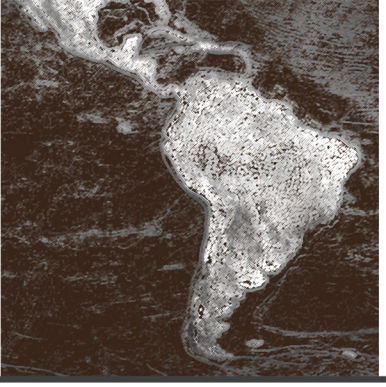

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Van den Boom, Giralt, Fankhauser & Moberg

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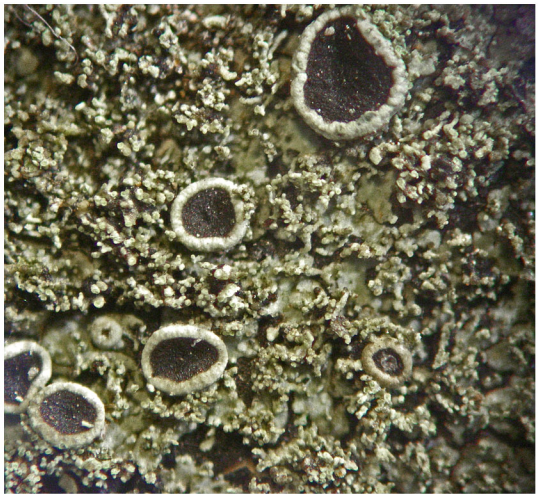

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Lichens of Panama: Biodiversity in *Physciaceae* (Ascomycota: Caliciales)

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Resumen — Van den Boom, P. P. G., Giralt, M., Fankhauser, J. D. & Moberg, R. (2013) Lichens of Panama: Biodiversity in *Physciaceae* (Ascomycota: Caliciales). *Glalia* **5(1):** 1–15. — Como resultado de trabajo de campo en Panamá, se reportan 40 especies de Physciaceae, incluyendo 30 nuevos registros para el país. Especies neotropicales raras encontradas son *Buellia rubroreagens, Cratiria americana, Gassicurtia rufofuscescens, Hyperphyscia isidiata* y *Stigmatochroma kryptoviolascens*.

Abstract — Van den Boom, P. P. G., Giralt, M., Fankhauser, J. D. & Moberg, R. (2013) Lichens of Panama: Biodiversity in *Physciaceae* (Ascomycota: Caliciales). *Glalia* **5(1):** 1–15. — As a result of a fieldtrip to Panama, 40 species of *Physciaceae* are reported, including 30 first records for the country. Rare Neotropical species encountered are *Buellia rubroreagens, Cratiria americana, Gassicurtia rufofuscescens, Hyperphyscia isidiata* and *Stigmatochroma kryptoviolascens*.

Palabras clave • Key words — *Buellia* s.l., Neotropics, Central America, lichen chemistry, new records.

Introduction

The most recent checklist of lichens of Panama (FEUERER 2008) indicates that some groups (e.g. foliicolous lichens, lichenicolous fungi and *Thelotremataceae*) are rather well represented in that country, while other families are not. For the *Physciaceae* (calicioid taxa excluded), for instance, only a few genera and no more than nine species are reported. However, for Costa Rica over 66 species are known (UMAÑA-TENORIO et al. 2002), indicating that the family is very diverse in the region. That suggests that the family is still poorly known in Panama.

A fieldtrip to Panama in February-March 2010 by the first author and his wife provided an opportunity for doing collecting work in this country. Lichens were collected from all kinds of

substrata, in lowland, coastal and upland areas in the provinces of Bocas del Toro, Chiriquí, Coclé and Panama (Fig. 1). The results show that the family *Physciaceae* is well-represented in Panama, and a list of the encountered species is given here. A summary was already presented as a poster during the IAL7 congress in Bangkok, January 2012, where two of us (PB and JDF) attended.

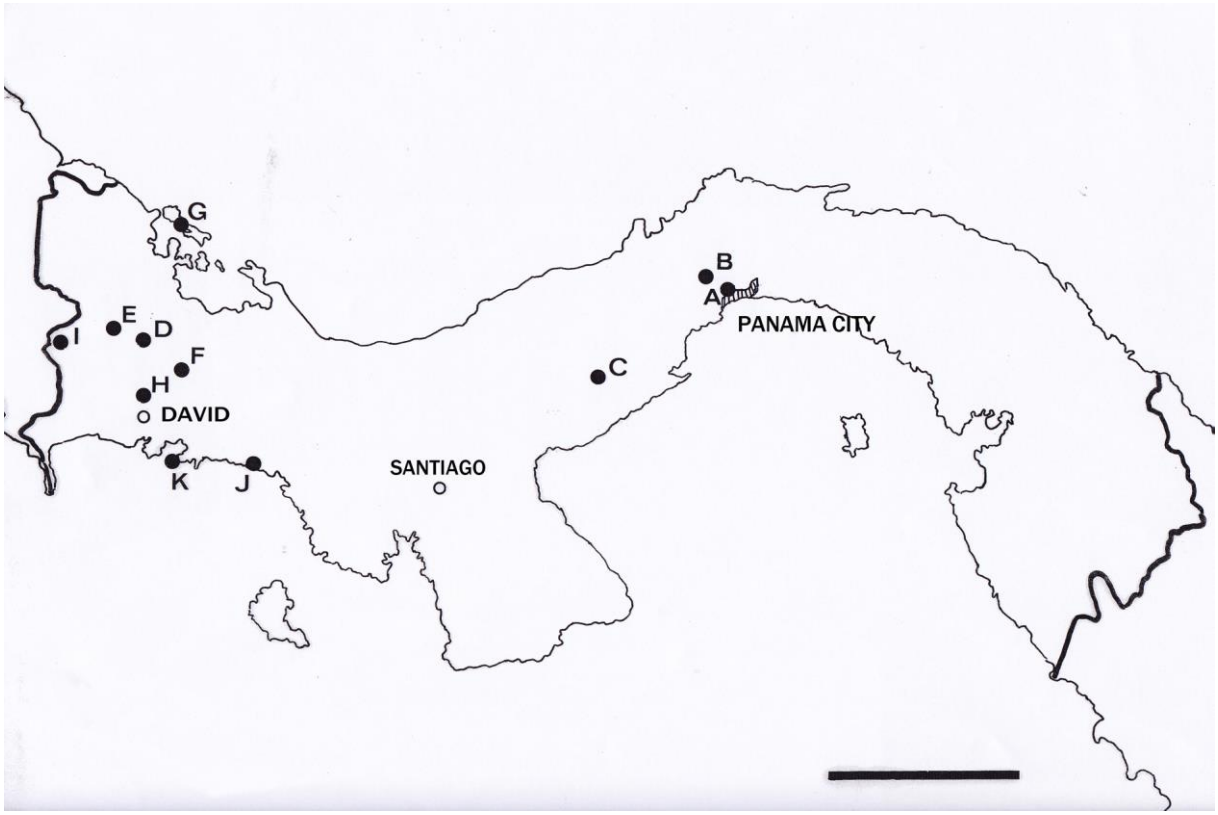

Figure 1 — The collecting areas in Panama. A = Panama City; B = Summit Park; C = El Valle; D = Boquete; E = Cerro Punta; F = Gualaca; G = Bocas del Toro; H = Volcán; I = Santa Clara/Rio Senero; J = Las Lajas; K = Boca Brava. Scale = 100 km.

Material and methods

The collections were examined by light microscopy, mounted in water. The specimens are kept in the herbarium of the collector (van den Boom), unless otherwise indicated. Chemical constituents were identified by TLC and/or HPLC.

Results

We collected material of 40 species of *Physciaceae*, which are presented below in an annotated list. Among them 30 are new records for Panama. Others are particularly interesting and rare Neotropical species (e.g. *Cratiria americana, Gassicurtia rufofuscescens, Stigmato-*

chroma kryptoviolascens). The best represented genus is *Heterodermia*, with 12 species, not taking into account *Buellia* s. lat., which is treated here in the restricted sense following MARBACH (2000), ELIX (2011) and KALB et al. (2012).

Species with an asterisk (*) are new for Panama. The letters A–K (in brackets) refer to the collecting areas of the distribution map (Fig. 1).

***Amandinea efflorescens* (Müll. Arg.) Marbach**

Remarks — We found the following chemical compounds: 4,5-dichlorolichexanthone (major), 5-chlorolichexanthone, 4,5-dichloro-3-O-methylnorlichexanthone, 4,5-dichloronorlichexanthone (minor), lobaric acid, gyrophoric acid and two unidentified xanthones (traces). The first compound and lobaric acid are mentioned for this species by MARBACH (2000) and ELIX (2011). This species is known in the Neotropics from the Guianas and Puerto Rico (MARBACH 2000).

Specimen examined — (J) Prov. Chiriquí, ESE of David, S of Las Lajas, playa Las Lajas, small forest along beach, mixed trees, on a trunk of palm, 81° 52.0' W, 8° 10.2' N, 7 m, 21. II. 2010, *P. & B. van den Boom 44279*, *44280* (hb. v.d. Boom).

***Amandinea lecideina* (H. Mayrhofer & Poelt) Scheid. & H. Mayrhofer**

Remarks — The chemistry was not tested; according to ELIX (2011) the species lacks lichen compounds or, rarely, contains norstictic and connorstictic acids. BUNGARTZ et al. (2007) suggest that *Buellia prospersa* (Nyl.) Riddle is the correct name for *Amandinea lecideina.* It is probably a cosmopolitan species from coastal areas (BUNGARTZ et al. 2007). SIPMAN (2007) recorded this species from Saba as *Buellia prospersa* (Nyl.) Riddle.

Specimens examined — (K) Prov. Chiriquí, SE of David, island 'Boca Brava', at E side of the island, tropical forest, gardens and coastal outcrops, on acidic outcrop, 82° 12.6' W, 8° 12.7' N, 20 m, 2. III. 2010, *P. & B. van den Boom 44745* (hb. v.d. Boom).

***Baculifera imshaugiana* (R. C. Harris) Marbach**

Remarks — Two specimens have been studied by TLC, *43924* and *44561*, and atranorin, norstictic and connorstictic acids have been found in both, which agrees with the description in MARBACH (2000). Previously the species was recorded from the USA and Mexico (MARBACH 2000).

Specimens examined — (C) Prov. Coclé, SW of Panama-city, small village El Valle, in old crater of an extinct volcano, unpaved road to the small Zoo 'El Nispero', scattered mixed roadside trees, on an unidentified tree, 80° 08.0' W, 8° 36.0' N, 600 m, 15. II. 2010, *P. & B. van den Boom 43870* (hb. v.d. Boom); ibid., SW of Panama-city, centre of small village El Valle, in old crater of extinct volcano, roadside trees, W of church, along fence of field, on an unidentified tree, 80° 8.0' W, 8° 36.0' N, 595 m, 15. II. 2010, *P. & B. van den Boom 43924* (hb. v.d. Boom). (F) Prov. Chiriquí, NE of David, NE of Gualaca, along road to Chiriquí Grande, 2 km south of 'Reserva Florestal Fortuna', roadside trees along garden, near house, on an unidentified tree, 82° 12.8' W, 8° 38.1' N, 1000 m, 27. II. 2010, *P. & B. van den Boom 44561* (hb. v.d. Boom).

**Buellia parastata* (Nyl.) Zahlbr.

Remarks — Chemistry not tested; according to ELIX (2011) this species contains atranorin, diploicin, isofulgidin and fulgidin. MARBACH (2000) included this species in *Hafellia* as *H. parastata* (Nyl.) Kalb, H. Mayrhofer & Scheid. and recorded it already from central America (Costa Rica). It has a wide pantropical distribution (MARBACH 2000).

Specimen examined — (C) Prov. Coclé, SW of Panama-city, E side of small village El Valle, in old crater of extinct volcano, small Zoo 'El Nispero', including a botanical garden with many different trees, on a *Guapira* sp., 80° 8.0' W, 8° 36.0' N, 595 m, 15. II. 2010, *P. & B. van den Boom 43907* (hb. v.d. Boom).

**Buellia rubroreagens* A. Nordin

Remarks — We found atranorin, chloroatranorin, norstictic and connorstictic acids in our specimen, the same chemistry as mentioned by NORDIN (2000). This species is morphologically and chemically very similar to *Cratiria lauricassiae* (Fée) Marbach, but differs by the presence of a yellowish pigment in the median part of the proper exciple reacting K+ purple-red. In NORDIN (2000), *B. rubroreagens* is mentioned from Brazil and the West Indies.

Specimen examined — (I) Prov. Chiriquí, NW of David, WNW of Volcán, Rio Senero, 4 km E of village, secondary road, fence posts and mixed trees along trail, coffee plantation and field, on wood of fence post, 82° 47.0' W, 8° 50.0' N, 1050 m, 25. II. 2010, *P. & B. van den Boom 44507* (hb. v.d. Boom).

**Buellia stellulata* (Taylor) Mudd

Remarks — Chemistry not tested; according to ELIX (2011) containing atranorin, confluentic and/or 2'-*O*-methylperlatolic acids. This saxicolous species has a worldwide distribution and is known from every continent (COPPINS et al. 2009). In UMAÑA-TENORIO et al. (2002), the species is mentioned from Costa Rica.

Specimen examined — (H) Prov. Chiriquí, NNW of David, 1 km N of Volcán, along road, outcrops of volcanic rock in field, near road, on outcrops, 82° 37.2' W, 8° 48.6' N, 1580 m, 26. II. 2010, *P. & B. van den Boom 44537* (hb. v.d. Boom).

**Cratiria aggrediens* (Stirt.) Marbach

Remarks — In specimen *44228* we found arthothelin and 2,4,5-trichlorolichexanthone. This pantropical species is reported by MARBACH (2000) from the neighboring countries Costa Rica and Colombia, but not from Panama.

Specimens examined — (D) Prov. Chiriquí, N of David, Boquete, WNW of village, W of Los Naranjos, trail to Volcan Barú, from entrance of Park National Barú, up 1 km, along tropical rainforest, on an unidentified tree, 82° 29.5' W, 8° 47.7' N, 1800 m, 18. II. 2010, P. & B. *van den Boom 44124* (hb. v.d. Boom). (D) Prov. Chiriquí, N of David, Boquete, NW of village, N of Bajo Mono, road to office of 'Quetzal Trail', N of main road, paved road along tropical forest and fields, including iron of pipeline, on *Cupressus*, 82° 30.6' W, 8° 50.11' N, 2100 m, 19. II. 2010, *P. & B. van den Boom 44228* (hb. v.d. Boom). (E) Prov. Chiriquí, NNW of David, N of Cerro Punta, Guadalupe, garden from hotel 'Los Quetzales', trees and shrubs, on a *Brugmansia* sp., 82° 34.3' W, 8° 52.3' N, 1895 m, 22. II. 2010, *P. & B. van den Boom 44332* (hb. v.d. Boom). (I) Prov. Chiriquí, NW of David, WNW of Volcán, Rio Senero, 4 km E of village, secondary road, fence posts and mixed trees along trail, coffee plantation and field, on wood of fence post, 82° 47.0' W, 8° 50.0' N, 1050 m, 25. II. 2010, *P. & B. van den Boom 44507* (hb. v.d. Boom).

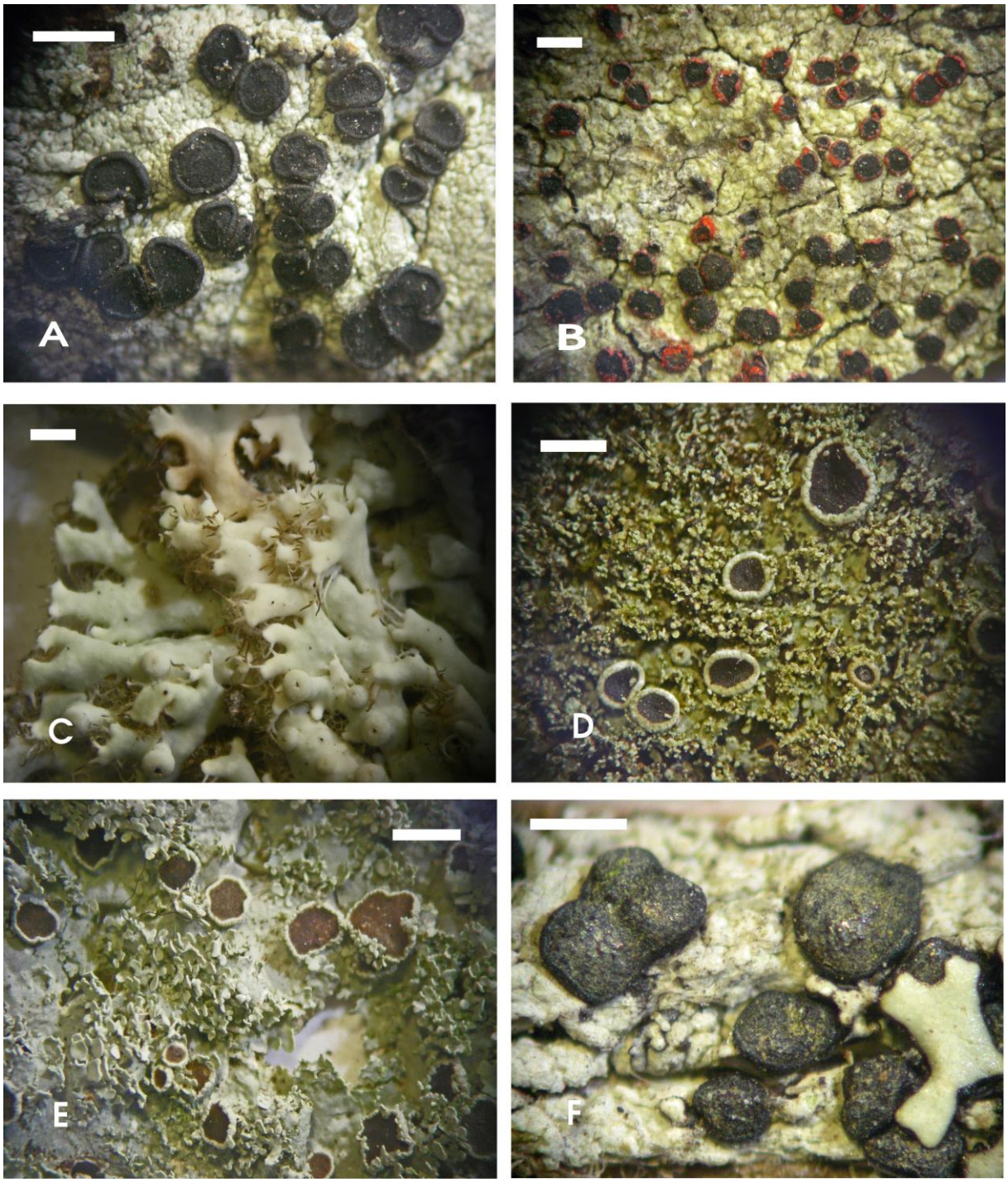

Figure 2 — Some of the treated species. A = *Cratiria americana*; B = *Gassicurtia rufofuscescens*; C = *Heterodermia galactophylla*; D = *Hyperphyscia isidiata*; E = *Physcia manuelii;* F = *Stigmatochroma kryptoviolascens*. Scale = A, C, D, 1 mm; B, F, 0.5 mm; E, 1.5 mm.

***Cratiria americana* (Fée) Kalb & Marbach** Fig. 2A

Remarks — We found atranorin, norstictic and connorstictic acids in our specimen, the same chemistry as mentioned by MARBACH (2000) and ELIX (2011). The species was previously cited only from four localities in Brazil, El Salvador and Mexico and also from Papua New Guinea (MARBACH 2000).

Specimen examined — (I) Prov. Chiriquí, NW of David, WNW of Volcán, Santa Clara, 2 km W of village, roadside fence posts and mixed trees along field, on an unidentified tree, 82° 43.3' W, 8° 48.6' N, 1180 m, 25. II. 2010, *P. & B. van den Boom 44497* (hb. v.d. Boom).

***Cratiria obscurior* (Stirton) Marbach & Kalb**

Remarks — In specimen *44553* we found atranorin, norstictic, connorstictic and vioxanthin. The first three compounds agree with the description in MARBACH (2000) and ELIX (2011), but the latter was not reported before. Although *C. obscurior* is widely distributed in the Neotropics and many records are mentioned in MARBACH (2000), it was not mentioned from Panama before.

Specimens examined — (C) Prov. Coclé, SW of Panama-city, small village El Valle, in old crater of an extinct volcano, unpaved road to the small Zoo 'El Nispero', scattered mixed roadside trees, on an unidentified tree, 80° 08.0' W, 8° 36.0' N, 600 m, 15. II. 2010, *P. & B. van den Boom 43862* (cf.; hb. v.d. Boom); id., SW of Panama-city, centre of small village El Valle, in old crater of extinct volcano, roadside trees, W of church, along fence of field, on an unidentified tree, 80° 08.01' W, 8° 36.00' N, 595 m, 15. II. 2010, *P. & B. van den Boom 43932* (hb. v.d. Boom). (J) Prov. Chiriquí, ESE of David, SW of Las Lajas, between Santa Cruz and coast, small forests, fence posts and trees along field, on wood of fence post, 81° 55.3' W, 8° 13.8' N, 30 m, 21. II. 2010, *P. & B. van den Boom 44296* (hb. v.d. Boom); ibid., ESE of David, N of Las Lajas, San Felix, N of village, roadside trees along fields, 81° 52.0' W, 8° 17.85' N, 125 m, 21. II. 2010, *P. & B. van den Boom 44319* (cf.; hb. v.d. Boom). (H) N of David, 2 km N of city, along road, row of *Pachira quinata* trees along field, on *P. quinata*, 82° 25.3' W, 8° 32.5' N, 200 m, 26.II.2010, *P. & B. van den Boom 44553* (hb. v.d. Boom).

***Dirinaria aegialita* (Ach.) Moore**

Remarks — We found divaricatic acid, atranorin and chloroatranorin in our specimen. The species is recorded already from Panama (BREUSS 2008), Costa Rica (UMAÑA-TENORIA et al. 2002) and El Salvador (SIPMAN 2001).

Specimen examined — (G) Archipelago 'Bocas del Toro', island Colón, center of island, near 'La Gruta', along road among tropical forest, roadside trees, fence post and scattered shrubs, on a palm tree, 82° 16.3' W, 9° 23.7' N, 22 m, 1. III. 2010, *P. & B. van den Boom 44677* (hb. v.d. Boom).

***Dirinaria confluens* (Fr.) D. D. Awasthi**

Remarks — We found atranorin, divaricatic acid and chloroatranorin in our specimens. The species was already reported from Nicaragua (BREUSS 2002) and Guatemala (VAN DEN BOOM et al. 2007).

Specimens examined — (C) Prov. Coclé, SW of Panama-city, small village El Valle, in old crater of an extinct volcano, unpaved road to the small Zoo 'El Nispero', scattered mixed roadside trees, on an unidentified tree, 80° 8.00' W, 8° 36.00' N, 600 m, 15. II. 2010, *P. & B. van den Boom 43847, 43872* (hb. v.d. Boom). (J) Prov.

Chiriquí, ESE of David, N of Las Lajas, San Felix, N of village, roadside trees along fields, 81° 52.0' W, 8° 17.85' N, 125 m, 21. II. 2010, *P. & B. van den Boom 44321* (hb. v.d. Boom).

***Dirinaria picta* (Sw.) Clements & Shear**

Remarks — We found atranorin, chloroatranorin and divaricatic acid in our specimens. The species is mentioned as being frequent in Panama by ETAYO & APTROOT (2005). It was also reported from Costa Rica (UMAÑA-TENORIO et al. 2002), Nicaragua (BREUSS 2002), Guatemala (VAN DEN BOOM et al. 2007) and El Salvador (SIPMAN 2001).

Specimens examined — (A) Prov. Panama, NW side of Panama-city, small green hill, 'Ancón Hill', NE of Canal Administrative Building, road along parkland with scattered houses and scattered trees, including mature palm trees, on a palm tree, 79° 33.1' W, 8° 57.6' N, 55 m, 14. II. 2010, *P. & B. van den Boom 43841* (hb. v.d. Boom). (J) Prov. Chiriquí, ESE of David, S of Las Lajas, playa Las Lajas, small forest along beach, mixed trees, on a *Terminalia* sp., 81° 52.0' W, 8° 10.2' N, 7 m, 21. II. 2010, *P. & B. van den Boom 44258* (hb. v.d. Boom).

***Gassicurtia catasema* (Tuck.) Marbach**

Remarks — We found barbatic acid as major in the specimen *43784*. According to MARBACH (2000) and ELIX (2011), it contains also obtusatic (trace) acid and lichexanthon (minor). In the Neotropics, this species is recorded from Brazil, Central America and West Indies, but not from Panama (MARBACH 2000).

Specimens examined — (A) Prov. Panama, SW side of Panama-city, small green hill, "Ancón Hill", tropical rainforest with small paved road up to the top, 079º 33.67' W, 08º 57.33' N, 135 m, 13. II. 2010, *P. & B. van den Boom 43681* (hb. v.d. Boom). (B) Prov. Panama, NW of Panama-city, along road to Gamboa, NNW of Paraiso, Summit Park, Botanical Garden, including small Zoo, with many different scattered trees, on a dead Palm tree, 079º 38.75' W, 09º 03.85' N, 620 m, 14. II. 2010, *P. & B. van den Boom 43784* (hb. v.d. Boom). (J) Prov. Chiriquí, ESE of David, S of Las Lajas, playa Las Lajas, small forest along beach, mixed trees, on *Terminalia catappa*, 081º 52' W, 08'10.2' N, 7 m, 21. II. 2010, *P. & B. van den Boom 44255* (hb. v.d. Boom)

***Gassicurtia coccinea* Fée**

Remarks — This species is easily recognized by the reddish pigment in the thallus and the epruinose, black apothecia. It is widely distributed in the Neotropics, especially in Brazil (MARBACH 2000). Our material was not tested for chemistry; according to KALB & ELIX (1998) the species contains thiophaninic and chiodectonic acids, 4-chlorolichexanthone and an unknown secalonic derivative. Reported previously from Panama by ETAYO & APTROOT (2005).

Specimen examined — (J) Prov. Chiriquí, ESE of David, SW of Las Lajas, between Santa Cruz and coast, small forests, fence posts and trees along field, on wood of fence post, 81° 55.3' W, 8° 13.8' N, 30 m, 21. II. 2010, *P. & B. van den Boom 44304* (hb. v.d. Boom).

***Gassicurtia rufofuscescens* (Vain.) Marbach** Fig. 2B

Remarks — This is another red-pigmented species, but the thallus is white and the red pigment is located in the proper exciple and the apothecia are red-brown pruinose. Our material was not chemical analyzed; according to MARBACH (2000) the species contains chiodectonic,

thiophanic and 3-O-methylthiophanic acids. Beside the type species from Brazil, there are so far only tree further records, from Brazil, Costa Rica and Mexico (MARBACH 2000).

Specimen examined — (J) Prov. Chiriquí, ESE of David, S of Las Lajas, playa Las Lajas, small forest along beach, mixed trees, on unidentified tree, 81° 52.0' W, 8° 10.2' N, 7 m, 21. II. 2010, *P. & B. van den Boom 44271* (hb. v.d. Boom).

***Heterodermia allardii* (Kurok.) Trass**

Remarks — Our specimen contains atranorin, norstictic, connorstictic acids and zeorin, the latter compound in low amount. On Gwannon.com (2013), the species is mentioned from Costa Rica and Panama.

Specimen examined — (E) Prov. Chiriquí, NNW of David, N of Cerro Punta, Guadalupe, Finca Dracula Farm, trees in garden and small forest, on *Brugmansia* sp., 82° 34.3' W, 8° 52.4' N, 1935 m, 23. II. 2010, *P. & B. van den Boom 44367* (hb. v.d. Boom).

****Heterodermia diademata* (Taylor) Awasthi**

Remarks — Our specimen contains atranorin. Leucotylin is also known from this species, but we did not identify it. The species was already reported from Guatemala (VAN DEN BOOM et al. 2007) and Costa Rica (UMAÑA-TENORIO et al. 2002).

Specimen examined — (C) Prov. Coclé, SW of Panama-city, small village El Valle, in old crater of an extinct volcano, unpaved road to the small Zoo 'El Nispero', scattered mixed roadside trees, on unidentified tree, 80° 08.0' W, 8° 36.0' N, 600 m, 15. II. 2010, *P. & B. van den Boom 43856* (hb. v.d. Boom).

***Heterodermia flabellata* (Fée) Awasthi**

Remarks — Our specimen contains atranorin and 7-chloroemodin. Leucotylin is also known from this species, but we did not identify it. The species was so far reported from Panama (FEUERER 2008), Costa Rica (UMAÑA-TENORIO et al. 2002) and Nicaragua (BREUSS 2002).

Specimen examined — (C) Prov. Coclé, SW of Panama-city, small village El Valle, in old crater of an extinct volcano, unpaved road to the small Zoo 'El Nispero', scattered mixed roadside trees, on an unidentified tree, 80° 8.0' W, 8° 36.0' N, 600 m, 15. II. 2010, *P. & B. van den Boom 43890* (hb. v.d. Boom).

****Heterodermia galactophylla* (Tuck.) W. L. Culb.** Fig. 2C

Remarks — Our specimens contains atranorin. The species is reported before from Costa Rica (UMAÑA-TENORIO et al. 2002), Guatemala (VAN DEN BOOM et al. 2007) and El Salvador (SIPMAN 2001).

Specimens examined — (D) Prov. Chiriquí, N of David, Boquete, NW of village, N of Bajo Mono, 'Quetzal Trail', trail to Cerro Punta, tropical forest along river 'Rio Caldera', on a fallen branch, 82° 31.06' W, 8° 50.8' N, 2350 m, 19. II. 2010, *P. & B. van den Boom 44178* (hb. v.d. Boom). (E) Prov. Chiriquí, NNW of David, N of Cerro Punta, Guadalupe, Finca Dracula farm, trees in garden and small forest, on a *Brugmansia* sp., 82° 34.3' W, 8° 52.4' N, 1935 m, 23. II. 2010, *P. & B. van den Boom 44357* (hb. v.d. Boom).

***Heterodermia hypoleuca* (Ach.) Trevis.**

Remarks — The specimens *43950* and *43960* contain atranorin, zeorin and norstictic acid. The latter specimen has also a triterpene. UMAÑA-TENORIO et al. (2002) mention the species from Costa Rica.

Specimens examined — (C) Prov. Coclé, SW of Panama-city, NW of small village El Valle, in old crater of extinct volcano, trail in tropical forest, from El Valle up to La India Gormida, on *Cupressus*, 80° 8.27' W, 8° 36.09' N, 585 m, 16. II. 2010, *P. & B. van den Boom 43950, 43960* (hb. v.d. Boom).

Specimen examined (atranorin only) — (D) Prov. Chiriquí, N of David, Boquete, WNW of village, W of Los Naranjos, trail from main road to entrance of Park National Barú, fields with fence posts, including *Datura* trees, on *Cupressus*, 82° 28.8' W, 8° 47.8' N, 1685 m, 18. II. 2010, *P. & B. van den Boom 44068* (hb. v.d. Boom).

***Heterodermia isidiophora* (Vain.) D. D. Awasthi**

Remarks — Our specimen contains atranorin. Leucotylin is also known from this species, but we did not identify it. The species has been reported before from Panama (FEUERER 2008), Costa Rica (UMAÑA-TENORIO et al. 2002) and Guatemala (VAN DEN BOOM et al. 2007).

Specimens examined — (D) Prov. Chiriquí, N of David, Boquete, WNW of village, W of Los Naranjos, trail from main road to entrance of Park National Barú, fields with fence posts, including *Datura* trees, on an unidentified tree, 82° 28.8' W, 8° 47.8' N, 1685 m, 18. II. 2010, *P. & B. van den Boom 44055* (hb. v.d. Boom). (E) Prov. Chiriquí, NNW of David, Cerro Punta, E of village, Bajo Grande, paved road to 'Los Quetzales Trail', along fields with roadside trees, on *Cupressus*, 82° 33.35' W, 8° 51.9' N, 2135 m, 24. II. 2010, *P. & B. van den Boom 44488* (hb. v.d. Boom).

***Heterodermia japonica* (Sato) Swinscow & Krog**

Remarks — Our specimens contain atranorin. A cosmopolitan species known from tropical and subtropical areas (MOBERG & NASH III 2002). It was reported before from Panama (FEUERER 2008) and Guatemala (VAN DEN BOOM et al. 2007).

Specimens examined — (C) Prov. Coclé, SW of Panama-city, small village El Valle, in old crater of an extinct volcano, unpaved road to the small Zoo 'El Nispero', scattered mixed roadside trees, on an unidentified tree, 80° 8.0' W, 8° 36.0' N, 600 m, 15. II. 2010, *P. & B. van den Boom 43849* (hb. v.d. Boom); ibid., SW of Panama-city, NW of small village El Valle, in old crater of extinct volcano, trail in tropical forest, from El Valle up to La India Gormida, on *Cupressus*, 80° 8.27' W, 8° 36.09' N, 585 m, 16. II. 2010, *P. & B. van den Boom 44767* (hb. v.d. Boom). (D) Prov. Chiriquí, N of David, Boquete, WNW of village, W of Los Naranjos, trail from main road to entrance of Park National Barú, fields with fence posts, including *Datura* trees, on an unidentified tree, 82° 28.8' W, 8° 47.8' N, 1685 m, 18. II. 2010, *P. & B. van den Boom 44074* (hb. v.d. Boom).

***Heterodermia leucomela* (L.) Poelt**

Remarks — We did not chemically analyze the material. This is one of the most common species of the genus, widespread in the tropics and subtropics (MOBERG & NASH III 2002). In Central America it was reported from Panama (FEUERER 2008), Guatemala (VAN DEN BOOM et al. (2007), Costa Rica (UMAÑA-TENORIO et al. 2002), Nicaragua (BREUSS 2002) and El Salvador (SIPMAN 2001).

Specimen examined — (E) Prov. Chiriquí, NNW of David, N of Cerro Punta, Guadalupe, Finca Dracula Farm, trees in garden and small forest, on a *Brugmansia* sp., 82° 34.3' W, 8° 52.4' N, 1935 m, 23. II. 2010, *P. & B. van den Boom 44369a* (hb. v.d. Boom).

**Heterodermia lutescens* (Kurok.) Follm.

Remarks — Our specimens contain atranorin. The lower surface contains a yellow pigment. UMAÑA-TENORIO et al. (2002) mentioned the species from Costa Rica.

Specimens examined — (C) Prov. Coclé, SW of Panama-city, small village El Valle, in old crater of an extinct volcano, unpaved road to the small Zoo 'El Nispero', scattered mixed roadside trees, on an unidentified tree. 80° 8.0' W, 8° 36.0' N, 600 m, 15. II. 2010, *P. & B. van den Boom 43888* (hb. v.d. Boom); ibid., SW of Panama-city, NW of small village El Valle, in old crater of extinct volcano, trail in tropical forest, from El Valle up to La India Gormida, on *Citrus*, 80° 8.27' W, 8° 36.09' N, 585 m, 16. II. 2010, *P. & B. van den Boom 43951* (hb. v.d. Boom). (E) Prov. Chiriquí, NNW of David, N of Cerro Punta, Guadalupe, Finca Dracula farm, trees in garden and small forest, on a *Brugmansia* sp., 82° 34.3' W, 8° 52.4' N, 1935 m, 23. II. 2010, *P. & B. van den Boom 44369* (hb. v.d. Boom).

**Heterodermia podocarpa* (Bél.) D. D. Awasthi

Remarks — Our specimen contains atranorin and norstictic acid. The species was reported from Costa Rica (UMAÑA-TENORIO et al. 2002) and Guatemala (VAN DEN BOOM et al. 2007).

Specimen examined — (E) Prov. Chiriquí, NNW of David, N of Cerro Punta, Guadalupe, Finca Dracula Farm, trees in garden and small forest, 82° 34.3' W, 8° 52.4' N, 1935 m, 23. II. 2010, *P. & B. van den Boom 44368* (hb. v.d. Boom).

**Heterodermia speciosa* (Wulfen) Trevis.

Remarks — Our specimen contains atranorin, zeorin and leucotylin. UMAÑA-TENORIO et al. (2002) mentioned the species from Costa Rica.

Specimen examined — (F) Prov. Chiriquí, NE of David, NE of Gualaca, along road to Chiriquí Grande, 2 km south of 'Reserva Forestal Fortuna', roadside trees along garden, near house, 82° 12.8' W, 8° 38.1' N, 1000 m, 27. II. 2010, *P. & B. van den Boom 44560* (hb. v.d. Boom).

**Heterodermia vulgaris* (Vain.) Follm. & Redón

Remarks — Our specimen contains atranorin and the lower surface has a reddish pigment. The species was reported from Costa Rica (UMAÑA-TENORIO et al. 2002) and El Salvador (SIPMAN 2001).

Specimen examined — (E) Prov. Chiriquí, NNW of David, N of Cerro Punta, Guadalupe, Finca Dracula farm, trees in garden and small forest, on an unidentified shrub and on a *Brugmansia* sp., 82° 34.3' W, 8° 52.4' N, 1935 m, 23. II. 2010, *P. & B. van den Boom 44388* (hb. v.d. Boom).

**Hyperphyscia isidiata* Moberg

Fig. 2D

Remarks — We found skyrin in traces. This tropical species was hitherto only once recorded for America, from Nicaragua (BREUSS 2002). For the world distribution see Fig. 3.

Specimens examined — (H) Prov. Chiriquí, N of David, 2 km N of city, along road, row of *Pachira quinata* trees along field, on *P. quinata*, 82° 25.3' W, 8° 32.5' N, 200 m, 26. II. 2010, *P. & B. van den Boom 44547, 44548* (UPS, hb. v.d. Boom).

**Phaeophyscia endococcinoides* (Poelt) Essl.

Remarks — We found skyrin in the sample. According to ESSLINGER (2004) this widely distributed species is known from North America, Central America, Europe, Asia and Africa. In SIPMAN et al. (2008), it was mentioned from Colombia.

Specimen examined — (D) Prov. Chiriquí, N of David, Boquete, NW of village, N of Bajo Mono, road to office of 'Quetzal Trail', N of main road, paved road along tropical forest and fields, including iron of pipeline, on iron, 82° 30.6' W, 8° 50.11' N, 2100 m, 19. II. 2010, *P. & B. van den Boom 44215* (hb. v.d. Boom).

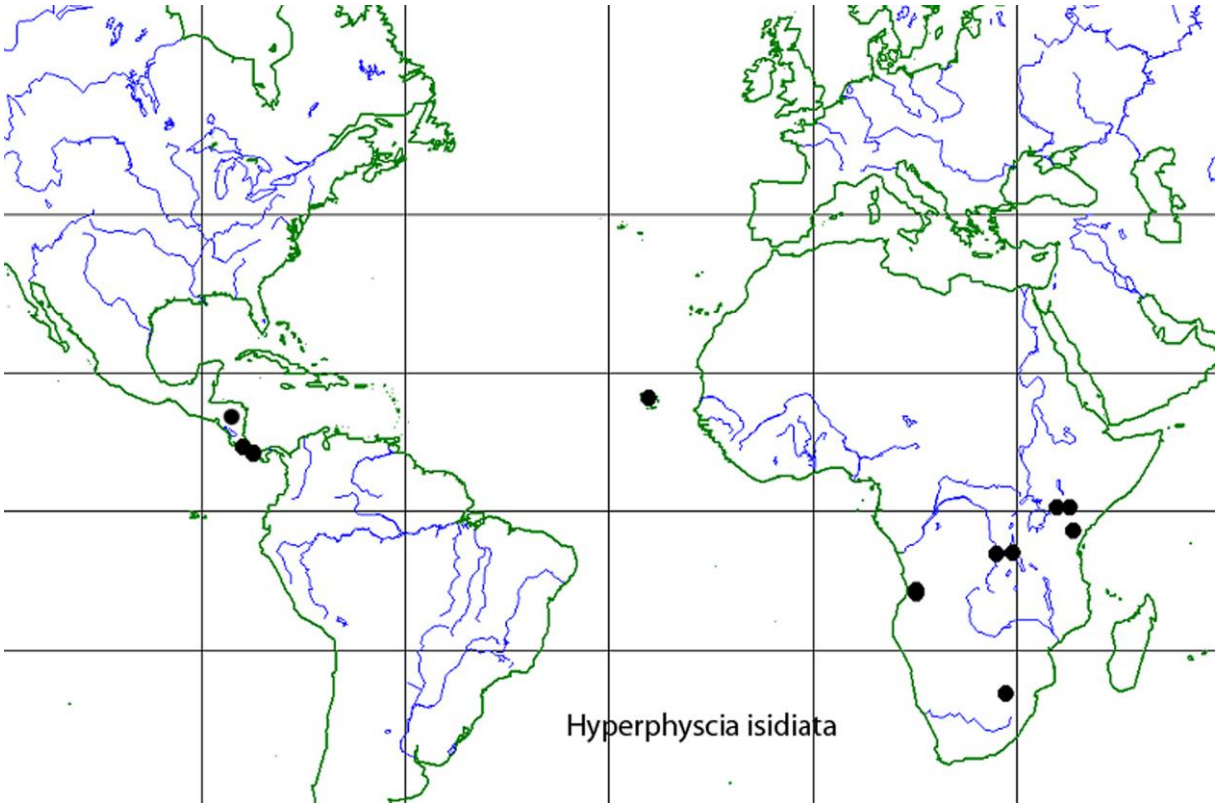

Figure 3 — Worldwide distribution of *Hyperphyscia isidiata*.

**Phaeophyscia hispidula* (Ach.) Moberg

Remarks — We found no chemical compounds. The species was previously reported in Central America from Costa Rica (UMAÑA-TENORIO et al. 2002), Guatemala (VAN DEN BOOM et al. 2007) and El Salvador (SIPMAN 2001).

Specimens examined — (D) Prov. Chiriquí, N of David, Boquete, W rim of village, road to Valle Escondido along fields, fence posts, including small trees and some mature roadside trees, on an unidentified tree, 82° 26.3' W, 8° 46.7' N, 1110 m, 18. II. 2010, *P. & B. van den Boom 44038* (hb. v.d. Boom); ibid., N of David, Boquete, WNW of village, W of Los Naranjos, trail from main road to entrance of Park National Barú, fields with fence posts, including *Datura* trees, terricolous, 82° 28.8' W, 8° 47.8' N, 1685 m, 18. II. 2010, *P. & B. van den Boom 44063* (hb. v.d. Boom); ibid., N of David, Boquete, NW of village, N of Bajo Mono, road to office of 'Quetzal Trail', N of main road, paved road along tropical forest and fields, including iron of pipeline, on iron, 82° 30.6' W, 8° 50.11' N, 2100 m, 19. II. 2010, *P. & B. van den Boom 44222* (hb. v.d. Boom).

**Physcia alba* (Fée) Müll. Arg.

Remarks — We found atranorin and zeorin as well as an additional triterpene in our specimen. According to MOBERG (1990) this species is only known from America, where it is widely distributed from Guatemala to Uruguay. UMAÑA-TENORIO et al. (2002) mentioned it from Costa Rica, VAN DEN BOOM et al. (2007) from Guatemala.

Specimen examined — (D) Prov. Chiriquí, N of David, Boquete, W rim of village, garden of Isla Verde, with scattered trees and shrubs, on a young *Mangifera* sp., 82° 26.1' W, 8° 46.5' N, 1090 m, 18. II. 2010, *P. & B. van den Boom 44030* (hb. v.d. Boom).

Physcia atrostriata Moberg

Remarks — We found atranorin and zeorin in our specimen. MOBERG (1990) mentioned this species from the province Chiriquí in Panama, without precise locality. FEUERER (2008) recorded it as the only species of the genus for Panama. It was further reported from Costa Rica (UMAÑA-TENORIO et al. 2002), Guatemala (VAN DEN BOOM et al. 2007) and Nicaragua (BREUSS 2002).

Specimen examined — (K) Prov. Chiriquí, SE of David, island 'Boca Brava', at E side of the island, tropical forest, gardens and coastal outcrops, on an unidentified tree, 82° 12.6' W, 8° 12.7' N, 20 m, 2. III. 2010, *P. & B. van den Boom 44737* (hb. v.d. Boom).

Physcia integrata Nyl.

Remarks — We found atranorin and zeorin in our specimens. MOBERG (1990) mentioned this species from the province of Chiriquí in Panama, without precise locality. It was further reported from Costa Rica (UMAÑA-TENORIO et al. 2002), Guatemala (VAN DEN BOOM et al. 2007) and El Salvador (SIPMAN 2001).

Specimens examined — (C) Prov. Coclé, SW of Panama-city, small village El Valle, in old crater of an extinct volcano, unpaved road to the small Zoo 'El Nispero', scattered mixed roadside trees, on an unidentified tree, 80° 8.0' W, 08° 36.0' N, 600 m, 15. II. 2010, *P. & B. van den Boom 43884* (hb. v.d. Boom). (H) Prov. Chiriquí, N of David, 2 km N of city, along road, row of *Pachira quinata* trees along field, on *P. quinata*, 82° 25.3' W, 8° 32.5' N, 200 m, 26. II. 2010, *P. & B. van den Boom 44555* (hb. v.d. Boom).

**Physcia lacinulata* Müll. Arg.

Remarks — We found atranorin and zeorin in our specimen. UMAÑA-TENORIO et al. (2002) mentioned the species from Costa Rica and SIPMAN (2001) from El Salvador. MOBERG (1990) mentioned it from Central and South America, but not specifically from Panama.

Specimen examined — (D) Prov. Chiriquí, N of David, Boquete, W rim of village, road to Valle Escondido along fields, fence posts, including small trees and some mature roadside trees, on an unidentified tree, 82° 26.3' W, 8° 46.7' N, 1110 m, 18. II. 2010, *P. & B. van den Boom 44049* (hb. v.d. Boom).

***Physcia manuelii* Moberg** Fig. 2E

Remarks — We found atranorin in our sample. Previously this species was only known from the Dominican Republic and Venezuela (MOBERG 1990).

Specimen examined — (D) Prov. Chiriquí, N of David, Boquete, W rim of village, garden of Isla Verde, with scattered trees and shrubs, on an unidentified shrub, 82° 26.1' W, 8° 46.5' N, 1090 m, 18. II. 2010, *P. & B. van den Boom 44024* (hb. v.d. Boom).

***Physcia sorediosa* (Vain.) Lynge**

Remarks — We found atranorin and zeorin in our sample. UMAÑA-TENORIO et al. (2002) reported this species from Costa Rica and VAN DEN BOOM et al. (2007) from Guatemala. It is widely distributed in tropical areas (MOBERG1990).

Specimen examined — (E) Prov. Chiriquí, NNW of David, Cerro Punta, E of village, Bajo Grande, paved road to 'Los Quetzales Trail', along fields with roadside trees, on *Cupressus*, 82° 33.35' W, 8° 51.9' N, 2135 m, 24. II. 2010, *P. & B. van den Boom 44485* (hb. v.d. Boom).

***Pyxine cocoes* (Sw.) Nyl.**

Remarks — Our sample has lichexanthone. In Central America this species was already reported from Costa Rica (UMAÑA-TENORIO et al. 2002), Nicaragua (BREUSS 2002), and Guatemala (VAN DEN BOOM et al. 2007). It is widely distributed in the tropics and subtropics (KALB 2002).

Specimen examined — (A) Prov. Panama, NW side of Panama-city, small green hill, 'Ancón Hill', NE of Canal Administrative Building, road along parkland with scattered houses and scattered trees, including mature palm trees, on a palm tree, 79° 33.1' W, 8° 57.6' N, 55 m, 14. II. 2010, *P. & B. van den Boom 43838* (hb. v.d. Boom).

***Rinodina guianensis* Aptroot**

Remarks — We found no chemical compounds in our sample. This species is known from the type locality in French Guiana (APTROOT 1987), the Cape Verde Islands (GIRALT & VAN DEN BOOM 2008), Brazil, Guatemala and Venezuela (GIRALT et al. 2009). We disagree with SHEARD (2010), who considers this taxon conspecific with *R. colobinoides* (Nyl.) Zahlbr. Whereas the ascospores of *R. colobinoides* develop after an ontogeny of type A and have a well developed torus (GIRALT et al. 1995), those of *R. guianensis* have an ontogeny of type B and lack a torus (GIRALT et al. 2009).

Specimen examined — (D) Prov. Chiriquí, N of David, Boquete, W rim of village, road to Valle Escondido along fields, fence posts, including small trees and some mature roadside trees, on *Cupressus*, 82° 26.3' W, 8° 46.7' N, 1110 m, 18. II. 2010, *P. & B. van den Boom 44044* (hb. v.d. Boom).

**Stigmatochroma epimarta* (Nyl.) Marbach

Remarks — We found atranorin, norstictic and connorstictic acids in our sample, which fits well with the description in MARBACH (2000). According to ELIX (2011) traces of parietin are present in the pruina of the apothecia. This pantropical species is known from several neotropical countries, including Costa Rica, but not yet from Panama (MARBACH 2000).

Specimen examined — (I) Prov. Chiriquí, NW of David, WNW of Volcán, Rio Senero, 4 km E of village, secondary road, fence posts and mixed trees along trail, coffee plantation and field, on wood of fence post, 82° 47.0' W, 8° 50.0' N, 1050 m, 25. II. 2010, *P. & B. van den Boom 44503* (hb. v.d. Boom).

**Stigmatochroma kryptoviolascens* Marbach

Fig. 2F

Remarks — Previously this species was only known from Brazil (MARBACH 2000). According to this author it contains norstictic and connorstictic acids, atranorin and lichexanthone. We did not test our sample on chemistry.

Specimen examined — (I) Prov. Chiriquí, NW of David, WNW of Volcán, Rio Senero, 4 km E of village, secondary road, fence posts and mixed trees along trail, coffee plantation and field, on wood of fence post, 82° 47.0' W, 8° 50.0' N, 1050 m, 25. II. 2010, *P. & B. van den Boom 44507b* (hb. v.d. Boom).

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Scaphis Eschw., *Systema Lichenum*: 14 (1824). – Tipo: *Scaphis anfractuosa* Eschw. ≡ *Graphis anfractuosa* (Eschw.) Eschw.

(Fig. 2A–F, 5J–L)

Descripción — Talo grisáceo a marrón amarillento pálido ...

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Especímenes examinados — COSTA RICA. **PUNTARENAS:** Parque Nacional Corcovado, 83° 15' O, 10° 12' N, 100 m, Estación Sirena, sobre corteza de *Bombacaceae*, Mayo 2005, *Chaves 3113* (INB). — COLOMBIA. ...

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Claves taxonómicas:

Usar numeración consecutiva, separando las parejas de alternativas con las letras a/b en minúscula. Tabulación: 1 cm en la margen izquierda y sangría de 1 cm; 16 cm en la margen derecha utilizando puntos [.....], dejando un espacio a la izquierda y a la derecha de cada linea de puntos como se muestra a continuación:

15a Ascosporas pequeñas, menos de 20 µm de largo 16
15b Ascosporas medianas a grandes, más de 20 µm de largo 18

Figuras, fotografías e ilustraciones:

Las figuras, fotografías e ilustraciones deben ser preparadas en formato TIFF o JPG de alta calidad, con un tamaño final de máximo 22 cm × 16 cm, en resolución de 300 dpi. Se alienta el envío de figuras en color. En el caso de figuras compuestas, usar lineas blancas finas para separar cada imagen y letras mayúsculas en las imagenes para su identificación (**A**, **B**, **C**, ...). Se sugiere usar ARIAL BLACK de 20 puntos para las letras indicativas.

Tablas:

Tabla 1 — Separación tradicional de géneros en la familia *Graphidaceae* (según MÜLLER ARGOVIENSIS 1880, 1882, 1887a, b, 1894a; ZAHLBRUCKNER 1907, 1923, 1926).

Organización apotecios	Ascosporas hialinas transversal	Ascosporas hialinas muriformes	Ascosporas marrón grisáceas transversal	Ascosporas marrón grisáceas muriformes
Lirelas solitarias	*Graphis*	*Graphina*	*Phaeographis*	*Phaeographina*
Lirelas estromáticas	*Glyphis*	*Medusulina*	*Sarcographa*	*Sarcographina*

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