Status of Borers Infesting Apple Burrknots and Their Management in New York Orchards

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Seventy percent of dwarf and semidwarf trees have burrknots susceptible to borer infestation. Prebloom or petalfall applications of Lorsban will control both dogwood borer and American plum borer season-long.

The dogwood borer, *Synanthedon scitula* (Harris), was first recognized as a pecan pest during the earl 1940s, but was not an economic pest of apple until the introduction of clonal apple rootstocks. Such rootstocks tend to produce burrknots, which are attractive oviposition and entry sites for dogwood borer (Figure 2). Because size-controlling rootstocks have become so prevalent in modern apple culture, the consequential incidence of dogwood borer infestations has also risen. Earlier work in New York (Riedl et.al. 1985) highlighted this borer as a prevalent and important pest of apple. Their examinations of apple orchards in western New York and the Hudson Valley revealed that 70 percent of trees on dwarfing or semi-dwarfing rootstocks had burrknots and that an average of 40 percent of the burrknots in any particular orchard were infested by dogwood borers.

Dogwood borer is in the family *Sesiidae*, commonly known as clearwing moths. This family also contains peachtree borer, lesser peachtree borer and a number of borers that infest forest trees and shrubs. Dogwood borer larvae are creamy white with a yellowish-brown head capsule and the last instar is about half an inch long (Figure 1).

Results of tree trunk surveys of tart cherry and peach, performed during 1994 and 1995 in western New York, the Hudson Valley and on Long Island determined that American plum borer, *Euzophera semifuneralis* (Walker), is the predominant tree-boring insect pest in tart cherry in western New York, but not in the other two regions (Kain and Agnello, 1999). More recently, a number of apple orchards in western New York with rootstocks expressing burr knots were infested almost exclusively with plum borer. It is likely that tart cherries are reservoirs of plum borer, from which other susceptible crops (i.e., apples with burr knots) may become infested. Plum borer is in the family *Pyralidae*, which contains many pest species—most notably the European corn borer. Plum borer adults are obscurely colored grayish moths with a wingspread of slightly under one-inch. The larvae range from blackish-green to blackish-purple with a yellowish-brown to dark brown head capsule and are about three-quarter to one inch long in the final instar. Plum borers also have long hairs projecting from the body at right angles and are often found inside white, silken cocoons (Figure 3).

In apple, borers gain entry through burrknots that form on the above-ground part of dwarfing rootstocks. They initially feed on tissues within the burrknot, which is thought to be the least harmful type of feeding. They may move outward from there to feed on the surrounding inner bark and can eventually girdle the tree. While dogwood borer infestations can greatly affect plantings on dwarfing rootstocks, plum borer infestations are probably a greater cause for concern because the larvae are larger and more voracious, are usually more abundant within a particular wound, and feed in a more girdling fashion. Researchers in California have noted that plum borer infestations of young pecan trees has led to outright death of the young trees or crotch splitting later in the lives of the trees.

Past recommendations for dogwood borer management have called for one trunk spray of Lorsban in mid-July to mid-

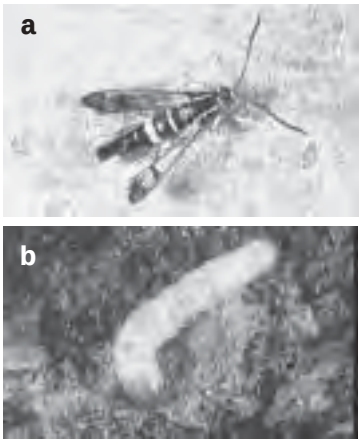

Figure 1. Dogwood borer (a.) adult (b.) larva


Figure 2. Burrknots

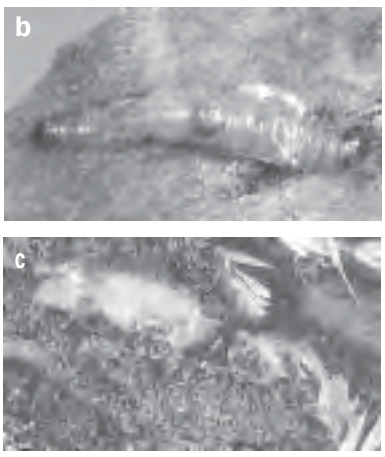

Figure 3. American plum borer. (a.) adult (b.) larva (c.) cocoon

August, or two applications of endosulfan—one in early July and one in early August. However, because the peak of the first flight of plum borer occurs at about the end of May, these summer treatments for dogwood borer miss the first generation of this pest (Figure 3).

During 2000, in accordance with the Food Quality Protection Act, the EPA established a 'zero' tolerance for Lorsban on fruit and consequently limited its use on apple to prebloom applications only. While awaiting results of additional analyses of residues on fruit, the EPA and NYSDEC have granted a temporary amendment to the Lorsban label that allows a maximum of two postbloom trunk sprays for the control of these borers. For a number of reasons, Lorsban has long been the standard treatment for borers infesting pome and stone fruits. Because the continued prebloom or postbloom usage of this insecticide is by no means assured, we are compelled to seek alternatives.

Research Objectives

Because testimonials by growers, agents and nurserymen suggest that the incidence of borer infestations are increasing throughout the Northeastern and Mid-Atlantic apple production states, our objectives were to: a) determine the prevalence and species distribution of borers in apple, b) determine which of the two pests are present in any given production region, because the flight periods of dogwood borer and plum borer do not coincide, and c) devise new or altered control strategies for borers of apple.

Results

Preliminary surveys (Table 1) provided evidence that plum borer is prevalent near infested tart cherry and peach orchards, old stumps of these trees, and wild cherry trees. In orchards more isolated from stone fruits, such as the Hudson and Champlain valleys, dogwood borer is more likely to be the predominant pest. Both borers were more likely to be found in orchards with mouseguards.

We performed efficacy trials on apple during 2000 and determined that Lorsban, applied as a coarse trunk spray at petal fall, provided season-long control of both plum borer and dogwood borer (Table 2). In addition to preventing infestation by larvae hatching after application, the insecticide penetrated the burrknot and controlled overwintering larvae within.

These data suggest that Lorsban applied much earlier than previously recommended would control borers. During 2001, we evaluated prebloom applications at half-inch green and at pink. We did not find enough American plum borer larvae to evaluate efficacy against them, so results given are from an orchard where only dogwood borers were present (Table 3). Early sprays were the superior treatments in early (late-June) evaluations because they controlled overwintered larvae before they began spring feeding, as evidenced by decreased production of frass.

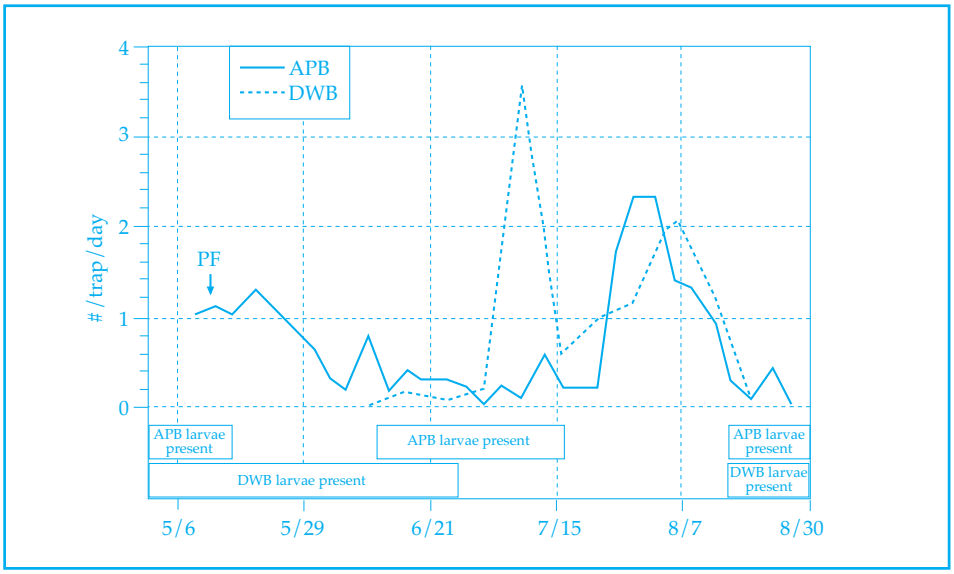

Figure 3. Seasonal occurrence of dogwood borer and American plum borer in New York.

TABLE 1

Incidence of trunk borers in New York apple orchards, 1999-2001.

Location	Block	proportion w/burrknots	proportion infested	Average damage rating	Larvae per 10 infested trees DWB	Larvae per 10 infested trees APB	Mouseguards	Stone fuit w/in 0.5 mi.
Wayne Co.	1	0.66	0.58	0.61	7	0	No	No
Wayne Co.	2	0.68	0.76	1.26	12	0	No	No
Wayne Co.	3	0.94	0.94	2.64	12	12	No	Yes
Wayne Co.	4	0.82	0.46	0.63	0	15	Yes	Yes
Wayne Co.	5	0.98	0.94	2.18	9	7	Yes	Yes
Wayne Co.	6	0.78	0.56	1.56	15	2	Yes	Yes
Wayne Co.	7	0.30	0.00	0.00	0	0	Yes	Yes
Wayne Co.	8	0.52	0.27	0.50	6	0	Yes	No
Wayne Co.	9	0.78	0.62	1.44	17	0	No	Yes
Wayne Co.	10	0.88	0.16	0.43	8	1	No	Yes
Champlain	1	0.52	0.00	0.50	0	0	Yes	No
Champlain	2	0.50	0.15	0.15	1	0	Yes	No
Champlain	3	0.52	0.34	1.18	3	0	Yes	No
Champlain	4	0.28	0.00	0.69	0	0	No	No
Orleans	1	0.60	0.23	1.46	1	7	No	Yes
Orleans	2	0.90	0.05	0.27	2	1	No	No
Orleans	3	0.20	0.12	0.62	3	0	No	No
Orleans	4	0.40	0.02	0.43	1	0	No	No
Orleans	5	0.84	0.00	0.36	0	0	No	Yes
Orleans	6	0.80	0.15	0.65	1	5	No	Yes
HV	1	0.38	0.50	1.35	10	0	No	No
HV	2	0.40	0.23	0.61	8	0	Yes	No
HV	3	0.32	0.42	1.00	6	0	No	No
HV	4	0.40	0.16	0.30	9	0	No	No
HV	5	0.18	0.08	0.12	1	0	No	No
HV	6	0.48	0.18	0.48	9	0	No	No
HV	7	0.62	0.23	0.73	10	0	No	No
HV	8	0.44	0.20	0.45	11	0	No	No
Albany	1	0.80	0.58	1.13	12	0	No	Yes
Albany	2	0.38	0.11	0.26	4	0	Yes (on 1/2)	Yes
Albany	3	0.68	0.35	1.56	13	0	No	No
Albany	4	0.48	0.00	0.38	0	0	No	No

* Damage rating: 0 = none; 1 = burrknot feeding only, < 50% consumed; 2 = burrknot feeding only, > 50% consumed; 3 = feeding outside burrknot, < 25% trunk girdled; 4 = feeding outside burrknot, 25–50% trunk girdled; 5 = feeding outside burrknot, > 50% trunk girdled

TABLE 2

Efficacy of Lorsban trunk sprays against borers infesting apple in two Western NY orchards.

Wafler Orchards - 2000	% trees infested	
Treatment (Lorsban 50W timing)*	late June (n=50)	October (n=25)
Petal fall	1.3 a	5.3 a
Petal fall + mid-July	4.0 a	2.7 a
Mid-July	24.7 b	1.3 a
Untreated	40.0 c	66.7 b

Fowler Orchards - 2000	% trees infested	
Treatment (Lorsban 50W timing)*	6/28/00	10/5/00
Petal fall	5.0 a	0 a
Petal fall + mid-July	7.5 a	0 a
Mid-July	32.5 b	5.0 a
Untreated	30.0 b	35.0 b

Means followed by the same letter are not significantly different ($P < 0.001$).
*1.5 lb Lorsban 50W/100 gal

TABLE 3

Efficacy of insecticides and white paint against borers infesting apple in Western NY, 2001. Evaluated late June.

Wafler Orchards - 2001		
Treatment	% trees infested	Mean No. DWB larvae/tree
Lorsban 4EC (3 qt/100) @ HIG	6.7 a	0.03 a
Lorsban 4EC (3 qt/100) + paint (1 part paint: 2 parts water) @ HIG	13.3 a	0.17 ab
Lorsban 4EC (3 qt/100) @ Pink	16.7 a	0.03 a
Lorsban 4EC (3 qt/100) @ PF	50.0 b	0.20 ab
Avaunt 30WG (6 oz/100) @ PF	50.0 b	0.40 bc
Avaunt 30WG (6 oz/100) @ PF + July	60.0 bc	0.70 cd
Endosulfan 3EC (1 qt/100) @ PF + July + August	63.3 bc	0.67 cd
Paint alone (1 part paint: 2 parts water) @ HIG	63.3 bc	0.67 cd
Untreated	76.7 c	0.90 d

Means followed by the same letter are not significantly different ($P < 0.001$). n=10

TABLE 4

Efficacy of insecticides and white paint against borers infesting apple in Western NY, 2001. September 11 Evaluation.

Wafler Orchards - 2001		
Treatment	% trees infested	Mean No. DWB larvae/tree
Lorsban 4EC (3 qt/100) @ HIG	6.7 ab	0.07 a
Lorsban 4EC (3 qt/100) + paint (1 part paint: 2 parts water) @ HIG	3.3 a	0.03 a
Lorsban 4EC (3 qt/100) @ Pink	13.3 ab	0.13 a
Lorsban 4EC (3 qt/100) @ PF	3.3 a	0.03 a
Avaunt 30WG (6 oz/100) @ PF	40.0 cd	0.50 bc
Avaunt 30WG (6 oz/100) @ PF + July	23.3 bc	0.23 ab
Endosulfan 3EC (1 qt/100) @ PF + July + August	33.3 cd	0.43 bc
Paint alone (1 part paint: 2 parts water) @ HIG	46.7 d	0.53 c
Untreated	76.7 e	0.90 d

Means followed by the same letter are not significantly different ($P < 0.001$). n=10

In the late September evaluation (Table 4), the petal fall Lorsban application was equal to, and maybe a little better than the earlier Lorsban applications, indicating that Lorsban applied prebloom may be beginning to lose some of its effectiveness by mid-July, when the dogwood borer flight peaks. However, the addition of paint to Lorsban at half-inch green appears to have extended the duration of Lorsban activity from that early application. All treatments were better than the check, in terms of both the proportion of trees infested and the number of larvae, but Lorsban treatments were better than all others. Efficacy of Avaunt applied at petal fall and again in mid-July was intermediate.

Current Recommendations

- Avoid the development of burrknots in the first place; where there are no burrknots, there are no borers. When establishing a new orchard, plant trees so that the graft union is 2 inches above the soil surface. This will encourage buried burrknots to establish roots and decrease the number of active burrknots. Care must be taken to avoid planting too deeply allowing the development of scion rooting.
- In established orchards, mound the soil up to within a couple of inches of the graft union. Mounds must be wide enough to prevent freezing injury to the buried rootstock.
- Because shade and increased humidity promote the development of burrknots, good weed control around the trunk is essential.
- Orchards with mouseguards, especially the plastic spiral type, have substantially greater problems with both species of borer.
- Use directed sprays of Lorsban while it is available to reduce the population. We are currently evaluating other materials in the event we ultimately lose the use of Lorsban altogether.

Borers in tree fruits may be thought of as unimportant or secondary by many because the damage they cause is less visible and less immediately threatening than other forms of insect damage. Over the long run however, they can substantially decrease the lives of trees. It is estimated that the lives of tart cherry trees infested by plum borers are shortened by about one-third. We have witnessed situations in which the same is true for dogwood borer. Young trees may be killed outright, or weakened and deformed later in their lives. Although it is harder to quantify, borers may also reduce tree vigor and yield and open the way for increased disease problems.We have established apple plantings to determine the long-term effects of borer infestations on the growth and performance of size-controlled apple trees.

References

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