

---

## Discoveries through social media and in your own backyard: two new species of *Allographa* (*Graphidaceae*) with pigmented lirellae from the Palaeotropics, with a world key to species of this group

Muhammad Feisal JATNIKA, Gothamie WEERAKOON , Omal ARACHCHIGE, Iin Supartinah NOER, Anna VOYTSEKHOVICH and Robert LÜCKING 

**Abstract:** The genus *Graphis sensu* Staiger was recently divided into two genera, *Graphis* s. str. and *Allographa*. The latter contains mostly species with robust lirellae with a well-developed, often massively carbonized excipulum. With one exception, it also contains all species with a pigmented, yellow to orange pruina on the lirellae. Until now, seven species of *Allographa* were known with this character, all present in the Neotropics and one also in Africa. Here we describe two further species, both from tropical Asia, thus extending the known distribution of *Allographa* species with pigmented lirellae to the entire tropics. *Allographa kamojangensis* Jatnika, Noer & Lücking sp. nov. from Indonesia (Java) was recognized as a new taxon on the social media Facebook site *Lichens Connecting People*. Detailed studies showed that it deviates from the neotropical *A. firferi* in the much larger ascospores and the orange, K+ immediately purple-violet pigment, and from *A. lutea* in the completely carbonized excipulum and the larger ascospores. *Allographa jayatilakana* Weerakoon, Arachchige & Lücking sp. nov. was discovered in the second author's backyard during a recent inventory of *Graphidaceae* in Sri Lanka. It differs from *A. flavominiata* in the much shorter ascospores, from *A. firferi* in the terminally muriform ascospores, and from *A. ochracea* in the yellow–orange, K+ yellow then slowly purple-violet pruina. A key is presented to all nine species of *Allographa* with pigmented lirellae.

**Key words:** *Allographa chrysocarpa*, anthraquinone pigments, Colombo, Kamojang, lichens, taxonomy

Accepted for publication 28 January 2019

---

### Introduction

*Graphidaceae* is the largest family of tropical lichen fungi, with well over 2000 species known and more than 3000 predicted (Lücking *et al.* 2014, 2017). The family was traditionally divided into eight genera based on

ascoma and ascospore types but recent revisions have substantially changed genus concepts in *Graphidaceae*, now recognizing c. 80 genera (Staiger 2002; Frisch *et al.* 2006; Rivas Plata *et al.* 2012; Lumbsch *et al.* 2014; Lücking *et al.* 2017). In its revised definition, the type genus, *Graphis*, was circumscribed as having lirellate, carbonized ascomata and distoseptate, hyaline, I+ amyloid ascospores (Staiger 2002; Lücking 2009; Lücking *et al.* 2009). However, it was subsequently shown that *Graphis sensu* Staiger included two distantly related lineages (Rivas Plata *et al.* 2011), a finding already anticipated by Staiger (2002). This separation was recently formalized by reinstating the genus *Allographa* for the second lineage (Lücking & Kalb 2018). The latter differs from *Graphis* in the usually prominent, robust, mostly massively carbonized lirellae, generally larger ascospores, often lack of secondary substances, and type

---

M. F. Jatnika and I. S. Noer: Department of Biology, Faculty of Mathematics and Natural Science, Universitas Padjadjaran, Bandung, Indonesia.

G. Weerakoon: Department of Life Sciences, Natural History Museum, Cromwell Road, London SW7 5BD, UK.

O. Arachchige: Wichita State University, 1845 Fairmount St, Wichita, Kansas 67260, USA.

A. Voytsekhovich: Bush Habitat Restoration Co-operative, 120 Fitzgerald Avenue, Maroubra, New South Wales 2035, Australia.

R. Lücking (corresponding author): Botanischer Garten und Botanisches Museum, Freie Universität Berlin, Königin-Luise-Straße 6–8, 14195 Berlin, Germany. Email: [r.luecking@bgbm.org](mailto:r.luecking@bgbm.org)

B hymenial inspersion *sensu* Lücking (2009). With one exception (*Graphis ferruginea* Vain.), *Allographa* now contains all species of *Graphis sensu* Staiger with pigmented lirellae, including its type species, *A. lutea* Chevall.

On 7 November 2015, the first author posted a picture of an orange *Graphis sensu* Staiger from Java (Fig. 1) on the Facebook page *Lichens Connecting People* (<https://www.facebook.com/groups/150880938305901>).

This group page was founded in 2011 by Anna Voytsekhovich and currently has over 3700 members from 79 countries worldwide. Around 90% of the group members are amateurs, with *c.* 10% being professional lichenologists from 46 countries. Since 2011, more than 6000 lichen-related posts have been published on this social media page, often depicting unknown and potentially undescribed taxa from remote places. The orange *Graphis sensu* Staiger was immediately recognized by the senior author as unusual, since this group of species was not known from the eastern Palaetropics at the time (Fig. 1). Subsequent study revealed that it differed from other species with pigmented lirellae in the very large, transversely septate ascospores and therefore represented an undescribed taxon. At around the same time, another *Graphis sensu* Staiger with pigmented lirellae was collected in the backyard of the second author's home in Sri Lanka and was initially considered to be conspecific with the material from Java; however, a closer look revealed that both differed in important features, including ascospore size and septation and pigment chemistry, and therefore the material from Sri Lanka also represented an undescribed taxon. These discoveries underline the importance of social media in facilitating communication between collectors and experts to quickly identify potentially undescribed species from almost anywhere in the world, as well as the importance of sometimes just looking in one's own backyard to reveal new taxa.

Herein we describe both species formally in the recently segregated genus *Allographa* and provide a key to all species of the genus with pigmented lirellae.

## Material and Methods

The material from Indonesia (Java) was studied at the Department of Biology in Universitas Padjadjaran, using an Olympus SZ61 dissecting microscope. Sections of thallus and lirellae were examined with an Olympus CX31 compound microscope. The material from Sri Lanka was studied at the Field Museum, Chicago, and at the Botanischer Garten und Botanisches Museum, Freie Universität Berlin, using Leica MS5, Motic K400, Olympus SZX12 and Leica Zoom 2000 dissecting microscopes. Sections of thallus and lirellae mounted in tap water were examined under Olympus BH-2, Vista-Vision VWR V036 and Zeiss Axioscop compound microscopes. Secondary chemistry was assessed using KOH spot tests and verified with standardized thin-layer chromatography (TLC) using solvent system C (Orange *et al.* 2010). Lugol's solution (Fluka 62650) was used for iodine reactions.

## Results and Discussion

### *Allographa kamojangensis* Jatnika, Noer & Lücking sp. nov.

MycoBank No.: MB 829357

Differing from *Allographa firferi* in the much larger ascospores and the orange, K+ immediately purple-violet pigment, and from *A. lutea* in the completely carbonized excipulum and the larger ascospores.

Type: Indonesia, West Java, Kamojang, 07°07'30''S, 107°48'00''E, on bark and twig of *Arthocarpus heterophyllus*, 5 November 2015, *M. Feisal Jatnika* L.BIOUNPAD.G.0023 (UNPAD—holotype!).

(Fig. 2A–C)

*Thallus* corticolous, epiperidermal, up to 6 cm diam., continuous, white-grey, uneven; prothallus not observed. *Thallus* in section 100–200 µm thick, with prosoplectenchymatous cortex, 20–30 µm thick, and photobiont layer, 50–70 µm thick, nubilous with numerous small crystals.

*Ascomata* lirellate, irregularly branched, prominent, 2–4 mm long, 0.3–0.4 mm wide, 0.1–0.2 mm high; disc concealed; labia mostly entire but becoming striate in older lirellae, apically exposed, black, laterally covered by a yellow-orange pruina. *Excipulum* completely and massively carbonized, laterally 50–100 µm wide, basally up to 250 µm high; periphysoids absent; hypothecium 20–30 µm high, hyaline to greyish. *Hymenium* 250–300 µm high, clear; paraphyses unbranched, apically smooth. *Asci* 200–



FIG. 1. Original post of the new species from Java in the Facebook group *Lichens Connecting People*. In colour online.

250 × 40–60 μm, oblong. *Ascospores* 8 per ascus, 13–15-septate, 100–140 × 20–25 μm, oblong, 4–6 times as long as wide, with thickened septa and lens-shaped to rectangular lumina, hyaline, I+ violet-blue.

**Secondary chemistry.** No substances detected by TLC in the thallus; lirellae covered with orange anthraquinone, K+ immediately purple-violet in microscopic section.

**Etymology.** The epithet refers to the type locality, a geothermic field and popular tourist location in West Java.

**Distribution and ecology.** The original vegetation cover of the type locality in the Kamojang geothermal area corresponds to broadleaf evergreen forest but most of the area has been deforested (Budi *et al.* 2009), and the material was collected on semi-exposed trees in a crop plantation. The

species is likely to be more common in the upper strata of forest remnants in the area.

**Remarks.** *Allographa kamojangensis* is generally very similar to the neotropical *A. chrysocarpa* and the neotropical-African palaeotropical *A. ochracea* (Staiger 2002; Lücking *et al.* 2008; Lücking & Kalb 2018), sharing the completely carbonized lirellae with orange, K+ immediately purple-violet pruina. It differs from both in the transversely septate ascospores. In *A. chrysocarpa* the ascospores are richly muriform and comparatively longer and narrower (120–190 × 17–23 μm, 6–8 times as long as wide), whereas in *A. ochracea* they are terminally muriform (appearing transversely septate when not carefully checked) and distinctly narrower (70–120 × 10–15 μm, 7–8 times as long as wide). The only other species with transversely septate ascospores in this group are the neotropical *A. firferi* and *A. lutea* (Lücking *et al.* 2008; Lücking & Kalb 2018); *A. firferi* differs in the yellow, K+ yellow then slowly purple-violet



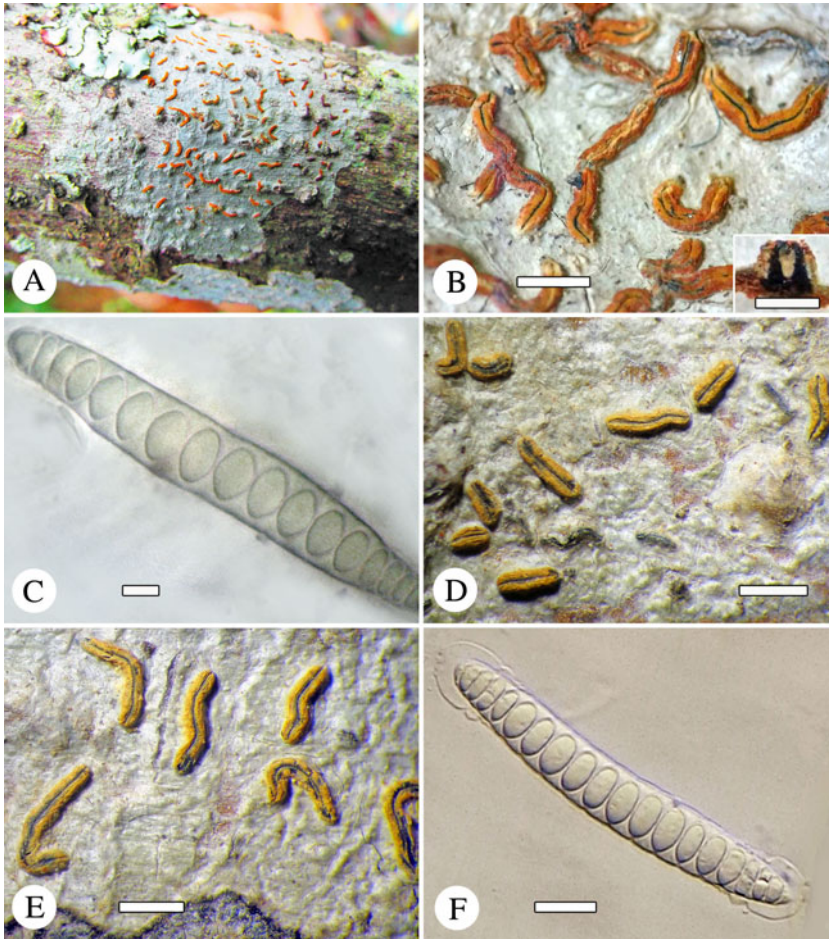


FIG. 2. A–C, *Allographa kamojangensis* (holotype); A, thallus *in situ*; B, lirellae, inset showing section through lirellae with completely carbonized excipulum; C, ascospore. D–F, *A. jayatilakana* (holotype); D & E, thallus with lirellae; F, ascospore. Scales: B, D & E = 1 mm; B inset = 0.5 mm; C & F = 10  $\mu$ m. In colour online.

pigment, whereas *A. lutea* has an apically carbonized excipulum only. Both also have distinctly smaller and narrower ascospores (70–100  $\times$  11–15  $\mu$ m, 6–7 times as long as wide).

***Allographa jayatilakana* Weerakoon, Arachchige & Lücking sp. nov.**

Mycobank No.: MB 829360

Differing from *Allographa flavominiata* in the much shorter ascospores, from *A. firferi* in the terminally muriform ascospores, and from *A. ochracea* in the yellow-orange, K+ yellow then slowly purple-violet pruina.

Type: Sri Lanka, Western Province, Colombo City, Hokandara, garden of Weerakoon residence, 06° 52'49"N, 79°58'00"E, 75 m, on bark of ornamental *Ficus benjamina*, 28 April 2015, G. Weerakoon GW 100 (PDA—holotype!; B, BM—isotypes!).

(Fig. 2D–F)

*Thallus* corticolous, epiperidermal, up to 10 cm diam., continuous, white-grey, uneven; prothallus not observed. *Thallus* in section 100–150  $\mu$ m thick, with prosoplectenchymatous cortex, 20–30  $\mu$ m thick, and photobiont layer, 50–70  $\mu$ m thick, nubilous with numerous small crystals.

*Ascomata* lirellate, unbranched to sparsely branched, prominent, 1–5 mm long, 0.3–0.4 mm broad, 0.3–0.4 mm high; disc concealed; labia mostly entire but becoming striate in older lirellae, apically exposed, black, laterally covered by a yellow to yellow-orange pruina. *Excipulum* completely and massively carbonized, laterally 50–100 µm wide, basally up to 250 µm high; periphysoids absent; hypothecium 20–30 µm high, hyaline to greyish. *Hymenium* 140–170 µm high, clear; paraphyses unbranched, apically smooth. *Asci* 140–160 × 20–30 µm, oblong. *Ascospores* 8 per ascus, terminally muriform, with 15–19 transverse septa and usually one or two of the (sub)terminal cells on each side with a longitudinal septum, 80–120 × 9–12 µm, oblong with rounded proximal and acute terminal end, 8–10 times as long as wide, with thickened septa and lens-shaped lumina and with gelatinous caps at both ends, rounded at the proximal end, fin-like at the distal end, hyaline, I+ violet-blue.

*Secondary chemistry.* No substances detected by TLC in the thallus; lirellae covered with unknown yellow anthraquinone, K+ yellow slowly turning violet, in microscopic section with vanishing K+ yellow efflux and pigment granules then turning purple-violet.

*Etymology.* This new species honours the memory of the late Jayatilaka Bandara Weerakoon, father of the second author and

owner of the property where the species was collected.

*Distribution and ecology.* The original vegetation of the type locality would have been tropical wet evergreen forest, but today most of the region has undergone land use change through urbanization and agriculture (Myers et al. 2000; Gunawardene et al. 2007). Before being further converted into a private property garden, the location was a monoculture plantation of *Cocos nucifera*. As with the preceding taxon, this species is likely to be more common in the upper strata of forest remnants in the area.

*Remarks.* The yellow anthraquinone, K+ yellow slowly turning purple-violet pruina is shared by the new species and *Allographa firferi*, *A. flavoaltamirensis* and *A. flavominiata*, all described from Costa Rica (Lücking et al. 2008). *Allographa flavoaltamirensis* differs in the interspersed hymenium and muriform ascospores, whereas *A. flavominiata* possesses terminally muriform ascospores but these are much larger (100–170 × 12–15 µm). *Allographa firferi* has ascospores of about the same size as the new species, but slightly broader, and they lack longitudinal septa. The neotropical-African palaeotropical *A. ochracea* (Lücking et al. 2008; Lücking & Kalb 2018) agrees with the new species in lirella anatomy and ascospore size and septation, but has a different, orange, K+ immediately purple-violet pigment.

**Key to the species of *Allographa* with pigmented lirellae**

- 1      Excipulum apically carbonized only; pigment orange, K+ immediately purple-violet; hymenium clear; ascospores transversely septate, 90–100 × 11–13 µm, 7–8 times as long as wide; Neotropics . . . . . **Allographa lutea** Chevall.  
       Excipulum completely carbonized; pigment, hymenium and ascospores . . . . . variable . . . . . 2
- 2(1)    Hymenium strongly interspersed; labia usually striate; pigment yellow, K+ yellow slowly turning purple-violet; ascospores regularly muriform, 80–100 × 10–17 µm, 6–8 times as long as wide; Neotropics.....  
       . . . . . **Allographa flavoaltamirensis** (Sipman & Lücking) Lücking & Kalb  
       Hymenium clear; labia, pigment and ascospores variable . . . . . 3

- 3(2) Ascospores regularly muriform, 120–190 × 17–23 µm, 6–8 times as long as wide; pigment orange, K+ immediately purple-violet; Neotropics . . . . .  
 . . . . . **Allographa chrysocarpa** (Raddi) Lücking & Kalb  
 Ascospores transversely septate or terminally muriform only, their size variable; pigment variable . . . . . 4
- 4(3) Ascospores transversely septate (check carefully) . . . . . 5  
 Ascospores terminally muriform (check carefully) . . . . . 6
- 5(4) Ascospores 100–140 × 20–25 µm, 4–6 times as long as wide; pigment orange, K+ immediately purple-violet; eastern Palaeotropics . . . . .  
 . . . . . **Allographa kamojangensis** Jatnika *et al.*  
 Ascospores 70–100 × 11–15 µm, 6–7 times as long as wide; pigment yellow, K+ yellow slowly turning purple-violet; Neotropics . . . . .  
 . . . . . **Allographa firferi** (Lücking) Lücking & Kalb
- 6(4) Lirellae soon striate, with complete thalline cover that may rupture to expose the pigmented pruina; pigment orange, K+ immediately purple-violet; ascospores 80–100 × 10–15 µm, 6–8 times as long as wide; Neotropics . . . . .  
 . . . . . **Allographa miniata** (Redinger) Lücking & Kalb  
 Lirellae usually remaining entire, with the pigmented pruina exposed; pigment and ascospores variable . . . . . 7
- 7(6) Ascospores 100–170 × 12–15 µm, 8–12 times as long as wide; pigment yellow, K+ yellow slowly turning purple-violet; Neotropics . . . . .  
 . . . . . **Allographa flavominiata** (Moncada & Lücking) Lücking & Kalb  
 Ascospores 70–120 × 9–15 µm, 7–8 times as long as wide; pigment variable . . . 8
- 8(7) Pigment yellow, K+ yellow slowly turning purple-violet; eastern Palaeotropics . . .  
 . . . . . **Allographa jayatilakana** Weerakoon *et al.*  
 Pigment orange, K+ immediately purple-violet; Neotropics and African Palaeotropics. . . . . **Allographa ochracea** (C. W. Dodge) Lücking & Kalb  
 [= *Graphis subchrysocarpa* Lücking]

## AUTHOR ORCIDS

Gothamie Weerakoon: 0000-0001-8290-2910. Robert Lücking: 0000-0002-3431-4636.

Data obtained for this study were gathered as part of several projects funded by the National Science Foundation: “TICOLICHEN” (DEB-0206125 to The Field Museum; PI Robert Lücking); “Neotropical Epiphytic Microlichens – An Innovative Inventory of a Highly Diverse yet Little Known Group of Symbiotic Organisms” (DEB-715660 to The Field Museum; PI R. Lücking) and “ATM – Assembling a Taxonomic Monograph: The Lichen Family *Graphidaceae*” (DEB-1025861 to The Field Museum; PI T. Lumbsch, CoPI R. Lücking). GW is grateful for research funding from Dilmah Conservation and the National Geographic Society (CS-R001-17) and the opportunity to use the research facilities at the Field

Museum, Chicago. She also extends her gratitude to Prof. Siril Wijesundara and Pat Wolseley. MFJ thanks Ruchyat Partasasmita, chief of the Department of Biology, as well as Joko Kusmoro and Ririn Eka Permatasari. Two anonymous reviewers are thanked for comments that helped to improve the manuscript.

## REFERENCES

- Budi, P. L., Harijadi, K., Suryo, A., Beni, O. & Yudi, S. (2009) Spatial model approach on deforestation of Java Island, Indonesia. *Journal of Integrated Field Science* **6**: 37–44.
- Frisch, A., Kalb, K. & Grube, M. (2006) Contributions towards a new systematics of the lichen family *Thelotrema* *tremataceae*. *Bibliotheca Lichenologica* **92**: 1–556.

- Gunawardene, N. R., Daniels, D. A., Gunatilleke, I. A. U. N., Gunatilleke, C. V. S., Karunakaran, P. V., Nayak, G. K., Prasad, S., Puyravaud, P., Ramesh, B. R., Subramanian, K. A., et al. (2007) A brief overview of the Western Ghats – Sri Lanka biodiversity hotspot. *Current Science* **93**: 1567–1572.
- Lücking, R. (2009) The taxonomy of the genus *Graphis sensu* Staiger (Ascomycota: *Ostropales*: *Graphidaceae*). *Lichenologist* **41**: 319–362.
- Lücking, R. & Kalb, K. (2018) Formal reinstatement of *Allographa* (*Graphidaceae*): how to deal with a hyperdiverse genus complex with cryptic differentiation and paucity of molecular data. *Herzogia* **31**: 535–561.
- Lücking, R., Chaves, J. L., Sipman, H. J. M., Umaña, L. & Aptroot, A. (2008) A first assessment of the Tico-lichen Biodiversity Inventory in Costa Rica: the genus *Graphis*, with notes on the genus *Hemithecium* (Ascomycota: *Ostropales*: *Graphidaceae*). *Fieldiana (Botany), New Series* **46**: 1–126.
- Lücking, R., Archer, A.W. & Aptroot, A. (2009) A world-wide key to the genus *Graphis* (*Ostropales*: *Graphidaceae*). *Lichenologist* **41**: 363–452.
- Lücking, R., Johnston, M. K., Aptroot, A., Kraichak, E., Lendemer, J. C., Boonpragob, K., Cáceres, M. E. S., Ertz, D., Ferraro, L. I., Jia, Z.-F., et al. (2014) One hundred and seventy five new species of *Graphidaceae*: closing the gap or a drop in the bucket? *Phytotaxa* **189**: 7–38.
- Lücking, R., Hodkinson, B. P. & Leavitt, S. D. (2017) ('2016') The 2016 classification of lichenized fungi in the Ascomycota and Basidiomycota – approaching one thousand genera. *Bryologist* **119**: 361–416.
- Lumbsch, H. T., Kraichak, E., Parmen, S., Rivas Plata, E., Aptroot, A., Cáceres, M. E. S., Ertz, S., Feuerstein, S. C., Mercado-Díaz, J. A., Staiger, B., et al. (2014) New higher taxa in the lichen family *Graphidaceae* (lichenized Ascomycota: *Ostropales*) based on a three-gene skeleton phylogeny. *Phytotaxa* **189**: 39–51.
- Myers, N., Mittermeier, R. A., da Fonseca, G. A. B. & Kent, J. (2000) Biodiversity hotspots for conservation priorities. *Nature* **403**: 853–857.
- Orange, A., James, P. W. & White, F. J. (2010) *Microchemical Methods for the Identification of Lichens*. 2nd edition. London: British Lichen Society.
- Rivas Plata, E., Hernández, J. E., Lücking, R., Staiger, B., Kalb, K. & Cáceres, M. E. S. (2011) *Graphis* is two genera: a remarkable case of parallel evolution in lichenized Ascomycota. *Taxon* **60**: 99–107.
- Rivas Plata, E., Lumbsch, H. T. & Lücking, R. (2012) A new classification for the lichen family *Graphidaceae* s. lat. (Ascomycota: Lecanoromycetes: *Ostropales*). *Fungal Diversity* **52**: 107–121.
- Staiger, B. (2002) Die Flechtenfamilie *Graphidaceae*. Studien in Richtung einer natürlicheren Gliederung. *Bibliotheca Lichenologica* **85**: 1–526.