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Aggressiveness of Loose Kernel Smut Isolate from Johnson Grass on Sorghum Line BTx643

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Abstract: An isolate of loose kernel smut obtained from Johnson grass was inoculated unto six BTx643 sorghum plants in the greenhouse to determine its aggressiveness. All the BTx643 sorghum plants inoculated with the Johnson grass isolate were infected. Mean size of the teliospores from the Johnson grass, infected BTx643, and naturally infected sorghum was similar, measuring 0.79, 0.75, and 0.82 µm, respectively. This short communication shows that loose smut on Johnson grass if not controlled around production areas could pose a serious threat to sorghum production.

Keywords: Johnson grass loose smut; sorghum; *Sporisorium cruentum*; teliospores.

1. Introduction

Johnson grass (*Sorghum halepense*) a perennial weed is widespread in most areas, including crop fields in the southeastern U.S. In production fields, Johnson grass can significantly reduce yields in sorghum (*Sorghum bicolor*) and other annual crops such as corn, soybean, and cotton [1]. In addition, *Sporisorium cruentum* (Kühn) K. Vánky, the fungus that incites loose kernel smut of Johnson grass also infects sorghum [2]. With the expected increase in the world's population, increase in annual cereal production which includes limiting the effects of noxious weeds and diseases will be needed to meet this challenge [3]. In some sorghum growing regions, loose kernel smut is prevalent [4-6]. Taye, *et al.* [5] found loose smut on sorghum in five of six districts surveyed in Borana Zone of Ethiopia during the 2013-2014 growing seasons. While Tefere and Wubshet [6] noted 37% of the fields surveyed in South Tigray, Ethiopia, in 2014 were infected with head and loose smut. *Sporisorium cruentum* is seedborne and when teliospore contaminated seed is planted, the fungus germinates and systematically infects the growing seedling [7]. Symptoms are manifested either before or after heading when long, black, pointed smut galls are observed on the infected panicle [2, 7, 8]. Also, sorghum infected with the loose kernel smut usually heads earlier than healthy plants [7, 9]. Loose smut on sorghum results in losses to both fodder and grain yields [7]. Kutama, *et al.* [9] noted significant reduction in growth and yield components on infected sorghum plants when compared to healthy plants. Figures 1 and 2 show loose kernel smut on Johnson grass and on inoculated BTx643 sorghum line.

In this short communication, we report the virulence of loose smut isolate collected from Johnson grass on a sorghum line BTx643. The size of the teliospores from the Johnson grass, greenhouse infected BTx643 sorghum line inoculated with the Johnson grass isolate, and naturally infected sorghum plant from the field also was measured.

2. Materials and Methods

The loose smut isolate was obtained from infected Johnson grass plants growing in an area GPS coordinates: Lat 30.627542 Long -96.336672 around College Station, Texas.

Seeds of BTx643 were planted at a rate of 5 seeds per 1gal round pots (6.75″x 5.875″) (Hummert International) with Sungrow #4 mix soil (BWI) mixed osmocote classic fertilizer 17-7-12 (O.M. Scott & Sons Company). All plants were fertilized on a bi-weekly basis pre-inoculation with Peters excel multi-purpose 15-5-15 (O.M. Scott & Sons Company). The inoculum preparation and syringe injection technique used in this study were as previously described by Prom, *et al.* [10]. Teliospores were surface disinfected with 70 % ethanol for 5 minutes and rinsed three times with sterilized water and then allowed to dry at room temperature under the laminar flow hood. The teliospores were spread unto half-strength potato dextrose agar for few days to germinate, and the resulting sporidial colonies put into a flask containing potato dextrose broth. The flask was placed on a rotary shaker set at 150 rpm, and after 4 d of growth the inoculum was filtered through 2-layers of cheese cloth and the concentration adjusted to 1

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X 10^5 spores ml^{-1}. Six plants of BTx643 were inoculated by injecting 0.5 ml of sporidial suspension using a Precision Glide Needle ® # 22 G x 1 in. (Becton, Dickinson and Company, Franklin Lakes, NJ) attached to a 30 ml hypodermic syringe below the apical meristem of 18-day-old seedlings. At heading, the characteristic symptoms of loose smut were observed on the inoculated plants.

Loose kernel smut teliospores from the Johnson grass, greenhouse inoculated BTx643, and from naturally infected sorghum plants were measured using compound microscope set at the 100 x magnification.

2.1. Data Analysis

Data for the teliospore measurements were analyzed using PROC MEANS (SAS, version 9.4, SAS Institute, Cary, NC).

Fig-1. Loose kernel smut on Johnson grass

Fig-2. Loose kernel smut on sorghum line BTx643 after been inoculated with the Johnson grass isolate.

Table-1. Means, standard deviation, minimum, and maximum values for the size of the teliospores[a]

Variable	N[b]	Mean	Std Dev	Minimum	Maximum
Johnson grass	50	0.78	0.06	0.70	0.90
BTx643[c]	50	0.75	0.08	0.60	0.90
Sorghum[d]	50	0.82	0.05	0.70	0.90

3. Results and Discussion

Sorghum is one of the most indispensable crops, especially in the drier tropics where it supplies the daily calories needs of 100 of millions of people [11]. However, sorghum productivity and profitability are hampered by biotic stresses, including those organisms that incite smuts. *Sporisorium cruentum*, the fungus that incites loose kernel smut on Johnson grass, a weed often observed in sorghum production area also infects sorghum [8]. This was confirmed in this study when greenhouse-grown BTx643 sorghum lines inoculated with teliospores from Johnson grass were all infected (Fig. 2). Similarly, when loose smutted Johnson grass plants were placed around healthy growing sorghum plants, some of them became infected [2]. In addition, sizes of the teliospores from infected Johnson grass, greenhouse infected sorghum BTx643 that was inoculated with teliospores from the Johnson grass, and naturally infected with loose kernel smut also were determined. Table 1 shows the descriptive statistics for the size of the teliospores which was similar among the three hosts, measuring 0.79, 0.75, and 0.82 µm, respectively.

S. cruentum is seedborne, survival of the teliospores in the soil is said to be low and may not contribute to primary infection on the subsequent crop [7]. However, in dry soil, teliospores may survive long enough to affect the next crop [7]. Consequently, the presence of infected Johnson grass plants near or in sorghum production fields will then contribute to the buildup of teliospores in the soil. Millholon [2] also noted that wind-blown spores from loose kernel smutted Johnson grass can infect nearby healthy sorghum plants.

4. Conclusion

This study confirmed that *S. cruentum*, the fungus that incites loose kernel smut on Johnson grass can also infect sorghum. Thus, loose smut on Johnson grass if not controlled around production areas could pose a serious threat to sorghum production. Future research on loose kernel smut should include determining the survivability and longevity of the teliospores in different soils and soil temperatures, the importance of teliospores in the soil as primary source of inoculum, and the role that infected Johnson grass near production fields play in the epidemics of the disease in sorghum.

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