A Possible "Resistance" to the Male Confusion Technique by Lesser Peachtree Borer Males

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Introduction

Chemical disruption of mating has been used with success against a variety of insect pests (5). The lesser peachtree borer (LPTB), *Synanthedon pictipes* (Grote and Robinson) has been shown to be susceptible to this type of control tactic (4). Much basic research, however, needs to be done on various biological aspects of mating disruption. Bartell and Lawrence (1) reported that low concentrations of pheromone in the atmosphere could cause habituation within the male, resulting in lack of response to calling females. Another factor operative with some species occurs when males are responsive, but a high background of pheromone in the area prohibits them from locating the point source represented by the calling female. Also, males may be attracted to artificial pheromone sources, thus diluting the numbers reaching the females; or in some species, both sexes may exhibit abnormal mating behavior where large concentrations of pheromone are present. These and other aspects of biology should be investigated for each species as disruptive tactics are developed.

This paper reports on results of experiments conducted to access the effect of (Z,Z)3,13-octadecadien-1-ol acetate (ZZ-ODDA) (6), the principal component of the sex pheromone of peachtree borer, *Synanthedon exitiosa* (Say), as a disruptant of lesser peachtree borer. It also reports on the unexpected reaction of laboratory reared males when released into areas treated with this material.

Materials and Methods

During the seasons of 1977, 1978 and 1979, observations were made of effects of ZZ-ODDA on distruption of mating of lesser peachtree borer. The test site was a portion of a commercial peach orchard near Patoka, IN, consisting of 10-12 yr. old Redskin peachtrees. The treated area of the orchard consisted of 135 trees in which a ZZ-ODDA pheromone disruptant lure supplied by Albany International Company was hung in the top of each tree. Each lure consisted of plastic capillary tubes open at one end and containing ca 15-20 mg of pheromone. One lure was used per tree, supposedly insuring a pheromone laden atmosphere throughout the treatment block. The untreated block was south of the treated block and consisted of a like number of trees. Prevailing winds were from the southwest to northeast. Five sticky traps containing 5 virgin females each were positioned within the 2 blocks to monitor male attraction. Lesser peachtree borer were reared in the laboratory on immature applies (2,3). Males were collected and marked with fluorescent pigments (7). In 1977 and 1978, such males were released into a peach orchard. In 1978, a series of experiments were initiated using caged trees to better assess the male behavior. During 1978 and 1979, only one cage was used while 2 separate trees were caged for the 1980 and 1981 tests. Cages were made of wood and galvanized screen wire, 3.5 x 3.5 x 3.5 M square. The treatment consisted of 3 ZZ-ODDA dispensers hung in the top of the tree. Laboratory reared males were marked and released in the cage. Wild males, captured in a walk-in trap baited with virgin females were collected and also released in the cage. A sticky trap baited with 3 virgin females was placed in the tree canopy to monitor male response. Percentage recapture was recorded and results analyzed using a paired comparison test.

Results and Discussion

During the 3 yrs of observations of male LPTB capture on female baited traps, a substantial decrease in capture was noted within the treated area. Total male capture during the 3 test seasons was 94, 85 and 28 in the treated areas respectively. In the control area, 507, 1527 and 1411 were captured in 1977, 1978 and 1979 respectively. The percentage reduction in capture was 84.4, 94.7, and 98.1% for the 3 years, indicating that efficiency of the disruption technique apparently increased.

TABLE 1. *Numbers of laboratory reared lesser peachtree borer males released and recaptured in a peach orchard. Treated block contained one ZZ-ODDA dispenser per tree.*

	No. released in	No. recaptured in		
	Treated	Treated	Untreated	Total
1977	3081	1155 (37.5%)	460 (14.9%)	1615
1978	950	336 (35.4%)	147 (15.5%)	483
	Untreated			
1977	3740	223 (6%)	1942 (51.9%)	2165
1978	950	61 (6.4%)	302 (47.3%)	363
	Between Blocks			
1977	785	70 (8.9%)	212 (27%)	282

Results of the 1977 and 1978 releases of laboratory reared males are shown in Table 1. Those males released into the untreated block were mostly recaptured within that block, with only 10% of the 2165 recovered males moving into and being trapped in the treated area. Of the males released in the treated block, 72% of those recovered were recaptured there. In 1978, essentially the same thing occurred. Of the 483 males recaptured from the release into the treated block, 70% were trapped in the treated plot. Such results were contradictory to those expected so further tests were conducted in cages.

Table 2 presents the results of 4 seasons of such observations. The summation of these 4 seasons indicates that only 10% of the wild males released in treated cages were recaptured, while 44% of the laboratory reared males were recaptured. In untreated cages, 26% of wild and 48% of lab males were recaptured.

The cage experiments showed a.) that laboratory reared males were more responsive to the females calling in the cages, a greater percentage being captured than the wild males, b.) that there was no significant difference in the number of laboratory reared males attracted to females in a pheromone laden atmosphere or clean atmosphere, c.) that a significantly lesser number of wild males were captured in pheromone treated cages than in untreated cages and d.) that significantly greater numbers of lab males were trapped in treated cages than wild males while there was no significant difference between numbers captured in untreated cages.

According to these results gathered over a 4 yr period, the male confusion control technique, although very successful against feral LPTB males, and indeed, actually appearing to improve from season to season, was essentially unsuccessful

TABLE 2. *Recapture of laboratory reared and wild males after release into untreated tree cages. Treatment consisted of 3 ZZ-ODDA dispensers in tree. Means followed by the same letter are not significantly different at the 5% level.*

	Number released				Number recaptured			
	LAB		WILD		LAB		WILD	
	Treated	Untreated	Treated	Untreated	Treated	Untreated	Treated	Untreated
1978[1]	250	125	250	125	121	91	20	34
1979[1]	546	135	407	125	273	50	57	50
1980[2]	450	450	159	159	240	263	15	30
1981[2]	890	890	180	180	312	366	11	39
Ave.	534	400	249	147	237[a]	193[a]	26[b]	38[c]

[1] 1 cage used with alternate treated and untreated tests conducted.

[2] 2 cages used, one with treatment, one untreated.

against males reared in the laboratory. At this time, we can only speculate on the biological basis for this phenomenon.

Under high density condition, short range stimulii may provide the chief mechanism for mate finding. Laboratory reared males may move around more and through short range stimuli, contact greater numbers of females than wild males do. This would also be true if the great numbers of males released overflooded the treatment area. This however, fails to account for the results in the cages, where equal numbers of laboratory and wild males were normally released.

It is also within the realm of possibility that laboratory reared males may have developed a type of "resistance" to confusion. They are reared in high numbers in close proximity, male to female. Mating occurs in rooms where a high level of pheromone is undoubtably present. Whether this may represent a genetic change or only a behavioral adaptation is also unknown. If such an adaptation could occur in the laboratory, how many generations will it take for males developing in orchards containing high levels of pheromone chemicals to also adapt to this new means of control? This is another aspect of biology that needs further research.

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