The lichens of the Golfo Dulce region
Líquenes de la región de Golfo Dulce

Othmar Breuss

Abstract: A short historical survey of the study of lichens in Costa Rica and the Golfo Dulce region is provided, followed by an overview of the lichenological investigations currently undertaken in the region. A general characterisation of the lichen flora of the Golfo Dulce region with remarks on the occurrence of species within particular habitat types is presented, and the biogeographical relationships of the lichen flora is shortly discussed. Special attention is given to foliicolous lichens which account for the greatest proportion of the species. A list of all lichen species so far known to occur in the region, based on the literature as well as on own collections, is presented.

Key words: biodiversity, lichens. mycoflora of Costa Rica, Central America.

Resumen: Se entrega una breve revisión histórica del estudio de los líquenes en Costa Rica y la región de Golfo Dulce, seguida de una descripción de las investigaciones liquenológicas que actualmente se llevan a cabo en la región. Se presenta una caracterización general de la flora de líquenes de la región de Golfo Dulce con énfasis en la presencia de especies dentro de habitat particulares y se discute brevemente las relaciones biogeográficas de la flora de líquenes. Se otorga especial atención a los líquenes folícolas que representan el mayor número de especies. Se incluye una lista de todas las especies de líquenes hasta ahora conocidas para la región, basada en la literatura como también en nuestras colecciones.

Palabras clave: biodiversidad, líquenes, micoflora de Costa Rica, América Central.

History of lichen exploration in Costa Rica

The first lichen reported from Costa Rica was *Cora pavonia* in Fries (1851), followed by a short list by Nylander (1877) of a few species collected by H. Polakowsky. The first comprehensive publications dealing with Costa Rican lichens are those by Müller (1891, 1893) with treatments of c. 300 lichen species collected by H. Pittier and A. Tonduz with many of them described as new. Other extensive collections made by A. S. Ørsted in 1846-1848 have never been published as a unit. After Müller's (loc.cit.) papers, interest in Costa Rican lichenology declined for many years until Dodge (1933) published a study on foliose and fruticose lichens. The next papers were those by Dodge (1936) and Hedrick (1942) which report several species that have been collected during the 1934 Allan Hancock Expedition to the west coast of Costa Rica. Santesson (1952) in his pioneering work on foliicolous lichens included many collections from Costa Rica. Additional lichen records from Costa Rica have been found in publications by Müller (1881, 1895), Vainio (1894), Howe (1914), Dodge (1929), Hillmann (1930), Motyka (1936-38), des Abbayes (1939), and Imshaug (1955). A summary of all previous lichen records from Costa Rica was provided by Imshaug (1956).

The first native Costa Rican to publish on lichens was Gómez (1972) who treated Costa Rican basidiolichens. Tibell (1982) revised the order Caliciales in Costa Rica, and Kappelle & Sipman (1992) reported foliose and fruticose lichens from oak forests in the Talamanca Mountain Range. Within the last two decades, interest in Costa Rican lichens has increased considerably. Much fieldwork has been carried out by various collectors resulting in the production of too many papers to be cited individually. Of particular importance is the extensive work of Lücking (1992, 1995, 1997, 1998, 1999 and others) and Lücking & Vezda (1998) on foliicolous lichens. Many Costa Rican lichen samples are cited in modern monographs and revisions of certain genera (Brako 1991, Tibell 1996, Ahti 2000, Staiger 2002). In a recent series, Breuss (2000, 2001, 2004, 2006) published lists of lichen collections mainly from south-western Costa Rica. A field guide with descriptions and colour photographs of selected lichens from Costa Rica was provided by Umaña & Sipman (2002). Recently, in the course of the TICOLICHEN project, several genus accounts (Lücking et al. 2006,

Stapfia **88**, zugleich Kataloge der oberösterreichischen Landesmuseen Neue Serie **80** (2008): 193-208

Plate 1: Lichen habitats: tropical rainforest (Esquinas forest), (**a**) interior of primary rainforest, (**b**) understory along a creek near Esquinas Rainforest Lodge, (**c**) interior of rainforest on ridge top, (**d**) canopy layer of rainforest, (**e**) interior of primary rainforest in a ravine, (**f**) margin of primary forest near field station "Tropenstation La Gamba". Photos: O. Breuss.

2007, NELSEN et al. 2006, among others) and a treatment of pyrenocarpous lichens (APTROOT et al. 2008) have been published.

Lichenological research in the Golfo Dulce area

Until recently, the Golfo Dulce region received little attention, lichenologically. DODGE (1933) reported a few species from the Osa peninsula. LÜCKING (1992, 1995, 1997a,b, 1999a,b,c) examined extensive collections from the Osa peninsula and Golfito. BREUSS (2000, 2006) and BREUSS & NEUWIRTH (2007) focused on lichens from the Bosque Esquinas and its surroundings. BALOCH & GRUBE (2006) included collections from the Bosque Esquinas in their molecular studies on the Porinaceae. Several new taxa have been described from the Golfo Dulce region, namely *Calenia solorinoides*, *Enterographa byssoidea*, *Ocellularia auratipruinosa*, *Anisomeridium flavovulcanus*, *Arthonia isidiata*, and, most recently, *Porina pilifera* and *Byssolecania pluriseptata*.

Lichen sampling in the Golfo Dulce region has been rather fragmentary and local. Epiphyllous lichens have been collected at several sites in the Golfo Dulce area and are rather well represented, whereas non-foliicolous lichens were mainly collected in the Bosque Esquinas region except for several macrolichen samples from the Osa peninsula and mentioned by DODGE (1933). LÜCKING's (loc. cit.) collections of foliicolous lichens are from a few sites on the Osa peninsula, from the Golfito Wildlife Refuge and from the vicinity of the Golfito airfield. The recent collecting work of BREUSS (2000, 2006) and BREUSS & NEUWIRTH (2007), which covers foliicolous as well as corticolous and lignicolous lichens, was undertaken during three one-week stays in 1999, 2002 and 2004 in the hillside forests of the Bosque Esquinas, including a riverine forest (Quebrada Chorro) and gallery woodland (Valle Bonito). Collecting work in a coastal forest has been done at one site only (San Josecito). Mangroves in tidal estuaries of the larger rivers have not yet been investigated for their lichen flora.

A part of the author's collection is still undetermined. There are a number of specimens which require critical study, and further results will be published in forthcoming papers. Continuation of the lichenological investigations in the study area is planned for the near future. In recent years, lichenologists from Graz University have carried out several lichenological expeditions to the Bosque Esquinas and their work focuses on the following fields: the colonisation of artificial leaves by foliicolous lichens in different rainforest plots (Martin Grube), phylogenetic relationships of tropical lichens (Elisabeth Baloch), and the taxonomy of sterile crustose lichens (Barbara Emmerer, Josef Hafellner).

There is a need for further research; since the lichen flora in the Golfo Dulce area has only been explored in any depth in a few places, it is too early to attempt a detailed analysis of the local lichen flora. Only a rough and fragmental overview can therefore be given in the present contribution.

Lichen flora of Costa Rica

Fungi form a species-rich group of organisms. The estimated number of known ascomycetes is 30.000-40.000, half of which are lichenised. Contrary to the ascomycetes, lichen-forming basidiomycetes are very few. At present, nearly 1400 lichen species are known from Costa Rica, according to the preliminary Internet checklist (UMAÑA TENORIO et al. 2002). As the knowledge of tropical lichens in general is very incomplete, the number of taxa will undoubtedly rise considerably with ongoing efforts of investigation, and the total number of Costa Rican lichen species may be estimated as twice that number. A critical catalogue of all lichen species so far reported from Costa Rica is in preparation and will will probably be published in 2009 (BREUSS & NEUWIRTH, in prep.).

Lichen flora of the Golfo Dulce area

General characterisation

Lowland rainforest is the major habitat type in the Golfo Dulce area and the lichens, therefore, are predominantly crustose. The largest proportion of the known lichen flora is represented by foliicolous lichens, whereas corticolous crustose lichens are known to a lesser extent.

Macrolichens are scarce in the lowland rainforest with species richness rising significantly in more open secondary habitats. There, members of the Parmeliaceae constitute most of the foliose lichen flora, followed by species of the genera *Dirinaria*, *Leptogium*, *Parmeliella*, *Physcia* and *Pyxine*. Fruticose lichens such as *Cladonia* and *Usnea* species account for only a very small proportion of the lichen flora. A rich macrolichen flora is developed in anthropogenic vegetation: on fence posts and trees along roads and brooks, in pastureland and around villages, in riperian shrub vegetation and gardens.

The soil lichen flora is poorly developed in the wet tropics and usually confined to compacted soil in strongly disturbed secondary vegetation types. A luxuriant terricolous lichen growth in the investigated area was a large cover of *Baeomyces rufus* on compacted earth

Plate 2: Lichen habitats, (**a**) valley of Río Bonito, river banks and gallery woodland, (**b**) cultivated land and secondary forest near Río Bonito, (**c**) pasture and hillside forest near La Gamba, (**d**) roadside vegetation at field station "Tropenstation La Gamba". Photos: O. Breuss.

on a vertical road cutting at Fila Gamba.A small growth of *Cladonia subradiata* was found in the garden of the Esquinas Rainforest Lodge.

No lichens have yet been found growing on stone due to the scarcity of rocky areas. Coastal cliffs and riverine rocks may bear a sparse and inconspicuous lichen growth but have not yet been investigated.

Biogeographical relationships

Nearly all lichen species occurring in the Golfo Dulce area are not confined to this region but have wider distributions. Most species are pantropical to pantropical-temperate or intercontinentally distributed, whereas about one third are wide neotropical or American. A few species have narrower geographical ranges. Only 23 species are potentially endemic to Costa Rica or Central America. Endemism is generally rare in the lichen flora of the neotropics.

Of the foliicolous lichens (see below), 112 are pantropical, some of which extend their range into subtropical or temperate regions (including *Byssoloma leucoblepharum*, *B. subdiscordans*, *Gyalectidium filicinum*, *Opegrapha filicina*, *Strigula nitidula*, and *S. smaragdula*). There are 84 neotropical species (32%); of these, four (*Coccocarpia tenuissima*, *Malcolmiella amazonica*, *Mazosia praemorsa*, *M. tumidula*) are centred on the Amazon Basin, one species (*Porina pocsii*) is Central American, and eleven species (*Byssolecania pluriseptata*, *Calenia subdepressa*, *Dimerella minima*, *D. siquirrensis*, *Enterographa byssoidea*, *Fellhanera muhlei*, *Gyalideopsis actinoplacoides*, *Opegrapha alba*, *Paratricharia paradoxa*, *Porina pilifera*, and *Trichothelium longisporum*) are putatively endemic to Costa Rica. Some 26 epiphyllous species show a neotropical-African distribution pattern, and 22 species are amphi-Pacific (Neotropics and Eastern paleotropics), two of which have range extensions into the Valdivian (*Porina rubrosphaera*) or Hawaiian (*Tapellaria nana*) regions. Several species occur in all tropical regions and one extratropical region: *Arthonia cyanea* is pantropical-Valdivian, *Porina rubentior* is pantropical-Tethyan, and *Tapellaria phyllophila* is pantropical-Neozealandic-Tasmanian (LÜCKING 2003).

The non-foliicolous lichens have similar distribution patterns. About 91 species are pantropical (partly without Australia), 13 of which extend their distribution range into subtropical or temperate regions. Common pantropical species include *Bulbothrix goebelii*, *Coc-*

cocarpia erythroxyli, *C. pellita*, *Dirinaria picta*, *Glyphis cicatricosa*, *Leptogium azureum*, *L. phyllocarpum*, *Malcolmiella granifera*, *Megalospora tuberculosa*, *Ocellularia cavata*, *Parmotrema cristiferum*, *Porina mastoidea*, *Pyrenula anomala* and *Pyrrhospora russula*. One species is cosmopolitan in oceanic places (*Normandina pulchella*), and a further two (*Baeomyces rufus* and *Peltigera collina*) are widespread temperate to boreal. *Pertusaria tetrathalamia* is American. About 71 species are widespread throughout the neotropics, seven species (*Mycomicrothelia oleosa*, *Myriotrema barroense*, *Ocellularia landronii*, *O. subemersa*, *Polymeridium flavothecium*, *Pyrenula falsaria*, and *Thelotrema neei*) are Central American, and four species (*Anisomeridium flavovulcanus*, *Arthonia isidiata*, *Gyrotrema wirthii* and *Ocellularia auratipruinosa*) are supposedly endemic to Costa Rica. *Coccocarpia domingensis*, *Leiorreuma sericeum*, and *Stegobolus auberianus* are neotropical-Pacific. Eleven species have a neotropical-African distribution pattern. Amphi-Pacific ranges (Neotropics and Eastern paleotropics) are shown in 28 species, a few of them with occurrences within the Pacific region.

Foliicolous lichens

As pointed out above, the knowledge of tropical lichens is very incomplete. Among those groups which are being more intensely studied are the foliicolous lichens, i.e. those growing on living leaves of vascular plants. Because of the short-lived substrate this life form involves short life cycles – which implies rapid reproduction – in combination with small thalli. These adhere to the leaf surface by a thin layer of mucilage except for the species of *Strigula* that grow below the leaf cuticle. Dozens of species may occur on a single leaf. A survey of general aspects of the biology of foliicolous lichens is given by SANTESSON (1952) and LÜCKING (2001).

At present, about 800 species of foliicolous lichens are known world-wide (LÜCKING 2003). The great majority of them are confined to the tropics and most of them are obligately epiphyllous. SANTESSON's (1952) monograph laid the basis for the study of foliicolous lichens which has expanded steadily in recent years. Thus, the number of 482 species world-wide known in 1993 (FARKAS & SIPMAN 1993) has been enlarged by over 300 since then. Most research concentrates on regional diversity and taxonomy, and only a few authors take up ecological studies such as to host-substrate preferences, species associations, successional colonisation and interspecific competition in epiphyllous communities (see CONRAN 1997). Studies of the distribution ecology of foliicolous lichens in Costa Rica were undertaken by LÜCKING (1992b, 1998, 1999), and LÜCKING (1997d) pointed out the possible role of epiphyllous lichens as bioindicators.

Species diversity of foliicolous lichens is highest in undisturbed rainforests. Their optimal habitat appears to be the foliage of small woody plants, young trees and ferns in the transitional position from the shady understory to natural light gaps where light level is dim and humidity is high. There are fewer species higher up in the trees, and the outer canopy exhibits low species diversity (LÜCKING 1997c). Little is known about possible host preferences, but phorophyte specificity seems to be rare in foliicolous lichens. Colonisation of leaves by lichens is greatly influenced by surface features as smoothness or hairiness and surface relief.

Due to the fragmentary study of the phyllosphere at a world-wide scale, the distribution of many species is poorly known. The increasing knowledge of epiphyllous lichens also provides a better understanding of their distribution. Many species were found to have a wider range than indicated by former literature data; in fact, the vast majority seem to be pantropical. Types of distributions in foliicolous lichens in comparison with floristic regions based on vascular plants are outlined by LÜCKING (2003).

The foliicolous lichen flora of Costa Rica is well studied. With more than 400 species currently known, which corresponds to about half of the world's species number and three quarters of all species known from the neotropics, Costa Rica's foliicolous lichen flora is the best known in the world (LÜCKING 1997c). The highest species diversity of epiphyllous lichens in Costa Rica is found in the wet undisturbed primary lowland forests where single sites can support up to 280 species (LÜCKING 1997a).

The Golfo Dulce area has a rich epiphyllous lichen flora. The 245 presently known species comprise 58% of the species number known from Costa Rica. They belong to 18 families and 50 genera. Dominant families are the Gomphillaceae, Porinaceae, and Pilocarpaceae with 51, 49, and 46 species, respectively. The most well represented genera are *Porina* (33 species), *Strigula* (15 species), and *Trichothelium* (14 species).

Rainforests

Large areas of the Golfo Dulce region are still covered by rainforest. The Golfo Dulce rainforests belong to the most luxuriant and species-rich forests in Central America, which is also true with respect to lichens. The main forest type in the region is the Tropical Wet Forest according to HOLDRIDGE (1967) which covers the lowlands of the Golfo Dulce area. It is a multi-layered forest with abundant stilt-rooted palms, dwarf palms and broad-leaved herbs dominating the shrub layer (WEISSENHOFER et al. 2001) which clothes the plains and hillsides. Due to forest clearing for planta-

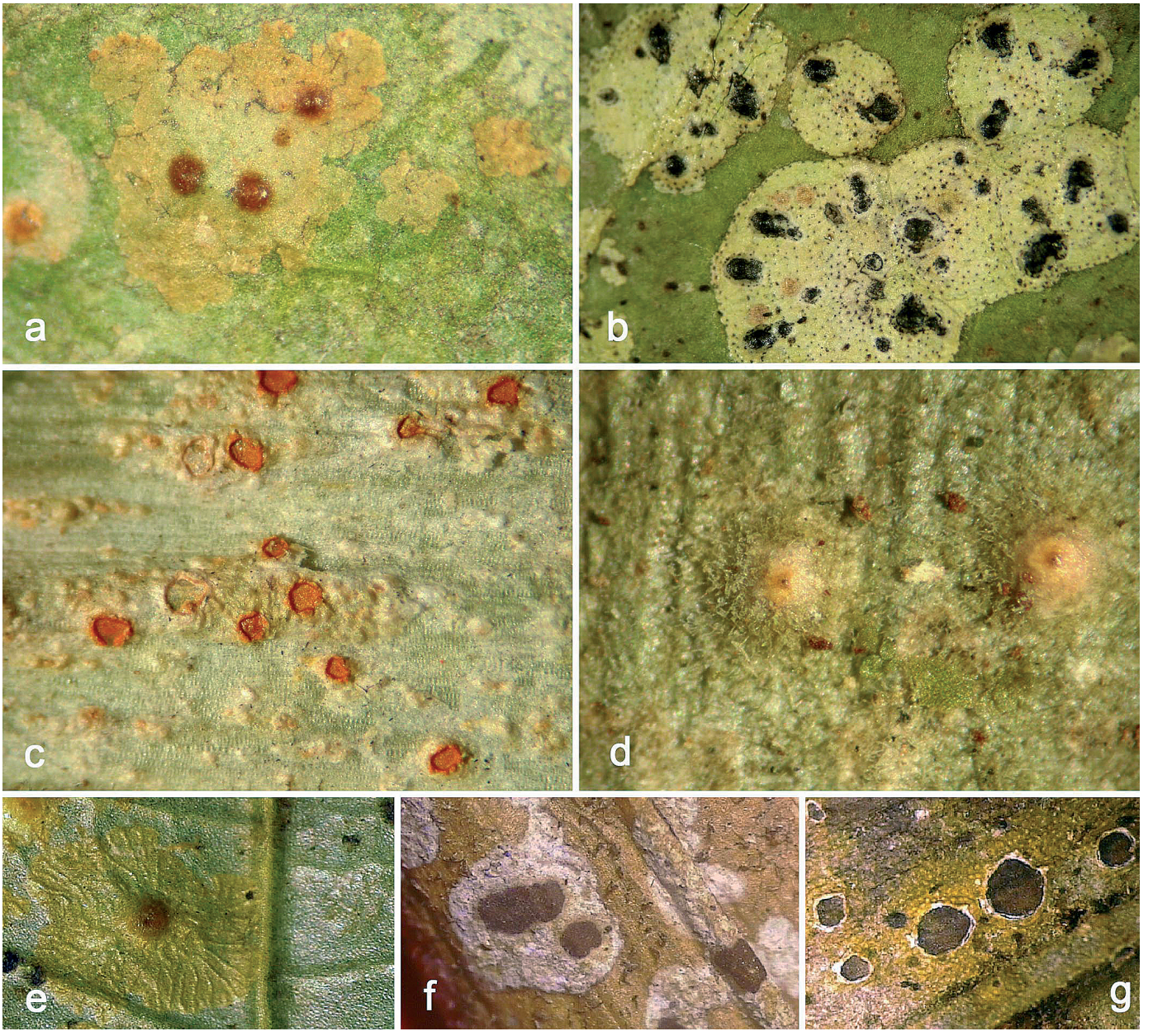

Plate 3: Epiphyllous lichens, (**a**) *Porina limbulata*, (**b**) *Strigula schizospora*, (**c**) *Chroodiscus coccineus*, (**d**) *Porina pilifera*, (**e**) *Porina radiata*, (**f**) *Echinoplaca wilsoniorum*, (**g**) *Mazosia melanophthalma*. Photos: G. Neuwirth.

tions and pastures or timber exploitation on flat land, the flat forest types are preserved only in the Corcovado National Park and have vanished from other regions where rainforests are restricted to the hillsides, e.g. in Piedras Blancas National Park. The hills and ridges (filas) often have very steep slopes and deep ravines which are difficult to access. The fila ridges are the "driest" parts, the ravines the wettest. The rainforest on the highest hill-tops and ridges shows premontane affinities with dense groundlayer mainly of ferns and a rich epiphyte cover.

Down in the dense forest with a closed canopy layer, where light levels are low, crustose lichens overwhelmingly dominate; few species are macrolichens (foliose and fruticose growth forms). Squamulose, leprose, and filamentous lichens are also rare. The dominant role of crustose lichens in lowland rainforests has been pointed out by several investigators (see KOMPOSCH & HAFELLNER 2002). One reason for the absence of macrolichens under these conditions may be physiological (ZOTZ 1999). Most macrolichens that occur near ground level within the forest are species with blue-green photobionts such as *Leptogium* and *Coccocarpia* species. The macrolichen flora becomes increasingly richer in situations where light intensities are higher than within the forest – on stream-side trees, in larger light gaps, on forest edges and in the canopy. It can part-

ly be observed on fallen canopy branches and is represented by common and widespread species especially of the family Parmeliaceae but is not characteristic for lowland rainforests.

Typical lichen crusts in shade on tree bases and lower trunks include several *Porina* species (*Porina dolichophora*, *P. epimelaena*, *P. exasperatula*, *P. mastoidea*, *P. rudiuscula*, *P. tijucana*), *Anisomeridium flavovulcanus*, *Pyrenula* spp., *Malcolmiella granifera*, *Myeloconis* spp. and members of the large family Thelotremataceae. There is a high proportion of sterile, sorediate, isidiate or otherwise vegetatively reproducing species which are difficult to identify. The squamulose growth form is represented by *Eschatogonia prolifera* and *Phyllopsora* species. Filamentous lichens are *Dictyonema* and *Coenogonium* species. Besides unknown sterile crusts, several *Porina* species seem to be among the most shade-tolerant lichens that form extensive species-poor mosaics on buttresses, stiltroots and woody lianas above the forest floor.

Characteristic foliicolous species on shady understory leaves are *Arthonia accolens*, *A. leptosperma*, *Dimerella siquirrensis*, *Fellhanera fuscatula*, *Gyalidea epiphylla*, *Phylloblastenia amazonica*, *Porina epiphylla*, *P. limbulata*, *P. mirabilis*, *P. rufula*, *Strigula phyllogena*, *Strigula platypoda*, and *Trichothelium epiphyllum*, whereas *Arthonia palmulacea*, *Badimia dimidiata*, *Chroodiscus coccineus*, *Eremothecella calamicola*, *Mazosia* species, *Opegrapha filicina*, *Phyllobathelium firmum*, *Porina fulvella*, *Porina subepiphylla*, *Strigula maculata*, *S. subtilissima*, and *Paratricharia paradoxa* prefer less damp and lighter spots in the forest. Epiphyllous associations in light gaps include *Actinoplaca strigulacea*, *Aspidothelium fugiens*, *Calenia depressa*, *Calopadia foliicola*, *C. fusca*, *Echinoplaca* species, *Gyalectidium filicinum*, *Gyalideopsis vulgaris*, *Strigula smaragdula*, *Tricharia urceolata*, and *T. vainioi*.

Much of the Golfo Dulce rainforest is pristine forest and supports special lichen communities. *Amazonomyces farkasiae*, *Arthonia orbygniae*, *Aulaxina microphana*, *Badimia galbinea*, *Byssoloma minutissimum*, *Caleniopsis laevigata*, *Fellhanera verrucifera*, *Gyalidea epiphylla*, *Mazosia longispora*, *M. rubropunctata*, *M. tenuissima*, *Paratricharia paradoxa*, *Porina radiata*, *P. guianensis*, *P. pseudofulvella*, and *Strigula macrocarpa* are exampes of species which seem to be restricted to primary forests, whereas occurrences of *Asterothyrium* species, *Bullatina aspidota*, *Porina vezdae*, and *Strigula antillarum* indicate secondary forests. Most species found in the study area have a wide altitudinal distribution, but *Badimia galbinea*, *Bapalmuia palmularis*, *Byssolecania* species, *Cryptothecia filicina*, *Mazosia tumidula* and *Porina radiata* are largely confined to lowland forests.

Secondary vegetation

Although the Golfo Dulce region is largely uninhabited, parts of the landscape have been affected by human activities. Land outside the national parks became fragmented, fenced, grazed and cultivated and locally shows different stages of recolonisation and successions. Disturbed forests and secondary vegetation shelter lichen communities which are very different from those in virgin forests. There is a decline in foliicolous lichens, a predominance of corticolous species, and a richer macrolichen flora in the more open vegetation. The close proximity of (nearly) undisturbed primary forest and secondary habits created by man affects biodiversity levels considerably. It is the interlinking of primary and secondary vegetation with transition features between forested and open areas and their contrasting plant communities that provides high numbers of lichen species within comparatively small areas.

The synanthropic lichen flora has been investigated in the surroundings of the village of La Gamba. Solitary trees along roads or in pastures have a rich growth of lichens. *Arthothelium galbineum*, *Glyphis cicatricosa*, *Leptogium phyllocarpum*, *Normandina pulchella*, *Parmeliella stylophora*, *Physcia atrostriata*, *P. krogiae*, and *P. lobulata* are among those lichens that have been found only in cultivated areas. Large thalli of *Parmotrema cristiferum*, *P. dilatatum* and *P. endosulphureum* colonise well-lit stems and branches. Fence posts support a rich cover of lignicolous lichen communities that are dominated by Graphidaceae. Lichens present on dead wood include *Carbacanthographis chionophora*, *Graphis chrysocarpa*, *G. disserpens*, *G. proserpens*, *G. rimulosa*, *G. striatula*, *G. vestitoides* and *Thalloloma anguinaeforme*. Most of these species are absent or rare in natural habitats.

Species inventory

At present, 471 lichen taxa are known from the Golfo Dulce region. They are listed below with foliicolous and non-foliicolous lichens enumerated separately (species found on both leaves and bark or lignum are shown in both sections). The list is based on literature records and on (unpublished) collections by the author. Taxonomy of foliicolous lichens mostly follows LÜCKING et al. (2000). *Dimerella* is retained as a genus distinct from *Coenogonium*. To facilitate comparison of literature data, the most recent changes in generic delimitations, e.g. within the Gomphillaceae (LÜCKING et al. 2005), have not been considered. Taxonomy of Graphidaceae follows STAIGER (2002). Every species name is followed by abbreviations referring to the subregions of the area (BE, Go, Osa, Caño) and the literature references.

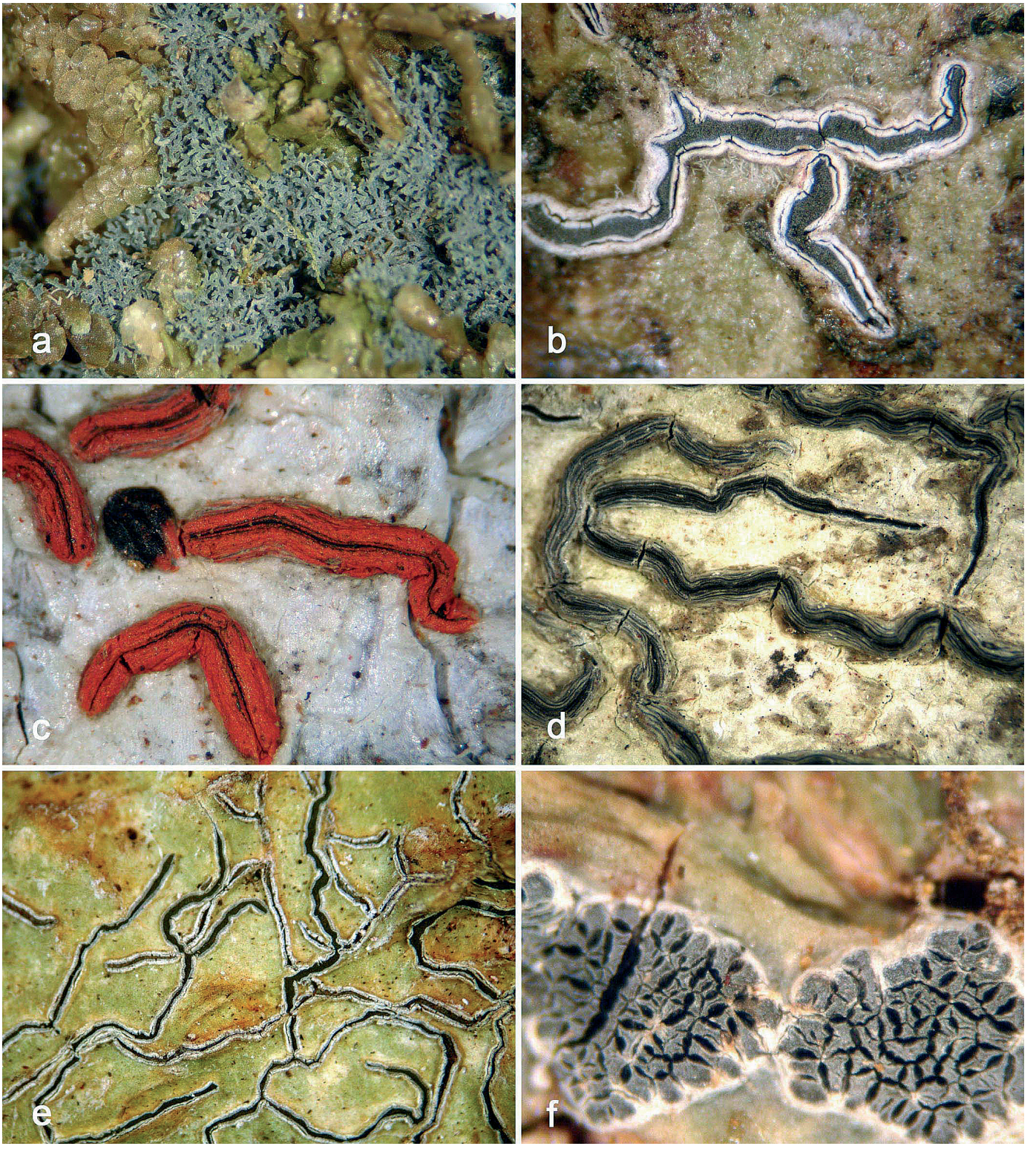

Plate 4: Corticolous lichens, (**a**) *Coccocarpia filiformis*, (**b**) *Sarcographa ramificans*, (**c**) *Graphis chrysocarpa*, (**d**) *Graphis vestitoides*, (**e**) *Platythecium allosporellum*, (**f**) *Sarcographa labyrinthica*. Photos: G. Neuwirth.

Abbreviations:

BE = Bosque Esquinas and La Gamba, Go = Golfito, Osa = Peninsula de Osa, Caño = Isla del Caño; Ap&al08 = APTROOT et al. 2008, BaGr06 = BALOCH & GRUBE 2006, Br00 = BREUSS 2000, Br06 = BREUSS 2006, BrNe07 = BREUSS & NEUWIRTH 2007, HaKa95 = HAFELLNER & KALB 1995, Lü95 = LÜCKING 1995, Lü97 = LÜCKING 1997, Lü99 = LÜCKING 1999, LüMa96 = LÜCKING & MATZER 1996, LüSér.97 = LÜCKING & SÉRUSIAUX 1997

Foliicolous lichens

Actinoplaca strigulacea MÜLL. ARG.: BE, Br06
Amazonomyces farkasiae (LÜCKING) LÜCKING, SERUS. & THOR: BE, Osa, Lü95, BrNe07
Arthonia accolens STIRT.: BE, Osa, Br06, Lü95
Arthonia aciniformis STIRT.: BE, Br00, BrNe07, Lü95
Arthonia cinnabarinula MÜLL. ARG.: BE, BrNe07
Arthonia cyanea MÜLL. ARG.: BE, Go, Br06, Lü92, Lü95
Arthonia epidendri (REHM) R. SANT.: BE, BrNe07
Arthonia intermedia MATZER: Osa, MATZER 1996
Arthonia leptosperma (MÜLL. ARG.) R. SANT.: BE, Osa, Br00, Br06, BrNe07, Lü95
Arthonia mira R. SANT.: Go, Lü92
Arthonia orbignyae (UPADHYAY) MATZER: BE, Osa, Br00, Lü95
Arthonia palmulacea (MÜLL. ARG.) R. SANT.: BE, Go, Osa, Br06, BrNe07, Lü95,
Arthonia trilocularis MÜLL. ARG.: BE, Go, Osa, BrNe07, Lü92, Lü95
Aspidothelium fugiens (MÜLL. ARG.) R. SANT.: BE, Br06, BrNe07
Aspidothelium geminiparum (MALME) R. SANT.: BE, BrNe07
Aspidothelium ornatum LÜCKING: BE, Br06
Aspidothelium papillicarpum LÜCKING: BE, Br06
Aspidothelium scutellicarpum LÜCKING: BE, BrNe07
Aspidothelium trichothelioides SÉRUS. & VĚZDA: BE, Br06
Asterothyrium microsporum R. SANT.: BE, BrNe07
Asterothyrium pittieri MÜLL. ARG.: Go, Lü92
Asterothyrium rotuliforme (MÜLL. ARG.) SÉRUS.: BE, BrNe07
Aulaxina intermedia LÜCKING: BE, BrNe07
Aulaxina microphana (VAIN.) R. SANT.: BE, BrNe07
Aulaxina minuta R. SANT.: BE, Osa, Br06, BrNe07, Lü97
Aulaxina multiseptata R. SANT.: BE, Br06
Aulaxina opegraphina FÉE: BE, Go, Br06, Lü92
Aulaxina quadrangula (STIRT.) R. SANT.: BE, Osa, Br06, BrNe07, Lü97
Aulaxina submuralis KALB & VĚZDA: BE, BrNe07
Bacidina apiahica (MÜLL. ARG.) VĚZDA: BE, BrNe07
Bacidina pallidocarnea (MÜLL. ARG.) VĚZDA: BE, Br06
Badimia dimidiata (BAB. ex LEIGHTON) VĚZDA: BE, Br00, Br06, BrNe07
Badimia galbinea (KREMP.) VĚZDA: BE, Br00, Br06, BrNe07
Badimia pallidula (KREMP.) VĚZDA: BE, Br00, Br06
Badimia tuckermanii (R. SANT.) LÜCKING, LUMBSCH & ELIX: BE, BrNe07
Bapalmuia costaricensis LÜCKING & KALB: BE, BrNe07
Bapalmuia palmularis (MÜLL. ARG.) SÉRUS.: BE, Br06
Bullatina aspidota (VAINIO) VĚZDA & POELT: BE, Go, Br06, Lü92
Byssolecania deplanata (MÜLL. ARG.) R. SANT.: BE, Br06, BrNe07
Byssolecania fumosonigricans (MÜLL. ARG.) R. SANT.: BE, Br06, BrNe07
Byssolecania hymenocarpa (VAIN.) KALB et al.: BE, BrNe07
Byssolecania pluriseptata BREUSS: BE, BrNe07
Byssolecania variabilis VĚZDA, KALB & LÜCKING: BE, BrNe07
Byssolecania vezdae KALB & LÜCKING: BE, BrNe07
Byssoloma aeruginascens VĚZDA: Osa, ELIX & al. 1995
Byssoloma leucoblepharum (NYL.) VAINIO: BE, Br00, Br06, BrNe07
Byssoloma lueckingii SÉRUS.: Go, SÉRUSIAUX 1995
Byssoloma minutissimum KALB & VĚZDA: BE, Br06, BrNe07
Byssoloma subdiscordans (NYL.) P. JAMES: BE, Br06, BrNe07
Byssoloma tricholomum (MONT.) ZAHLBR.: BE, BrNe07
Byssoloma vanderystii SÈRUS.: BE, BrNe07
Calenia bullatinoides LÜCKING: Go, LÜCKING et al. 2001
Calenia depressa MÜLL. ARG.: BE, Br06, BrNe07
Calenia graphidea VAIN.: BE, Osa, BrNe07, Lü97
Calenia lueckingii HARTMANN: BE, BrNe07
Calenia phyllogena (MÜLL. ARG.) R. SANT.: BE, Osa, Br06, BrNe07, Lü97
Calenia solorinoides LÜCKING: Go, Lü91, Lü92
Calenia subdepressa LÜCKING: BE, Osa, Br06, BrNe07, Lü97
Calenia thelotremella VAIN.: Osa, Lü97
Calenia triseptata ZAHLBR.: BE, Osa, BrNe07, Lü97
Caleniopsis laevigata (MÜLL. ARG.) VĚZDA & POELT: BE, BrNe07
Calopadia foliicola (FÉE) VĚZDA: BE, Osa, Br06, Lü99
Calopadia fusca (MÜLL. ARG.) VEZDA: BE, Caño, Go, Osa, Br06, BrNe07, Lü92, Lü99
Calopadia perpallida (NYL.) VĚZDA: BE, Br00, BrNe07
Calopadia phyllogena (MÜLL. ARG.) VĚZDA: BE, Osa, Br06, BrNe07, Lü99
Calopadia puiggarii (MÜLL. ARG.) VĚZDA: BE, Caño, Br06, BrNe07, Lü99
Calopadia subcoerulescens (ZAHLBR.) VĚZDA: BE, Br06, BrNe07
Caprettia neotropica LÜCKING & SÉRUS.: Osa, SÉRUSIAUX & LÜCKING 2003
Chroodiscus australiensis LUMBSCH & VĚZDA: BE, Br06
Chroodiscus coccineus (LEIGHT.) MÜLL. ARG.: BE, Go, Osa, Br00, Br06, BrNe07, Lü92, Lü99b
Coccocarpia domingensis VAIN.: BE, BrNe07
Coccocarpia epiphylla (FÉE) KREMP.: BE, Br06
Coccocarpia stellata TUCK.: BE, Br00, Br06
Coccocarpia tenuissima MÜLL. ARG.: BE, BrNe07
Coenogonium ciliatum KALB & LÜCKING: BE, BrNe07
Coenogonium implexum NYL.: BE, Br00
Coenogonium moniliforme TUCK.: Osa, Lü99c
Cryptothecia filicina (ELLIS & EVERH.) LÜCKING et al.: BE, Osa, BrNe07, Lü95
Dictyonema phyllogenum (MÜLL. ARG.) ZAHLBR. f. *phyllogenum*: BE, Br06, BrNe07
Dictyonema sericeum (SW.) BERK. f. *phyllophilum* PARM.: BE, BrNe07
Dimerella dilucida (Kremp.) R. SANT.: BE, Br06, BrNe07, Osa, Lü99c

Dimerella epiphylla (Müll. Arg.) Malme: BE, Go, Osa, Br06, BrNe07, Lü92, Lü99c
Dimerella fallaciosa (Müll. Arg.) Vězda: BE, Br06, BrNe07
Dimerella flavicans Vezda & Farkas: BE, Br00
Dimerella hypophylla Vězda: BE, Osa, Br06, BrNe07, Lü99c
Dimerella isidiifera Lücking: Osa, Lü99c
Dimerella lisowskii Vězda: BE, BrNe07
Dimerella minima (Müll. Arg.) R. Sant.: BE, Br06, BrNe07, Osa, Lü99c
Dimerella siquirrensis Lücking: BE, Go, Osa, Br06, BrNe07, Lü99c
Dimerella subzonata Lücking: BE, Osa, Br06, Lü99c
Dimerella usambarensis Vězda & Farkas: BrNe07
Echinoplaca bispora Kalb & Vězda: BE, Br06, BrNe07
Echinoplaca diffluens (Müll. Arg.) R. Sant.: BE, Br06, BrNe07
Echinoplaca epiphylla Fée: BE, Go, Osa, Br06, BrNe07, Lü92, Lü97
Echinoplaca furcata Sérus.: Osa, Lü97
Echinoplaca fusconitida Lücking: BE, Br06, BrNe07
Echinoplaca handelii (Zahlbr.) Lücking: BE, Br06
Echinoplaca hymenocarpoides (Vain.) Lücking: BE, BrNe07
Echinoplaca leucotrichoides (Vain.) R. Sant.: BE, Osa, Br06, BrNe07, Lü97
Echinoplaca marginata Lücking: BE, Osa, BrNe07, Lü97
Echinoplaca pellicula (Müll. Arg.) R. Sant.: BE, Go, Osa, Br06, BrNe07, Lü97
Echinoplaca trichariodes Kalb & Vězda: BE, BrNe07
Echinoplaca verrucifera Lücking: BE, Caño, Osa, Br06, Lü97
Echinoplaca wilsoniorum Lücking: vicinity of field station La Gamba
Enterographa angustissima (Vain.) R. Sant.: Go, Lü92
Enterographa byssoidea Lücking: BE, Go, Lü92, BrNe07
Eremothecella calamicola Syd.: BE, Osa, BrNe07, Lü95
Fellhanera angustispora Lücking: Osa, Lü97b
Fellhanera fuscatula (Müll. Arg.) Vězda: Osa, Lü97b
Fellhanera muhlei Lücking: Osa, Lü97b
Fellhanera rhapidophylli (Rehm) Vězda: BE, BrNe07
Fellhanera rubida (Müll. Arg.) Lücking: Osa, Lü97b
Fellhanera stanhopeae (Müll. Arg.) Lücking, Lumbsch & Elix: Osa, Lü97b
Fellhanera subfuscatula Lücking: Osa, Lü97b
Fellhanera subternella (Nyl.) Vězda: BE, Br06, BrNe07
Fellhanera verrucifera Lücking: Osa, Lü97b
Gyalectidium ciliatum Lücking, Thor & Matsumoto: BE, BrNe07
Gyalectidium filicinum Müll. Arg.: BE, Osa, BrNe07, Lü97
Gyalidea epiphylla Vězda: BE, Osa, Br06, Lü99b
Gyalideopsis actinoplacoides Lücking: BE, BrNe07
Gyalideopsis rubescens Vězda: BE, Go, BrNe07, Lü92
Gyalideopsis verruculosa Vězda & Haf.: BE, Br06
Gyalideopsis vulgaris (Müll. Arg.) Lücking: BE, Osa, Br06, BrNe07, Lü97
Lasioloma arachnoideum (Kremp.) R. Sant.: BE, Go, Osa, Br06, BrNe07, Lü92, Lü99
Lichenopeltella setifera Matzer: BE, BrNe07
Loflammia epiphylla (Fée) Lücking & Vězda: BE, Br06
Loflammia gabrielis (Müll. Arg.) Vezda: Go, Osa, Lü99
Lyromma nectandrae Bat. & H. Maia: Go, Lü92
Macentina perminuta Vězda: BE, BrNe07
Malcolmiella amazonica (Redinger) Kalb & Lücking: BE, BrNe07
Mazosia bambusae (Vainio) R. Sant.: BE, Osa, Br06, BrNe07, LüMa96
Mazosia dispersa (Hedrick) R. Sant.: BE, Go, Osa, Br06, BrNe07, Lü92, LüMa96
Mazosia longispora Lücking & Matzer: BE, BrNe07
Mazosia melanophthalma (Müll. Arg.) R. Sant.: BE, Go, Br06, BrNe07, LüMa96
Mazosia paupercula (Müll. Arg.) R. Sant.: BE, Br00
Mazosia phyllosema (Nyl.) Zahlbr.: BE, Go, Br00, Br06, BrNe07, Lü92
Mazosia pilosa Kalb & Vězda: BE, Go, Osa, Br00, Br06, BrNe07, LüMa96
Mazosia praemorsa (Stirt.) R. Sant.: BE, Br06, BrNe07
Mazosia pseudobambusae Kalb & Vězda: BE, Osa, BrNe07, LüMa96
Mazosia rotula (Mont.) A. Massal.: BE, Caño, Osa, Br00, Br06, BrNe07, LüMa96
Mazosia rubropunctata R. Sant.: Caño, LüMa96
Mazosia tenuissima Lücking & Matzer: BE, Osa, Br00, Br06, BrNe07, LüMa96
Mazosia tumidula (Stirt.) Müll. Arg.: BE, Osa, Br00, Br06, BrNe07, LüMa96
Microtheliopsis uleana Müll. Arg.: BE, BrNe07
Musaespora kalbii Lücking & Sérus.: Osa, LüSér97
Opegrapha alba Lücking: Go, Lü91, Lü92
Opegrapha filicina Mont.: BE, Caño, Go, Br06, BrNe07, Lü92, LüMa96
Opegrapha lambinonii Sérus.: Osa, LüMa96
Opegrapha phylloporinae Müll. Arg.: BE, BrNe07
Opegrapha puiggarii Müll. Arg.: Go, Lü92
Opegrapha sipmanii Matzer: Osa, Matzer 1996
Opegrapha strigulae R. Sant.: BE, BrNe07
Paratricharia paradoxa (Lücking) Lücking: BE, Br00, Br06, BrNe07
Phyllobathelium firmum (Stirt.) Vězda: BE, Br06, BrNe07
Phyllobathelium leguminosae (Cavalc. & A.A. Silva) Lücking & Sérus.: BE, BrNe07
Phylloblastia amazonica Kalb & Vězda: BE, Br06, BrNe07
Porina alba (R. Sant.) Lücking: BE, Osa, Baloch & Grube 2006, Br06, BrNe07, LüVe98
Porina andreana Lücking & Vezda: BE, Br06
Porina atriceps (Vain.) Vain.: BE, BrNe07
Porina barvica Lücking: BE, BrNe07
Porina conspersa Malme: BE, Br06
Porina distans Vězda & Vivant: BE, Br06
Porina epiphylla (Fée) Fée: BE, Osa, BaGr06, Br06, BrNe07
Porina fulvella Müll. Arg.: BE, Go, Lü92, Br00, BE, BrNe07
Porina fusca Lücking: BE, BrNe07
Porina andreana Lücking & Vězda: BE, Br06
Porina guianensis Lücking & Vězda f. *guianensis*: BE, Br06
Porina imitatrix Müll. Arg.: BE, Br06
Porina karnatakensis Makh., Adaw. & Patw.: BE, Osa, LüVe98, Br06, BrNe07
Porina leptosperma Müll. Arg.: BE, Br00, BrNe07
Porina leptospermoides Müll. Arg.: BE, Br06, BrNe07
Porina limbulata (Kremp.) Vainio: BE, BaGr06, Br00, Br06, BrNe07

Porina lucida R. Sant.: BE, Osa, LüVe98, Br00, Br06, BaGr06, BrNe07
Porina nitidula Müll. Arg.: BE, BaGr06, BrNe07
Porina octomera (Müll. Arg.) F. Schill.: BE, BrNe07
Porina ornata Vězda: BE, BrNe07
Porina papillifera (Stirt.) F. Schill.: BE, BrNe07
Porina pilifera Neuwirth: BE, Neuwirth & Pfaller 2006, BrNe07
Porina pocsii Vězda: BE, Br06
Porina pseudofulvella Sérus.: BE, Br00, BrNe07
Porina radiata Kalb, Lücking & Vězda: BE, Osa, LüVe98, BaGr06, Br00, Br06, BrNe07
Porina repanda (Stirt.) Lücking & R. Sant.: BE, Osa, HaKa95, BaGr06, Br00, BrNe07
Porina rubentior (Stirt.) Müll. Arg.: BE, BaGr06, Br00, Br06, BrNe07
Porina rubescens (Lücking) Haf. & Kalb: Osa, HaKa95
Porina rubrosphaera R. Sant.: BE, BrNe07
Porina rufula (Kremp.) Vainio: BE, Br00, Br06, BaGr06, BrNe07
Porina subepiphylla Lücking & Vězda: BE, Go, Osa, LüVe98, BaGr06, Br06, BrNe07
Porina tetracerae (Afz.) Müll. Arg.: BE, Br06
Porina tetramera (Malme) R. Sant.: BE, Br06, BrNe07
Porina vezdae Lücking: BE, BrNe07
Pseudocalopadia mira Lücking: Osa, Lü99
Sporopodium antonianum Elix, Lumbsch & Lücking: Osa, Elix et al. 1995, Lü99
Sporopodium citrinum (Zahlbr.) Elix et al.: BE, Osa, Br00, Lü99
Sporopodium leprieurii Mont.: BE, Go, Osa, Br06, BrNe07, Elix et al. 1995. Lü99
Sporopodium phyllocaris (Mont.) A. Massal.: Caño, Lü99
Sporopodium xantholeucum (Müll. Arg.) Zahlbr.: BE, Br00
Strigula antillarum (Fée) Müll. Arg.: Go, Lü91, Lü92
Strigula complanata (Fée) Mont.: BE, Br06, BrNe07
Strigula concreta (Fée) R. Sant.: BE, Go, Lü92, BrNe07
Strigula macrocarpa Vainio: BE, Br06, BrNe07
Strigula maculata (Cooke & Massee) R. Sant.: BE, Br06, BrNe07
Strigula nemathora Mont. var. *nemathora*: BE, Br06, BrNe07
Strigula nemathora Mont. var. *pulchella* (Müll. Arg.) R. Sant.: BE, BrNe07
Strigula nitidula Mont.: BE, Br00
Strigula obducta (Müll. Arg.) R.C. Harris: BE, BrNe07
Strigula phaea (Tuck.) R.C. Harris: Osa, Ap&al08
Strigula phyllogena (Müll. Arg.) R.C. Harris: BE, Br00, Br06, BrNe07
Strigula platypoda (Müll. Arg.) R.C. Harris: BE, Br06, BrNe07
Strigula schizospora R. Sant.: BE, BrNe07
Strigula smaragdula Fr.: BE, Go, Lü92, Br06, BrNe07
Strigula subelegans Vainio: BE, Br06, BrNe07
Strigula subtilissima (Fée) Müll. Arg.: BE, Br06, BrNe07
Strigula viridis (Lücking) R.C. Harris: BE, BrNe07
Tapellaria bilimbioides R. Sant.: BE, BrNe07
Tapellaria epiphylla (Müll. Arg.) R. Sant.: BE, Osa, Lü99, Br00, Br06, BE, BrNe07
Tapellaria malmei R. Sant.: BE, Osa, Lü99, BrNe07
Tapellaria nana (Fée) R. Sant.: BE, Br06
Tapellaria nigrata (Müll. Arg.) R. Sant.: BE, BrNe07
Tapellaria phyllophila (Stirt.) R. Sant.: BE, Br06, BE, BrNe07
Tapellaria puiggarii (Müll. Arg.) R. Sant.: BE, BrNe07
Tapellariopsis octomera Lücking: Osa, Lü99
Tricharia albostrigosa R. Sant.: BE, Br00, Br06, BrNe07
Tricharia amazonum Vain.: Osa, Lü97
Tricharia carnea (Müll. Arg.) R. Sant.: Osa, Lü97
Tricharia couepiae (Bat.) Lücking & Sérus.: Osa, Lü97
Tricharia helminthospora R. Sant.: BE, Osa, Lü97, BrNe07
Tricharia heterella (Stirt.) Lücking: BE, Osa, Lü97, Br06, BrNe07
Tricharia hyalina Kalb & Vězda: BE, Osa, Lü97, BrNe07
Tricharia planicarpa Lücking: BE, BrNe07
Tricharia santessoniana Kalb & Vezda: BE, BrNe07
Tricharia urceolata (Müll. Arg.) R. Sant.: BE, Osa, Lü97, Br00, Br06, BrNe07
Tricharia vainioi R. Sant.: BE, Osa, Lü97, Br06, BrNe07
Trichothelium alboatrum Vain.: BE, BrNe07
Trichothelium annulatum (Karst.) R. Sant.: Osa, Lü98
Trichothelium bipindense F. Schill.: BE, Osa, Lü98, Br00, Br06, BrNe07
Trichothelium epiphyllum Müll. Arg.: BE, Osa, Lü98, Br00, Br06, BaGr06, BrNe07
Trichothelium juruense (P. Henn.) F. Schill.: BE, Osa, Lü98, BrNe07
Trichothelium longisporum Lücking: BE, Osa, Lü98, Br06, BrNe07
Trichothelium minus Vain.: BE, Go, Osa, Lü98, Br06, BrNe07
Trichothelium minutum (Lücking) Lücking: BE, Osa, Lü98, BrNe07
Trichothelium mirum Lücking: Osa, Lü98
Trichothelium montanum Lücking: BE, Osa, Lü98, BrNe07
Trichothelium pallescens (Müll. Arg.) F. Schill.: BE, Osa, Lü98, Br06, BrNe07
Trichothelium pallidesetum Lücking: BE, Br06
Trichothelium sipmanii R. Lücking s.str.: BE, Osa, Lü98, Br06
Trichothelium sipmanii R. Lücking f. *multiseptatum* Lücking: BE, Osa, Lü98, BrNe07
Trichothelium ulei (P. Henn.) Höhnel: Osa, Lü98

Non-foliicolous lichens

Anisomeridium ambiguum (Zahlbr.) R.C. Harris: Osa, Ap&al08
Anisomeridium americanum (A. Massal.) R.C. Harris: Caño, Ap&al08
Anisomeridium flavovulcanus Komposch: BE, Osa, Komposch 2005, BrNe07
Anisomeridium infernale (Mont.) R.C. Harris: BE, BrNe07
Anthracothecium prasinum (Eschw.) R.C. Harris: Osa, Ap&al08
Arthonia complanata Fée: BE, Br00, BrNe07
Arthonia isidiata Grube, Lücking & Umana-Tenorio: Osa, Grube & al. 2004
Astrothelium crassum (Fée) Aptroot: Osa, Ap&al08
Astrothelium eustomum (Mont.) Müll. Arg.: BE, Br06
Astrothelium galbineum BE, Osa, Br06, BrNe07, Ap&al08
Astrothelium eustomum (Mont.) Müll. Arg.: BE, Br06
Astrothelium interjectum R.C. Harris: BE, Br06

Astrothelium variolosum (ACH.) MÜLL. ARG.: BE, Br06
Bacidia lutescens MALME: BE, BrNe07
Baeomyces rufus (HUDSON) REBENT.: BE, BrNe07
Bathelium degenerans (VAIN.) R.C. HARRIS: Osa, Ap&al08
Bathelium feei (MEISSN.) APTROOT: Osa, Ap&al08
Biatora furfurosa TUCK. ex NYL.: BE, BrNe07
Bulbothrix apophysata (HALE & KUROK.) HALE: BE, Br06, BrNe07
Bulbothrix goebelii (ZENKER) HALE: BE, BrNe07
Bulbothrix klementii HALE: BE, BrNe07
Bulbothrix laevigatula (NYL.) HALE: BE, BrNe07
Bulbothrix suffixa (STIRTON) HALE: BE, Br06
Calopadia cf. *chacoensis* (MALME) KALB & VĚZDA: BE, Br00
Calopadia foliicola (FÉE) VĚZDA: BE, Osa, Br06, Lü99
Calopadia isidiosa KALB & VĚZDA: BE, BrNe07
Calopadia lecanorella (NYL.) KALB & VĚZDA: BE, Br06, BrNe07
Calopadia perpallida (NYL.) VĚZDA: BE, Br00, BrNe07
Calopadia subcoerulescens (ZAHLBR.) VĚZDA: BE, BrNe07
Carbacanthographis chionophora (REDINGER) STAIGER & KALB: BE, Br06, BrNe07
Celothelium aciculiferum (NYL.) VAIN.: BE, BrNe07
Cladonia subradiata (VAIN.) SANDST.: area of the Esquinas Rainforest Lodge
Coccocarpia dissecta SWINSC. & KROG: Osa, LÜCKING et al. 2007
Coccocarpia epiphylla (FÉE) KREMP.: BE, Br06
Coccocarpia erythroxyli (SPRENGEL) SWINSC. & KROG: BE, Osa, Br00, LÜCKING et al. 2007
Coccocarpia filiformis L. ARVIDSS.: BE, BrNe07
Coccocarpia glaucina KREMP.: Osa, LÜCKING et al. 2007
Coccocarpia palmicola (SPRENGEL) ARVIDSS. & GALLOWAY: BE, Osa, Br00, DODGE 1933, LÜCKING et al. 2007
Coccocarpia pellita (ACH.) MÜLL. ARG.: BE, Osa, Br06, DODGE 1933
Coccocarpia stellata TUCK.: BE, Br00, Br06
Coenogonium acrocephalum MÜLL. ARG.: near Esquinas Rainforest Lodge, Fila Golfito
Coenogonium implexum NYL.: BE, Br00
Coenogonium interplexum NYL.: BE, Br06
Coenogonium leprieurii (MONT.) NYL.: BE, BrNe07
Coenogonium linkii EHRENB.: BE, Br06, BrNe07
Coenogonium subvirescens (NYL.) NYL.: BE, Osa, DODGE 1933, BrNe07
Crocynia gossypina (SW.) A. MASSAL.: BE, Br06, BrNe07
Crocynia pyxinoides NYL.: BE, Br00
Dichosporidium nigrocinctum (EHRENB.: FR.) THOR: BE, Br00
Dictyonema glabratum (SPRENG.) D. HAWKSW.: BE, Br06
Dictyonema sericeum (SW.) BERK.: BE, Br00, Br06
Diorygma confluens (FÉE) KALB, STAIGER & ELIX: BE, Br00
Diorygma poitaei (FÉE) KALB, STAIGER & ELIX: BE, Br06
Diorygma pruinosum (ESCHW.) KALB, STAIGER & ELIX: BE, BrNe07
Diorygma reniforme (FÉE) KALB, STAIGER & ELIX: BE, Br06, BrNe07
Dirinaria aegialita (ACH.) MOORE: BE, BrNe07
Dirinaria picta (SW.) CLEM. & SHEAR: BE, Br00, BrNe07
Dyplolabia afzelii (ACH.) A. MASSAL.: BE, BrNe07
Echinoplaca bispora KALB & VĚZDA: BE, Br06, BrNe07
Echinoplaca similis KALB & VĚZDA: BE, BrNe07
Eschatogonia prolifera (MONT.) R. SANT.: BE, Br06, BrNe07
Fissurina cingalina (NYL.) STAIGER: BE, BrNe07
Gassicurtia coccinea FÉE: BE, Br06
Glyphis cicatricosa ACH.: BE, Br06, BrNe07
Graphis acharii FÉE: BE, Br06
Graphis analoga NYL.: BE, BrNe07
Graphis anfractuosa (ESCHW.) ESCHW.: BE, BrNe07
Graphis anguilliformis TAYLOR: BE, Br06, BrNe07
Graphis antillarum VAIN.: BE, BrNe07
Graphis cf. *furcata* FÉE: BE, BrNe07
Graphis chrysocarpa (RADDI) SPRENG.: BE, Br06, BrNe07, STAIGER 2002
Graphis dimidiata VAINIO: BE, Br00, BrNe07
Graphis disserpens NYL.: BE, BrNe07
Graphis duplicata ACH.: BE, Br06
Graphis elegans (SM.) ACH.: BE, BrNe07
Graphis elongatoradians FINK: BE, BrNe07
Graphis flexibilis KREMP.: BE, Br00, Br06
Graphis cf. *haemographa* NYL.: BE, Br00
Graphis leptocarpa FÉE: BE, BrNe07
Graphis longula KREMP.: BE, Br06, BrNe07
Graphis paraserpens LIZANO & LÜCKING: BE, BrNe07
Graphis plurispora (REDINGER): BE, Br06
Graphis proserpens VAIN.: BE, BrNe07
Graphis rimulosa (MONT.) TREVISAN: BE, Br00, Br06, BrNe07
Graphis striatula (ACH.) SPRENG.: BE, BrNe07
Graphis vestitoides (FINK) STAIGER: BE, Br00, Br06, BrNe07
Gyalideopsis confluens KALB & VĚZDA: BE, BrNe07
Gyalideopsis lambinonii VĚZDA: BE, BrNe07
Gyalideopsis vainioi KALB & VĚZDA: BE, BrNe07
Gyrotrema wirthii RIVAS PLATA, LÜCKING & LUMBSCH: Osa, RIVAS PLATA et al. 2008
Haematomma leprarioides (VAINIO) VAINIO: BE, Br06
Laurera subdisjuncta (MÜLL. ARG.) R.C. HARRIS: Osa, Ap&al08
Leiorreuma exaltatum (MONT. & V. D. BOSCH) STAIGER: BE, Br00, Br06, BrNe07
Leiorreuma hypomelaenum (MÜLL.ARG.) STAIGER: BE, Br06
Leiorreuma lyellii (SM.) STAIGER: BE, BrNe07
Leiorreuma sericeum (ESCHW.) STAIGER: BE, BrNe07
Leptogium austroamericanum (MALME) DODGE: BE, Br00, BrNe07
Leptogium azureum (SW.) MONT. s.str.: BE, Osa, Br00, Br06, BrNe07, DODGE 1933
Leptogium caespitosum (TAYLOR) SWINSCOW & KROG: BE, Br06
Leptogium coralloideum (MEYEN & FLOT.) VAIN.: BE, BrNe07
Leptogium denticulatum NYL.: BE, Osa, BrNe07, DODGE 1933
Leptogium foveolatum NYL.: BE, Br06
Leptogium marginellum (SW.) S.F. GRAY: BE, Br00, Br06, BrNe07
Leptogium phyllocarpum (PERS.) MONT.: BE, Br06, BrNe07
Leptogium standleyi DODGE: BE, Br06
Leptogium stipitatum VAINIO: BE, Br06, BE, BrNe07
Leptogium tuckermanii DODGE: BE, Br00
Leptogium ulvaceum auct.: BE, Br00, Br06
Malcolmiella granifera (ACH.) KALB & LÜCKING: BE, Br00, Br06, BrNe07
Malcolmiella psychotrioides KALB & LÜCKING: BE, BrNe07
Megalospora tuberculosa (FÉE) SIPMAN: BE, BrNe07

Megalotremis biocellata APTROOT: Osa, Ap&al08
Megalotremis nemorosa (R.C. HARRIS) APTROOT: BE, Osa, Br06, Ap&al08
Megalotremis verrucosa (MAKH. & PATW.) APTROOT: BE, Osa, BrNe07, Ap&al08
Musaespora gigas (ZAHLBR.) R.C. HARRIS: Osa, Ap&al08
Mycomicrothelia hemisphaerica (MÜLL. ARG.) D. HAWKSW.: Osa, Ap&al08
Mycomicrothelia oleosa APTROOT: BE, BrNe07
Mycoporum eschweileri (MÜLL. ARG..) R.C. HARRIS: Osa, Ap&al08
Myeloconis fecunda P.M. MCCARTHY & ELIX: BE, Br06, BrNe07
Myeloconis guyanensis P.M. MCCARTHY & ELIX: BE, Br06
Myriotrema album FÉE: BE, Br00, Br06
Myriotrema barroense (HALE) HALE: BE, BrNe07
Myriotrema glaucophaenum (KREMP.) HALE: BE, Br06, BrNe07
Myriotrema myriocarpum (FÉE) HALE: BE, Br06
Myriotrema pachystomum (NYL.) HALE: BE, BrNe07
Myriotrema trypaneoides (NYL.) HALE: BE, BrNe07
Nadvornikia hawaiensis (TUCK.) TIBELL: BE, Br06
Normandina pulchella (BORRER) NYL.: BE, BrNe07
Ocellularia alborosella (NYL.) R. SANT.: BE, Br00, Br06
Ocellularia auratipruinosa BREUSS: BE, Br00, Br06
Ocellularia cavata (ACH.) MÜLL. ARG.: BE, BrNe07
Ocellularia comparabilis (KREMP.) MÜLL. ARG.: BE, Br06
Ocellularia crocea (KREMP.) OVEREEM: BE, Br06
Ocellularia dactyliza HALE: BE, BrNe07
Ocellularia interposita (NYL.) HALE: BE, Br06
Ocellularia landronii HALE: BE, BrNe07
Ocellularia perforata (LEIGHTON) MÜLL. ARG.: BE, Br00, Br06
Ocellularia rhodostroma (MONT.) ZAHLBR.: BE, Br00, Br06, BrNe07
Ocellularia subemersa MÜLL. ARG.: BE, Br06
Ocellularia xanthostroma (NYL.) ZAHLBR.: BE, Br06, BrNe07
Opegrapha curvula REDINGER: BE, Br06
Parmeliella isidiopannosa P.M. JØRG.: BE, BrNe07
Parmeliella pannosa (SW.) MÜLL. ARG.: BE, BrNe07
Parmeliella stylophora (VAIN.) P.M. JØRG.: BE, Br06, BrNe07
Parmotrema cristiferum (TAYLOR) HALE: BE, Br00, BrNe07
Parmotrema dilatatum (VAINIO) HALE: BE, Br06, BrNe07
Parmotrema endosulphureum (HILLM.) HALE: BE, Br00, Br06, BrNe07
Parmotrema flavescens (KREMP.) HALE: BE, BrNe07
Parmotrema rubifaciens (HALE) HALE: BE, Br06
Parmotrema sulphuratum (NEES & FLOTOW) HALE: BE, Br00, Br06
Peltigera collina (ACH.) SCHRAD.: BE, BrNe07
Pertusaria tetrathalamia (FÉE) NYL.: BE, Br06
Phaeographis caesiodisca STAIGER: BE, BrNe07
Phaeographis decipiens (FÉE) MÜLL. ARG.: BE, Br06
Phaeographis haematites (FÉE) MÜLL. ARG.: BE, Br00
Phaeographis intricans (NYL.) STAIGER: BE, BrNe07
Phaeographis lindigiana MÜLL. ARG.: BE, Br06
Phaeographis schizoloma Müll. ARG.: BE, Br06
Phyllopsora buettneri (MÜLL. ARG.) ZAHLbr. var. *glauca* (DE LESD.) BRAKO: BE, Br06
Phyllopsora confusa SWINSCOW & KROG: BE, BrNe07
Phyllopsora corallina (ESCHW.) MÜLL. ARG. var. *ochroxantha* (NYL.) BRAKO: BE, Br06
Phyllopsora furfuracea (PERS.) ZAHLBR.: BE, BrNe07
Physcia atrostriata MOBERG: BE, Br00, Br06, BrNe07
Physcia krogiae MOBERG: BE, Br00
Physcia lobulata MOBERG: BE, BrNe07
Physcidia wrightii TUCK.: BE, BrNe07
Physma byrsaeum (ACH.) TUCK.: BE, BrNe07
Platythecium allosporellum (NYL.) STAIGER: BE, BrNe07
Platythecium grammitis (FÉE) STAIGER: BE, Br06
Polymeridium albidum (MÜLL. ARG.) R.C. HARRIS: BE, BrNe07
Polymeridium contendens (NYL.) R.C. HARRIS: BE, BrNe07
Polymeridium flavothecium R.C. HARRIS: BE, Br06, BrNe07
Porina dolichophora (NYL.) MÜLL. ARG.: BE, Br06, BrNe07
Porina eminentior (NYL.) MCCARTHY: BE, BrNe07
Porina epimelaena VAINIO ex REDINGER: BE, Br06, BrNe07
Porina exasperatula VAINIO: BE, KOMPOSCH 2005
Porina mastoidea (ACH.) MÜLL. ARG.: BE, Br06, BrNe07
Porina rudiuscula (NYL.) MÜLL. ARG.: BE, Br06, BrNe07
Porina tijucana VAINIO: BE, Br06, BrNe07
Pseudopyrenula diluta (FÉE) MÜLL. ARG.: *BE,* BrNe07
Pseudopyrenula subnudata MÜLL. ARG.: BE, Br00, Br06
Psorella leucophyllina (NYL.) ZAHLBR.: BE, BrNe07
Pyrenula acutalis R.C. HARRIS: BE, Br06
Pyrenula acutispora HAF. & KALB: Osa, Ap&al08
Pyrenula anomala (ACH.) VAIN.: BE, Osa, BrNe07, Ap&al08
Pyrenula aspistea (ACH.) ACH.: BE, Osa, Br06, BrNe07, Ap&al08
Pyrenula cocoes MÜLL. ARG.: BE, Br06
Pyrenula concatervans (NYL.) R.C. HARRIS: Osa, Ap&al08
Pyrenula confinis (NYL.) R.C. HARRIS: Osa, Ap&al08
Pyrenula cryptothelia (MÜLL. ARG.) APTROOT & ETAYO: Osa, Ap&al08
Pyrenula dermatodes (BORR.) SCHAER.: Osa, Ap&al08
Pyrenula duplicans (NYL.) APTROOT: BE, Br06
Pyrenula cf. *falsaria* (ZAHLBR.) R.C. HARRIS: BE, BrNe07
Pyrenula laetior MÜLL. ARG.: BE, Osa, Br06, Ap&al08
Pyrenula leucostoma ACH.: Osa, Ap&al08
Pyrenula lineatostroma APTROOT: Osa, Ap&al08
Pyrenula mamillana (ACH.) TREV.: BE, Osa, Br06, Ap&al08
Pyrenula massariospora (STARB.) R.C. HARRIS: BE, Osa, BrNe07, Ap&al08
Pyrenula microcarpa MÜLL. ARG.: BE, Br06
Pyrenula pyrenuloides (MONT.) R.C. HARRIS: Caño, Ap&al08
Pyrenula quassiaecola FÉE: Osa, Ap&al08
Pyrenula septicollaris (ESCHW.) R.C. HARRIS: BE, BrNe07
Pyrenula subcongruens MÜLL. ARG.: Caño, Ap&al08
Pyrenula tenuisepta R.C. HARRIS: Osa, Ap&al08
Pyrrhospora russula (ACH.) HAF.: BE, Br06, BrNe07
Pyxine eschweileri (TUCK.) VAIN.: BE, BrNe07
Sarcographa cinchonarum FÉE: BE, BrNe07
Sarcographa heteroclita (MONT.) ZAHLBR.: BE, Br06, BrNe07
Sarcographa labyrinthica (ACH.) MÜLL. ARG.: BE, Br00, Br06, BrNe07
Sarcographa medusulina (NYL.) MÜLL. ARG.: BE, Br06
Sarcographa ramificans (KREMP.) STAIGER: BE, BrNe07
Sarcographa tricosa (ACH.) MÜLL. ARG.: BE, BrNe07
Sporopodium xantholeucum (MÜLL. ARG.) ZAHLBR.: BE, Br00
Stegobolus auberianus (MONT.) A. FRISCH & KALB: BE, Br06
Stegobolus wrightii (TUCK.) A. FRISCH: BE; Br06, FRISCH & KALB 2006, BrNe07

Tapellaria epiphylla (MÜLL.ARG.) R. SANT.: BE, Br00
Thalloloma anguinaeforme (VAIN.) STAIGER: BE, Br06
Thalloloma cinnabarinum (FÉE) STAIGER: BE, Br06
Thalloloma hypoleptum (NYL.) STAIGER: BE, STAIGER 2002
Thelotrema glaucopallens NYL.: BE, Br06
Thelotrema neei (HALE) HALE: BE, BrNe07
Tricharia fumosa KALB & VĚZDA: BE, BrNe07
Trypethelium annulare (FÉE) MONT.: BE, Br06
Trypethelium neogalbineum R.C. HARRIS: Osa, Ap&al08
Trypethelium nitidiusculum (NYL.) R.C. HARRIS: BE, Osa, Br06, Ap&al08
Trypethelium papulosum (NYL.) MAKH. & PATW.: BE, Br06
Trypethelium subcatervarium MALME: BE, Br06
Trypethelium tuberculosum (VAIN.) R.C. HARRIS: Osa, Ap&al08
Trypethelium variolosum ACH.: BE, BrNe07
Usnea brasiliensis (ZAHLBR.) MOT.: BE, BrNe07

Discussion

A total of 469 species are known from the Golfo Dulce area, which represents 33% of the species so far accepted to occur in Costa Rica. Though very far from complete, the list demonstrates the remarkable nature of the investigated area and highlights the need for maintaining conservation efforts. The catalogue includes 110 genera and 471 infrageneric taxa, the richest genera being *Porina* (40 species), *Graphis* and *Pyrenula* (22 each), *Strigula* and *Trichothelium* (15 each), *Arthonia* and *Mazosia* (13 each). The largest proportion is held by foliicolous lichens (52%). As in other parts of the tropics, the most species-rich families are the Porinaceae with mainly epiphyllous species, the Thelotremataceae with mainly rainforest species, and the Graphidaceae with a higher diversity in open places. One reason for the high diversity is the interlinking of primary rainforest with secondary vegetation types. Given the extraordinary biodiversity of Costa Rica and the rather fragmentary collecting work in the study area, the real species number can be expected to be significantly higher. There are a great many species yet to be discovered by further field work, especially in the more remote areas of the region.

Acknowledgements

The author thanks Dr. G. Neuwirth (Tumeltsham) for providing the lichen photos, and Dr. M. Grube (Graz) and Dr. R. Lücking (Chicago) for comments and corrections.

References

AHTI T. (2000): Cladoniaceae. — Flora Neotropica Monograph **78**: 1-362.

APTROOT A., LÜCKING R., SIPMAN H.J.M., UMAÑA L. & J.L. CHAVES (2008): Pyrenocarpous lichens with bitunicate asci. A first assessment of the lichen biodiversity inventory in Costa Rica. — Bibl. Lichenol. **97**: 1-162.

BALOCH E. & M. GRUBE (2006): Evolution and phylogenetic relationships within Porinaceae (Ostropomycetidae), focusing on foliicolous species. — Mycol. Res. **110**: 125-136.

BRAKO L. (1991): Phyllopsora (Bacidiaceae). — Flora Neotropica Monograph **55**: 1-66.

BREUSS O. (2000): Flechten aus Costa Rica I. Regenwald der Österreicher (Bosque Esquinas). — Linzer biol. Beitr. **32**(2): 1043-1051.

BREUSS O. (2001): Flechten aus Costa Rica II. — Linzer biol. Beitr. **33**(2): 1025-1034.

BREUSS O. (2004): Flechten aus Costa Rica III. — Linzer biol. Beitr. **36**(1): 77-80.

BREUSS O. (2006): Flechten aus Costa Rica IV. Bosque Esquinas (2) — Linzer biol. Beitr. **38**(2): 1061-1069.

BREUSS O. & G. NEUWIRTH (2007): Flechtenfunde im Bosque Esquinas, Costa Rica. — Linzer Biol. Beitr. **39**(1): 557-569.

CONRAN J.G. (1997): Host plant associations of some understorey foliicolous lichens in south eastern Queensland, Australia. — Abstracta Bot. **21**(1): 45-52.

DES ABBAYES H. (1939): Revision monographique des *Cladonia* du sous-genre *Cladina* (Lichens). — Bull. Soc. Sci. Bretagne **16**(2): 1-154.

DODGE C.W. (1929): A synopsis of *Stereocaulon* with notes on some exotic species. — Ann. Crypt. Exot. **2**: 93-153.

DODGE C.W. (1933): The foliose and fruticose lichens of Costa Rica. — Ann. Missouri Bot. Gard. **20**: 373-467.

DODGE C.W. (1936): Lichens of the Allan Hancock Expedition of 1934 collected by Wm. R. Taylor. — Allan Hancock Pacific Exped. **3**(3): 33-46.

ELIX J.A., LUMBSCH, H.T. & R. LÜCKING (1995): The chemistry of foliicolous lichens 2. Constituents of some *Byssoloma* and *Sporopodium* species. — Bibl. Lichenol. **58**: 81-96.

FARKAS E. & H.J.M. SIPMAN (1993): Bibliography and checklist of foliicolous lichenized fungi up to 1992. — Trop. Bryol. **7**: 93-148.

FRIES E.M. (1851): Novae symbolae mycologicae, in peregrinis terris a botanicis Danicis collectae. — Nov. Act. R. Soc. Sci. Upsal. **III**. 1: 17-136.

FRISCH A. & K. KALB (2006): A monograph of Thelotremataceae with a complex structure of the columella. — Bibl. Lichenol. **92**: 371-516.

GÓMEZ L.D. (1972): Los Basidiolíquenes de Costa Rica. — Rev. Biol. Trop. **20**: 81-92.

HAFELLNER J. & K. KALB (1995): Studies in Trichotheliales ordo novus. — Bibl. Lichenol. **57**: 161-186.

HEDRICK J. (1942): Some lichens from the American tropics collected by Wm. R. Taylor. — Allan Hancock Pacific Exped. **3**(9): 183-187.

HILLMANN J. (1930): Studien über die Flechtengattung *Teloschistes* NORM. — Hedwigia **69**: 303-343.

HOLDRIDGE L.R. (1967): Life zone ecology. — San José, Costa Rica: Tropical Science Center.

Howe R.H. Jr. (1914): North American species of the genus *Ramalina*. Part V. — The Bryologist **17**(3): 33-40.

Imshaug H.A. (1955): The lichen genus *Buellia* in Central America. — The Bryologist **58**: 277-287.

Imshaug H.A. (1956): Catalogue of Central American Lichens. — The Bryologist **59**(2): 69-114.

Kappelle M. & H. Sipman (1992): Foliose and fruticose lichens of Talamanca montane Quercus forests, Costa Rica. — Brenesia **37**: 51-58.

Komposch H. (2005): *Anisomeridium flavovulcanus*, a new corticolous lichen from Costa Rica. — Lichenologist **37**(6): 519-526.

Komposch H. & J. Hafellner (2002): Life form diversity of lichenized fungi in an Amazon lowland rainforest. — Bibl. Lichenol. **82**: 311-326.

Lücking R. (1992): Foliicolous lichens: a contribution to the knowledge of the lichen flora of Costa Rica, Central America. — Beih. Nova Hedwigia **104**: 1-179.

Lücking R. (1992b): Zur Verbreitungsökologie foliikoler Flechten in Costa Rica, Zentralamerika Teil 2. — Herzogia **9**(1+2): 181-212.

Lücking R. (1995): Additions and corrections to the foliicolous lichen flora of Costa Rica. The family Arthoniaceae, with notes on the genus *Stirtonia*. — Lichenologist **27**(2): 127-153.

Lücking R. (1997): Additions and corrections to the knowledge of the foliicolous lichen flora of Costa Rica. The family Gomphillaceae. — Bibl. Lichenol. **65**: 1-109.

Lücking R. (1997b): Additions and corrections to the foliicolous lichen flora of Costa Rica. The genus *Fellhanera*, with notes on *Bacidia pauciseptata*. — Trop. Bryol. **13**: 141-173.

Lücking R. (1997c): Estado actual de las investígacíones sobre líquenes foliícolas en la región Neotrópica, con un análisis biogeográfico preliminar. — Trop. Bryol. **13**: 87-114.

Lücking R. (1997d): The use of foliicolous lichens as bioindicators in the tropics, with special reference to the microclimate. — Abstracta Bot. **21**(1): 99-116.

Lücking R. (1998): Additions and corrections to the knowledge of the foliicolous lichen flora of Costa Rica. The genus *Trichothelium* (lichenized Ascomycetes: Trichotheliaceae). — Nova Hedwigia **66**: 375-417.

Lücking R. (1998b): Ecology of foliicolous lichens at the Botarrama trail (Costa Rica), a neotropical rainforest site. II. Patterns of diversity and area cover and their dependence on microclimate and phorophyte species. — Ecotropica **4**: 1-24.

Lücking R. (1999): Ergänzungen und Verbesserungen zur Kenntnis der foliikolen Flechtenflora Costa Ricas. Die Familie Ectolechiaceae. — Phyton (Horn) **39**: 131-165.

Lücking R. (1999b): Addiciones y correcciones al conocimiento de la liquenoflora foliícola de Costa Rica. La familia Asterothyriaceae y el género *Chroodiscus* (Thelotremataceae), con un análisis filogenético. — Cryptogamie, Mycol. **20**(3): 193-224.

Lücking R. (1999c): Additions and corrections to the foliicolous lichen flora of Costa Rica. The family Gyalectaceae. — Lichenologist **31**(4): 359-374.

Lücking R. (1999d): Ecology of foliicolous lichens at the "Botarrama" trail (Costa Rica), a neotropical rainforest site IV. Species associations, their salient features, and their dependence on environmental variables. — Lichenologist **31**: 269-289.

Lücking R. (2001): Lichens on leaves in tropical rainforests: life in a permanently ephemerous environment. — Diss. Bot. **346**: 41-77.

Lücking R. (2003): Takhtajan's floristic regions and foliicolous lichen biogeography: a compatibility analysis. — Lichenologist **35**(1): 33-54.

Lücking R., Aptroot A., Chaves J.L., Sipman J.H.M. & Umaña L. (2007): A first assessment of the Ticolichen biodiversity inventory in Costa Rica: the genus Coccocarpia (Peltigerales: Coccocarpiaceae). — Bibl. Lichenol. **95**: 429-457.

Lücking R., Aptroot A., Umaña L., Chaves J.L., Sipman J.H.M. & M.P. Nelsen (2006): A first assessment of the Ticolichen biodiversity inventory in Costa Rica: the genus *Gyalideopsis* and its segregates (Ostropales: Gomphillaceae), with a world-wide key and name status checklist. — Lichenologist **38**(2): 131-160.

Lücking R., Farkas E., Sérusiaux E. & H.J.M. Sipman (2000): Checklist of foliicolous lichens and their lichenicolous fungi. Part 1: Foliicolous lichens (extended version). — http://www.uni-bayreuth.de/planta2/ass/robert/lichens/checkfol.html (Version: October 31st, 2000).

Lücking R. & M. Matzer (1996): Ergänzungen und Verbesserungen zur Kenntnis der foliikolen Flechtenflora Costa Ricas. Die Familie Opegraphaceae (einschließlich der Gattung *Mazosia*). — Nova Hedw. **63**: 109-144.

Lücking R. & E. Sérusiaux (1997): *Musaespora kalbii* (lichenized Ascomycetes: Melanommatales), a new foliicolous lichen with a pantropical distribution. — Nord. J. Bot. **16**(6): 661-668.

Lücking R., Sérusiaux E. & A. Vězda (2005): Phylogeny and systematics of the lichen family Gomphillaceae (Ostropales) inferred from cladistic analysis of phenotype data. — Lichenologist **37**(2): 123-170.

Lücking R., Streimann H. & J.A. Elix (2001): Further records of foliicolous lichens and lichenicolous fungi from Australasia, with an updated checklist for continental Australia. — Lichenologist **33**(3): 195-210.

Lücking R. & A. Vězda (1998): Taxonomic studies in foliicolous species of the genus *Porina* (lichenized Ascomycotina: Trichotheliaceae) II. The *Porina epiphylla* group. — Willdenowia **28**: 181-225.

Matzer M. (1996): Lichenicolous Ascomycetes with fissitunicate asci on foliicolous lichens. — CAB Mycological Papers **171**: 1-202.

Motyka J. (1936-38): Lichenum generis *Usnea* studium monographicum. Pars systematica. — Vols. I & II. Leopoldi. 1-651.

Müller J. (1881): Lichenologische Beiträge XII. — Flora **64**: 81-88, 100-112.

Müller J. (1891): Lichenes. — In: Durand T. & H. Pittier, Primitiae florae costaricensis. Bull. Soc. Roy. Bot. Belg. **30**(1): 49-97.

Müller J. (1893): Lichenes, seconde énumération. — In: Durand T. & H. Pittier, Primitiae florae costaricensis. Bull. Soc. Roy. Bot. Belg. **32**(1): 122-173.

Müller J. (1895): Lichenes exotici III. — Hedwigia **34**: 27-38.

Nelsen M.P., Lücking R., Chaves J.L., Sipman J.H.M., Umaña L. & E. Navarro (2006): A first assessment of the Ticolichen biodiversity inventory in Costa Rica: the genus *Haematomma* (Lecanorales: Lecanoraceae). — Lichenologist **38**(3): 251-262.

Neuwirth G. & K. Pfaller (2006): *Porina pilifera* (Porinaceae), a new foliicolous lichen from Costa Rica (Central America). — Lichenologist **38**(5): 417-420.

Nylander W. (1877): Lichenes. — In: Polakowsky H., Bryophytas et Cormophytas costaricenses anno 1875 lectas. Jour. Bot. **15**: 225-226.

Rivas Plata E., Lücking R., Lumbsch T.H. & J.L. Chaves (2007): Gyrotrema wirthii, a new species of Gyrotrema (Ascomycota: Ostropales: Graphidaceae) from Costa Rica. — Sauteria **15:** 417-420.

Santesson R. (1952): Foliicolous lichens I. A revision of the taxonomy of the obligately foliicolous, lichenized fungi. — Symb. Bot. Upsal. **12**(1): 1-590.

Sérusiaux E. & R. Lücking (2003): The lichen genus *Caprettia* Bat. & H. Maia (Monoblastiaceae). — Bibl. Lichenol. **86**: 161-176.

Staiger B. (2002): Die Flechtenfamilie Graphidaceae. Studien in Richtung einer natürlicheren Gliederung. — Bibl. Lichenol. **85**: 1-526.

Tibell L. (1982): Caliciales of Costa Rica. — Lichenologist **14**(4): 219-254.

Tibell L. (1996): Caliciales. — Flora Neotropica Monograph **69**: 1-78.

Umaña L. & H. Sipman (2002): Líquenes de Costa Rica = Costa Rica Lichens. — INBio, Santo Domingo de Heredia.

Umaña Tenorio L., Sipman H.J.M. & R. Lücking (2002): Preliminary checklist of lichens from Costa Rica. Version 1.2 (june 2002). http://www.fieldmuseum.org/research_collections/botany/botany_sites/ticolichen/checklist.html

Vainio E. (1894): Monographia Cladoniarum Universalis. II. — Acta Soc. Fauna Fl. Fenn. **10**: 1-499.

Weissenhofer A., Huber W., Zamora N., Weber A. & J. González (2001): A brief outline of the Flora and vegetation of the Golfo Dulce region. — Stapfia **78**: 15-24.

Zotz G. (1999): Altitudinal changes in diversity and abundance of non-vascular epiphytes in the tropics an ecophysiological explanation. — Selbyana **20**: 256-260.

Address of author:

Othmar Breuss
Botanische Abteilung
Naturhistorisches Museum
Burgring 7
A-1010 Vienna, Austria
E-mail: obreuss@bg9.at