N O T E

Survey of Grape Root Borer, *Vitacea polistiformis* (Harris), Using Pheromone Traps in Virginia Vineyards[1]

J. Christopher Bergh,[2] Douglas G. Pfeiffer[3] and Kenner P. Love[4]

Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061, USA

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The grape root borer, *Vitacea polistiformis* (Harris), is a potentially destructive, monophagous pest of grapevines in the eastern United States (Dutcher and All 1979, J. Econ. Entomol. 72: 159-161). Distributed from Michigan to Florida and west to Missouri and Arkansas (Snow et al. 1991, J. Entomol. Sci. 26: 157-168), it has been especially problematic in the southern portions of its geographical range. Larvae of grape root borer feed and develop on roots of all species of *Vitis* grown commercially and native *Vitis* species that are a common component of the forest understory (Brooks 1918, U.S. Dept. Agric. Bull. 730: 1-28; All et al. 1987, Down to Earth 43: 10-12). It is generally assumed that infestations in commercial vineyards originate from moths that immigrate from native vines. Established infestations in vineyards can have adverse horticultural impacts, ranging from poor growth, vigor and productivity of individual vines to the demise of entire plantings (reviewed in Olien et al. 1993, HortScience 28: 1154-1156). Although the likelihood of infestation by grape root borer may increase as vineyards age, young vines also are susceptible to attack (Clark and Enns 1964, J. Kansas Entomol. Soc. 37: 56 - 63; All et al. 1987). A 1987 survey of grape growers in Virginia revealed that 80.5% of respondents were uncertain about the importance of grape root borer, whereas the remainder ranked it as not important (Pfeiffer et al. 1990, Pp. 45-61, *In* N.J. Bostanian, L.T. Wilson and T.J. Dennehy [eds.], Monitoring and Integrated Management of Arthropod Pests of Small Fruit Crops, Intercept, Andover, UK). Pfeiffer et al. (1990) suggested that grape root borer populations were generally low in most vineyards in Virginia at that time, but predicted that its abundance and pest status would increase as plantings aged. Between 1995

Correspondence to: J. Christopher Bergh Virginia Polytechnic Institute and State University Alson H. Smith, Jr. Agricultural Research and Extension Center 595 Laurel Grove Road Winchester, VA 22602 Telephone (540) 869-2560 ext. 32

[1]Received 26 January 2005; accepted 27 February 2005.

[2]Address inquiries (email: cbergh@vt.edu). Alson H. Smith, Jr. Agricultural Research and Extension Center, Winchester, VA 22602.

[3]Department of Entomology.

[4]Rappahannock County Extension office, 311G Gay Street, Washington, VA 22747.

and 2000, grape production in Virginia increased by 51%, from 574 to 868 ha (Anon 2001, VA Agric. Stat. Serv. Publ. 76), and production in Virginia currently ranks ninth in the United States. The only published data on monitoring grape root borer in Virginia using pheromone traps are those of Pfeiffer et al. (1990), also included in Snow et al. (1991). In two commercial vineyards over two consecutive years (1986-1987), they showed that the onset of emergence and flight occurred between late June and early July, peaked from late July to early August and subsided to very low levels by late August or early September. Given the increasing number of vineyards in Virginia and the increasing age of established vineyards, a current assessment of the risk posed by grape root borer was warranted. Toward this end, a survey of the presence and relative abundance of grape root borer was conducted in vineyards in Virginia, using sex pheromone baited sticky traps. Although the abundance of grape root borer in the native forest is considered to be low, there are no data comparing the capture of moths in traps deployed simultaneously inside and outside commercial vineyards. Given that grape root borer males are strong fliers and that many vineyards are in close proximity to native forest with wild grape hosts, it is possible that pheromone traps inside a vineyard could attract males from outside the planting. Understanding the moth "pressure" from native hosts is important to evaluating the risk to both new and established plantings and to the interpretation of moth captures in traps deployed within a vineyard. To address these questions, a study involving transects of pheromone traps extending from the forest into commercial vineyards was conducted in 2004.

Between 2003 and 2004, pheromone traps for adult male grape root borer were deployed in 19 vineyards from seven counties in Virginia (Table 1). Delta style sticky traps were used most commonly, but wing style traps were used in vineyards 8, 11, 14 and 15. Traps at most vineyards were baited with Scenturion™ lures (Suterra, Portland, OR), although lures from Trécé (Salinas, CA) and IPM Tech (Portland, OR) were used at vineyards 12 and 13, and 4 and 11, respectively. Traps were deployed in the interior of blocks by suspending them from trellis wires at ≈1.0-1.5m. In 2003, traps at most sites were deployed for the majority of the flight period, and the pheromone lures were replaced once in mid-August. Moth captures were recorded weekly at some locations, biweekly at others and at irregular intervals at two vineyards (Table 1). In 2004, the duration of trapping spanned only the period of peak flight, and all traps were checked weekly. Trap liners were replaced when ≥12 moths had been captured since the previous evaluation or when they had become excessively dirty. When fewer moths were found, they were removed from the liner.

Delta Bio-lure™ traps and Scenturion lures (Suterra, Portland, OR) were used in the trap transect study. At vineyards A, B and C, traps were deployed on 16 July and checked twice weekly for moth captures through 19 August. At vineyard D, traps were deployed on 23 July and the number of moths captured was recorded weekly through 19 August. Trap liners were cleaned of moths or replaced, as described above. A single transect was deployed at each vineyard, consisting of one trap at each transect point, and the line of traps was oriented perpendicularly to the rows in each vineyard. At vineyards A and B, the trap transect followed a line from the forest into the vineyard; whereas, the trap line at vineyards B and C extended from the forest on one side of the vineyard, through the vineyard and into the forest on the opposite side. Details about the number of traps per site, and their specific locations are included with Fig. 1. Traps in the vineyards were suspended from trellis wires at heights ranging from

Table 1. Survey of adult grape root borer using pheromone traps in commercial vineyards in Virginia, 2003-2004

Vineyard	Age* (yrs)	County	Trapping period** (no. traps)	Moth captures			Mean no. moths/trap at peak flight§	Mean total no. moth/trap
				First†	Peak	Last‡		
1	3	Loudoun	13 Jul-11 Sep, 2003 (2)		31 Jul	28 Aug	5.0	8.0
2	8-18	Loudoun	3 Jul-11 Sep, 2003 (2)		31 Jul	11 Sep	23.0	53.0
3	7	Loudon	3 Jul-11 Sep, 2003 (2)		31 Jul	14 Aug	7.5	11.0
4	16-26	Fauquier	2 Jul-11 Sep, 2003 (3)	9 Jul	1 Aug	11 Sep	28.0	127.7
5	18-21	Fauquier	2 Jul-11 Sep, 2003 (2)		15 Aug	29 Aug	32.5	65.0
6	8-23	Fauquier	2 Jul-11 Sep, 2003 (2)		15 Aug	29 Aug	21.0	39.0
7	15-18	Fauquier	2 Jul-11 Sep, 2003 (2)		1 Aug	11 Sep	21.5	65.5
8	4	Rappahannock	9 Jul-11 Sep, 2003 (2)		15 Aug	31 Aug	24.5	52.0
9	2-8	Rappahannock	9 Jul-11 Sep, 2003 (2)		1 Aug	11 Sep	11.0	16.0
10	6-8	Rappahannock	11 Jul-17 Sep, 2003 (2)		5 Aug	11 Sep	26.5	115.0
11	14-16	Rappahannock	2 Jul-29 Aug, 2003 (4)	9 Jul	8 Aug		24.8	91.8
12	13	Rappahannock	17 Jul-25 Sep, 2003 (3)		7 Aug	17 Sep	25.3	86.8
13	3	Madison	17 Jul-14 Sep, 2003 (3)		18 Aug	14 Sep	18.0	50.3
14	40-45	Augusta	3 Jul-12 Sep, 2003 (3)	11 Jul	2 Aug	12 Sep	16.3	63.7
15	40-45	Augusta	3 Jul-12 Sep, 2003 (3)	18 Jul	2 Aug	12 Sep	30.0	97.0
16	24-27	Shenandoah	3 Jul-11 Sep, 2003 (2)	13 Jul	31 Jul	11 Sep	14.0	42.0
17	2-21	Shenandoah	15 Jul-19 Aug, 2004 (2)		19 Jul		20.5	35.5

Table 1. Continued.

Vineyard	Age* (yrs)	County	Trapping period** (no. traps)	Moth captures First†	Peak	Last‡	Mean no. moths/trap at peak flight§	Mean total no. moth/trap
18	5	Shenandoah	23 Jul-19 Aug, 2004 (3)		6 Aug		0.7	1.3
19	6-14	Frederick	22 Jul-19 Aug, 2004 (1)		29 Jul		12 (1 trap)	17 (1 trap)

* Age of vineyard at time of survey.

** Traps checked at the following intervals: weekly at vineyards 4, 10, 11 and 14-19, biweeekly at vineyards 1-3 and 5-9, and irregularly (weekly or biweekly) at vineyards 12 and 13.

† Date of first capture reported only for vineyards in which traps were deployed early in July and checked weekly.

‡ Date of last capture reported only for vineyards in which traps remained in place through ca. mid-September.

§ Values for the date of peak light, the mean no. moths/trap at peak flight and the mean total no. moths/trap were influenced by the frequency at which moth captures were recorded and provide relative estimates of those parameters.

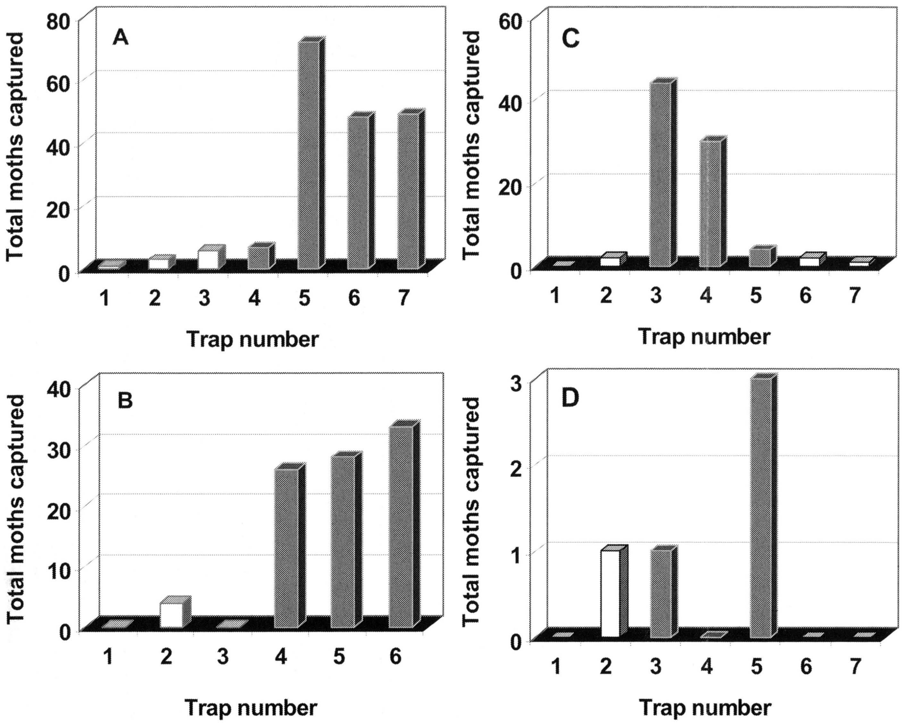

Fig. 1. The number of male, grape root borer moths captured in pheromone traps deployed as transects from the native forest (white bars) into commercial vineyards (gray bars) in Virginia. Individual trap locations were as follows. Vineyard A: trap 1 at ≈70m into forest; trap 2 at ≈34m into forest; trap 3 at ≈7m into forest; trap 4 at vineyard edge, ≈26m from forest edge; trap 5 at ≈26m into vineyard; trap 6 at ≈56m into vineyard; trap 7 at ≈89m into vineyard. Vineyard B: trap 1 at ≈78m into forest; trap 2 at ≈38m into forest; trap 3 at ≈13m into forest; trap 4 near vineyard edge, ≈43m from forest edge; trap 5 at ≈46m into vineyard; trap 6 at ≈90m into vineyard. Vineyard C: trap 1 at ≈82m into forest; trap 2 at ≈8m into forest; trap 3 at ≈21m from forest edge and ≈11m into vineyard; trap 4 at ≈56m into vineyard; trap 5 at ≈113m into vineyard; trap 6 at ≈15m into forest; trap 7 at ≈80m into forest. Vineyard D: trap 1 at ≈93m into forest; trap 2 at ≈21m into forest; trap 3 at ≈30 from forest edge and ≈8m into vineyard; trap 4 at ≈39m into vineyard; trap 5 at ≈130m into vineyard; trap 6 at ≈21m into forest; trap 7 at ≈90m into forest.

≈1.0-1.5 m, whereas those in the forest were suspended from available vegetation, including wild grapevines, at heights ranging from ≈1.5-2.0 m. The numbers of male grape root borer captured in the forest and in the vineyard were compared using the two-sample *t*-test at $\alpha = 0.05$ (PROC TTEST, SAS Institute, 2001, Cary, NC).

Grape root borer was captured in all vineyards surveyed, and in relatively high numbers at some (Table 1). It is probable that the trapping efficiency of sticky trap liners is greatly diminished after 25-30 grape root borer have been captured. Consequently, the trap captures from sites with high populations and/or from some of the sites where traps were checked biweekly or at irregular intervals probably did not reflect the true size of the resident population. Generally, fewer moths were captured in younger than in older vineyards, although vineyard 9 showed a relatively large population, despite being only 4 yrs old.

Significantly more moths were captured in traps deployed in vineyards (mean ± SD/trap; 25.5 ± 22.7) than in adjacent forest (1.4 ± 1.8) ($t = -3.97$, df = 12.1, $P = 0.0018$). At vineyard A, similar numbers of moths were captured near the forest edge and near the edge of the vineyard (Fig. 1). Traps deployed further into the vineyard showed a pronounced increase in captures. At vineyard B, there was no indication of a gradient in captures from one habitat to another, but rather an abrupt increase beginning near the edge of the vineyard. At vineyard C, the "vineyard effect" was even more apparent, showing a pronounced peak of moth captures inside the vineyard and markedly reduced captures in traps in the forest on both sides. Although the grape root borer population was much lower at vineyard D, the same general trend as in vineyard C was evident (Fig. 1). These data suggest strongly that the majority of male grape root borer captured in pheromone traps deployed within a vineyard likely also emerged from vines within. Grape root borer populations in the native forest surrounding these sites were present, but at rather low levels. However, Bergh (unpublished data) found that grape root borers were captured fairly commonly in traps baited with experimental pheromone lures for another sesiid pest, the dogwood borer, in commercial apple orchards adjacent to native forest but far removed from any commercial vineyard.

It appears that grape root borer poses a risk to many, if not most, vineyards in Virginia and that some vineyards presently support damaging infestations, concurring with the predictions of Pfeiffer et al. (1990). Young vines are not immune to attack and are susceptible to infestations originating from mated females immigrating from native hosts and from nearby plantings of older vines with established populations. Although we do not yet understand the relationship between the capture of grape root borer in pheromone traps and larval infestation levels, it appears that trap captures reflect primarily emergence from within the vineyard. Grape growers in Virginia should incorporate pheromone trap based monitoring of grape root borer into their annual vineyard management plans. This will enable an appropriate response to existing problems and, over time, should reveal either developing problems or decreasing populations associated with intervention and management.

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