – Guajalito: *96-243* (QCA), *96-1028* (hb. Lücking), *96-1029* (QCNE).

Lyromma nectandrae Bat. & H. Maia – Jatun Satcha: *96-146* (QCA), *96-592* (QCNE).

Mazosia dispersa (Hedr.) R. Sant. – Jatun Satcha: *96-454* (QCA, hb. Lücking), *96-763* (QCNE, hb. Lücking).

M. longispora Lücking & Matzer in Nova Hedwigia 63: 119. 1996 – Jatun Satcha: *96-99* (hb. Lücking), *96-950* (QCA).

M. melanophthalma (Müll. Arg.) R. Sant. – Jatun Satcha: *96-98* (QCA), *96-124* (QCNE), *96-455* (hb. Lücking).

M. phyllosema (Nyl.) Zahlbr. – Jatun Satcha: *96-768* (QCA), *96-921* (QCNE); Guajalito: *96-1170* (QCA).

M. pilosa Kalb & Vězda – Jatun Satcha: *96-456* (QCA, hb. Lücking), *96-770* (QCNE).

M. praemorsa (Stirt.) R. Sant. – Jatun Satcha: *96-100* (QCA), *96-949* (QCNE, hb. Lücking).

M. pseudobambusae Kalb & Vězda – Jatun Satcha: *96-466* (QCA), *96-467* (hb. Lücking), *96-920 (*QCNE).

M. rotula (Mont.) Massal. – Jatun Satcha: *96-77* (QCA), *96-101* (QCNE, hb. Lücking), *96-469* (QCA), *96-470* (QCNE).

M. rubropunctata R. Sant. – Jatun Satcha: *96-755* (QCA), *96-756* (hb. Lücking), *96-922* (QCNE).

M. tenuissima Lücking & Matzer in Nova Hedwigia 63: 133. 1996 – Jatun Satcha: *96-471* (QCA), *96-776* (QCNE, hb. Lücking).

M. tumidula (Stirt.) R. Sant. – Jatun Satcha: *96-772* (hb. Lücking), *96-773* (QCA), *96-936* (QCNE).

Microtheliopsis uleana Müll. Arg. – Jatun Satcha: *96-593* (hb. Lücking), *96-594* (QCA), *96-873* (QCNE), *96-986* (QCA).

M. winkleri Lücking – Jatun Satcha: *96-102* (QCA).

Musaespora kalbii Lücking & Sérus. in Nordic J. Bot. 16: 661. 1997 – Jatun Satcha: *96-495* (QCA), *96-874* (QCNE, hb. Lücking).

Parmeliella sp. – Guajalito: *96-294* (hb. Lücking).

Parmeliopsis sp. – Jatun Satcha: *96-83* (hb. Lücking).

Parmotrema sp. – Guajalito: *96-298* (hb. Lücking).

Phyllobathelium epiphyllum (Müll. Arg.) Müll. Arg. – Jatun Satcha: *96-605* (QCA), *96-607* (QCNE), *96-608* (hb. Lücking).

Ph. leguminosae (Cavalc. & A. A. Silva) Lücking & Sérus. in Lichenologist 30: 157. 1998 [≡ *Septoriomyces leguminosae* Cavalc. & A. A. Silva] – Jatun Satcha: *96-596* (QCA), *96-876* (QCNE).

Ph. thaxteri (Vain.) Zahlbr. – Jatun Satcha: *96-790* (QCA), *96-1210* (hb. Lücking).

Phyllophiale alba R. Sant. – Jatun Satcha: *96-103* (QCA), *96-151* (QCNE, hb. Lücking); Guajalito: *96-229* (QCA).

Ph. fusca R. Sant. – Jatun Satcha: *96-609* (QCA), *96-841* (QCNE).

Ph. viridis Cáceres & Lücking in Lichenologist 31: 355. 1999 – Jatun Satcha: *96-418* (hb. Lücking), *96-630* (QCA, filed under *P. alba*).

Porina andreana Lücking & Vězda in Willdenowia 28: 189. 1998 – Jatun Satcha: *96-393* (hb. Lücking).

P. atrocoerulea Müll. Arg. – Jatun Satcha: *96-155* (QCA, hb. Lücking), *96-976* (QCNE); Guajalito: *96-235* (hb. Lücking).

P. atropunctata Lücking & Vězda in Willdenowia 28: 192. 1998 – Jatun Satcha: *96-618* (QCA), *96-852* (hb. Lücking).

P. conspersa Malme – Jatun Satcha: *96-865* (hb. Lücking).

P. distans Vězda & Vivant sensu Lücking & Vězda in Willdenowia 28: 196. 1998 – Jatun Satcha: *96-390* (QCA), *96-866* (hb. Lücking).
P. epiphylla (Fée) Fée – Jatun Satcha: *96-634* (hb. Lücking), *96-635* (QCA), *96-853* (QCNE).
P. fulvella Müll. Arg. – Jatun Satcha: *96-413* (hb. Lücking), *96-615* (QCA).
P. fusca Lücking – Jatun Satcha: *96-843* (QCA).
P. guianensis Lücking & Vězda in Willdenowia 28: 205. 1998 – Jatun Satcha: *96-845* (QCA, hb. Lücking).
P. imitatrix Müll. Arg. – Jatun Satcha: *96-626* (QCA), *96-867* (QCNE, hb. Lücking).
P. leptosperma Müll. Arg. – Jatun Satcha: *96-640* (QCA); Guajalito: *96-230* (hb. Lücking), *96-1175* (QCNE).
P. leptospermoides Müll. Arg. – Jatun Satcha: *96-613* (hb. Lücking), *96-614* (QCA), *96-848* (QCNE).
P. limbulata (Krempelh.) Vain. – Jatun Satcha: *96-1221* (QCA, QCNE, hb. Lücking); Guajalito: *96-1162* (QCA).
P. lucida R. Sant. – Jatun Satcha: *96-398* (QCA), *96-400* (hb. Lücking), *96-620* (QCNE).
P. mirabilis Lücking & Vězda in Willdenowia 28: 211. 1998 – Jatun Satcha: *96-388* (QCA, with *Phyllophiale alba*), *96-840* (hb. Lücking, with *Phyllophiale alba*).
P. moralesiae Lücking – Jatun Satcha: *96-394* (hb. Lücking).
P. nitidula Müll. Arg. – Jatun Satcha: *96-958* (QCA); Guajalito: *96-227* (QCNE, hb. Lücking).
P. nucula Ach. – Jatun Satcha: *96-396* (QCA).
P. papillifera (Stirt.) F. Schill. – Jatun Satcha: *96-78* (QCA), *96-386* (QCNE), *96-1222* (QCA, QCNE, hb. Lücking).
P. radiata Kalb, Lücking & Vězda in Willdenowia 28: 214. 1998 [= *Porina rugosa* Kalb & Vězda, nom. illeg.] – Jatun Satcha: *96-150* (QCA), *96-399* (QCNE), *96-622* (hb. Lücking), *96-1220* (QCA, QCNE, hb. Lücking).
P. rubentior (Stirt.) Müll. Arg. – Jatun Satcha: *96-612* (QCA).
P. rufula (Krempelh.) Vain. – Jatun Satcha: *96-839* (QCA); Guajalito: *96-251* (QCNE, hb. Lücking).
P. subepiphylla Lücking & Vězda in Willdenowia 28: 217. 1998 – Jatun Satcha: *96-152* (QCA, hb. Lücking), *96-417* (QCA, QCNE, hb. Lücking), *96-851* (QCA).
P. tetramera (Malme) R. Sant. – Jatun Satcha: *96-154* (QCA, hb. Lücking), *96-415* (QCNE, hb. Lücking); Guajalito: *96-1173* (QCNE).
P. triseptata (Vězda) Lücking in Nova Hedwigia 66: 378. 1998 [≡ *Trichothelium triseptatum* Vězda] – Guajalito: *96-256* (QCA, hb. Lücking).
P. vezdae Lücking – Jatun Satcha: *96-391* (hb. Lücking).
Pseudocalopadia mira Lücking in Phyton (Horn) 39 (in press) – Guajalito: *96-191* (QCA, hb. Lücking).
Pseudocyphellaria sp. – Guajalito: *96-295* (hb. Lücking).
Psorotheciopsis albomaculans (Rehm) R. Sant. – Guajalito: *96-234* (QCA), *96-284* (QCNE).
Psorotheciopsis patellarioides (Rehm) R. Sant. – Jatun Satcha: *96-707* (QCA), *96-1215* (QCNE); Guajalito: *96-217* (QCNE, hb. Lücking), 96-283 (QCA).
Psorotheciopsis philippinensis (Rehm) Lücking in Cryptog. Mycol. 20 (in press) [= *Linhartia vezdana* Lücking] – Guajalito: *96-340* (QCA, hb. Lücking).
Sporopodium antonianum Elix, Lumbsch & Lücking – Jatun Satcha: *96-357* (QCA), *96-539* (hb. Lücking), *96-542* (QCNE).
S. aurantiacum (Zahlbr.) Lücking in Phyton (Horn) 39 (in press) – Jatun Satcha: *96-1153* (hb. Lücking).
S. citrinum (Zahlbr.) Elix, Lumbsch & Lücking – Jatun Satcha: *96-544* (QCA), *96-813* (QCNE), *96-1024* (hb. Lücking).
S. leprieurii Mont. – Jatun Satcha: *96-105* (QCA), *96-540* (hb. Lücking), *96-541* (QCNE); Guajalito: *96-202* (hb. Lücking).

S. xantholeucum (Müll. Arg.) Zahlbr. – Jatun Satcha: *96-373* (hb. Lücking).
Strigula antillarum (Fée) Müll. Arg. – Jatun Satcha: *96-122* (QCA), *96-582* (QCNE); Guajalito: *96-245* (QCA), *96-1167* (QCNE).
S. concreta (Fée) R. Sant. – Jatun Satcha: *96-160* (QCA), *96-473* (QCNE); Guajalito: *96-1177* (QCA, hb. Lücking).
S. janeirensis (Müll. Arg.) Lücking in Trop. Bryol. 15: 65. 1998 [≡ *Raciborskiella janeirensis* (Müll. Arg.) R. Sant.] – Jatun Satcha: *96-734* (QCA), *96-1223* (QCA, QCNE).
S. macrocarpa Vain. – Jatun Satcha: *96-157* (QCA, hb. Lücking), *96-744* (QCNE).
S. maculata (Cooke & Massee) R. Sant. – Jatun Satcha: *96-486* (QCA), *96-888* (QCNE).
S. nemathora Mont. – Jatun Satcha: *96-483* (QCA), *96-745* (QCNE); Guajalito: *96-223* (QCA, hb. Lücking), *96-277* (QCNE).
S. nitidula Mont. – Jatun Satcha: *96-158* (QCA), *96-474* (QCNE); Guajalito: *96-1000* (hb. Lücking), *96-1176* (QCNE).
S. obducta (Müll. Arg.) R. C. Harris – Jatun Satcha: *96-481* (QCA), *96-742* (QCNE).
S. phyllogena (Müll. Arg.) R. C. Harris – Jatun Satcha: *96-737* (QCA, QCNE, hb. Lücking), *96-889* (QCNE), *96-1218* (QCA).
S. platypoda (Müll. Arg.) R. C. Harris – Jatun Satcha: *96-156* (QCA), *96-487* (QCNE); Guajalito: *96-209* (QCNE), *96-1163* (QCA).
S. prasina Müll. Arg. – Jatun Satcha: *96-733* (QCA).
S. schizospora R. Sant. – Jatun Satcha: *96-886* (hb. Lücking); Guajalito: *96-222* (QCNE, hb. Lücking), *96-1165* (QCA).
S. smaragdula Fr. – Jatun Satcha: *96-739* (QCA), *96-740* (QCNE); Guajalito: *96-190* (QCA, hb. Lücking), *96-1166* (QCNE).
S. subtilissima (Fée) Müll. Arg. – Jatun Satcha: *96-752* (QCA), *96-753* (QCNE).
Tapellaria epiphylla (Müll. Arg.) R. Sant. – Jatun Satcha: *96-106* (QCA), *96-161* (QCNE); Guajalito: *96-279* (QCA), *96-1037* (QCNE, hb. Lücking).
T. molleri (Henriq.) R. Sant. – Jatun Satcha: *96-1204* (hb. Lücking); Guajalito: *96-1034* (QCA).
T. nana (Fée) R. Sant. – Jatun Satcha: *96-164* (QCA); Guajalito: *96-236* (QCNE).
T. nigrata (Müll. Arg.) R. Sant. – Jatun Satcha: *96-171* (QCA, hb. Lücking).
T. phyllophila (Stirt.) R. Sant. – Guajalito: *96-203* (QCA, hb. Lücking).
Tapellariopsis octomera Lücking in Phyton (Horn) 39 (in press) – Jatun Satcha: *96-803* (QCA).
Thelotrema sp. – Guajalito: *96-275* (hb. Lücking).
Tricharia albostrigosa R. Sant. – Jatun Satcha: *96-681* (QCA), *96-682* (hb. Lücking); Guajalito: *96-1086* (QCA, QCNE, hb. Lücking).
T. amazonum Vain. – Jatun Satcha: *96-698* (QCA).
T. carnea (Müll. Arg.) R. Sant. – Jatun Satcha: *96-165* (QCA), *96-784* (QCNE).
T. farinosa R. Sant. – Jatun Satcha: *96-904* (QCA).
T. helminthospora R. Sant. – Jatun Satcha: *96-908* (QCA, hb. Lücking).
T. heterella (Stirt.) Lücking in Bibl. Lichenol. 65: 82. 1997 [= *Tricharia membranula* (Müll. Arg.) R. Lücking] – Jatun Satcha: *96-684* (QCA), *96-905* (QCNE, hb. Lücking).
T. lancicarpa Kalb & Vězda – Jatun Satcha: *96-785* (QCA).
T. longispora Kalb & Vězda – Jatun Satcha: *96-719* (QCA), *96-720* (QCNE), *96-721* (hb. Lücking).
T. planicarpa Lücking in Bibl. Lichenol. 65: 86. 1997 – Jatun Satcha: *96-679* (QCA), *96-680* (QCNE), *96-732* (hb. Lücking).
T. pseudosantessonii Lücking in Bibl. Lichenol. 65: 87. 1997 – Guajalito: *96-1080* (QCA, hb. Lücking).
T. urceolata (Müll. Arg.) R. Sant. – Jatun Satcha: *96-107* (QCA), *96-169* (QCNE, hb. Lücking).
T. vainioi R. Sant. – Jatun Satcha: *96-900* (QCA), *96-1197* (QCNE); Guajalito: *96-278* (QCA), *96-1077* (QCNE).
Trichothelium ake-assii Becker & Lücking – Jatun Satcha: *96-1158* (hb. Lücking).

T. annulatum (Karst.) R. Sant. – Jatun Satcha: *96-405* (QCA), *96-628* (QCNE), *96-650* (hb. Lücking).
T. argenteum Lücking & Ferraro in Lichenologist 29: 217. 1997 – Jatun Satcha: *96-163* (QCA), *96-411* (QCNE, hb. Lücking).
T. bipindense F. Schill. [= *T. amazonense* J. L. Bezerra & Cavalc.] – Jatun Satcha: *96-108* (QCA), *96-167* (QCNE, hb. Lücking).
T. epiphyllum Müll. Arg. – Jatun Satcha: *96-410* (QCA, QCNE, hb. Lücking), *96-646* (QCA), *96-648* (hb. Lücking).
T. epiphyllum Müll. Arg. "*montanum*" form sensu Lücking in Nova Hedwigia 66: 392. 1998 – Guajalito: *96-1179* (QCA, hb. Lücking).
T. epiphyllum Müll. Arg. "*ulei*" form sensu Lücking in Nova Hedwigia 66: 392. 1998 – Jatun Satcha: *96-407* (QCA), *96-603* (hb. Lücking).
T. juruense (P. Henn.) F. Schill. – Jatun Satcha: *96-651* (QCA), *96-652* (hb. Lücking), *96-862* (QCNE).
T. minus Vain. – Jatun Satcha: *96-402* (QCA), *96-863* (QCNE).
T. minutum (Lücking) Lücking in Nova Hedwigia 66: 397. 1998 – Jatun Satcha: *96-857* (QCA).
T. mirum Lücking in Nova Hedwigia 66: 397. 1998 – Jatun Satcha: *96-401* (QCA), *96-972* (QCNE), *96-1184* (QCA, hb. Lücking).
T. pallescens (Müll. Arg.) F. Schill. – Jatun Satcha: *96-168* (QCA, hb. Lücking), *96-395* (QCNE).
T. pallidesetum Lücking in Nova Hedwigia 66: 401. 1998 – Jatun Satcha: *96-858* (QCA).
T. porinoides Vězda – Jatun Satcha: 96-406 (hb. Lücking), *96-414* (QCA).
T. sipmanii Lücking in Nova Hedwigia 66: 404. 1998 – Jatun Satcha: *96-170a* (QCA, hb. Lücking), *96-389* (QCA, QCNE, hb. Lücking).
T. sipmanii Lücking "*multiseptatum*" form sensu Lücking in Nova Hedwigia 66: 405. 1998 – Jatun Satcha: *96-170b* (QCNE, hb. Lücking), *96-403* (hb. Lücking), *96-959* (QCA, hb. Lücking).
Vezdaea foliicola Sérus. – Guajalito: *96-1172* (QCA).
Woessia pseudohyphophorifera Lücking & Sérus. – Jatun Satcha: *96-581* (QCA).

4. Floristic observations

3.3. Further lichenicolous fungi found at "Jatun Satcha" and "Guajalito" Biological Stations in Ecuador, and their host species (in brackets)

Arthonia pseudopegraphina Matzer in Mycol. Pap. 171: 46. 1996 – Jatun Satcha: *96-929* (QCA, *Mazosia rubropunctata*).
Gyalideopsis cochlearifera Lücking & Sérus. in Lichenologist 30: 543. 1998 – Jatun Satcha: *96-926* (QCA, *Calenia triseptata*); Guajalito: *96-1119* (hb. Lücking, *Echinoplaca fusconitida*).
Opegrapha porinicola Matzer in Mycol. Pap. 171: 80. 1996 – Jatun Satcha: *96-479* (hb. Lücking, *Phyllophiale alba*), *96-788* (QCA, *Porina* sp.).
O. velata (Müll. Arg.) Vain. – Jatun Satcha: *96-783* (QCA, *Gyalectidium filicinum*), *96-924* (QCNE, *Gyalectidium filicinum*).
Lichenopeltella epiphylla R. Sant. – Jatun Satcha: *96-475* (QCA, *Porina* sp.).
Pyrenidium santessonii Lücking in Trop. Bryol. 15: 64. 1998 – Jatun Satcha: *96-925* (QCA, *Bapalmuia* sp. nova ined.).
P. zamiae (Müll. Arg.) Matzer in Mycol. Pap. 171: 152. 1996 – Jatun Satcha: *96-792* (QCA, *Porina* sp.).
Sphaeromma mazosiae H. B. P. Upadhyay – Jatun Satcha: *96-484* (hb. Lücking, *Mazosia phyllosema*).
S. porinae Matzer in Mycol. Pap. 171: 127. 1996 – Jatun Satcha: *96-485* (hb. Lücking, *Porina subepiphylla*).

Stigmidium porinae Matzer in Mycol. Pap. 171: 161. 1996 – Jatun Satcha: *96-498* (QCA, *Microtheliopsis uleana*), *96-973* (hb. Lücking, *Trichothelium* sp.).

4- Floristic observations

The inventory of "Jatun Satcha" and "Guajalito" resulted in 62 genera and 297 species. These can be divided into four categories: (1) typically foliicolous (mostly confined to leaves but occasionally on other substrata), with 259 species; (2) ubiquitous (not substrate specific and often found on leaves, e.g. *Byssoloma subdiscordans*, *Coccocarpia domingensis*, *Coenogonium linkii*, *Malcolmiella psychotrioides*, *Porina distans*), with 12 species; (3) facultatively or accidentally foliicolous (mostly confined to other substrata but occasionally found on leaves, e.g. *Graphis* spp., *Leptogium* spp., *Phaeographis* spp.), with 15 species; (4) lichenicolous, with 11 species. The differentiation between ubiquitous and facultatively or accidentally foliicolous species is based on observed differences in abundance and individual development between leaf and bark specimens. This differentiation is in part tentative but makes sense, since facultatively or accidentally foliicolous lichens should require non-foliicolous individuals for successful reproduction, while ubiquitous taxa do not. Together with earlier records (Santesson 1952, Kalb & Vězda 1988, Sérusiaux 1995, Matzer 1996), this gives a total of about 275 typically foliicolous or ubiquitous lichens and 11 lichenicolous fungi. The genera richest in species are *Porina* (31), *Trichothelium* (16), *Echinoplaca* (15), *Fellhanera* (15), *Strigula* (14), *Tricharia* (13), *Mazosia* (11), *Byssoloma* (11), *Asterothyrium* (11), *Calenia* (10), and *Dimerella* (10).

As compared to Costa Rica and Guyana, two recently investigated and well-known foliicolous lichen floras, some remarkable patterns appear. Costa Rica shelters the highest diversity, with approximately 380 species of typically foliicolous or ubiquitous lichens and 39 lichenicolous fungi (Lücking 1995a, b, 1997a-b, 1998b, 1999a-c, and in prep., Lücking & Matzer 1996, Matzer 1996). From Guyana, 250 foliicolous lichens and 19 lichenicolous fungi are known (Aptroot & Sipman 1993, Matzer 1996, Sipman 1997, Lücking 1998a). Part of these differences are due to sample effort, which has been much greater in Costa Rica. Examples are the lichen genera *Asterothyrium* and *Psorotheciopsis*, typical canopy dwellers, which are well studied in Costa Rica (21 species, Lücking 1995c, 1999a) and Ecuador (18 species), but undercollected in Guyana (only 3 species known). Since Costa Rica and Ecuador exhibit similar topography and vegetation structure (Harling 1979, Gómez 1986), it can be expected that the actual foliicolous lichen diversity in Ecuador equals that of Costa Rica, especially because Ecuador includes part of the Amazon forest, which shelters a number of endemic taxa (Lücking 1997c). The similarity between both countries is reflected by the finding that more than 90 % of the foliicolous lichens and all lichenicolous fungi reported for Ecuador are also found in Costa Rica.

Guyana differs from both Costa Rica and Ecuador in its topography and vegetation structure. It is largely covered by humid lowland to submontane forest and exhibits only in the west some higher elevations on isolated table mountains (Daniels 1984). Although the sample effort has been higher in Guyana as compared to Ecuador, the diversity of foliicolous lichens is lower. This confirms the assumption that, although the highest diversity of foliicolous lichens is generally found in the lowland forest (Lücking 1995a), areas dominated by lowland forest alone are less diverse than areas including high mountain ranges (Lücking 1998a). Ecuador has 190 species (70 %) in common with Guyana, that means that further 60 species known from Guyana were not found in Ecuador. Since the Amazon forest, which in a wide sense also includes the Guianas and the eastern parts of Venezuela, Colombia, Ecuador and Peru, seems to be rather homogeneous in its foliicolous lichen flora (Lücking 1997c, 1998a), it could be expected that most of the species found in Guyana do also occur in Amazonian Ecuador, which apparently has not been sufficiently explored up to the present. This particular lack of knowledge may account for differences in diversity between Ecuador and Costa Rica.

Even if the foliicolous lichen diversity is lower, Guyana shelters distinctly more lichenicolous fungi than Ecuador. This is another hint that the lowland forest of Ecuador is

undercollected, since lichenicolous fungi are more abundant and diverse at low elevations. Their distribution follows that of the appropriate hosts, i.e. foliicolous lichens of the genera *Porina*, *Mazosia* and *Strigula* (Matzer 1996), which are most abundant in the lowland rain forest (Lücking & Matzer 1996, Lücking 1997d). Some lichenicolous fungi from Guyana, i.e. *Opegrapha kalbii* Matzer, *O. matzeri* Lücking, *O. strigulae* R. Sant. ex Matzer & R. Sant. and *Porina epilucida* Aptroot & Sipman, are not known from Costa Rica. Guyana and Ecuador also shelter about 30 foliicolous lichens not known from Costa Rica but are typical for the Amazon region and apparently do not extent into Central America, such as *Amazonomyces sprucei* (R. Sant.) Lücking, *Anisomeridium musaesporoides* Etayo & Lücking, *Arthonia lecythidicola* (Bat. & H. Maia) Lücking & Sérus., *Bapalmuia verrucosa* Sérus. & Lücking, *Byssoloma amazonicum* Kalb & Vězda, *Malcolmiella trailiana* (Müll. Arg.) Vězda, *Phyllobathelium thaxteri* (Vain.) Zahlbr., *Strigula melanobapha* (Krempelh.) R. Sant. or *S. multipunctata* (R. Sant.) R. C. Harris. Part of the high diversity in Costa Rica is made up by rare species, whose distribution patterns are unknown but which have occasionally been found in other regions of the Neotropics and probably occur in Ecuador as well, e.g. *Arthonia nigratula* (Müll. Arg.) R. Sant., *Calopadia perpallida* (Nyl.) Vězda, *Chroodiscus neotropicus* Kalb & Vězda, *Eremothecella cingulata* (R. Sant.) Ferraro & Lücking, *Mazentina perminuta* Vězda, *Strigula subelegans* Vain. and *Tapellaria malmei* R. Sant. Only few more common species seem to be confined to Central America, such as *Amazonomyces farkasiae* (Lücking) Lücking, Sérus. & Thor and *Paratricharia paradoxa* (Lücking) Lücking. All together, the combined floras of Costa Rica, Ecuador and Guyana are certainly representative for the Neotropics, resulting in about 450 species of typically foliicolous or ubiquitous lichens and 43 lichenicolous fungi.

5. Comparison of lowland and montane rain forest

The comparison of the two sites "Jatun Satcha" and "Guajalito" reveals differences regarding both diversity and species composition. The lowland forest site shelters more than twice as many species as the montane forest site (Tab. 1). This agrees with other studies, which demonstrate that species richness of foliicolous lichens generally decreases with altitude (Lücking 1995a). The pattern holds for three of the four categories distinguished here (particularly for lichenicolous fungi), except for facultatively foliicolous lichens, which are more diverse at the montane forest site (where they are certainly even undercollected!). The 232 typically foliicolous and ubiquitous lichens found at "Jatun Satcha" are the second largest site diversity ever recorded. A higher diversity is only known from "La Selva" in Costa Rica, with 280 species (Lücking 1999d). The high diversity found at Jatun Satcha is particularly remarkable since it is based on a single collection, so an even higher actual diversity can be expected.

"Jatun Satcha" and "Guajalito" have 76 species in common, resulting in a comparatively low Sørensen index of 0.41. No less than 172 out of 247 species (70 %) are exclusive to the lowland forest site, while only 50 out of 127 (40 %) are restricted to the montane forest site. A similar, though less pronounced pattern is known from lichens in general (Sipman 1992). A number of genera are discriminative in their diversity between the two sites, and most of them have a distinctly higher diversity at the lowland forest site. This applies in particular to *Arthonia*, *Dimerella*, *Mazosia*, *Porina*, and *Trichothelium* (Tab. 1). Several further genera poor in species are only found at "Jatun Satcha", viz. *Amazonomyces, Anisomeridium, Badimia, Byssolecania, Eremothecella, Flavobathelium, Lyromma, Malcolmiella, Musaespora* and *Opegrapha*. Some genera rich in species, viz. *Aspidothelium, Asterothyrium, Aulaxina, Echinoplaca* and *Fellhanera*, exhibit a similar diversity at both sites. Only in *Gyalideopsis* the diversity is significantly higher at the montane forest site, and two genera with a single species each, *Vezdaea* and *Logilvia*, are restricted to "Guajalito".

Several genera, which exhibit no significant difference in their diversity between the two sites, differ markedly in their species composition, in particular *Aspidothelium* and *Echinoplaca* (Sørensen coefficient = 0.36-0.50). Both genera have typical lowland and montane species. The

Tab. 1. Comparison of generic diversity and species composition of foliicolous lichens and lichenicolous fungi at "Jatun Satcha" and "Guajalito" Biological Stations in Ecuador.

Genus	Number of species				Sørensen's
	total	"Jatun Satcha"	"Guajalito"	in common	coefficient
(1) Typically foliicolous lichens					
Actinoplaca	1	1	1	1	1.00
Amazonomyces	1	1	0	0	0.00
Anisomeridium	2	2	0	0	0.00
Arthonia	7	7	1	1	0.25
Aspidothelium	8	5	5	2	0.40
Asterothyrium	13	7	10	4	0.47
Aulaxina	6	6	4	4	0.80
Bacidia	2	2	0	0	0.00
Bacidina	6	6	2	2	0.50
Badimia	2	2	0	0	0.00
Bapalmuia	4	4	0	0	0.00
Barubria	1	0	1	0	0.00
Byssolecania	4	4	0	0	0.00
Byssoloma	11	10	5	4	0.53
Calenia	10	9	5	4	0.57
Calopadia	4	4	4	4	1.00
Chroodiscus	2	2	1	1	0.67
Coenogonium	1	1	0	0	0.00
Dictyonema	1	1	0	0	0.00
Dimerella	10	9	3	2	0.33
Echinoplaca	15	9	11	5	0.50
Eremothecella	1	1	0	0	0.00
Fellhanera	15	13	11	9	0.75
Flavobathelium	1	1	0	0	0.00
Gyalectidium	3	3	2	2	0.80
Gyalidea	1	1	0	0	0.00
Gyalideopsis	9	2	9	2	0.31
Lasioloma	1	1	1	1	1.00
Loflammia	2	2	1	1	0.67
Logilvia	1	0	1	0	0.00
Lyromma	2	2	0	0	0.00
Mazosia	11	11	1	1	0.17
Microtheliopsis	2	2	0	0	0.00
Musaespora	1	1	0	0	0.00
Opegrapha	1	1	0	0	0.00
Phyllobathelium	4	4	1	1	0.40
Phyllophiale	3	3	1	1	0.50
Porina	31	29	8	6	0.32

continued on the next page

Genus	Number of species				Sørensen's
	total	"Jatun Satcha"	"Guajalito"	in common	coefficient
Pseudocalopadia	1	0	1	0	0.00
Psorotheciopsis	4	1	4	1	0.40
Sporopodium	5	5	1	1	0.33
Strigula	14	14	7	7	0.67
Tapellaria	6	5	4	3	0.67
Tapellariopsis	1	1	0	0	0.00
Tricharia	13	11	4	2	0.27
Trichothelium	16	15	1	0	0.00
Vezdaea	1	0	1	0	0.00
(2) Ubiquitous lichens					
Aspidothelium	1	0	1	0	0.00
Coccocarpia	5	5	2	2	0.57
Coenogonium	2	2	0	0	0.00
Cryptothecia	2	2	0	0	0.00
Malcolmiella	2	2	0	0	0.00
(3) Facultatively foliicolous lichens					
Cryptothecia	1	0	1	0	0.00
Graphis	4	2	3	1	0.40
Heterodermia	1	0	1	0	0.00
Hypotrachyna	1	0	1	0	0.00
Leptogium	2	2	0	0	0.00
Parmeliella	1	1	0	0	0.00
Parmeliopsis	1	0	1	0	0.00
Parmotrema	1	0	1	0	0.00
Phaeographis	3	0	3	0	0.00
(4) Lichenicolous fungi					
Arthonia	1	1	0	0	0.00
Gyalideopsis	1	1	1	1	1.00
Lichenopeltella	1	1	0	0	0.00
Opegrapha	3	3	0	0	0.00
Pyrenidium	2	2	0	0	0.00
Sphaeromma	2	2	0	0	0.00
Stigmidium	1	1	0	0	0.00
Total: 62 genera	297	247	127	76	0.41

most distinct discrimination is found in *Echinoplaca*, with *E. epiphylla*, *E. furcata*, *E. leucotrichoides* and *E. pellicula* as lowland and *E. atrofusca*, *E. fusconitida*, *E. lucernifera* and *E. serusiauxii* as montane species. The genera *Strigula*, *Aulaxina*, *Coccocarpia*, *Fellhanera*, *Calopadia*, and *Tapellaria* seem to be largely indifferent between the sites even on specific level

Tab. 2. Percentages of foliicolous lichen diversity at family level at "Jatun Satcha" and "Guajalito" Biological Stations in Ecuador (selected families comprising typically foliicolous species).

Family	Jatun Satcha (lowland rain forest site)	Guajalito (montane rain forest site)
Arthoniaceae	4.7 %	1.8 %
Opegraphaceae	5.1 %	0.9 %
Strigulaceae	8.1 %	7.3 %
Trichotheliaceae	18.8 %	8.2 %
Asterothyriaceae	3.8 %	8.2 %
Gomphillaceae	17.5 %	32.7 %
Gyalectaceae	4.7 %	2.7 %
Pilocarpaceae	12.4 %	14.5 %
Ectolechiaceae	7.7 %	12.7 %

(Sørensen's coefficient = 0.57-1.00). Among those with high species diversity, the least discriminating genus is *Fellhanera*: of the 15 species, 9 are shared between the two sites.

Lücking (1997d) suggested that different altitudinal zones can be distinguished by the composition and species diversity of the families. Thus, *Arthoniaceae* and *Opegraphaceae* would account for more than 10 % of the diversity in the lowland forest while being insignificant in the montane forest. A similar pattern would apply to the *Gyalectaceae*. The *Pilocarpaceae* and *Ectolechiaceae* together would make less than 20 % in the lowland forest but 25-30 % in the montane forest. The *Gomphillaceae* would be below 20 % in the lowland forest and above 30 % in the montane forest. These patterns are consistent for typically foliicolous and ubiquitous lichens (Tab. 2). *Arthoniaceae*, *Opegraphaceae* and *Trichotheliaceae* are most representative for the lowland forest, while *Gomphillaceae* clearly dominate in the montane forest.

High mountain ranges, in the present case the Andean Cordilleras, are usually claimed to provoke distinct biogeographical differences between the areas divided by them. Thus far, no data are available on the foliicolous lichen flora of the northern Pacific lowland rain forest of Ecuador. However, the differences found here between the eastern Amazonian rain forest and the Pacific montane rain forest are certainly largely due to altitudinal zonation rather than geographical isolation, since many of the species involved have a wider distribution. That mountain ranges can provide a barrier for foliicolous lichen distribution and even produce vicariant taxa in particular cases seems to be indicated by the couple *Amazonomyces sprucei* and *A. farkasiae*. While *A. sprucei* is restricted to the Amazon forest (known so far from Ecuador, Guyana and Brazil), *A. farkasiae* has only been found in Costa Rica and in the Pacific lowland rain forest of Colombia (Sipman, pers. comm. 1995).

It should be mentioned that two further localities were visited during this trip, both at high altitudes: the páramo "El Angel" in northern Ecuador near the Colombian border (3900-4200 m) and the summit region of the Cotopaxi National Park in central Ecuador south of Quito (4000-4600 m). At both localities, no foliicolous lichens were detected. This confirms the assumption that foliicolous lichen diversity strongly declines at high altitudes and that these organisms are usually absent in the subandine and andine vegetation above the timber line (Lücking 1992a-b, 1995a, Aptroot 1997). Only a few species, in particular *Fellhanera bouteillei*, *Byssoloma subdiscordans* and *Tapellaria epiphylla*, which are also extending into extra tropical regions, are occasionally found at very high altitudes (more than 4000 m) and sometimes even above the tree level, but then only in very sheltered microsites. The reason might be the extreme daily variation in temperature, as well as the atmospherically "dry" conditions on the exposed leaf surfaces, since high wind speed causes rapid evaporation (Hedberg 1964, Beck 1995).

6. Conclusions

The number of 297 species resulting from two collections indicates that the foliicolous lichen flora of Ecuador is extremely rich in species and may equal or even surpass that of the well-studied Costa Rica. The number of newly discovered taxa is comparatively high, considering that most species have a wide distribution and therefore the likeliness to detect new taxa in consecutive collections decreases. A floristic-biogeographic comparison between Ecuador, Costa Rica and Guyana demonstrates that Ecuador is less well explored with respect to the lowland rain forest and in particular with respect to lichenicolous fungi.

The comparison of the lowland and the montane forest confirms general patterns of diversity and distribution in foliicolous lichens: (1) decreasing diversity with increasing altitude; (2) decreasing percentage of exclusive species with increasing altitude; (3) dominance of different families with varying altitude, especially *Arthoniaceae*, *Opegraphaceae* and *Gomphillaceae*. On the generic level, the following patterns can be distinguished: (1) genera discriminating between altitudinal zones by their diversity *(Arthonia, Mazosia, Gyalideopsis)*; (2) genera discriminating between altitudinal zones by their species composition *(Aspidothelium, Echinoplaca)*; (3) non-discriminative genera *(Aulaxina, Calopadia, Coccocarpia, Fellhanera, Strigula, Tapellaria)*.

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