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## Control of Leaf-Feeding Insects on Yellow-Poplar

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Yellow-poplar, *Liriodendron tulipifera* L., also known as the tulip-poplar, is an important source of pulpwood and saw timber, and it is widely used as a shade tree. Numerous insect species attack the foliage of yellow-poplar. In 1965, *Odontopus calceatus* (Say) was first observed seriously damaging yellow-poplar in Tennessee (Russell and Stanley 1967). Defoliation was so severe at the University of Tennessee Oak Ridge Forest Experiment Station that growth reduction was attributed to this pest (Buckner 1972). In 1967, observations by one of us (E.A.H.) indicated that several other insects attack yellow-poplar leaves during the spring. Infestations of the aphid *Macrosiphum liriodendri* (Monell) and gall midges, *Cecidomyia* sp. and *Thecodiplosis liriodendri* Osten Sacken, were common. *Cecidomyia* sp. was called tulip vein gall, and *T. liriodendri* tulip spot gall, by Felt (1940), who described their damage. Since no measures had been determined for their control, a series of tests was conducted to determine the efficacy of various insecticide treatments.

### Methods and Materials

Four tests were conducted from 1968 to 1971 at Oak Ridge Forest Experiment Station. Trees selected were 15–25 years old, ca. 30–40 ft tall, and ca. 9–12 in. diam. In a preliminary test in 1968, dicrotophos technical was injected at 0.6, 1.0, and 1.6 ml/in. DBH and oxydemetonmethyl at 1.6, 2.1, and 4.7 ml/in. DBH. All injections were made with a Mauget injector unit (J. J. Mauget Co., 777 Front St., Burbank, CA 91502). Oxydemeton-methyl was applied

as a bark spray at 2.0 and 5.0 %, and disulfoton 10G was applied under the drip line at 4.0 oz AI/in. DBH. Based on results of the preliminary test, only G systemics were used in the 1969–71 tests.

Prior to application of granules, leaf litter was removed from around the drip line. Granules were applied to the soil and raked in, just before leaf buds opened. Treatments were replicated 4 times, with 1 tree serving as a replicate. Observations on insect damage were made by removing 100 leaves from the upper and lower crown portion of each tree ca. 4 weeks posttreatment.

## Results

All trees injected in the 1968 test exhibited phytotoxic effects varying from slight at the lower dosages to severe at higher. Oxydemeton-methyl at the 4.7 ml/in. DBH rates caused total browning and drying of the leaves. Only disulfoton G provided promising results.

### *M. liriodendri*

In the 1969 test, all treatments had significantly fewer aphid-infested leaves than the check (Table 1). Trees treated with disulfoton at the 8 oz/in. DBH rate, had the lowest percent leaves infested (0.3 compared with 27.5 in check). In 1970, aphid populations were much lower, with only 4.5% of check leaves infested. All chemical treatments again reduced aphid infestation significantly below the check, with no leaves infested in the 8 oz/in. DBH disulfoton and in both carbofuran and phorate treatments.

**Table 1.** Effect of G. systemic insecticides on formation of galls by *Cecidomyia* sp. and *T. liriodendri*, and prevention of feeding by the aphid *M. liriodendri*, and weevil *O. calceatus*, 1969–71

Insecticide and formulation	Dosage oz/in. DBH	% leaves with aphid, <i>M. liriodendri</i> <sup>a</sup>		% leaves with <i>Cecidomyia</i> sp. vein galls	% leaves with <i>T. liriodendri</i> spot galls		% leaves with <i>O. calceatus</i> feeding damage		
		1969	1970	1970	1969	1970	1969	1970	1971
Disulfoton 10G	4	3.3 b	0.3 b	15.8 c	67.3 ab	28.5 b	41.3a	59.7 ab	2.5 a
Disulfoton 10G	8	0.3 b	0.0b	2.8 c	67.0 ab	9.5 bc	31.5 a	69.3 ab	1.6a
Phorate 10G	4	8.0 b	.0 b	2.0 c	49.5 ab	9.3 bc	34.5 a	66.0 ab	1.6 a
Phorate 10G	8	9.0 b	.0 b	1.8 c	54.0 ab	7.0 c	30.5 a	61.3 ab	2.0 a
Phorate-Thionazin	4	— <sup>b</sup>	.3 b	32.3 b	—	28.5 b	—	72.0 ab	—
Phorate-Thionazin	8	—	.3 b	16.8 c	—	24.8 bc	—	63.0 ab	—
Carbofuran 10G	4	2.0 b	.0 b	6.5 c	46.5 b	20.8 bc	36.0 a	45.8 b	1.0a
Carbofuran 10G	8	8.5 b	.0 b	11.8 c	70.5 ab	22.8 bc	33.5 a	54.3 ab	1.5 a
Check		27.5 a	4.5 a	52.5 a	75.3 a	50.0 a	49.8 a	81.3 a	1.6 a

a. All means followed by the same letter are not significantly different at the 0.05 level of probability.

b. The Phorate-Thionazin treatment was not applied in 1969

### *Cecidomyia* sp.

Vein galls were observed on 52.5% of check leaves. All chemical treatments significantly reduced gall attack below the check with trees treated with both phorate rates having lowest percent infestation. Phorate-Thionazin at 4 oz/in. DBH provided poorest control, with 32.3% of leaves gall infested.

***T. liriodendri***

Leaf-spot galls were abundant in both 1969 and 1970, with 75.3 and 50.0% of check leaves infested, respectively. Only one of the treatments reduced gall infestation significantly below the check, but even then control was not satisfactory. In 1969, control was more effective, with all treatments having significantly fewer galls than the check. Phorate 10G at the 8 oz rate had lowest infestation (7.0% compared with 50.0% in check).

***O. calceatus***

Percent attack was high in 1969 and 1970 and almost nil in 1971. None of the treatments provided satisfactory control, and only one reduced attack significantly below the check. Analyses of rainfall data indicate that each year ca. 2 in. fell within 2 weeks after G application. This amount was considered sufficient for dissolution and uptake of chemicals.

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