

# Ethephon Stimulates Abscission of Eastern Dwarf Mistletoe Aerial Shoots on Black Spruce

W. H. LIVINGSTON, Graduate Research Assistant, Department of Plant Pathology, and M. L. BRENNER, Professor, Department of Horticultural Science and Landscape Architecture, University of Minnesota, St. Paul 55108

## ABSTRACT

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Ethephon, an ethylene releasing agent, was sprayed at 1,250, 2,500, and 5,000  $\mu\text{g/g}$  on black spruce (*Picea mariana*) branches infected with eastern dwarf mistletoe (*Arceuthobium pusillum*). At the two highest concentrations, the numbers of seeds and aerial shoots on infected branches were reduced 90–100%. Ethephon treatment resulted in partial dieback of dwarf mistletoe brooms.

Control of dwarf mistletoe (*Arceuthobium* spp.) with chemicals has been tried (1,8–10). Ethylene-releasing agents, however, have not been tested. Ethylene is a growth regulator that promotes abscission of plant parts (7). If ethylene

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## MATERIALS AND METHODS

Three black spruce trees in Carlton County, MN, measuring 6–20 cm in diameter 1.4 m above the ground were used for testing ethephon. Four brooms bearing dwarf mistletoe seeds were located on each tree. Within each broom, the three branch segments with the largest number of seed-bearing dwarf mistletoe shoots were tagged and the shoots counted. All newly formed dwarf mistletoe shoots, in contrast with the 1-yr-old seed-bearing shoots, were counted on branch segments arising from the tagged branch segments. On 28 August 1981, distilled water (used as a control) and ethephon (Ethrel) in distilled water at three concentrations (1,250, 2,500, 5,000  $\mu\text{g}$  of active material per gram of solvent) were sprayed on tagged brooms selected at random on each tree. A hand-held aspirator was used to spray the dwarf mistletoe plants to runoff. Temperature at the time of treatment was 20 C. After

could stimulate dwarf mistletoe seed capsules or shoots to abscise before maturity when the seeds are not viable, a new method of dwarf mistletoe control would be realized. Ethephon (Cepha, Ethrel) releases ethylene within plant tissues and is routinely used in agricultural practice to promote abscission of leaves and fruit (3). This paper reports the results of spraying ethephon on eastern dwarf mistletoe (*A. pusillum* Pk.) infecting black spruce (*Picea mariana* (Mill.) B.S.P.).

**Table 1.** Abscission (%) of eastern dwarf mistletoe shoots on black spruce branches sprayed with ethephon<sup>a</sup>

Tree	Control		1,250 $\mu\text{g/g}$ Ethephon		2,500 $\mu\text{g/g}$ Ethephon		5,000 $\mu\text{g/g}$ Ethephon	
	1-Yr shoots	New shoots	1-Yr shoots	New shoots	1-Yr shoots	New shoots	1-Yr shoots	New shoots
1	44	4	100	75	100	100	100	100
2	0	0	100	0	100	90	100	100
3	9	0	42	5	100	96	100	100

<sup>a</sup>Three branch segments, each with 15–274 dwarf mistletoe shoots, sprayed per tree.

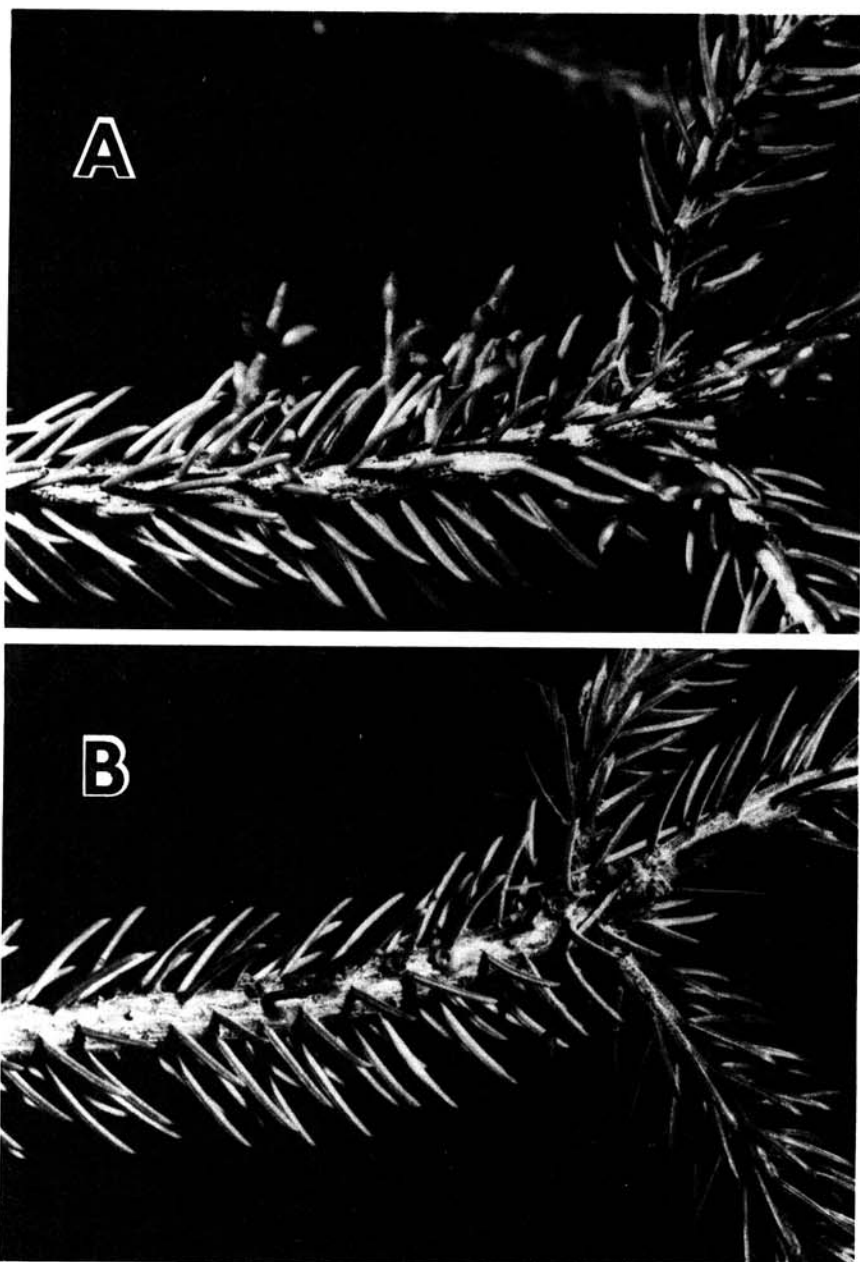


Fig. 1. Black spruce branches (A) bearing healthy female dwarf mistletoe shoots with seed capsules and (B) showing only basal cups of dwarf mistletoe shoots 11 days after spraying with 2,500  $\mu\text{g/g}$  ethephon.

11 days, the numbers of 1-yr-old and newly formed dwarf mistletoe shoots on each tagged branch were counted.

#### RESULTS AND DISCUSSION

Within 11 days after treatment, ethephon sprayed at 2,500 and 5,000  $\mu\text{g/g}$  stimulated the abscission of most (90–100%) mistletoe shoots, both newly formed and 1 year old (Table 1). Basal cups remained on the stems but dwarf mistletoe shoots and seed capsules

shriveled and fell (Fig. 1).

No visible effects of ethephon on black spruce were observed until 1 mo after spraying. At that time, needles formed 1–3 yr previously began to yellow on branches sprayed with ethephon. By June 1982, some of the infected tissue treated with ethephon had died. The percentages of dead buds on the tagged branches were 3.2–27 for the control, 11–25 for tissue treated with 1,250  $\mu\text{g/g}$  ethephon, 35–60 for 2,500  $\mu\text{g/g}$ , and 74–75 for 5,000  $\mu\text{g/g}$ .

Ethephon treatments using concentra-

tions similar to those used in our experiment have been applied to healthy conifer seedlings grown in the greenhouse and to seed-orchard trees (2,4,5,12). The treatments did not cause stem dieback similar to what we observed on infected black spruce, but ethephon did induce bud dormancy, decrease shoot elongation, and reduce the number of lateral branches on healthy conifers. These effects on healthy conifers differ from the effects of dwarf mistletoe infections on conifers, ie, proliferation and elongation of tree shoots (6,11). Additional studies are needed to test the long-term effects of ethephon treatments on dwarf mistletoe and its host.

Our experiment demonstrates that ethephon can promote abscission of all aerial shoots of eastern dwarf mistletoe. Therefore, ethephon treatment has potential for preventing seed dispersal of this parasitic plant for at least 2 yr. This is true because new shoots need 1 yr to develop and the mistletoe seed needs an additional year to mature. In addition, this chemical is safe to use (3). Ethephon has the potential to protect conifer seedlings from dwarf mistletoe infection by eliminating mistletoe seed production in adjacent overstory trees.

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