

## Two new species in the lichen family *Graphidaceae* from India

Bharati O. SHARMA and Pradnya KHADILKAR

**Abstract:** *Graphis parvicarpa* and *Pallidogramme bengalense* are described as new to science from India. *Graphis parvicarpa* is characterized by a striate excipulum, inspersed hymenium, muriform ascospores, and norstictic acid in the thallus. *Pallidogramme bengalense* is characterized by a striate exciple, muriform, hyaline to pale brown ascospores, inspersed hymenium and no lichen substances in the thallus.

**Key Words:** Ascomycota, *Graphis*, lichenized fungi, *Ostropales*, *Pallidogramme*, taxonomy

### Introduction

The lichen genus *Graphis sensu* Staiger (2002) is one of the largest genera in the lichen family *Graphidaceae*, comprising over 300 taxa, and so far 54 species have been recorded throughout the world with an inspersed hymenium (Lücking *et al.* 2009). *Graphis insulana* (Müll. Arg.) Lücking & Sipman is the only species from India known to have an inspersed hymenium (Chitale *et al.* 2011).

The lichen genus *Pallidogramme* Staiger, Kalb & Lücking, a genus that was recently introduced to accommodate species previously placed in *Hemithecium* subgenus *Leucogramma* Staiger (Lücking *et al.* 2008), includes seven species worldwide (Lücking *et al.* 2008; Archer 2009; Chitale *et al.* 2009), three of which have been recorded from India (Chitale *et al.* 2009). The genus is characterized by well-developed labia, a convergent, non-carbonized exciple that is mostly crenate and with internal striae, the disc not being visible, an inspersed hymenium, and pale brown to brown, I+ reddish brown ascospores.

During the course of our revisionary studies on the lichen family *Graphidaceae*, we

have come across two interesting new species which belong to the lichen genera *Graphis* and *Pallidogramme*, and these are described here as *Graphis parvicarpa* and *Pallidogramme bengalense*, respectively.

### Materials and Methods

Herbarium specimens collected from the South Western Ghats, Eastern Himalaya, Western Himalaya and the Andaman and Nicobar Islands of India by various lichenologists from Agharkar Research Institute and deposited in Ajrekar Mycological Herbarium (AMH) were analyzed. Hand-cut sections of thalli and ascomata were mounted in water and lactophenol cotton blue for examination. Thin-layer chromatography was carried out using standardized methods (Culberson & Kristinsson 1970; Culberson 1972; White & James 1985) with the solvent systems A (toluene-dioxane-acetic acid: 180:45:5) and G (toluene-ethyl acetate-formic acid: 139:83:8). The specimens were also examined under UV light (365 nm). Specimens of *Graphis* were identified using the world key of *Graphis* (Lücking *et al.* 2009) and by comparison with types and protologues. The specimens have been deposited in the Ajrekar Mycological Herbarium (AMH).

### The Species

#### *Graphis parvicarpa* sp. nov.

Mycobank No: MB 561698

(Fig. 1 A, C, E)

B. O. Sharma and P. Khadilkar: Agharkar Research Institute, G.G. Agarkar Road, Pune—411004, India. Email: bharatiomsharma@gmail.com

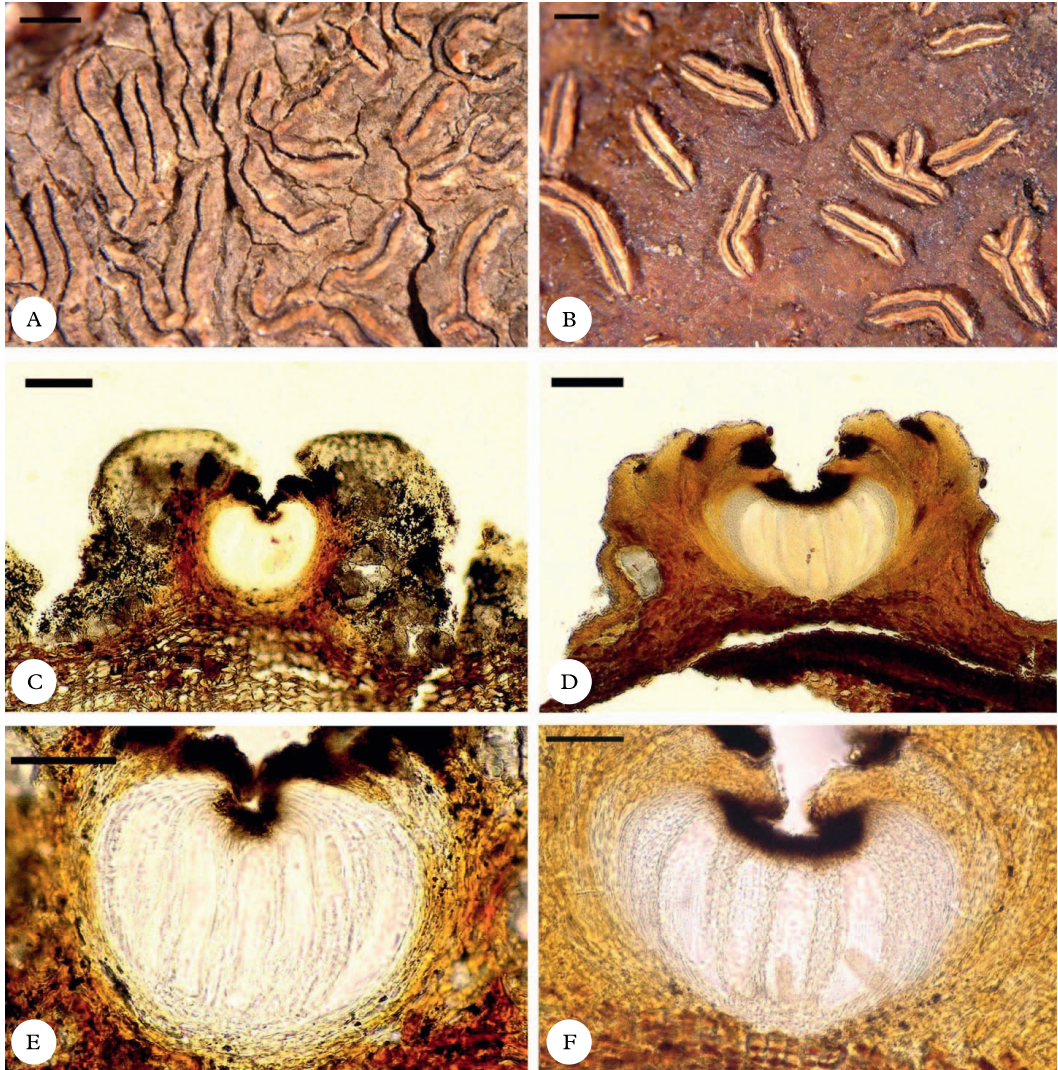


FIG. 1. *Graphis parvicarpa* (holotype, AMH). A, habitus; C, vertical section of ascocarp; E, vertical section of ascocarp showing inspersion. *Pallidogramme bengalense* (holotype, AMH). B, habitus; D, vertical section of ascocarp; F, vertical section of ascocarp showing inspersion. Scales: A & B = 1 mm, C & D = 100  $\mu$ m, E & F = 50  $\mu$ m.

Similis *Graphis tenorensis*, sed hymenio insperso et acidum norsticticum continens differt.

Typus: India, Karnataka, Chikkaballapur district, Nandi hills, 1 December 1999, U. V. Mahija, 99.360 (AMH—holotypus).

*Thallus* crustose, corticate, epiphloeodal, yellowish grey, highly cracked, glossy, uneven, delimited by a very thin, black hypothallus.

*Ascomata* lirelline, 1–3 mm long, 0.2–0.3 mm wide, simple to sparsely branched, concolorous with the thallus, prominent, terminally obtuse. *Disc* narrow, epruinose. *Proper exciple* 1–4-striate, apically carbonized, converging apically, with thick lateral thalline margin, bulging apically, studded with crystals. *Hymenium* hyaline, inspersed with small oil droplets that partially persists

in KOH, I–. *Paraphyses* simple, brownish at apices. *Asci* 1–2-spored. *Ascospores* hyaline, muriform,  $62\text{--}122 \times 17\text{--}32 \mu\text{m}$ , I+ violet.

**Chemistry.** Norstictic acid present in the thallus.

**Remarks.** The new species *Graphis parvicarpa* is characterized by short, prominent lirellae, an apically carbonized, striate exciple, interspersed hymenium, 1–2-spored asci, muriform ascospores, and by the presence of norstictic acid.

*Graphis tenoriensis* Lücking & Chavas differs from *G. parvicarpa* in having no lichen acids in the thallus and a clear hymenium. *Graphis nigroglauca* Leight., a species with similar morphology, has trans-septate ascospores.

*Graphis semirigida* (Müll. Arg.) Lücking, with more or less similar characters in having a striate exciple, large, muriform ascospores and norstictic acid, however, has a clear hymenium. *Graphis bipartita* (Müll. Arg.) Lücking also shares similar morphological characters, but has prominent, elongate, irregularly branched lirellae and a clear hymenium.

*Graphis insulana* (Müll. Arg.) Lücking, with large, muriform ascospores, interspersed hymenium, and no lichen substances, differs from *G. parvicarpa* in having laterally carbonized entire labia.

Lücking *et al.* (2009), in his world key to *Graphis*, has enumerated 20 groups for the identification of a large number of species of *Graphis*, based on characters such as exciple, hymenium and ascospore septation. So far no species has been recorded having the combination of striate labia with apical or lateral combination, interspersed hymenium and muriform ascospores, and apparently it seems that *Graphis parvicarpa* is the first known in the genus so far.

Although the degree of carbonization of the exciple is weak or irregular, it is always present at least in the apical part, thus avoiding confusion with species of *Hemithecium* which have a dark brown coloration in the apical region of the exciple. *Hemithecium oryzaeformis* (Fée) Staiger shares some mor-

phological characters, especially the hyaline, muriform, large ascospores and presence of norstictic acid in the thallus; however, apart from the non-carbonized exciple, it has slightly short, oryzaeform lirellae  $1\text{--}1.5 \mu\text{m}$  long, 1-spored asci and a clear hymenium.

The new species has been collected from the semi-evergreen forest area in the Western Ghats of India.

**Additional specimens examined.** **India:** Karnataka: Chikkaballapur district, Nandi hills, 1999, U. V. Makhija, 99.368 (AMH).

### ***Pallidogramme bengalense* sp. nov.**

MycoBank No: MB 561699

(Fig. 1 B, D, F)

Similar *Pallidogramme commutabilis* sed ascosporis minoribus differt.

Typus: India, West Bengal, Darjeeling district, Kurseong, c. 4864 ft., 14 November 1977, P. G. Patwardhan & M. B. Nagarkar, 77.1717 (AMH—holotypus).

**Thallus** crustose, corticate, epiphloeodal, blackish brown, glossy, cracked, smooth, surrounded by a thin, black hypothallus.

**Ascomata** lirelline, short to long,  $0.5\text{--}7 \text{ mm}$  long,  $0.2\text{--}0.3 \text{ mm}$  wide, creamish, simple to branched, striate, semi-emergent, terminally acute. **Disc** narrow, epruinose. **Exciple** striate, apically dark brown, convergent, covered with lateral thalline margin. **Hymenium** hyaline, interspersed with oil globules that partially dissolve in KOH. **Paraphyses** simple. **Asci** 8-spored. **Ascospores** initially hyaline but later turning pale brown, muriform,  $50\text{--}80 \times 12\text{--}20 \mu\text{m}$ , I+ blue.

**Chemistry.** No lichen substances present.

**Remarks.** *Pallidogramme bengalense* is a distinct taxon characterized by its striate exciple, muriform, hyaline to pale brown ascospores, interspersed hymenium, and no lichen substances.

The only other species lacking substances known in the genus, *Pallidogramme commutabilis* (Kremph.) Chitale & Makhija, differs from *P. bengalense* in having its ascomata

more or less aggregated in diffuse patches on the thallus, an entire exciple, and large, broad ascospores,  $66\text{--}126 \times 21\text{--}30 \mu\text{m}$ . *Pallidogramme bengalense* is distinguished from other species of *Pallidogramme* by the absence of lichen acids: *P. chapadana* (Redinger) Staiger, Kalb & Lücking, *P. chlorocarpoides* (Nyl.) Staiger, Kalb & Lücking, *P. chrysenderon* (Mont.) Staiger, Kalb & Lücking, *P. indica* Dube & Makhija, and *P. montiscalvi* (A. W. Archer) A. W. Archer, all have stictic acid and satellite substances.

*Pallidogramme bengalense* was collected in subtropical forest regions of Darjeeling.

*Additional specimens examined.* **India:** West Bengal: Darjeeling district, Kurseong, c. 4864 ft., 1977, P. G. Patwardhan, & M. B. Nagarkar, 77.1698, 77.1699, 77.1703, 77.1715 (AMH).

We are grateful to the Department of Science and Technology, Government of India, New Delhi, for their financial support.

#### REFERENCES

- Archer, A.W. (2009). *Graphidaceae*. In *Flora of Australia, Volume 57: Lichens 5* (P. M. McCarthy, ed.): 84–194. Melbourne: ABR/CSIRO.
- Chitale, G., Makhija, U. & Sharma, B. O. (2009) New combinations and new species in the lichen genera *Hemitecium* and *Pallidogramme*. *Mycotaxon* **108**: 83–92.
- Chitale, G., Makhija, U. & Sharma, B. O. (2011). Additional species of *Graphis* from Maharashtra, India. *Mycotaxon* (in press).
- Culberson, C. F. (1972) Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. *Journal of Chromatography* **72**: 113–125.
- Culberson, C. F. & Kristinsson, H. (1970) A standardized method for the identification of lichen products. *Journal of Chromatography* **46**: 85–93.
- Lücking, R., Chaves, J. L., Sipman, H. J. M., Umaña, L. & Aptroot, A. (2008) A first assessment of the Ticolichen biodiversity inventory in Costa Rica: the genus *Graphis*, with notes on the genus *Hemitecium* (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.
- Staiger, B. (2002) Die Flechtenfamilie *Graphidaceae*: Studien in Richtung einer natürlicheren Gliederung. *Bibliotheca Lichenologica* **85**: 1–526.
- White, F. J. & James, P. W. (1985) A new guide to microchemical techniques for the identification of lichen substances. *British Lichen Society Bulletin* **57** (Suppl.): 1–41.

*Accepted for publication 13 May 2011*