

# The Genus *Letrouitia* (Letrouitiaceae: Lichenized Ascomycota) New to Cambodia

Haixia Shi<sup>1,2</sup>, Zigang Qian<sup>1</sup>, Xinyu Wang<sup>2</sup>, Dong Liu<sup>2</sup>, Yanyun Zhang<sup>2</sup>, Xin Ye<sup>1</sup>, Hiroshi Harada<sup>3</sup> and Lisong Wang<sup>2,\*</sup>

<sup>1</sup>Yunnan University of Traditional Chinese Medicine, Kunming 650500, China

<sup>2</sup>Key Laboratory of Biodiversity and Biogeography, Kunming Institute of Botany, Chinese Academy of Sciences, Kunming 650201, China

<sup>3</sup>Natural History Museum and Institute, Chiba 260-8682, Japan

**Abstract** The genus *Letrouitia* is newly recorded for Cambodia, including the four species as *L. domingensis*, *L. leprolytoides*, *L. sayeri*, and *L. subvulpina*. A brief description and illustrations are provided.

**Keywords** Cambodia, *Letrouitia*

The genus *Letrouitia* was established by Hafellner and Bellemere [1] to accommodate species of *Bombyliospora* with anthraquinones, *Letrouitia*-type ascus and thick spore septa. *Letrouitia* comprises 18 species [2-4], that occur typically on trees, very rarely on wood and rock. It is widely distributed in tropical and subtropical regions. Cambodia locates in the tropical area, however, no species of *Letrouitia* has been reported before this study, many specimens of the genus were collected during our surveys on diversity of lichens in this country. They were carefully examined, and four species are reported as new for Cambodia in the paper, detailed descriptions and illustrations were provided based on the Cambodia materials.

Specimens used in this study are deposited in the herbarium, Kunming Institute of Botany, Chinese Academy of Sciences (KUN). Morphological observations and thin hand-cut sections were made under a NIKON SMZ 745T dissecting microscope (Nikon, Tokyo, Japan). The vertical sections of apothecial were mounted in water, K solution (a 10% aqueous solution of KOH), and GAW (glycerol:

ethanol:water = 1:1:1). Anatomical descriptions are based on observations of these preparations under a NIKON Eclipse 50i microscope (Nikon), and photos were taken using NIKON digital camera head DS-Fi2 (Nikon).

***Letrouitia domingensis* (Pers.) Haf. & Bellem., Nova Hedwigia 35: 281 (1981) (Fig. 1A and 1B).**

≡ *Patellaria domingensis* Pers., Ann. Wetter. Gesellsch. Ges. Naturk. 2: 12 (1810).

- *Bombyliospora domingensis* (Pers.) Zahlbr., in Wawra & Beck, Itin. Princ. S. Coburgi 2: 153 (1888).

**Morphology:** Thallus greenish yellow to orange yellow, smooth to verrucose, verrucae ± type, effuse, lacking soredia and isidia, K+ violet-purple, photobiont coccoid green algae. Apothecia biatorine, round to somewhat distorted, sessile, constricted at base, up to 2 mm in diam. Disc red-brown, brown-black to black, concave, plane to more or less convex, margin prominent, orange-yellow, elevated above disc. Exciple K+ violet-purple, epithecium red-brown, hymenium colourless, hypothecium hyaline. Asci (6~)8-spored, spores hyaline, transversely septate, 6~10 locular, locules lens-shaped, 20~40 × 10~14 μm, no vertical septa; paraphyses branched and anastomosing.

**Habitat and distribution:** On bark in tropical forests; widely distributed in tropical and subtropical regions [2]; new to Cambodia.

**Comments:** The species is characterized by the (6~) 8-spored asci and transversely multisepate spores with 6~10 lens-shaped locules. It has been confused with *L. flavocrocea*, but the latter has somewhat smaller spores.

**Specimens examined:** Cambodia: Mondul Kiri Prov., Phum Laoka Village, 12°31' N, 107°08' E, 640 m, on bark, 30 Oct 2012, Xinyu Wang 12-37247; Mondul Kiri Prov., Phum Tmery Village, 12°29' N, 107°04' E, 430 m, on bark, 28 Oct 2012, Xinyu Wang 12-37226; Mondul Kiri Prov.,

Mycobiology 2015 June, 43(2): 163-165  
<http://dx.doi.org/10.5941/MYCO.2015.43.2.163>  
 pISSN 1229-8093 • eISSN 2092-9323  
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\*Corresponding author

E-mail: wanglisong@kib.ac.cn

Received August 27, 2014

Revised October 3, 2014

Accepted November 6, 2014

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Phum Tmery Village, 12°28' N, 107°03' E, 460 m, on bark, 28 Oct 2012, Xinyu Wang 12-37203; Mondul Kiri Prov., Pulung Village, 12°30' N, 107°15' E, 660 m, on bark, 1 Nov 2012, Xinyu Wang 12-37335.

**Additional specimen examined:** China: Yunnan Prov., Xishuangbanna, Menglun, Tropical Botanical Garden, 21°55' N, 101°15' E, 550 m, on bark of *Cocos*, 31 Oct 2002, Aptroot 57063.

***Letrouitia leprolytoides* S. Y. Kondr. & Elix, Australas. Lichenol. 62: 16~19 (2008) (Fig. 1C and 1D).**

**Morphology:** Thallus greenish or greenish yellow, with finger-like isidia, sometimes soredial, true soredia absent, photobiont coccoid green algae. Apothecial biatorine, round to somewhat distorted, sessile, constricted at base, up to 1.3 mm, disc concave at first, pale brown to dark orange brown, margin prominent, orange yellow, disc and margin K+ purple-violet. Exciple concolourous with epihymenium, K+ violet, epihymenium orange yellow K+ violet; hymenium colourless, 80~100  $\mu$ m; hypothecium colourless to yellow; asci (4~6~) 8-spored. Ascospore ellipsoidal, transversely septate with (4~) 6 (~8) lens-shaped locules, usually 35  $\times$  12.5  $\mu$ m, with 0~1 vertical septa, paraphyses thin, branched, not swollen towards the tips, ca. 2  $\mu$ m diameter.

**Habitat and distribution:** On bark in tropical forests; previously only known in Australia [3] and new to Cambodia and Nepal.

**Comments:** The species is characterised by the present of finger-like to coralloid isidia on the surface of thallus, (4~6~) 8-spored asci and (4~) 6 (~8)-locular ascospores. It is similar with *L. leprolyta*, while the latter has short, wart-like or erumpent isidia.

**Specimens examined:** Cambodia: Ratanakiri Prov., Kalai 3 Village, 13°53' N, 105°56' E, 150 m, on bark, 4 Nov 2012, Xinyu Wang 12-37352; Ratanakiri Prov., Kamal Village, 13°50' N, 107°00' E, 350 m, on bark, 3 Nov 2012, Xinyu Wang 12-37338.

**Additional specimen examined:** Nepal: Ketawang, 1,600 m, on bark of *Alnus*, 20 Dec 2011, Lisong Wang *et al.* 11-32840.

***Letrouitia sayeri* (Müll. Arg.) Elix., Australas. Lichenol. 61: 21~25 (2007) (Fig. 1E and 1F).**

≡ *Heterothecium sayeri* Müll. Arg., Flora 70: 338 (1887).

- *Lecidea sayeri* (Müll.Arg.) Shirley, Proc. R. Soc. Queensland 6: 184 (1889).

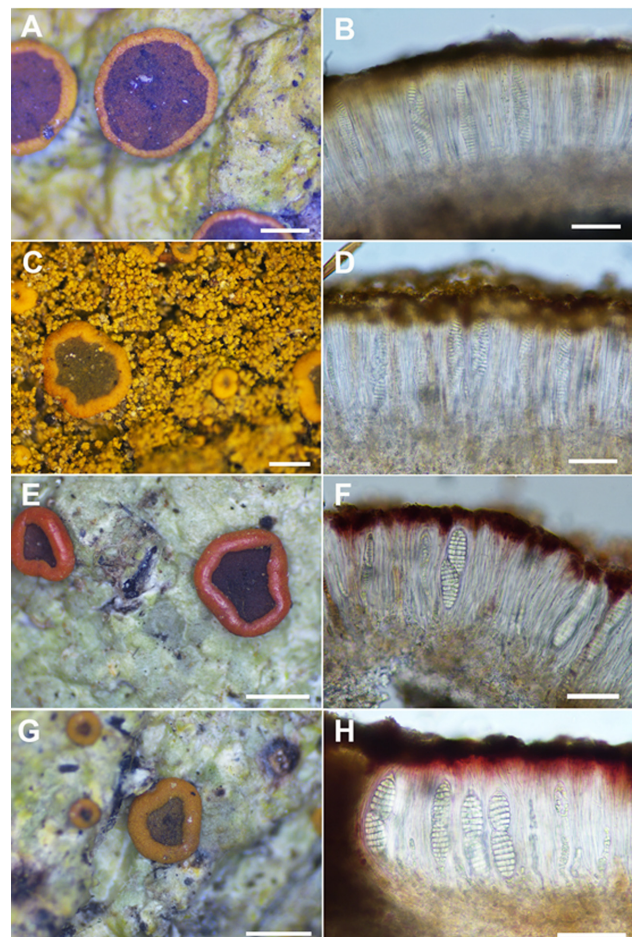
- *Lopadium sayeri* (Müll.Arg.) Zahlbr., Cat. Lich. Univ. 4: 313 (1926).

**Morphology:** Thallus greenish to olive-grey, lamellate; lacking soredia and isidia, photobiont coccoid green algae. Apothecia common and dispersed over the thallus, round to somewhat distorted, concave, sessile, constricted at the base, up to 1.3 mm wide; disc dark rust-red to blackberry-red, margin prominent, rust-red, disc and margin K+ blue-violet (appearing black under the microscope); exciple biatorine, composed of hyaline, radiating, agglutinated

hyphae, the outer layer encrusted with red anthraquinone crystals, the inner layer colourless and lacking anthraquinone crystals; epihymenium encrusted with red anthraquinone crystals, K+ blue or blue violet; hymenium colourless, 80~100  $\mu$ m high; hypothecium colourless to yellow; asci usually 2-spored, rarely 1-spored, up to 100  $\times$  25  $\mu$ m or 102.5  $\times$  22.5  $\mu$ m; ascospores ellipsoid, densely muriform, up to 62.5  $\times$  26  $\mu$ m, usually ca. 50  $\times$  22.5  $\mu$ m when mature; paraphyses branched and anastomosing; conidia not seen.

**Habitat and distribution:** On bark in tropical forests; previously only known in Australia [4] and new to Cambodia.

**Comments:** The species is characterized by dark rust-red to blackberry-red apothecia, K+ blue to blue-violet. It was considered to be synonymous with *Letrouitia subvulpina* by Hafellner and Bellemere [1], but the chemical test [5] show that *L. subvulpina sens. lat.* exhibited two chemotypes and was distinguished as *L. subvulpina sens. str.* and *L. sayeri* [4]. Besides the differences in chemical substance, the ascospores of *L. sayeri* were found to be broader than



**Fig. 1.** *Letrouitia* species. A, *L. domingensis*; B, *L. domingensis*: the section of apothecia with spores; C, *L. leprolytoides*; D, *L. leprolytoides*: the section of apothecia with spores; E, *L. sayeri*; F, *L. sayeri*: the section of apothecia with spores; G, *L. subvulpina*; H, *L. subvulpina*: the section of apothecia with spores (scale bars: A, C, E, G = 0.5 mm, B, D, F, H = 50  $\mu$ m).

**Table 1.** The relations among three confused species

Species	<i>Letrouitia vulpina</i>	<i>L. subvulpina</i>	<i>L. sayeri</i>
Compounds	Dibenzofurans present	Dibenzofurans present	Dibenzofurans absent
Spores size ( $\mu\text{m}$ )	28~40 $\times$ 15~19	32~50 $\times$ 16~20	32~50 $\times$ 20~25
Apothecia color	Red-orange to orange, or the disc becoming brown	Dark rust, rarely the edge a little brighter	Dark rust-red to blackberry-red
Apothecia K-reaction	K+ purple	K+ violet-blue	K+ violet-blue
Distribution	Australia, Bolivia, Brazil, Costa Rica, France, India, Oceania, Papua New Guinea, Thailand, Tonga, USA, Vanuatu	Thailand, Papua New Guinea, Oceania, France, new to Cambodia	Australia, new to Cambodia

those of *L. subvulpina*.

**Specimen examined:** Cambodia: Kampot Prov., Bokor National Park, 10°37' N, 104°05' E, 870 m, on bark, 16 Nov 2012, Xinyu Wang 12-37536.

***Letrouitia subvulpina* (Tuck.) Haf. & Bellem., Nova Hedwigia 35: 705 (1983) (Fig. 1G and 1H).**

≡ *Lecidea subvulpina* Nylander in Bull. Soc. Linn. Normandie, Sér. 2 2: 89, not. (1868).

- *Heterothecium sayeri* Müll. Arg. in Flora 70: 338 (1887).

**Morphology:** Thallus corticolous, crustose, yellowish olive-grey, smooth to cracked, soredia and isidia absent, K-, photobiont coccoid green algae; apothecia sessile, constricted at base, up to 1.2 mm in diameter; disc brown to black, plane, margin yellowish-orange to brownish-orange, elevated than the disc, inflexed; exciple biatorine, K+ purple, epithecium red-brown, K+ violet-purple, hymenium hyaline to pale yellowish, hypothecium yellow to pale brown. Asci clavate, (1~) 2 spored, spores hyaline, muriform, mature spores with (6~) 8~10 transverse and (1~) 2~5 vertical septa, usually ca.  $40 \pm 2.5 \times 20 \pm 2.5 \mu\text{m}$ , paraphyses branched and anastomosing.

**Habitat and distribution:** On bark in tropical forests; Asia [6] (Thailand), Oceania (Papua New Guinea, New Caledonia) [7, 8] and new to Cambodia.

**Comments:** The species is characterized by the present of dibenzofurans, dark rust apothecia, K+ violet-purple. It very close to *L. vulpina* but the latter has red-orange to orange apothecia, and K+ purple. The detailed comparison of the three confused species (*L. vulpina*, *L. subvulpina*, and *L. sayeri*) are shown in Table 1.

**Specimen examined:** Cambodia: Kampot Prov., Bokor National Park, 10°37' N, 104°05' E, 870 m, on bark, 16 Nov 2012, Xinyu Wang 12-37532.

## ACKNOWLEDGEMENTS

We are greatly thankful to Prof. Bernard Goffinet from University of Connecticut for providing numerous useful comments on the manuscript. This study was supported by a grant from the National Natural Science Foundation of China (No. 31170023, 31370069), West Light Foundation of The Chinese Academy of Sciences, Foundation of Key Laboratory for Plant Diversity and Biogeography, Kunming Institute of Botany, CAS (KLBB-201210), and Flora Lichenum Sinicorum (KSCX2 -EW-Z-9).

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