

First Report of *Rhizopus* causing Hypocotyl and Root Rot in Sugar Beet (*Beta vulgaris*. L) Seedlings in Montana, USA.

Md Ehsanul Haque¹ and Most Shanaj Parvin^{2*}

¹North Dakota State University, Fargo, ND 58203

²Bangladesh Agricultural Research Institute, Joydebpur, Gazipur-1701, Bangladesh

*Corresponding Author: Most Shanaj Parvin, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur-1701, Bangladesh.

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Sugar beet is commercially grown in Minnesota, Idaho, North Dakota, Michigan, Nebraska, Montana, California, Wyoming, Colorado, Oregon, and Washington [3]. The cultivars are relatively high-yielding and are moderately resistant to most of the common soil-borne and foliar pathogens. Most cultivars have a minimum level of resistance to root pathogens such as *Rhizoctonia solani*, *Aphanomyces cochlioides*, *Clonostachys rosea*, *Globisporangium ultimum*, *Rhizopus stolonifera*, and *Fusarium equiseti* [1, 2, 3, 4]. In June 2019, sugar beet seedlings were observed with hypocotyl and root rot in Sidney (47.7167° N, 104.1563° W), Montana. The disease affected about 20% of the 10 ha commercial field (Figure 1). Hypocotyl of infected seedlings was surface sterilized with 70% ethanol for 30 seconds, rinsed with sterile distilled water, and cultured on 10% water agar (WA) for 7 days at 25°C. Macroscopically, on WA the colonies had profuse white cottony mycelia with black dot-like heads (Figure 2). Microscopically, the sporangiophores developed in groups (3 to 5) simple rhizoids and stolons at their ends (Figure 3). The globose sporangia were large with a size of 90.24 (50.67 to 140.55) μm, and the sporangiospores ranged from ellipsoid to ovoid and measured 5.55 (5.00–8.14) μm × 3.4 (2.92–5.46) μm. Based on the morphological characteristics, the fungus was identified as *Rhizopus stolonifera* [5]. Pathogenicity assay was done using 8, 2-week old sugar beet seedlings grown individually in pots (4"×4"×6"). Seedlings were inoculated with a mycelial plug which was kept close to the seedlings. Inoculated and control plants were placed in the greenhouse at 25 ± 2°C, and 80% to 85% relative humidity. In 4-5

days, six out of 8 inoculated seedlings showed symptoms similar to those observed in the field and non-inoculated seedlings were symptomless. This study was repeated (Figure 4). The fungus was isolated from diseased roots and confirmed to be *Rhizopus stolonifera* based on morphological characters. *Rhizopus stolonifera* and *R. arrhizus* are the most common fungi mostly found in moist agricultural soils. *Rhizopus stolonifera* causes disease at low temperatures of 57° to 61°F. Recently, *Globisporangium ultimum* was reported to cause constriction on hypocotyl of sugar beet seedlings [4]. To our knowledge, this is the first report of *Rhizopus stolonifera* causing hypocotyl and root rot on sugar beet seedlings in Montana.



Figure 1

Figure 2



Figure 3

Figure 4

Figure 1: Infected sugar beet hypocotyl rot collected from the field in Montana.

Figure 2: Appearance of *Rhizopus* grown on water agar.

Figure 3: Morphological characteristics of *Rhizopus*.

Figure 4: Symptoms on sugar beet seedlings inoculated artificially with *Rhizopus*.

References

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