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Damping-off of Edible Aster Caused by *Rhizoctonia solani* AG-4

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In August 2021, we surveyed diseases of wild vegetables grown in Taebaek, Gangwon Province, Korea. During the disease survey, we observed severe damping-off symptoms in young edible aster (*Aster scaber*) plants in a vinyl greenhouse investigated. The incidence of the disease in the plants ranged from 5% to 20%. Diseased plants of edible aster were collected from the vinyl greenhouse, and fungi were isolated from petiole lesions of the diseased plants. *Rhizoctonia* sp. was consistently isolated from the petiole lesions. We examined morphological characteristics and anastomosis groups of nine *Rhizoctonia* sp. isolates obtained from the petiole lesions. The examination results revealed that all the isolates corresponded to *Rhizoctonia solani* AG-4 based on the morphological characteristics and anastomosis test. Three isolates of *R. solani* AG-4 were tested for their pathogenicity on edible aster plants by artificial inoculation. Inoculation tests showed that the tested isolates caused damping-off symptoms on the inoculated plants. The induced symptoms were similar to those observed in the vinyl greenhouse investigated. Damping-off of edible aster caused by *R. solani* AG-4 is first reported in this study.

Keywords: Anastomosis, Damping-off, Edible aster, *Rhizoctonia solani* AG-4

Edible aster (*Aster scaber*) is a perennial belonging to the family Asteraceae. It grows primarily in the temperate biomes and is distributed in China, Korea, Japan, Inner Mongolia, and Russian Far East (Plants of the World Online, 2022). In Korea, the plant is cultivated as a wild vegetable and used as a vegetable dish. In August 2021, we surveyed diseases of wild vegetables grown in Taebaek, Gangwon Province, Korea. During the disease survey, we observed severe damping-off symptoms in young edible aster (*Aster scaber*) plants in a vinyl greenhouse investigated. The disease symptoms initially appeared on the petioles of the plants at the soil line. The infected plant parts turned softened and rotted showing brown to dark brown in color. Diseased plants wilted and later blighted (Fig. 1A, B). Five sites were observed in the vinyl greenhouse, and 100 plants at each site were investigated for the disease occurrence. The incidence of the disease in the plants ranged from 5% to 20%.

Diseased plants of edible aster were collected from the vinyl greenhouse, and fungi were isolated from petiole lesions. The petiole lesions were cut in to 3–5 mm-long pieces and plated on 2% water agar (WA) after surface-sterilizing with 1% sodium hypochlorite solution for one min. The WA plates were incubated at 25°C for 1–2 days, and fungal mycelia grown from the lesion pieces were transferred to potato dextrose agar (PDA) slants. Nine fungal isolates were obtained from the petiole lesions and used for identification. Morphological characteristics of the isolates were examined as previously described (Kim et al., 2022). Young vegetative hyphae branched near the distal septa of the hyphal cells. Hyphae were constricted at the points of hyphal branches, and septa were formed at a short distance from the points of hyphal branches. The isolates did not produce conidia and clamp

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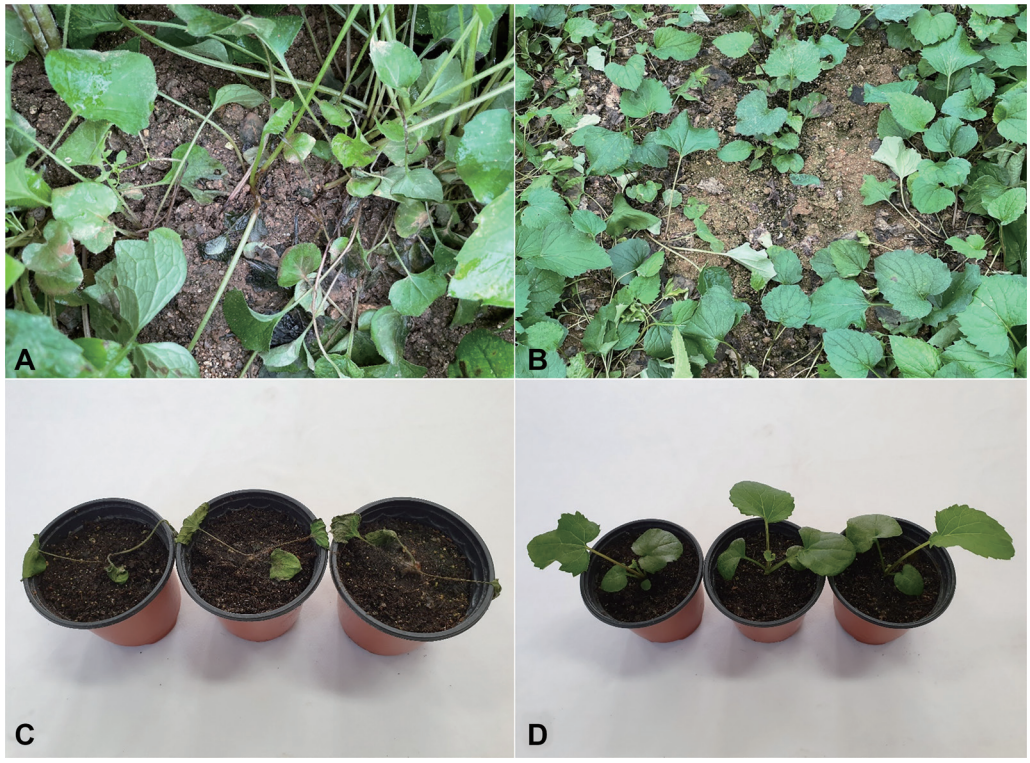

Fig. 1. Damping-off of edible aster plants. (A, B) Symptoms observed in the vinyl greenhouse investigated. (C) Symptoms induced by artificial inoculation tests with *Rhizoctonia solani* AG-4 isolates. (D) Non-inoculated plants (control).

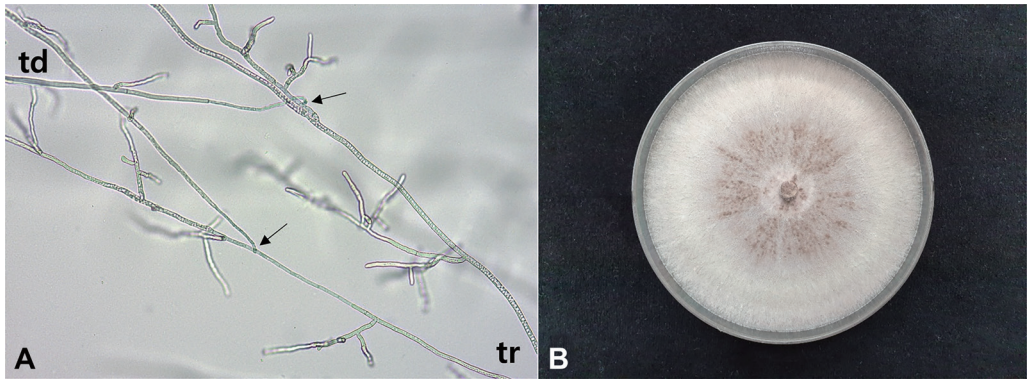

Fig. 2. Anastomosis test of *Rhizoctonia solani* isolate from edible aster and cultural appearance of the isolate. (A) Anastomosis reactions between the tested isolate (td) and the tester isolate (tr) of *R. solani* AG-4. The arrows indicate points of hyphal anastomosis. (B) A colony of *R. solani* AG-4 isolate grown on potato dextrose agar at 25°C for 10 days.

connections on hyphae. The morphological characteristics were identical to those of *Rhizoctonia solani* Kühn described in previous studies (Parmeter and Whitney, 1970; Sneh et al., 1991).

Anastomosis groups of the *R. solani* isolates were examined using tester isolates of *R. solani* (AG-1 through AG-5), as previously described (Kim et al., 1994, 2022). All the tested isolates anastomosed with the tester isolate of *R. solani* AG-4. The anastomosed cells of the tested isolate and the tester isolate showed killing reactions (Fig. 2A). The colony of the isolates cultured on PDA displayed whitish light brown in color (Fig. 2B). Sclerotia were absent or rarely formed on the medium.

Three isolates of *R. solani* AG-4 were tested for pathogenicity on young plants of edible aster using artificial inoculation, as previously described (Kim, 1996). Mycelial disks of 6 mm in diameter from each isolate grown on PDA were placed on petioles at the soil surface level of 40-day-old edible as-

ter plants that were grown in circular plastic pots (height, 9 cm; upper diameter, 10 cm; lower diameter, 7 cm) in a vinyl greenhouse. Plastic boxes (60 cm×43 cm×33 cm) were used to maintain a relative humidity of 100% at room temperature (24–26°C). The inoculated plant pots were placed in the plastic boxes for 2 days, then taken out of the plastic boxes and placed indoors. The inoculation test was performed in triplicate, and the result of inoculation tests was investigated 5 days after inoculation. Inoculation tests showed that the tested isolates cause damping-off symptoms in the inoculated plants (Fig. 1C), but no symptoms were produced in the non-inoculated plants (Fig. 1D). The induced symptoms were similar to those observed in the vinyl greenhouse investigated. Re-isolation of the inoculated isolates from the lesions was confirmed,

R. solani has very wide range of host plants, and its anastomosis groups have different genetic and pathological characteristics (Sneh et al., 1991). It has been reported that *R. solani* AG-4 causes various diseases such as damping-off, stem rot, leaf rot, root rot, bottom rot, etc. in many crops (Kim, 1996). However, there has been no report on damping-off of edible aster caused by the fungal anastomosis group. Damping-off of edible aster caused by *R. solani* AG-4 is first reported in this study.

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

Acknowledgments

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