Evaluation of Ergot Resistance and Disease Escape in Kentucky Bluegrass Cultivars

Jeremiah Dung, Cara Boucher, and Stephen Alderman

Introduction

Ergot is an important disease of Kentucky bluegrass seed production in Oregon. The disease is caused by the fungal pathogen *Claviceps purpurea*, which infects flowers prior to fertilization resulting in the production of sclerotia rather than seed. Sclerotia are the overwintering structures of the fungus and produce airborne ascospores that serve as primary inoculum the following growing season. In some years the timing of ascospore release by the fungus may not coincide with grass flowering (anthesis), which is the only period of host susceptibility, and cultivars with short, uniform flowering periods, or those that flower outside of periods of peak spore production, may potentially escape infection. The objective of this study was to evaluate Kentucky bluegrass cultivars for the potential to escape or resist ergot under central Oregon field conditions. It was hypothesized that cultivars which flower before or after peak ergot spore production, or those with shortened periods of anthesis, would have reduced ergot incidence and severity compared to cultivars with prolonged periods of anthesis or those which flower when ergot spores are present in large numbers.

Materials and Methods

A total of 11 Kentucky bluegrass cultivars ('Blue Ghost', 'DB-1013', 'Fielder', 'Gateway', 'Gladstone', 'Jumpstart', 'Merit', 'Midnight II', 'PST-K4-7', 'Right', and 'Shamrock') were planted in plots at COARC in August 2015. Plots (26 ft long and 5 ft wide consisting of 6 rows of plants) were planted at a seeding rate of 5 lb seed/acre. Each plot was replicated four times and cultivars were arranged in a randomized complete block design. The border of the experiment area was artificially infested in October 2015 with Kentucky bluegrass sclerotia collected from seed lots produced in central Oregon.

Crop phenology was assessed weekly from April until mid-June to determine the timing and duration of anthesis for each Kentucky bluegrass cultivar. Crop phenology was measured using the Feekes scale, whereby the appearance of stigmas and/or anthers was considered the beginning of flowering (stage 10.51). The percentage of tillers with flowers at each Feekes stage were estimated for each plot. Flowering was considered to be completed when 90% of the tillers in a plot reached Feekes stage 11.1. Disease incidence (number of infected seed heads) and severity (number of sclerotia) were determined from a random sample of 100 seed heads collected from each plot at harvest. Data were analyzed using ANOVA and multiple comparisons were made using Tukey's test.

A Burkard 7-day recording volumetric spore sampler was used to collect airborne ascospores of *C. purpurea*. The spore sampler was placed in the middle of the plots from April 20 to June 21, 2016 with the air intake orifice located approximately 2 ft above the soil. Spore trap tapes were replaced weekly and each tape was cut into daily segments, stained, and the number of *C. purpurea* ascospores were determined for each hour and then totaled to establish daily counts.

Results and Discussion

A total of 3,748 ascospores were trapped between May 1 and June 21, 2016. Honeydew was first observed on May 31 and was present in most plots by June 7. Significant differences in ergot incidence and severity were observed among Kentucky bluegrass cultivars. Similar to 2015, Midnight II exhibited the highest ergot incidence and severity among the cultivars tested (Table 1; Fig. 1). PST-K4-7 and Fielder exhibited the lowest ergot incidence and severity (Table 1; Fig. 1); Fielder also exhibited relatively low ergot incidence and severity ratings in the 2015 trial. Ergot severity ratings in 2015 and 2016 were highly correlated for the 10 cultivars that were evaluated in both years ($r = 0.86$) (Fig. 2); ergot incidence ratings were also highly correlated ($r = 0.84$).

Anthesis was first observed in the earliest flowering cultivars on May 12 and significant differences in anthesis initiation date, anthesis termination date, and anthesis duration were observed among the 12 KBG cultivars ($P \leq 0.03$) (Table 1). However, significant correlations were not observed between anthesis initiation, termination, or duration and ergot incidence or severity. Further research is needed to determine if the differences in ergot levels were due to genetic/physiological resistance to ergot, environmental conditions during anthesis, or other factors.

Acknowledgements

The researchers would like to thank the Oregon Seed Council, Washington Turfgrass Seed Commission, and Oregon Department of Agriculture Alternatives for Field Burning Research Financial Assistance Program for financial support. The authors are grateful for the in-kind support provided by Central Oregon Seeds Inc., CHS Inc., Jacklin Seed, Pure Seed, and Wilbur-Ellis. The authors also thank Hoyt Downing for providing technical assistance. Ms. Boucher's internship was made possible by the Oregon State University Branch Experiment Station Experiential Learning Internship program.

Tables

Table 1. Ergot incidence and severity, anthesis initiation, termination, and duration, and total number of ergot spores captured during anthesis of 11 Kentucky bluegrass cultivars grown in artificially-infested plots at COARC[1]

Cultivar	Ergot incidence (%)	Ergot severity	Anthesis initiation[2]	Anthesis termination[2]	Anthesis duration (days)	Total spores during anthesis
Blue Ghost	26.8 d	81.8 b	138.5 ab	155.5 ab	17.0 a	1269.0
DB-1013	17.3 c	57.0 ab	133.0 a	157.3 ab	24.3 b	1582.8
Fielder	7.3 ab	15.8 a	133.0 a	157.3 ab	24.3 b	1582.8
Gateway	18.0 c	38.3 ab	144.0 bc	159.0 b	15.0 a	1475.0
Gladstone	14.0 bc	38.8 ab	138.5 ab	157.3 ab	18.8 ab	1442.3
Jumpstart	11.3 abc	25.8 ab	138.5 ab	153.8 ab	15.3 b	1095.8
Merit	10.9 abc	17.1 a	142.6 b	158.1 b	15.5 b	1423.5
Midnight II	31.0 d	153.8 c	141.3 ab	159.0 b	17.8 ab	1545.3
PST-K4-7	3.3 a	6.8 a	144.0 b	159.0 b	15.0 b	1475.0
Right	11.8 abc	37.3 ab	135.8 ab	152.0 a	16.3 b	992.8
Shamrock	11.5 abc	19.3 ab	133.0 a	153.8 ab	20.8 ab	1236.3
***P*-value**	**< 0.0001**	**< 0.0001**	**0.0001**	**0.0032**	**0.0241**	**0.0518**

[1] Means followed by the same letters are not statistically different using Tukey's comparison.
[2] Anthesis initiation and termination dates are presented as perpetual Julian days (133 = May 12; 159 = June 7).

Figures

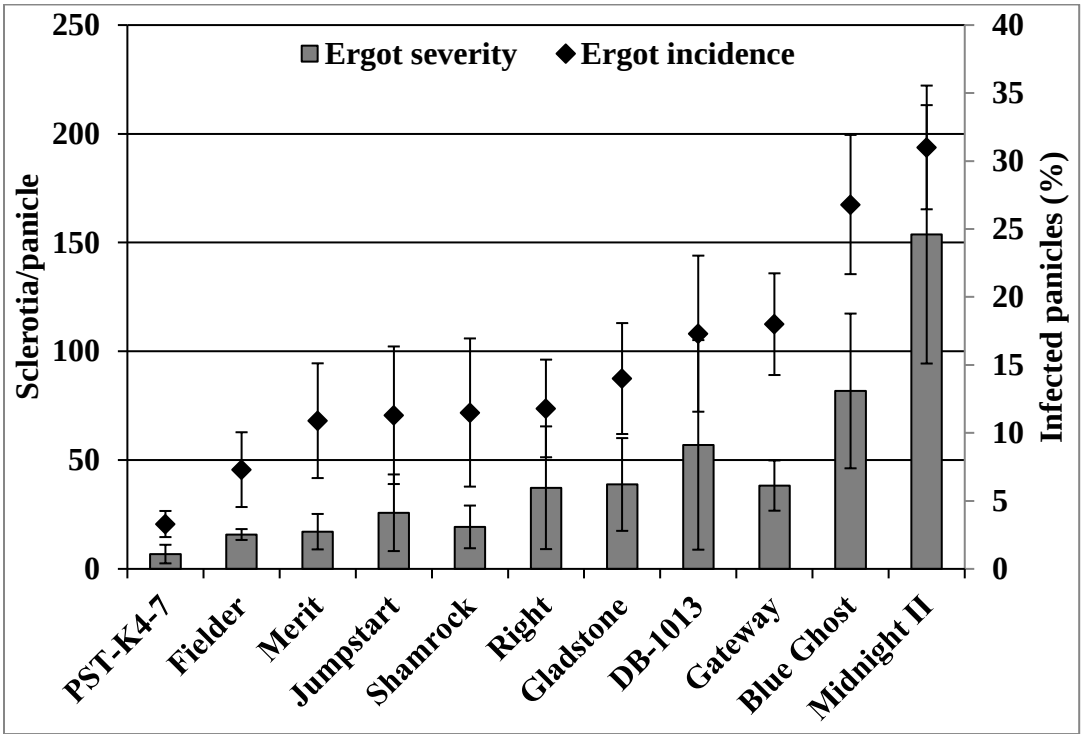

Figure 1. Ergot incidence (% infected panicles out of 100 sampled) and severity (average number of sclerotia per 100 panicles) among 11 Kentucky bluegrass cultivars grown in artificially-infested plots at COARC.

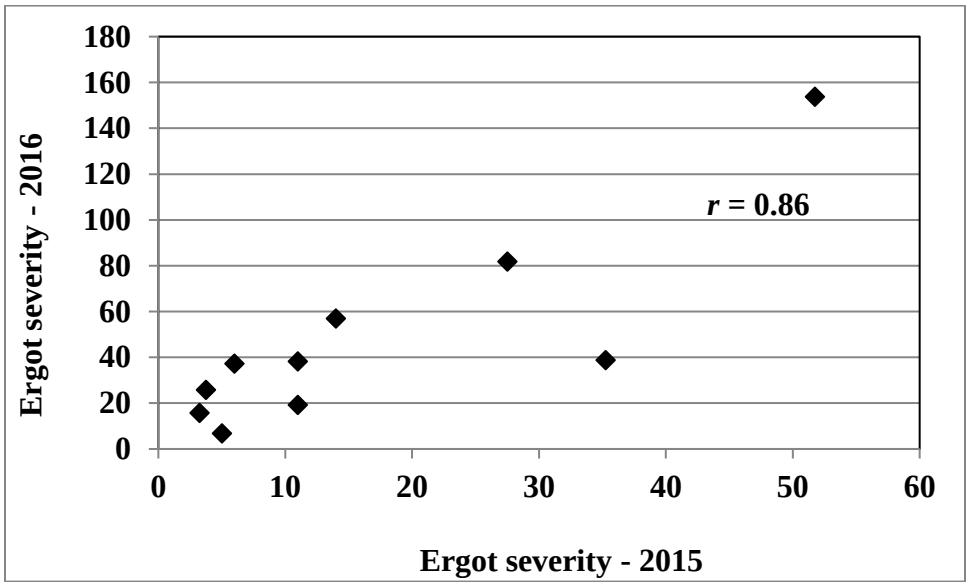

Figure 2. Correlation between ergot severity ratings among 10 Kentucky bluegrass cultivars evaluated in 2015 and 2016. Ergot incidence ratings were also highly correlated between the two years (r = 0.84).