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RESEARCH NOTE

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

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ABSTRACT

Damping-off symptoms were frequently observed on young plants of edible amaranth (*Amaranthus mangostanus*) grown in vinyl greenhouses by farmers located in Goyang and Yangpyeong in Korea during disease surveys carried out in 2019 and 2020. The incidence of the disease was 1−20%. A total of eight isolates of *Rhizoctonia* sp. were obtained from the stems of the diseased plants. All the isolates were identified as *Rhizoctonia solani* AG-4, based on the morphological characteristics and anastomosis test. Three isolates of *R. solani* AG-4 were tested for pathogenicity on edible amaranth by artificial inoculation. All the tested isolates of *R. solani* AG-4 induced damping-off symptoms on the inoculated plants; these symptoms were similar to those observed on the vinyl greenhouse plants surveyed. This is the first report of *R. solani* AG-4 causing damping-off in edible amaranth.

Keywords: anastomosis group, damping-off, edible amaranth, pathogenicity, *Rhizoctonia solani*

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Edible amaranth (*Amaranthus mangostanus* L.) is grown in the oriental countries as a vegetable crop. The crop is mostly cultivated in vinyl greenhouses in Korea. Damping-off symptoms were frequently observed on young plants of edible amaranth grown in vinyl greenhouses by farmers located in Goyang and Yangpyeong in Korea during disease surveys carried out in 2019 and 2020. The symptoms began on the soil surface parts of the plant stems. The infected parts of the stems receded and became thin, discolored and rotten. Diseased plants fell down and were wholly blighted (Fig. 1A and B). The incidence of the disease was 1−20% in the vinyl greenhouses investigated during the disease surveys (Table 1).

Rhizoctonia sp. was frequently isolated from the diseased plants of edible amaranth. A total of eight isolates of *Rhizoctonia* sp. were obtained from the stems of the diseased plants. All the isolates were identified as *Rhizoctonia solani* Kühn based on the morphological characteristics according to the descriptions of previous workers [1,2]. The isolates were tested to classify anastomosis groups using tester isolates of *R. solani* as previously conducted [3]. The tester isolates of *R. solani*, AG-1 (KACC 40101), AG-2-1 (KACC 40119), AG-2-2 (40125), AG-3 (KACC 40138), AG-4 (KACC 40139) and AG-5 (KACC 40146) were obtained from Agricultural Microbiology Division, National Institute of Agricultural Sciences

in Korea. All the tested isolates were classified as *R. solani* AG-4. Anastomosis reactions between an isolate and tester isolate of *R. solani* AG-4 were shown in Fig. 1C. The cultural appearance of *R. solani* AG-4 isolate is shown in Fig. 1D.

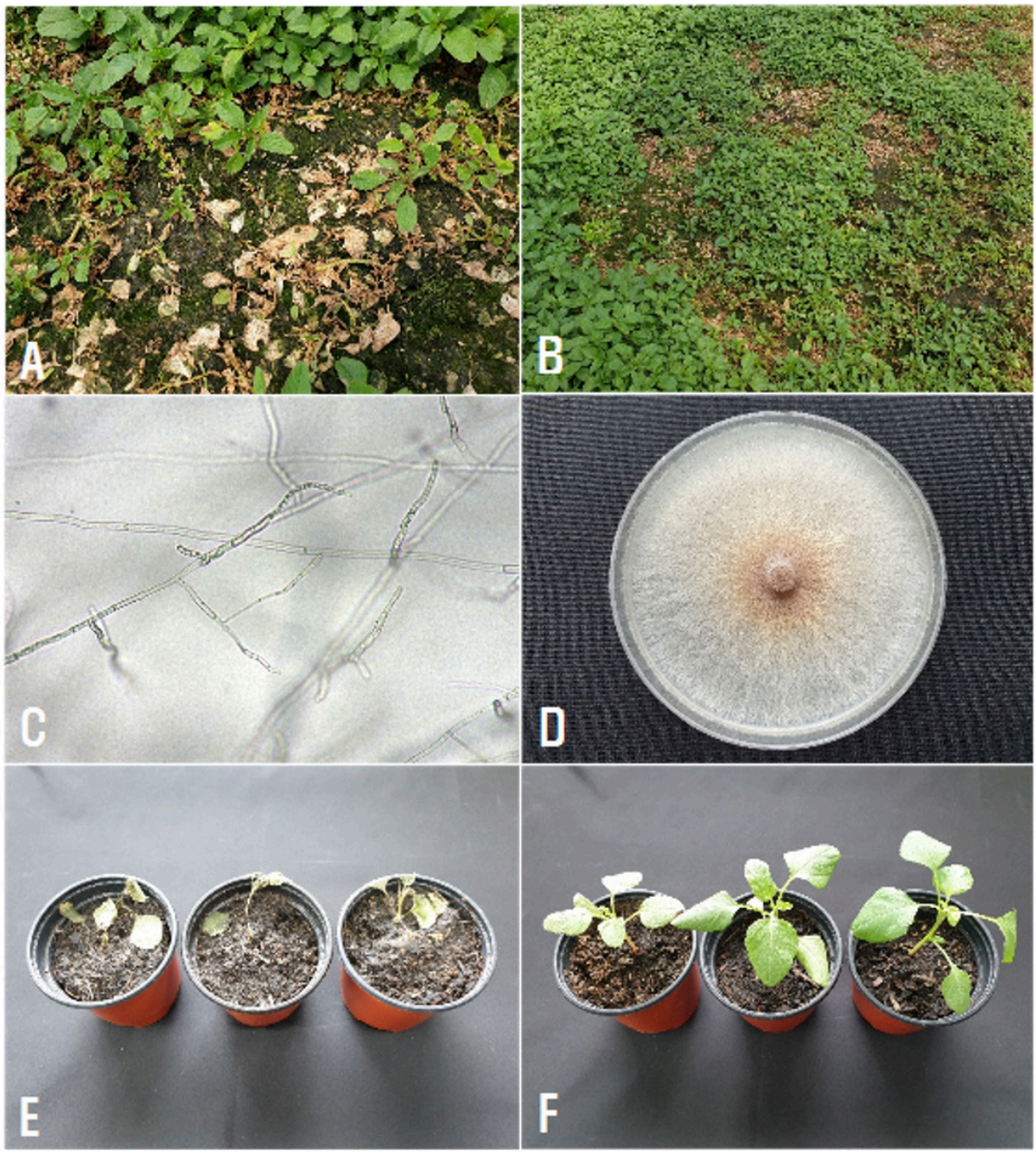

Fig. 1. Damping-off symptoms of edible amaranth and identification of the causal fungus, *Rhizoctonia solani* AG-4. A and B, damping-off symptoms on edible amaranth plants observed in the vinyl greenhouse; C, anastomosis reactions between an isolate and tester isolate of *R. solani* AG-4; D, a colony of *R. solani* AG-4 isolate grown on PDA at 25℃ for 10 days; E, damping-off symptoms induced by artificial inoculation tests with *R. solani* AG-4 isolates. F, non-inoculated plants (control).

Table 1. Occurrence of damping-off of edible amaranth in vinyl greenhouses of farmers located in Goyang and Yangpyeong in Korea in 2019 and 2020.

Location investigated	Period investigated	No. of vinyl greenhouses investigated	No. of vinyl greenhouses with disease	% diseased plants[a]
Goyang	May, 2019	4	2	1-10
Yangpyeong	May, 2019	12	12	1-10
	April, 2020	16	16	1-20

[a]One hundred plants in each vinyl greenhouse were investigated with three replicates.

Three isolates of *R. solani* AG-4 were tested for pathogenicity on edible amaranth by artificial inoculation. Mycelial disks of 6 mm in diameter cut from the margins of actively growing cultures of each isolate on potato dextrose agar (PDA) were placed on stem bases of 25-day-old edible amaranth plants grown in circular plastic pots (9 ㎝ in height, 10 ㎝ in upper diameter and 7 ㎝ in lower diameter) in the vinyl greenhouse. Inoculated plant pots were placed in plastic boxes (60×43×33 ㎝) with 100% relative humidity at room temperature (24-26°C) for three days. After that, the inoculated plant pots were taken out of the boxes and then kept indoors. Virulence of the isolates was rated based on the degree of damping-off symptoms induced at five days after inoculation. The inoculation test was performed with three replicates.

All the tested isolates of *R. solani* AG-4 induced damping-off symptoms on the inoculated plants (Fig. 1E). There was no symptom on the control plants (Fig. 1F). The symptoms on the plants induced by artificial inoculation were similar to those observed on the vinyl greenhouse plants surveyed. The isolates which induced symptoms on the plants were re-isolated from the symptoms.

R. solani was reported to cause damping-off in many crops [4-6]. Yang et al. [7] reported that *R. solani* AG-4HG-III causes stem canker and wirestem on green amaranth (*Amaranthus viridis* L.) and Chinese amaranth (*Amaranthus tricolor* L.). However, there has been no report on damping-off of edible amaranth caused by *R. solani*. This is the first report of *R. solani* AG-4 causing damping-off in edible amaranth.

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