Sauteria 15, 2008 Contributions in Honour of Volkmar WIRTH 433-458

Notes on poorly known, small cyanobacterial lichens from predominantly wet tropical to subtropical regions

Notizen über kaum bekannte, kleine cyanobakterielle Flechten überwiegend aus den feuchten Tropen und Subtropen

Matthias SCHULTZ & André APTROOT

Key words: cyanobacterial lichens, wet tropics, subtropics.

Schlagwörter: cyanobakterielle Flechten, feuchte Tropen, Subtropen.

Summary: Sixty two species of mostly poorly known cyanobacterial lichens from predominantly wet tropical and subtropical regions are reported. Most records are new entries to the lichen flora of the corresponding country. Disjunctive distribution patterns in tropical to subtropical regions are commonly observed in members of the Lichinaceae.

Zusammenfassung: Zweiundsechzig Arten kaum bekannter cyanobakterieller Flechten aus überwiegend feuchten tropischen bis subtropischen Regionen werden behandelt. Die meisten Nachweise sind Neufunde für die Flechtenflora des jeweiligen Landes. Viele Vertreter der Lichinaceae zeigen disjunkte Verbreitungsmuster in tropischen und subtropischen Regionen.

Introduction

Crustose cyanobacterial lichens (mostly of the Lichinaceae) are among the least-known lichens. In arctic to temperate regions, they are generally not diverse and rarely abundant (perhaps except along the margins of rivers and lakes). In subtropical and especially desert areas, however, they can be very conspicuous often covering large areas of rock and soil. From the (wet) tropics, relatively few species have been recorded so far. The reasons are under-collecting, lack of general taxonomic knowledge and literature. Furthermore, the

growth of saxicolous lichens is limited in forrested areas with little open rock and soil surfaces. In the wet tropics rock surfaces undergo rapid weathering and competition with other organisms (especially mosses, algae, cyanobacteria and phanerogams) is high. An exemption form so-called inselbergs, i.e. remnants of old rocky land surfaces that withstand weathering much longer than the surrounding rock and constitute comparably xeric "islands" in areas with a humid to semi-humid regional climate. Inselbergs are found world-wide in the tropics and many aspects have been studied in detail (see POREMBSKI & BARTHLOTT 2000). There exist a couple of recent publications on lichens of inselbergs that include cyanobacterial ones (BECKER 2002, BÜDEL 1987, BÜDEL et al. 1997, SCHULTZ et al. 2000, UPRETI & BÜDEL 1990, WESSELS & BÜDEL 1989). Certainly, the most prominent representatives of cyanobacterial lichens on inselbergs are species of the genus *Peltula*.

Still, crustose (and dwarf-fruticose) cyanobacterial lichens of the Lichinaceae turn out to be present, albeit in little abundance, in nearly all tropical regions. Interestingly, the only two crustose cyanobacterial lichen species that are known to occur as epiphytes in the wet tropics (e.g. *Lecidopyrenopsis corticola* VAIN. and *Leprocollema nova-caledonianum* A.L. SM.) are members of the Lichinaceae. In contrast to what was so far known about these, and many other species, they turn out to be widely distributed (pantropical), and not rare but with scattered occurrences. Below we present an overview of the crustose and small-fruticose cyanobacterial lichens (mostly Lichinaceae, Peltulaceae, some Collemataceae, but excluding Pannariaceae etc.) recently recorded from predominantly wet tropical and subtropical regions including some gatherings from high-altitude localities. Our enumeration serves mainly to attract attention to these widely distributed but largely neglected taxa in tropical regions. Based on reliable literature records and the observations presented here it is attempted to circumscribe the potential distribution area for a selection of species from the Lichinaceae. However, we are aware that much more data is needed to obtain a more reliable picture of the actual distribution patterns of these lichens.

Material and methods

Most of the specimens were collected by the senior author during field trips to China, Hong Kong & Taiwan, Papua New Guinea, Hawaii, Puerto Rico, Costa Rica and Brazil. Additional collections were made by the first author in Cameroon. Material from various colleagues was sent for identification to the first author: P VAN DEN BOOM (Mexico), F. BUNGARTZ (Galapagos), P. DÖBBELER & J. POELT (Costa Rica) forwarded by W. OBERMAYER, T. FEUERER (Brazil, Bonaire), K. KALB (Australia, Brazil), S. POREMBSKI (and co-workers) (Brazil), A. RAUHUT (India, in herb. B. Büdel), M. SEAWARD (Seychelles), E. SÉRUSIAUX (Madagascar, Rwanda, Uganda), H. SIPMAN (Guyana), H. THÜS (Venezuela) &

C. WETMORE (Dominican Rep., Puerto Rico). A set of unidentified collections made by R.J. HNATIUK on Aldabra kept at BM was forwarded to the first author by M. SEAWARD.

All specimens collected by the second author are preserved in herb. ABL, often with duplicates in herbaria in the country of origin and/or HBG. Specimens were studied with a Zeiss compound microscope and a Wild stereo lens.

Results

Some regions proved to be richer in lichens than others, e.g. many more species are reported here from Taiwan than from Papua New Guinea, although more time was spent in the latter country. Sampling is too scattered to go into more details, but the pattern that emerges is discussed. All species mentioned below are first reports for the respective countries, unless mentioned otherwise.

Enumeration of the taxa

Collema pustulatum (ACH.)

This is an interesting find. The species was hitherto only known from the New World (DEGELIUS 1974). The new record from coral reef rock on Aldabra suggests that the lichen may be much wider distributed in tropical regions with occurences in coastal and island habitats.

Aldabra, Bassin Cabri, on limestone, 26 Aug. 1974, HNATIUK 731868 (BM, dupl. in herb. M. SCHULTZ); Bassin Flamant, on rock, 11 Nov. 1973, HNATIUK 731034-5 (BM, dupl. in herb. M. SCHULTZ); Ile Polymnie, on rock, 10 Nov. 1973, HNATIUK 730987 (BM, dupl. in herb. M. SCHULTZ); Ile Esprit, on limestone, 17 Aug. 1974, HNATIUK 731772 (BM, dupl. in herb. M. SCHULTZ; ster.).

Collema rugosum KREMP.

This species is a widespread epiphyte in the tropics ranging from western Pacific regions to eastern tropical Africa. The record from Cameroon suggest that it is present across tropical Africa. However, it may also be expected from the New World tropics.

Cameroon, Prov. South-West, Buea, beginning of trail to Mount Cameroon just above governmental farm, midsized tree, partly shaded, 1100 m, 10 March 2007, SCHULTZ 20058 (herb. M. SCHULTZ).

Collema texanum TUCK.

This species is rather easily recognized due to the repeatedly furcate and canaliculate, radiating lobes and 2-celled, fusiform ascospores. In South America *Collema texanum* occurs in Paraguay (DEGELIUS 1974). Otherwise, it is fairly

widespread ranging from the Caribbean, Mexico and the southern United States to India, China and Japan.

Venezuela, Edo. Merida, Distr. Sucre, Chiguara, bei der Milchsammelstelle, Finca Antonio Basillio, in einem relativ trockenen Weidewäldchen, 900 m, 2 Aug. 1989, KALB 24065 & MORALES (herb. K. KALB).

Collema thamnodes RIDDLE

This lichen is known only in sterile condition. Nevertheless, it is fairly conspicuous due to the isidiate, subfruticolose thallus. It was hitherto known from Bermuda, Jamaica, Guadeloupe, Marie-Galante, Martinique, Mexico, Colorado, and northern India (DEGELIUS 1974). The new record closes a gap in the distribution of this species suggesting a disjunctive pantropical distribution with preference of coastal or island habitats.

Aldabra, Ile Picard, on rock, 11 July 1973, HNATIUK 730639 (BM, dupl. in herb. M. SCHULTZ).

Digitothyrea polyglossa (NYL.) P. MORENO & EGEA

This species is very distinct when fully developed. It forms closely adpressed rosettes of sparsely furcate, tongue-shaped lobes. The present material consists of juvenile thalli with the tongue-shaped lobes and the branchings being rather short. The species is certainly widespread in Central America and the Caribbean. It is not known to occur in the Old World tropics.

Dominican Rep., Prov. Pedernales, 2 km N of Pedernales, in partly burned pasture on dry limestone with Agave, cactus and scrub, 14 June 1968, WETMORE 17870 (MIN).

Puerto Rico, Distr. Ponce, Guanica, alt. 10 m, on limestone, May 1989, APTROOT 25802 p.p. (accomp. *Psorotichia obpallescens, Thelochroa montinii).*

Ephebe brasiliensis (VAIN.) HENSSEN

This is a robust species with thick main branches. It was re-collected on its *locus classicus* in Brazil. It is remarkable that it remained in this area for at least a century. The records from Sao Paulo (HENSSEN 1963: 56) and from Guyana suggest a wide distribution at least in tropical South America.

Brazil, Minas Gerais, Carassa, alt. 1300 m, on wet sandstone along rivulet, 20 Sept. 1997, APTROOT 41616 (TOPOTYPE).

Guyana, Potaro-Siparuni region, surrounding of village Paramakatoi, 900 m, on granite (?) boulders in river, 24 Feb. 1996, SIPMAN (B 41324).

Ephebe lanata (L.) VAIN.

This species is widely distributed in the northern hemisphere, where it seems to be the dominant species of this group. According to HENSSEN (1963: 44)

the record of *Ephebe lanata* from Patagonia (see ZAHLBRUCKNER 1917: 11) represents *Zahlbrucknerella maritima* HENSSEN.

Taiwan, Hualien Co., Hohuan Shan, alt. 3000 m, on shale on exposed mountain ridge, 12 Oct. 2001, APTROOT 52863.

Ephebe solida BORN.

The determination of *Ephebe* species is very tricky especially when fruiting bodies are absent. The specimens from Madagascar and Venezuela were carefully compared with *Ephebe*-material in HBG annotated by A. HENSSEN. The new records are somewhat surprising because *Ephebe solida* was hitherto only known from North America (HENSSEN 1963). Obviously, the species is much wider distributed with scattered occurrences at high altitudes in the tropics.

Madagascar, Andringitra Mts., Antanifotsi, alt. 1900-2000 m, on rock in stream, 24 Sept. 1994, A. VOJTKO (9463/Y, in ABL).

Venezuela, Sierra Nevada de Merida, outflow of Laguna Victoria in spray zone of the cascades at the road, Dec. 2004, THÜS 11045b (herb. H. THÜS).

Euopsis pulvinata (SCHAER.) NYL.

This record is remarkable since *Euopsis pulvinata* was hitherto only known from arctic-boreal to montane-alpine habitats in Europe, North America and Greenland. Few records exist from continental Europe (e.g. southern Black Forest in Germany). The records published by APTROOT & SEAWARD (1999) belong to *Metamelanea melambola* (TUCK.) HENSSEN (see below). The present high altitude locality in South China suggests comparable conditions as for example in the European arctic-boreal regions.

China, Yunnan, Jianchan Co., Mt. Laojuenshan, alt. 3900–4000 m, on siliceous rock, 18 Oct. 2002, APTROOT 56274.

Gloeoheppia turgida (ACH.) GYELN.

The Aldabra specimens were found growing directly on rock and the squamules were only slightly inflated and fastened to the rocky substrate by a minute umbilicus or stalk. *Gloeoheppia turgida* is a common species on the Canary Islands and occurs across the Mediterranean region, the Arabian Peninsula and Socotra extending into the Irano-Turanian region and farther east to Mongolia. The species is usually found in soil crust communities. However, rock clefts with accumulations of some dust and sand are frequently colonized in arid regions whereas bare, calcareous rock is rarely colonized. *Gloeoheppia turgida* seems to be absent from the arid regions of North, Central and South America. In the New World, suitable habitats are colonized by close relatives such as *Gloeoheppia squamulosa* (ZAHLBR.) M. SCHULTZ, *G. polyspora* HENSSEN or *Pseudopeltula dicyanophora* HENSSEN and *P. myriocarpa* HENSSEN (see SCHULTZ 2007a).

Gloeoheppia turgida has a clear preference for drier climatic conditions. However, numerous records from the Canary Islands as well from southern Europe suggest a wide ecological amplitude. Nonetheless, the record from elevated coral limestone cliffs on Aldabra is somewhat surprising since the atoll is said to receive more than 1.000 mm annual precipitation. However, the overall climatic conditions may be comparable to those found on Socotra Island and the southern coast of the Arabian Peninsula some 3.000 km north where the species is found frequently in the coastal cliffs. Local orographic and climatic conditions with uprising moist air originating from the Arabian Sea may explain this phenomenon.

Aldabra, Takamaka Grove, on rock, 8 Aug. 1974, HNATIUK 731701 (BM, dupl. in herb. M. SCHULTZ); Bassin Flamat, on rock, 14 Nov. 1973, HNATIUK 731035a (BM, dupl. in herb. M. SCHULTZ), Cinque Cases, on rock, 9 Feb. 1974, HNATIUK 733004 (BM, dupl. in herb. M. SCHULTZ; accomp. *Psorotichia* spec.).

Heppia despreauxii (MONT.) TUCK.

This species has a scattered, world-wide distribution occurring in soil crust communities in arid to warm-temperate regions. It has recently been reported from Zimbabwe (BECKER 2002). However, it was hitherto not known to occur in South America.

Paraguay, Gran Chaco, zwischen Filadelfia und Mcal. Estigarribia, in einem von Kakteen durchsetzten Wald, 250 m, 6 June 1980, KALB 35078 (herb. K. KALB).

Lecidopyrenopsis corticola VAIN.

This species was hitherto only known from the type locality on Koh Chang, Thailand. According to the new records, *Lecidopyrenopsis corticola* seems to be a widespread tropical lichen. Due to the small size and general inconspicuousness it may have been overlooked among the various epiphytic lichens that are usually found on coastal trees in the tropics.

Costa Rica, Prov. Limon, Coco-reiche Strandwälder bei Manzanillo, El Puerto Viejo, 0–2 m, 2.3.1990, P. DÖBBELER & J. POELT (GZU, dupl. herb. M. SCHULTZ).

French Guyana, Saül, on bark, alt. 500 m, 1986, Montfoort & Ek (ABL, B, U).

Seychelles, Amirantes, St. Joseph Island, alt. 1 m, on trunk of *Cocos nucifera*, 5 March 2003, HILL L4 (ABL, herb. SEAWARD); Mt. Corgat, alt. 240 m, on bark of planted *Mangifera indica*, 28 Sept. 2000, SEAWARD 067 (ABL, herb. SEAWARD).

Taiwan, Nantou Co., Meifeng, alt. 2000–2100 m, on bark of planted *Cryptomera japonicia*, 9 Oct. 2001, APTROOT 52150.

Lemmopsis arnoldiana (HEPP) ZAHLBR.

This is the first record for this species from E Asia. It was so far only known from Europe and North America. *Lemmopsis arnoldiana* forms dark greenish areolate crusts on bare rock and produces distinctly sessile apothecia with a prominent, dark red to dark reddish brown or brick-coloured proper exciple. The thalline margin is soon receding. The ascospores are 12.5–25 × 7.5–12.5 µm large. Apothecial and ontogenetical characteristics separate this species from other crustose-areolate members of the Lichinaceae such as *Psorotichia*. The Taiwanese specimens agree very well with material of *Lemmopsis arnoldiana* from Central Europe.

Taiwan, Pingtung Co., Fangshan, alt. 20 m, on coastal conglomeratic rock outcrop, 16 Oct. 2001, APTROOT 53071 (accomp. *Stromatella bermudana*, *Pyrenopsis* spec., unidentified cyanolichen).

Lemmopsis pelodes KÖRB. ex B. STEIN

Lemmopsis pelodes is an inconspicuous granulose-crustose species growing ephemeral on sandy clay soil in disturbed sites. It is so far known from the type locality in Silesia, Poland and was later reported from Sweden and Lithuania (see JØRGENSEN & MOTIEJŪNEITĖ 2005). Our Hong Kong material is somewhat tentatively identified as *Lemmopsis pelodes* because of slight deviations mainly in ascospore size and in the shape of the thallus margin of the apothecia. In the type material of *Lemmopsis pelodes* found in B the apothecia have a thin, receding thallus margin, a pale brick-coloured, prominent excipulum proprium and a somewhat concave, dark reddish apothecial disc. According to ELLIS (1981) the ascospore size in *Lemmopsis pelodes* is 17.5–32.5(37.5) × 7.5–15 µm. In the Hong Kong material the apothecia have a dark reddish to dark brick-coloured almost biatorine margin with hardly any thalline margin left which is seen at best in very juvenile apothecia. The apothecial disc is dark reddish brown, ascospores are (13)15–23(25) × 7.5–10 µm large and therefore somewhat smaller than reported by ELLIS (1981) for the type material in WRSL but almost identical with the spore size given by JØRGENSEN & MOTIEJŪNEITĖ (2005) for the Lithuanian material. *Lemmopsis oblongans* (NYL. ex CROMB.) A.L. Sm. is similar. Like *Lemmopsis pelodes* it grows on clay soil and is unknown to occur outside Great Britain. *Lemmopsis oblongans* has ascospores that are at least three times as long as wide and 15–25(27.5) × 5–7.5 µm in size (ELLIS 1981). However, the author also pointed to the fact that many asci in the material studied are degenerate and contain less than eight spores. The apothecia have a prominent, yellowish or brownish or faintly reddish excipulum proprium surrounding a roughly concolorous apothecial disc and an evanescent thalline margin. On comparison with the type material of *Lemmopsis pelodes* in B and *L. oblongans* in BM our Hong Kong material seems to be partly close to each of the two species. ELLIS (1981) also draw much attention to the differences between *Lemmopsis oblongans* and *L.*

arnoldiana (HEPP) ZAHLBR., the latter species being found on calcareous rock and, in our opinion, being rather distinct from the soil living species of the genus. Given the sparse material of *Lemmopsis pelodes* and *L. oblongans* available for study and the lasting uncertainty about the identity of the latter we consider our determination to be provisional. Future studies may reveal whether *Lemmopsis oblongans* and *L. pelodes* are conspecific and the two species display only part of the variation of a rapidly growing early colonizer or whether the two lichens can be satisfactorily separated at species level.

China, Hong Kong, Victoria Peak, alt. 500 m, on soil in mountain forest, June 1998, APTROOT 43608;

Lung Fu Shan, alt. 300 m, on soil between defence works, June 1998, APTROOT 43408 (both collections reported earlier as *Lempholemma chalazanum* by APTROOT & SEAWARD 1999).

Lempholemma chalazanum (ACH.) B. DE LESD.

This lichen is widely distributed in the northern hemisphere. In Central Europe the species is locally common in urban sites where it is found in pavement clefts. *Lempholemma chalazanum* is also known from and India.

Taiwan, Hualien Co., Hohuan Shan, alt. 3000 m, on soil in garden of field station, 12 Oct. 2001, APTROOT 52733.

Lempholemma lingulatum (TUCK.) HENSSEN

This is a conspicuous species due to its tongue-shaped lobes. Young thalli appear squamulose and there are only few, short lobes. Old thalli such as the type collection in FH and BM are distinctly lobate with the lobes being elongated, branched and distinctly tongue-shaped.

The species seems to be common in the Caribbean. It colonizes exposed coastal limestone cliffs.

Dominican Rep., Prov. Independencia, 3 km W of Duverge at road to Jimani, steep N slope, 12 June 1968, WETMORE 17807 (MIN) (accomp. *Psorotichia obpallescens*); Prov. Pedernales, about 20 km E of Pedernales on karst limestone in low mountains along road in cactus-thorn scrub, 13 June 1968, WETMORE 17863 (MIN); 15 km E of Pedernales in karst limestone area near road, with cactus, lignum vitae and scrub, 200 ft., 14 June 1968, WETMORE 17886 (MIN) (accomp. *Collema* spec.).

Puerto Rico, Guanica State Forest 9.8 km from Guanica on highway 333, on rocks along shore with scrub plants, 20 ft, 5 July 1968, WETMORE 18048 (MIN) (accomp. *Thelochroa montinii).*

Lempholemma polycarpum M. SCHULTZ

This lichen was recently described from limestone outcrops in forest remnants in the extensions of the Dhofar Mountains in south-eastern Yemen (SCHULTZ 2005a). The new records from Aldabra and Madagascar are not surprising due to the rather similar climatic and substrate conditions. The record from Puerto Rica is somewhat vague since the thallus rosettes are rather small and juvenile and no mature fruiting bodies where observed. However, the *Nostoc*-photobiont, the thallus anatomy and the presence and type of the pycnidia that later may be transformed into apothecia are characteristic.

The species is rather conspicuous due to its lobate rosettes which are soon covered by very abundant apothecia. The apothecia remain immersed or become only slightly elevated above thallus level. The apothecial discs remain punctiform or become only slightly opened. At first glance this lichen may be mistaken for either a species of *Collema*, *Leptogium*, *Digitothyrea* or *Thyrea*. However, the presence of *Nostoc* photobionts, simple ascospores and prototunicate asci are diagnostic features.

Aldabra, on rock near site AB 75 (?GIONNET), 6 Oct. 1974, HNATIUK 731958 (BM, dupl. in herb. M. SCHULTZ).

Madagascar, Réserve des Tsingy de Bemahara 17 km N de Bekopaka, 300 m, lapiaz déchiquetés, partie sommitale, Aug. 2003, SÉRUSIAUX (LG) (accomp. *Paulia perforata).*

Puerto Rico, in Guanica State Forest 8.6 km from Guanica, gentle S facing slope on karst limestone with cactus-thorn scrub, 50 ft, 5 July 1968, WETMORE 18038 (MIN); Distr. Ponce, Reserva Forestal de Guanica, road 333, km 7.9, dry scrub forest on limestone, 10 m, 21–31 Mar. 1989, APTROOT 25794.

Lempholemma spec.

This species belongs to the critical group around *Lempholemma botryosum* (A. MASSAL.) ZAHLBR., *L. isidiodes* (ARNOLD) H. MAGN., *L. dispansum* H. MAGN., *L. cladodes* (TUCK.) ZAHLBR. and *L. condensatum* (ARNOLD) ZAHLBR. The material from Puerto Rico formes minute rosettes composed of short, entire to once furcate, ± cylindrical lobules. Usually there are abundant globose isidia.

Costa Rica, Prov. Guanacaste, Barra Honda, alt. 450–500 m, on limestone, 22 March 2004, APTROOT 60804; 60808.

Leprocollema americanum VAIN.

This is the first record from outside America, and also the first record in a century or so. The material from Taiwan matches the type in TUR. The species was found on mortar of an old (Dutch) brick fortress, a much overlooked type of habitat in the tropics. Another two recent collection were made by P. VAN DEN BOOM in Baja California Sur. The species forms irregularly areolate-crustose

thalli with sessile apothecia with a thick, brick-coloured excipulum proprium surrounding a multiply divided, rough disc.

Mexico, Baja California Sur, SE of La Paz, road San Pedro to Los Barriles, near San Antonia, small valley with steep strong slope along dry stream near road, 400 m, 10 July 2000, VAN DEN BOOM 24765, 24767 (herb. V.D. BOOM).

Taiwan, Tainan Co., Anping, Fort Zeelandia, on mortar of fortress, 15 Oct. 2001, APTROOT 53006, 53008.

Leprocollema nova-caledonianum A.L. SM.

The genus *Leprocollema* used to be treated in the Collemataceae due to the presence of filamentous, *Nostoc*-like photobionts (ZAHLBRUCKNER 1926). As pointed out earlier by ELLIS (1981) the photobiont in *Leprocollema americanum* VAIN. is not a filamentous cyanobacterium. It is a single-celled cyanobacterium forming very small, clustered cells under lichenized condition. The same is also true for material of *Leprocollema americanum* reported in this publication as well as for the corticolous collections of *L. nova-caledonianum* cited below.

The thallus anatomy is small-celled paraplectenchymatous and ecorticate. The photobiont is a single-celled cyanobacterium with very thin gelatinous sheaths. The thallus is dark green, granulose-crustose becoming thick with age. The ascoma initials are very small, globose and soon sorrounded by a thin wall of interwoven hyphae. The primary paraphyses are very slender, much branched and anastomosing. The apothecial discs become soon visible as pale brownish spots. Later, the discs are open and brown surrounded by a distinct, pale brown or wax-coloured proper margin. The thalline margin is soon receding and therefore the lichen resembles certain small species of *Leptogium*. The type of *Lemmopsis nova-caledonianum* could not be traced in BM though an empty envelope was found. This is one of two, apparently widespread tropical, corticolous crustose cyanobacterial lichens of the Lichinaceae.

Chagos, Eagle Island, alt. 1 m, on husks of *Cocos nucifera*, 15 March 1996, SEAWARD (ABL, herb. SEAWARD).

Costa Rica, Prov. Limón, Playa Manzanillo, alt. 1 m, on roots of *Cocos nucifera*, 11 march 2004, APTROOT 60303.

Thailand, Khiri Khan Prov., Khir Khan, alt. 1 m, on coastal shrub, 7 Jan. 1993, AGUIRRE-HUDSON, JAMES & WOLSELEY 2027 (ABL, BM); Uthai Thani Prov., Khao Kiew, alt. 1150 m, on tree, 7 Jan. 1992, AGUIRRE-HUDSON & WOLSELEY 5048 (ABL, BM).

Leprocollema spec. 1

This seems to be a new species. It has a very thin, smooth to cracked, crustose thallus with immersed to semi-immersed apothecia. The apothecial discs

are dark red and distinctly umbonate. This species will be dealt with in detail in a forthcoming publication.

China, Hong Kong, Lung Fu Shan, alt. 300 m, on brick of defence works, June 1998, APTROOT 43415 (reported earlier as *Lempholemma chalazanum* by APTROOT & SEAWARD 1999).

Leprocollema spec. 2

This is a very unusual lichen and it seems to be a new species as well. There is no external thallus discernable but cyanobacteria grow abundantly directly below the surface of the coral reef rock. The apothecia are quite conspicuous, 0.45–0.75 mm in size remaining completely immersed. The apothecial discs are pale brick coloured, distinctly umbonate and surrounded by flat, pale excipulum proprium.

Due to the lacking thallus this remarkable lichen appears to be close to *Psorotichia obpallescens*. The latter, however, has distinctly sessile apothecia. Due to the immersed apothecia the species is also close to *Leprocollema* spec. 1 treated above.

Papua New Guinea, Madang Prov., near Gogol river bridge, 17 km S of Madang along road to Lae, on raised coral reef, alt. 10 m, 15 Aug. 1992, APTROOT 33279.

Lichinella minnesotensis (FINK) ESSL.

This species is fairly widespread in the American SW (SCHULTZ 2005b) and it is likely to be present across the Caribbean. The species forms small, squamulsoe thalli growing directly on rock

Puerto Rico, in Guanica State Forest 5.15 km from Guanica on highway 333, on gentle S facing slope on karst limestone with cactus and scrub, 50 ft, 5 July 1968, WETMORE 18020 (MIN) (accomp. *Pseudopeltula dicyanophora, Psorotichia obpallescens);* WETMORE 18021 (MIN).

Lichinella spec.

This lichen is most probably new but our material is too scarce to serve as holotype. It belongs to those members of the genus having large, lobate, deeply branched thalli (traditionally referred to *Gonohymenia).* The species is fairly close to *Lichinella nigritella* (LETTAU) P. MORENO & EGEA. It differs, however, in the substrate (soil!) and more slender, erect and subcylindrical branches. The thallinocarpous fruiting bodies are situated terminally on the lobes. Partial hymenia are usually present adding to the similarities with *L. nigritella* and *L. cribellifera.* The east-Asian species *L. hondoana* (ZAHLBR.) P. MORENO & EGEA differs in the preference for rocky substrate. In growth form *L. hondoana* is even closer to *L. nigritella* and perhaps just a variation of the latter.

This is an interesting and fairly conspicuous foliose-fruticose soil lichen which should be searched for.

China, Yunnan Prov., Lunan Co. near Shilin Stone Forest, alt. 1900 m, on calcareous soil, 27 Oct. 2002, APTROOT 56962.

Metamelanea melambola (TUCK.) HENSSEN

This lichen was originally described from Alabama, U.S.A. (see HENSSEN 1989) and was later reported from Venezuela (SCHULTZ et al. 2000). *Metamelanea* species are fairly remarkable due to the peculiar thallus structure: angulate thallus areoles composed of densely aggregated, vertically growing lobes or packets. The apothecia are immersed with a multiply divided dark brownish to blackish disc. One of us (M.S.) is aware of a collection from southern Yemen that may belong here as well. The material from Uganda is sterile and thus the determination remains somewhat uncertain. With the new records the species shows a disjunctive world-wide distribution – a typical pattern of distribution in the Lichinaceae.

China, Hong Kong, Lung Fu Shan, alt. 200 m, on wet granite along stream, June 1998, APTROOT 43096; Pok Fu Lam, alt. 200 m, on wet granite along mountain stream, June 1988, APTROOT 43700 (both collections reported earlier as *Euopsis pulvinata* by APTROOT & SEAWARD 1999).

Uganda, Hoima adminis. region, eastern side of Lake Albert, road Biso-Hoima, track to the lake shore (hot springs) from Kibiro, granitic outcrops in sparsely wooded savanna, 915 m, Oct. 2005, SÉRUSIAUX (LG) (sterile; accomp. *Peltula placodizans).*

Paulia aldabrensis HENSSEN

Being described from Aldabra this lichen has been reported from Socotra (SCHULTZ et al. 1999, SCHULTZ & MIES 2002) and it is also known from Mainland Yemen (unpublished records) and Queensland, Australia. This suggests a disjunctive paleotropic distribution. The present material is very well developed with some specimens approaching the size of *P. perforata* but lacking the conspicuously imbricate lobules of the latter.

Aldabra, Bassin Cabri, on rock, 11 Mar. 1974, HNATIUK 731255 (BM, dupl. in herb. M. SCHULTZ), Gionnet, on rock, 8 Oct. 1974, HNATIUK 731854 (BM, dupl. in herb. M. SCHULTZ), near Cinque Cases Well, on rock, 26 Sep. 1973, HNATIUK 733003 (BM, dupl. in herb. M. SCHULTZ).

Paulia gibbosa HENSSEN

This species was described from coastal limestone cliffs on Bermuda and, therefore, the record from Puerto Rico is not surprising. It is however, also known from granite inselbergs at the Orinoco in Venezuela (SCHULTZ et al.

2000). The new locality on the Minloa inselberg in Cameroon was found to be very similar to the Venezuelan localities. It remains to be seen whether this species is restricted to tropical and subtropical regions on both sides of the Atlantic Ocean.

Cameroon, Prov. Centre, western outskirts of Yaundé, Minloa Inselberg, on SW-exposed, 30° inclined, smooth granite rock surface, 890 m, 28 Feb. 2007, SCHULTZ 20001, 20008 (herb. M. SCHULTZ, dupl. YA).

Puerto Rico, Distr. Aguadilla, Guajataca, alt. 200 m, on limestone, May 1989, APTROOT 25750.

Paulia nitidula (MÜLL. ARG.) M. SCHULTZ

These records widen the known distribution area of *Paulia nitidula* considerably. So far, the species was known from its type locality on Socotra and a few collections from South Yemen (unpublished). According to SCHULTZ & BÜDEL (2002) *Paulia schroederi* (ZAHLBR.) HENSSEN – described from Kenya – may be conspecific with *P. nitidula*. The distribution area of *P. nitidula* seems to resemble that of *P aldabrensis* and *P. perforata*.

Aldabra, Dune de Messe, on limestone, 28 Aug. 1973, HNATIUK 731045 (BM, dupl. herb. M. SCHULTZ) (originally identified by M.S. as *P. schroederi).*

Australia, Northern Territory, Gregory National Park, ca. 31 km S von Timber Creek, 110 m, 10 Aug. 1995, KALB 30717 (herb. K. KALB) (accomp. *Psorotichia* spec.).

Hawaii, Oahu Island, Honolulu, Diamond Head Crater, alt. 100 m, on volcanic rock, June 1989, APTROOT 26269.

Taiwan, Pingtung Co., Fangshan, alt. 20 m, on coastal conglomeratic rock outcrop, 16 Oct. 2001, APTROOT 53068.

Paulia perforata (PERS.) ASAHINA

Paulia perforata is fairly conspicuous due to its rosette-shaped thallus composed of numerous densely imbricate lobules. The rosettes may reach a size up to 20 mm. The species seems to have the same distribution range like *Paulia nitidula* and *P. aldabrensis*. So far, records exist from the Mariana Islands, Indonesia, southern Mainland Yemen and Socotra.

Madagascar, Réserve des Tsingy de Bemahara 17 km N de Bekopaka, 300 m, lapiaz déchiquetés, partie sommitale, Aug. 2003, SÉRUSIAUX (LG) (accomp. *Lempholemma polycarpum).*

Paulia stipitata HENSSEN

This seems to be the smallest of the *Paulia* species. The thallus is fastened to the substrate by a rather conspicuous stipe. The squamules are roundish, convex with some immersed to semi-immersed apothecia. *Paulia stipitata* was so

far only known from Puerto Rico, however, it may be found on coastal limestone cliffs across the Caribbean.

Bonaire, costal limestone cliffs, 30 Sept. 2005, FEUERER (HBG).

Peltula auriculata BÜDEL, M. SCHULTZ & GRÖGER

Peltula auriculata is unlikely to be confused with other species of *Peltula* due to its remarkable lobes with ear-shaped appendices. It was first recorded from several granite inselbergs in southern Venezuela and Guyana (SCHULTZ et al. 2000). Later, it was reported from Baja California Sur (BÜDEL & NASH 2002). This is the first record from the Old World suggesting a similar distribution than many other species of *Peltula* found on inselbergs and comparable sites.

Brazil, Est. Roraima, 23 km S of Boa Vista, close to Cerra da Cantá, foot of granite inselberg in dense forest, c. 150 m, 11 Feb. 1997, FEUERER (HBG) (accomp. *Peltula tortuosa).*

Cameroon, Prov. Centre, western outskirts of Yaundé, Minloa Inselberg, on SW-exposed, 30° inclined, smooth granite rock surface, 890 m, 28 Feb. 2007, SCHULTZ 20005 (herb. M. SCHULTZ, dupl. YA); Prov. Sud, Lobé Falls 7 km S of Kribi, on periodically inundated or moistened siliceous rock at water fall, relatively exposed, 25 m, 7 Mar. 2007, SCHULTZ 20043 (herb. M. SCHULTZ, dupl. YA).

Peltula boletiformis (HUE) HENSSEN & BÜDEL

This species was hitherto only known from a few localities in central to southern Africa. The thallis is composed of small, clavate to tongue-shaped or inversely bell-shaped lobules.

Brazil, Est. Bahia, Südufer des Rio Sao Francisco, ca. 38 km NNW von Paulo Afonso, in einem von Kakteen durchsetzten, lockeren Dornbusch-Gestrüpp 300 m, 30 July 1993, KALB 26912, 26930 & 26931 (herb. K. KALB) (accomp. *Pterygiopsis guyanensis).*

Peltula clavata (KREMP.) WETMORE

So far, the Taiwanese records remain to be the only ones from Asia. *Peltula clavata* is fairly conspicuous due to the presence of erect, clavate, hollow lobules that may become isidiate in the apical parts.

Australia, Queensland, etwa 20 km südlich von Townsville, an Granitfelsblöcken in einem sehr lichten Eucalyptus-Wald, 150 m, 21 Aug. 1988, KALB 19229 & 19758 (accomp. *Porocyphus lichinelloides)* (herb. K. KALB).

Rwanda, Prov. Kibungo, quarzitic outcrops at Nyarubuye with scattered trees vegetation, 1800 m, 10 Apr. 2005, SÉRUSIAUX (LG).

Taiwan, Tiachung Co., Kukwan, alt. 700 m, on shale along the road, 20 Oct. 2001, APTROOT 53522.

Peltula congregata (NYL.) SWINSC. & KROG

This species is widely distributed in Africa, Asia and South America. The thallus is composed on numerous fruticose-squamulose, flattened lobules that are widened at the apices.

Brazil, Est. Espirito Santo, near Nova Venez., Pedra do Elephanto, granitic outcrop, on exposed rock, c. 150 m, 11 Apr. 1996, POREMBSKI 2903, MARTINELLI & LEITMAN (RB 321983); Est. Permambuco, Brejo da Madre de Deus, rock outcrop at the N shore of the Sitio Oítis dam, 560 m, 11 Nov. 1999, KRAUS 267 & LIEBIG (PEUFR 30136); Est. Minas Gerais, c. 10 km N of Serra dos Aimorés, granitic rock outcrop, fringing a Vellozia-mat, c. 250 m, 10 Apr. 1996, POREMBSKI 2893, MARTINELLI & LEITMAN (RB 321977).

Peltula euploca (ACH.) POELT

This is very common and widespread species in tropical, subtropical and warm temperate regions. It is characterized by squamulose-peltate, sorediate thalli.

Brazil, Est. Pernambuco, wenige km S von Serra Talhada, in einem Dornbuschwald, 650 m, 29 July 1993, KALB 26908, 27071 & 27072 (accomp. *Peltula placodizans)*, 27070 (accomp. *Peltula placodizans, Pyrenopsis* spec.) (herb. K. KALB); Est. Bahia, Südufer des Rio Sao Francisco, ca. 80km NW von Paulo Afonso, in einem Dornbusch-Gestrüpp mit ± offenen Sandsteinfelsen, 350 m, 30 July 1993, KALB 26916 (accomp. *Peltula impressa)* (herb. K. KALB).

Uganda, Hoima adminis. region, eastern side of Lake Albert, road Biso-Hoima, track to the lake shore (hot springs) from Kibiro, granitic outcrops in sparsely wooded savanna, 915 m, Oct. 2005, SÉRUSIAUX (LG) (accomp. *Peltula placodizans, Synalissa* spec., *Porocyphus dimorphus);* Masindi adminis. region, Murchinson Falls National Park, on top of the Nile falls, granitic outcrops near the falls in sparsely wooded grasslands, 655-660 m, 15 Oct. 2005, SÉRUSIAUX (LG) (accomp. *Peltula placodizans).*

Peltula impressa (VAIN.) SWINSC. & KROG

This species resembles *Peltula placodizans* (ZAHLBR.) Wetmore in the effigurate-placodioid thallus. For separation see BÜDEL (1987). It was hitherto known from central to southern Africa, Mainland Yemen and Socotra as well as from Australia.

Brazil, Est. Bahia, Südufer des Rio Sao Francisco, ca. 80km NW von Paulo Afonso, in einem Dornbusch-Gestrüpp mit ± offenen Sandsteinfelsen, 350 m, 30 July 1993, KALB 26914 & 26916 (accomp. *Peltula euploca)* (herb. K. KALB).

Peltula lingulata (VAIN.) SWINSC. & KROG

This lichen is mainly characterized by its dark olive, erect, tongue-shaped, squamulose to subfruticose thalli. It is known from central to southern Africa and South America.

Uganda, Masindi adminis. region, Murchinson Falls National Park, on top of the Nile falls, granitic outcrops near the falls in sparsely wooded grasslands, 655-660 m, 15 Oct. 2005, SÉRUSIAUX (LG) (accomp. *Peltula placodizans*, *Synalissa* spec., *Pyrenopsis triptococca).*

Peltula obscurans (NYL.) GYELN.

This is a common species in desert or semi-desert habitats. However, it may also occur in wet tropical regions wherever suitable dry microhabitats are found (see also SCHULTZ et al. 2000). It is also known from warm-temperate regions.

Puerto Rico, Distr. Ponce, Guanica, alt. 10 m, on limestone, May 1989, APTROOT 25795.

Peltula placodizans (ZAHLBR.) WETMORE

This is a widespread species in tropical and subtropical regions. The thallus is areolate-squamulose with an effigurate margin. Sometimes, soralia are formed at the tips of the central areoles.

Brazil, Est. Pernambuco, Brejo da Madre de Deus, rock outcrop at the N shore of the Sitio Oítis dam, Alt. 560 m, 16 Nov. 1999, KRAUSE 268 & LIEBIG (PEUFR 30004); wenige km S von Serra Talhada, in einem Dornbuschwald, 650 m, 29 July 1993, KALB 27071 & 27072 (accomp. *Peltula euploca)*, 27070 (accomp. *Peltula euploca*, *Pyrenopsis* spec.).

Papua New Guinea, Mandang Prov., Ramu valley, 10 km W of Ramu Sugar factory, on conglomerate boulders in grassland, 100 m, 30 Oct. 1995, APTROOT 38825.

Uganda, Hoima adminis. region, eastern side of Lake Albert, road Biso-Hoima, track to the lake shore (hot springs) from Kibiro, granitic outcrops in sparsely wooded savanna, 915 m, Oct. 2005, SÉRUSIAUX (LG) (accomp. *Metamelanea melambola);* Masindi adminis. region, Murchinson Falls National Park, on top of the Nile falls, granitic outcrops near the falls in sparsely wooded grasslands, 655–660 m, 15 Oct. 2005, SÉRUSIAUX (LG) (accomp. *Peltula lingulata*, *Synalissa* spec., *Pyrenopsis triptococca).*

Peltula tortuosa (NEES) WETMORE

This is a common species widely distributed on rocky substrates such as rock pools in the tropics extending into subtropical regions. The thallus is composed of numerous erect, contorted lobules.

Brazil, Est. Roraima, 23 km S of Boa Vista, close to Cerra da Cantá, foot of granite inselberg in dense forest, c. 150 m, 11 Feb. 1997, FEUERER (accomp. *Peltula auriculata, Psorotichia polyspora, Pterygiopsis atra)*; Est. Espirito Santo, near Pancas, granitic rock outcrop, on exposed rock, c. 750 m, 11 Apr. 1996, POREMBSKI 2940, MARTINELLI & LEITMAN (RB 321995); Est. Minas Gerais, c. 10 km N of Serra dos Aimorés, granitic rock outcrop, on exposed rock below Vellozia-mat, c. 300 m, 10 Apr. 1996, POREMBSKI 2901, MARTINELLI & LEITMAN (RB 321982); Est. Pernambuco, Bezerros, Pedra pintada - Serra Negra de Bezerros, 795 m, 16 Oct. 1999, KRAUSE 245 & LIEBIG (PEUFR 30134); Alagoinha, rock outcrop at ca. 700 m SW of the fazenda Morros, 750 m, 28 Sept. 1999, KRAUSE 202 & LIEBIG (PEUFR 30109); Serra de Borborema, oberhalb Triunfo, ca. 30 km NE von Serra Talhada, in einem lockeren Cerrado bzw. an offenen Felsen, 1150 m, 28 July 1993, KALB 27062 (herb. K. KALB) (accomp. *Pyrenopsis* spec.).

Phylliscidium monophyllum (KREMP.) FORSS.

This species was described from Brazil and later reported from Venezuela and French Guiana (SCHULTZ et al. 2000). The new records from India suggest a disjunctive, pantropical distribution on inselbergs and similar localities. At first glance the lichen may be mistaken for a species of *Phylliscum*. However, it differs from the latter in the dense thallus anatomy with a fan-shaped hyphal pattern in juvenile thallus parts and a large-celled paraplectenchymatous anatomy in older thallus parts. The apothecial development starts with ascogones beneath pycnidia (pycnoascocarps).

India, Orissa, Khorda Distr., Dhauli Hills, on W-exposed quartzite (?) rock, 50 m, 22 Feb. 2003, RAUHUT 7, 8 (herb. B. BÜDEL) (accomp. by *Pyrenopsis* spec.); Kerala, Calicut Distr., Kozhiparram water falls, on fully exposed mica schist boulders along the river bed, 450 m, 12 Feb. 2003, RAUHUT 2 (herb. B. BÜDEL).

Phylliscum testudineum HENSSEN

This species was hitherto known from Brazil, Venezuela, Ivory Coast and Hong Kong. It seems to be rare but widespread in the tropics occurring on inselbergs and similar sites.

Australia, Queensland, a few km SE of Townsville, basal outcrops in an Eucalyptus forest with frequent fires, 30 m, 22 Aug. 2002, KALB 35075 & 35076 (accomp. *Porocyphus lichinelloides*) (herb. K. KALB).

Cameroon, Prov. Centre, western outskirts of Yaundé, Minloa Inselberg, on SW-exposed, 30° inclined, smooth granite rock surface, 890 m, 28 Feb. 2007, SCHULTZ 20003 (herb. M. SCHULTZ, dupl. YA).

India, Orissa, Ganjam Distr., close to Maniakati Village, Danthinga, 85 m, 23 Feb. 2003, RAUHUT 11 (herb. B. BÜDEL).

Phylliscum spec.

This is most probably a new species. It does not fit to any other of the species described in the genus. The presence of pycnoascocarps, 8-spored asci, paraphyses, rounded ascus tips and the lack of periphysoids characterze the species as a member of the *P. macrosporum*-group. The separation of the members of the *P. macrosporum*-group from species of *Anema* is tricky and based on rather weak characters: *Phylliscum* – reddish gelatinous sheath, K+ purple, *Anema* – yellowish brown, K-. However, *Anema* spp. usually have wide open discs and a slightly different hyphal anatomy, whereas in *Phylliscum* the apothecial disc are often punctiform.

India, Orissa, Khorda Distr., Dhauli Hills, on metamorphic sandstone in half shade, 50 m, 19 Feb. 2003, RAUHUT 3 (herb. B. BÜDEL); on quartzite, S-exposed, 22 Feb. 2003, RAUHUT 6 (herb. B. BÜDEL).

Puerto Rico, Distr. Ponce, Guanica, alt. 10 m, on limestone, May 1989, APTROOT 25793.

Porocyphus lichinelloides HENSSEN

This lichen is rather conspicuous due to its dwarf-fruticose growth form (see SCHULTZ 2007b, p. 506, fig. 5). It was described by HENSSEN (1963) from Western Australia and was later reported from Papua New Guinea (APTROOT et al. 1997). *Porocyphus dimorphus* is rather similar and was recently recorded from Uganda and Namibia (SCHULTZ 2007b).

Australia, Queensland, etwa 20 km südlich von Townsville, an Granitfelsblöcken in einem sehr lichten Eucalyptus-Wald, 150 m, 21 Aug. 1988, KALB 19229 & 19758 (accomp. *Peltula clavata)*, 19748 & 19760 (accomp. *Pterygiopsis guyanensis)* (herb. K. KALB); a few km SE of Townsville, basal outcrops in an Eucalyptus forest with frequent fires, 30 m, 22 Aug. 2002, KALB 35075 & 35076 (accomp. *Phylliscum testudineum)* (herb. K. KALB).

Pseudopeltula dicyanophora HENSSEN

This is a dark olive, squamulose lichen with immersed dark red apothecia growing on coastal limestone cliffs in the Caribbean.

Puerto Rico, in Guanica State Forest 5.15 km from Guanica on highway 333, on gentle S facing slope on karst limestone with cactus and scrub, 50 ft, 5 July 1968, WETMORE 18020 (MIN) (accomp. *Lichinella minnesotensis).*

Pseudopeltula myriocarpa HENSSEN

A remarkable species that is unlikely to be confused with any other member of *Pseudopeltula*, *Gloeoheppia*, *Heppia* or *Peltula*. The thallus of *Pseudopeltula myriocarpa* has an olive colour and is squamulose-peltate. Mature apothecia are large, immersed with a widely open, multiply divided, reddish brown disc.

Pseudopeltula myriocarpa was so far only known from two localities in southern Mexico.

Puerto Rico, Distr. Ponce, Guanica, alt. 10 m, on limestone, May 1989, APTROOT 25792; 25798; 25802 p.p.

Psorotichia hassei FINK

Psorotichia hassei is quite common in the American Southwest and was recently reported from Socotra (SCHULTZ & MIES 2003) and the Canary Islands (SCHULTZ & VAN DEN BOOM 2007). The species is quite distinct due to the areoles which are composed of isidia-like outgrowths.

Aldabra, Bassin Cabri, on limestone, 26 Aug. 1974, HNATIUK 731869 (BM, dupl. in herb. M. SCHULTZ)

Seychelles, Anse Vars, open ridge, Mar 1973, leg. ? (BM).

Psorotichia murorum A. MASSAL.

This species is characterized by a granulose to areolate-crustose thallus with usually abundant, sometimes crowded small apothecia. Both collections match the type material of Massalongo, Lich. Ital. no. 300 in UPS fairly well.

Galapagos, Santa Cruz Island, Puerto Ayora, CDRS, on concrete, 1 m, 15 Feb. 2006, BUNGARTZ 3967 (CDRS).

Taiwan, Taipei Co, Sanji, alt. 0-5 m, on volcanic rock at the seashore, 22 Oct. 2001, APTROOT 53572 p.p.

Psorotichia obpallescens (NYL.) FORSS.

This is a remarkable species. The lichen seems to consist only of scattered to crowded sessile apothecia. The thallus is virtually absent as already pointed out by NYLANDER (1883) in his diagnosis: "Thallus evanescens vel nullus (sine microscopio) visibilis" The apothecia are roundish, sessile and have a multiply divided discs surrounded by a thick, paraplectenchymatous proper exciple. The thalline exciple is soon receding. Taking these observations together it becomes obvious that *Psorotichia obpallescens* can hardly be accommodated in the genus *Psorotichia* as used today. Due to the multiply divided discs the species approaches the genus *Leprocollema* with the type species *L. americanum*. However, the general structure, shape and development bring it also very close to *Lemmopsis*. Unfortunately, *Leprocollema* itself may fall under the variation of *Lemmopsis*. Therefore, we refrain from any nomenclatural changes at this stage until the status and relationship of *Lemmopsis* and *Leprocollema* have been settled.

Dominican Rep., Prov. Independencia, 3 km W of Duverge at road to Jimani, steep N slope, 12 June 1968, WETMORE 17807 (MIN) (accomp. *Lempholemma lingulatum).*

Puerto Rico, Distr. Ponce, Guanica, alt. 10 m, on limestone, May 1989, APTROOT 25802 p.p. (accomp. juv. *Digitothyrea polyglossa, Thelochroa montinii);* in Guanica State Forest 5.15 km from Guanica on highway 333, on gentle S facing slope on karst limestone with cactus and scrub, 50 ft, 5 July 1968, WETMORE 18020 (MIN) (accomp. *Lichinella minnesotensis).*

Psorotichia polyspora M. SCHULTZ & BÜDEL

This species was described from inselbergs in Venezuela and later identified among material collected by Mark SEAWARD on the Seychelles. The present Brazilian material matches the type-collection in all aspects with the small sessile apothecia and the polysporous asci as main distinguishing characteristics. Interestingly, *Psorotichia polyspora* did not cluster together with *P. murorum* A. MASSAL. and *P. schaereri* (A. MASSAL.) ARNOLD in ncSSU sequence data analyses (see SCHULTZ & BÜDEL 2003). In fact, the polysporous asci, the non-amyloid hymenium and the very small-celled thallus anatomy are similarities to certain members of *Pterygiopsis*, especially those not having pycnoascocarps.

Brazil, Est. Roraima, 23 km S of Boa Vista, close to Cerra da Cantá, foot of granite inselberg in dense forest, c. 150 m, 11 Feb. 1997, FEUERER (HBG) (accomp. *Peltula tortuosa).*

Seychelles, Trail to Anse Lascars Silhouette, 40 m, 29 July 2000, SEAWARD (herb. M. SEAWARD).

Psorotichia schaereri (A. MASSAL.) ARNOLD

The identity of this specimen is slightly uncertain. The species is reported with certainty only from Europe and N. America.

Taiwan, Taichung Co., Taichung, on sandstone in *Citrus* garden, 7 Oct. 2001, APTROOT 51739.

Psorotichia vermiculata (NYL.) FORSS.

This specimen agrees in all aspects with original material distributed by Lojka from Romania as well as with material collected by HANDEL-MAZZETTI in the Middle East.

The species shows close affinities to members of *Metamelanea.* The apothecia are sunken, broadly opened with a multiply divided disc.

China, Yunnan, Lijiang, alt. 2500-2600 m, on dolomitic limestone, 20 Oct. 2002, APTROOT 56114.

Pterygiopsis atra VAIN.

The species has been described from Minas Gerais, Brazil and was later reported from south-western North America (see SCHULTZ 2006). It is mainly

characterized by an areolate thallus with effigurate margin and a small-celled, vertical fan-shaped thallus anatomy.

Brazil, Est. Roraima, 23 km S of Boa Vista, close to Cerra da Cantá, foot of granite inselberg in dense forest, c. 150 m, 11 Feb. 1997, FEUERER (HBG) (accomp. *Peltula tortuosa).*

Pterygiopsis guyanensis M. SCHULTZ, POREMBSKI & BÜDEL

Pterygiopsis guyanensis differs from the preceding species in the presence of cylindrical to coralloid isidia and the type of ascoma ontogeny (pycnoascocarps). It was originally described from Guyana but is obviously much wider distributed.

Australia, Queensland, etwa 20 km südlich von Townsville, an Granitfelsblöcken in einem sehr lichten Eucalyptus-Wald, 150 m, 21 Aug. 1988, KALB 19230 (accomp. *Peltula* cf. *impressa, Pyrenopsis triptococca)* & 19233 (accomp. *Peltula* cf. *impressa, Caloplaca),* 19748 & 19760 (accomp. *Porocyphus lichinelloides),* 19743 (accomp. *Pyrenopsis* spec.) (herb. K. KALB).

Brazil, Est. Bahia, Südufer des Rio Sao Francisco, ca. 38 km NNW von Paulo Afonso, in einem von Kakteen durchsetzten, lockeren Dornbusch-Gestrüpp 300 m, 30 July 1993, KALB 26912, 26930, 26931 (accomp. *Peltula boletiformis*), 27705 (accomp. *Phylliscum* spec.) (herb. K. KALB).

Cameroon, Prov. Centre, western outskirts of Yaundé, Minloa Inselberg, on SW-exposed, 30° inclined, smooth and hard siliceous rock surface, 890 m, 28 Feb. 2007, SCHULTZ 20004 (herb. M. SCHULTZ, dupl. YA).

Pyrenopsis picina (NYL.) FORSS.

This lichen forms very thin, rimose-areolate crusts with very small, very flat apothecia. The apothecial disc is small, punctiform to slightly opened and black. The asci contain ca. 16 subglobose to broad ellipsoid spore, 3–5 × 3–4 µm. There are only few species in *Pyrenopsis* having polysporous asci: *P. grummulifera* NYL., *P. pleiobola* NYL. and *P. separans* HULTING the latter being dubious because of the lack of paraphyses and, therefore, probably belonging to *Cryptothele.* Because species concepts and circumscription are problematic our determination remains somewhat vague.

Taiwan, Pingtung Co., Kenting, near Frog Rock, on conglomerate rock, 0–1 m, 18 Oct. 2001, APTROOT 53346.

Pyrenopsis subareolata NYL.

The Taiwanese specimen matches European material of the species rather well. The lichen forms spreading areolate crusts with flat, angulate areoles and immersed to semi-immersed apothecia opening with a punctiform disc.

Taiwan, Taipei Co, Sanji, alt. 0-5 m, on volcanic rock at the seashore, 22 Oct. 2001, APTROOT 53572 p.p.

Pyrenopsis triptococca NYL.

This species was known so far from southern Europe and the Canary Islands. It is also present in the Sonoran Desert (see upcoming third volume of the Sonoran Desert Lichen Flora by NASH et al. 2007). The new records from South Africa, India and southern China result in considerable range extension. Similar disjunctive distribution patterns are fairly common in the Lichinaceae.

Australia, Queensland, etwa 20 km südlich von Townsville, an Granitfelsblöcken in einem sehr lichten Eucalyptus-Wald, 150 m, 21 Aug. 1988, KALB 19230 (accomp. *Peltula* cf. *impressa, Pterygiopsis guyanensis).*

China, Yunnan, Heqin Co., Song Guei, alt. 2400 m, on shale in sclerophyll forest, 21 Oct. 2002, APTROOT 56201.

India, Orissa, Ganjam Distr., close to Maniakati Village, Danthinga, on siliceous rock, 23 Feb. 2003, RAUHUT 13 (herb. B. BÜDEL) (accomp. *Peltula* spec.); 24 Feb. 2003, RAUHUT 19, 26 (herb. B. BÜDEL).

South Africa, Western Cape Prov., Swellendam, Bontebok, 5 Oct 1997, C.M. VAN HERK s.n. (in ABL).

Uganda, Masindi adminis. region, Murchinson Falls National Park, on top of the Nile falls, granitic outcrops near the falls in sparsely wooded grasslands, 655-660 m, 15 Oct. 2005, SÉRUSIAUX (LG) (accomp. *Peltula placodizans, P. lingulata, Synalissa* spec.).

Spilonema revertens NYL.

This is a widespread species on exposed rocks. It is much overlooked or confused with species of *Ephebe*. However, it is readily separated from the latter genus by the dark bluish hypothallus and septate ascospores.

China, Yunnan Prov., Jianchuan Co, Mt. Shibaoshan, alt. 2500 m, on sandstone, 19 Oct. 2002, APTROOT 55952; 55761.

Stromatella bermudana (RIDDLE) HENSSEN

Stromatella bermudana was originally described from Bermuda as a species of *Psorotichia*. HENSSEN (1989) pointed to the remarkable thallus form with densely packed upright growing lobules. This type of thallus growth is similarly found in species of *Paulia, Phylliscum, Phyllisciella, Pseudopaulia* and *Metamelanea*. *Stromatella bermudana* was later reported from limestone boulders in central Arizona (SCHULTZ 2002). The peculiar, stromatoid development of the ascomata could neither be observed in the Arizona material nor in the material from Taiwan. In both collections apothecia were found to develop from pycnidia (i.e. pycnoascocarps) which was also observed by HENSSEN (1989) in the type. De-

spite the rather conspicuous thallus this lichen is apparently rare with a disjunctive distribution in the northern hemisphere. In the Taiwanese collection *Stromatella bermudana* was accompanied by *Lemmopsis arnoldiana*, a species of *Pyrenopsis* and a very peculiar minutely squamulose cyanolichen of greenish olive colour.

Taiwan, Pingtung Co., Fangshan, alt. 20 m, on coastal conglomeratic rock outcrop, 16 Oct. 2001, APTROOT 53071 (accomp. *Lemmopsis arnoldiana*, *Pyrenopsis* spec., unidentified cyanolichen).

Thelochroa montinii A. MASSAL.

Thelochroa montinii (=*Psorotichia montinii* (A. MASSAL.) FORSS.) forms small patches on bare calcareous or calciferous rock. The thallus is minutely areolate crustose. This lichen is only known from scattered localities in Europe in mountainous and alpine regions. It seems to be rare but may have been overlooked. It will be reported from SW North America in the upcoming third volume of the Sonoran Desert Lichen Flora by NASH et al. (2007).

Puerto Rico, Distr. Ponce, Guanica, alt. 10 m, on limestone, May 1989, APTROOT 25802 p.p. (accomp. juv. *Digitothyrea polyglossa*, *Psorotichia obpallescens*); Guanica State Forest 9.8 km from Guanica on highway 333, on rocks along shore with scrub plants, 20 ft, 5 July 1968, WETMORE 18048 (MIN) (accomp. *Lemopholemma lingulatum*).

Taiwan, Taichung Co., Taichung, alt. 100 m, on limestone in the garden of the Natural History Museum, 6 Oct. 2001, APTROOT 51579.

Thyrea confusa HENSSEN

This species is widespread on limestone in the northern hemisphere. It occurs as far north as southern Norway and southern Sweden. It has its southernmost known records on Socotra. In temperate regions it colonizes warm and dry habitats such as open, S-exposed limestone rock faces. In desert or semi-desert regions the species is found in more sheltered situations such as steep, N-facing boulders or shaded rocky slopes. The species may also occur in the southern hemisphere but in spite of its rather conspicuous bluish grey pruinose distinctly lobate thalli no corresponding records are known to the authors.

China, Yunnan, Lunan Co, Shilin, alt. 2000 m, on limestone of "Stone Forest", 27 Oct. 2002, APTROOT 56996.

Thyrea plectopsora A. MASSAL.

The material from the Dominican Republic and Madagascar is strongly pruinose and the peltate squamules are quite small in comparison with the Indian material. Similarly small and heavily pruinose thalli of *Thyrea plectopsora* have been collected on limestone on Socotra (SCHULTZ & MIES 2003). The Indian

material is entirely epruinose, it was collected on granite and the squamules are somewhat larger (2–5 mm) than in the collections cited above. Finally, the gelatinous sheath of the photobiont cells is reddish in the Indian material whereas it is yellowish brown in all material collected on calciferous rock. Because no substantial differences in the general growth form and thallus anatomy could be observed it seems to be likely that these differences in thallus size, pruinosity and colour of the photobiont sheaths are caused by the deviating climatic and substrate conditions. The species seems to have a disjunctive word-wide distribution.

Dominican Rep., Prov. Pedernales, 15 km E of Pedernales in karst limestone area near road, with cactus, lignum vitae and scrub, 200 ft, 14 June 1968, WETMORE 17889 (MIN); 2 km N of Pedernales, in partly burned pasture on dry limestone with Agave, cactus and scrub, 14. June 1968, WETMORE 17873 (MIN).

India, Kerala, Calicut Distr., Kozhiparram water falls, on fully exposed granite boulders along the river bed, 450 m, 12 Feb. 2003, RAUHUT 1 (herb. B. BÜDEL).

Madagascar, Réserve des Tsingy de Bemahara 17 km N de Bekopaka, 300 m, lapiaz déchiquetés, partie sommitale, Aug. 2002, SÉRUSIAUX (LG).

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addresses:

Matthias SCHULTZ
Biocentèr Klein Flottbek
University of Hamburg
Ohnhorstsr. 18
D-22609 Hamburg
Germany
email: schultzm@botanik.uni-hamburg.de

André APTROOT
ABL Herbarium
G.v.dVeenstr. 107
NL-3762 XK Soest
The Netherlands
email: andreaptroot@wanadoo.nl