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A new species of *Allocetraria* (*Parmeliaceae*, Ascomycota) in China

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Abstract: *Allocetraria yunnanensis* R. F. Wang, X. L. Wei & J. C. Wei is described as a new species from the Yunnan Province of China, and is characterized by having a shiny upper surface, strongly wrinkled lower surface, and marginal pseudocyphellae present on the lower side in the form of a white continuous line or spot. The phylogenetic analysis based on nrDNA ITS sequences suggests that the new species is related to *A. sinensis* X. Q. Gao.

Key words: *Allocetraria yunnanensis*, lichen, taxonomy

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Introduction

The lichenized genus *Allocetraria* Kurok. & M. J. Lai was described in 1991, with a new species *A. isidiigera* Kurok. & M. J. Lai, and two new combinations: *A. ambigua* (C. Bab.) Kurok. & M. J. Lai and *A. stracheyi* (C. Bab.) Kurok. & M. J. Lai (Kurokawa & Lai 1991). The main distribution area of *Allocetraria* species was reported to be in the Himalayas, including China, India, and Nepal.

Allocetraria is characterized by dichotomously or subdichotomously branched lobes and a foliose to suberect or erect thallus with sparse rhizines, angular to sublinear pseudocyphellae, palisade plectenchymatous upper cortex, as well as producing usnic acid but never atranorin (Kurokawa & Lai 1991). It is a well-supported monophyletic group within the cetrarioid clade in *Parmeliaceae* (Saag *et al.* 2002; Thell *et al.* 2009; Nelsen *et al.* 2011). Ten species of *Allocetraria* have been accepted in the genus worldwide; China is the main distribution area of the genus, as all ten species have been reported there (Kurokawa & Lai 1991; Thell *et al.* 1995; Randlane *et al.* 2001; Wang *et al.* 2014). During our taxonomic study of *Allocetraria*, a new species was found.

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Materials and Methods

A dissecting microscope (ZEISS Stemi SV11) and compound microscope (ZEISS Axioskop 2 plus) were used to study the morphology and anatomy of the specimens. Colour test reagents [10% aqueous KOH, saturated aqueous $Ca(OCl)_2$, and concentrated alcoholic *p*-phenylenediamine] and thin-layer chromatography (TLC, solvent system C) were used for the detection of lichen substances (Culberson & Kristinsson 1970; Culberson 1972).

Nineteen fresh specimens were chosen for DNA extraction (Table 1), in which eight species of *Allocetraria* were included. The remaining three species of the genus, *A. capitata* R. F. Wang *et al.*, *A. denticulata* (Hue) A. Thell & Randlane and *A. isidiigera*, are absent because of a lack of fresh specimens and corresponding sequences in NCBI. The extraction procedure followed the modified CTAB method (Rogers & Bendich 1988). PCR amplifications were performed using a Biometra T-Gradient thermal cycler. The primer pairs ITS1 (White *et al.* 1990) and LR1 (Vilgalys & Hester 1990) were used to amplify the nrDNA ITS regions. Twenty-seven sequences were aligned with the program MEGA5 (Tamura *et al.* 2011); 19 specimens were sequenced by the authors, and 8 sequences were downloaded from GenBank, including outgroups *Tuckermanopsis ciliaris* (Ach.) Gyeln., *Usnocetraria oakesiana* (Tuck.) M. J. Lai & J. C. Wei, and *Vulpicida juniperinus* (L.) J. E. Mattsson & M. J. Lai. The phylogenetic analysis was executed with MEGA5. Model

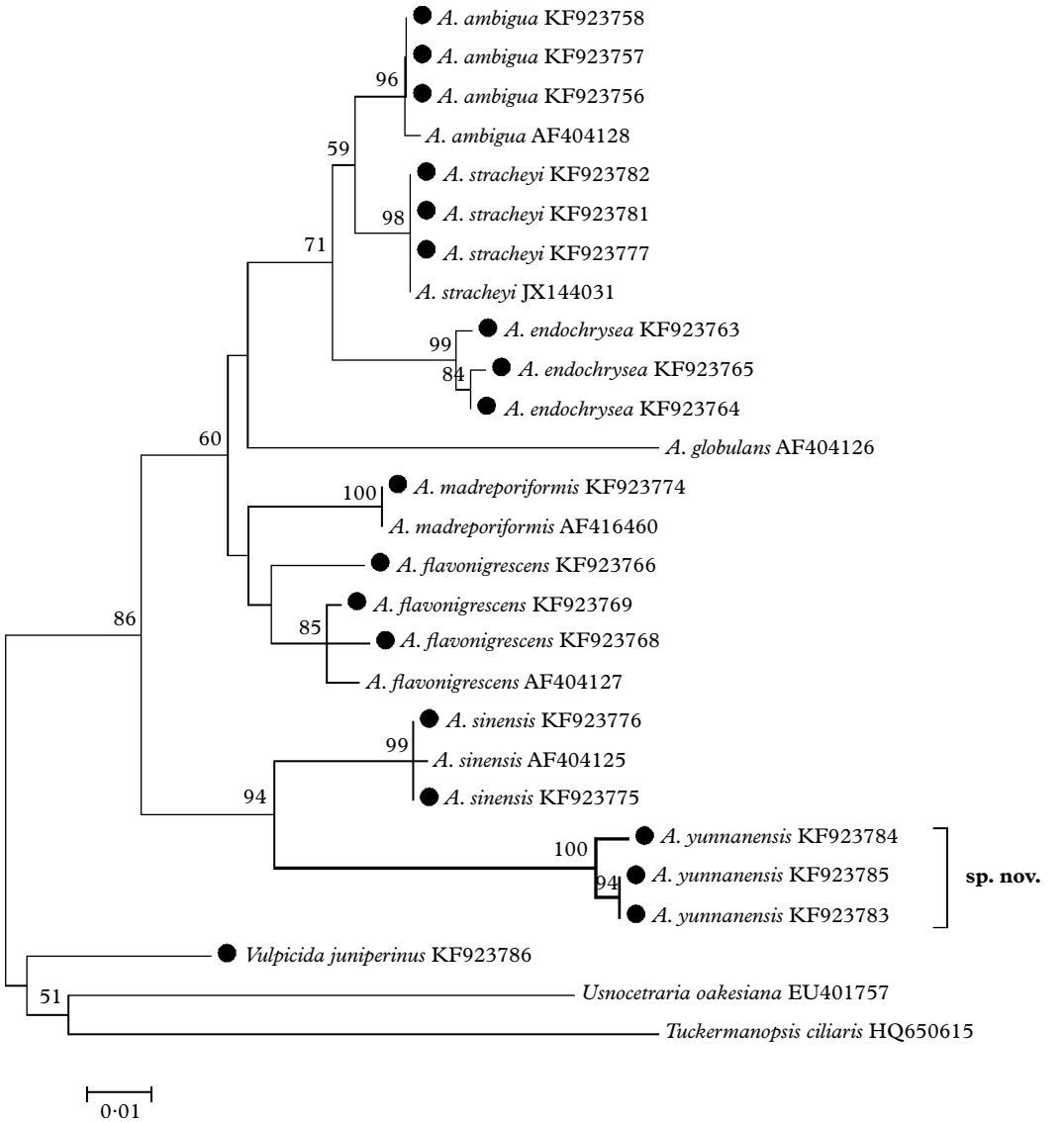

FIG. 1. The ML tree based on nrDNA ITS region sequences, the specimens marked with '●' were examined by the authors. Nucleotide: TN93+G model, bootstrap = 1000. Genetic distance scale = 0·01. The number at each node represents bootstrap support value (numbers lower than 50 are not shown).

TN93+G was set according to the lowest BIC scores (Bayesian Information Criterion). The Maximum Likelihood (ML) method was used in constructing the phylogenetic tree and the reliability of the inferred tree was tested by 1000 bootstrap replications.

Results and Discussion

The ML tree (Fig. 1) based on the ITS sequences demonstrates that the eight species of *Allocetraria* clustered into a moderately well-supported (86% bootstrap value) monophyletic clade. *Allocetraria yunnanensis* R. F. Wang *et al.* is well clustered (94% bootstrap value) together with the similar species *A. sinensis* X. Q. Gao as a separate group, despite their obvious differences. Therefore *A. yunnanensis* is a new species, well supported by DNA data.

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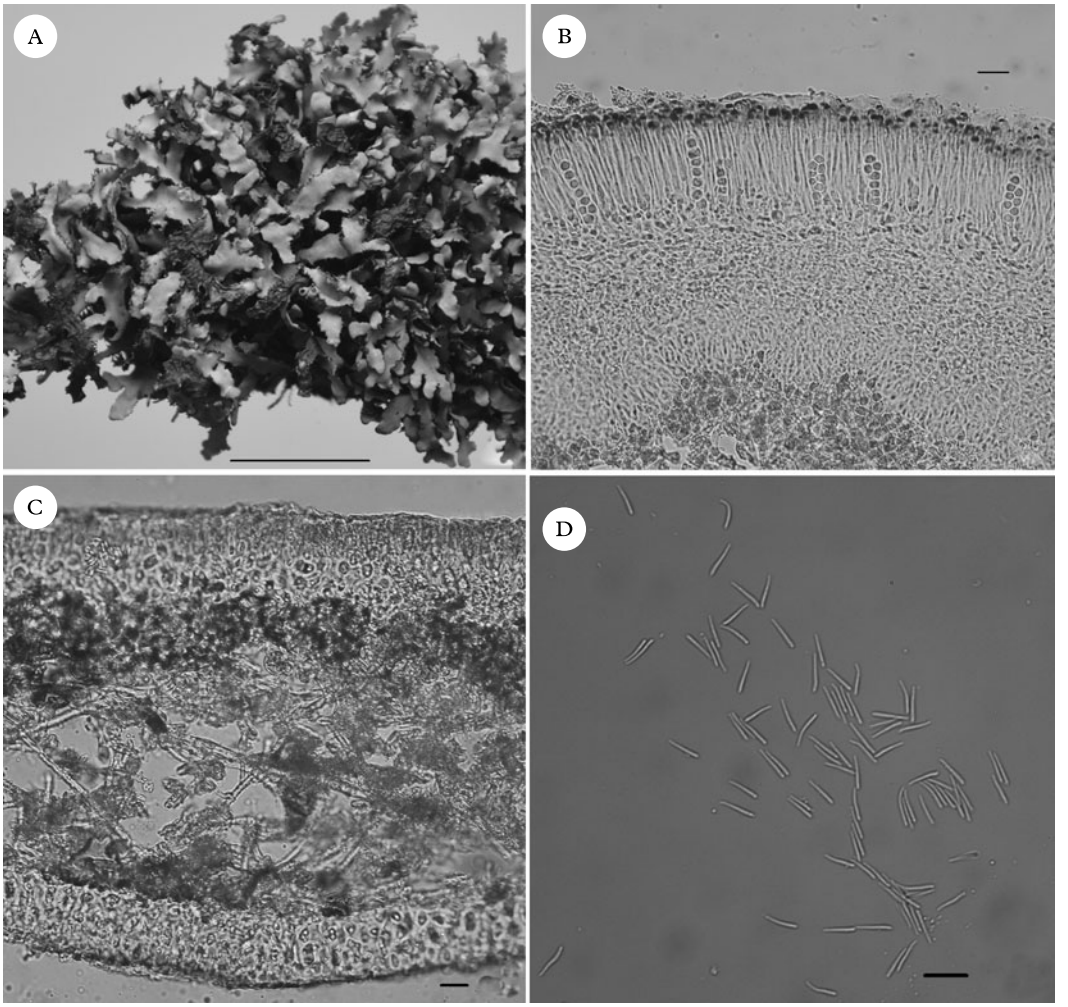

FIG. 2. *Allocetraria yunnanensis* R. F. Wang, X. L. Wei & J. C. Wei, sp. nov. (holotype). A, habit; B, anatomy of apothecium in vertical section; C, longitudinal section of the thallus; D, pycnoconidia. Scales: A = 1 cm; B–D = 20 μm.

The New Species

Allocetraria yunnanensis R. F. Wang, X. L. Wei & J. C. Wei sp. nov.

MycoBank No.: MB809069

Similar to *A. sinensis* in habitus, but differs from the latter and all other members in the genus by having a shiny upper surface and a lower surface which is strongly wrinkled and has marginal pseudocyphellae present on the lower side in the form of a white continuous line or spot.

Type: China, Yunnan Province, Deqin County, Meli Village, Meili Snow Mountain, on soil, 28°38·191′N, 98°36·304′E, alt. 4800 m, 10 September 2012, *R. F. Wang* YK12012 (HMAS-L128218—holotype).

(Fig. 2)

Thallus foliose, suberect to prostrate, dorsiventral, caespitose, 1·0–1·5 cm high. *Lobes* narrow, 1–4 mm wide, 200–350 μm thick, sublinear-elongate, flat to slightly concave, irregularly branched lobules. *Upper surface* greenish yellow to yellow or green, smooth, slightly shiny. *Lower surface* white to brown or almost dark brown, strongly

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wrinkled, dull. *Pseudocyphellae* located on the ridges of the lower surface, forming a continuous line or spot. *Rhizines* marginal on the lower side, sparse, simple, dark, 1–2 mm long. *Epicortex* 10–15 µm thick, non-cellular; *upper cortex* 30–60 µm thick, more or less palisade plectenchymatous; *lower cortex* 35–50 µm thick, more or less palisade plectenchymatous. *Medulla* light yellow to yellow.

Apothecia rare, terminal or marginal, up to 6 mm diam., with brown disc; *thalline* margin rather thick and crenulate. *Asci* narrowly cylindrical 35–50 × 10–15 µm; *ascospores* globose, 5–9 µm diam., or subglobose, 6–8 × 5–7 µm.

Pycnidia marginal, frequent, black, on emergent projections; *pycnoconidia* filiform, one end slightly swollen, 10–18 × 1·0–2·5 µm.

Chemistry. Lichesterinic, protolichesterinic, secalonic and usnic acids; cortex K–, KC+ yellow; medulla K–, C–, KC–, PD–.

Etymology. The epithet '*yunnanensis*' is derived from the locality of the new species 'Yunnan', a province of China. Known only from the type locality.

Ecology and substratum. On the ground, mixed with moss.

Specimens examined. **China:** *Yunnan Province*: Deqin County, Meli Village, Meili Snow Mountain, on soil, 28°38·191′N, 98°36·304′E, alt. 4800 m, 2012, *R. F. Wang* YK12004 (HMAS-L-128219), YK12018 (HMAS-L-128220).

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