

新疆异极衣科地衣的初步研究

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摘 要: 本实验对新疆天山南部的蓝藻型地衣异极衣科的 1 个中国新记录属以及 2 个中国新记录种进行了分类学研究。采用形态解剖、化学及生态等传统分类方法, 利用显色反应法(CT)、薄层层析法(TLC)等生物化学方法, 鉴定采样区异极衣科地衣的 1 个中国新记录属——半被果衣属(*Lempholemma* Körb)以及 2 个中国新记录种——叶状枝半被果衣 [*Lempholemma cladodes* (Tuck.) Zahlbr.] 和幼芽状盘衣属(*Lichinella* Nyl.) 的黑色幼芽状盘衣 [*Lichinella nigritella* (Lettau) P. Moreno & Egea]。半被果衣属的主要特点是子囊果为半被果或密果, 共生藻为念珠藻; 黑色幼芽状盘衣的鉴别特征为地衣体多叶状, 顶端常具小裂片, 上表面具小、球状裂芽。本研究对半被果衣属以及叶状枝半被果衣和黑色幼芽状盘衣进行了详细的描述, 并提供了相关彩色图片, 为新疆地衣的进一步研究提供了实验依据, 并为中国异极衣科地衣的研究奠定了基础。

关键词: 蓝藻型地衣; 叶状枝半被果衣; 黑色幼芽状盘衣; 分类

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Preliminary Study on the Lichen Family Lichinaceae Nyl. in Xinjiang, China

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Abstract: Specimens for this study were collected from Southern Tianshan Mt. in Xinjiang Province, China. In the laboratory, standard methods of morphological, anatomical and chemotaxonomical analyses were used. The chemical analyses were carried out using spot tests (TC), thin layer chromatography (TLC). As a result, we found one lichen genus *Lempholemma* Körb with one species, *Lempholemma cladodes* (Tuck.) Zahlbr and another species, *Lichinella nigritella* (Lettau) P. Moreno & Egea in the Lichen genus *Lichinella* Nyl are recognized in the lichen family Lichinaceae in Xinjiang Province and are described as new to China. *Lempholemma* is characterized by its hemiangiocarpous or pycnoascocarps ascoma and Nostoc photobionts. *L. nigritella* is characterized by its polyphyllous thalli, small lobules at the lobe tips, minute globose isidia at upper surface. Detailed taxonomic descriptions with comments and photos are provided. This study provides not only valuable information for the application of research on Xinjiang lichens, but also scientific research materials for the diversity of lichen in China.

Key words: cyanobacterial lichen; *Lempholemma cladodes*; *Lichinella nigritella*; taxonomy

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Approximately 250 species in c. 42 genera are currently recognized in the cyanobacterial lichen family Lichinaceae^[1-2]. The family Lichinaceae is characterized by a great diversity in morphology and development of the thallus and apothecia^[3-6]. Lichinaceae occurs worldwide in all climatic and orographic zones. Centres of distribution are arid to semi-arid and Mediterranean regions. In humid or semi-humid tropical regions comparably dry microhabitats such as inselbergs are preferred^[7-9].

Xinjiang is located in northwestern China and is an arid or semiarid region. The lichen species of Lichinaceae such as *Lempholemma* spp., *Lichinella* spp., and *Thyrea* spp. are widely dispersed in this area. In China, one *Lichinella* species, *Lichinella hondoana* has been reported^[10]. Besides, 4 genera with 12 species of Lichinaceae are included in "An enumeration of lichens in China"^[11]. As a result of thorough field and herbarium studies of Lichinaceae lichens from the northwestern China, one genus *Lempholemma* and two species new to China are reported, and brief descriptions with notes, photographs, and distribution are given. Because the absence of apothecia of *Lempholemma cladodes* in our collection, in the description of the genus, the type of ascoma ontogeny, asci and ascospores, pycnidia, and conidiophores are mainly based on Schultz's description^[12]. This study is the first of a series distributional data on *Lempholemma* and *Lichinella* in Xinjiang, China and provides details for new localities of two taxa.

1 Materials and methods

The examined specimens were stored in XJU (Herbarium of the Lichens' Research Center in Arid Zones of Northwest China, Xinjiang University). Morphological and anatomical illustration was made with dissecting microscope Leica ZOOM 2000 and Motic Light microscopy on squash preparations and hand-cutting sections of thalli that were mounted in water. The amyloid reaction of the hymenium was studied by adding Lugol's solution directly to sections mounted in water without pretreatment with KOH. Anatomical structures of lichens were

photographed using a Nikon MODEL ECLIPSE CIL and Nikon MODEL ECLIPSE E200. The chemical analyses were carried out using thin layer chromatography (TLC) following Culberson & Kristinsson^[13], Orange *et al.*^[14].

2 Results and discussion

2.1 *Lempholemma* Körb., Syst. Lich. Germ. : 400 (1855)

Thallus growth form various, umbilicate, squamulose, lobate, black, dark olive when wet, smooth or granulose, sometimes with globose isidia or with swellings; thallus ecorticate, anatomy homoiomerous, loose hyphal network surrounding photobiont cells; photobionts Nostoc; Ascomata apothecial, laminal on thallus or terminal, immersed to semi-immersed, margin distinct; ascoma ontogeny hemiangiocarpous (ascogones arising in a tangle of generative hyphae beneath the thallus surface) or pycnoascocarps (ascogones arise beneath pycnidia)^[12]. Conidiomata: pycnidial, laminal or marginal, immersed, ellipsoid; conidiophores: simple, with elongated cells^[12]. Secondary metabolites: none detected.

Distribution: *Lempholemma* is distributed in North America, Europe, and India^[12]. New to China.

Comments: Some *Collema* species are similar with *Lempholemma*, both of which occur in same habitats and have *Nostoc* photobionts. The former has sessile apothecia, septate ascospores, however the latter differs in ascoma ontogeny and ascospores.

2.2 *Lempholemma cladodes* (Tuck.) Zahlbr., Cat. Lich. Univers. 3: 23 (1924)^[1925] (Fig. 1, A—C)

Thallus black, dwarf fruticose, spreading to rosette-shaped, up to 3.5(—4) mm wide. Lobes cylindrical or slightly flattened, appressed, dichotomously to irregularly branched to the end, 1—5 mm long, 0.1—0.3 mm wide, apically with globose swellings (hormocystangia), up to 0.15 mm wide; thallus ecorticate, anatomy homoiomerous, central hyphae forming loose network surrounding few photobiont cells; upper surface: black, lobes granu-

lose; lower surface: attached by rhizohyphae; Apothecia not seen.

Chemical tests: Cortex K—, C—, KC—, P—.

Secondary metabolites: No lichen substances detected (TLC).

Distribution: *Lempholemma cladodes* occurs in Europe and North America^[12]. New to China.

Selected specimens examined: China, Xinjiang Prov.: **Korla, Hejing** County, Mt. Southern Tianshan, Bayinbulak grassland, alt. 2 880 m, on soil crusts on rock, 28 Jul. 2013, ABBAS A & MAMUT R, 20131715 (XJU); **Kuqa** County, Mt. Southern Tianshan, Kuqa large dragon pool, alt. 2 481 m, on soil crusts on rock, 9 Aug. 2012, ABBAS A

& MAMUT R, 20121623 (XJU). Urumqi County, Mt. Tianshan, No. 1 Glacier, alt. 3 200 m, on soil crusts on rock, 27 Jul. 2013, ABBAS A & MAMUT R, 20131155 (XJU).

Comments: *Lempholemma cladodes* is a very widely distributed species in Xinjiang arid situation. It is usually accompanied by *Peltula* spp. The presence of *Nostoc* photobionts distinguishes the species from other dwarf fruticose, single-celled cyanobacterial lichens in Lichinaceae. It is relatively easy to recognize because of having branched, cylindrical lobes, and globose hormocystangia at the lobe tips.

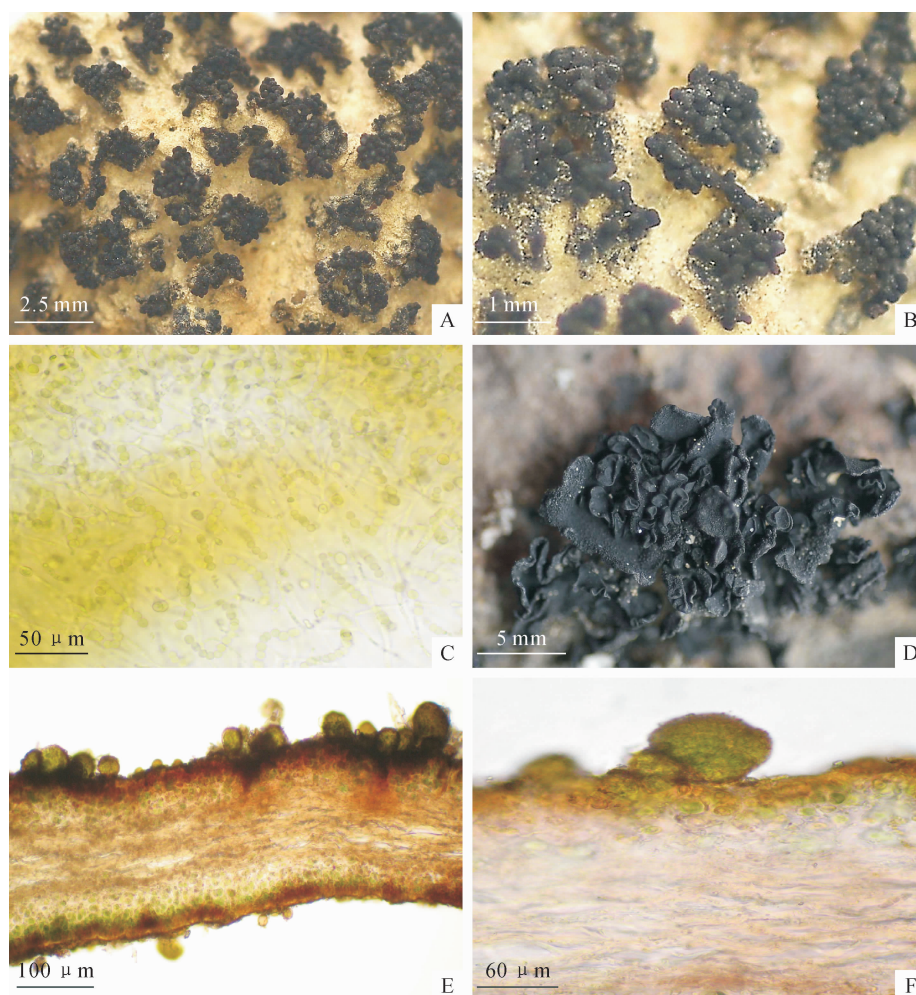


Fig. 1 *Lempholemma cladodes* & *Lichinella nigritella*

- A. Thallus of *Lempholemma cladodes*; B. Part of Thallus, showing upper surface with swellings;
C. Cross section of thallus, showing *Nostoc* photobionts; D. Thallus of *Lichinella nigritella*;
E. Cross section of thallus, upper and lower surface covered by minute globose to scale-like isidia; F. Cross section of thallus, magnifying the isidia on upper surface

2.3 *Lichinella nigritella* (Lettau) P. Moreno & Egea, Cryptogamie, Bryol. Lichénol. 13: 246. 1992 (Fig. 1, D—F).

Thallus foliose-fruticose, polyphyllous, cushions up to 20 mm wide. The lobes are deeply divided, 1—2 mm wide at the base, 3—4 mm wide at the apices, heteromerous, centrally with hyphal strand lacking photobiont cells, 200—240 μm thick, the lobe tips round and slightly upturned. Towards the tips, the lobes often become dissected into small lobules, 0.5—1.5 mm wide. Upper surface: black, dull or somewhat glossy, densely covered by minute globose to scale-like isidia, rarely with grayish pruina on lobe surface. Lower surface concolorous with the upper surface, dull, also have scattered globose isidia. Apothecia not seen.

Chemical tests: Cortex K—, C—, KC—, P—.

Secondary metabolites: No lichen substances detected (TLC).

Distribution: North America, Europe, North Africa^[15-16]. New to China.

Specimen examined: China. Xinjiang Prov.: Miquan County, Ha xiong gou, Mt. Tianshan, alt. 1 870 m, on calcareous rock, 8 Jul. 2013, ABBAS A, MAMUT R, 20131970 (XJU); Urumqi County, Mt. Tianshan, No. 1 Glacier, alt. 3 200 m, on rock, 27 Jul. 2013, ABBAS A & MAMUT R, 20131645 (XJU).

Comments: Because of globose to scale-like isidia on lobe surface, *Lichinella nigritella* is easily recognisable species among the fruticose-foliose members of the genus.

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