New Record of *Xylaria persicaria* on *Liquidambar* Fruits in Korea

Jae-Gu Han and Hyeon-Dong Shin*

*Division of Environmental Science and Ecological Engineering, College of Life Sciences and Biotechnology, Korea University, Seoul 136-701, Korea*

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Some *Xylaria* materials growing on the fruits of *Liquidambar* spp. were collected. They were identified as *X. persicaria* on the basis of morphological characteristics and sequence analysis of the complete ITS region (ITS1-5.8S-ITS2) of rDNA. This is the first record of this species from Korea.

**KEYWORDS:** Identification, ITS, Korea, *Liquidambar*, *Xylaria*

*Xylaria* Hill ex Schrank is one of the largest genera in the Xylariaceae accommodating about 100 species (Kirk *et al.*, 2001). Up to now, only six species, viz. *X. carpophila*, *X. filiformis*, *X. hypoxylon*, *X. longipes*, *X. oxyacanthae* and *X. polymorpha*, have been recorded in Korea (Lee and Lee, 2000).

In the course of mycofloristic investigation, *Xylaria* materials growing on the fruits of *Liquidambar* spp. were found. All collections were air-dried at room temperature and housed in the herbarium of Korea University (KUS). Morphological observation and sequence analysis of ITS rDNA (ITS1-5.8S-ITS2) were performed to identify the *Xylaria* materials. Sequence data used in the present study and their sources were listed in Table 1.

Each specimen was examined in the morphological characteristics of asci, ascospores, paraphyses and other structures of taxonomic value. Melzer’s reagent, cotton-blue in lactic acid and distilled water were used for mounting media of microscopy. Dried materials were rehydrated in 3% aqueous KOH. Photographic works were carried out with the aid of a differential interference contrast microscope (Olympus BX51) equipped with a digital camera (ARC-CM13c).

Extraction of genomic DNA was undertaken according to the method outlined by Lee and Tayler (1990). The complete ITS rDNA regions were amplified by PCR using primers ITS1 and ITS4 (White *et al.*, 1990). The success of the amplification was monitored by electrophoresis on 1% agarose gels, and purified using a QIAquick gel extraction kit (Qiagen, Hilden, Germany). Purified DNAs were directly sequenced on an automatic sequencer (ABI Prism TM 377 DNA Sequencer), with primers identical for PCR.

Sequences were introduced and edited with DNASTar (DNASTar, Inc., Madison, Wis.). Phylogenetic analysis was performed according to the neighbor-joining (NJ) method in PAUP* ver. 4b10 and relative robustness of the branches was estimated by bootstrapping using 1000 replications. *Daldinia concentrica* (AF163021), member of the Xylariaceae was selected as outgroup.

### Results and Discussion

According to the morphological observation the fungus collected on the *Liquidambar* fruits was determined as *Xylaria persicaria* (Schwein.) Berk. & M. A. Curtis, that was characterized by its ascospores with a long spiral ger-
mination slit and ecological habit. Since Schweinitz (1822) originally described *Sphaeria persicaria* (= *X. persicaria*) as an inhabitant of buried peach seeds, it has been more frequently collected on *Liquidambar* fruits (Rogers, 1979; San Martin and Rogers, 1989). *Xylaria carpophila* (Pers.) Fr. is externally similar to the present species, but it has ascospores with a straight germination slit and occurs on fallen *Fagus* fruits (Rogers, 1979).

In phylogenetic tree inferred from NJ method, our materials formed a segregated clade with *X. persicaria* (AY909021) and this grouping was supported by high bootstrap value of 100% (Fig. 2). Phylogenetic relationship of some *Xylaria* spp. was studied by Lee et al. (2000), in which *Xylaria* spp. were classified into three groups based on the morphological and molecular similarity, viz. *X. apiculata*, *X. arbascula* and *X. mali* in Group A; *X. acuta*, *X. castorea*, *X. cornu-damae*, *X. enteroleuca*, *X. fioriana* and *X. longipes*, in Group B; *X. hypoxylon* and *X. polymorpha* in Group C. *X. persicaria* clade was nested in the Group A with 57% bootstrap supporting in NJ analysis. But morphological common features of Group A such as a straight germ slit of ascospores were not observed in our materials.

Seed and fruit inhabiting *Xylaria* species have been generally reported to be highly host-specific. Rogers et al. (2002) separated *Xylaria* on *Liquidambar* fruit from *X. persicaria* and proposed a new species *X. liquidambaris* J. D. Rogers, Y. M. Ju & F. San Martin. However, They did not provided appreciable morphological differences between *X. liquidambaris* and *X. persicaria* because the type specimen of the latter was immature (Ellis and Everhart, 1892) and lacking ascospores (Rogers et al., 2002). The validation of *X. liquidambaris* remains uncertain until further morphological and molecular work is carried out. We decided the Korean materials to place in *X. persicaria* (Schwein.) Berk. & M. A. Curtis, non Rogers et al. (2002).

**Description**

*Xylaria persicaria* (Schwein.) Berk. & M. A. Curtis, *Pungnamukongggoturibeoseot* (Fig. 1).

Stromata erect, up to 9 cm high, exterior black to brownish black, solid, divided into fertile head and sterile stalk. Head parts clavate to cylindric-clavate, 0.4~2.8 cm high and 0.1~0.3 cm wide, with longitudinally fine wrinkles, apex commonly pointed like a needle. Stalk parts irregularly twisted and crooked, often thickened toward the base, glabrous to pubescent, somewhat flattened on one side, deeply furrowed in longitudinal direction, 0.5~3.0 cm high, concolorous or paler than head parts, occasionally branched. Perithecia embedded in a stroma, black. Interior flesh white. Growing singly or in clusters. Asci 8-
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spored, cylindrical, long stipitate, hyaline, apical pore blue in Melzer’s reagent, 135–150 × 5–6 µm. Ascospores elliptical to bean-shaped, commonly flatten on one side, with spiraling germination slit, uniseriate, hyaline when immature stage, becoming dark brown with one distinct oil-drop, 12–15 × 4–6 µm. Paraphyses cylindrical, hyaline, abundant.

**Distribution:** Florida, USA (Rogers et al., 2002), Mexico (Rogers, 1979; San Martin and Rogers, 1989), China (Rogers, 1979), and Korea.

**Specimens examined:** Korea, Namhae, Mt. Geumsan, 3 Jun 2004, on the fruits of *Liquidambar styraciflua* (KUS-F50693) and *L. formosana* (KUS-F50694); Korea, Jinju, Gajwa Arboretum, 17 Oct 2004, on the fruits of *L. styraciflua* (KUS-F50748) and *L. formosana* (KUS-F50749); Korea, Jinju, Gajwa Arboretum, 29 Jun 2006, on the fruits of *L. formosana* (KUS-F51475).

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