Small Infestations of *Seymeria cassioides* (Scrophulariaceae) Reduce Growth of Potted Slash Pine

WILLIAM F. MANN, JR., Chief Silviculturist, USDA Forest Service, Southern Forest Experiment Station, Alexandria Forest Center, LA, and LYTTON J. MUSSELMAN, Department of Biological Sciences, Old Dominion University, Norfolk, VA 23508

ABSTRACT

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Slash pine seedlings were grown alone and with one, three, five, and seven seymeria plants per pot to determine how seymeria affect pine growth in the first year. Each host had 16–233 haustoria. A single parasite did not affect growth of pines, but three or more reduced dry weight by 65% and also reduced diametric growth. Height was not affected. Many pines were chlorotic.

Additional key words: parasitic weed, phanerogamic parasitism, *Pinus elliottii*, root parasite, semiparasite

Seymeria (*Seymeria cassioides* (J. F. Gmel.) Blake) is an annual, parasitic weed that attacks roots of all southern pines. It occurs throughout much of the Southeast from Virginia to central Louisiana on a variety of soils (3). Seymeria has been recognized as a potential forest pathogen only in the last decade (2).

Infestations of seymeria are most common in young stands established on sites prepared mechanically or otherwise disturbed. A hundred or more seymeria plants may surround an individual pine. These large populations can cause severe chlorosis, stunted growth, and death of pine seedlings. Fitzgerald et al (1) found that costly control measures are justified if dense populations develop.

However, we know little about small infestations, where only a few parasites are attached to an individual host. We began this study in October 1978 to determine the growth losses of slash pines (*Pinus elliottii* Engelm.) when parasitized by small numbers of seymeria in the first year.

W. F. Mann, Jr., died before this paper was submitted for publication. His research interests during his 40 years of service centered on the culture of southern pine.

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MATERIALS AND METHODS

Twenty-five plywood boxes (63 cm^2 × 46 cm) were filled with a 1:1 mixture of peat moss and vermiculite. Slash pines grown in containers for 14 wk were transplanted, one into each box. The pines were 24–30 cm tall at transplanting, but the seedlings were arranged so that heights did not vary more than 1 cm within a block.

About 30 seymeria seeds were immediately sown in each box, the seeds separated to prevent clustering. When the seymeria plants had grown to a height of about 10 cm, they were thinned to none, one, three, five, or seven parasites per box. Each treatment was replicated five times in a randomized block design. The plants were watered as needed and fertilized with 20:19:18 NPK through the watering system every 30 days. The greenhouse was maintained at a temperature of 26 C and an 18-hr photoperiod.

At the end of the study we counted haustoria, measured heights and groundline diameters of hosts and parasites, and determined their dry weights above the ground (tops) (Table 1). For each box, we averaged the number of haustoria per parasite because it was impossible to tell from which plant a haustorium originated.

RESULTS

Parasite growth. Most seymeria seeds germinated within 3 wk. Several months elapsed before the required number of parasites began active height growth. This growth was irregular, probably because the parasites varied in the time they required to complete attachment to host roots.

By late March of 1979, the required

number of parasites was growing in all treatments. Heights of parasites ranged from 3 to 54 cm. Average heights varied according to the number of parasites in the treatment: 14 cm for one parasite per host, 18 cm for three, 17 cm for five, and 9 cm for seven. Most seymeria plants grew vigorously in the next 90 days; heights ranged from 56 to 78 cm in early July (Table 1). The slowest plants to flower were in the seven-parasite treatment, but only one parasite in all treatments failed to flower by early July.

The study ended 3 July 1979 after all but one parasite had flowered. In the last month, three small plants died. No pines died, but several with five or more parasites were chlorotic and had needles only at tips of branches.

Numbers of haustoria per replicate varied greatly. In an extreme case, the pine of one replicate of the one-parasite treatment had 519 haustoria attached to its roots; in another replicate, the pine had only eight haustoria. Thus, numbers of haustoria did not differ significantly (Table 1). Average heights of parasites were about the same. Only average diameter and total dry weight varied significantly. Total dry weights of parasites ranged from 4.5 to 21.1 g/host, and the one-parasite treatment resulted in smaller diameters and weights than the other treatments.

Pine growth. Heights of pines did not differ significantly in early July (Table 2). We were surprised by this result because two pines having seven parasites were dying, and several others had sparse, short needles. In general, pines with three or more parasites had pale yellow needles, while others had dark green needles.

Pines without a parasite and with one parasite had much larger groundline diameters than those in other treatments (Table 2). Pines having three, five, and seven parasites did not differ in diameter.

Similarly, pines growing alone were about three times heavier than pines with three or more parasites. For every 10-g increase in seymeria weight, pine weight decreased about 16 g.

Table 1. Size of seymeria and number of haustoria developing on slash pine seedlings[z]

Parasites per box (no.)	Haustoria per host (no.)	Haustoria per parasite (avg. no.)	Avg. height of parasites (cm)	Avg. diameter of parasites (mm)	Total dry weight of parasite tops (g)
1	136 a	136 a	61 a	3.8 a	4.5 a
3	187 a	62 a	78 a	3.5 b	21.1 b
5	233 a	47 a	73 a	2.9 b	18.9 b
7	149 a	21 a	56 a	2.4 b	18.9 b

[z]Treatment means not followed by the same letter differ significantly ($P = 0.05$) according to Duncan's multiple range test.

DISCUSSION

A single parasite averaged 136 attachments, which can severely damage young pines by killing small roots beyond the point of haustorial penetration. Despite the many haustoria, however, host growth was not seriously retarded. Parasites reduced diametric growth more than height growth. But in the 90 days when parasites were growing most vigorously, controls had a height growth of only 11 cm.

The best measure of growth reduction was the dry weight of pine tops. A single parasite failed to reduce pine weights significantly. Three or more parasites decreased pine weights by about 65%, a sharp reduction when we consider the short time in which parasites were large enough to affect the pines.

Because plants were watered regularly, less water was lost to parasites. In the field, where less water is available, hosts are more likely to suffer from the parasitism.

Even when seymeria do not parasitize pines after the first year, pine growth can be reduced in later years (1). The extent of this reduction would depend on the damage suffered in the first year.

Under natural conditions, parasites commonly multiply in the second year. They weaken pine seedlings in the first year, continue to do so in the next, and eventually the pines begin to die. In this study, two pine seedlings having seven parasites were dying. Heavy populations of seymeria in the field could cause mortality in the first year.

Table 2. Effect of seymeria on the growth of slash pine[y,z]

Parasites per pine (no.)	Height of pines (cm)	Diameter of pines (mm)	Dry wt. of pine tops (g)
0	51 a	17 a	224.9 a
1	50 a	16 a	215.5 a
3	45 a	10 b	80.2 b
5	43 a	10 b	75.9 b
7	45 a	10 b	76.9 b

[y]The slash pine seedlings were 1 yr old when measurements were taken in July 1979.
[z]Treatment means not followed by the same letter differ significantly ($P = 0.05$) according to Duncan's multiple range test.

This study did not fully quantify growth losses of pine by different numbers of parasites. We did find that the vigor of pines growing in a favorable environment was reduced by just a few seymeria plants. Early detection and control of parasites are important in maintaining a high level of growth in young pine stands.

LITERATURE CITED

1. Fitzgerald, C. H., Shultz, R. C., Fortson, J. C., and Terrell, S. 1977. Effects of *Seymeria cassioides* infestation on pine seedling and sapling growth. South. J. Appl. For. 1:26-30.
2. Mann, W. F., Jr., Grelen, H. E., and Williamson, B. C. 1969. *Seymeria cassioides*, a parasitic weed on slash pine. For. Sci. 15:318-319.
3. Musselman, L. J., and Mann, W. F., Jr. 1978. Root parasites of southern forests. U.S. Dep. Agric. South. For. Exp. Stn. Gen. Tech. Rep. SO-20. 76 pp.