New Disease Reports

First report of *Rhizoctonia solani* AG-1 IC causing head rot of cabbage in Japan

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In the summer of 2015, mature cabbage (*Brassica oleracea* var. *capitata*) plants showing head rot symptoms were found in Hokkaido, the northernmost island of Japan. Diseased plants had wet decay at the base of the outer leaves. Lesions then expanded to cover the entire head (Fig. 1). Approximately 10% of plants were affected.

Leaves with symptoms were surface-sterilised and incubated on potato dextrose agar (PDA) containing streptomycin. *Rhizoctonia*-like fungi were frequently recovered. A pure culture designated isolate CMA1 was obtained. Hyphae of the isolate were 7.6-11.4 µm wide with 3-15 nuclei per cell. Using isolates belonging to *Rhizoctonia solani* anastomosis groups (AGs) 1-5, isolate CMA1 anastomosed with isolate AG-1. A three-week-old PDA culture of the isolate was pale brown in colour. Dark brown sclerotia, c. 1 mm in diameter, formed on the surface (Fig. 2) and were similar in appearance to that of *R. solani* AG-1 IC (Hyakumachi & Sumino, 1984). PCR using specific primers for detection of *R. solani* AG-1 IA, IB, and IC (Kuninaga, 2003) was conducted. Only AG-1 IC-specific primers produced a PCR product 550 bp long from DNA of isolate CMA1 (Fig. 3). The amplicon was sequenced and the sequence (GenBank Accession No. LC325492) was identical with that of AG-1 IC (JX499037), indicating that the isolate belongs to AG-1 IC.

AG-1 IC isolates are known as a damping-off pathogen of various crops (Hyakumachi & Sumino, 1984); therefore, the pathogenicity of isolate CMA1 on mature cabbage plants grown in 1/5,000-a Wagner pots for two months and cabbage seedlings grown in 7 cm diameter pots for two weeks were compared with that of two AG-1 IC reference isolates, i.e., damping-off pathogens of carrot (isolate RD1) and broccoli (isolate BR1). Wheat bran culture incubated at 25°C for 10 days was used as the inoculum. The growing media of mature plants and seedlings were infested with each isolate by placing 3 g and 1 g of inoculum, respectively, on the surface of the media. To facilitate disease development, a pot with a mature plant was filled 5 cm above the soil line with additional soil. Sterilised wheat bran served as the control. Inoculated plants were grown in a greenhouse with average temperatures of 25.3°C (mature plants) and 26.1°C (seedlings). Each inoculation test consisted of replicate pots of three mature plants or five seedlings. Isolate CMA1 and the two reference isolates showed head rot and basal rot of outer leaves on all three inoculated mature plants 30 days after inoculation (Fig. 4). One of the five seedlings inoculated with isolate CMA1 showed damping-off with wilt symptoms and the other four seedlings showed basal stem rot without wilt symptoms 12 days after inoculation (Fig. 5a). Three of the five seedlings inoculated with isolate RD1 and four of the five seedlings inoculated with isolate BR1 showed damping-off with wilt symptoms (Fig. 5b, c). Control plants remained healthy. The causal agents were re-isolated and Koch's postulates were fulfilled.

Although *R. solani* AG-1 IB and AG-2-1 have been reported as pathogens causing cabbage head rot in Japan (Hoshi *et al*., 1997), this is the first report of AG-1 IC causing head rot of cabbage. Here, we demonstrated that three AG-1 IC isolates infected mature cabbage plants as well as cabbage seedlings. The isolate CMA1 was deposited in the NIAS Genebank, National Institute of Agrobiological Sciences as MAFF245727.

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Figure 1

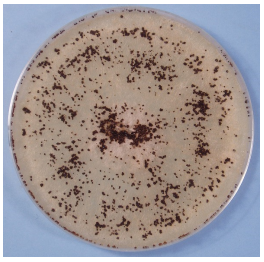

Figure 2

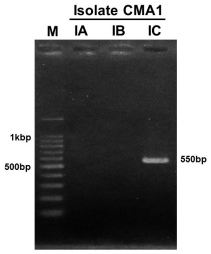

Figure 3

Figure 4

Figure 5

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