Diseases Caused by Fungi and Fungus-Like Organisms

First Report of *Rhizoctonia solani* AG 1-IG Causing Root Rot and Stem Canker of Kale in Taiwan

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In July 2018, characteristic *Rhizoctonia* symptoms, root rot and stem canker, occurred severely on kale (*Brassica oleracea* var. *alboglabra*) in an organic farm, located in Rende District, Tainan City of Taiwan, with more than 50% mortality. Stem and root tissues with necrotic symptoms were excised into small pieces, surface sterilized in 1% sodium hypochlorite for 1 min, rinsed in sterilized distilled water, dried on filter paper, and put on 2% water agar (WA). Twenty-four to 48 h later, hyphae characteristic of *Rhizoctonia* (Sneh et al. 1991) prevailed on WA plates; pieces from the hyphal front were transferred to potato dextrose agar (PDA) for 21 days of incubation. The colonies were olive brown producing black sclerotia (~0.5 to 2.0 mm). Width of hyphae was $9.38 \pm 1.79 \mu\text{m}$. Nuclear stain was made using 0.3% safranin-O and 1% KOH. There are two to six nuclei in each cell with an average of 4.5 nuclei by calculating 20 cells. To identify the specific anastomosis group (AG) for this fungus, a molecular method was

conducted. DNA was extracted according to a silica-based DNA extraction method (Höss and Pääbo 1993). The internal transcribed spacer (ITS) of ribosomal DNA was sequenced with the primer pair Bd1a and ITS4 (Goka et al. 2009; White et al. 1990). BLAST analysis revealed that the ITS sequence (LC494248) had 99.68 and 99.68% similarity to KF907730.1 and JF701750.1 respectively, which are under the name of *Rhizoctonia solani* AG 1-IG (Hua et al. 2014). Pathogenicity testing was carried out using 3-week-old kale pots with three replicates. Inoculation was made by the PDA agar disk (6 mm in diameter) cut from mycelial front of a 5-day-old colony and applied to the base of stem. An agar disk without inoculum served as a control. Plants were maintained at 20°C with a 12-h photoperiod. After 2 weeks, the base of the stem appeared necrotic and had canker lesions. A fungus with *Rhizoctonia* appearance was isolated. It is the same fungus as the original inoculum, confirmed by ITS sequencing. *R. solani* AG 1-IG was reported as the causal agent on Chinese flowering cabbage (*Brassica parachinensis*) in Vietnam and chickpea (*Cicer arietinum*) in India (Hua et al. 2014). To our knowledge, this is the first record of root rot and stem canker caused by *R. solani* AG 1-IG on kale in Taiwan, and it is the third report of *R. solani* AG 1-IG in the world. Although *R. solani* AG 1-IG did not cause serious disease previously, this study shows that this fungus has the potential to be a critical problem in organic farms.

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