Xylaria curta and *X. partita* (*Xylariales*) from Yunnan province[1]

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Abstract: Xylariaceous fungi were examined from Yunnan province, China. Two *Xylaria* species, *X. partita* and *X. curta*, are described and illustrated based on the Chinese material. *Xylaria partita* is reported here for the first time for China.

Zusammenfassung: Xylarioide Pilze aus der Provinz Yunnan in China wurden untersucht. Zwei *Xylaria*-Arten, *X. partita* und *X. curta*, werden basierend auf dem chinesischen Material detailliert beschrieben und illustriert. *Xylaria partita* wird hier zum ersten Mal für China berichtet.

Members of the genus *Xylaria* are important components in forest ecosystems as wood decomposer organisms (MERRILL & al. 1964; RAJAGOPALAN 1966; ROGERS 1979, 2000; WHALLEY 1985, 1996; RAYNER & BODDY 1986; SONG & al. 2014), where most of them grow on wood in tropical and subtropical areas (DENNIS 1956, 1957, 1958; WHALLEY 1993; JU & ROGERS 1999; HSIEH & al. 2010; ROGERS & JU 2012; FOURNIER 2014). Most *Xylaria* species have a strong capacity to degrade cellulose and lignin, causing physiological white rots (SUTHERLAND & CRAWFORD 1981, WEI & al. 1992, WHALLEY & EDWARDS 1995, WHALLEY 1996, ROGERS 2000), and some can rival basidiomycetes in substrate degradation (MERRILL & al. 1964, NILSSON & al. 1989). *Xylaria* collections from tropics and subtropics of China contain a very high percentage of taxa unknown to science. However, so far, in comparison with the total number of known species worldwide, xylariaceous fungi have been inadequately and unsystematically investigated in China, and many species remain undiscovered and require a thorough investigation.

During the survey of xylariaceous fungi in China, newly collected materials from southern China were examined. Two species, *Xylaria partita* and *Xylaria curta*, are

[1] The genus *Xylaria* in the south of China – 9.

described and illustrated based on the Chinese material. *Xylaria partita* is reported here for the first time for China.

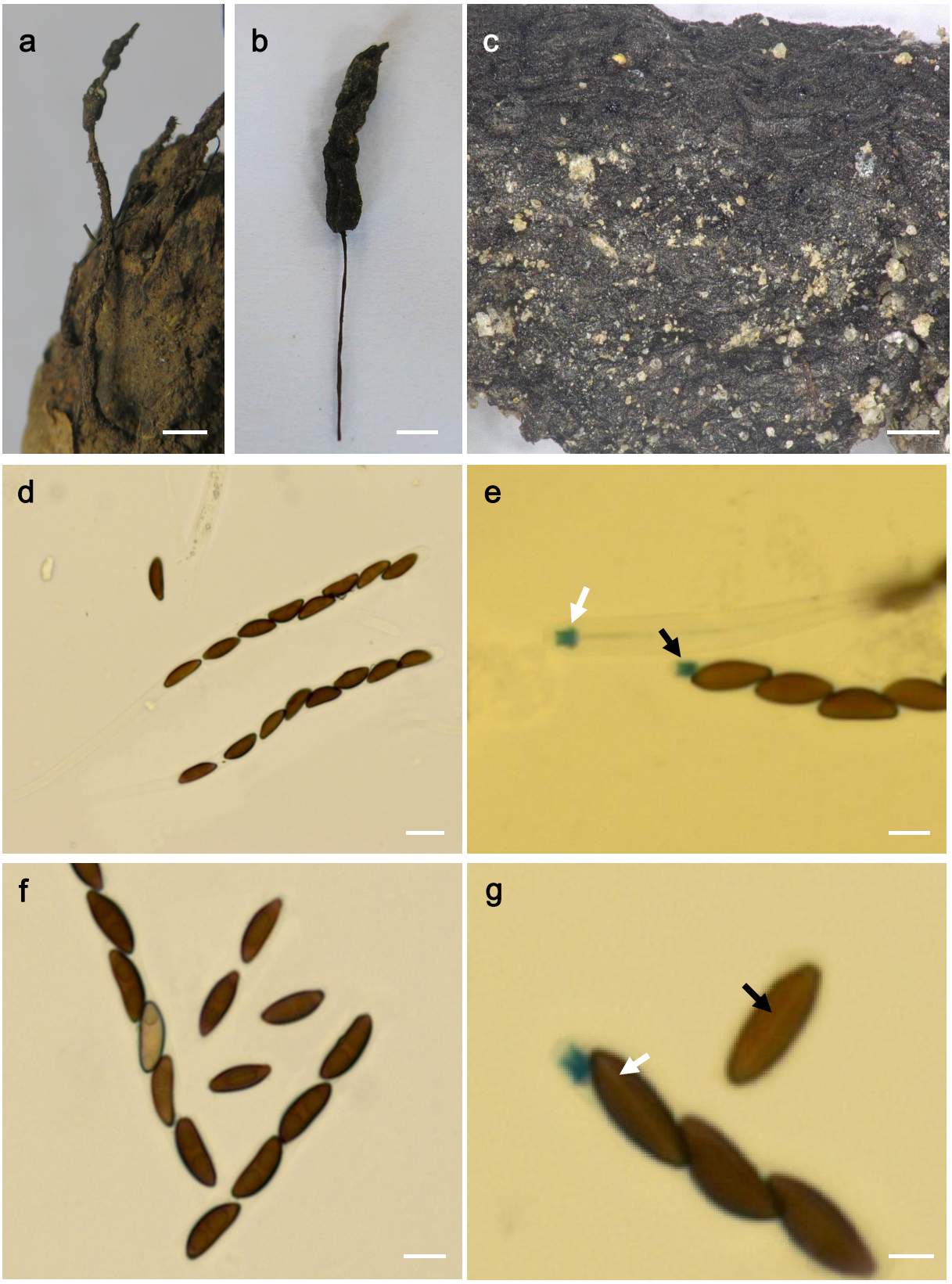

Fig. 1. *Xylaria partita* (FCATAS 613). *a, b* Stromata. *c* Stromatal surface. *d* Asci. *e* amyloid apical apparatus (arrows). *f* Ascospores. *g* Ascospores showing germ slit (arrows). Bars: a 3 mm; b 2 mm; c 0.2 mm; d 10 µm; e 6 µm; f 7µm; g 4 µm.

Materials and methods

Morphological studies: The specimens were collected from a natural broadleaf forest in a tropical rain forest in southern China, and deposited in the Fungarium of Institute of Tropical Bioscience and Biotechnology, Chinese Academy of Tropical Agricultural Sciences (FCATAS). Macromorphological characters of stromata were taken using a Canon G16 camera. Microscopic observations were made from slide preparations mounted in water and MELZER's iodine reagent. Measurements were taken by using a ZEISS digital microscope on samples of 30 ascospores, 20 asci, 20 ascal apical rings, and 10 perithecia.

DNA extraction and sequencing: Total DNA from a small piece of stromata was extracted by using a modified cetyltrimethylammonium bromide (CTAB) extraction kit for plant genome (Aidlab Biotechnologies, Beijing, China) according to the manufacturer's instructions. The internal transcribed spacer (ITS) regions were amplified with the primer pair ITS4/ITS5 (WHITE & al. 1990), using the following procedure: initial denaturation at 98 °C for 5 min, followed by 30 cycles of 95 °C for 1 min, 55 °C for 1 min and 72 °C for 2 min, and a final extension of 72 °C for 10 min. DNA sequencing was performed at BGI tech, Guangzhou, China. Sequences were assembled and edited with the program BioEdit 7.0.5.3(HALL 1999).

Results

Xylaria partita C. G. LLOYD, Mycol. Writings 5: 675, 1917. **(**Fig.1)

S t r o m a t a : upright or prostrate, unbranched, 2–3.5 cm high, long-stipitate; fertile parts 3–10 mm long × 1–1.5 mm broad, nearly conical to cylindrical, scattered clusters, with up to 10 mm long acute sterile apex, surface blackish, with conspicuous perithecial mounds and ostiolar papillae, sometimes overlain with remnants of outermost layer; sterile parts 1.5–2.2 cm long × 0.6–1.5 mm broad, terete to nearly flattened, most often contorted, conspicuously tomentose, arising from a slightly enlarged pannose base, black brown; interior white, solid, woody, texture soft.

P e r i t h e c i a : subglobose, 200–300 µm in diam.

O s t i o l e s : papillate.

A s c i : eight-spored, uniseriate, cylindrical, long-stipitate, (120–)130–170(–185) µm long, the spore-bearing parts (72–)75–80(–82) µm long × (5.0–)5.5–6.0(–6.5) µm wide, the stipes 50–105 µm long, with apical apparatus bluing in MELZER's reagent, urn-shaped, 2.5–3.0 µm high × 2.0–2.5 µm in diam.

A s c o s p o r e s : light brown to brown, unicellular, ellipsoid-inequilateral with narrowly rounded ends, sometimes pinched on one end, smooth, (10–)10.5–12.5(–13.0) × (4–)4.5–5(–5.5) µm, with a conspicuous straight germ slit spore-length.

M a t e r i a l e x a m i n e d : China: Yunnan Province, Jinghong City, Forest Park, on rotten wood, 22. October 2013, HAI XIA MA Col. 49 (FCATAS 613).

Remarks: *Xylaria partita* was originally described and illustrated by C. G. LLOYD (1917) from Puerto Rico. RIO PIEDRAS (LLOYD 1917), and JU & al. (2016) described and verified LLOYD's collections from North America (JU & al. 2016). They were reported with a shorter fertile part, and ascospores 10–12 × 4.5–5.5 µm (JU & al. 2016). The Chinese material grows on rotten wood, which has scattered clusters of fertile parts of stromata, with acute long sterile apices, and conspicuously tomentose stipes. The species resembles *X. arbuscula* SACC. in stromatal gross morphology, but the latter has larger ascospores (12–)13–17(–18) × 4–6 µm and an apical apparatus 3.5–5.5 µm high × 2.5–3 µm wide (MARTÍN & ROGERS 1989). Even though no sequence of the *X. partita* from North America is deposited in GenBank, the Chinese collections

Fig. 2. *Xylaria curta* (HMJAU23989). *a, b* Stromata. *c* Stromatal surface. Bars: a 8.5 mm, b 4 mm, c 0.8 mm.

match well with the original description (LLOYD 1917).

The rDNA- ITS1-5.8S-ITS2-sequence with 589 bps of *X. partita* (MF045812) differs from any known *Xylaria* sequences. Through a Blast search against the sequences in GenBank DNA database, the rDNA-ITS sequence of the species can be compared with 1009 max scores and 98% maximal identities (JX256819, KU940160), and 990 max scores and 98% maximal identities to those of *X. bambusicola* Y. M. JU & J. D. ROGERS (EF026123, GU300088) (JU & ROGERS 1999), respectively. However, *X. bambusicola* can be distinguished from *X. partita* by morphological characters. *X. bambusicola* grows on bamboo culm, and has larger stromata up 9 cm long, short acute sterile apices, and slightly smaller ascospores, 9.5–11(–12.5) × 4–5 µm, sometimes with a tiny hyaline cellular appendage on one end (HSIEH & al. 2010).

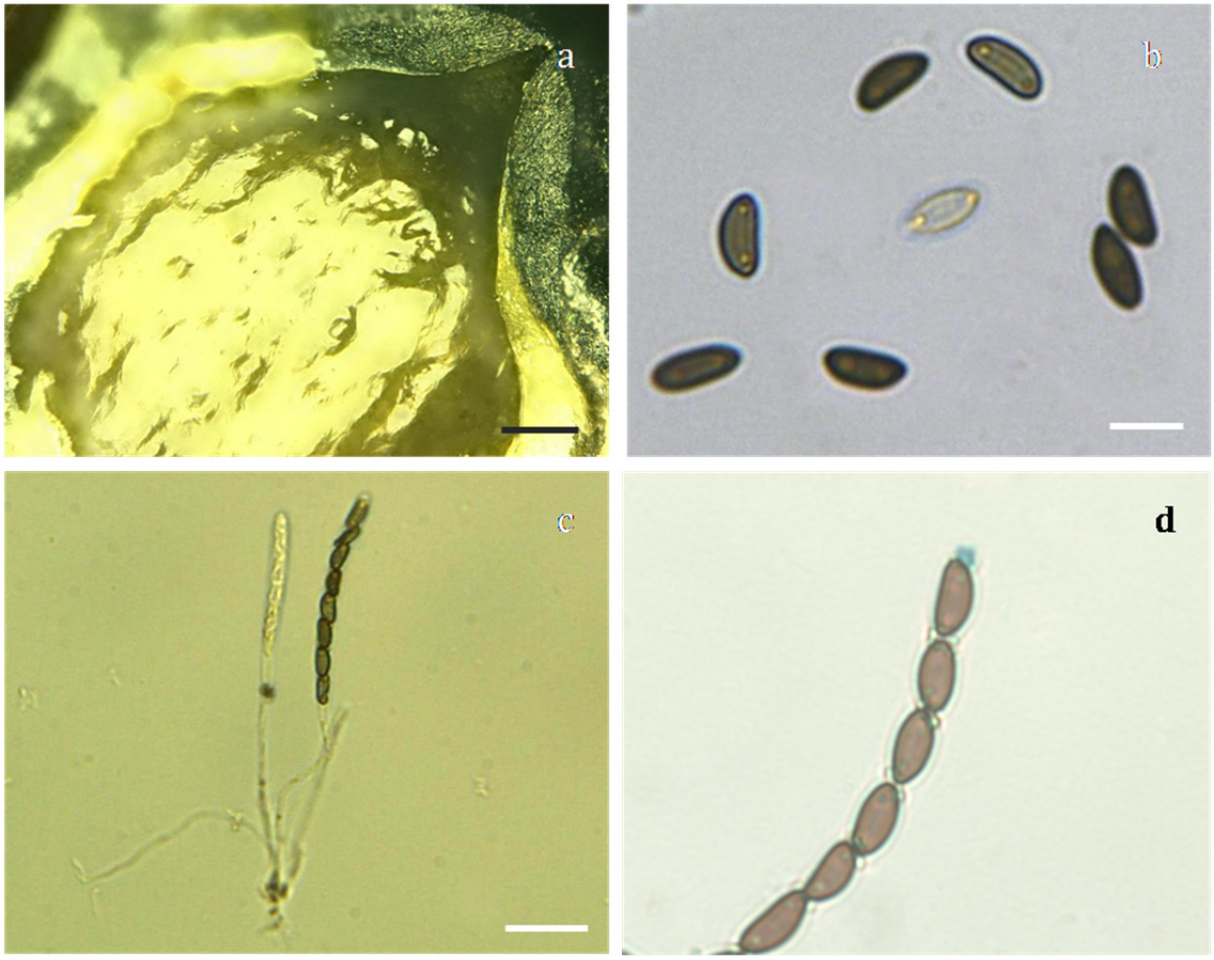

Fig. 3. *Xylaria curta* (HMJAU23989). *a* Perithecia and conic ostiole. *b* Ascospores. *c* Asci. *d* Ascal apical ring. Bars: a 74 µm, b 8 µm; c 25 µm, d 8 µm.

Xylaria curta FR., Nova. Acta Reg. Sci. Upsal. Ser. 3,1:126.1851. (Figs. 2–3)

S t r o m a t a : unbranched or branched, cylindrical-clavate to clavate to flattened-irregular, solitary to several arising from a common base, with rounded fertile apices, on short or obsolete stipes, 1–3 cm long, 3–8 mm in diam.; externally brownish black with whitish to tan sloughing scales, internally white. Texture woody. Surface more or less roughened by wrinkles and scales.

P e r i t h e c i a : subglobose, 0.5–0.7 mm in diam.

O s t i o l e s : fairly conspicuous conical.

A s c i : eight-spored, cylindrical, long-stipitate, 115–135 µm long × 5–7 µm wide, the spore-bearing part (60–)70–75(–80) µm long, with apical ring bluing in MELZER's iodine reagent, inverted hat-shaped, 1–2 µm high × 1.5–2 µm wide.

A s c o s p o r e s : brown, unicellular, ellipsoid-inequilateral, with broadly to narrowly rounded ends, smooth, (9–)9.5–11(–11.5) × 4.5–5.5 µm, with straight germ slit slightly less than spore-length.

M a t e r i a l e x a m i n e d : China: Yunnan Province, Mengla County, Xinshuangbanna Tropical Botanical Garden, on rotten wood, 8. August 2010, HAI–XIA MA (HMJAU22967); 9. August 2010, HAI–XIA MA (HMJAU23989).

Remarks: This species was already known from Yunnan province, China (DENNIS 1961). The Chinese collections fit well the type of this species described by ROGERS (1983) on the basis of specimens collected in USA (ROGERS 1983). It seems to be common on dead wood throughout the tropics, and immature stromata covered with white or cream-colored scales are especially frequent. However, it was not noted and reported by subsequent authors, there are no records in Sylloge Fungi of China and Fungorum Sinicorum (TENG 1963, TAI 1979). Since *X. curta* is somewhat similar to several species of *Xylaria* in stromatal morphology or other features, the names *X. corniformis* (FR.) FR., *X. castorea* BERK. and *X. feejeensis* subsp. *faveolis* (LLOYD) D. HAWKSW. were misapplied to *X. curta*. The differences and relationships of these species have been clarified in detail by ROGERS (1983) and LÆSSØE (1987). The sequence comparison showed that three base pairs divergences existed in the ITS1 rDNA region and one base pair in the ITS2 rDNA region between the Chinese material (HMJAU23989) and a collection from Martinique (GU322444) (HSIEH & al. 2010). These differences are treated as infraspecific variations.

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