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Taxonomical studies on the lichen genus *Platygramme* (*Graphidaceae*) in China

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Abstract: In the present paper, seven species of the lichen genus *Platygramme* are reported from China. Two of these, *Platygramme pudica* and *P. platyloma*, are new to China and two species, *Platygramme hainanensis* and *P. lueckingii*, both from a tropical rain forest in Hainan Island, are described as new to science. The new species belong to a group within *Platygramme*, which is characterized by concealed discs, while the type species, P. *caesiopruinosa*, and some others have widely open discs. Descriptions and the known distribution of each species are given and a working key to the Chinese species is provided.

Key words: lichenized fungi, lirellae, *Ostropales*, taxonomy

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Introduction

The family *Graphidaceae*, with 1200 species (now also including *Thelotremataceae*), is one of the largest groups of crustose lichens and has a wide distribution in tropical regions. The family belongs to *Ostropales*, which is the largest order within *Ostropomycetidae* (Lumbsch & Huhndorf 2007; Kirk *et al*. 2008; Mangold *et al*. 2008). Staiger (2002) revised the spore-based generic system established by Müller Argoviensis (1880*a*, *b*, 1882) for the family *Graphidaceae*, and reintroduced several genera with a revised concept, including the genus *Platygramme* Fée. *Platygramme* is a tropical and subtropical taxon, which is characterized by lirelliform ascomata, an apically or laterally carbonized proper exciple often wedge-like in appearance, an inspersed hymenium and greyish to pale brown transversely septate or muriform ascospores.

In a study of the genus *Platygramme* for the *Flora Lichenum Sinicorum*, Miao *et al*. (2007) reported two species from China, namely *P. discurrens* (Nyl.) Staiger, which was also reported as *Graphis discurrens* from Hong Kong (Nylander 1863), and *P. pachyspora* (Redinger) Staiger, described as a new record for China. Subsequently, *Platygramme muelleri* was added by Li (2010). In the present paper, *Platygramme pudica* and *P. platyloma* are reported from China for the first time, and the two species *Platygramme hainanensis* and *P. lueckingii* are described as new to science.

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Materials and Methods

The lichen specimens were examined with a dissecting microscope (TECH XTS-20 and AIGO Digital Viewer GE-5) and a compound microscope (OLYMPUS CHB-213) for morphological and anatomical studies. Hand-cut sections mounted in tap water were routinely examined. Amyloidity of the ascospores was tested using Lugol's solution. Spot tests with KOH (20%) were performed on the thallus surface and on thin thallus sections. The chemistry was determined by thin-layer chromatography (TLC) using standard methods.

Key to the species of *Platygramme* from China

1 Ascospores with transverse septa, 5–25(–30) × 5–8 μm . . . . . **Platygramme discurrens (Nyl.) Staiger**
Ascospores submuriform or muriform 2

2(1) Ascospores 1 per ascus, longer than 100 μm when mature 3
Ascospores 2–8 per ascus, shorter than 100 μm when mature 5

3(2) Echinocarpic acid present, ascospores 150–180 × 18–25 μm; disc concealed, labia covered by thallus . . . . . **Platygramme pudica (Mont. & Bosch.) M. Nakan. & Kashiw.**
Lichen compounds absent 4

4(3) Lirellae conspicuously open, disc visible; ascospores 110–160 × 18–25 μm . . . . . **Platygramme muelleri (A. W. Archer) Staiger**
Lirellae closed to slightly open, disc concealed, with thick labia; ascospores 120–180 × 25–35 μm . . . . . **Platygramme platyloma (Müll. Arg.) M. Nakan. & Kashiw.**

5(2) Ascospores submuriform, 45–80 × 12–18 μm; disc very narrow . . . . . **Platygramme pachyspora (Redinger) Staiger**
Ascospores muriform, shorter than 50 μm; disc concealed, labia covered by thallus . . 6

6(5) Ascospores 8 per ascus, 30–50 × 6·5–13·0 μm . . . . . **Platygramme hainanensis Z.F. Jia & Kalb**
Ascospores 2(4) per ascus, 35–45 × 11·0–15·5 μm . . . . . **Platygramme lueckingii Z.F. Jia & Kalb**

The Species

Platygramme hainanensis Z.F. Jia & Kalb sp. nov.

MycoBank No: MB801119

Sicut *P. australiensis* sed sporis minoribus differt.

Typus: China, Hainan Island, Mt. Wuzhishan, 18°92′N, 109°68′E, alt. 680 m, 28 August 2008, coll. *Jing Li* HN081281 (HMAS-L—holotypus).

(Fig. 1A–D)

Thallus corticolous, crustose, pale white to greenish, unevenly thickened, tightly attached to the substratum.

Apothecia elongate, 1–10 mm long, 0·2–0·4 mm wide, simple or rarely slightly branched, prominent, with basal thalline margin, black, curved and straight, often rounded at the ends, not striate, scattered over the thallus, labia covered with thin white pruina; *disc* concealed. *Proper exciple* apically to laterally carbonized. *Epithecium* 8–10 μm thick, brownish. *Hymenium* colourless, inspersed, 130–180 μm high, I–. *Paraphyses* unbranched, filiform, up to 1·0–1·5 μm wide. *Asci* cylindrical, 110–150 × 15–25 μm, 8-spored. *Ascospores* greyish brown, oblong to ellipsoid, muriform, 8–9 × 1–3-locular, 30–50 × 6·5–13·0 μm, I+ red-brown. *Hypothecium* brownish, 8–15 μm high.

Chemistry. No lichen compounds detected.

Etymology. The specific epithet '*hainanensis*' refers to the type locality of the new species, Hainan Island.

Remarks. *Platygramme hainanensis* is characterized by the conspicuous, closed, prominent, apically-carbonized lirellae with closed disc and thick labia, the muriform ascospores (30–50 μm long), and by the absence of lichen compounds. It is distinguished from *P. australiensis* Staiger & Malthes-Leicht by smaller ascospores.

Additional specimens examined. **China**: *Hainan*: Mt. Wuzhishan, 790 m, 2009, *Li Jing* HN216 (HMAS-L); 730 m, 2009, *Li Jing* HN233 & HN 233-1 (HMAS-L).

FIG. 1. *Platygramme hainanensis* (*Jing Li* HN081281). A, habit; B, cross-section of an apothecium; C, ascus containing ascospores; D, ascospore. Scales: A = 1 mm; B = 50 μm; C = 50 μm; D = 50 μm. In colour online.

Platygramme lueckingii Z.F. Jia & Kalb sp. nov.

MycoBank No: MB801120

Sicut *P. hainanensis* sed ascis 2-sporis differt.

Typus: China, Hainan Island, Mt. Jianfengling, 18°71′N, 108°83′E, alt. 740 m, 1 October, 2008, *Li Jing* HN081395 (HMAS-L—holotypus).

(Fig. 2A–C)

Thallus corticolous, crustose, yellowish green to greenish, thin, tightly attached to the substratum.

Apothecia elongate, lirelliform, 1–5 mm long, 0·3–0·4 mm wide, simple, often branched, erumpent to prominent, with basal thalline margin, black, curved and straight, often rounded at the ends, not striate, scattered over the thallus, labia covered with white pruina; *disc* concealed. *Proper exciple* apically wedge-shaped, carbonized. *Epithecium* 8–10 μm thick, brownish. *Hymenium* colourless, inspersed, 110–160 μm high, I−. *Paraphyses* unbranched, filiform, up to 1·0–1·5 μm wide. *Asci* cylindrical, 90–110 × 13–25 μm, 2-spored. *Ascospores* greyish, oblong to ellipsoid, muriform, 8–9 × 1–3-locular, 35–45 × 11·0–15·5 μm, I+ weakly blue. *Hypothecium* brownish, 8–15 μm high.

Chemistry. No lichen compounds detected.

Etymology. The new species is named in honour of our colleague and friend Dr Robert Lücking for his many contributions to the knowledge of *Graphidaceae*.

Remarks. *Platygramme lueckingii* is characterized by the conspicuous, closed, erumpent to prominent, apically carbonized lirellae with closed disc and thick labia, the muriform ascospores (35–45 μm long), and the absence of lichen products. It is distinguished from *P. hainanensis* by the 2-spored asci. At present the new species is known only from Mt. Jianfengling, Hainan Island, which is situated in the tropical parts of China.

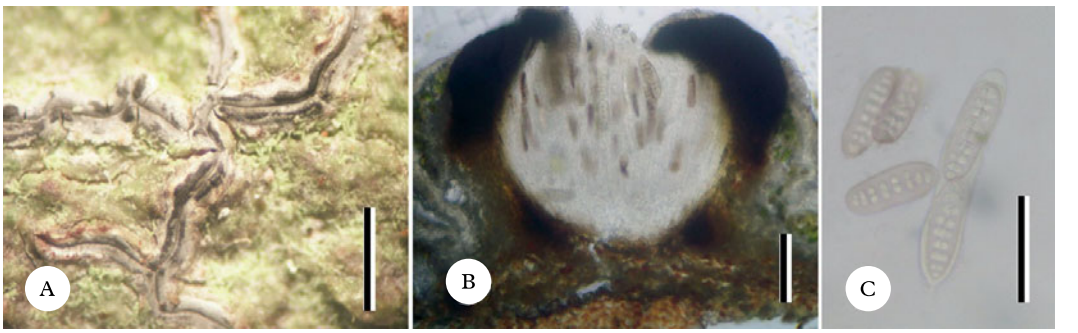

FIG. 2. *Platygramme lueckingii* (*Li Jing* HN081395). A, habit; B, cross-section of an apothecium; C, ascospores. Scales: A = 1 mm; B = 50 μm; C = 50 μm. In colour online.

Platygramme discurrens (Nyl.) Staiger

Biblioth. Lichenol. **85**: 361 (2002).—*Graphis discurrens* Nyl., *Ann. Sci. Nat., Bot. sér. 4*, **19**: 358 (1863*b*).—*Phaeographina discurrens* (Nyl.) Müll. Arg., *Flora*, **65**: 604 (1882).

(Fig. 3A & B)

Thallus corticolous, yellow-green, thin, surface shiny, flat to somewhat rough.

Apothecia lirelliform, greyish black, often branched, conspicuous, prominent, 1–6 mm long and 0·1–0·3 mm wide, lips closed, with thin white pruina, without thalline margin. *Disc* concave, very narrow. *Proper exciple* convergent, apically carbonized. *Hymenium* inspersed, 70–100 μm high. *Ascospores* 8 per ascus, pale brown, elongate, with transverse septa only, 4–7-locular, 15–25(–30) × 5–8 μm, I+ red-brown.

Chemistry. Stictic acid (major) and constictic acid (trace).

Remarks. *Platygramme discurrens* is characterized by the closed, conspicuously prominent, apically carbonized lirellae with closed disc and thick labia, the small ascospores (15–25 μm long) with transverse septa, and the presence of stictic acid. The type specimen of this species was collected in Hong Kong and originally described in the genus *Graphis* (Nylander 1863), but later transferred to the genus *Platygramme* by Staiger (Staiger 2002).

Specimens examined. **China**: *Hainan*: Mt. Wuzhishan, 680–800 m, 2009, *Li Jing* HN220-1, HN226-1 (HMAS-L). *Yunnan*: Menglun County, 560 m, 1981, *Jiang Yu-Mei* 1015-3 (HMAS-L); 650 m, 1981, *Jiang Yu-Mei* 949 (HMAS-L). *Fujian*: Mt. Wuyi, Wanmulin, 250 m, 2004, *Jia Ze-Feng* FJ360 & *Wei Xin-Li* 0189 (LHS).

Platygramme muelleri (A. W. Archer) Staiger

Biblioth. Lichenenol. **85**: 364 (2002).—*Phaeographina muelleri* Archer, *Telopea* **8**(4): 473 (2000).—*Phaeographina caesiopruinosa* var. *monospora* Müller Arg., *Bull. Herb. Boissier* **3**(7): 322 (1895*c*).

(Fig. 3C & D)

Thallus corticolous, greenish yellow, thin, surface matt, somewhat rough.

Apothecia lirelliform, black, single and sometimes branched, conspicuous, sessile, 1·0–2·5 mm long, 0·3–0·6 mm wide, lips inconspicuous, with a distinct thalline margin. *Disc* open, black, with a thin pruina. *Proper exciple* apically carbonized, wedge-shaped. *Hymenium* inspersed, 150–200 μm high. *Ascospores* 1 per ascus, pale brown, elongate, densely muriform, 28–40 × 4–7-locular, 110–160 × 18–25 μm, I+ red-brown.

Chemistry. No lichen compounds detected.

Remarks. *Platygramme muelleri* is characterized by the conspicuous, open, apically carbonized lirellae with opened disc and delicate labia, the large muriform ascospores (110–160 μm long), and the absence of

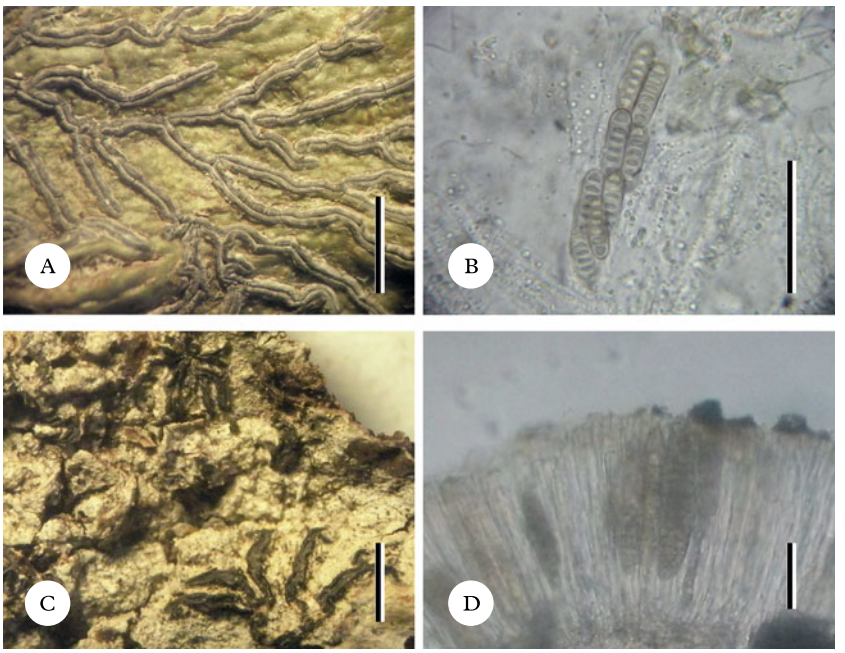

FIG. 3. *Platygramme discurrens* (*Jing Li* HN081281). A, habit; B, cross-section of an apothecium. *P. muelleri* (*Jing Li* HN081281). C, habit; D, cross-section of an apothecium. Scales: A & C = 1 mm; B = 50 μm; D = 50 μm. In colour online.

lichen compounds. It was reported from China by Li (2010).

Specimens examined. **China**: *Yunnan*: Weixi County, 1900 m, 1981, *Wang Xian-Ye et al.* 3749 (HMAS-L). *Hainan*: Mt. Wuzhishan, 700 m, 2009, *Li Jing* HN09096 (HMAS-L); Mt. Jianfengling, 2008, *Li Jing* HN081330 & HN081400 (HMAS-L).

Platygramme pachyspora (Redinger) Staiger

Biblioth. Lichenol., **85**: 364 (2002).—*Phaeographis pachyspora* Redinger, *Ark. Bot.* **27** A (3): 77 (1935).

(Fig. 4 A–C)

Thallus corticolous, grey-greenish, thin, surface matt, smooth to rough.

Apothecia lirelliform, greyish black, single, conspicuous, erumpent to sessile, 1–7 mm long, 0·2–0·4 mm wide, with thalline margin. *Disc* very narrow. *Proper exciple* convergent, laterally carbonized, wedge-shaped. *Hymenium* inspersed, 150–170 μm high. *Ascospores* 8 per ascus, pale brown, elongate, submuriform, 10–12 × 1–2-locular, (45–)50–80 × 12–18 μm, I+ red-brown.

Chemistry. No lichen compounds detected.

Remarks. *Platygramme pachyspora* is characterized by the wedge-shaped, carbonized lateral exciple with closed disc and thick labia, the submuriform ascospores (45–80 μm long), and the absence of lichen compounds. It was first reported from China by Miao (Miao *et al*. 2007).

Specimen examined. **China**: *Fujian*: Mt. Wuyi, 250 m, 2004, *Jia Ze-Feng* FJ 370 (LHS).

Platygramme platyloma (Müll. Arg.) M. Nakan. & Kashiw.

Bull. Natn. Sci. Mus., Tokyo, Ser. B, **29**: 89 (2003).—*Phaeographis platyloma* Müll. Arg., *Flora*, **65**: 389 (1882).

(Fig. 4D–F)

Thallus corticolous, yellow-greenish, thin, surface matt, rough.

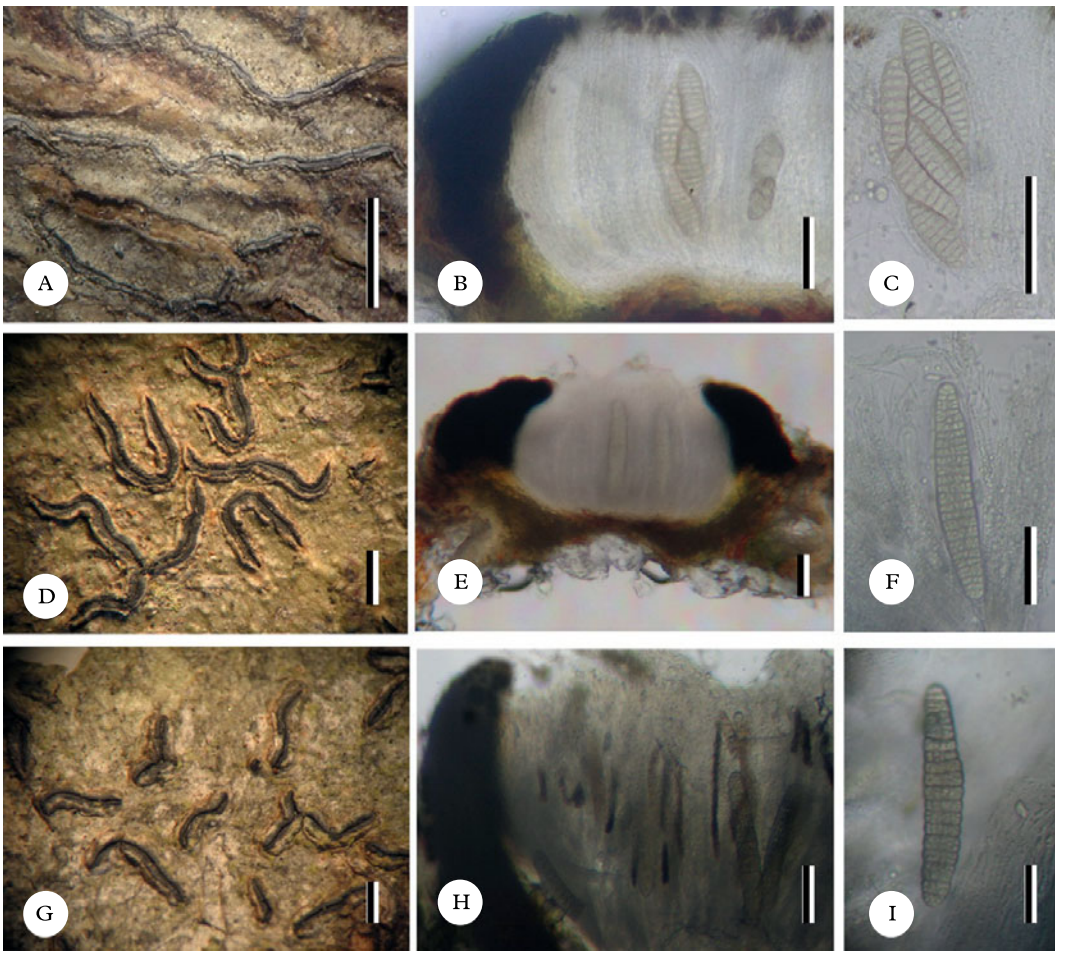

FIG. 4. *Platygramme pachyspora*; A, habit; B, cross-section of an apothecium; C, ascospores. *P. platyloma*; D, habit; E, cross-section of an apothecium; F, ascospore. *P. pudica*; G, habit; H, cross-section of an apothecium; I, ascospore. Scales: A, D & G = 1 mm; B, E & H = 50 μm; C, F & I = 50 μm. In colour online.

Apothecia lirelliform, conspicuous, scattered, prominent, black, single, 1·0–5·0 mm long and 0·4–0·6 mm wide, with lateral thalline margin. *Proper exciple* convergent, apically to laterally carbonized, wedge-shaped. *Disc* very narrow. *Hymenium* inspersed, 180–230 μm tall. *Ascospores* 1 per ascus, brownish, elongate-ellipsoid, densely muriform, 120–180 × 25–35 μm, I+ red-brown.

Chemistry. No lichen compounds detected.

Remarks. *Platygramme platyloma* is characterized by conspicuous lirellae with the proper exciple laterally wedge-shaped and carbonized, a narrow disc and thick labia, large muriform ascospores (120–180 × 25–35 μm), and the absence of lichen substances. It occurs in Australia, Indonesia and Japan (Nakanishi *et al.* 2003; Archer 2006). It is first reported from China in the present paper.

Specimens examined. **China**: *Fujian*: Jianou County, Wanmulin, 420–430 m, 2007, *Meng Qing-Feng* FJ1020 & FJ1221 (LHS).

Platygramme pudica (Mont. & Bosch) M. Nakan. & Kashiw.

Bull. Natn. Sci. Mus., Tokyo, Ser. B, **29**: 89 (2003).—*Graphis pudica* Mont. & Bosch, in Junghuhn, *Plantae Junghuhnianae*, **4**: 474 (1855).

(Fig. 4G–I)

Thallus crustose, corticolous, upper surface matt, rough.

Apothecia lirelliform, numerous, single, curved or sinuous, 1·0–5·0 mm long, 0·5–0·8 mm wide, prominent, black, with lateral thalline margin. *Proper exciple* convergent, laterally carbonized, red-brown in the base. *Hymenium* inspersed, 180–250 µm tall. *Ascospores* 1 per ascus, pale brownish, elongate or ellipsoid, muriform, 20–25 × 5–6-locular, 150–180 × 18–25 µm, I+ red-brown.

Chemistry. Echinocarpic acid (major) and conechinocarpic acid (minor).

Remarks. *Platygramme pudica* is characterized by conspicuous lirellae with a laterally carbonized proper exciple and closed and thickish labia, large muriform ascospores (120–180 µm long) and the presence of echinocarpic acid. It occurs in Australia, Indonesia and Japan (Nakanishi *et al*. 2003; Archer 2006). This species is reported here from China for the first time.

Two species reported from Fujian province, *Phaeographina elaeoplaca* A. Zahlbr. and *Ph. granulans* A. Zahlbr., with large fuscescent muriform ascospores and sessile lirellae, and with concealed disc and thick labia (Zahlbruckner 1932), appear to belong in *Platygramme*. They are very similar to *Platygramme pudica*, but differ slightly in ascospores size, with the ascospores of *Phaeographina elaeoplaca* being 110–120 × 30–32 µm and *P. granulans* 140–160 × 29–31 µm (Zahlbruckner 1932). As we have not yet investigated the types of these species, we refrain from formally proposing them as synonyms.

Specimens examined. **China**: *Fujian*: Jianou County, Wanmulin, 420 m, 2007, *Meng Qing-Feng* FJ856 (LHS); 600 m, 2007, *Li Jing* FJ1000 (LHS) .

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