

Additional new species of the lichen genus *Pertusaria* from China

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Abstract

Three *Pertusaria* species are described as new to science from China: *Pertusaria laceromarginata* Q. Ren has disciform apothecia with lacerate margins and slightly pruinose, pink disc; a K– epihymenium; 1-spored asci and the presence of hypothamnolic acid. *Pertusaria montana* Q. Ren has disciform apothecia with epruinose or slightly pruinose, pink disc; a K– epihymenium; 1-spored asci and the presence of gyrophoric acid. *Pertusaria yulongensis* Q. Ren has verruciform apothecia with concave, black apices; a K+ violet epihymenium; 8-spored asci with dominantly biseriate spores and the presence of fumarprotocetraric acid.

Introduction

Pertusaria is a large genus in the Pertusariaceae, a widely distributed family throughout the world. The diagnostic characters for species in the Pertusariaceae are the apothecial structure, the number of ascospores per ascus, and spore structure and chemistry (Archer 1997, Schmitt & Lumbsch 2004). During a survey of the Chinese *Pertusaria* lichen flora, we examined specimens collected from the high mountains in Yunnan and Shaanxi provinces and found three species, here described as new to science. Two of the newly described species were found from the northwestern corner of Yunnan Province belonging to Hengduan Mountains (the southeastern part of the Qingzang Plateau). The other one was found from Mt. Taibai at 3700 m, which is the tallest mountain of the Qinling Mountains in southern Shaanxi Province.

Material & methods

The specimens examined in the present study are preserved in the herbarium of Shandong Normal University, China (SDNU) and herbarium of Kunming Institute of Botany, CAS, China (KUN). The morphology and anatomy of all specimens were studied using an Olympus SZX16 stereomicroscope and an Olympus BX61 compound microscope and photographed using an attached Olympus DP72 digital camera. The chemical constituents were identified by spot tests and thin-layer chromatography (Orange et al. 2001).

New Species

Pertusaria laceromarginata Q. Ren, sp. nov.

Fungal Name No.: FN 570269

Similar to *Pertusaria wulingensis* Z. S. Sun & Z. T. Zhao but is distinguished by a 1-spored asci and it contains hypothamnolic acid.

Type: China: Yunnan: Gongshan County, Qiqi Natural Reserve, alt. 1900 m, on bark, *M. Zang s.n.* (*Herb. No. 4449*), 19 Jul 1982 (holo: KUN).

Thallus grey or ash-grey, thin, the margin entire and unzonated; surface smooth or weakly tuberculate, generally matt, fissured in the older parts; isidia and soredia absent. *Fertile apothecia* abundant, disciform, crowded or well dispersed, rarely fused, concolorous with the thallus, initially closed and becoming ruptured with age, (0.3–) 0.5–1.0 mm diam., the margins crenulate or lacerate. *Disc* pink, slightly pruinose; the fruit center pink; epihymenium hyaline, K–; hypothecium hyaline. *Asci* 1-spored, clavate; ascospores hyaline, cylindrical or ellipsoidal, 160–180 × 50–65 μm; spore wall single, 2–3 μm thick, smooth and not trimmed. *Pycnidia* not seen. **Fig. 1.**

Chemistry: Cortex K–, C–, KC–, Pd–; medulla K+ purple, C+ red (quickly fading), KC–, Pd–; containing hypothamnolic acid (TLC).

Etymology: *laceromarginata* from the Latin *lacer*, torn and *marginata*, margin, a reference to the lacerate margins of the disciform apothecia.

Ecology and distribution: *Pertusaria laceromarginata* is a rare, corticolous species, known only from Gongshan County, Yunnan Province in southwestern China. It grows on bark at altitudes between 1700 m and 1900 m.

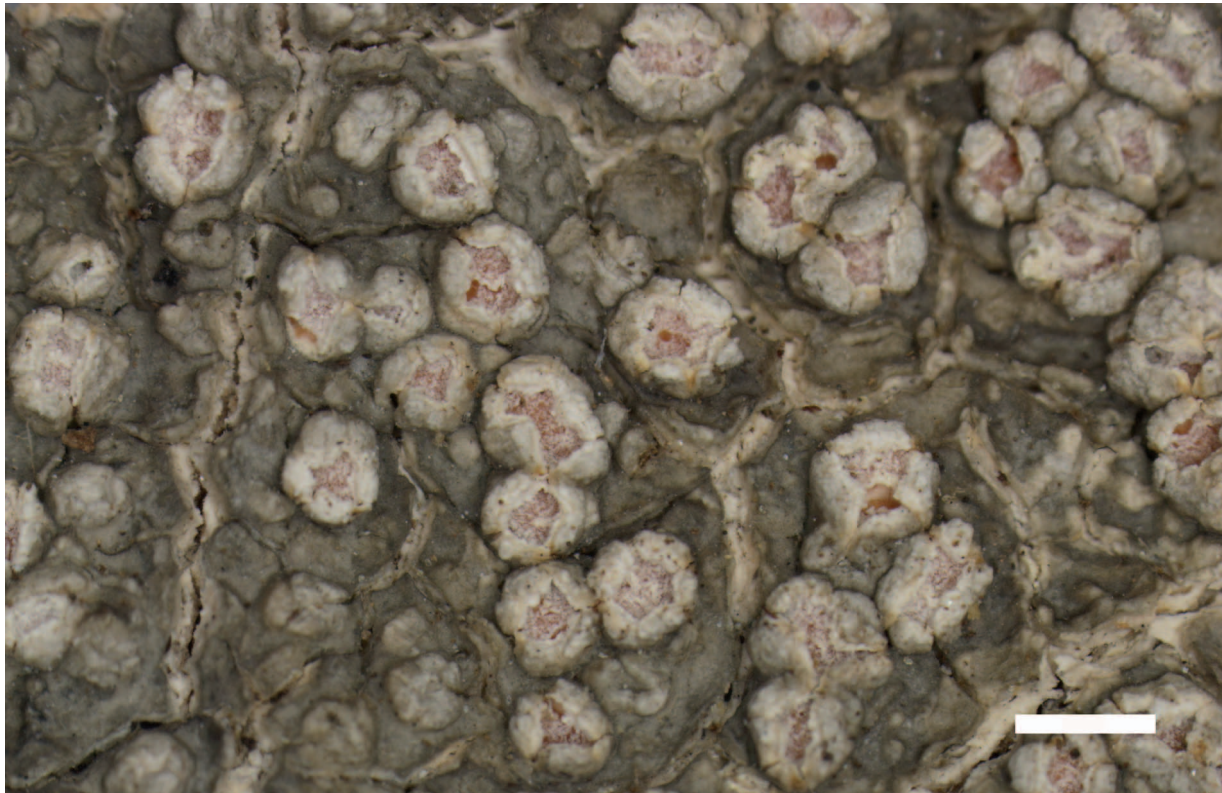


Fig. 1. *Pertusaria laceromarginata* (holotype). Image showing disciform apothecia with lacerate margins and pruinose, pink disc. Scale bar = 1 mm.

Comments: *Pertusaria laceromarginata* is characterized by a grey and matt thallus, lecanorine apothecia with 1–3 pink discs covered with weak pruina, 1-spored asci with cylindrical or ellipsoidal spores, the walls of which are smooth and not trimmed, and the presence of hypothamnolic acid. Morphologically, the new species resembles *Pertusaria wulingensis*, but the latter species has 8 ascospores per ascus and contains psoromic acid (Ren et al. 2009). The new species is chemically identical to *Pertusaria novaezealandiae* Szatala, but the latter

species occurs in south-eastern Australia and New Zealand from sea level to 1400 m elevation, and has a K+ violet epihymenium and heavily pruinose or sorediate disc, and possesses smaller spores that are 140–170 × 30–55 µm (Kantvilas 1990). *Pertusaria laceromarginata* resembles *Pertusaria hypothamnolica* Dibben (Dibben 1980) in that both species contain hypothamnolic acid and possess asci with a single ascospore. However, *P. hypothamnolica* is found in the south-eastern United States and contains additional lichexanthone, which is absent from *P. laceromarginata*.

Additional specimen examined: CHINA: YUNNAN: Gongshan County, Dulongjiang Town, Dizhengdang Village, alt. 1700 m, Q. Ren 554, 28 Aug 2002 (SDNU).

***Pertusaria montana* Q. Ren, sp. nov.**

Fungal Name No.: FN 570268

Distinguished from the closely similar *Pertusaria bryontha* (Ach.) Nyl. possessing a pink disc, having a K- epihymenium and lacking stictic acid.

Type: China: Shaanxi: Mt. Taibai, alt. 3700 m, on moss, Y. J. Li & W. Fu L-134, 5 Aug 2005 (holo: SDNU).

Thallus white or whitish grey, thin, margins indefinite, not zoned; surface smooth or slightly tuberculate, generally matt, continuous. Isidia and soredia absent. *Fertile apothecia* disciform, concolorous with thallus, numerous, solitary, subspherical to discoid, dispersed or occasionally crowded, (0.5–) 0.8–2.5 mm diam. *Disc* pink, plane, epruinose or slightly pruinose; the margins prominent, initially entire but later crenulate. *Epihymenium* dark brown, K-; hymenium hyaline. *Asci* 1-spored, clavate; ascospores hyaline, ellipsoidal or cylindrical, (138–) 188–208 × 53–70 (–75) µm; spore wall single, 5–12 µm thick, smooth and trimmed, the end wall 17–25 µm thick. *Pycnidia* not seen. **Fig. 2.**

Chemistry: cortex K-, C+ yellow, KC+ yellow, Pd-; medulla K-, C-, KC-, Pd-; epihymenium K-, C+ red, KC+ red, Pd-; containing gyrophoric acid and trace of thiophanic acid (TLC).

Etymology: From the Latin *montana*, mountain, a reference to the high mountain habitat.

Comments: *Pertusaria montana* resembles *P. bryontha* both in general appearance and habitat. Both are arctic-alpine species growing on mosses and plant debris and contain one ascospore per ascus. *Pertusaria bryontha* has a dark brown disc, contains stictic acid and its epihymenium is K+ purple (Chambers et al. 2009) whereas the new species has a pink disc, lacks stictic acid and has a K- epihymenium.



Fig. 2. *Pertusaria montana* (holotype). Image showing a muscicolous thallus and disciform apothecia with epruinose or slightly pruinose, pink disc. Scale bar = 2 mm.

***Pertusaria yulongensis* Q. Ren, sp. nov.**

Fungal Name No.: FN 570266

Similar to *Pertusaria leioplaca* DC. but differs in having 8-spored asci and in containing fumarprotocetraric acid.

Type: China: Yunnan: Yulong County, Yulong Snow Mountain, on branch, *L. S. Wang 88-353a*, 6 Nov 1988 (holo: KUN).

Thallus grey to black-grey, thin, prothallus absent; isidia and soredia absent. *Apothecia* verruciform, fertile verrucae abundant, concolorous with the thallus, globose, usually single, rarely 2–3 fused, 0.5–1.0 mm diam., with concave, black apices; ostiole 1 per verruca, inconspicuous; epihymenium K⁺ violet; hymenium hyaline. *Asci* 8-spored; ascospores mostly biseriata, 38–70 × 25–40 μm; spore wall double, smooth and not trimmed, 3–5 μm thick. *Pycnidia* not seen. **Fig. 3.**

Chemistry: Cortex K⁻, C⁻, KC⁻, Pd⁻; medulla K⁺ yellow, C⁻, KC⁻, Pd⁺ yellow; containing fumarprotocetraric acid (TLC).

Etymology: From the Latin *ensis*, place of origin, and Yulong County.

Comments: *Pertusaria yulongensis* is characterized by asci with eight mostly biseriata spores and the presence of fumarprotocetraric acid. *Pertusaria yulongensis* resembles *P. leioplaca* in morphology, but *P. leioplaca* usually has four spores per ascus and contains 4,5-dichlorolichexanthone (Chambers et al. 2009). The new species is distinguished from the chemically similar species *P. yunnana* G. L. Zhou & Lu L. Zhang, also from Yunnan Province, by the disciform apothecia and the larger ascospores (Zhao et al. 2014).

Additional specimen examined: CHINA: YUNNAN: Yulong County, Lidiping, alt. 3250 m, on branch, *J. X. Xi 0159(h)*, 16 Jun 1984 (KUN 11537).



Fig. 3. *Pertusaria yulongensis* (holotype). Image showing verruciform apothecia with concave, black apices. Scale bar = 1 mm.

Acknowledgments

The authors thank Dr. Alan W. Archer (National Herbarium of New South Wales, Australia) for a pre-submission review. This project is supported by the National Natural Science Foundation of China (31370066), and the Excellent Young Scholars Research Fund of Shandong Normal University.

References

- Archer AW (1997) The lichen genus *Pertusaria* in Australia. *Bibliotheca Lichenologica* 69: 1–249.
- Chambers SP, Gilbert OL, James PW, Aptroot A, Purvis OW (2009) *Pertusaria*. In Smith CW, Aptroot A, Coppins BJ, Fletcher A, Gilbert OL, James PW, Wolseley PA. (eds) *The lichens of Great Britain and Ireland*. (British Lichen Society: London)
- Dibben MJ (1980) *The chemosystematics of the lichen genus Pertusaria in North America north of Mexico*. Milwaukee Publications. In *Biology and Geology* 5: 1–162.
- Kantvilas G (1990) The genus *Pertusaria* in Tasmanian rainforests. *Lichenologist* 22: 289–300. <http://dx.doi.org/10.1017/S0024282990000329>
- Orange A, James PW, White FJ (2001) *Microchemical methods for the identification of lichens*. (British Lichen Society: London)
- Ren Q, Sun ZS, Zhao ZT (2009) *Pertusaria wulingensis* (*Pertusariaceae*), a new lichen from China. *Bryologist* 112: 394–396. <http://dx.doi.org/10.1639/0007-2745-112.2.394>
- Schmitt I, Lumbsch HT (2004) Molecular phylogeny of the *Pertusariaceae* supports secondary chemistry as an important systematic character set in lichen-forming ascomycetes. *Molecular Phylogenetics and Evolution* 33: 43–55. <http://dx.doi.org/10.1016/j.ympev.2004.04.014>
- Zhao ZT, Zhao X, Gao W, Zhou GL, Zhang LL (2014) *Pertusaria yunnana*, a new species from south-west China. *Lichenologist* 46: 169–173. <http://dx.doi.org/10.1017/S0024282913000881>

Manuscript received 12 March 2016, accepted 12 September 2016

