Southern Sclerotium Root Rot Caused by *Athelia rolfsii* on Table Beet in New York

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Southern Sclerotium root rot caused by *Athelia rolfsii* (syn. *Sclerotium rolfsii*) is a damaging soilborne disease of field and specialty crops (Mullen 2006). In 2015, 2016, and 2017, wilted plants, root rot, and decay in six table beet (*Beta vulgaris* spp. *vulgaris*) fields across New York were observed. In these outbreaks, losses ranged between 5 and 25%. White mycelial mats and golden brown sclerotia (1 to 2 mm diameter) were observed on diseased plants (Fig. 1A) and decayed roots (Fig. 1B). The objective of this study was to identify the fungus associated with these symptoms and assess pathogenicity in table beet.

Diseased roots ($n = 5$ to 10) were collected from each outbreak (2015, 2016, and 2017). Sclerotia ($n = 2$ to 4) were surface sterilized in 2% sodium hypochlorite for 1 min, followed by rinsing in sterile

water. Sclerotia were dried and placed on 2% water agar plus 0.02% ampicillin (WA), followed by incubation at 25°C for 24 h before a hyphal tip was transferred to potato dextrose agar (PDA). Symptomatic tissues (5 mm²) from lesion margins were placed on WA and isolated as above. Morphological characteristics of the isolates resembled *A. rolfsii*. Isolation frequencies ranged from 80 to 95%.

Morphological studies to confirm the fungal identity used two isolates (17-006 and BA-0060) obtained from sclerotia removed from diseased roots. On PDA, cultures were white to off-white and grew rapidly, reaching a diameter of 90 mm in 3 to 4 days. Abundant sclerotia (1.5 to 2.5 mm diameter) were formed on PDA after 5 to 7 days, which changed color from white to golden to dark brown within 3 days. Cultures were lodged with the International Collection

FIGURE 1

Disease symptoms and fungal signs typically observed in association with infection by *Athelia rolfsii* on table beet roots (cultivar Touchstone Gold) in New York. These include **A**, mycelial mats and golden brown sclerotia at the crown, and **B**, black lesions at the terminal end of the tap root.

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FIGURE 2

Root rot symptoms observed in pathogenicity trials following inoculation with *Athelia rolfsii* isolate 17-006 including **A**, profuse development of signs of the pathogen (mycelial mats and golden brown sclerotia) in cultivar Merlin, and **B**, internal necrosis of root tissues in cultivar Touchstone Gold.

TABLE 1

Effect of table beet cultivar and *Athelia rolfsii* isolate on incidence and severity of root rot in pathogenicity testing conducted in a misting chamber in 2018^x

Treatment	Disease incidence (%) ^y	Disease severity (%) ^z
Cultivar		
Detroit Dark Red	85	35
Merlin	75	41
Touchstone Gold	80	38
<i>P</i>	0.579 (ns)	0.421 (ns)
Isolate		
BA-0060	60 b	14.8 b
17-006	100 a	61.2 a
LSD	15.6	7.5
<i>P</i>	<0.001	<0.001

^x No disease was observed in the noninoculated control plants. Means within columns followed by different letters are significantly different ($P < 0.05$). LSD = least significant difference ($P = 0.05$), and ns = not significant.

^y Disease incidence = number of diseased plants/total number of plants $\times 100$.

^z Disease severity = area of a bisected root affected by necroses/total area of bisected root surface $\times 100$.

of Micro-organisms from Plants (ICMP 21915 and 21916). DNA was extracted from fungal mycelia using the Wizard Genomic DNA Extraction kit (Promega, Madison, WI). The species-specific polymerase chain reaction reported by Jeeva et al. (2010) was used to amplify a 540-bp product within the internal transcribed spacer region using the primer pair SCR-F/SCR-R. Products were sequenced at Cornell University, Ithaca, NY. Sequences were 99% similar to *A. rolfsii* isolate CBS 191.62 and deposited into GenBank (MK140940 [BA-0060] and MK140941 [17-006]).

Pathogenicity testing was conducted on 7-week-old plants of the table beet cultivars 'Detroit Dark Red', 'Merlin', and 'Touchstone Gold'. For each *A. rolfsii* isolate, five plants of each cultivar were inoculated by placing three plugs (7-mm diameter) of colonized PDA around a 2-cm-long $\times$ 0.5-cm-deep incision made into the top of the crown. The same incision with noncolonized PDA plugs was performed on five control plants of each cultivar. After inoculation, plants were covered in clear, individual plastic bags for 24 h and then placed in a misting chamber at 25°C with a 12-h photoperiod for 24 days. Plants were removed from pots and roots bisected and evaluated for disease. Isolations from diseased root tissue (three per cultivar per isolate) were as described above. The trial was repeated and data combined for analysis (Genstat version 17.1).

Inoculation with *A. rolfsii* had a significant effect on disease incidence and severity ($P < 0.001$; Table 1; Fig. 2). Disease was not observed in the noninoculated controls. Cultivar had no significant effect on disease incidence and severity ($P \leq 0.579$). Inoculation with *A. rolfsii* isolate 17-006 resulted in significantly ($P < 0.001$) higher disease incidence and severity compared with BA-0060 (Table 1). The interaction between cultivar and isolate on disease incidence and severity was not significant ($P \geq 0.180$). *A. rolfsii* was reisolated in all samples.

The prevalence and severity of Southern Sclerotium root rot in table beet in New York is concerning and suggests conditions may be suitable for sclerotia to survive in the soil for many years, this pathogen may affect cropping rotations. The distribution of *A. rolfsii* is generally restricted to tropical and subtropical areas (Mullen 2006). However, reports on ornamentals (USDA 1960), an invasive weed (Gibson et al. 2012), and corn (Hanlin et al. 1978) have occurred in New York. In the United States, the pathogen causes disease in the related species Swiss chard (Koike 2014) and sugar beet (Harveson 2009). We recommend strict farm hygiene protocols to prevent pathogen spread.

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