

New species of *Bactrospora*, *Enterographa*, *Graphidastra* and *Lecanographa* from northern Thailand and Vietnam

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Abstract: *Bactrospora perspiralis*, *B. subdryina*, *Enterographa mesomela*, *Graphidastra laii* and *Lecanographa atropunctata* (Roccellaceae) are described as new to science based on specimens collected in the wet subtropical lowlands of northern Thailand and Vietnam. The new *Graphidastra* is the third species in the genus and was also found in Taiwan.

Key words: *Arthoniales*, *Roccellaceae*, Taiwan, Thailand, Vietnam.

Introduction

Only a few lichenologists have collected and studied crustose lichens in disturbed (sub)-tropical lowlands. The limited taxonomic knowledge is a problem especially for people carrying out ecological studies in these areas. During fieldwork evaluating the effects of air pollution on lichens by Saipunkaew (2000), many unknown, corticolous crustose lichens were collected in the vicinity of Chiang Mai, northern Thailand (Saipunkaew *et al.*, 2005a). Further fieldwork in lowland areas of seven provinces of upper northern Thailand during 2002–2004 (Saipunkaew *et al.*, 2005b) has added to the collection of unknown corticolous lichens from northern Thailand. As a result, we describe five new species in the genera *Bactrospora*, *Enterographa*, *Graphidastra* and *Lecanographa* (*Arthoniales*: *Roccellaceae*).

Materials and Methods

Samples were taken from exposed trunks of *Mangifera indica* L. more than 60 cm in girth in a range of urban and rural habitats. Trees were sampled in parks, school grounds, orchards and gardens. Additional material has been collected in the summer of 2004 during a short field trip to northern Thailand and Vietnam by the first and last authors. One specimen was collected by the last author in Taiwan in 2003. Herbarium material including duplicates has been deposited in ABL, BM, CMU, FH, H, NSW, RAMK and hb. Sparrius.

Microscopical characters have been examined in tap water or, if stated, in 10% KOH (K). Amyloidy was tested with a 0.25% iodine solution (I), sometimes pre-treated with K (KI). Secondary metabolites have been detected with TLC (solvent system A) on Merck silica gel 60F₂₅₄ precoated glass plates.

Bactrospora

The genus *Bactrospora* was revised by Egea & Torrente (1993), with three additional species documented by Egea & Torrente (1995), Egea *et al.* (1997) and Kantvilas (2004). This genus has rarely been reported from lowland areas in the seasonal wet tropics. Aptroot & Sipman (2001) mentioned *Bactrospora myriadea* (Fée) Egea & Torrente from Hong Kong, and the same species was reported from upland areas in Taiwan by Aptroot & Sparrius (2003). *Bactrospora leptoloma* (Müll. Arg.) Egea & Torrente is still only known from the type, collected on Labuan (Malaysia). Two new

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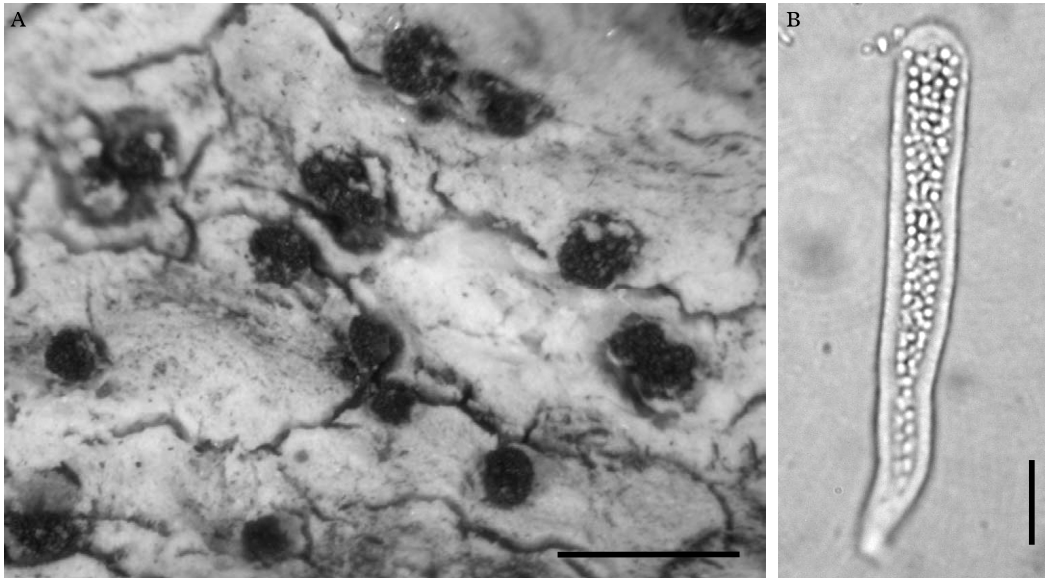


FIG. 1. *Bactrospora subdryina* (holotype) A, thallus with apothecia; B, ascus and ascocidia in water. Scales: A=0.5 mm; B=10 μ m.

species, both with rather small ascomata and no secondary compounds, are described below and compared with similar taxa.

***Bactrospora subdryina* Sparrius, Saipunkaew & Wolseley sp. nov.**

Bactrospora thallus endophloeodiscus, ascomata punctiformia, thallus sine acidis lichenicis. Ascosporeae typo *Dryina*, 50–70 \times 2.0–3.0 μ m, fragmentatae, cellulibus (3–)5–8 \times 2–3 μ m.

Typus: Thailand, Chiang Mai Province, Ban Lom Luang, on *Mangifera indica* L., 19°03'N, 98°58'E, 330 m, 5 June 1998, Saipunkaew 31, T4S3 (BM 000764065—holotypus; CMU—isotypus).

(Fig. 1)

Thallus endophloeodal, film-like, white to cream-coloured. *Photobiont* *Trentepohlia*. *Prothallus* thin, dark brown or black. *Medulla* not apparent.

Ascomata immersed, rounded, 0.10–0.20 mm diam.; disc black, not pruinose. *Thalline margin* absent. *Excipulum* c. 50 μ m wide, black-brown in section. *Hypothecium* straw-coloured to brown, 100–150 μ m tall, K–, KI+ deep blue. *Hymenium* hyaline,

150–170 μ m tall. *Paraphysoids* 0.8 μ m wide, apices not swollen, branched and anastomosed, readily separating in water. *Epithecium* c. 25 μ m tall, with dark brown crystals of c. 1 μ m diam., unchanged in K. *Asci* c. 120 \times 20 μ m, cylindrical, 8-spored; *Bactrospora*-type. *Ascospores* parallel arranged in the ascus, *Dryina*-type, acicular, 50–70 \times 2.0–3.0 μ m, disintegrating in the ascus into 1 or few celled segments (ascocidia); cells (3–)5–8 \times 2–3 μ m; perispore absent.

Conidiomata punctiform, black, c. 0.05 mm diam.; wall dark brown in section; *conidia* bacilliform, 5–7 \times 1.0–1.5 μ m.

Chemistry. Thallus C–, K–, PD–, UV–; TLC: no compounds found.

Distribution and ecology. So far known only from northern Thailand where it was found on exposed trunks of cultivated *Mangifera indica* L. in suburban areas of Chiang Mai and Lamphun.

Remarks. This species is similar to *Bactrospora dryina* (Ach.) A. Massal. but the

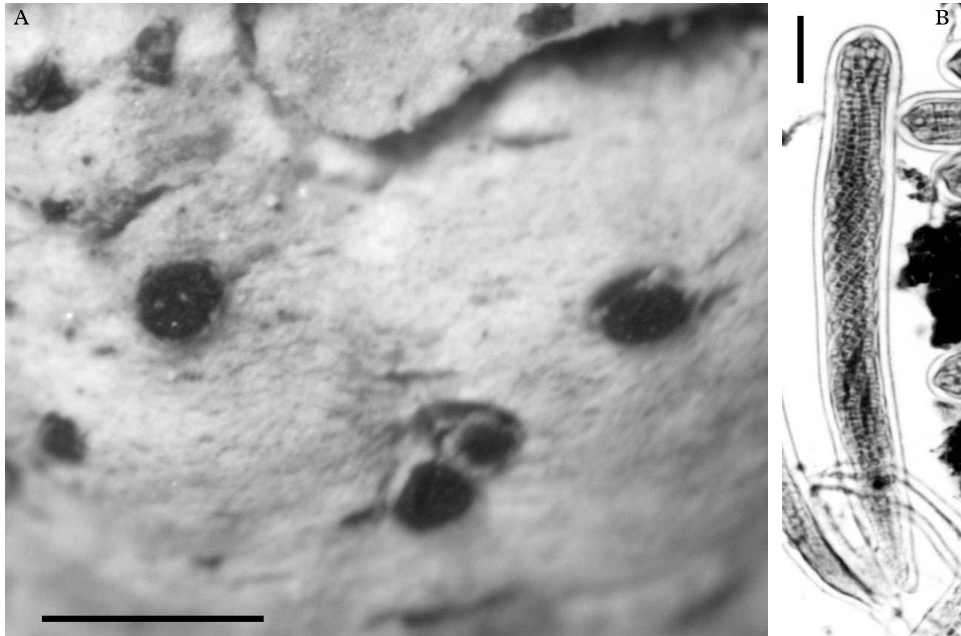


FIG. 2. *Bactrospora perspiralis* (holotype). A, thallus with apothecia; B, ascus with ascospores in KI. Scales: A=0.5 mm; B=10 μ m.

ascomata are much smaller (0.2–0.7 mm in *B. dryina*) and the conidia are longer.

Additional specimens examined. Thailand: Chiang Mai: Ban Lom Luang, 19°03'N, 98°58'E, 330 m, 1998, *Saipunkaew* T1S7 (RAMK); Ban Pa Bong, 18°55'N, 98°59'E, 350 m, 1998, *Saipunkaew* T5S4 (UPS). *Lamphun:* Amphur Saraphi, 18°43'N, 99°03'E, 330 m, 1998, *Saipunkaew* 33, T2S4 (BM 000764070).

***Bactrospora perspiralis* Sparrius, Saipunkaew & Wolseley sp. nov.**

Bactrospora thallus endophloeodicus, ascomata punctiformia, thallus sine acidis lichenicis. Ascospores typo *Patellarioidis*, 80–100 \times 2.0–3.0 μ m, 25–50-septatae, spiraliter in ascis.

Typus: Thailand, Lampang Province, Ban Fai Noi, on *Mangifera indica* L. in a suburban area, 18°20'N, 99°33'E, 240 m, 3 November 2003, *Saipunkaew* 30, T3S6 (BM 000764064—holotypus; CMU—isotypus).

(Fig. 2)

Thallus mostly endophloeodal, film-like, white to cream-coloured. *Photobiont* *Trentepohlia*. *Prothallus* thin, dark brown or absent.

Medulla with calcium oxalate crystals of c. 15 μ m diam.

Ascomata punctiform, immersed to sessile, solitary, 0.15–0.25 mm. diam.; disc black, not pruinose; margin thin, not apparent or slightly crenate. *Thalline margin* absent. *Excipulum* 30–50 μ m wide, brown-black in section. *Hypothecium* straw-coloured to brown, 150–200 μ m tall, KI+ deep blue, K–. *Hymenium* hyaline, 200–250 μ m tall. *Paraphysoids* 0.8 μ m wide, apices not swollen, branched and anastomosed, readily separating in water. *Epithecium* 25–30 μ m tall, with dark brown crystals of 1.0 μ m diam., K–. *Asci* 150–200 \times 15–20 μ m, cylindrical, 8-spored; *Bactrospora*-type. *Ascospores* distinctly spirally arranged in the ascus, spiral-acicular, 80–100 \times 2.0–3.0 μ m, 25–50-septate; *Patellarioides*-type; spore cells c. 2 \times 2 μ m, often separating outside the ascus; perispore absent.

Conidiomata punctiform, black, c. 0.05 mm diam.; wall brown-black in section; conidia bacilliform, 4–5 \times 2.5 μ m.

Chemistry. Thallus C⁻, K⁻, PD⁻, UV⁻; TLC: no compounds found.

Distribution and ecology. So far known only from the type locality in northern Thailand where it was found on cultivated *Mangifera indica* L. in a suburban area east of Lampang city. Occurring on vertical trunks in well-lit conditions with other crustose species.

Remarks. *Bactrospora spiralis* Egea & Torrente differs in having fragmenting *Dryina*-type ascospores. Similar to *Bactrospora patellarioides* (Nyl.) Almq., but with smaller ascomata and ascospores spirally arranged in the ascus.

The two new species are likely to be found growing together. *Bactrospora perspiralis* can be recognized by the slightly larger ascomata, which are more frequently sessile rather than immersed.

Additional specimen examined. Type locality, *ibid.*, 2003, Saipunkaew T2S6 (CMU).

Enterographa

The genus *Enterographa* has been revised by Sparrius (2004) and to date comprises 35 species. It is characterized by the immersed ascomata, *Opegrapha*-type asci, the thin, branched and anastomosed paraphyses, the unpigmented hypothecium and excipulum, and hyaline spores.

Enterographa mesomela Sparrius, Saipunkaew & Wolseley sp. nov.

Enterographa thallus endophloeodus, acidis confluentis continens, ascomata punctiformia vel ellipsoidea, hypothecio acidis norsticticis continens. Ascospores 50–60 × 4.0–5.0 µm, 7–9-septatae.

Typus: Vietnam, Vin Phuc Province, Ba Vi National Park, on *Acacia mangium* Willd. in parkland around office building, 21°05'51"N, 105°24'11"E, 70–80 m, 2004, Sparrius 8471 & Aptroot 61719 (BM—holotypus; hb Sparrius, ABL—isotypi).

(Figs 3, 6A & 7)

Thallus thin, grey-green, slightly cracked to areolate. *Photobiont* *Trentepohlia*. *Prothallus* thin, dark brown or absent. *Medulla* not apparent.

Ascomata immersed, rounded to ellipsoid, not constricted below, 0.2–0.3 × 0.3–0.8 mm; disc black. *Pseudothalline margin* present, white, paler than the thallus. *Excipulum* 30–50 µm wide, chocolate-brown in section, K⁺ green. *Hypothecium* hyaline, 20–30 µm tall, K⁺ diffusing yellow, rapidly forming red crystals. *Hymenium* hyaline, c. 100 µm tall. *Paraphysoids* 0.8 µm wide, branched and anastomosed; apices not swollen. *Epithecium* 15–20 µm tall, pale brown, with brown crystals of 1.0 µm diam., K⁺ green. *Asci* c. 70 × 15 µm, ellipsoid-cylindrical, 8-spored. *Ascospores* fusiform-acicular, tapering to one end and often slightly curved, 32–40 × 4.0–5.0 µm, 7–9-septate; perispore <2.5 µm wide.

Conidiomata punctiform, dark brown to black, c. 0.1 mm diam.; wall dark brown in section; *conidia* bacilliform, straight, 5–6 × 0.8–1.0 µm.

Chemistry. Thallus C⁻, K⁻, PD⁻, UV⁺ whitish; TLC: confluent acid in the thallus, and norstictic acid in the hypothecium; asci and excipulum I⁺ red, KI⁺ dark blue; epithecium and hymenium I⁺ and KI⁺ weak blue.

Distribution and ecology. Known from the northern parts of Thailand and Vietnam (Fig. 11). A corticolous pioneer species on *Mangifera indica* L. and *Acacia mangium* Willd. in plantations, urban and parkland areas.

Remarks. Easily recognized by the thin, dark green thallus with black apothecia with a white rim. The neotropical *Enterographa quassiaecola* Fée has broader conidia and a purplish grey, K⁺ yellow thallus. *Enterographa tropica* Sparrius, a common member of the urban flora in tropical Asia has a similar thallus and chemistry, but differs in the presence of large black conidiomata and rather inconspicuous lirelliform ascomata.

Additional specimens examined. **Thailand:** Chiang Rai Province: Chiang Rai City, on bark of *Mangifera indica* L., 19°53'99"N, 99°49'95"E, 400 m, 2004, Saipunkaew 32, T2S11 (BM 000764066, CMU).—**Vietnam:** Vin Phuc Province: c. 20 km E of Doan Hung,

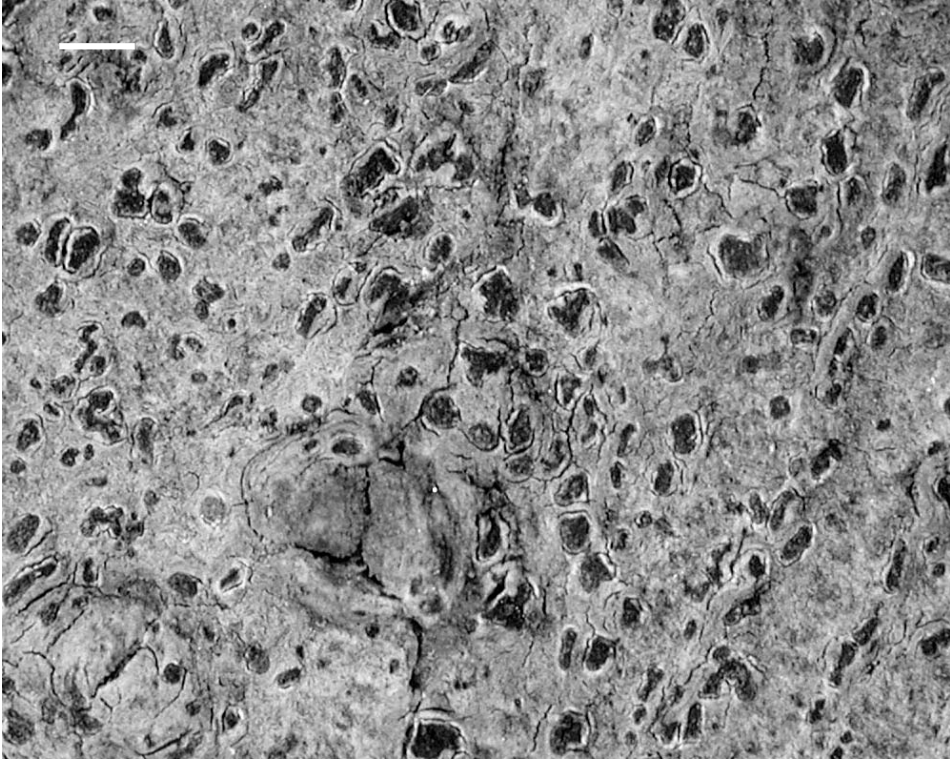


FIG. 3. *Enterographa mesomela*, thallus with apothecia (holotype). Scale=0.5 mm.

Yen Lap, near Hotel Du Lich Soi Tien, 21°20'48"N, 105°03'27"E, 60 m, dominant on bark of jackfruit trees (*Artocarpus heterophyllus* Lam.) in courtyard between buildings, 2004, *Aptroot* 61518 (ABL).

Graphidastra

This genus has been revised by Thor (1990). The two currently known species in the genus differ from *Schismatomma* and *Chiodecton* in the biclavate ascospores, paraphyses type, the variable (rounded to lirelliform) shape of the ascomata and the absence of a distinct cortex in the excipulum. The species described below differs in the ascospore shape, being acicular, thick-walled and curved. It shares most other characters, including the conidial type and hamathecium characters with the other species in the genus.

Graphidastra laii Aptroot & Sparrius sp. nov.

Graphidastra thallus viridus, acidis confluentis et 2-*O*-methylmicrophyllinicus continens, ascomata marginibus saepe acidis protocetraricis continens, ascosporae acicularae, curvatae, 25–40 × 2.5–3.5 μm, 3-septatae, non clavatae.

Typus: Thailand, Chiang Mai Province, NW of Chiang Mai, Tung Joaw trail off road to Pae, corticolous on smooth bark in forest, 19°08'24"N, 98°38'17"E, 800–900 m, 30 June 2004, *Aptroot* 61263 & *Sparrius* 8595 (BM—holotypus; ABL, hb Sparrius—*isotypi*).

(Figs 4 & 6B)

Thallus thin, dull, pale to dark green. *Photobiont* *Trentepohlia*. *Prothallus* thin, dark brown or absent. *Medulla* not apparent in the thallus, but white at the thallus margin.

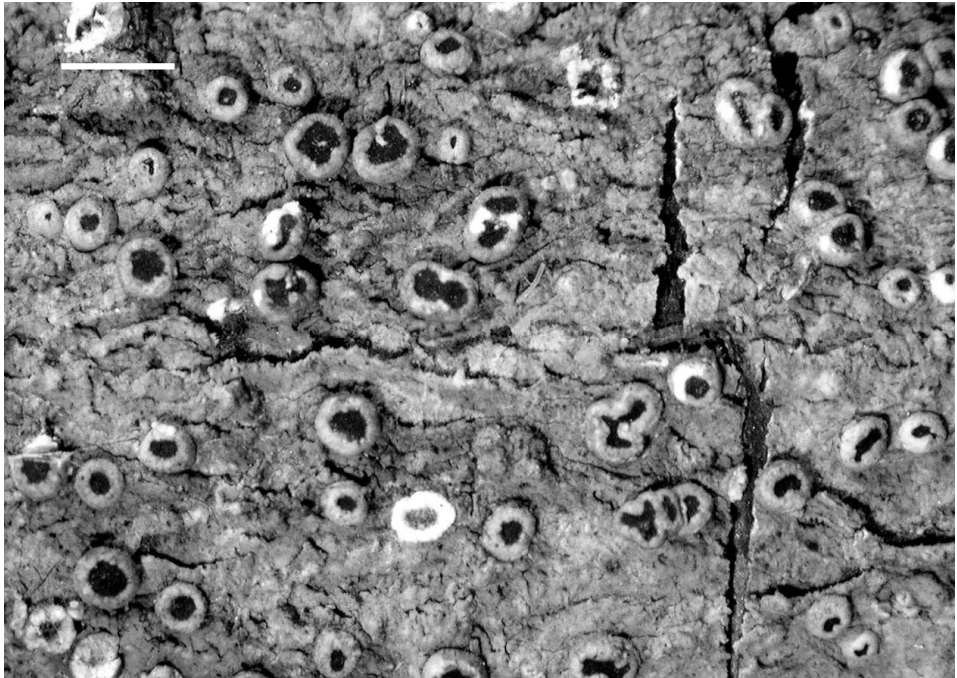


FIG. 4. *Graphidastra laii*, thallus with apothecia (holotype). Scale=0.5 mm.

Ascomata emergent to sessile, rounded to ellipsoid, rarely irregularly lirelline to forked, not constricted below, 0.05–0.20 × 0.1–0.3 mm.; disc black. *Pseudothalline margin* 0.1–0.2 mm thick, taller than the disc, paler than the thallus, often partly abraded, revealing the white medulla filled with small crystals that dissolve in K. *Excipulum* usually absent, rarely up to 100 µm wide and dark reddish brown to black in section. *Hypothecium* black, 30–120 µm tall, K+ diffusing yellow and then forming red crystals. *Hymenium* hyaline, c. 100 µm tall. *Paraphysoids* unbranched, 0.8 µm wide; up to 3.0 µm wide. *Epithecium* 30–50 µm tall, pale brown, with brown pigment, K+ green. *Asci* 90–120 × 20–30 µm, cylindrical, 8-spored. *Ascospores* fusiform-acicular, slightly curved, 25–40 × 2.5–3.5 µm, 3-septate; median septum above the middle; wall rather thick; perispore often distinct and <1.0 µm wide.

Conidiomata punctiform, black, especially near the thallus margin, 0.07–0.10 mm diam.; wall brown in section, K–; *conidia* filiform, strongly curved, 13–17 × 0.8 µm.

Chemistry. Thallus C–, K–, PD– (apothecial margin PD+ red or PD–), UV+ whitish; TLC: confluent acid and 2-O-methylmicrophyllinic acid in the thallus, protocetraric acid present in the apothecial margin of most specimens; epithecium, asci and excipulum I+ red, KI+ blue; hypothecium and hymenium I+ and KI+ weak blue.

Distribution and ecology. Known from Taiwan and northern Thailand. Corticolous on *Mangifera indica* L. and *Cinchona pubescens* Vahl in plantations and for example *Castanopsis* in primary or secondary forest. The type locality, where the species is abundant, is in a nature reserve in semi-deciduous secondary forest around a hill top dominated by smooth-barked trees sized 20–30 cm d.b.h.

Remarks. This species is named in honour of Prof. M.-J. Lai, the Taiwanese lichenologist, who organized the field-trips on which the species was discovered. It is very similar

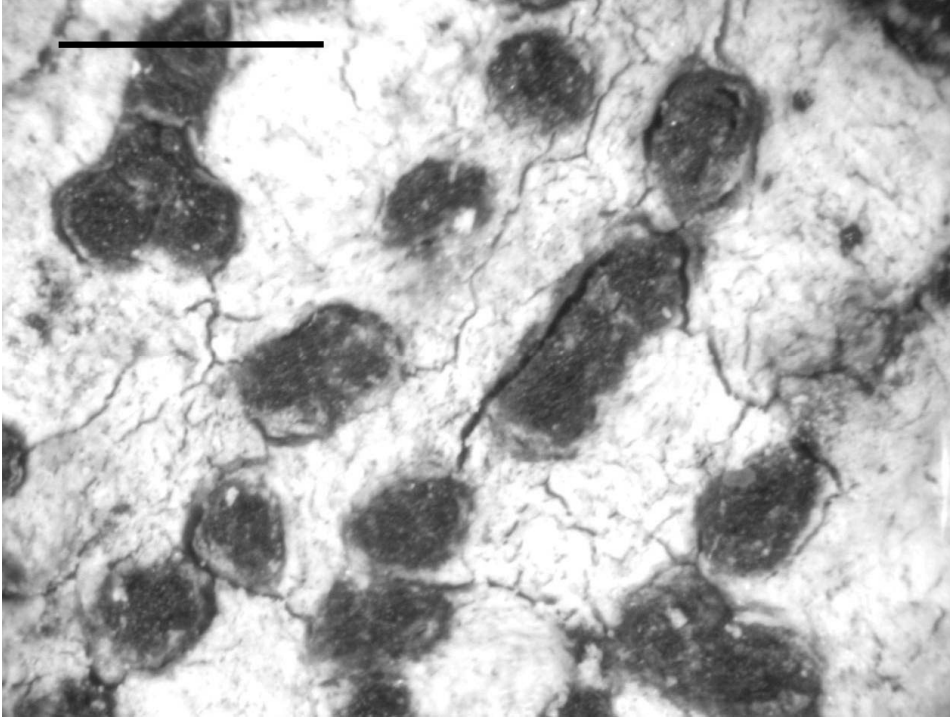


FIG. 5. *Lecanographa atropunctata*, thallus with apothecia (holotype). Scale=1 mm.

in appearance to *Graphidastra multiformis* (Mont. & Bosch) Thor, but the ascomata remain somewhat smaller and the thallus is distinctly green (grey in *G. multiformis*). The new species differs microscopically in the ascospores, being needle-shaped and evenly curved (biclavate or curved at one end in the other species in the genus) and the somewhat longer conidia.

Additional specimens examined. Thailand: Chiang Mai Province: Doi Suthep-Pui National Park, medicinal herb garden, on *Cinchona pubescens* in orchard, 18°48'17"N, 98°54'43"E, 1000–1100 m, 2002, *Aptroot* 55271 (ABL); *Sparrius* 7086 (hb Sparrius).—**Taiwan:** Taichung County: Tahsueshan Forest Recreation Area, near entrance, 22 km E of Tungshi, on *Cryptomeria japonica*, 24°14'N, 120°58'E, 1500 m, 2001, *Aptroot* 51838 (ABL) & *Sparrius* 5785 (hb Sparrius).

Selected specimens of G. multiformis seen for comparison: Indonesia: Java: sine dato, F.F.W. Junghuhn 112c (L 0414798), sub *Platygrapha dirinea*; Mt Tengger, between Nongkodjar and Andanasari, on tree, 1100–1200 m, 1938, P. Groenhart 4488 (L 0414792); Mt Merapi, Kali Urang, on tree, 1000 m, 1936, P. Groenhart 2803 (L 0414789).—**Papua New Guinea:**

Madang Province: Manam Island, on tree on lower border of mountain forest, 450 m, 1992, *Aptroot* 30525 (ABL). Northern Province: Myola, on tree in primary forest, 2100 m, 1995, *Aptroot* 37449 (ABL).

Lecanographa

The genus *Lecanactis* s. lat. was revised by Egea & Torrente (1994) and additional species from the tropics have been described by Egea & Aptroot (1992), Egea, Sérusiaux & Torrente (1996), Egea *et al.* (1997) and Kantvilas (2004). The new species described below belongs to *Lecanographa*, which is characterized by the presence of a thick perispore, *Grumulosa*-type asci, ellipsoid to shortly lirelliform ascomata, which are often pruinose in part.

Lecanographa atropunctata Sparrius, Saipunkaew & Wolseley sp. nov.

Lecanographa thallus endophloeodeticus, acidis schizopelticis continens; ascomata punctiformia vel ellipsoidea;

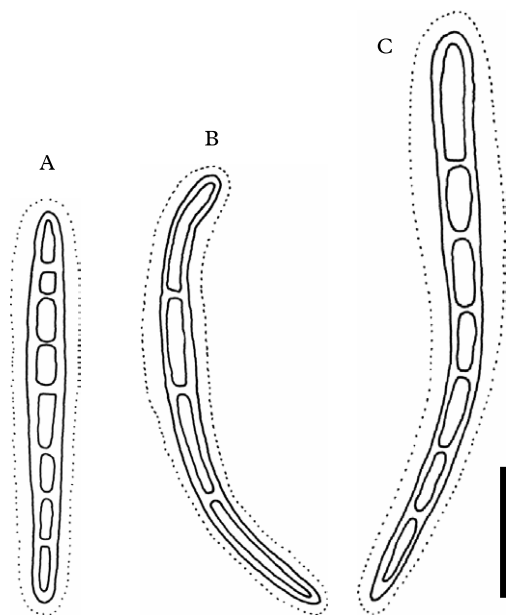


FIG. 6. Ascospores of new species of Arthoniales. A, *Enterographa mesomela* (holotype); B, *Graphidastra laii* (holotype); C, *Lecanographa atropunctata* (holotype). Scale = 10 μm .

ascosporae 50–60 \times 4.0–5.0 μm , 7–9-septatae, asci typo *Grumulosae*.

Typus: Thailand, Chiang Mai Province, Ban Bo Hin, on *Mangifera indica* L., 99°06'E, 18°52'N, 360 m, 1 June 1998, Saipunkaew 29, T1S4 (BM 000764063—holotypus; CMU—isotypus).

(Figs 5, 6C & 7)

Thallus endophloeodal, film-like, white to cream-coloured. *Photobiont* *Trentepohlia*. *Prothallus* thin, dark brown or absent. *Medulla* not apparent.

Ascomata immersed to sessile, rounded to ellipsoid, rarely forked, not constricted below, 0.1–0.3 \times 0.05–0.20 mm; disc black; margin not apparent, rarely thin and then white pruinose. *Pseudothalline margin* paler than the thallus. *Excipulum* c. 100 μm wide, dark reddish brown to black in section. *Hypothecium* black, 100–120 μm tall, K–. *Hymenium* hyaline, c. 100 μm tall. *Paraphysoids* 0.8 μm wide, branched and anastomosed; apices not swollen. *Epithecium* 15–20 μm tall, pale brown, with brown crystals 1 μm diam., unchanged in K. *Asci*

90–120 \times 20–30 μm , cylindrical, 8-spored, *Grumulosa*-type. *Ascospores* fusiform-acicular, tapering to one end and there often slightly curved, 50–70 \times 5.0–7.5 μm , 7–13-septate; perispore <3.0 μm wide.

Conidiomata punctiform, dark brown to black, 0.07–0.10 mm diam.; wall dark brown in section; *conidia* filiform, straight or slightly curved, 10–12 \times 1 μm .

Chemistry. Thallus C–, K–, PD–, UV–; TLC: schizopeltic acid; epithecium, asci and excipulum I+ red, KI+ blue; hypothecium and hymenium I+ and KI+ weak blue.

Distribution and ecology. So far only known from northern Thailand where it is widely distributed in rural and, occasionally, in urban areas. Corticolous on exposed and well-lit trunks of *Mangifera indica* L., usually on older trees with rather rough bark.

Remarks. This species is characterized by the large ascospores (the largest in the genus) and the minute apothecia. Similar to *Lecanographa microcarpella* (Mull. Arg.) Egea & Torrente (1994), which also has very small, semi-immersed apothecia, but differs in the much larger, 'tailed' ascospores with more septa. *Lecanographa nothofagi* Kantvilas (2004) has a leprose thallus, contains confluent acid and has smaller ascospores.

Tentatively placed in *Lecanographa* as the ascomata are immersed in the thallus and have an inconspicuous proper margin and possess a pseudothalline margin; it shares these characters with *Lecanographa microcarpella* and *L. nothofagi*. The dark pigmented hypothecium, the presence of schizopeltic acid and the narrow spores exclude this species from both *Enterographa* and *Sclerophyton*.

Additional selected specimens examined (all on bark of *Mangifera indica*). **Thailand:** *Lampang Province*: Ban Hong Kok, 18°20'N, 99°27'E, 220 m, 2003, Saipunkaew T3S2 (UPS), T4S2 (CMU), T4S9 (NSW), T5S10 (B), T6S6 (RAMK), T7S4 (H) & T8S4 (FH). *Chiang Mai Province*: Ban Mae Kuang, 99°04'E, 18°50'N 330 m, 1998, Saipunkaew T3S7 (H). *Lamphun Province*: Ban Umong, 18°40'N,

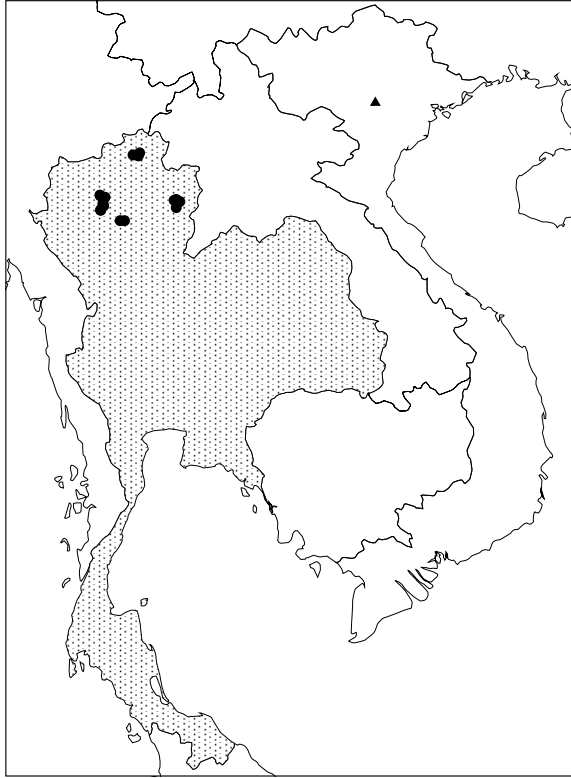


FIG. 7. Distribution of *Lecanographa atropunctata* in Thailand (grey) and the type locality of *Enterographa mesomela* (▲) in Vietnam.

99°04'E, 290 m, 1998, Saipunkaew 20, T2S5 (BM 000764061) & T4S8 (NSW); Ban Sri Muang Yoo, 99°0'E, 18°34'N, 260 m, 1998, Saipunkaew T1S2 (RAMK).

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