Water-Soluble Extracts from Leaves of Shining Sumac Inhibit Germination and Radicle Growth of Loblolly Pine

Michael L. Smith

Biological laboratory technician, USDA Forest Service, Southern Forest Experiment Station, Pineville, LA

*Water-soluble extracts from leaves of shining sumac (*Rhus copallina *L.) had a phytotoxic effect on both germination and radicle growth of loblolly pine (*Pinus taeda *L.) seeds in laboratory tests. This finding suggests that shining sumac may interfere with the regeneration of loblolly pine stands from seed.* Tree Planters' Notes 41(3):33–34; 1990.

Shining sumac (*Rhus copallina* L.) is a common shrub in southern pine forests. It is usually found growing in colonies and averages less than 3 feet in height *(2)*. Often associated with broomsedge (*Andropogon* spp.) and blackberry (*Rubus* spp.) along the edge of forest clearings, shining sumac may persist in the understory until crown closure *(1)*.

Allelopathic properties of shining sumac have been found to significantly inhibit germination and seedling growth in climax prairie ecosystems *(3)*. The known effect of shining sumac on other plants led to the present examination of the effects of water-soluble extracts from shining sumac leaves on germination and radicle growth of loblolly pine (*Pinus taeda* L.).

Methods

Shining sumac leaves were harvested on the Catahoula Ranger District of the Kisatchie National Forest at the time of leaf fall in October 1988, freeze-dried, and ground in a Wiley mill using a 2-mm screen. Seven extract solutions were made by placing 0.00, 0.95, 1.90, 3.75, 7.50, 15.0, and 30.0 g of dried leaves (equivalent to 0.0, 18.9, 37.9, 75.8, 151.5, 303.0, and 606.0 g of dried leaves per m^2 of soil surface, respectively) and 200 ml of distilled water in Erlenmeyer flasks, shaking continuously for 2 days, and then filtering under a vacuum. Distilled water was used to bring the extracts to a total volume of 200 ml each.

Germination test. Large germination trays (495.6 cm^2) were filled with medium (50% potting mixture and 50% sand) to a depth of 5 cm. Fifty stratified loblolly seeds were placed in each of seven germination trays. Each tray was then sprayed once with one of the seven extract solutions. The trays were fitted with lids so they would not have to be watered again and were placed in a germination room under standard conditions for 28 days. There were three replications of this test.

Radicle test. Stratified loblolly seeds from a common seed source (Rapides Parish, Louisiana) were germinated and held in untreated media until radicles were long enough to transplant (5 to 20 mm). Then 750 germinated seeds were randomly selected, and the lengths of their radicles measured. Seeds were divided into samples of 50 germinants, and each sample was planted in a large germination tray (495.6 cm^2) that had been filled with medium to a depth of 5 cm.

Each of the 15 trays was sprayed once at the time of planting to provide 3 treatment replications of each of the following 5 extract solutions: 0.00 (control), 0.95, 1.90, 3.75, and 7.50 g per 200 ml. The trays were fitted with lids and placed in the germination room under standard conditions. Radicle length was measured to the nearest millimeter after 3 days. The test was discontinued at this time because some radicles were reaching the bottom of the trays, and further growth would have made extracting the intact radicle difficult.

Analysis of data. Data for germination and radicle growth were recorded for each concentration of sumac extract, and differences were determined by analysis of

Table 1—*Effect of shining sumac extraction on germination of loblolly pine seed after 28 days*

Concentrations of sumac extract		% Germination	
g/200 ml	g/m²	Normal	Abnormal
0.00	0.0	93 a	0 c
0.95	18.9	95 a	0 c
1.90	37.9	95 a	0 c
3.75	75.8	92 a	0 c
7.50	151.5	86 a	6 c
15.0	303.0	52 b	43 b
30.0	606.0	29 b	69 a

Values in a column followed by the same letter are not significantly different at P = 0.05, based on Duncan's multiple range tests. Abnormality was exhibited by the radicle being dark colored and unable to penetrate the medium.

Table 2—*Influence of shining sumac extract on mean radicle growth of loblolly pine*

Concentration of sumac extract		
g/200 ml	g/m²	Radicle growth (mm)
0.00	0.00	20.0 a
0.95	18.8	18.0 a
1.90	38.0	13.1 b
3.75	75.8	3.6 c
7.50	151.5	2.1 c

Values in the results column followed by the same letter are not significantly different at P = 0.05, based on Duncan's multiple range tests.

variance (P = 0.05). When statistically significant differences were found, mean separation was determined with Duncan's multiple range tests (P = 0.05).

Results

Germination test. The concentration of shining sumac extract applied to the trays did not significantly affect total germination of loblolly seeds, but it did significantly reduce normal seedling germination (table 1).

Toxicity to radicles was seen at the higher concentrations; affected radicles were dark colored and could not penetrate the medium. With the 7.50 g/200 ml extract, few (6%) of the radicles were affected, but toxicity was significant with the 15.0 g/200 ml and the 30 g/200 ml extracts (table 1).

Radicle test. Radicle growth was normal with the 0.00 and 0.95 g/200 ml extracts (table 2). However, with the 1.90 g/200 ml extract, radicle growth was 35% less than that of the control and some radicles were black and wilted. At the 7.50 g/200 ml extract, radicle growth was only 11% of that of the control, and all radicles were black and wilted.

Discussion

In the laboratory, water-soluble extracts from leaves of shining sumac had an adverse effect on loblolly seed germination and radicle development. This phytotoxic reaction suggests that shining sumac colonies growing on forest lands may have a more adverse influence on loblolly pine establishment from natural or artificial seeding than can be explained by competition only.

Literature Cited

1. Edwards, M. 1977. Shining sumac (*Rhus copallina* L. var. *copallina*). In: Halls, L.K., ed. Southern fruit producing woody plants used by wildlife. Gen. Tech. Rep. SO–16. New Orleans: USDA Forest Service, Southern Forest Experiment Station: 74–75.
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