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Comparative Trapping Efficiency of Five Different Blends of the Two Sex Pheromone Components in *Dichocrocis punctiferalis* (Lepidoptera: Pyralidae) at Chestnut Orchards in Korea

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Abstract : Trapping efficiency of various sex pheromone blends of the peach pyralid moth, *Dichocrocis punctiferalis* was compared by field study to develop monitoring system with its sex pheromone at chestnut orchards in Korea. Five candidates of the sex pheromone blends used for the field trapping of *D. punctiferalis* males were 70:30, 75:25, 80:20, 85:15 and 90:10 mixture of (*E*)-10-hexadecenyl aldehyde (*E*10-16:Al) and (*Z*)-10-hexadecenyl aldehyde (*Z*10-16:Al). All lures were treated with 1 or 2 mg of each blends. During 2 years of field survey, the 75:25 blend was usually the most effective in attracting males among 5 blends tested. For the 2nd generation, the best capturing activity for *D. punctiferalis* male was observed by lure with 75:25 blend. Both 90:10 and 75:25 blends showed highest efficiency for the 3rd generation. In most cases, lures treated with 1 mg of blend caught more male moths than these treated with 2 mg of blend.

Key words **:** *Sex pheromone,* Dichocrocis punctiferalis, *field trapping, (E)-10-hexadecenyl aldehyde (E10-16:Al), (Z)-10-hexadecenyl aldehyde (Z10-16:Al), chestnut orchards*

Introduction

Chemical insecticides have been widely used to control agricultural and medical insect pests, but due to their insecticidal mechanisms based on neurotoxicity, they have caused several side effects, such as toxicity to other non-target organisms including men and domestic animals, toxic residues in agricultural products and environment, insecticide resistance, etc. In order to overcome and/or minimize these side effects, it is needed to develop other means of insect control. One of these new approaches is to utilize insect sex pheromones. Especially, for a successful performance of an integrated pest management (IPM), development of the insect monitoring system is necessary. Use of pheromone trap with sex pheromone, natural or synthetic, is acknowledged as a very convenient method of detecting seasonal occurrence of many moth species. These data may provide the basic information for the timing of insecticide applications before building-up of pest populations to injury levels (Jutsum and Gordon, 1989).

The peach pyralid moth, *D. punctiferalis* causes a serious damage to chestnut, peach, apple, persimmon, apricot, etc. in Korea and Japan (Choi, 1998 and Konno *et al.*, 1981). In Korea, the peach pyralid moth, *Dichocrocis punctiferalis* showed trivoltine at chestnut orchards and the 2nd generation caused the most serious damage to chestnut (Choi *et al.*, 2004 and 2006). Population monitoring of this species has depended entirely on field observations on injured fruits. Therefore, development of a convenient monitoring system for this species using a trap baited with a synthetic sex pheromone is necessary for managing this species effectively. But, composition of insect sex pheromone is not always constant for any particular species. It is various depending on the geographical area within the distribution of a species, as can be seen in the case of the Asian corn borer moth, *Ostrinia furnacalis* and the oriental fruit moth, *Grapholita molesta* (Boo, 1998). Therefore, it is important to find out the suitable ratio for the purpose of monitoring or controlling in each area or nation. The trap of sex

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pheromone is so comfortable in their place which was just like home. Also the sweet of lure is just like their partner.

In this study, field assays was conducted to find the optimal female sex pheromone composition by voltaism for monitoring or control of the peach pyralid moth at chestnut orchards in Korea.

Materials and Methods

To verify the attractiveness of the pheromone compositions to males of *D. punctiferalis*, and to develop amount of sex pheromone blend, two field experiments were conducted in chestnut orchards in the Gongju and Jinju from 2003 to 2004. In each experiment, two orchards were used as test fields. The area of each orchard was 6ha in Gongju and 20 ha in Jinju. Chestnut trees in Gongju and Jinju were ca. 12-year-old, 400 trees and 35-year-old, 150 trees planted per 1 ha. respectively (Figure 1). Field trapping assay with synthetic sex pheromone (Chemtech, The Netherlands) was carried out at two chestnut orchards in Gongju and Jinju, Korea, respectively. No insecticides were sprayed at the trees during all experimental periods.

Field trapping conducted in two different orchards from May. 20 to Oct. 20 in 2003 and from Jun. 16 to Oct. 25 in 2004. Chemical blends of (*E*)-10-hexadecenyl aldehyde (*E*10-16:Al) and (*Z*)-10-hexadecenyl aldehyde (*Z*10-16:Al) were 70:30, 75:25, 80:20, 85:15 and 90:10. And, the total amount of 1 or 2 mg were impregnated into a rubber-septum (9 mm O.D., Sigma Co., USA) with 200 μL hexane to be baited in a Pherocon Wing Trap (made in Daegu Apple Research Instituter, Figure 2). A rubber septum impregnated with hexane only was used as a control, which were suspended at 1.5 m above the ground. The traps were set out at late May and a number of moth were monitored with five-days interval until late October. The pheromone lures and traps were replaced once per month. The trap catches were expressed as the number of moth caught per trap during five-days interval. The captured insects were counted and removed. Tests were arranged in a randomized complete block design using 5 wing traps per treatment. A number of moths caught by 5 traps were pooled. The distance

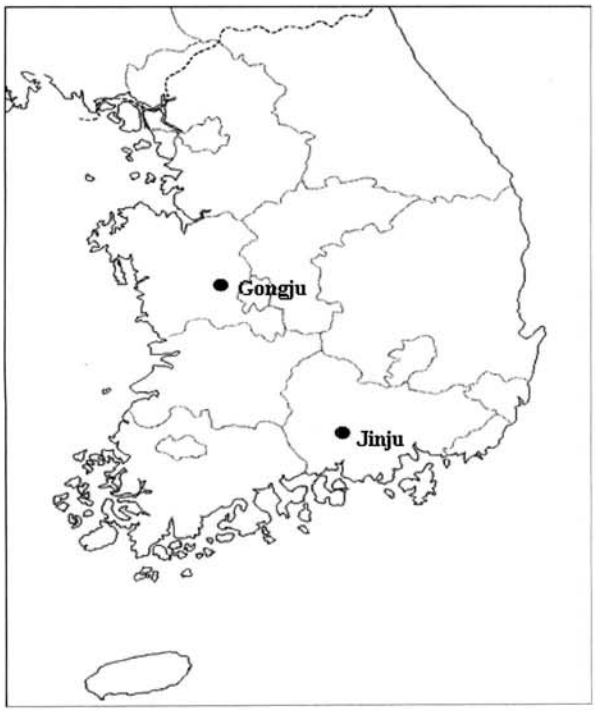

Figure 1. Experiment sites of male moth trapping with pheromones.

Figure 2. Pherocon wing trap and a rubber septum used in this experiment.

Table 1. Total number of *D. functiferalis* males caught in 5 pherocon wing traps baited with 2 ratios of *E*10-16:Al : *Z*10-16:Al in Gongju and Jinju chestnut orchard (late July ~ Mid. Oct. 2003 and 2004).

County	Gongju				Jinju			
Year	2003		2004		2003		2004	
ratio	75:25*	90:10	75:25	90:10	75:25	90:10	75:25	90:10
2nd	34	9	25	18	32	14	26	16
3rd	18	24	9	31	16	31	19	29

*The standard amount of components loaded in each rubber septum was 1 at the ratio of 75:25 and 90:10 with *E*10-16:Al and *Z*10-16:Al.

between traps within replicates was about 10 m. The influence of composition in sex pheromone on trapping efficiency analyzed using ANOVA (SAS Institute, 2001). The means were separated by using the Tukey's test (α=0.05).

Results and Discussion

Among the blends with five different compositions between (*E*)-10-hexadecenyl aldehyde (*E*10-16:Al) and (*Z*)-10-hexadecenyl aldehyde (*Z*10-16:Al) treated during test period, 85:15, 80:20 and 70:30 were less attractive than 2 blends (75:25 and 90:10) in almost cases (F=68.67; df=11, 47, Pr<0.0001) (Figure 3~5). The blend of 75:25 was the most attractive composition both in 2nd and 3rd generation whereas the blend of 90:10 was the most attractive in 3rd generation. In similar, the serious apple pests, *Phyllonorycter ringoniella* in the last generation showed the highest attractiveness to the males with 4:6 blends of *Z*10-14:Ac and *E*4, *Z*10-14:Ac in field trapping experiments, but it was not significantly with ratios of 7:3 and 9:1 in the 1st generation. The amount of blends also affected the efficiency of trap and the more moth caught in lure treated 1 mg than in lure treated 2 mg. Therefore, the optimum amount of the pheromone blend was 1 mg (Figure 3~5). There are for reasons poor capture because more amount of blend cause mating disruption. But, more number of males was captured with increasing amount of artificial sex pheromone in a little amount (less than 5 mg) of blends (Jung, 1995). Quan-

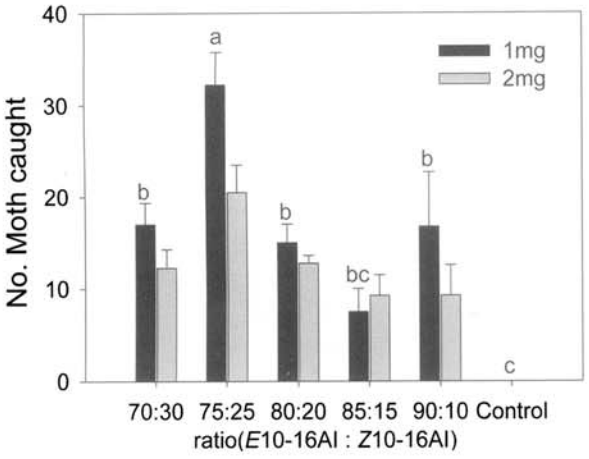

Figure 3. Total number of 2nd generation *D. punctiferalis* males caught in a Pherocon wing trap (5 replications) baited with different blends of *E*10-16:Al and *Z*10-16:Al in Gongju and Jinju chestnut orchard during 2 years (2003 and 2004). Bars topped by the same letter are not significantly different by Tukey's test (α=0.05).

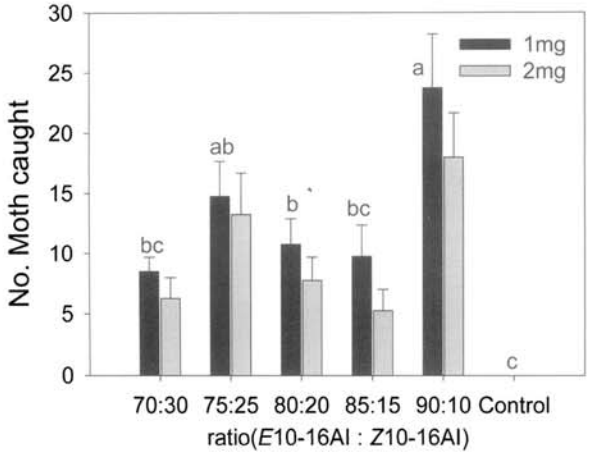

Figure 4. Total number of 3rd generation *D. punctiferalis* males caught in a Pherocon wing trap (5 replications) baited with different blends of *E*10-16:Al and *Z*10-16:Al in Gongju and Jinju chestnut orchard during 2 years (2003 and 2004). Bars topped by the same letter are not significantly different by Tukey's test (α=0.05).

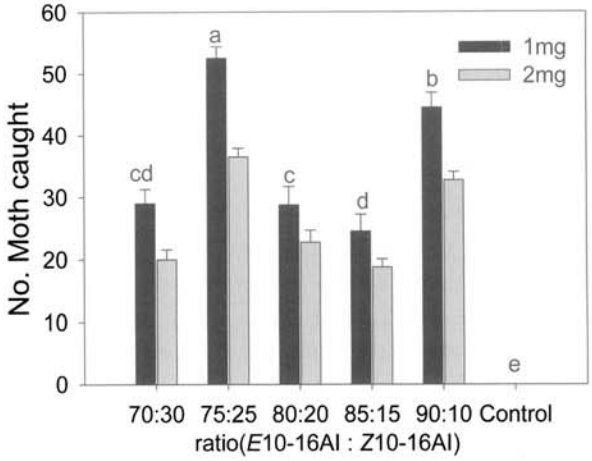

Figure 5. Total number of 2nd and 3rd generation *D. punctiferalis* males caught in a Pherocon wing trap (5 replications) baited with different blends of *E*10-16:Al and *Z*10-16:Al in Gongju and Jinju chestnut orchard during 2 years (2003 and 2004). Bars topped by the same letter are not significantly different by Tukey's test (α=0.05).

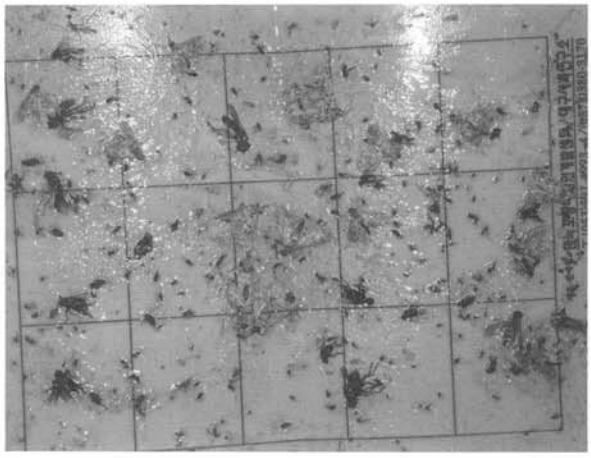

Figure 6. *D. functiferalis* male caught by Pherocon wing trap.

tity of blend affected trapping efficiency of the sex pheromone. The number of moths caught in lures treated 1 mg was higher than that in lures treated 2 mg (Figure 3~5). This result showed that the quantity of the pheromone from lure treated 2 mg exceeded the ability of chemoreceptor in olfactory system of *D. punctiferalis*.

In the study, it is generally believed that monitoring and mating disruption are most efficiently achieved by using the blend that most closely approximates that of the virgin female moth. And, the mentioned above artificial lure of *D. punctiferalis* was not certified as mating disruption for the effect of control.

The yellow peach moth, *D. punctiferalis*, was also found to show three distinct populations in the northeastern Asia region. In respect of geographical variations in the sex pheromone composition of *D. punctiferalis*, it is interesting to result that reported 90:10 and 80:20 in Japan (Konno *et al.*, 1982), 70:30 and 90:10 in China (Liu *et al.*, 1994), 70:30~80:20 in Korea (Boo *et al.*, 1996 and Jung *et al*, 2000).

In this work, the rate of two components of the sex pheromone in *D. punctiferalis*, is different in the 2nd and 3rd generation. This result could be attribued to difference in kind of food consumed by *D. punctiferalis* in according to generation. The food of *D. punctiferalis*, in the 2nd generation have various hosts except to chestnut, but the food of *D. punctiferalis*, in the 3rd generation have mainly chestnut (Choi, *et al.,* 2006). Boo and Park (1998) reported different pheromone composition of Asian corn borer moth, *Ostrinia furnacalis* that was the mean ratio of *E*12-14:Ac and *Z*12-14:Ac were 2:1 in corn field and 5:1 in ginger field. Choi *et al* (2006) reported that the developmental degree of *D. punctiferalis* larva showed different in the hosts. That is to say, the quantity and/or composition in the sex pheromone components are usually dependent on food, geographical and environmental condition.

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