Powdery Mildew of *Rudbeckia hirta* var. *pulcherrima* Caused by *Podosphaera fusca*

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(Received on March 24, 2010; Accepted on May 11, 2010)

Rudbeckia hirta var. *pulcherrima* (syn. *R. bicolor*, *R. serotina*), commonly known as “black-eyed Susan”, is a flowering plant belonging to the Asteraceae. The plant is native to North America and was introduced to Korea for ornamental purposes in the 1950s; it is now naturalized and can be found growing wild here. In September 2009, occurrence of a previously unknown powdery mildew was observed on the plants in a public park and also in a private garden in Ganghwa, Korea. The leaf surfaces of affected plants were covered with white mycelia and conidia, occasionally having a necrotic center. Leaf distortions, which often result from these infections, reduce the ornamental value of this plant. Symptoms were also observed on stems and flower petals (Fig. 1A & B). Around 30% of the plants surveyed were affected by the disease. In November 2009, plants with symptoms were also found in Namyangju and Jeju, Korea. Representative samples (KUS-F24604, F24863, F24869) were deposited in Korea University.

Detailed microscopic examination of a representative sample (KUS-F24869) was made to identify the pathogen. Conidiophores were unbranched, cylindrical, 80–180×9–11(–13) μm, composed of a basal cell with a slightly constricted base and three to eight barrel-shaped conidia formed in chains (Fig. 1C). Appressoria were poorly developed, indistinct and nipple-shaped. Conidia were ellipsoid or doliiiform, 24–36×15–20 μm, containing distinct fibrosin bodies (Fig. 1D). No chasmothecia were found but the above characteristics are still consistent with *Podosphaera fusca* (Fr.) U. Braun & Shishkoff [syn. *Sphaerotheca fusca* (Fr.) S. Blumer] (Braun, 1987).

Fig. 1. Powdery mildew infections of *Rudbeckia hirta* var. *pulcherrima* caused by *Podosphaera fusca*. Symptoms on young leaves and stems (A) and a flower petal (B). Conidiophore (C) and conidia (D) containing conspicuous fibrosin bodies. Bar=50 μm.

To confirm the identity of the causal fungus, the complete ITS region of rDNA from KUS-F24869 was amplified with primers ITS5 and P3, as described by Takamatsu et al. (2009), and directly sequenced. The resulting sequence, of 477 bp, was deposited in GenBank, with the accession number of HM004615. MEGA4 with neighbor-joining method (using Tajima-Nei model) was used to perform phylogenetic analysis. In the phylogenetic tree (Fig. 2), the ITS sequence of the fungus infecting *R. hirta* var. *pulcherrima* was grouped with those of three isolates of *P. fusca* retrieved from GenBank. The present isolate shared 100% sequence similarity with those of *P. fusca* from *Lactuca indica* and *Tussilago farfara*, and 99% (1 bp substitution and 2 bp insertion) with a Japanese isolate from *R. hirta* var. *pulcherrima*.

Fig. 2. Phylogenetic relationship between *Podosphaera fusca* on *Rudbeckia hirta* var. *pulcherrima* and some reference isolates retrieved from GenBank, inferred by neighbor-joining method using the ITS rDNA region. Numbers above the branches represent the bootstrap values. Bar = Number of nucleotide substitutions per site.

Powdery mildew infections with *Golovinomyces cichoracearum* (syn. *Erysiphe cichoracearum*) have been recorded on several species of *Rudbeckia* from many countries (Farr and Rossman, 2010). However, powdery mildew infections with *P. fusca* (syn. *P. fuliginea*) were recorded on *R. laciniata* var. *hortensis* from Japan and on *R. amplexicaulis* from Romania (Farr and Rossman, 2010). Hirata et al. (2000) provided the first evidence that *P. fusca* is associated with *R. hirta* var. *pulcherrima*, by analyzing the ITS sequence of a Japanese isolate. The present work confirms this host-parasite combination, by providing consistent morphological and molecular data.

References

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