

NEW OR OTHERWISE INTERESTING RECORDS OF LICHENS AND LICHENICOLOUS FUNGI FROM MAINLAND ECUADOR AND SURROUNDINGS WITH DESCRIPTIONS OF FIVE NEW SPECIES

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Altogether 322 taxa of lichens and lichenicolous fungi are reported from Ecuador of which many are probably new records for the country. These include five species which are described as new to science: *Bacidia andina*, *Bacidina pulverula*, *Distopyrenis epidiorigma*, *Pertusaria lucidotetra* and *P. pseudoparnassia*. From the separately treated genera *Leprea* and *Pertusaria*, 12 species are recorded for Ecuador and/or other Neotropical countries. Notes on morphology, chemistry and ecology are given.

Key words: biodiversity, chemistry, ecology, lichenised Ascomycetes, S. America, taxonomy

INTRODUCTION

Ecuador is situated between latitudes 2°N and 5°S, bounded in the west by the Pacific Ocean, in the north by Columbia, in the south and east by Peru. The country has very diverse ecosystems depending on the wide range of climatic and geographical variation, in the first place the enormous variation in altitude, from sea level to the dominant Andean Cordillera, a central mountain range with its highest point in Mount Chimborazo reaching 6,268 m. The Pacific coast has a tropical climate with a severe rainy season. The climate in the Andean highlands is temperate and relatively dry, and the Amazon basin east of the mountains shares the climate of other equatorial rainforest zones (Wikipedia 2021).

Regarding to lichen diversity, Ecuador must be one of the richest countries in the world, in view of the wide array of biotopes. However, the lichen mycobiota of Ecuador is still very incompletely explored. Only the Galapagos Islands have been investigated in more detail. Bungartz *et al.* (2011) prepared

a web checklist, and they published several taxonomic treatments, including a treatment of *Pertusaria* (Bungartz *et al.* 2015). The only site in continental Ecuador, of which a more detailed lichen study was published, is the Reserva Biológica San Francisco. Nöske *et al.* (2007) published a list of 323 species from a mountain forest plot between 1820–2100 m in that reserve. The first and only checklist for mainland Ecuador was prepared by Cevallos (2012). It lists the names of 898 lichens and 32 lichenicolous fungi.

Several recent taxonomic treatments deal with Ecuador lichens. Ahti (2000) in a revision of Neotropical *Cladonia* treats all species known from Ecuador. The monograph of foliicolous lichens in the Neotropics by Lücking (2008) includes numerous species found in Ecuador, mainly from the provinces Pichincha and Napo. An extensive study of lichenicolous fungi from Ecuador was published by Etayo (2017); he describes 368 species, including 80 new species. González *et al.* (2017) treat about 30 terricolous lichen species from the Páramos. Davey (1999) records a small number of lichens from the city Quito. Jørgensen and Palice (2010) published a contribution to the Panariaceae, and Hestmark (2016) a survey of *Umbilicaria*. Sipman (1997) treated some groups of macrolichens above 2,500 m in Ecuador and Jørgensen and Arvidsson (2008) treat the genus *Erioderma* in Ecuador. Additional information is hidden in a multitude of publications, which do not deal specifically with Ecuadorian lichens or lichenicolous fungi (e.g. Moberg 1990, 1993, 2011, Nöske 2004). Much unpublished material exists in various herbaria. The most important is probably that collected by Arvidsson *et al.* during 4 expeditions in the 1970s and stored in GB (Arvidsson 1991).



Fig. 1. Topography of mainland Ecuador. Scale = 100 km. An asterisk is an indication of a locality, or a few localities close to each other. They are explained in 'Collecting sites' (below)

During a visit to mainland Ecuador by the first author in 2016, lichens and lichenicolous fungi were collected in 6 different provinces, from the Andes mountains near Quito and Cuenca, up to 4,000 m altitude, to the coastal areas along the Pacific Ocean (Fig. 1). Here the results of this fieldwork are presented, together with additions to Nöske *et al.* (2007).

Special attention was paid to the genera *Bacidia* and *Bacidina* based on the important studies available from North and South America, in particular Ekman (1996) and Malme (1935), and additions like the treatment of *Bacidina* species in van den Boom and

Sipman (2014) and Cáceres (2007). The latter includes a key to *Bacidia* and *Bacidina* in NE Brazil. Van den Boom *et al.* (2018) provided further valuable information on these genera, especially new species from Suriname. Further important recent publications used for comparison are Lendemer *et al.* (2016), who describes 3 new *Bacidia* species from the USA, and Lendemer (2020), describing one new species from the USA. The recent publications on Macaronesian representatives were also consulted (Ekman *et al.* 2021, van den Boom and Alvarado 2019, van den Boom and Magain 2020). Another special interest group was the genus *Pertusaria* s. l., for which very few distribution data in NW South America are published so far. Preliminary results are presented from an examination of about 300 specimens kept in B from Ecuador, Colombia and Costa Rica. They are based on the world key of Archer and Elix (2018) and various publications by Archer c.s.

MATERIAL AND METHODS

The specimens investigated were mainly collected in 2016 by the first author and his wife and are deposited in the herbarium of QCNE, with duplicates in the herbarium of the first author and some in B and in MAF-lichen herbarium. Further specimens were collected by HS and deposited in B and LOJA. Specimens by various collectors, stored in B, are cited in the species list below in full detail. Measurements of ascospores and pycnoconidia were made in tap water at 400× or 1,000× magnification, using an Olympus BH2 microscope. Amyloid reactions were tested using Lugol's iodine solution. The secondary metabolites of several crustose specimens were analysed by TLC using the methods of Culberson and Ammann (1979) and Culberson and Johnson (1982), using solvent systems A, B and C (Orange 2001). The identification of apothecial and pycnidial pigments follows Meyer and Printzen (2000). From several specimens of *Megalospora* and *Parmelia* s. l. DNA was extracted and used for verification.

The results of tlc and DNA extraction are added to the species list below. The DNA codes presented here are the lab codes of the MAF-lichen herbarium. The extracted DNA is stored in the DNA bank of their department (Departamento de Biología Vegetal II) and will be available to any researcher on request. Coordinates are provided as latitude-longitude in the WGS84 reference system, with degrees + decimal minutes.

Collecting sites of P. and B. van den Boom

(1) = Prov. Pichincha, Quito, park El Ejido, on scattered trees, including many mature *Cupressus macrocarpa* trees, 0° 12.51' S, 78° 29.87' W, 2,810 m, 27 January 2016.

- (2) = Prov. Pichincha, N of Quito, La Mitad del Mundo, in small park on scattered small trees, 0° 00.17' S, 78° 27.25' W, 2,485 m, 28 January 2016.
- (3) = Prov. Pichincha, N of Quito, Pululahua (Geobotanical reserve), south edge of volcano crater, N exposed slope along trail, 0° 01.54' S, 78° 29.03' W, 2,415 m, 28 January 2016.
- (4) = Prov. Pichincha, Quito, park El Arbolito, on few scattered trees, including some mature palm trees, 0° 12.67' S, 78° 29.84' W, 2,715 m, 29 January 2016.
- (5) = Prov. Pichincha, WNW of Quito, Mindo, SE of village, area of Hosteria Saguambi, garden with mixed trees along rio Saguambi and just outside the garden, along unpaved road, 0° 03.47' S, 78° 46.47' W, 1,255 m, 29 January 2016.
- (6) = Prov. Pichincha, WNW of Quito, Mindo, NE side of village, main trail from yellow house to entrance of trail # 1, fields, sometimes with cattle, 0° 03.03' S, 78° 46.05' W, 1,315 m, 30 January 2016.
- (7) = Prov. Pichincha, WNW of Quito, Mindo, SE side of village, with cable railway to trail to Cascada Reina, tropical rain forest, 0° 05.21' S, 78° 45.70' W, 1,550 m, 31 January 2016.
- (8) = Prov. Pichincha, WNW of Quito, Mindo, S side of village, S of stadium, orchid garden, with shrubs and trees, 0° 03.29' S, 78° 46.57' W, 1,275 m, 1 February 2016.
- (9) = Prov. Pichincha, WNW of Quito, Mindo, centre of village, in park on shrubs and some mature trees, 0° 03.17' S, 78° 46.46' W, 1,268 m, 1 February 2016.
- (10) = Prov. Pichincha, WNW of Quito, Mindo, N side of village, unpaved road from centre to yellow house, on trees and shrubs along fields, 0° 03.14' S, 78° 46.35' W, 1,270 m, 1 February 2016.
- (11) = Prov. Manabí, S of Manta, NE of Puerto López, Park National Machalilla, reserve Agua Blanca, small indigenous community, with small forests, fields and gardens, on shrubs and mature trees, 1° 32.11' S, 80° 44.07' W, 75 m, 4 February 2016.
- (12) = Prov. Manabí, S of Manta, N of Puerto López, Park National Machalilla, Los Frailies Beach, coastal area, on shrubs and some (poisonous) trees, close to the beach, 1° 29.54' S, 80° 47.54' W, 2 m, 4 February 2016.
- (13) = Prov. Manabí, SW of Manta, NW of Puerto López, Park National Machalilla, coastal area, trail from Ranger Station through centre of the island, on shrubs and some small trees, 1° 16.53' S, 81° 04.24' W, 60 m, 5 February 2016.
- (14) = Prov. Manabí, S of Manta, Puerto López, S side of village, just outside, coastal (hilly) area, small trail, on shrubs and some small trees, 1° 33.76' S, 80° 49.48' W, 80 m, 6 February 2016.
- (15) = Prov. Azuay, Cuenca, S side of the city, S side of rio Tometamba, park De La Madre, on shrubs and small trees, 2° 54.28' S, 79° 00.26' W, 2,535 m, 8 February 2016.
- (16) = Prov. Azuay, Cuenca, S side of the city, area between rio Yanuncay and rio Tarqui, small forest with *Eucalyptus* trees, 2° 54.93' S, 79° 00.40' W, 2,530 m, 8 February 2016.
- (17) = Prov. Azuay, W of Cuenca, Park National Cajas, northern part, N of the main road, trail from Laguna Toreadora Ranger Station to the east, open area near lake, on shrubs and outcrops in grassy places, 2° 46.99' S, 79° 13.33' W, 3,900 m, 9 February 2016.
- (18) = Prov. Azuay, Cuenca, S side of the city, N side of rio Tometamba, along AV. 3 de Noviembre, nearby Puente Roto, along trail on scattered shrubs and small trees and one outcrop, 2° 54.29' S, 79° 00.05' W, 2,510 m, 10 February 2016.
- (19) = Prov. Azuay, Cuenca, S side of the city, N side of rio Tometamba, along AV. 3 de Noviembre, trail along garden of park Pumapungo, on scattered shrubs and small trees, 2° 54.54' S, 78° 59.84' W, 2,505 m, 10 February 2016.

- (20) = Prov. Tungurahua, E of Ambato, Baños, S side of the city, Cabellera de la Virgen, garden of small park, on mature *Persea americana* tree, and trees along the street, including *Ficus benjamina*, 2° 54.54' S, 78° 59.84' W, 1,675 m, 12 February 2016.
- (21) = Prov. Tungurahua, E of Ambato, Baños, S side of the city, trail to Mirador Bellavista, in strongly sloping tropical forest, on fence posts, shrubs and trees, 1° 24.14' S, 78° 25.16' W, 1,960 m, 12 February 2016.
- (22) = Prov. Pastaza, E of Ambato, Puyo, NE side of the city, park Omaere, tropical forest with small trails, on shrubs and trees, 1° 28.56' S, 77° 59.82' W, 935 m, 13 February 2016.
- (23) = Prov. Pastaza, E of Ambato, Puyo, NE side of the city, touristic trail from park Omaere to the main road, to Fatima, park landscape, along a river, 1° 28.42' S, 77° 59.74' W, 946 m, 13 February 2016.
- (24) = Prov. Pichincha, Quito, Bellavista Alta, neighbourhood, garden of house of painter Guayasamin, including some mature trees, 0° 11.40' S, 78° 28.12' W, 2,900 m, 14 February 2016.
- (25) = Prov. Pichincha, Quito, park La Carolina, Botanical Garden, on shrubs and mature trees, 0° 11.14' S, 78° 29.05' W, 2,890 m, 15 February 2016.
- (26) = Prov. Pichincha, Quito, park La Carolina, central part, N side of the new running track, on mixed shrubs and trees, 0° 10.87' S, 78° 29.03' W, 2,760 m, 15 February 2016.

Collecting site of H. Sipman

- (27) = Prov. Zamora-Chinchiipe, Nature Reserve of Estación Científico San Francisco, S of road Loja-Zamora, ca 40 km from Loja, primary montane forest on steep slope, 3° 58' S, 79° 04' W, ca 2,025 m, 15 June–3 July 2004.

RESULTS

In this study 322 species of lichens and lichenicolous fungi are recorded from mainland Ecuador. Most are probably new records for the country, but no efforts were made to study their distribution in sufficient detail to prove this. 5 species are described as new to science, *Bacidia andina*, *Bacidina pulverula*, *Distopyrenis epidiorigma*, *Pertusaria lucidotetra* and *P. pseudoparnassia*. The distribution of the new records shows that the cities have a much less diverse lichen biota than the countryside around them. A few unexpected species were found in the parklands of Quito and Cuenca, cities at higher altitudes: *Bacidia heterochroa*, *Caloplaca cerinelloides*, *C. obscurella*, *Catillaria nigroclavata* and *Waynea cretica* in Quito, *Calicium hyperelloides*, *Cladonia borbonica* and *Japewiella tavaresiana* in Cuenca. Only one small island (Isla de la Plata), very close to the mainland, has been visited (locality 13). Here only few lichens were found, probably because of its very dry climate.

DESCRIPTIONS OF THE NEW SPECIES

Bacidia andina van den Boom, *spec. nova*
(Fig. 2)

Mycobank no.: MB 845426

A *Bacidia* species similar to *B. heterochroa* (Müll. Arg.) Zahlbr., which differs in the brownish thallus, the lack of enlarged cells at the outer rim of excipulum; apothecia dark brown to blackish; excipulum prosoplectenchymatic with conglutinated hyphae, completely filled with small crystals; epithecium yellowish brown, K+ reddish, N-; hypothecium pale to medium brown; ascospores acicular, often slightly curved, $45\text{--}50 \times 2\text{--}3\text{--}(3.5) \mu\text{m}$, 3–16-septate; pycnidia dark brown, up to ca $50 \mu\text{m}$ diam., conidia filiform, strongly curved, $25\text{--}35 \times 0.8 \mu\text{m}$.

Type: Ecuador, Prov. Pichincha, N of Quito, Pulahua (Geobotanical reserve), south edge of volcano crater, N exposed slope along trail, $0^\circ 01.54' \text{ S}$, $78^\circ 29.03' \text{ W}$, 2,415 m, 28 January 2016, P. & B. van den Boom 54024 (holotype: QCNE; isotype: hb van den Boom).

Thallus smooth to somewhat uneven, to slightly warted, pale brownish or dark grey, up to 0.2 mm thick, upper surface matt, ecorticated. Prothallus sometimes present and visible among the thallus parts as a dark rim. Photobiont chlorococcoid, cells 5–12 μm diam.

Apothecia abundant, dispersed or rarely confluent, roundish in outline, up to 0.6(–0.7) mm diam., thinly marginate when young; margin 30–50 mm wide, paler than the disc, pale brown to yellowish brown, slightly shiny, sometimes flexuose; disc flat, when young, becoming weakly convex, dark brown to blackish, never variously coloured; excipulum hyaline to brownish, 20–40 μm wide, full of fine crystals, with conglutinated radiating cells at inner part, small prosoplectenchymatous cells with walls of 1.5–3 μm wide lumina, with isodiametric to ellipsoid lumina ca $8 \times 2.5 \mu\text{m}$; epithecium yellowish brown to dark brown, some parts hyaline, with fine crystals, K+ reddish, N-; hymenium 65–90 μm high, with yellow brownish pigment; hypothecium pale to medium brown; hamathecium of paraphyses, thin, 1–1.5 μm wide, septate, sometimes slightly branched, not anastomosed, mid-hymenium cells ca $7\text{--}9 \times 1\text{--}1.5 \mu\text{m}$, tips usually slightly widened, up to 5 μm , yellow brown pigmented. Asci small cylindrical to slightly clavate, $45\text{--}55 \times 8\text{--}14 \mu\text{m}$, 8-spored, tholus staining dark blue in I with a paler blue, narrowly conical axial body, ocular chamber with a blunt body, surrounded by a rather small but strongly amyloid layer, not open at the apex. Ascospores \pm straight to rarely coiled in the ascus, acicular, rarely straight nearly always slightly curved, hyaline, $45\text{--}55 \times 2\text{--}3 \mu\text{m}$, 3–15-septate. Pycnidia ca 50 μm wide, ostiole margin medium brown in upper part; conidia filiform, strongly curved, $25\text{--}35 \times 0.8 \mu\text{m}$, not septate.

Chemistry: K-, C-, P-, UV-, no chemical compounds detected. *Arnoldiana*-brown pigment in proper exciple, hypothecium and epihymenium.

Etymology: The epithet refers to the mountain area where it was discovered.

Distribution and ecology: The new species is only known from the type locality where it grows abundantly on dead branches of a shrub, branches of 4 mm diam. and 10 mm diam.

Notes: *Bacidia andina* is an inconspicuous species, easily mistaken for *Bacidia heterochroa*, and microscopical control is needed to distinguish between both species with certainty. The latter has usually mottled apothecia with pale pink or pale orange parts on the disc, no crystals in the epithecium and

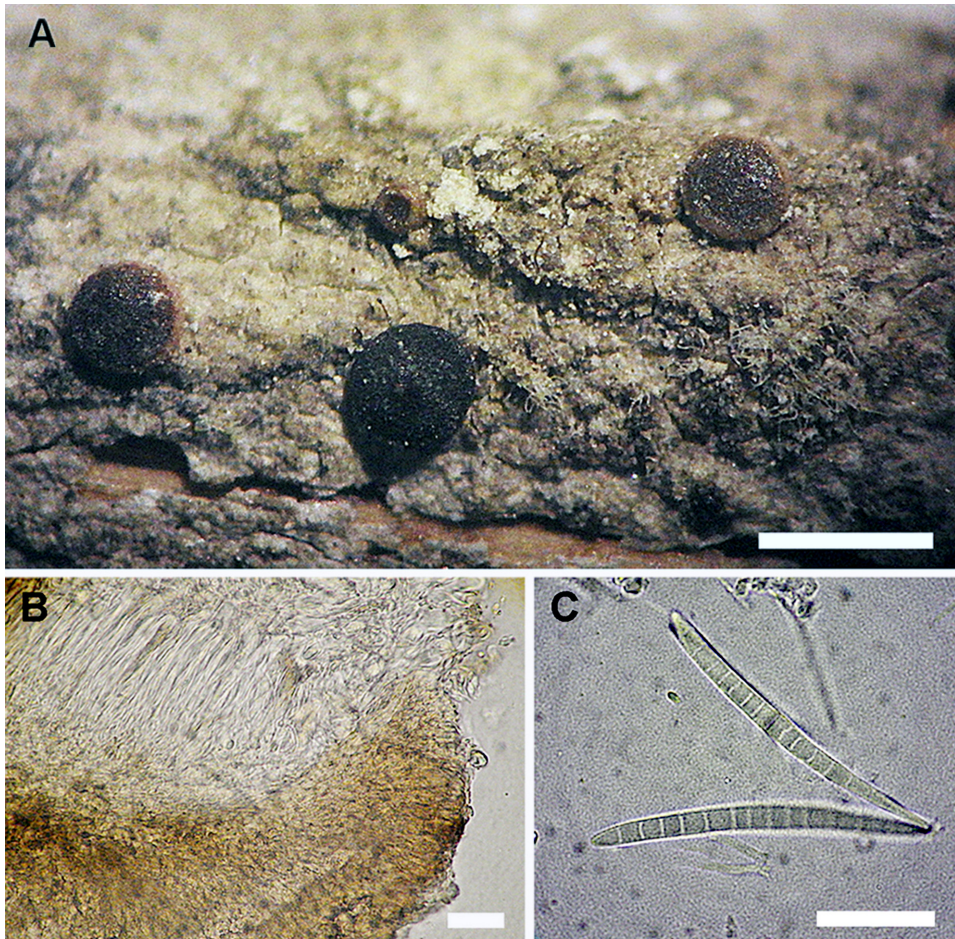


Fig. 2. *Bacidia andina*, holotype. A = habitus; B = excipulum; C = ascospores. Scales: A = 0.5 mm; B = 25 μ m; C = 20 μ m

sometimes only a few small clusters of crystals in the excipulum, the purplish brown epithecium is N+ reddish and the outer rim of the excipulum contains a row of enlarged cells with lumina of up to $9 \times 6 \mu\text{m}$. *Bacidia heterochroa* is known from the USA mostly in coastal areas in the west and southeast, and it is widely distributed in tropical areas (Ekman 1996). In Malme (1935) this species is treated as *Bacidia alutacea* (Krempplh.) Zahlbr. and recorded from Argentina, Brazil and Paraguay. *Bacidia megapotamica* Malme is also similar to the new species, but has an epithecium K-, ascospores of $35\text{--}50 \times 3\text{--}4 \mu\text{m}$, 7–11-septate. *Bacidia laurocerasi* (Delise ex Duby) Zahlbr. is similar in habitus, but has a greyish thallus, epithecium N-, hypothecium hyaline, ascospores $2.5\text{--}4 \mu\text{m}$ wide and conidia up to $17 \mu\text{m}$ long. An unknown *Stigmidium* is present on the thallus of the new species, with black perithecia up to 0.15 mm diam., and hyaline ascospores of *ca* $12\text{--}15 \times 3\text{--}5 \mu\text{m}$.

Bacidina pulverula van den Boom, *spec. nova*
(Fig. 3)

Mycobank no.: MB 845424

A Bacidina species similar in habitus to Bacidia fellhaneroides van den Boom, from which it differs in its fine powdery thallus; apothecia pale pinkish to reddish pink; margin flexuose; excipulum with paraplectenchymatous cells, lumina at outer rim up to $4 \mu\text{m}$ diam.; ascospores acicular to almost bacilliform, (1–)3–7-septate, $17\text{--}35 \times (1\text{--})1.5\text{--}2 \mu\text{m}$; pycnidia hyaline to pale brownish, up to $50 \mu\text{m}$ wide, conidia filiform, curved, $10\text{--}15 \times 0.8 \mu\text{m}$.

Type: Ecuador, Pastaza prov., E of Ambato, Puyo, NE side of the city, touristic trail from park Omaere to the main road, to Fatima, park landscape, along a river, $1^{\circ} 28.42' \text{ S}$, $77^{\circ} 59.74' \text{ W}$, 946 m, 13 February 2016, P. & B. van den Boom 54773 (holotype: QCNE; isotype: hb van den Boom).

Thallus powdery, pale greenish or very pale greenish grey, up to $30 \mu\text{m}$ thick, upper surface slightly uneven, matt, ecorticated. Prothallus not present. Photobiont chlorococcoid, cells $6\text{--}9 \mu\text{m}$ diam.

Apothecia abundantly present, scattered to crowded, irregular in outline, up to 0.8 mm diam., thinly marginate when young; margin $20\text{--}40 \mu\text{m}$ wide, often flexuose; slightly paler than the disc; disc flat to weakly convex, pale pinkish to orange-pink; excipulum hyaline, without crystals, with small conglutinated radiating cells at inner part, and up to $2.5 \mu\text{m}$ wide small paraplectenchymatous cells at outer layer of up to $4 \mu\text{m}$ diam., cells with thin walls, epithecium hyaline, without crystals, K-, N-; hymenium $35\text{--}50 \mu\text{m}$ high, without any pigment; hypothecium hyaline; hamathecium of paraphyses, thin, $1.5\text{--}2 \mu\text{m}$ wide, septate, sometimes slightly (shortly) branched, not anastomosed, mid-hymenium

cells $ca\ 7-9 \times 1.5-2\ \mu m$, tips not or slightly widened, up to $3\ \mu m$, not pigmented. Asci small cylindrical to slightly clavate, $30-35 \times 8-10\ \mu m$, 8-spored, tholus rather wide; ocular chamber with a blunt body, surrounded by a rather small but strongly amyloid layer, not open at the apex. Ascospores straight, rarely coiled or usually straight in the ascus, small, acicular to almost bacilliform, straight to slightly curved, $17-35 \times (1-1.5-2)\ \mu m$, (1-)3-7-septate. Pycnidia immersed in thallus, $ca\ 50\ \mu m$ wide, ostiole and margin hyaline to pale brownish; conidia filiform, weakly to strongly curved, $10-15 \times 0.8\ \mu m$, not septate.

Chemistry: K-, C-, P-, UV-, no chemical compounds detected. Rarely *Arnoldiana*-brown pigment in proper exciple.

Etymology: The epithet refers to the appearance of the thallus of the new species.

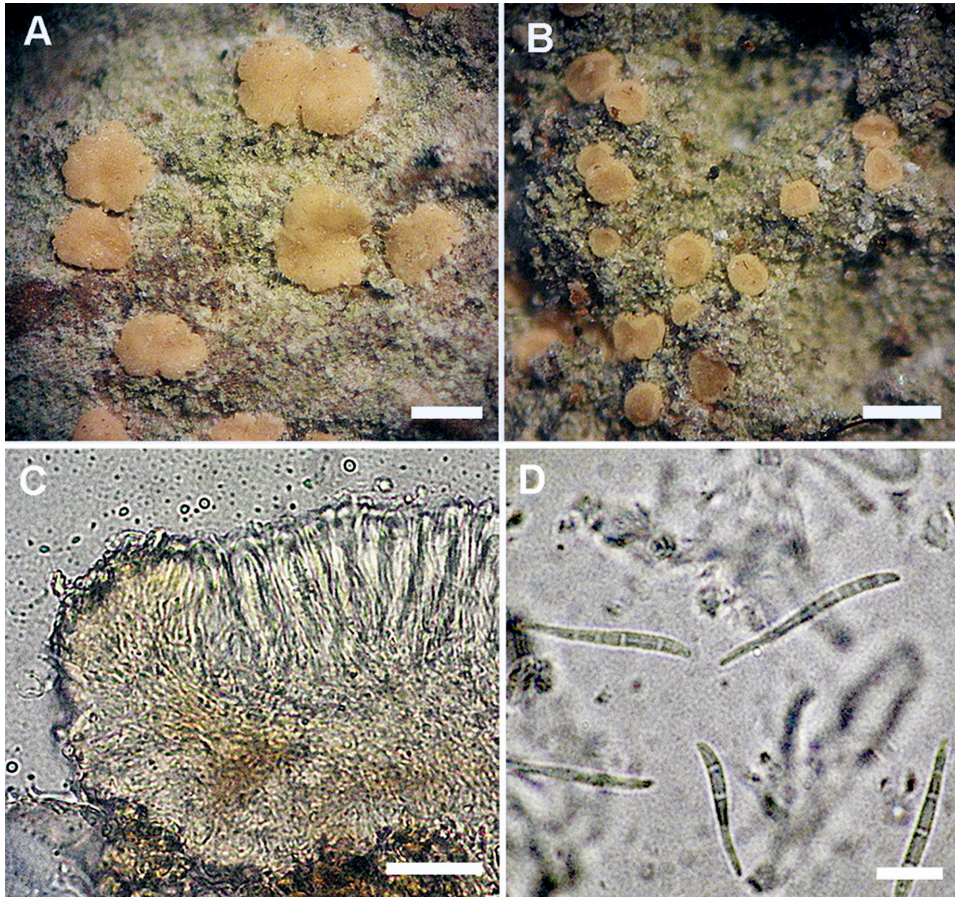


Fig. 3. *Bacidina pulverula*, holotype. A = habitus (when mature), B = habitus (when young), C = excipulum, D = ascospores. Scales: A = 0.5 mm; B = 0.5 mm; C = 25 μm ; D = 10 μm

Distribution and ecology: Known from the type locality only, where it grows abundantly corticolous on an unidentified tree along a river.

Notes: The new species is easily mistaken for *Bacidia fellhaneroides*, which has somewhat the same coloured apothecia also with a very thin margin, but a clearly different thallus, areolate to scurfy, relative short ascospores, $20\text{--}27 \times 1.2\text{--}2 \mu\text{m}$, 1–3(–6) septate, (van den Boom *et al.* 2018). The new species is not easily mistaken for other *Bacidia* or *Bacidina* species because the thallus is pulverulent and it has very characteristic apothecia, which are clearly marginate and roundish when young and irregularly flexuose and immarginate when mature. *Bacidina saxenii* (Erichsen) M. Hauck et V. Wirth has pinkish morphs comparable with the new species, but it has a scurfy-granular thallus. Granules are lacking in the new species. The ascospores in *B. saxenii* are somewhat longer, $25\text{--}40 \mu\text{m}$, but 3-septate. A further similar species is *Bacidina phacodes* (Körb.) Vězda, it has a more warted thallus, apothecia orange-pink, $0.2\text{--}0.5 \text{ mm}$ diam. and conidia $28\text{--}50 \times 1\text{--}1.5 \mu\text{m}$, 3–7 septate.

Distopyrenis epidiorygma Etayo et van den Boom, *spec. nova*
(Fig. 4)

Mycobank no.: MB 845425

A *Distopyrenis* species similar to *D. japonica* H. Harada but with smaller ascomata $100\text{--}320 \mu\text{m}$ diam. with a central ostiole, hymenium interspersed, ascospores citriform, with a verruculose wall and smaller, $10\text{--}12 \times 6\text{--}7.5 \mu\text{m}$. Furthermore, it is known to live on a different host, of the genus *Diorygma*.

Type: Pichincha province, WNW of Quito, Mindo, SE of village, area of Hostería Saguamby, garden with mixed trees along río Saguambi and just outside the garden along unpaved road, $0^\circ 03.47' \text{ S}$, $78^\circ 46.47' \text{ W}$, 1,255 m, 29 January 2016, P. & B. van den Boom 54082 (holotype: QCNE; isotype: hb van den Boom).

Lichenicolous fungus growing on *Diorygma*. Hyphae brown, $2\text{--}3 \mu\text{m}$ wide, connected with ascomata.

Ascomata perithecioid, firstly immersed and subsphaerical then erumpent and with flat upper part due to the apical ostiole that is generally a bit sunken. At first solitary, $100\text{--}170 \mu\text{m}$ diam., finally fused forming stromata or compound ascomata, $200\text{--}320 \mu\text{m}$ diam. Ascomatal wall brown, KOH+ greenish brown, with granulose pigment, in section nearly paraplectenchymatous, thin in small perithecia, *ca* $10 \mu\text{m}$ thick in lateral zones and to $30 \mu\text{m}$ in upper zones but thicker in larger ascomata to $70 \mu\text{m}$ around nucleus. Ostioles with thin, simple or sparsely branched, $1\text{--}1.5 \mu\text{m}$ wide periphysoids, interspersed with many small oil guttules. Paraphyses simple to sparsely branched, septate, not capitate apically, $1\text{--}2 \mu\text{m}$ thick but to $4 \mu\text{m}$ in some basal parts,

inspersed with oil guttules. Asci clavate, young ones with thickened lateral wall, mature with a cylindrical ocular chamber, I-, KI-, 8-spored, $47\text{--}60 \times 9\text{--}13 \mu\text{m}$. Ascospores citriform, brown, I-, biseriately disposed, with verruculose surface, with strongly thickened walls at apices and around septum, with 2 extremely angular lumina, similar to the *Mischoblastia*-type in the genus *Rinodina*, $10\text{--}12 \times 6\text{--}7.5 \mu\text{m}$. Pycnidia not seen.

Etymology: named after the genus *Diorygma*, which hosts this species, and is different from the *Graphis* host of *D. japonica*.

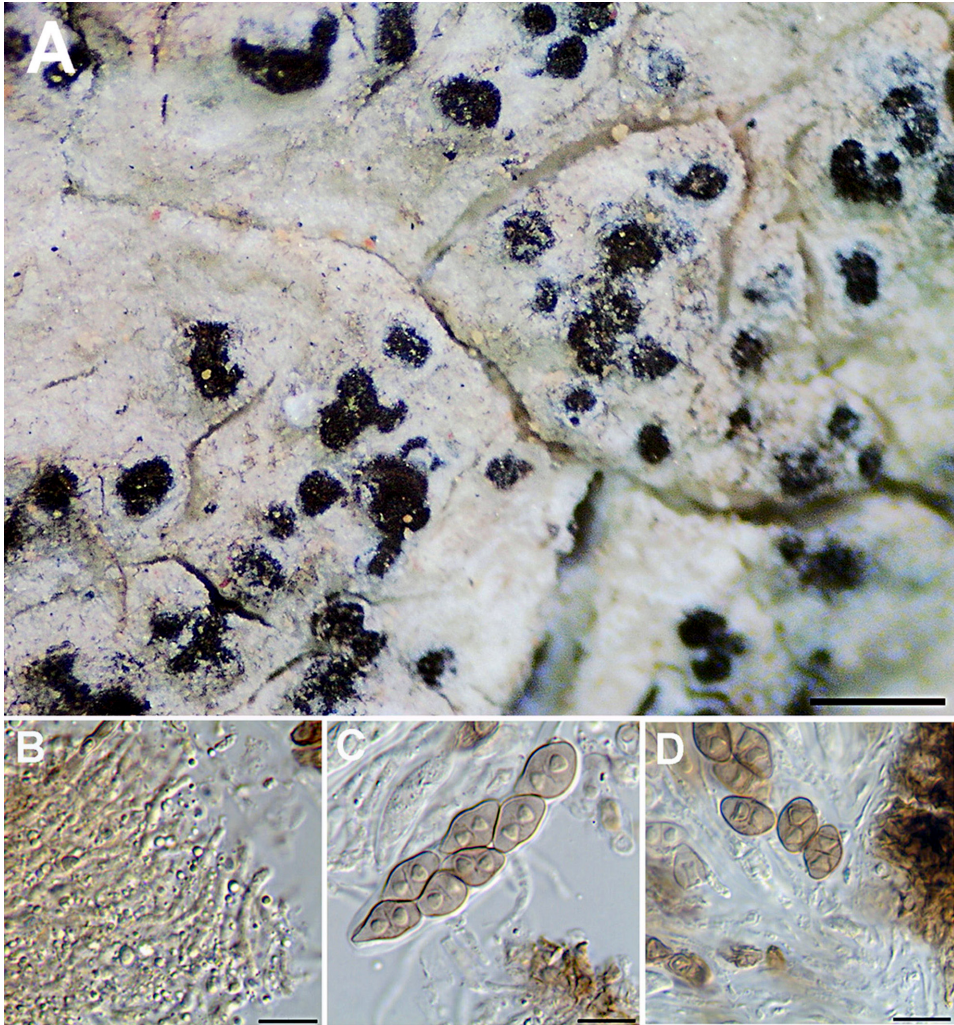


Fig. 4. *Distopyrenis epidorygma*, holotype. A = habitus; B = paraphyses; C = ascospores in ascus; D = ascospores outside ascus. Scales: A = 0.5 mm; B–D = 10 μm

Distribution and ecology: Collected only in the type locality on epiphytic *Diorygma*.

Notes: We are including this species in the genus *Distopyrenis* Aptroot (Aptroot 1991) because of its perithecial or compound ascomata and brown, 1-septate distoseptate ascospores. It differs from the other lichenicolous representative of the genus, *D. japonica* H. Harada (Harada 2000), because this species has perithecia normally larger 250–450 μm with sublateral ostiole, hymenium not interspersed, ascospores not citriform, with smooth wall and larger, 12–15 \times 5–6 μm . Furthermore, it is known to live on another host, *Graphis proserpens* Vain. Other members of the genus *Distopyrenis* are not lichenicolous. Harris (1995) recorded 9 species of which only 5 are named. All of them have larger spores, the only one with smaller ones is *D. composita* R. C. Harris with spores 12–14 \times 8–9.5 μm . A treatment of all known species of *Distopyrenis* is available in the recent key of Aptroot (2021).

***Pertusaria lucidotetra* Sipman, spec. nova**
(Fig. 5)

Mycobank no.: MB 845427

Similar to P. tetrathalamia (Fée) Nyl., which differs by the presence of 4,5-dichlorolichexanthone instead of lichexanthone.

Type: Colombia, Cauca, Popayan: Los Robles, campus of Fundación Universitaria, ca 15 km towards Timbío. Alt. 1,750 m. 2° 24' N, 76° 39' W. Hilltop in cultivated area, covered with scattered trees and lawns. Epiphytic on *Persea americana*, 29 May 1986, H. Sipman, R. Veloso *et al.* 32790 (holotype: B 60 0171458, isotype COL). tlc 12451265: lichexanthone, stictic, constictic acids.

Thallus corticolous, ca 100 μm thick, continuous or rimose; surface slightly rugulose, slightly shiny, whitish to pale greenish grey or pale brownish grey; marginal zone not differentiated; soredia and isidia absent. Fertile warts rather dense, concolorous with the thallus, (0.6–)1–2.5 mm in diam., 0.6–1 mm high, when young hemispherical and gradually delimited, when larger with constricted base, with upper side flattened to concave, often elongate, not exposing the hymenium, apically with 1–10 pale grey to pale brown, inconspicuous ostioles level with the surface or slightly depressed or raised; hymenium more or



Fig. 5. *Pertusaria lucidotetra*, holotype, fertile warts with tiny ostioles. Scale = 2 mm

less guttulate, sometimes with fine guttules about 1–3 μm , or almost without guttules; ascospores (2–)3–4 per ascus, colourless, ellipsoid, (90–)100–140 \times 25–35(–40) μm , with transversely reticulate-striate inner wall, at age with apically thickened walls.

Chemistry: lichexanthone, stictic, constictic acids (TLC); reactions UV+ yellow, K+ yellow turning orange.

Etymology: The epithet is derived from the species *P. tetralthalamia* (Fée) Nyl. from which the new species differs by the bright yellow fluorescence.

Distribution and ecology: Known so far from forest and parkland at 200–2,200 m in Costa Rica, Ecuador and the Guianas, and probably widespread in the northern Neotropics.

Notes: This species is closest to *P. tetralthalamia* and differs by the presence of lichexanthone instead of 4,5-dichlorolichexanthone. With Archer and Elix (2018) it keys out as *P. tenella* Müll. Arg. This agrees in chemistry and has a similar morphology (Archer and Elix 2018, Müller Argoviensis 1884: 353). It differs because the fertile warts have usually a single ostiole, do not become flat to concave apically, and remain less than 1 mm wide.

The difference of one substance only may seem poor evidence for a different species. However, no *Pertusaria* species is known with chemical races differing so fundamentally in xanthone composition.

Specimens with two-spored asci would key out in the world key (Archer and Elix 2018) as *P. tetralthalamia* var. *major*. However, the photograph of the holotype specimen of this variety in the Global Plants website (<https://plants.jstor.org/stable/viewer/10.5555/al.ap.specimen.g00295236>) shows annotation slips with the full chemical spectrum: lichexanthone, 2'-0-methylperlatolic, 2-0-methylperlatolic acids. Thus it differs from *P. luteotetra* substantially by the absence of the stictic acid aggregate and the presence instead of depsides. The species agrees in the world key (Archer and Elix 2018) also with *P. rhodiza*, except for the striate instead of smooth ascospores. However, the type specimen of *P. rhodiza* investigated by these authors, H-Nyl. p.m. 3703, has an annotation label giving the chemistry as norstictic acid (major), connorstictic acid (trace), 4,5-dichlorolichexanthone (trace). This is in accordance with annotations on a syntype specimen in M seen the Global Plants website (<https://plants.jstor.org/stable/viewer/10.5555/al.ap.specimen.m0207405>), and the presence of stictic acid and lichexanthone is presumably a mistake. *P. rhodiza* is keyed out a second time, between parentheses, for a species containing 4,5-dichlorolichexanthone and norstictic acid, and 4 smooth ascospores per ascus, which fits better to the characters reported from *P. rhodiza*.

Additional specimens examined: – ECUADOR, (27) S 54689, tlc: lichexanthone, stictic, constictic acids; (27) on *Elaeagia obovata*, 48 cm dbh, on crown branches, S 52689 pr.p., tlc: lichexanthone, stictic, constictic acids. – COSTA RICA, Puntarenas: Near Las Cruces Garden (distr. Coto Brus), ca 4 km SSE of San Vito. Alt. ca 1,300 m. 8° 43' N, 82° 57' W. Premontane

rain forest zone. On thin tree trunks along road among fields in valley. 31 Dec. 1978, Sipman 11855a, tlc: lichexanthone, stictic, constictic acids; id., on thin *Croton gossypifolium* tree trunks along path among pastures on hill ridge. 31 Dec. 1978, Sipman 11912, tlc: lichexanthone, stictic, constictic acids; San Vito de Coto Bruz, Estación Biológico Las Cruces. Alt. ca 1,200 m. 8° 47.1' N, 82° 57.6' W. Young planted trees in meadow on hilltop. On thin trunk of *Tabebuia* vs. *chrysantha*. 10–19 Oct. 2004, Sipman 53282a. tlc: lichexanthone, stictic, constictic acids; id., ca 500 m on road to San Vito. Trunklets (leguminosae) of living fence between meadow and gravel road. 17 Oct. 2004, Sipman 53337, tlc: lichexanthone, stictic, constictic acids; Fila Cedro (AC Amistad Pacifico). Estacion Las Alturas, 25 km NE of San Vito near Alturas, access road to station. Alt. 1,500 m. 8° 57' N, 82° 50' W. Montane rainforest zone: reforestation plot (*Cedrela odorata*) bordering pasture, on bark (lower trunk) of *Cedrela*. 26 June 2002, Sipman 47831, tlc: lichexanthone, stictic, constictic acids. – FRENCH GUYANA, Saül, 2 km south of the village, “Sentier Limonade”, alt. 180–210 m, 3° 32' N, 53° 12' W, lowland moist forest on lateritic soil, epiphytic on outermost canopy branches of *Ceiba pentandra*, 3 Sep. 1986, Montfoort, Ek 2158 [L 3979210], tlc: trace lichexanthone, stictic, constictic acids. – GUYANA, Potaro-Siparuni Region: Surroundings of Paramakatoi village, alt. ca 800 m, 4° 42' N, 59° 43' W, forest along trail to Kawatipu; epiphytic on trunk or canopy of felled tree (tree B), 22 Feb. 1996, Sipman 40682; tlc: lichexanthone, trace stictic acid.

Pertusaria pseudoparnassia* Sipman, *spec. nova
(Fig. 6)

Mycobank no.: MB 845428

Differs from Pertusaria parnassia Vain. by the presence of isidia and the basally constricted fertile warts.

Type: Ecuador, prov. Zamora-Chinchi: Reserva Biológica San Francisco, 30 km E of Loja on road to Zamora, trail of the canal, alt. 1,850 m, 3° 58.3' S, 79° 4.7' W, montane tropical rain forest, on bark, 7 May 2001, N. M. Nöske and H. J. M. Sipman 183 (holotype: LOJA; isotype: B 60 0130289). tlc 1238k984: lichexanthone, stictic, trace cryptostictic, trace constictic acids.

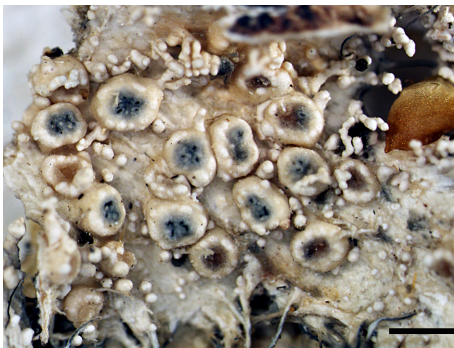


Fig. 6. *Pertusaria pseudoparnassia*, holotype, fertile warts and isidia. Scale = 2 mm

Thallus overgrowing organic litter (incl. lichens) and bark, ca 50 µm thick, continuous; surface smooth and following the irregularities of the substrate or slightly wrinkled, slightly shiny, whitish to pale grey; marginal zone not differentiated; soredia absent, isidia present, cylindrical, ca 0.3 mm thick and ca 0.5–1 mm long, somewhat gnarled and coralloid-branched. Fertile warts rather dense, concolorous with the thallus, sessile with constricted base, flattened semiglobose to

subglobose, 0.6–1.2 mm in diam. and about 0.5 mm high, apically exposing the hymenium in a depressed, grey area with 1–10 black, slightly depressed ostioles; hymenium guttulate; ascospores (5–)8 per ascus, colourless, ellipsoid, 140–180 × 45–50 µm, with shallowly striate inner wall.

Chemistry: lichexanthone, stictic, trace cryptostictic, constictic acids found by TLC; reactions UV+ yellow, K+ yellow turning orange.

Etymology: Named after the similarity to *P. parnassia* Vain.

Distribution and ecology: Known only from Andean forest in southern Ecuador.

Notes: In the world key (Archer and Elix 2018) the most similar species is *P. parnassia*. Its type description (Vainio 1890) and the web pictures of the type specimen. (<https://plants.jstor.org/stable/viewer/10.5555/al.ap.specimen.s-133353>) differ most clearly by the absence of isidia and the lack of a basal constriction of the fertile warts. Moreover in *P. pseudoparnassia* the fertile warts are more strongly flattened with a more widely exposed hymenium apically. Cryptostictic acid may also be a difference as it is a constant accessory in *P. pseudoparnassia* and is not mentioned for *P. parnassia* by Archer and Elix (2018).

Morphologically very similar is also *Pertusaria tapadensis* Elix et A. W. Archer, a recently described muscicolous species from Venezuela, which is reported below also for Colombia and Costa Rica. It agrees in its preference for muscicolous habitats, the basally constricted, widely appanate fertile warts with widely exposed hymenium, and the presence of stictic acid with traces of cryptostictic acid and with constictic acid. It differs by the spores with smooth inner walls occurring with no more than 4 per ascus, and chemically by the presence of 4,5-dichlorolichexanthone instead of lichexanthone, and the additional presence of 2-O-methylperlatolic acid.

Additional specimens examined: – ECUADOR, Zamora-Chinchi: Reserva Biológica San Francisco, 30 km E of Loja on road to Zamora, near shelter, alt. 2,450 m, 3° 58.3' S, 79° 4.7' W, upper montane forest, on bark, 23 Aug. 2001, Nöske 238, tlc: lichexanthone, stictic, trace cryptostictic, trace constictic acids; (27) on *Purdiaea nutans*, 23 cm dbh, in crown, S 53136a, tlc, 12421136: lichexanthone, stictic, trace cryptostictic, trace constictic acids.

ANNOTATED SPECIES LIST

The numbers in brackets correspond to the collecting sites listed above; they are followed by the substrate and the collection number of the voucher. Collection numbers preceded by B are those of P. and B. van den Boom, those preceded by S of H. Sipman. Collections from other sites are presented in detail.

Abrothallus caerulescens I. Kotte – (15) on outcrop, on *Xanthoparmelia*, B 54496a

Actinoplaca strigulacea Müll. Arg. – (23) on leaf, B 54805

Aderkomyces cubanus (Vězda) Lücking, Sérus. et Vězda – (22) on leaf, B 54751

- Alectoria ochroleuca* (Hoffm.) A. Massal. – (17) on acid rock, B 54615
- Allographa argentata* Lücking et L. Umaña – (27) on *Cecropia andina*, 38 cm dbh, in crown, S 52932
- Allographa macella* Kremp. – (5) on wood of fence, B 54045, on tree, B 54080; (6) on tree, B 54184 (Fig. 7E)
- Allographa mexicana* (Hale) Kalb, Lücking et Lumbsch – (27) on *Purdiaea nutans*, 23 cm dbh, on trunk, 5–7 m, S 53123
- Allographa ruiziana* (Fée) A. Massal. – (27) on *Cecropia andina*, 38 cm dbh, on trunk, 1–5 m, S 52884 (filed under *Graphis triphora*).
- Allographa triphora* (Nyl.) Lücking et Kalb – (27) on *Elaeagia obovata*, 48 cm dbh, on trunk 5–14 m and on crown branches, S 52661, S 52678, S 52695; on *Cecropia andina*, 38 cm dbh, on trunk, 1–5 m and in crown, S 52884, S 52931
- Allographa vestitoides* (Fink) Lücking et Kalb – (9) on tree, B 54307
- Anisomeridium foliicola* R. Sant. et Tibell – (23) on leaf, B 54829, B 54851
- Anomomorpha aggregans* (Nyl.) Staiger – (27) on *Elaeagia obovata*, 48 cm dbh, on crown branches, S 52687
- Arthonia anglica* Coppins – (16) on tree, B 54517, B 54524
- Arthonia cyanea* Müll. Arg. f. *minor* Lücking – (23) on leaf, B 54821
- Arthonia epiphyscia* Nyl. – (11) on tree, on *Physcia*, B 54362
- Arthonia phaeophysciae* Grube et Matzer – (17) on tree, on *Phaeophyscia orbicularis*, B 54626
- Arthonia rubella* (Fée) Nyl. – (14) on tree, B 54434, B 54438, B 54457 (Fig. 7A)
- Arthonia stellaris* Kremp. – (5) on tree, B 54064
- Arthotheliopsis hymenocarpoidea* Vain. – (23) on leaf, B 54830
- Arthrorhaphis alpina* (Schaerer) R. Sant. – (17) on sandy layer over outcrop, B 54548
- Aspidothelium fugiens* (Müll. Arg.) R. Sant. – (7) on leaf, B 54237; (23) on leaf, B 54809
- Aspidothelium macrosporum* (Müll. Arg.) Lücking – (23) on leaf, B 54825
- Aspidothelium ornatum* Lücking – (6) on leaf, B 54105
- Aspidothelium scutellincarpum* Lücking – (23) on leaf, B 54790
- Asterothyrium argenteum* Müll. Arg. – (6) on leaf, B 54091
- Asterothyrium aulaxinoides* Lücking – (5) on leaf, B 54059; (6) on leaf, B 54101
- Asterothyrium pittieri* Müll. Arg. – (8) leaf, B 54293
- Asterothyrium rondoniense* Bat. et H. Maia ex Hensen et Lücking – (5) on leaf, B 54060
- Asterothyrium uniseptatum* Lücking – (8) on leaf, B 54291
- Astrothelium nitidiusculum* (Nyl.) Aptroot et Lücking – (5) on tree, B 54085; (10) on tree, B 54328; (14) on tree, B 54481
- Athallia cerinelloides* (Erichsen) Arup, Frödén et Søchting – (1) on tree, B 53984; (2) on tree, B 54000
- Aulaxina intermedia* Lücking – (6) on leaf, B 54154; (23) on leaf, B 54841
- Aulaxina microphana* (Vain.) R. Sant. – (8) on leaf, B 54288
- Aulaxina multiseptata* R. Sant. – (10) on leaf, B 54324
- Aulaxina opegraphina* Fée – (7) on leaf, B 54236; (23) on leaf, B 54857
- Aulaxina quadrangula* (Stirt.) R. Sant. – (6) on leaf, B 54176
- Aulaxina submuralis* Kalb et Vězda – (23) on leaf, B 54838
- Bacidia andina* van den Boom, for details see section Description of new species
- Bacidia campalea* (Tuck.) S. Ekman et Kalb – (3) on dead branch of shrub, B 54008, B 54034; (20) on *Ficus*, B 54654, B 54668; (21) on *Yucca* trunk, B 54704
- Bacidia heterochroa* (Müll. Arg.) Zahlbr. – (16) on tree, B 54527; (20) on *Ficus*, B 54823; (25) on tree, B 54902; (34) on tree, B 54883

Bacidia laurocerasi (Delise ex Duby) Zahlbr. – (16) on *Eucalyptus*, B 54515, B 54581; on tree, B 54525; (25) on *Oreopanax*, B 54893; on tree, B 54896

Bacidia millegrana (Taylor) Zahlbr. – (20) on *Persea*, B 54647; on tree, B 54660; (21) on tree, B 54691 (Fig. 7B)

Bacidina apiahica (Müll. Arg.) Vězda – (7) on leaf, B 54248; (8) on leaf, B 54276, B 54289; (21) on leaf, B 54927

Bacidina defecta Vězda – (6) on leaf, B 54171

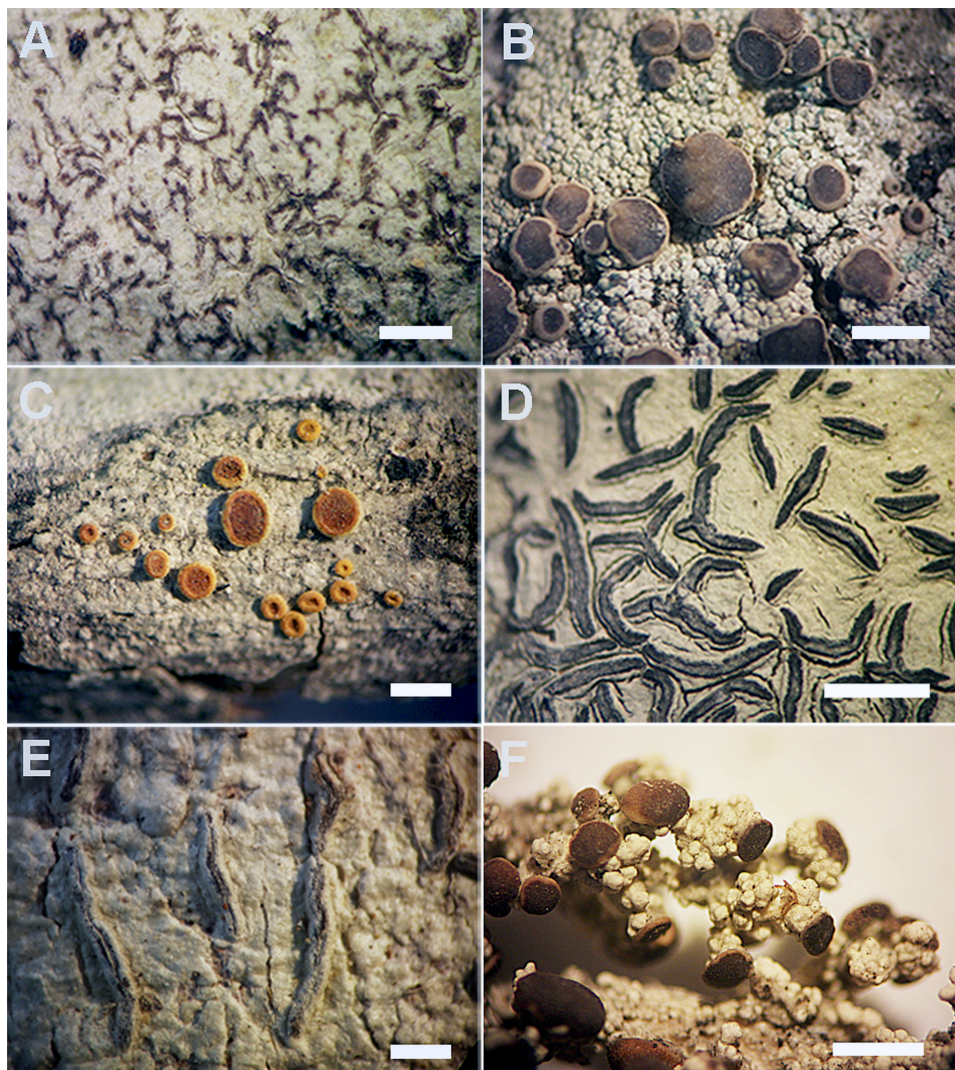


Fig. 7. Habitus figures: A = *Arthonia rubella*, 54457; B = *Bacidia millegrana*, 54660; C = *Caloplaca crocea*, 54037; D = *Graphis crebra*, 54315; E = *Allographa macella*, 54184; F = *Stereocaulon tomentosum*, 54613. Scales: A, C–F = 1 mm; B = 0.5 mm

- Bacidina medialis* (Tuck. ex Nyl.) Kistenich, Timdal, Bendiksbjerg et S. Ekman – (6) on tree, B 54185; (11) on tree, B 54339, B 54340, B 54347, B 54340, B 54363, B 54365; (14) on shrub, B 54490
- Bacidina phacodes* (Körber) Vězda – (20) on tree, B 54655; (21) wood of fence, B 54717; (23) on tree, B 54870
- Bacidia pulverula* van den Boom, for details see section Description of new species
- Bacidiopsis microphyllina* Kalb – (27) Tree 5/I-27, *Inga extra-nodis*, 40 cm dbh, on trunk 10–16 m, S 52342; on crown twigs, S 52826d
- Bactrospora myriadea* (Fée) Egea et Torrente – (11) on tree, B 54352, B 54358; (12) on Manzanilla, B 54377
- Baculifera orosa* Marbach – (27) on *Cecropia andina*, 38 cm dbh, in crown, S 52944a
- Bathelium carolinianum* (Tuck.) R. C. Harris – (14) on tree, B 54439, B 54478
- Buelliella physciicola* Poelt et Hafellner – (26) on tree, on *Hyperphyscia adglutinata*, B 54885
- Bulbothrix tabacina* (Mont. et Bosch) Hale – (6) on *Prunus*, B 54089 (DNA code 6859)
- Calenia aspidota* (Vain.) Vězda – (7) on leaf, B 54235
- Calenia dictyospora* Lücking – (6) on leaf, B 54169; (7) on leaf, B 54229; (23) on leaf, B 54788
- Calenia lueckingii* C. Hartmann – (6) on leaf, B 54098
- Calicium hyperelloides* Nyl. – (16) on stump, B 54506
- Calopadia foliicola* (Fée) Vězda – (6) on leaf, B 54165; (9) on leaf, B 54305, B 54318; (10) on leaf, B 54326
- Calopadia fusca* (Müll. Arg.) Vězda – (6) on leaf, B 54206; (7) on leaf, B 54258
- Calopadia perpallida* (Nyl.) Vězda – (6) on tree, B 54139
- Calopadia phyllogena* (Müll. Arg.) Vězda – (7) on leaf, B 54239
- Calopadia puiggarii* (Müll. Arg.) Vězda – (5) on leaf, B 54057; (6) on leaf, B 54103, B 54192
- Calopadia subcoerulescens* (Zahlbr.) Vězda – (5) on tree, B 54072
- Caloplaca caesiosorediata* Arup et van den Boom – (21) on acidic rock, B 54726
- Caloplaca cerina* (Hedw.) Th. Fr. s. l. – (26) on tree, B 54908
- Caloplaca crocea* (Kremp.) Hafellner et Poelt – (3) on dead branch of shrub, B 54037 (Fig. 7C); (27) on *Hyeronima asperifolia*, 47 cm dbh, on crown twigs, S 52534 (filed under *Coenogonium pyrophthalmum*)
- Caloplaca obscurella* (J. Lahm ex Körb.) Th. Fr. – (1) on tree, B 53983
- Candelaria concolor* (Dicks.) Stein – (19) on *Salix*, B 54106; (20) on *Ficus*, B 54666
- Catillaria nigroclavata* (Nyl.) J. Steiner – (25) on *Oreopanax*, B 54891; (26) on tree, B 54906
- Catinaria atropurpurea* (Schaer.) Vězda et Poelt – (3) on shrub, B 54012, B 54032; (17) on *Polylepis*, B 54563; (21) on tree, B 54711
- Celothelium cinchonarum* (Müll. Arg.) Vain. – (27) on *Cecropia andina*, 28 cm dbh, on trunk 5–10 m, S 52750b
- Cetraria aculeata* (Schreb.) Fr. – (17) on outcrop, B 54537
- Chaenotheca brunneola* (Ach.) Müll. Arg. – (27) on *Elaeagia obovata*, 48 cm dbh, on trunk 5–10 m, S 52652
- Chaenotheca olivaceorufa* (Vain.) Zahlbr. – (21) on wood of fence, B 54694
- Chapsa cinchonarum* (Fée) A. Frisch. – (27) on *Hyeronima asperifolia*, 47 cm dbh, on crown branches, S 52501; on *Cecropia andina*, 31 cm dbh, in crown, S 52977
- Chapsa leprocarpa* (Nyl.) Frisch – (27) on *Elaeagia obovata*, 48 cm dbh, on trunk, 10–14 m, S 52672a
- Chiodecton malmei* G. Thor – Prov. Esmeraldas: La Tola, elev. 1 m, mangrove, on *Rhizophora*, 13 July 1982, A. Aptroot and R. Hensen 11161 [B 60 0182255]

- Chiodecton sphaerale* Ach. – (27) on *Elaeagia obovata*, 48 cm dbh, on trunk 5–14 m, S 52647, B 52673; on *Cecropia andina*, 28 cm dbh, on trunk 5–10 m, S 52725; on *Alchornea grandiflora*, 32 cm dbh, on trunk 0–5 m, S 53150
- Chroodiscus coccineus* (Leight.) Müll. Arg. – (6) on leaf, B 54136; (8) on leaf, B 54298; (23) on leaf, B 54766
- Chrysothrix xanthina* (Vain.) Kalb – (16) on stump, B 54508
- Cladia aggregata* (Sw.) Nyl. – (17) terricolous, B 54556; on outcrop, B 54576
- Cladonia andesita* Vain. – (17) on outcrop, B 54542; terricolous, B 54614a
- Cladonia confusa* R. Sant. – (17) on outcrop, B 54569, B 54574
- Cladonia isabellina* Vain. – (17) terricolous, B 54614
- Coccocarpia epiphylla* (Fée) Kremp. – (23) on leaf, B 54929
- Coccocarpia filiformis* Arv. – (23) on leaf, B 54792
- Coccocarpia neglecta* Aptroot et Lücking – (6) on tree, B 54124
- Coccocarpia stellata* Tuck. – (23) on leaf, B 54780, B 54804
- Coenogonium geraldense* (Henn.) Lücking – (6) on leaf, B 54172
- Coenogonium linkii* Ehrenb. – (22) on tree, B 54733, B 54734; (23) on tree, B 54770
- Coenogonium lisowskii* (Vězda) Lücking – (23) on leaf, B 54811
- Coenogonium luteum* (Dicks.) Kalb et Lücking – (6) on tree, B 54149; (23) on tree, B 54872, B 54876
- Coenogonium pyrophthalmum* (Mont.) Lücking, Aptroot et Sipman – (27) on *Hyeronima asperifolia*, 47 cm dbh, on crown twigs, S 52534
- Coenogonium siquirrense* (Lücking) Lücking – (8) on leaf, B 54281
- Coenogonium tuckermanii* Mont. – (27) on *Inga extra-nodis*, 40 cm dbh, on thick crown branches, S 52359
- Coniambigua phaeographidis* Etayo et Diederich – (14) on tree, on *Leiorreuma*, B 54445
- Coniocarpon cinnabarinum* DC. – (3) on shrub, B 54035; (9) on tree, B 54320; (11) on tree, B 54357; (12) on shrub, B 54389; (13) on shrub, B 54405; (14) on tree, B 54454, B 54487
- Cresponea flava* (Vain.) Egea et Torrente – (11) on tree, B 54350
- Cresponea proximata* (Nyl.) Egea et Torrente – (23) on tree, B 54874 (Fig. 8A)
- Cryptothecia megalocarpa* (Müll. Arg.) R. Sant. – (14) on shrub, B 54453
- Dictyographa arabica* Müll. Arg. – (13) on shrub, B 54420 (Fig. 8B)
- Didymocyrtis melanelixiae* (Brackel) Diederich, R. C. Harris et Etayo – (21) on tree, on *Punctelia reducta*, B 54728
- Didymocyrtis ramalinae* (Roberge ex Desm.) Ertz, Diederich et Hafellner – (12) on shrub, on *Ramalina celsastri*, B 54396, B 54402
- Diorygma confluens* (Fée) Kalb, Staiger et Elix – (5) on tree, B 54074
- Diorygma epiglaucum* (Müll. Arg.) Kalb, Staiger et Elix – (5) on tree, B 54073
- Diorygma monophorum* (Nyl.) Kalb, Staiger et Elix – (5) on tree, B 54081; (8) on tree, B 54128
- Diploschistes scruposus* (Schreb.) Norman – (17) on acidic rock, B 54621
- Dirinaria confluens* (Fr.) D. D. Awasthi – (14) on tree, B 54462
- Dirinaria picta* (Sw.) Clem. et Shear – (14) on tree, B 54442, B 54467
- Distopyrenis epidiorgyma* Etayo et van den Boom, for details see section Description of new species
- Echinoplaca atrofusca* R. Sant. – (5) on leaf, B 54067
- Echinoplaca epiphylla* Fée – (6) on leaf, B 54114, B 54166; (7) on leaf, B 54221
- Echinoplaca handelii* (Zahlbr.) Lücking – (22) on leaf, B 54765
- Echinoplaca leucotrichoides* (Vain.) R. Sant. – (6) on leaf, B 54180; (7) on leaf, B 54243, B 54246; (22) on leaf, B 54735; (23) on leaf, B 54837

Enterographa pallidella (Nyl.) Redinger – (14) on tree, B 54448

Enterographa tropica Sparrius – (14) on tree, B 54433, B 54437

Erioderma pycnidiiferum P. M. Jørg. et Arv. – (27) on *Hyeronima asperifolia*, 47 cm dbh, on crown twigs, S 52509. Note: This specimen was published as *Erioderma papyraceum* P. M. Jørg. et Arv. in Nöske *et al.* (2007). The reidentification was provided by P. M. Jørgensen (Bergen), 2008.

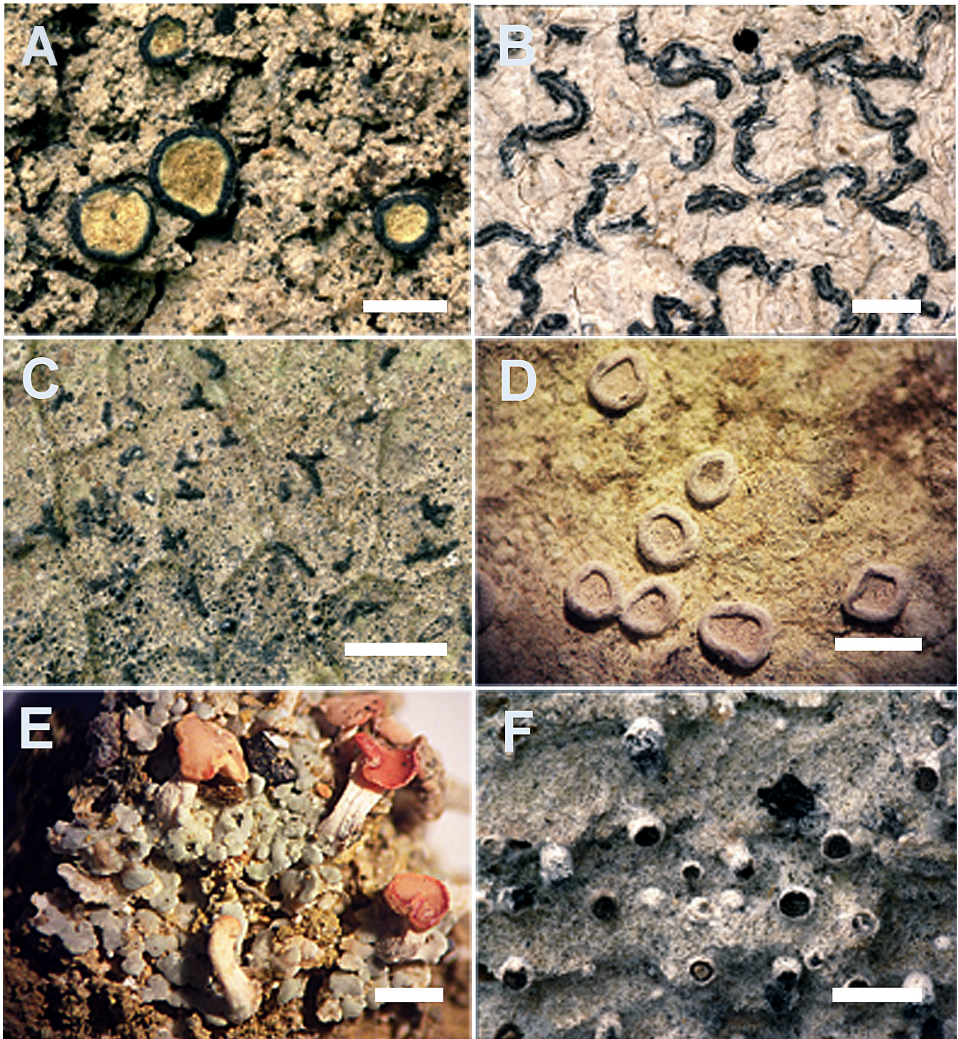


Fig. 8. Habitus figures: A = *Cresponea proximata*, 54874; B = *Dictyographa arabica*, 54420; C = *Hemigrapha strigulata*, 54739; D = *Lecanactis epileuca*, 54864; E = *Phyllobaeis erythrella*, 54779; F = *Tylophoron moderatum*, 54190. Scales: A–F = 1 mm

- Eschatogonia prolifera* (Mont.) R. Sant. – (27) on *Hyeronima asperifolia*, 47 cm dbh, on trunk 0–5 m, S 52443a [filed under *Eschatogonia cf. angustiloba*]
- Etayoa trypethelii* (Flakus et Kukwa) Diederich et Ertz – (5) on tree, on *Hemithecium*, B 54086
- Eugeniella leucocheila* (Tuck.) Lücking, Sérus. et Kalb – (22) on leaf, B 54744
- Fellhanera dictyospora* Lücking – (6) on leaf, B 54196
- Fellhanera naevia* (Vain.) Lücking et M. Cáceres – (8) on leaf, B 54297, B 54301
- Fellhanera paradoxa* (Vězda) Vězda – (7) on leaf, B 54263
- Fellhanera parvula* (Vězda) Vězda – (23) on leaf, B 54791
- Fellhanera semecarpi* (Vain.) Vězda – (6) on leaf, B 54167, B 54181, B 54195
- Fellhanera tubulifera* Rain. Schub. et Lücking – (7) on leaf, B 54257
- Flavoparmelia soredians* (Nyl.) Hale – (19) on tree, B 54636
- Flavopunctelia flaventior* (Stirt.) Hale – (1) on *Eucalyptus*, B 53988; (15) on tree, B 54499
- Glyphis cicatricosa* Ach. – (20) on tree, B 54671
- Graphis acharii* Fée – (6) on tree, B 54130, B 54184
- Graphis cincta* (Pers.) Aptroot – (11) on dead branch, B 54344
- Graphis crebra* Vain. – (9) on tree, B 54315; (20) on tree, B 54673 (Fig. 7D)
- Graphis dendrogramma* Nyl. – (14) on shrub, B 54452; on tree, B 54456, B 54482
- Graphis glaucescens* Fée – (14) on tree, B 54485
- Graphis lineola* Ach. – (11) on tree, B 54372; (20) on *Ficus*, B 54665
- Graphis proserpens* Vain. – (27) on *Prunus huantensis*, 22 cm dbh, on trunk, 5–11 m, S 53052
- Graphis rhizocola* (Fée) Lücking et Chaves – (27) on *Elaeagia obovata*, 35 cm dbh, on trunk 0–5 m, S 52597. Note: The ascospores are without apical gelatinous caps.
- Gyalectidium filicinum* Müll. Arg. – (6) on leaf, B 54209, B 54212
- Gyalideopsis laevithallina* Lücking – (7) on leaf, B 54261; (23) on leaf, B 54844
- Gyalideopsis pallescens* Lücking – (7) on leaf, B 54242
- Gyalideopsis rubescens* Vězda – (7) on leaf, B 54238
- Gyalideopsis vulgaris* (Müll. Arg.) Lücking – (6) on leaf, B 54214; (7) on leaf, B 54266
- Gyalolechia flavorubescens* (Huds.) Søchting, Frödén et Arup – (15) on shrub, B 54498
- Hemigrapha strigulae* Matzer – (22) on leaf, B 54739 (Fig. 8C)
- Heterodermia andina* Moberg – (18) on tree, B 54627; (19) on tree, B 54639; (20) on tree, B 54650; on *Ficus*, B 54669
- Heterodermia lamelligera* (Taylor) Trass – (27) on *Solanum grandiflorum*, 30 cm dbh, on crown branches, S 52568
- Heterodermia urtasuni* Chaves, L. Umaña et Sipman – (27) on *Solanum grandiflorum*, 30 cm dbh, on crown branches, S 52566
- Hyperphyscia adglutinata* (Flörke) H. Mayrhofer et Poelt – (12) on Manzanilla, B 54383; on shrub, B 54388; (18) on tree, B 54632; (19) on *Salix*, B 54635
- Hyperphyscia isidiata* Moberg – (20) on tree, B 54648
- Hyperphyscia pruinosa* Moberg – (11) on dead branch, B 54360; on tree, B 54368, B 54369
- Hypogymnia bitteri* (Lyngé) Ahti – (17) on acidic rock, B 54579
- Hypotrachyna andensis* Hale – (17) on outcrop, B 54538 (DNA code 6854)
- Hypotrachyna brevirhiza* (Kurok.) Hale – (17) on shrub, B 54597 (DNA code 6861)
- Hypotrachyna ensifolia* (Kurok.) Hale – (17) on outcrop, B 54619 (DNA code 6860)
- Hypotrachyna gondylophora* (Hale) Hale – (17) on shrub, B 54589 (DNA code 6868)
- Hypotrachyna imbricatula* (Zahlbr.) Hale – (9) on tree, B 54314 (DNA code 5777)
- Hypotrachyna meyeri* (Zahlbr.) Streimann – (17) on *Polylepis*, B 54560 (DNA code 6866)
- Hypotrachyna minarum* (Vain.) Krog et Swinscow – (21) on tree, B 54687 (DNA code 6869)

- Hypotrachyna partita* Hale – Prov. Loja: Loja-Saraguro road, 6 km N of Saraguro, Bosque Nativo Hurshapampa, alt. 2,900–2,970 m, 3° 39.7' S, 79° 16.2' W, upper montane forest to elfin forest, epiphyte on tree, 3 Oct. 2003, Kürschner et Parolly 03-335a, tlc: atranorin, anziaic, trace echinocarpic, conechinocarpic acids.
- Hypotrachyna pulvinata* (Fée) Hale – (17) on outcrop, B 54609 (DNA code 5776)
- Hypotrachyna rockii* (Zahlbr.) Hale – (5) on tree, B 54063 (DNA code 6863); on tree, B 54065 (DNA code 6862); (17) on shrub, B 54543 (DNA code 6867)
- Hypotrachyna sinuosa* (Sm.) Hale – (17) on outcrop, B 54535 (DNA code 6865); on *Polylepis*, B 54564
- Hypotrachyna steyermarkii* (Hale) Hale – (17) on outcrop, B 54533 (DNA code 5927)
- Hypotrachyna subphysodolica* (Hale) Hale – (17) on shrub, B 54594 (DNA code 5928)
- Japewiella tavaresiana* (H. Magn.) Printzen – (3) on dead branch of shrub, B 54901
- Lasioloma arachnoideum* (Kremp.) R. Sant. – (5) on leaf, B 54087
- Lecanactis epileuca* (Nyl.) Tehler – (23) on tree, B 54864 (Fig. 8D)
- Lecania cyrtella* (Ach.) Th. Fr. – (25) on *Oreopanax*, B 54894
- Lecania subfuscula* (Nyl.) S. Ekman – (21) on N exposed rock-face, B 54727
- Lecanora albella* (Pers.) Ach. – (16) on *Eucalyptus*, B 54518; (26) on tree, B 54912
- Lecanora albellula* (Nyl.) Th. Fr. – (1) on *Eucalyptus*, B 53996
- Lecanora helva* Stizenb. – (13) on shrub, B 54408
- Lecanora leproplaca* Zahlbr. – (9) on tree, B 54316
- Lecanora* aff. *subrauida* Nyl. – (16) on stump, B 54512
- Lecanora subalbellina* Vain. – (16) on tree, B 54522
- Lecanora strobilina* (Spreng.) Kieff. – (21) on *Eucalyptus*, B 53997
- Lecanora tropica* Zahlbr. – (20) on tree, B 54670
- Lecidella achristotera* (Nyl.) Hertel et Leuckert – (25) on *Laurus*, B 54900; (26) on tree, B 54905
- Leiorreuma sericeum* (Eschw.) Staiger – (14) on tree, B 54458
- Lepra commutata* (Müll. Arg.) Lendemer et R. C. Harris – ECUADOR, (27) on inner and outer crown branches, S 52273, S 52285, tlc: cryptothamnolic, haemathamnolic acids; on *Inga extra-nodis*, 40 cm dbh, on thick crown branches, S 52384, tlc: cryptothamnolic, haemathamnolic acids; on *Inga extra-nodis*, 40 cm dbh, on thick crown branches, S 52384a, tlc: lichexanthone, cryptothamnolic, haemathamnolic acids; on *Inga extra-nodis*, 40 cm dbh, on crown twigs, S 52400, tlc: lichexanthone, cryptothamnolic, haemathamnolic acids; on *Solanum grandiflorum*, 30 cm dbh, in crown, S 52593, tlc: lichexanthone?, cryptothamnolic, haemathamnolic acids; on *Elaeagia obovata*, 48 cm dbh, on crown branches, S 52691aa, tlc: lichexanthone, cryptothamnolic, haemathamnolic acids; on *Cecropia andina*, 38 cm dbh, on trunk, 5–9 m, S 52910a, tlc: lichexanthone, cryptothamnolic, haemathamnolic acids; on *Purdiaea nutans*, 23 cm dbh, in crown, S 53136, tlc: lichexanthone, cryptothamnolic, haemathamnolic acids. – Zamora-Chinchipe: Cordillera Numbala, Reserva Biológica San Francisco, S of road Loja-Zamora, surroundings of Station, 3° 58.3' S, 79° 04.7' W, corticolous on trunk of free-standing tree, 13 Oct. 1996, Frisch 935 [hb. Frisch], tlc: lichexanthone, cryptothamnolic, haemathamnolic acids; id., transect 2, alt. 2,000 m, 3° 58.3' S, 79° 4.7' W, montane tropical rain forest, on bark, 5 May 2001, Nöske, Sipman 95, tlc: lichexanthone, cryptothamnolic, haemathamnolic acids. – COLOMBIA, Cauca: Popayan, Los Robles, campus of Fundación Universitaria, ca 15 km towards Timbío, alt. 1,750 m, 2° 23' N, 76° 39' W, strongly disturbed forest relic in valley near rear gate of campus, 20–21 June 1986, Sipman, Velosa et al. 33663, tlc: haemathamnolic acid. – Cundinamarca: Munic. San Francisco, vereda Sabaneta, near Quebrada Cueva Grande, alt. 2,500 m,

4° 54' N, 74° 18' W, strongly influenced *Quercus* forest remnant and pasturefields, on trees along track through pasturefields, 17 July 1986, Sipman, Cardozo, Ballesteros 23633, tlc: haemathamnolic acid. – Nariño: Munic. Piedranca, S of Ricaurte (on road Pasto-Tumaco), along road from San Isidro to Reserva Natural La Planada, alt. 1,700 m, 1° 06' N, 77° 54' W, on small trees along road through cultivated fields (mossy montane forest zone), 15 June 1986, Sipman, Velosa *et al.* 33494a, tlc: haemathamnolic acid. – Risaralda: Mnpio. Santuario, carretera desde Santuario a Los Planes, alt. 2,000 m, 4° 57' N, 75° 59' W, selva subandina de roble (*Quercus humboldtii*), epífita sobre *Q. humboldtii*, Oct.–Dec. 1989, Wolf, Swaan, den Hollander 5935, tlc: cryptothamnolic, haemathamnolic acids. – COSTA RICA, Guanacaste: 15 km SSE of Nicoya, near Hojancha, Tropica Verde, Zona Protector Nossara, alt. 850 m, 10° 01.0' N, 85° 23.1' W, lower montane moist forest zone, small trunks in exposed fence between pasturefields and road, 22 March 2004, Sipman 52082, tlc: lichexanthone, cryptothamnolic, haemathamnolic acids. – Note: The available neotropical *Lepra* specimens are morphologically very uniform. Their thallus is densely covered with ca 1 mm wide, usually white-topped warts, which may contain an aborted hymenium or produce coarse soredia. They resemble *Varicellaria velata* (Turner) I. Schmitt et Lumbsch, from which they differ by the negative C-reaction. Chemically they contain variable amounts of the xanthone lichexanthone, sometimes seemingly absent, and specific sets of β -orcinol depsides, depsones or β -orcinol depsidones. These are used here as species criteria. In Ecuador three species were found. Specimens containing cryptothamnolic and haemathamnolic acid are included in *L. commutata*. This species is characterised by the presence of haemathamnolic acid (Archer and Elix 2018), and all specimens seen except some from Colombia have additionally cryptothamnolic acid. Specimens containing squamatic acid, often with a trace of 2-O-methylsquamatic, are included in *Pertusaria gedehana* Zahlbr. in accordance with Archer and Elix (2018). The third group, containing norstictic acid, is included in *L. erythrella*.

Lepra erythrella (Müll. Arg.) I. Schmitt, B. G. Hodk. et Lumbsch – ECUADOR, (27) on *Cecropia andina*, 31 cm dbh, on tree base, S 52948b, tlc: norstictic acid. – COLOMBIA, Bogotá D.E.: Región de Monserrate. Acueducto de Bogotá, “El Granizo”, alt. 3,200 m, sobre corteza de árbol, en bosque, 10 Abril 1980, Vargas 232, tlc: norstictic, connorstictic acids; Páramo de Chisacá, along road Usme-Nazareth, *Polylepis* woodland in valley of Río Santa Rosa, alt. 3,400 m, epiphyte on *Polylepis*, 4 Sep. 1984, Aguirre, Sipman 5081, tlc: norstictic, connorstictic acids. – Boyacá: N de Vado Hondo, Peña de Arnical, lado E, alt. 3,400 m, mancha de bosque húmedo alto-andino con *Gynoxis*, *Miconia*, *Hesperomeles*, *Weinmannia*, *Diplostephium* y *Eupatorium*, epífita sobre tronco de *Weinmannia*, 7 Abril 1973, Cleef 9497, tlc: norstictic, connorstictic acids. – Cundinamarca: Páramo de Guasca, Clla. Pena Negra, along road Guasca-Guacheta, Mnpio. Guasca, valley of El Chuscal, W-slope, alt. 3,200 m, mixed subparamo woodland of *Brunellia*, *Drimys*, *Miconia*, *Oreopanax* and *Clusia* with clearings, epiphyte, 6 Sep. 1984, Aguirre, Sipman 5108, tlc: norstictic, connorstictic acids. – Risaralda: Mnpio. Sta. Rosa de Cabal, Camino Real entre Termas de Sta. Rosa y Hacienda La Sierra, finca Berlin, alt. 2,970 m, 4° 50' N, 75° 31' W, selva andina con *Weinmannia rollottii*, *Brunellia* cf. *goudotii* y *Miconia* sp., epífita sobre *Clusia* aff. *multiflora* (Wolf 462), 4 Feb. 1986, Wolf 718, tlc: norstictic, connorstictic acids; Mnpio. Sta. Rosa de Cabal, Camino Real entre Termas de Sta. Rosa y Hacienda La Sierra, alt. 3,370 m, 4° 49.5' N, 75° 30.5' W, selva andina con *Neurolepis* sp., *Weinmannia mariquitae* y *W. tolimensis*, epífita sobre *W. mariquitae* (Wolf 822), 23 Feb. 1986, Wolf 740, tlc: norstictic, connorstictic acids. –

COSTA RICA, Cartago: Cordillera de Talamanca, Cerro de la Muerte, C. de la Asunción, Cra. Interamericana, alt. 3,350 m, 9° 34' N, 83° 46' W, subparamo shrub, ca 2 m tall, epiphyte on branchlets, 29 Dec. 1978, Sipman 11670, tlc: norstictic acid; Parque Nacional Tapanti (AC Amistad Pacifico), Cerro de la Muerte, km 93 on road (ruta 2) from Cartago to San Isidro, roadside, alt. 3,000–3,100 m, 9° 34' N, 83° 45' W, upper montane cloud forest zone: disturbed low forest, on bark (lower trunk), 3 July, 2002, Sipman 48221, tlc: norstictic, connorstictic acids; Parque Nacional Irazu (AC Cordillera Volcanica Central), summit of Volcan Irazu, 25 km ENE of San Jose, access road to crater and surroundings, alt. 3,300 m. 9° 59' N, 83° 51' W, alpine paramo zone: disturbed paramo vegetation, on bark (stem), 6 July 2002, Sipman 48328, tlc: norstictic, connorstictic acids. – San José: Cantón de Perez Zeledon, Cordillera de Talamanca, Cerro de la Muerte, alt. 3,000 m, 9° 30.8' N, 83° 45.8' W, *Escalonia* vegetation, 21 Feb. 1996, Inberg 1235, tlc: norstictic, trace connorstictic acids. – Puntarenas: Cordillera de Tilaran, Monteverde, near the cheese factory, alt. 1,450 m, 10° 18' N, 84° 49' W, premontane rain forest zone, forest relics among pasturefields, on tree trunks, 4 Jan. 1979, Sipman 12094, tlc: norstictic acid. – Note: Contrary to the other *Lepra* species reported here, all specimens of *L. erythrella* are sorediate and lack aborted ascocarps, and their inclusion in the genus *Lepra* is rather speculative.

Lepra gedehana (Zahlbr.) Sipman, **comb. nova** – Mycobank no.: MB 845429 – Basionym: *Pertusaria gedehana* Zahlbr., *Annals Cryptog. Exot.* 1(2): 189 (1928). – ECUADOR, (27) on *Hyeronima asperifolia*, 47 cm dbh, on crown branches, S 52500a, tlc: squamatic acid; on *Cecropia andina*, 28 cm dbh, on trunk, 10–13 m, and in crown, S 52762, S 52766, S 52774b, tlc: lichexanthone, squamatic acid; lichexanthone, trace 2-O-methylsquamatic, squamatic acids; on *Cecropia andina*, 31 cm dbh, in crown, S 52999, tlc: lichexanthone, squamatic acid; on *Prunus huantensis*, 22 cm dbh, in crown, S 53082, tlc: squamatic acid; on *Elaeagia obovata*, 34 cm dbh, on trunk, 7–10 m, S 52422, tlc: trace lichexanthone?, trace 2-O-methylsquamatic, squamatic acids; on *Hyeronima asperifolia*, 47 cm dbh, on crown twigs, S 52531b, tlc: lichexanthone, squamatic acid; on *Elaeagia obovata*, 48 cm dbh, on trunk 5–10 m, S 52655, tlc: trace squamatic acid; on *Cecropia andina*, 28 cm dbh, in crown, S 52766a, tlc: lichexanthone, squamatic acid. – Zamora-Chinchipe: Cordillera Numbala, Reserva Biológica San Francisco, S of road Loja-Zamora, Quebrada 5, Forest experiment plots, alt. ca 1,900 m, 3° 58' S, 79° 04' W, on fallen crown branch in mountain forest, in plot C, 21 Aug. 2003, Sipman, Mandl 51416, tlc: lichexanthone, trace 2-O-methylsquamatic, squamatic acids; id., near Refugio, alt. 2,450 m, 3° 58' S, 79° 04' W, on shrub branches in shrubby forest on mountain ridge, 22 Aug. 2003, Sipman, Mandl 51453, tlc: lichexanthone, trace 2-O-methylsquamatic, squamatic acids. – COLOMBIA, Cundinamarca: Munic. San Francisco, vereda Sabaneta, near Quebrada Cueva Grande, alt. 2,500 m, 4° 54' N, 74° 18' W, strongly influenced Quercus forest remnant and pasturefields, on trees along track through pasturefields, 17 July 1986, Sipman, Cardozo, Ballesteros 23632, tlc: squamatic acid. – Nariño: Munic. Piedrancha: S of Ricaurte (on road Pasto-Tumaco), along road from San Isidro to Reserva Natural La Planada, alt. 1,700 m, 1° 06' N, 77° 54' W, on small trees along road through cultivated fields (mossy montane forest zone), 15 June 1986, Sipman, Velosa *et al.* 33494, tlc: trace squamatic acid. – Risaralda: Mnpio. Sta. Rosa de Cabal, vereda La Colina, alt. 1,725 m, 4° 56' N, 75° 42' W, selva subandina con *Brosimum* sp. y *Ladenbergia* sp., epífita sobre *Dendropanax* cf. *macrocarpum* (Wolf 332), 22 Oct. 1985, Wolf 284, tlc: squamatic acid. – Santander: Mnpio. Charala, corregimiento Virolín. Cañaverales, near the Tienda, alt. 1,750 m, 6° 05' N, 73° 12' W, on fencepools

- and trees in pasturefields around farm in mountain valley, 25 Oct. 1988, Sipman, Aguirre 27509. tlc: squamatic acid. – Tolima: Munic. Venadillo, Vereda La Planada, alt. 1,290 m, selva calido-tropical con *Clusia*, *Ficus*, *Brunellia* y *Palicourea* cf. *rigida*, 9 Ago. 1980, van Reenen 2460, tlc: squamatic acid. – PANAMA, Chiriqui: N of David, Boquete, WNW of village, W of Los Naranjos, trail to Volcan Barú, from entrance of National Park Barú, up 1 km, along tropical rainforest, alt. 1,800 m, 08° 47.7' N, 82° 29.5' W, on mature branch, 18 Feb. 2010, van den Boom 44127 [hb. v.d. Boom], tlc: lichexanthone, squamatic acid; id., NW of village, N of Bajo Mono, road to office of Quetzal Trail, N of main road, paved road along tropical forest and fields, alt. 2,100 m, 08° 50.11' N, 82° 30.6' W, on *Pinus*, 19 Feb. 2010, van den Boom 44238 [hb. v.d. Boom], tlc 12391017: atranorin, trace lichexanthone, squamatic acid. – Coclé: SW of Panama City, NW of small village El Valle, in old crater of extinct volcano, top of tropical forest, La India Gormida, open hilly area with some scattered shrubs, small trees and a few outcrops, alt. 860 m, 08° 36.5' N, 80° 09.10' W, on S exposed sloping outcrop, 16 Feb. 2010, van den Boom 44021 [hb. v.d. Boom], tlc: lichexanthone, squamatic acid. – COSTA RICA, Heredia: Valle Central (AC Cordillera Volcanica Central), Carrizal, km 20 on road (ruta 9) from Heredia to Varablanca, roadside near Lecheria, alt. 1,900 m, 10° 06' N, 84° 10' W, montane rainforest zone: roadside pasture with living fence trees (chiefly *Erythrina*), on bark (lower trunk) of *Erythrina*, 7 July 2002, Sipman 48379, tlc: lichexanthone, squamatic acid. – San José: 15 km NE of San José, gas station near toll station on highway through Braulio Carrillo to Guápiles, alt. 1,500 m, 10° 01.5' N, 84° 01.3' W, lower montane moist forest zone, on roadside *Casuarina* trunks, 9 Mar. 2004, Sipman 51596, tlc: lichexanthone, squamatic acid; along highway through Braulio Carrillo, near toll station, alt. 1,500 m, 10° 02' N, 84° 01' W, on *Casuarina* along road, 9 Mar. 2004, Aptroot 60080, tlc: lichexanthone, squamatic, 1'-methyl squamatic acid. – Puntarenas: Zona Protectora Las Tablas (AC Amistad Pacifico), sector La Neblina, 25 km ENE of San Vito near Las Mellizas, access road to fincas, alt. 1,600 m, 8° 55' N, 82° 45' W, montane rainforest zone: pasture with scattered trees and stumps, on bark (lower trunk), 27 June 2002, Sipman 47900b, tlc: lichexanthone, squamatic acid; San Vito de Coto Bruz, Estación Biológico Las Cruces, alt. ca 1,200 m, 8° 47.1' N, 82° 57.6' W, young planted trees in meadow on hilltop, on trunk of *Cecropia* at margin, 10–19 Oct. 2004, Sipman 53357a, tlc: lichexanthone, squamatic acids. – Note: See under *Lepra commutata*.
- Lepraria congesta* (Nyl.) Lendemer et B. P. Hodk. – (17) on outcrop, B 54578
- Leptogium adpressum* Nyl. – (27) on *Hyeronima asperifolia*, 47 cm dbh, on crown twigs, S 52525
- Leptogium azureum* (Sw.) Mont. – (21) on tree, B 54716; (23) on tree, B 54793
- Leptogium brebissonii* Mont. – (23) on leaf, B 54789
- Leptogium phyllocarpum* (Pers.) Mont. – (23) on leaf, B 54856
- Leucodermia leucomelos* (L.) Kalb (syn. *Heterodermia leucomelos* (L.) Poelt) – (24) on tree, B 54884
- Leucodermia lutescens* (Kurok.) Kalb (syn. *Heterodermia lutescens* (Kurok.) Follmann) – (5) on fence, B 54046
- Lichenochora galligena* R. Sant. et Hafellner – (19) on *Sambucus*, on *Physcia*, B 54646; (26) on tree, on *Physcia*, B 54904
- Lichenocodium erodens* M.S. Christ. et D. Hawksw. – (26) on tree, on *Flavoparmelia*, B 54915
- Lichenostigma cosmopolites* Hafellner et Calat. – (15) on outcrop, on *Xanthoparmelia*, B 54496
- Lichenotubeufia heterodermyae* (Etayo) Etayo – (21) on wood of fence, on *Leucodermia leucomelos*, B 54917

- Lithothelium decumbens* (Müll. Arg.) Aptroot – prov. Zamora-Chinchipe: Cordillera Num-bala, Reserva Biológica San Francisco, S of road Loja-Zamora, Quebrada 5, Forest experiment plots, alt. ca 1,900 m, 3° 58' S, 79° 04' W, on tree trunk in mountain forest, within reach from the soil, in plot H, 21 Aug. 2003, Sipman, Mandl 51423, 51428; id., on thin trunk in montane mossy forest, close to the soil, 13 Aug. 2003, Sipman, Mandl 51269
- Loflammia epiphylla* (Fée) Lücking et Vězda – (23) on leaf, B 54878, B 54783
- Lopezaria versicolor* (Flot.) Kalb et Hafellner – (3) on tree, B 54004; (3) on dead branch of shrub, B 54011; (5) on tree, B 54083; (6) on tree, B 54131, B 54186, B 54191; (20) on tree, B 54649
- Malmidea fuscella* (Müll. Arg.) Kalb et Lücking – (3) on dead branch of shrub, B 54009
- Malmidea hypomela* (Nyl.) Kalb et Lücking – (5) on tree, B 54061; (6) on tree, B 54161
- Malmidea leptoloma* (Müll. Arg.) Kalb et Lücking – (27) on *Heliocarpus americanus*, 40 cm dbh, on outer crown branches, S 52231a; on *Cecropia andina*, 31 cm dbh, in crown, S 52995b
- Malmidea piperis* (Spreng.) Kalb, Rivas Plata et Lumbsch – (6) on tree, B 54920
- Mazosia dispersa* (J. Hedrick) R. Sant. – (22) on leaf, B 54747
- Mazosia phyllosema* (Nyl.) Zahlbr. – (22) on leaf, B 54750
- Megalospora tuberculosa* (Fée) Sipman – (5) on wood of fence, B 54052; (6) on tree, B 54187; on tree (DNA), B 54132; (23) on tree (DNA), B 54875
- Melaspilea cupularis* Müll. Arg. – (14) on shrub, on *Pyrenula*, B 54429, B 54493
- Myelochroa lindmanii* (Lyngé) Elix et Hale – (15) on tree, B 54500 (DNA code 5775)
- Nyungwea anguinella* (Nyl.) Aptroot – (12) on shrub, B 54394, B 54401; (13) on shrub, B 54422
- Ocellularia rhodostroma* (Mont.) Zahlbr. – (23) on tree, B 54767
- Opegrapha cactacearum* Riedl – (13) on tree, B 54426
- Opegrapha foreauii* (C. Moreau et M. Moreau) Hafellner et R. Sant. – (6) on tree, on *Leucoder-mia leucomelos*, B 54162
- Oropogon barbaticus* Essl. – (17) terricolous, B 54616
- Oropogon bicolor* Essl. – (17) terricolous, B 54555
- Oropogon loxensis* (Fée) Th. Fr. – (17) terricolous, B 54566
- Ovicuculispora parmeliæ* (Berk. et M. A. Curtis) Etayo – (1) on *Eucalyptus*, on *Flavopunctelia flaventior*, B 53989; (20) on *Ficus*, on *Physcia*, B 54667; (25) on *Laurus* s. l., on *Parmotrema*, B 54899
- Pallidogramme chrysenferon* (Mont.) Staiger, Kalb et Lücking – (5) on tree, B 54084; (10) on tree, B 54329
- Pannaria rubiginosa* (Thumb. ex Ach.) Delise – (17) on *Polylepis*, B 54561; on shrub, B 54591
- Parmeliella pannosa* (Sw.) Müll. Arg. – (6) on tree, B 54144; (20) on tree, B 54658
- Parmelinella wallichiana* (Taylor) Elix et Hale – (5) on tree, B 54056 (DNA code 6858)
- Parmotrema coralliforme* (Hale) Hale – (27) on *Elaeagia obovata*, 35 cm dbh, on trunk 5–10 m, S 52603, med. K+ y→r.
- Parmotrema flavotinctum* (Hale) Hale – (6) on tree, B 54174 (DNA code 5584)
- Parmotrema mellissii* (C. W. Dodge) Hale – (9) on tree, B 54312 (DNA code 5583)
- Peltula corticola* Büdel et R. Sant. – (11) on tree, B 54364
- Pertusaria flavida* (DC.) J. R. Laundon – (27) on *Inga extra-nodis*, 40 cm dbh, on trunk 10–16 m, S 52333, tlc: 2'-O-methylperlatolic acid.
- Pertusaria lucidotetra* Sipman, for details see section Description of new species
- Pertusaria pseudoparnassia* Sipman, for details see section Description of new species
- Pertusaria tapadensis* Elix et A. W. Archer – COLOMBIA, Cundinamarca: Páramo de Guasca, Clla. Pena Negra, along road Guasca-Guacheta, Mnpio. Guasca. Valley of El

Chuscal, W-slope. Alt. 3,200 m. Mixed subparamo woodland of *Brunellia*, *Drimys*, *Miconia*, *Oreopanax* and *Clusia* with clearings. Epiphyte. 6 Sep. 1984, Aguirre, Sipman 5091; tlc: 4,5-dichlorolichexanthone, 2-O-methylperlatolic, stictic, trace cryptostictic, trace constictic acids. – COSTA RICA, San José: P.N. Chirripó, 500 m S Valle Los Crestones, Sendero Cresta de Los Arrepentidos-Los Crestones. Alt. 3,350 m.s.m. 10° 27.2' N, 83° 30.7' W. Bosque quemado (1976) de *Quercus costaricensis* y *Comarostaphylis*. 19 Sep. 1988, Kappelle 2605; tlc: 4,5-dichlorolichexanthone, 2-O-methylperlatolic, stictic, trace cryptostictic, trace constictic acids; Cerro de la Muerte, along Panamerican Highway. Ca 2 m tall scrub with rock outcrops, 1 km N of Cerro Buenavista. Alt. 3,400 m. 9° 33' N, 83° 46' W. Terrestrial. 20 Mar. 1985, Sipman, Chaverri 20694; tlc: 4,5-dichlorolichexanthone, 2-O-methylperlatolic, stictic, trace cryptostictic, trace constictic acids; Cerro de la Muerte, along Panamerican Highway, ca 2 m tall scrub with rock outcrops, 1 km N of Cerro Buenavista. Alt. 3,400 m. 9° 33' N, 83° 46' W. Epiphyte on shrub. 20 Mar. 1985, Sipman & Chaverri 20754; tlc: 4,5-dichlorolichexanthone, 2-O-methylperlatolic, stictic, trace cryptostictic, trace constictic acids; Reserva Rio Macho, Ojo de Agua. Alt. ca 3,000 m. 9° 37' N, 83° 49' W. Secondary scrub near houses on ridge. 21 Mar. 2000, Sipman, Umaña 46588; tlc: 4,5-dichlorolichexanthone, 2-O-methylperlatolic, stictic, trace cryptostictic, trace constictic acids. – Cartago: Cordillera de Talamanca, Amistad Pacifico Conservation Area, Tapantí National Park; km 68 on road (ruta 2) from Cartago to San Isidro, roadside. Alt. 2,700 m. 9° 40' N, 83° 51' W. Disturbed upland peat bog with scattered shrubs and *Blechnum*; on bark (lower trunk), semishaded site. 25 Mar. 2004, Aptroot 60977; tlc: 4,5-dichlorolichexanthone, 2-O-methylperlatolic, stictic, trace cryptostictic, trace constictic acids. – Note: For differentiation from *P. pseudoparnassia* see there.

Pertusaria tenella Müll. Arg. – ECUADOR, Zamora-Chinchipec: Cordillera Numbala, Reserva Biológica San Francisco, S of road Loja-Zamora. Camino Canal, between Camino Zigzag and Transecto 2. Alt. ca 1,800 m. 3° 58' S, 79° 04' W. On thin trunks in secondary growth on clearing. 12 Aug. 2003, Sipman, Mandl 51259, tlc: lichexanthone, stictic, constictic acids. – COSTA RICA, Puntarenas: San Vito de Coto Bruz, Estación Biológica Las Cruces. Alt. ca 1,200 m. 8° 47.1' N, 82° 57.6' W. Young planted trees in meadow on hilltop. 10–19 Oct. 2004, Sipman 53354, tlc: lichexanthone, stictic, constictic acids. – Note: For further details see under *P. lucidotetra*.

Pertusaria tetrathalamia (Fée) Nyl. – ECUADOR, Zamora-Chinchipec: Cordillera Numbala, Reserva Biológica San Francisco, S of road Loja-Zamora. Quebrada 5, Trail from forest experiment plots downward. Alt. ca 1,800 m. 3° 58' S, 79° 04' W. On shrub in clearing with grassy vegetation. 13 Aug. 2003, Sipman, Mandl 51276, tlc: 4,5-dichlorolichexanthone, stictic, constictic acids. – COSTA RICA, Puntarenas: Zona Protectora Las Tablas (AC Amistad Pacifico). Estacion El Progreso, 20 km ENE of San Vito near La Lucha, surroundings of station. Alt. 1,300 m. 8° 54' N, 82° 48' W. Montane rainforest zone: roadside coffee plantations (shade trees and fence posts), on bark (lower trunk) of *Erythrina* shade tree. 28 June 2002, Sipman 47867, tlc: 4,5-dichlorolichexanthone, constictic acid; Parque Internacional La Amistad (AC Amistad Pacifico). Estacion Altamira, 20 km N of San Vito near Finca Colorado, access road to station. Alt. 1,350–1,450 m. 9° 01' N, 83° 00' W. Montane rainforest zone: roadside pasture with living fence posts, on bark (stem base) of Asteraceae. 29 June 2002, Sipman 48011j, tlc: 5,5-dichlorolichexanthone, constictic acid; id., Cerro Biolley, 30 km NNW of San Vito near Biolley, lower trail from road to Sabanas Esperanza. Alt. 1,300–1,400 m. 9° 04' N, 83° 03' W. Upland savanna zone: disturbed savanna vegetation with abundant

shrubs and trees, on bark (lower trunk). 2 July 2002, Sipman 48132, tlc: 4,5-dichlorolichexanthone, constictic acid.

Pertusaria texana Müll. Arg. – (16) on *Eucalyptus*, B 54516, tlc. 1238k957: thiophaninic, trace stictic acids.

Pertusaria thelocarpoides Nyl. – ECUADOR, Zamora-Chinchipe: Cordillera Numbala, Reserva Biológica San Francisco, S of road Loja-Zamora, Transecto 2, alt. 2,200 m, 3° 58' S, 79° 04' W, tree trunk in scrubby forest, within reach from the soil, 18 Aug. 2003, Sipman, Mandl 51324, tlc: 2'-O-methylperlatolic acid; id., upper montane forest, on base of tree, 20 Sep. 2002, Nöske 2081, tlc: 2'-O-methylperlatolic acid. – COLOMBIA, “Nova Granata, Tequendama”, alt. 2,500 m, 1863, Al. Lindig [H-Nyl 22969, type material], tlc: 2'-O-methylperlatolic acid. – Cundinamarca: Páramo de Guasca, Clla. Pena Negra, along road Guasca-Guacheta, Mnpio. Guasca, valley of El Chuscal, W-slope, alt. 3,200 m, mixed subparamo woodland of *Brunellia*, *Drimys*, *Miconia*, *Oreopanax* and *Clusia* with clearings, epiphyte, 6 Sep. 1984, Aguirre, Sipman 5110b, tlc: 2'-O-methylperlatolic acid. – Cundinamarca: Parque Nacional Natural Chingaza, Mnpio. Fomeque, Embalse de Chuza, SW-bank, alt. ca 3,000 m, 4° 38' N, 74° 45' W, relic of subandean forest, epiphytic, 15 Oct. 1988, Sipman, Aguirre 27410, tlc: 2'-O-methylperlatolic acid. – Cundinamarca: Mnpio. Supatá, Alto El Tablazo, along track from radar station to Supatá, alt. ca 3,200 m, 5° 01' N, 74° 13' W, Subparamo scrub in little valley at foot of cliff, epiphytic, 20 Oct. 1988, Sipman, Aguirre 27459, tlc: 2'-O-methylperlatolic acid. – Risaralda: W-slope of Cordillera Central, Mnpio. Santa Rosa de Cabal, ca 500 m S of Finca La Sierra, alt. 3,750 m, clearings in subparamo woodland, epiphytic in forest remnant, 16 Sep. 1984, Aguirre, Sipman 5446, tlc 1244/197: 2'-O-methylperlatolic acid. – COSTA RICA, San José: Cantón de Perez Zeledon, Cordillera de Talamanca, Cerro de la Muerte, alt. 3,000 m, 9° 30.8' N, 83° 45.8' W, *Escalonia* vegetation, 21 Feb. 1996, Inberg 1244, tlc: 2'-O-methylperlatolic acid. – VENEZUELA, Merida: Mun. Libertador. Alt. 3,705 m. Weg La Aguada – Loma Redonda, Dichter an Loma Redonda, auf Erde, 22 Jan. 1995, Wiegleb 469. – Note: This rarely reported species was available from Ecuador, Colombia, Venezuela and Costa Rica, from stunted, mossy, mountain forest at 2,200–3,750 m elevation. It is very characteristic by the subglobose apothecium warts with bisporous asci and the presence of 2'-O-methylperlatolic acid alone. The species keys out close to *Pertusaria velloziae* (Vain.) Erichsen with Archer and Elix (2018). However, it differs from the original description of this taxon (Vainio 1890) and the observations by Erichsen (1937) because the apothecium warts are smaller, 0.6–1 mm instead of 1–1.5 mm diam., the thallus is smooth, not granular, and the ascospores are smaller, 175–225 × 50 µm instead of (186–)210–264 × 49–63 µm, with 2/ascus instead of 3/ascus. Archer and Elix (2018) report 2'-O-methylstenosporic, 2'-O-methyldivaricatic and 2,2'-di-O-methyldivaricatic acids for *P. velloziae*. The specimens of *P. thelocarpoides* investigated by us, including type material from H-Nyl, show only a single depsid, 2'-O-methylperlatolic acid, in TLC. This species is not included in the world key of Archer and Elix (2018).

Pertusaria tuberculifera Nyl. – (27) Tree near 5/O-22, *Naucleopsis glabra*, ca 22 cm dbh, on trunk, S 52257, tlc: trace 4,5-dichlorolichexanthone?, 2-O-methylperlatolic acid; on *Hyeronima asperifolia*, 47 cm dbh, on crown branches, S 52500, tlc: 2-O-methylperlatolic acid; on *Cecropia andina*, 28 cm dbh, on trunk 0–5 m, S 52707, tlc: 2-O-methylperlatolic acid; on *Cecropia andina*, 38 cm dbh, on trunk, 5–9 m, S 52910, tlc: 2-O-methylperlatolic acid; on *Elaeagia obovata*, 48 cm dbh, on trunk 5–10 m, S 52654a, tlc: 2-O-methylperlatolic acid; on *Cecropia andina*, 28 cm dbh, on trunk 5–13 m, S 52742a,

- S 52762b, tlc: 2-O-methylperlatolic acid; on *Heliocarpus americanus*, 37 cm dbh, on crown branches, S 52855a, tlc: 2-O-methylperlatolic acid; on *Prunus huantensis*, 22 cm dbh, in crown, S 53082a, tlc: 2-O-methylperlatolic acid. – COSTA RICA, Puntarenas: Zona Protectora Las Tablas (AC Amistad Pacifico), Los Portones, 25 km ENE of San Vito, 4 km on gravel road from Progreso to Las Tablas, roadside. Alt. 1,500 m. 8° 55' N, 82° 48' W. Montane rainforest zone: disturbed remnant of primary forest, on bark (lower trunk). 28 June 2002, Sipman 47976, tlc: 2-O-methylperlatolic acid.
- Phaeographis intricans* (Nyl.) Staiger – (27) on *Elaeagia obovata*, 48 cm dbh, on trunk 0–5 m, S 52639; on trunk 0–5 m, S 52778
- Phaeographis scalpturata* (Ach.) Staiger – (6) on tree, B 54188; (9) on tree, B 54319; (10) on tree, B 54332
- Phaeographopsis neotropica* Kalb – prov. Los Rios: Quevado km 45 South. Alt. 200 m. Cocoa plantations. 5 Aug. 1982. A. Aptroot, R. Hensen 10421
- Phaeophyscia endococcinodes* (Poelt) Essl. – (17) on outcrop, B 54549; (21) on outcrop, B 54715
- Phaeophyscia hirsuta* (Mereschk.) Essl. – (26) on tree, B 54907
- Phaeophyscia hispidula* (Ach.) Essl. – (21) on outcrop, B 54714
- Phaeophyscia orbicularis* (Neck.) Moberg – (18) on tree, B 54625
- Phlyctella andensis* (Nyl.) Nyl. – (5) on tree, B 54071, B 54076; (20) on tree, B 54652
- Phlyctella brasiliensis* (Nyl.) Nyl. – (14) on tree, B 54483
- Phlyctidia boliviensis* (Nyl.) Müll. Arg. – (3) on dead branch of shrub, B 54031
- Phyllobaeis erythrella* (Mont.) Kalb – (23) terricolous, B 54779 (Fig. 8E)
- Phyllobaeis imbricata* (Hook.) Kalb et Gierl – (17) terricolous, B 54567
- Phyllobathelium firmum* (Stirt.) Vězda – (6) on leaf, B 54205, B 54215
- Phyllopsora pyxinoides* (Nyl.) Kistenich, Timdal, Bendiksby et S. Ekman – (6) on tree, B 54159
- Physcia biziana* (A. Massal.) Zahlbr. – (16) on tree, B 54529
- Physcia dimidiata* (Arnold) Nyl. – (19) on *Sambucus*, B 54645
- Physcia poncinsii* Hue – (15) on tree, B 54502; (16) on *Eucalyptus*, B 54584; (18) on tree, B 54633
- Physcia solediosa* (Vain.) Lynge – (5) on outcrop, B 54069; (16) on tree, B 54523; (20) on tree, B 54656, B 54659; (21) on *Yucca*, B 54706
- Physcia tribacia* (Ach.) Nyl. – (18) on tree, B 54630; (19) on outcrop, B 54637
- Physcia undulata* Moberg – (1) on tree, B 53987; (11) on tree, B 54338, B 54345; (15) on tree, B 54503; (19) on tree, B 54644
- Piccolia conspersa* (Fée) Hafellner – (3) on dead branch of shrub, B 54019
- Piccolia wrightii* (Tuck.) Hafellner – (23) on tree, B 54774, B 54871
- Placopsis gelida* (L.) Linds. – (17) on acidic rock, B 54546
- Platygramme caesiopruinosa* (Fée) Fée – (21) on tree, B 54685
- Platythecium serpentinellum* (Nyl.) Staiger – (27) on *Elaeagia obovata*, 48 cm dbh, on trunk 5–10 m, S 52661a; on *Cecropia andina*, 28 cm dbh, on trunk 5–10 m and in crown, S 52727, S 52768; on *Purdiaea nutans*, 23 cm dbh, in crown, S 53135
- Polyblastidium coralliphorum* (Taylor) Kalb (syn. *Heterodermia coralliphora* (Taylor) Skorepa) – (3) on dead branch, B 54010
- Porina africana* Müll. Arg. – (14) on tree, B 54475
- Porina atlantica* (Erichsen) P. M. Jørg. – (23) on tree, B 54771
- Porina epiphylla* Fée – (7) on leaf, B 54217; (8) on leaf, B 54279
- Porina internigrans* (Nyl.) Müll. Arg. – (7) on tree, B 54251
- Porina rufula* (Kremp.) Vain. – (7) on leaf, B 54220
- Porina tetramera* (Malme) R. Sant. – (8) on leaf, B 54273, B 54282, B 54300; (22) on leaf, B 54748; (23) on leaf, B 54839

- Pseudocyphellaria aurata* (Ach.) Vain. – (16) on tree, B 54526
Pseudocyphellaria clathrata (De Not.) Malme – (21) on tree, B 54693
Pseudopyrenula diluta (Fée) Müll. Arg. – (14) on tree, B 54441, B 54459, B 54471, B 54484
Pseudopyrenula subnudata Müll. Arg. – (6) on tree, B 54125, B 54183; (27) on *Cecropia andina*, 38 cm dbh, in crown, S 52937; – prov. Zamora-Chinchipe: Cordillera Numbala, Reserva Biológica San Francisco, S of road Loja-Zamora. Transecto 1, near and above refugio. Alt. ca 2,500 m. 3° 58' S, 79° 04' W. On shrub branch in scrubby forest on mountain rim. 18 Aug. 2003. Sipman, Mandl 51365
Pseudosagedia nitidula (Müll. Arg.) Hafellner et Kalb – (6) on leaf, B 54118, B 54164, B 54210; (8) on leaf, B 54292; (21) on leaf, B 54720
Psorotheciopsis philippinensis (Rehm) Lücking – (10) on leaf, B 54334
Puiggariella nemathora (Mont.) S. H. Jiang, Lücking et J. C. Wei – (6) on leaf, B 54110, B 54177; (8) on leaf, B 54294
Punctelia borreri (Sm.) Krog – (3) on outcrop, B 54027; (26) on tree, B 54910
Punctelia colombiana Sérus. – (20) on tree, B 54653
Punctelia constantimontium Sérus. – (20) on tree, B 54643 (DNA code 6997); (20) on tree, B 54676; (21) on tree, B 54709
Punctelia hypoleucites (Nyl.) Krog – (16) on tree, B 54530; (18) on tree, B 54628
Punctelia oxyspora (Tul.) Divakar, A. Crespo et Lumbsch – (17) on outcrop, on *Parmelia*, B 54536; (17) on outcrop, on *Hypotrachyna*, B 54623; (21) on tree, on *Punctelia rudecta*, B 54731
Punctelia reddenda (Stirt.) Krog – (24) on tree, B 54887 (DNA code 6998)
Punctelia rudecta (Ach.) Krog – (21) on tree, B 54729; (24) on tree, B 54888; (26) on tree, B 54916
Punctelia cf. *stictica* (Duby) Nyl. – (17) on acidic rock, B 54539, B 54577, B 54622
Punctelia subpraesignis (Nyl.) Krog – (17) on outcrop, B 54545; (26) on tree, B 54914
Pyrenula chilensis (Fée) R. C. Harris – (27) on *Cecropia andina*, 31 cm dbh, on trunk, 1–10 m, S 52962, S 52970; on *Prunus huantensis*, 22 cm dbh, on trunk 0–5 m, S 53039a
Pyrenula complanata (Mont.) Trevis. – Zamora-Chinchipe: Cordillera Numbala, Reserva Biológica San Francisco, 30 km E of Loja on road to Zamora, Quebrada 2. Alt. 1,950 m. 3° 58.3' S, 79° 4.7' W. Montane tropical rain forest, on bark. 7 May 2001, Nöske, Sipman 185; – id., Quebrada 5, forest experiment plots. Alt. ca 1,900 m. 3° 58' S, 79° 04' W. On thin trunk in montane mossy forest, close to the soil. 13 Aug. 2003, Sipman, Mandl 51268; – id., Quebrada 5, forest experiment plots. Alt. ca 1,900 m. 3° 58' S, 79° 04' W. On tree trunk in mountain forest, within reach from the soil. In plot M. 15 Aug. 2003, Sipman, Mandl 51300; – id., in quadr. H. 20 Aug. 2003, Sipman, Mandl 51393
Pyrenula cubana (Müll. Arg.) R. C. Harris – (27) on *Elaeagia obovata*, 48 cm dbh, on trunk 5–10 m, S 52664
Pyrenula macrocarpa A. Massal. – (7) on tree, B 54247
Pyrenula macularis (Zahlbr.) R. C. Harris – (14) on shrub, B 54923
Pyrenula massariospora (Starbäck) R. C. Harris – (27) on *Cecropia andina*, 28 cm dbh, on trunk 5–10 m, S 52739
Pyrenula microtheca R. C. Harris – prov. Zamora-Chinchipe: Cordillera Numbala, Reserva Biológica San Francisco, S of road Loja-Zamora. Quebrada 5, forest experiment plots. Alt. ca 1,900 m. 3° 58' S, 79° 04' W. On tree trunk in mountain forest, within reach from the soil. In quadr. H. 20 Aug. 2003, Sipman, Mandl 51390
Pyrenula montocensis Lücking – (27) on *Heliocarpus americanus*, 23 cm dbh, on trunk, 0–10 m, S 53005b, S 53014

- Pyrenula nitidula* (Bres.) R. C. Harris – (27) on *Heliocarpus americanus*, 23 cm dbh, on trunk, 0–7 m, S 53005a
- Pyrenula ochraceoflava* (Nyl.) R. C. Harris – (14) on tree, B 54488
- Pyrenula rubroanomala* Aptroot et Lücking – (12) on Manzanilla, B 54381
- Pyrenula schiffneri* (Zahlbr.) Aptroot – (27) on *Cecropia andina*, 38 cm dbh, on tree base and trunk, 1–9 m, S 52869, S 52885, S 52909; on *Heliocarpus americanus*, 23 cm dbh, on trunk, 0–7 m. 2 July 2004, S 53005; – prov. Zamora-Chinchipec: Reserva Biológica San Francisco, 30 km E of Loja on road to Zamora, quebrada 2. Alt. 2,000 m. 3° 58.3' S, 79° 4.7' W. Montane tropical rain forest, on bark. 7 May 2001, Nöske, Sipman 194
- Pyrenula subcongruens* Müll. Arg. – (27) on *Elaeagia obovata*, 35 cm dbh, in crown, S 52616 (filed under *Pyrenula macrocarpa*)
- Pyrgidium montelicum* (Beltr.) Tibell – (27) on *Cecropia andina*, 38 cm dbh, in crown, S 52941
- Pyxine cocoes* (Sw.) Nyl. – (11) on dead branch, B 54341, B 54354, B 54367; (12) on Manzanilla, B 54385; (21) on *Yucca*, B 54705
- Pyxine nubila* Moberg – (17) on tree, B 54629
- Pyxine cf. pungens* Zahlbr. – (11) on tree, B 54337
- Pyxine cf. retirugella* Nyl. – (1) on tree, B 53986
- Ramalina celastri* (Spreng.) Krog et Swinscow – (12) on shrub, B 54393; (16) on *Eucalyptus*, B 54514
- Ramalina dendroides* (Nyl.) Nyl. – (27) on *Alchornea grandiflora*, 32 cm dbh, in crown, S 53156
- Ramalina subpollinaria* Nyl. – (9) on tree, B 54310
- Reichlingia anomobrophila* (Coppins et P. James) Frisch – (5) on wood of fence, B 54050
- Remototrachyna costaricensis* (Nyl.) Divakar, Lumbsch, Ferencová, Prado et A. Crespo – (5) on tree, B 54077 (DNA code 6864)
- Rexiella fuliginosa* (Filson) S. Stenroos, Pino-Bodas et Ahti – (17) terricolous, B 54553, B 54568
- Roccella gracilis* Bory – (11) on tree, B 54351; (13) on shrub, B 54407
- Roccella linearis* (Ach.) Vain. – (11) on tree, B 54373; (12) on Manzanilla, B 54386
- Sclerococcum pseudospmani* Zhurb. et Diederich – (9) on tree, on *Parmotrema*, B 54317
- Segestria octomera* (Müll. Arg.) R. C. Harris – (8) on leaf, B 54290
- Sporopodium citrinum* (Zahlbr.) Elix, Lumbsch et Lücking – (9) on leaf, B 54309
- Sporopodium leprieurii* Mont. – (6) on leaf, B 54201; (8) on leaf, B 54302, B 54295; (9) on leaf, B 54304
- Sporopodium phyllocharis* (Mont.) A. Massal. – (23) on leaf, B 54847, B 54854
- Stereocaulon ramulosum* Räsusch. – (3) on tree, B 54002
- Stereocaulon tomentosum* Fr. – (17) terricolous, B 54613 (Fig. 7F)
- Strigula concreta* (Fée) R. Sant. – (7) on leaf, B 54262
- Strigula maculata* (Cooke et Masee) R. Sant. – (22) on leaf, B 54746; (23) on leaf, B 54832, B 54835
- Strigula nitidula* Mont. – (8) on leaf, B 54285
- Strigula phylogena* (Müll. Arg.) R. C. Harris – (22) on leaf, B 54753
- Strigula platypoda* (Müll. Arg.) R. C. Harris – (6) on leaf, B 54179; (7) on leaf, B 54218, B 54227
- Strigula vulgaris* (Müll. Arg.) Lücking – (7) on leaf, B 54259
- Sulcopyrenula cf. cruciata* Aptroot – (27) on *Cecropia andina*, 31 cm dbh, on trunk, 1–6 m, S 52963. – Note: the specimen deviates because the hymenium is guttulate.
- Tapellaria epiphylla* (Müll. Arg.) R. Sant. – (23) on leaf, B 54802
- Tapellaria phylophila* (Stirt.) R. Sant. – (7) on leaf, B 54256
- Teloschistes exilis* (Michx.) Vain. – (16) on *Eucalyptus*, B 54519
- Thamnomia vermicularis* (Sw.) Schaer. – (17) terricolous, B 54612

- Trapeliopsis granulosa* (Hoffm.) Lumbsch – (1) on *Olea*, B 53991; (16) on stump, B 54507
Tricharia farinosa R. Sant. – (23) on leaf, B 54873
Tricharia longispora Kalb et Vězda – (23) on leaf, B 54828
Tricharia vainioi R. Sant. – (7) leaf, B 54245; (22) on leaf, B 54745
Trichothelium argenteum Lücking et L. I. Ferraro – (8) on leaf, B 54287
Trichothelium epiphyllum Müll. Arg. – (7) on leaf, B 54226; (8) on leaf, B 54254
Trichothelium longisporum Lücking – (9) on leaf, B 54336
Trichothelium pallescens (Müll. Arg.) F. Schill. – (8) on leaf, B 54922
Trichothelium pallidisetum Lücking – (6) on leaf, B 54182
Trichothelium porinoides Vězda – (8) on leaf, B 54272
Tylophoron crassiusculum Tibell – (27) on *Cecropia andina*, 31 cm dbh, on trunk, 1–6 m, S 52954
Tylophoron moderatum Nyl. – (6) on tree, B 54160, B 54190 (Fig. 8F)
Waynea cretica Llop – (25) on *Oreopanax*, B 54982
Xenonectriella angulospora (Etayo) F. Berger – (20) on *Ficus*, on *Heterodermia*, B 54657, B 54661
Xenonectriella dirinariae Etayo et van den Boom – (21) on iron, on *Dirinaria*, B 54681

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