Effect of Tylenchorhynchus robustoides on Growth of Buffalo Grass and Western Wheatgrass[1]

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Abstract: Tylenchorhynchus robustoides reduced ($P = 0.05$) growth of *Agropyron smithii* (western wheatgrass) at soil temperatures of 20, 25, 30, and 35 C. Growth reduction increased with increasing soil temperatures. Highest populations of *T. robustoides* were recovered at 25 and 30 C. Clipping weights of *Buchloe dactyloides* (buffalo grass) were reduced at 25 and 30 C; however, root/crown weights were reduced at 15, 20, 30, and 35 C in nematode infested vs. non-infested soil. Reproduction of *T. robustoides* was greater at 25, 30, and 35 C than at 20 C on *B. dactyloides*. In a greenhouse study, *T. robustoides* reduced clipping and root/crown weights of both grasses 24–64%. *Key words:* stunt nematode, soil temperature.

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Nematodes are an important component of native grasslands in the Great Plains states (7,8,9,12,13), and nematicide treatments increase growth of native range grasses 28–59% in western South Dakota (12). Two dominant grasses in the mixed prairie of western South Dakota are the cool-season mid grass *Agropyron smithii* Rydb. and the warm-season short grass *Buchloe dactyloides* (Nutt.) Engelm. (10). There is little information concerning the effects of nematodes on growth of these grasses under controlled conditions, although a species of *Anguina* induces seed galls in *A. smithii* (6). *Tylenchorhynchus robustoides* Thorne and Malek is reported to be the dominant member of the Tylenchorhynchidae in a mixed prairie (12). The objective of this study, therefore, was to determine the effects of *T. robustoides* on growth of *A. smithii* and *B. dactyloides* in the greenhouse and at various constant soil temperatures.

MATERIALS AND METHODS

Tylenchorhynchus robustoides was obtained from a mixed prairie site in Jackson County, South Dakota, and inoculum was increased on *Triticum aestivum* L. (winter wheat) in the greenhouse. Two studies were conducted in temperature tanks (3) maintained at 10, 15, 20, 25, 30, and 35 C (±1 C). In the first study, 200 cm³ of sterile sand was placed at the bottom of 10-cm-diameter × 21-cm-long plastic tubes and covered with 600 cm³ of steam pasteurized soil (30% sand, 49% silt, 21% clay). A 2.5-cm-diameter × 5.5-cm-long vial was buried to a depth of 4 cm in each tube. The tubes were then seeded with 5 cc of *A. smithii* seed and covered with an additional 150 cm³ of soil. After seedling emergence, the vials were removed and a 20-ml suspension of 5,000 (± 200) *T. robustoides* or 20 ml of supernatant water from a settled *T. robustoides* suspension (control) was poured into the resulting depressions. The inoculum and control suspensions were each covered with 50 cm³ of moist soil. Each treatment was replicated four times. The tubes were then placed in the temperature tanks and supplemental lighting was supplied when necessary to increase the photoperiod to 15 h; they were watered as needed and fertilized monthly with 100 ml of 20-20-20 fertilizer (10 g/liter).

One month after placement in the tanks, the grass was clipped to a height of 8 cm and oven dried at 60 C for 5 days before

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weighing. Three additional clippings were obtained at 4-week intervals. After the final clipping, the plants were washed from the soil and the soil suspension volume was raised to 8 liters. Nematodes were extracted from a 2-liter aliquot by the Christie-Perry method (1), and their numbers estimated. Root/crown weights were recorded after oven drying for 5 days at 60 C. The second temperature tank study was conducted in essentially the same manner, except tubes were seeded with 5 cc of *B. dactyloides* seed.

A third experiment was conducted in a greenhouse where ambient air temperature was maintained at 24 ± 3 C. Six hundred cm^3 of steam pasteurized soil was placed in 13-cm clay pots and seeded with 5 cc of *A. smithii* or *B. dactyloides*. Half of the pots within each seeding were inoculated with a 20-ml suspension of 5,000 (± 200) *T. robustoides* and the remaining half received 20 ml of the supernatant. Pots received an additional 200 cm^3 of soil and were randomly arranged on a greenhouse bench. Each of the four treatments was replicated six times. The grasses were clipped to a height of 4 cm 2 months after seeding and at 4-week intervals for an additional 24 weeks. Supplemental lighting and fertilizer applications were similar to those in the temperature studies. Clipping and root/crown weights and nematode densities were determined in the same manner as described for the temperature studies.

RESULTS AND DISCUSSION

Tylenchorhychus robustoides reduced ($P = 0.05$) clipping weights of *A. smithii* at 20, 25, 30, and 35 C (Table 1). Root/crown weights were reduced ($P = 0.05$) at 25, 30, and 35 C. The percent reductions in both clipping and root/crown weights increased with increasing soil temperatures (Table 1). Populations of *T. robustoides* developed best at 25 and 30 C. These temperatures are similar to those reported for population development of *T. robustoides* on another cool season grass, *Poa pratensis* L. (5).

Significant reductions in clipping weights of *B. dactyloides* occurred at 25 and 30 C (Table 2). However, *T. robustoides* reduced ($P = 0.05$) root/crown weights at 15, 20, 30, and 35 C. There was no apparent relation between soil temperature and magnitude of growth reductions (Table 2). Highest populations of *T. robustoides* develeoped at 25, 30, and 35 C on *B. dactyloides*. The dissimilar population development of *T. robustoides* at 35 C (Tables 1

Table 1. Effect of *Tylenchorhynchus robustonides* on growth of *Agropyron smithii* at six soil temperatures.

Temperature (C)	*T. robustoides*† Pi	*T. robustoides*† Pf	Cumulative‡ clipping dry wt. (g)	Root/crown dry wt. (g)
10	0	0	3.06†	4.30
	5,000	3,784	3.07	3.61
15	0	0	3.43	4.33
	5,000	5,020	3.45	4.14
20	0	0	3.75	3.84
	5,000	23,256	3.45*	3.26
25	0	0	3.83	3.81
	5,000	27,900	3.08*	2.70*
30	0	0	3.31	2.56
	5,000	31,420	2.32*	1.69*
35	0	0	1.07	1.04
	5,000	7,936	0.25*	0.39*
	F.L.S.D. .05 = 6860			

†Pi = initial population, Pf = final population.
‡Cumulative from four cuttings. Average of four replications.
*Significant at .05 level.

Table 2. Effect of *Tylenchorhynchus robustoides* on growth of *Buchloe dactyloides* at six soil temperatures.

Temperature (C)	*T. robustoides*† Pi	Pf	Cumulative‡ clipping dry wt. (g)	Root/crown dry wt. (g)
10	0	0	0	0.66
	5,000	2,552	0	0.55
15	0	0	0.74	2.68
	5,000	3,852	0.54	1.98*
20	0	0	3.85	4.40
	5,000	10,052	4.00	3.67*
25	0	0	6.08	4.55
	5,000	23,000	5.42*	4.22
30	0	0	7.28	4.72
	5,000	19,300	6.67*	3.81*
35	0	0	7.19	4.57
	5,000	20,500	6.68	3.12*
	F.L.S.D. .05 = 6072			

†Pi = initial population, Pf = final population.
‡Cumulative from four cuttings. Average of four replications.
*Significant at .05 level.

and 2) was apparently in response to the differential growth of the two grasses at this temperature. The Tylenchorhynchidae were mostly limited to the upper 10 cm of soil in a mixed prairie study (12), due in part to the preference of *T. robustoides* for higher soil temperatures.

Clipping and root/crown weights of both grasses were reduced by *T. robustoides* in the greenhouse study (Table 3). In general, the growth reductions in this study were greater than those observed in the temperature studies (Tables 1–3). The greater growth reductions may have been due to the longer duration of the greenhouse study, resulting in greater nematode populations, and to the lower clipping height, which may have stressed the grasses.

It appears that *A. smithii* was more sensitive than *B. dactyloides* to *T. robustoides*, particularly at the higher soil temperatures. However, *A. smithii* completes much of its vegetative development in South Dakota mixed prairie before average soil temperatures at 10 cm exceed 20 C (2, 4); thus it is probable that *A. smithii* escapes some *T. robustoides* damage.

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Table 3. Effect of *Tylenchorhynchus robustoides* on growth of *Agropyron simthii* and *Buchloe dactyloides*.

Grass	*T. robustoides*† Pi	Pf	Cumulative‡ clipping dry wt. (g)	Root/crown dry wt. (g)
A. Smithii	0	—	20.33	20.98
	5,000	41,932	15.49*	7.54*
B. dactyloides	0	—	19.32	20.82
	5,000	30,120	12.23*	10.52*

†Pi = initial population, Pf = final population.
‡Cumulative from seven cuttings. Average of six replications.
*Significant at .05 level.

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