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NEW DISEASE REPORT

Rust on *Hosta longipes* caused by *Puccinia oncospora* in Korea

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Hosta longipes (Liliaceae), widely distributed throughout Korea, China, Japan, and eastern Russia, is one of the most popular ornamental perennials in public and private gardens. In Korea, this species has long been used as a traditional medicine for the treatment of coughs, phlegm, burns, swelling and asthma (Kim *et al.*, 2014), and its young leaves are also consumed as a salad vegetable. In June 2016, rust disease was observed on *H. longipes* plants growing naturally around a stream at Mount Gongjaksan in Hongcheon-gun, Korea (Fig. 1). The disease incidence rate was c. 10%. Symptoms appeared as yellowish, round, chlorotic spots on the upper surface of the infected leaves (Fig. 2) and yellow to orange-coloured aecia on the corresponding lower surface and petiole (Fig. 3). After the first findings, the same disease was observed in 2017, 2019 and 2020. Herbarium specimens of infected material were deposited in the Korea University Herbarium (Accession Nos. KUS-F29182, F29810, F30967, and F31685).

Leaves affected by the rust infection were examined under a dissecting microscope (M205C; Leica, Germany), a DIC microscope (Axio Imager 2; Carl Zeiss, Germany), and a scanning electron microscope (S-4800+EDS; Hitachi, Japan). Spermogonia were mostly epiphyllous but rarely hypophyllous, densely grouped, pale brown, and subepidermal. Aecia were hypophyllous, often densely grouped, yellow, cupulate with peridia, and 196–300 μm in diameter (Fig. 4). Aeciospores were hyaline, globose to subglobose, angular, and (20.2-)22.0-24.9(-27.4) × (17.0-)19.6-22.5(-24.2) μm (mean 23.4 × 21.0 μm) (Fig. 5). Aeciospore wall was densely verrucose and 0.6-1.6 μm (mean 1.0 μm) in thickness (Fig. 6). Uredinial and telial stages were not observed. These morphological characteristics were consistent with those of *Puccinia oncospora* (Ji *et al.*, 2022).



FIGURE 1 Rust symptoms caused by *Puccinia oncospora* on *Hosta longipes*.

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FIGURE 2 Yellow to whitish leaf spots (A) and small, brownish spermogonia (B) of *Puccinia oncospora* on the upper leaf surface of *Hosta longipes*.



FIGURE 3 Aecia of *Puccinia oncospora* on the lower leaf surface of *Hosta longipes*.

To confirm the morphology-based identification, genomic DNA was extracted from four specimens using a MagListo 5M plant Genomic DNA Extraction Kit (Bioneer, Korea). Two ribosomal DNA regions were amplified: the internal transcribed spacer (ITS) with primers ITS5u and ITS4rust (Pfunder *et al*., 2001) and the large subunit (LSU) rDNA with primers LRust1R and LRust3 (Beenken *et al*., 2012). The resulting sequences were deposited in GenBank (Accession Nos. OQ061206-9 for ITS and OQ073721-4 for LSU) and compared to other reference

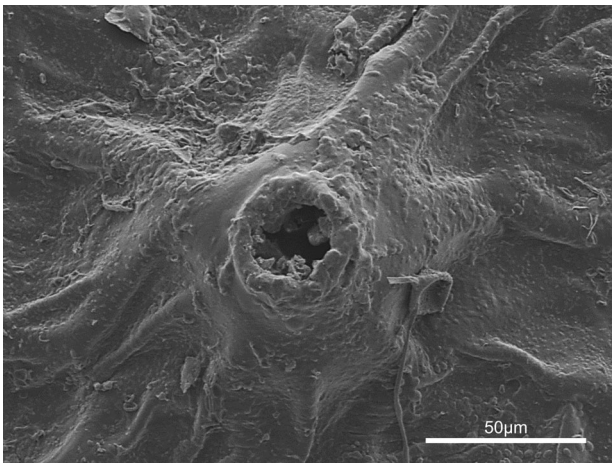


FIGURE 4 Spermogonium of *Puccinia oncospora* on *Hosta longipes* leaf under a scanning electron microscope.

sequences using BLASTn. The ITS sequences of Korean specimens were identical to those of *P. oncospora* ex *Trillium kamtschaticum* and *Phalaris arundinacea* for ITS (MW404821-5) and LSU sequences (MW404981-5). In maximum-likelihood phylogenetic trees for ITS (Fig. 7A) and LSU (Fig. 7B) sequences, the Korean samples were grouped with the reference sequences of *P. oncospora* with high bootstrap supporting values of 93% in ITS and 96% in LSU.

Puccinia oncospora is a recently described rust species that is so far only known from China, where it completes its life cycle by forming an aecial stage on *Trillium kamtschaticum* (Melanthiaceae, previously Liliaceae) and a telial stage on *Phalaris arundinacea* (Poaceae; Ji *et al.*, 2022). So far, three species of *Puccinia* have been recorded on *Hosta longipes*, namely, *P. funkiae*, *P. hemerocallidis*, and *P. majanthemi* (Hiratsuka & Sato, 1951; Farr & Rossman, 2022). Also, a species complex *P. sessilis* was considered parasitic on *H. longipes* (Hiratsuka & Sato, 1951), but it is phylogenetically and morphologically distinguishable from *P. oncospora*. To our knowledge, this is the first record of rust disease on *Hosta longipes* and this rust pathogen in Korea. As there have been no records of rust on *P. arundinacea*, a telial host plant of *P. oncospora*, in Korea, finding an alternative host for that rust is necessary to develop effective control measures.

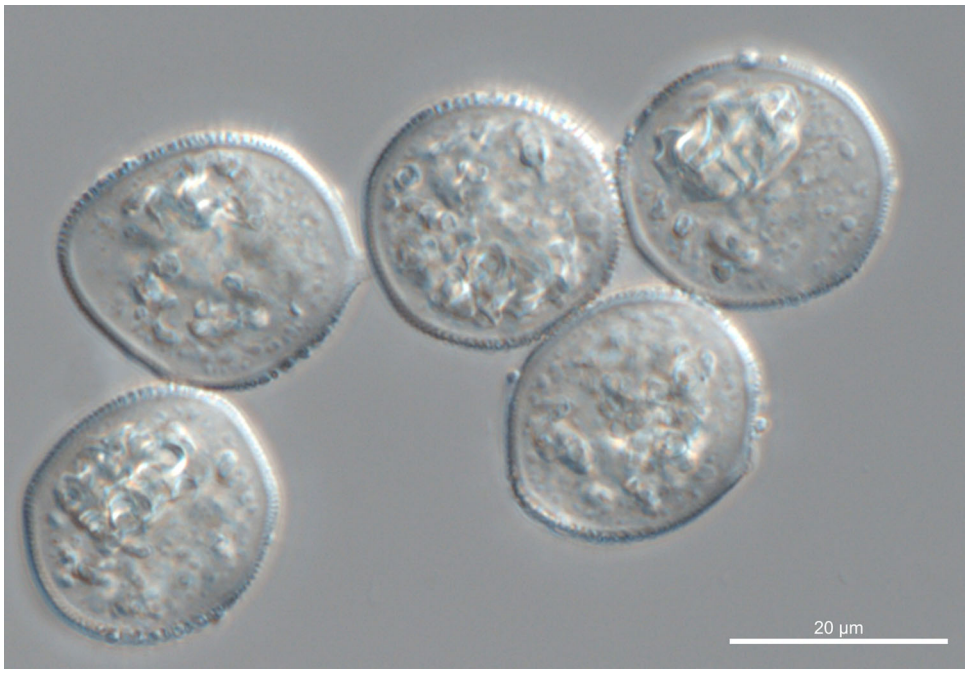


FIGURE 5 Aeciospores of *Puccinia oncospora* from *Hosta longipes* leaf under a DIC light microscope.

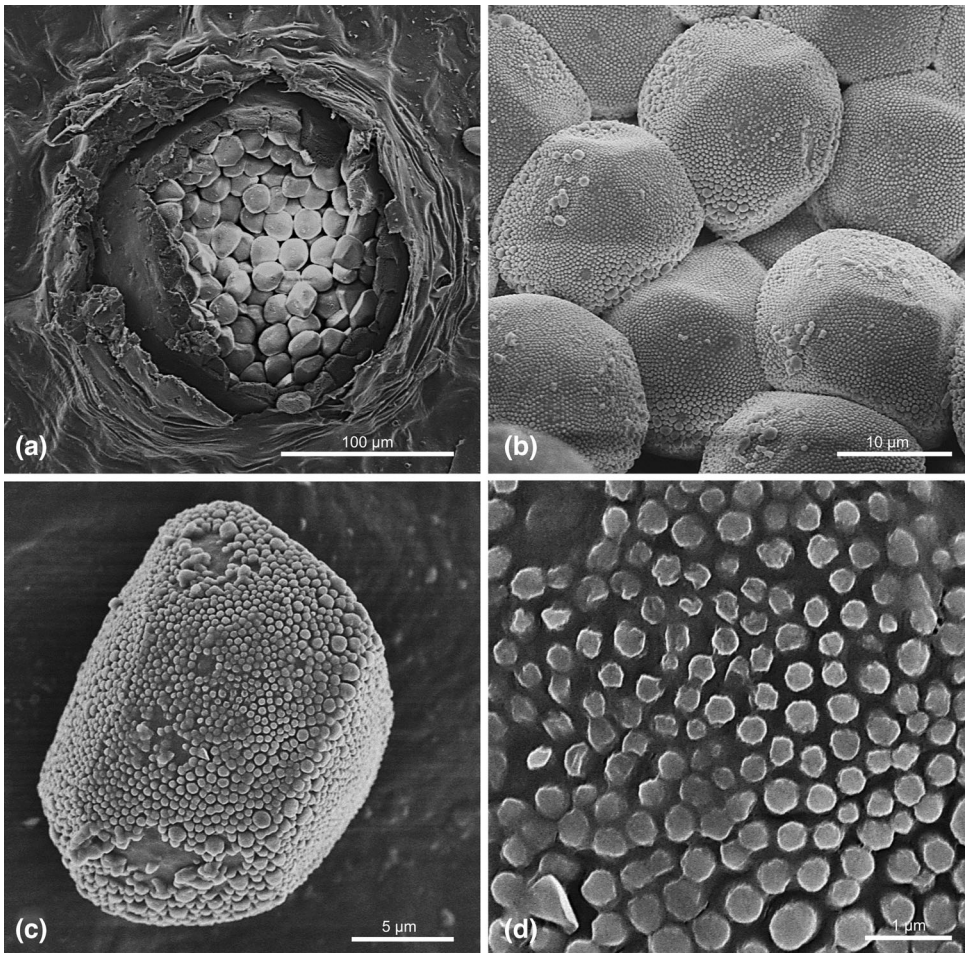


FIGURE 6 Aecia and aeciospores of *Puccinia oncospora* on *Hosta longipes* under a scanning electron microscope. (A) aecium, (B) aeciospores in a group, (C) aeciospore, and (D) densely verrucose wall surface of aeciospore.

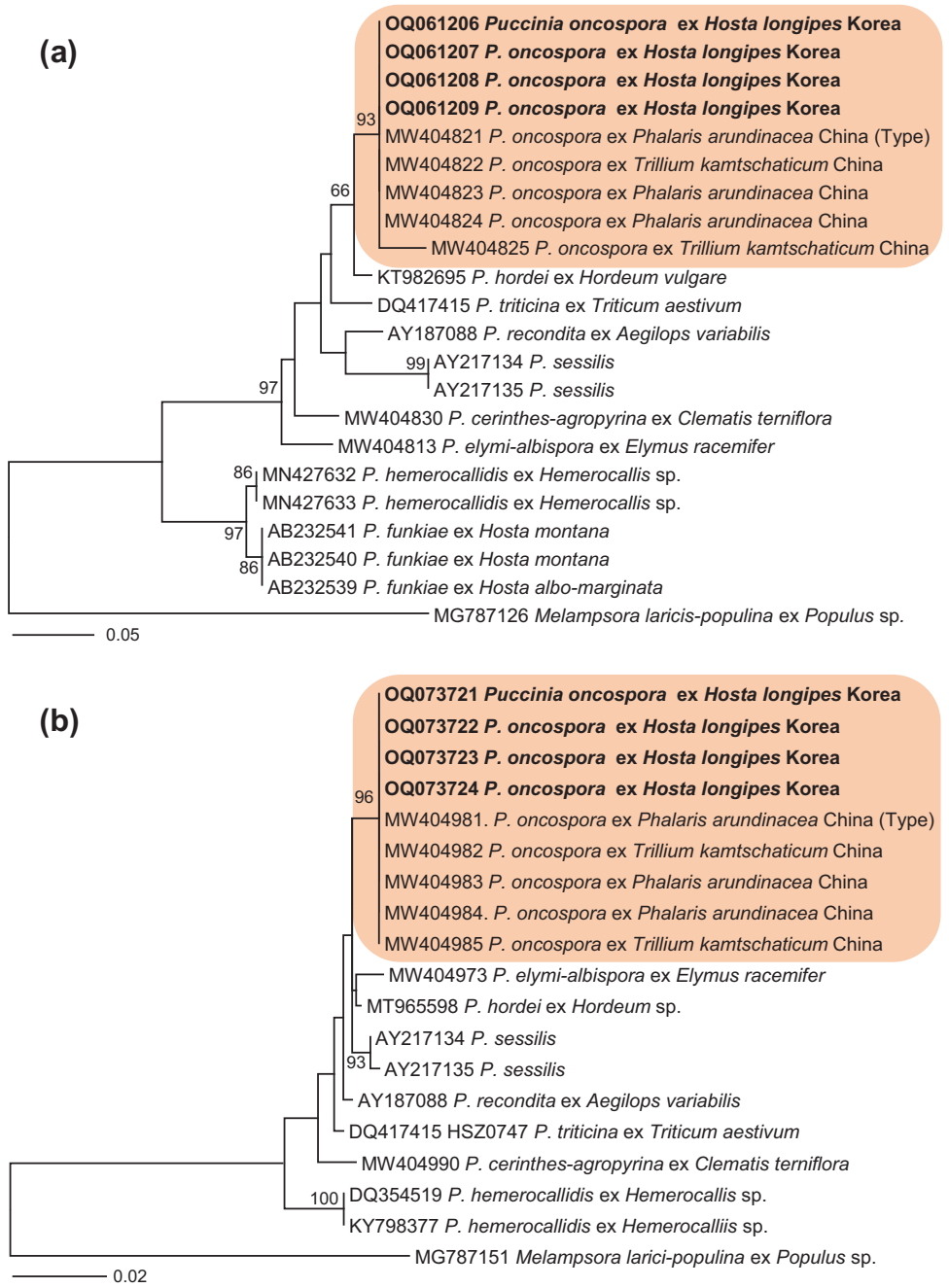


FIGURE 7 Phylogenetic trees between *Puccinia oncospora* and related rust fungi retrieved from GenBank, inferred by the maximum-likelihood method with the ITS (A) and LSU (B) rDNA sequences. Bootstrap values based on 1,000 replications are indicated at the branches. The Korean specimens used in the present study are shown in bold.

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