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Preference for Some Nursery-grown Hybrid *Populus* Trees by the Spotted Poplar Aphid and Its Suppression by Insecticidal Soaps (Homoptera: Aphididae)

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PREFERENCE FOR SOME NURSERY-GROWN HYBRID *POPULUS* TREES BY THE SPOTTED POPLAR APHID AND ITS SUPPRESSION BY INSECTICIDAL SOAPS (HOMOPTERA: APHIDIDAE)

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ABSTRACT

Susceptibility ranking of more than 50 clones of hybrid *Populus* whips showed a wide range of attack ranging from none to very heavy. Clones with *P.* × *jackii* parentage were the most susceptible, whereas Carolina poplar was unscathed. Growth loss differed little between very heavily aphid-attacked whips and unattacked whips. Two insecticidal soaps adequately controlled the aphid but one caused some phytotoxicity to *Populus*.

The spotted poplar aphid, *Aphis maculatae* Oestlund,[2] has long been an incidental pest of young *Populus* stands in northern North America. The summer hosts normally are aspens and cottonwoods (Palmer 1952), and dogwoods, *Cornus* spp., are the winter hosts (Patch 1938). Spring migrants move from dogwood to *Populus* during the summer and form colonies which sometimes exceed 2500 individuals (Osgood 1962). Nymphs and adults feed on the apical meristem and the newly emerging leaves, and large colonies may completely cover several centimeters of the growing tips. Aphids move upward with the advancing growth and leave behind tiers of distorted or puckered leaves.

In the past decade, the aphid has been observed in the Lake States in young plantings and nurseries of hybrid *Populus*. In 1979, numerous aphid colonies were found in Michigan scattered throughout the clonal nursery owned by Packaging Corporation of America (PCA). The infestation from the start indicated that some clones had many aphid colonies while others had far fewer or none. This suggested a probable wide range of host resistance, so we set out to determine host preference by the aphid for the various clones in the nursery. Additionally we measured growth impact of feeding by large colonies of aphids and sought colony suppression with two insecticidal soaps.

MATERIALS AND METHODS

The study was conducted at the Packaging Corporation of America nursery at Freesoil, Michigan. The nursery has both rooting beds and cutting (stool) beds. Irrigation is by overhead sprinkler in one portion and by trickle irrigation in another portion. Each year the rooting beds were planted with 18-cm hardwood cuttings cut the previous fall from various clones of hybrid *Populus* whips grown in the stool beds. Cuttings were planted 4–6 cm apart in rows about 0.75 m apart. There were from one to three rows for each clone, and each clone was usually planted in two or more locations in the nursery. Single, and

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occasionally double or triple shoots (whips) grew from the cuttings in this study. By fall, the whips were 0.6–1.5 m tall and ready to lift as rooted stock or to be made into hardwood cuttings.

In a trial sample in 1979, we examined 11 clones for aphid colonies in a rooting bed in the overhead irrigation area near the center of the nursery where the infestation was heaviest. Colonies were assessed on 35–100 whips of each clone on 22 August. The terminal of one whip of each cutting was examined for aphids. Then the colonies were ranked by habit and size on a geometric scale as follows:

0—no aphids
1—a few aphids or small colony on the growing tips on one or two leaves
2—small colony on the growing tip and covering two or more upper unfolding leaves
4—medium colony covering 2–3 cm of the growing tip and leaves; a few leaves curled and distorted
8—large colony covering 4–5 cm of the growing tip and leaves; some curled or cupped leaves
16—very large colony covering more than 5 cm of the growing tip and leaves; several leaves tightly curled and wrinkled

Colony size was considered in the analysis because it could influence growth of the whip. Each clonal sample then was assigned an infestation index based on mean number and size of the colonies on that clone. Sampling was repeated in 1980 on 50 whips of all the clones in both the overhead and trickle irrigation areas.

Growth impact was assessed in 1979 on a small scale on two *P.* × *jackii* clones (DBJ2-1 and DBJ2-2) which were the most heavily attacked clones that year (Table 1). The test included 36 whips with large aphid colonies and 18 comparable whips without aphids. Half (18) of the aphid-infested whips were sprayed on 22 August with a conventional dosage of malathion to kill the aphids in order to observe growth recovery of the whips. Height of the whips was measured on 19 October after the aphids were gone and the trees had hardened off.

Two insecticidal soaps were tested in 1981 against large aphid colonies on two clones (DN-22, DN-55) at the PCA nursery. The chemicals tested were Safer Insecticidal Soap® concentrate containing 50.5% potassium salts of fatty acids, and 10% Mono-L- Pesticide IV (MLP-IV) developed in the Department of Biomechanics at Michigan State University. Both soaps were tested as 0.5 and 1.0% active ingredients. Number of aphids per colony was estimated just before the test and then the colonies were sprayed on 12 August between 0930 and 1500 h. Post-spray estimates of aphids were made on 13 August. Ten whips with one colony each were used in each data set.

Additional spray tests were made with MLP-IV on clones DN-28 and Reverdeau at the Raymor Nursery at Manistee, Michigan. Dosages and number of trees were the same as in the PCA test. Spraying was done on 14 August between 0900 and 1000 h and post-spray estimates of control were made at 1500 h the same day.

RESULTS AND DISCUSSION

The clones from the overhead irrigation area show a near continuous though wide range of infestation with indices ranging from 0 to 9.7 for 1980 (Table 1). Several clones with *Populus* × *jackii* parentage were the most vulnerable to attack and nearly always ranked highest in both 1979 and 1980. Location within the nursery apparently did not affect the degree of attack because two of the most heavily attacked clones (DBJ2-2 and LUJ-7) flanked two of the least attacked clones (NE-19 and NE-20). Several clones were never attacked throughout the study, which may mean they are highly resistant or perhaps immune to the aphid. Carolina Poplar (DN-34), which is one of the favored clones for plantings and windbreaks, was not attacked and faired as well as native cottonwood (D-38) (Table 1).

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Table 1. Susceptibility ranking of hybrid *Populus* clones to the spotted poplar aphid in the overhead irrigation regime at the PCA Nursery, 1979–1980.

Clone	Parentage	Infestation Index[a] 1980	1979
LJ-14	*P.* × *jackii*	9.7	3.2
DBJ2-2	*P.* × *jackii*	9.1	8.2
DBJ2-1	*P.* × *jackii*	8.3	10.7
ELJ-14	*P.* × *jackii*	—	7.4
NE-360	*P. deltoides* × *P. nigra* var. *caudina*	7.4	
NE-209	*P. deltoides* × *P. trichocarpa*	6.5	
NE-298	*P. nigra* var. *betulifolia* × *P. trichocarpa*	6.4	
LUJ-7	*P.* × *jackii*	6.3	0.8
NE-386	*P. candicans* × (*P.* × *berolinensis*)	5.5	
NE-10	*P. nigra* × *P. trichocarpa*	4.8	
NE-41	*P. maximowiczii* × *P. trichocarpa* 'Androscoggin'	4.4	
NE-265	*P. deltoides* var. *angulata* × *P. nigra* 'Volga'	4.4	
NE-264	*P. deltoides* var. *angulata* × *P. nigra* 'Volga'	4.0	
NE-359	*P. deltoides* × *P. nigra* var. *caudina*	3.9	1.8
GRJ-6	*P.* × *jackii*	3.5	1.9
NE-225	*P. deltoides* × *P. nigra* var. *caudina*	3.1	
DN-22	*P. euramericana* 'I-262'	3.1	
NE-387	*P. candicans* × (*P.* × *berolinensis*)	2.8	
NE-1	*P. nigra* × *P. laurifolia* 'Strathglass'	2.6	
NE-388	*P. maximowiczii* × *P. trichocarpa*	2.2	
NE-252	*P. deltoides* var. *angulata* × *P. trichocarpa*	2.1	
DN-28	*P. euramericana* 'Ostria'	2.0	
NE-300	*P. nigra* var. *betulifolia* × *P. trichocarpa*	1.9	
DN-55	*P.* × *euramericana*	1.7	1.1
DN-17	*P.* × *euramericana* 'Robusta'	1.3	
DN-18	*P.* × *euramericana* 'Tardif de Champagne'	1.2	
NE-299	*P. nigra* var. *betulifolia* × *P. trichocarpa*	0.6	
NE-207	*P. deltoides* × *P. trichocarpa*	0.6	
NE-318	*P. deltoides* var. *charkowiensis* × *P. deltoides*	0.5	
NE-255	*P. deltoides* var. *angulata* × *P. trichocarpa*	0.5	
NE-351	*P. deltoides* × *P. nigra* var. *caudina*	0.4	
DN-19	*P.* × *euramericana* 'Blanc du Poitou'	0.3	
NE-206	*P. deltoides* × *P. trichocarpa*	0.2	1.8
NE-308	*P. nigra* var. *charkowiensis* × *P. nigra* 'Incrassata'	0.2	
DN-30	*P.* × *euramericana* 'Canada Blanc'	0.2	
NE-19	*P. nigra* var. *charkowiensis* × *P. nigra* var. *caudina*	0.1	0.1
NC-5258	*Populus* sp.	0.1	
NE-374	*P. deltoides* var. *angulata* × *P. trichocarpa*	0.1	
NE-373	*P. deltoides* var. *angulata* × *P. trichocarpa*	0.1	
NE-346	*P. deltoides* × *P. trichocarpa*	0.1	
NE-214	*P. deltoides* × *P. trichocarpa*	0.1	
DN-96	*P.* × *euramericana*	0.1	
NE-20	*P. nigra* var. *charkowiensis* × *P. nigra* var. *caudina*	0.0	0.1
I-45/51	*P.* × *euramericana* 'I-45/51'	0.0	
RAV	*P.* × *euramericana* 'Raverdeau'	0.0	
NE-375	*P. deltoides* var. *angulata* × *P. nigra* var. *plantierensis*	0.0	
NE-238	*P. deltoides* × *P. nigra* 'Volga'	0.0	
NE-224	*P. deltoides* × *P. nigra* var. *caudina*	0.0	
DN-34	*P.* × *euramericana* 'Eugenei'	0.0	
D-38	*P. deltoides*	0.0	

[a]Index calculated from mean number and size of colonies, range 0–16.

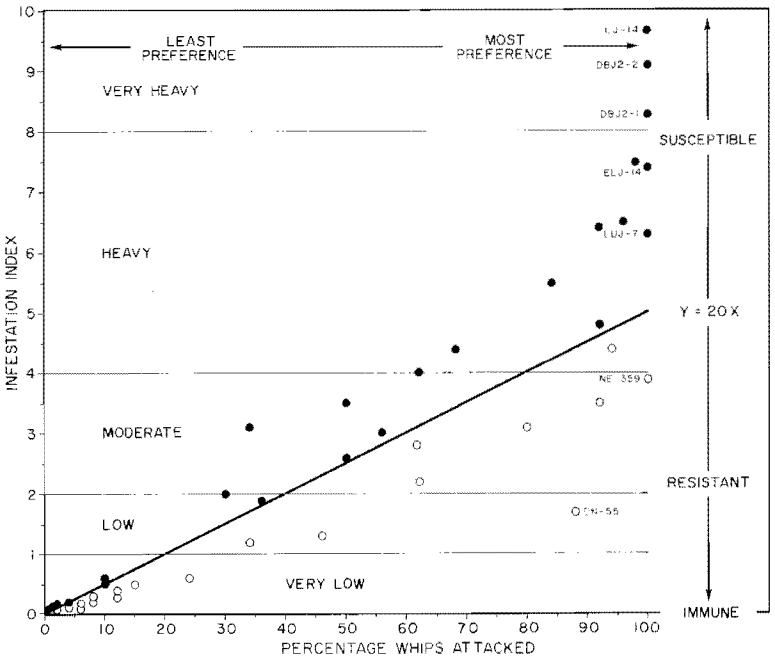

Fig. 1. Relation between aphid infestation level and percentage of *Populus* whips with aphid colonies.

Data from the 50 clones plotted in Figure 1 show that there was a full range of percentage of whips attacked (0–100%). Further, the data approximate a regression line corresponding to Y = 20X and conveniently may be used to delimit clones that are most resistant (below the line) and those that are most susceptible (above). Most points fall within the range expected about the line, but there are a few exceptions. For example, the wide range of infestation indices at the 100% level of attack (i.e., 3.9–9.7) may signify an unknown resistance in some clones, so clonal indices may vary by a factor of more than two, a difference of 1000 insects or more. However, we should not discount the possibility that a large colony is the product of the offspring of a few or several migrant female aphids and thus a union of several colonies rather than one. In either instance, most *P.* × *jackii* clones were 100% attacked and colonies on them were so large that their indices suggest a heavy or very heavy infestation (Fig. 1). In contrast NE-359, which was also 100% attacked, generally had smaller colonies and was ranked as moderately infested. DN-55 is especially noteworthy as having 88% of the whips infested, but with an infestation index of about 1.7, a low infestation level.

Clones from the trickle irrigation area of the nursery showed far less attacks than in the overhead area. NE-225 had the highest index (2.2), but still a low infestation level, a rank it also held in the overhead irrigation beds. The only *jackii* clone present in this part of the nursery was JAC-7 with a very low index of 0.4. This clone was not in the overhead irrigation beds and could not be compared. There were, however, 14 clones common to both areas (Table 2). Differences are generally unenlightening except perhaps for clone NE-386, which shows a difference of 4.9 by comparing a ranking of 0.6 (very low) to 5.5 (heavy). NE-386 was one of two *P. candicans* × (*P.* × *berolinensis*) hybrids; the other one (NE-387) had a low infestation. Comparisons between the two

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Table 2. Infestation indices of *Aphis maculatae* on hybrid *Populus* clones in overhead and trickle irrigation areas of the PCA Nursery.

Clone	Overhead	Trickle	Difference
RAV	0.0	0.0	0.0
NE-238	0.0	0.0	0.0
NE-206	0.3	0.1	0.2
NE-318	0.5	0.0	0.5
DN-17	1.3	0.8	0.5
NE-300	1.9	1.2	0.7
NE-225	3.1	2.2	0.9
DN-18	1.2	0.0	1.2
DN-28	2.0	0.4	1.6
DN-55	1.7	0.0	1.7
NE-252	2.1	0.3	1.8
NE-387	2.8	0.7	2.1
NE-264	4.0	1.3	2.7
NE-386	5.5	0.6	4.9

areas are especially difficult because the clones in the stool beds in the overhead area were 2 years older, and they also produced much larger and apparently more vigorous whips. Osgood (1962) noticed that *A. maculatae* colonies were more numerous and much larger on vigorous aspen suckers than on less vigorous young trees. This may have been one of the reasons some of the clones in the overhead areas sustained heavier attacks. Even though we found a wide range of infestation among clones, further testing in provenance plantings is needed in order to get statistically sound mean and variance estimates.

The two *jackii* clones showed no significant differences in end-of-season height growth between whips that had large aphid colonies and the uninfested controls. Height of all whips average 155 cm and the two clones with the aphid colonies averaged 1.0 and 2.5 cm shorter than the controls which was inconsequential to future growth and biomass production. Similarly, whips treated to remove aphids were only 1.0–2.3 cm shorter than the controls.

Although our tests showed no important growth loss, Osgood (1962) has shown that the aphid can reduce growth and cause deformities. He found that quaking aspen suckers grew very little during the entire first growing season and took on a bushy appearance when infested for 2 months with a large aphid colony. When he compared growth between several aspen sucker test-pairs (pairs uninfested and fully infested for 2 weeks), he found by the end of the season the infested ones were about 30% shorter. These, however, caught up in height by mid-August of the second year. Also, he noted that the lateral buds burst on these suckers and caused much branching, a trait reserved mostly for 2-year growth.

In the two insecticidal soap tests, both formulations and dosages controlled the aphids about equally on the three clones DN-22, DN-28, and RAV (Table 3). Control was slightly less on DN-55. We saw no reinfestation of the test whips, although reinfestation often does occur after a colony vacates or is removed from aspen suckers (Osgood 1962). We concluded that the insecticidal soaps gave sufficient control to disrupt the aphids for the remainder of the season.

MLP-IV may in time have some advantages over Safer's soap. It contains the most active hydrocarbon chain in pure form. Also it is a lipophilic compound, unlike Safer's, which is water soluble, and thus may be less likely to wash off in the rain. The MLP-IV dosage, however, caused some burning of the foliage and thus needs further formula adjustments before it is used on *Populus* species and clones.

Table 3. Insecticidal soap tests for *Aphis maculatae* on hybrid *Populus* clones at Packaging Corporation of America Nursery and Raymor Nursery, 1981.

Clone	Insecticide	Percentage Dosage	No. Aphid Colonies Treated	Mean Infestation Index	Percentage Aphids Controlled
PCA Nursery					
DN-22	Safer	0.5	10	7.2	88
	Safer	1.0	10	5.3	91
	MLP-IV	0.5	10	7.2	90
	MLP-IV	1.0	10	6.0	94
DN-55	Safer	0.5	10	6.0	76
	Safer	1.0	10	6.8	77
	MLP-IV	0.5	10	8.4	86
	MLP-IV	1.0	10	7.2	84
Raymor Nursery					
DN-28	MLP-IV	0.5	10	16.0	96
	MLP-IV	1.0	10	16.0	91
RAV	MLP-IV	0.5	10	16.0	93
	MLP-IV	1.0	10	16.0	88

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