FIELD TRAPPING OF THE TOMATO WORM, *Scrobipalpuloides absoluta* (MEYRICK) (LEPIDOPTERA: GELECHIIDAE) USING VIRGIN FEMALES

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ABSTRACT

Field Trapping of the Tomato Worm, *Scrobipalpuloides absoluta* (Meyrick) (Lepidoptera: Gelechiidae) Using Virgin Females

Studies were carried out on catches of *Scrobipalpuloides absoluta* (Meyrick) males using traps baited with virgin females as a source of natural sex pheromone. Six different traps heights, six distinct colors and seven traps design were evaluated. It was found that the height of trap placement had an influence on male capture, and that the optimum height varied according to the growth stage of the plant. The design of the trap also influenced the efficiency of capture. The models "PVC 200" and Pherocon 1C^R were the most efficient for the capture of male *S. absoluta*. The data on trap color suggested that dark colors provided higher catches than lighter colored traps.

KEY WORDS: Insecta, pheromone, chemical ecology, insect monitoring, traps.

RESUMO

Estudos foram conduzidos sobre a captura de machos de *Scrobipalpuloides absoluta* (Meyrick) em armadilhas contendo fêmeas virgens, como fonte de feromônio natural. Foram avaliadas seis diferentes alturas de instalação, seis cores distintas e sete modelos de armadilhas, em plantios de tomate estaqueado. Constatou-se que houve influência da altura de instalação das armadilhas sobre a captura de machos e que a altura mais adequada variou segundo o estágio de crescimento das plantas. O modelo das armadilhas também exerceu influência sobre a eficiência de captura. Os modelos "PVC 200" e Pherocon 1C^R foram os mais eficientes para a captura de machos de *S. absoluta*.

PALAVRAS-CHAVE: Insecta, feromônio, ecologia química, monitoramento de insetos, armadilhas.

INTRODUCTION

Traps baited with sexual attractants are a valuable tool for the detection and monitoring of many species of insect pests. Nevertheless, factors such as the amount of attractants; size and type of release mechanism, the height of placement, color and trap design influence catch efficiency (Kennedy 1975).

Recebido em 27/08/93.

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The sex pheromone of *Scrobipalpuloides absoluta* (Meyrick) is yet to be identified, however, before it could be successfully used in the field, factors which can effect efficiency in trap catches must be known. Few studies on the effect of height, color or design of traps for *S. absoluta* have been published. In a preliminary study with processing-tomatoes in Chile, Quiroz (1978) used a handmade trap employing virgin females of *S. absoluta* as attractants, positioned at 0.80 m above ground level. A large average number of male *S. absoluta* (100/ trap/night) were caught.

In this work, the effect of trap height, color and design on catching of *S. absoluta* was investigated in a plantation of fresh-market tomatoes with natural levels of infestation, utilizing virgin females as attractants.

MATERIAL AND METHODS

The experiments were carried out in Indaiatuba and Salto, in the State of São Paulo. Pheromone traps were loaded with a sticky insert, constituted by a white card (19 x 19 cm) covered with Bio-Tac 3^{R}. The traps were placed in the field on bamboo stakes and orientated so that the openings were directed facing the prevailing wind. Preliminary tests were carried out using Pherocon^{R} traps and results suggested that traps spaced at 30 m positioned along a line perpendicular to direction of the prevailing wind produced highest male catches.

One-day old virgin female *S. absoluta* were used as attractants for the traps. They were obtained from pupae collected from infested tomato field and separated by sex according to Quiroz (1976). Pupae were kept for emergence in Petri dishes of 100 mm diameter lined with filter paper and covered with transparent acrylic cups (200 ml). After emergence the female moths were paralysed with ether and transfered to cages (2,5 x 2,5 x 2,5 cm) made from copper wire wrapped in transparent nylon stocking material, which were hung inside the traps. Cotton wool soaked in water was placed inside each cage and kept moist daily.

The experimental distribution of traps was carried using latin square design (Perry *et al.* 1980). Statistic analyses were carried out using ANOVA and, when necessary, the data were transformed according to Little & Hills (1979). Traps were positioned across the prevailing wind direction in order to minimize interactions between different treatments (Wall & Greenway 1981). The traps were visited daily in order to count male catches, replace sticky inserts and redistribute the traps in such a way that by the end of the experiment each position had received each treatment for a period of 24 hours.

Trap Height. In order to verify the importance of trap height, six bioassays were carried out on different occasions, in a same field, from August, 28 to November 14, 1990. The first bioassay was performed a week before transplanting of the seedlings, and the second 25 days after transplanting, when plants were about 20 cm high. The next two bioassays were carried out during the peak of flowering, one when tomato plants were 1.10 m high and the other when they were 1.60 m high, on the average. The final two bioassays were carried out at the end of the harvest period, when plants were 2.00 and 2.20 m high, respectively.

Six distinct heights were tested: 0,40; 0.80; 1.20; 1.60; 2.00 and 2.40 m. The traps used were yellow Pherocon^{R} traps. They were attached to bamboo stakes, with holes drilled every 40 cm to facilitate the daily redistribution. Each bioassay had a duration of six consecutive days.

Trap Color. Six Pherocon^{R} traps were tested in the following colours: black, red, green, blue, yellow and white. The yellow and white traps were imported from Great Britain. Others were

constructed using the Bristish traps as a model. Numbers of males *S. absoluta* and *Phthorimaia operculella* (Zeller) captured was determined. The experiment was repeated four times.

Trap Design. The experiments were carried out in a tomato field at the harvesting stage, with high population level of *S. absoluta*. Seven trap designs were tested, five commercial models: Pherocon^R, Pherocon 1C^R, Delata^R; Delat^R-type "pink bollworm" and Delta Poliondas^R and two homemade models: "PVC 150" and "PVC 200" (made from PVC tubing of 25 or 30 cm in lenght and 150 or 200 mm diameter). The Pherocon, Delta and Delta Poliondas traps were yellow. The Delta-type "pink bollworm" were red, and the Pherocon 1C and the homemade traps were white.

RESULTS AND DISCUSSION

Trap Height. The optimum height in general varied depending on the average height of the crop (Fig. 1). When traps were placed in an area prior to planting, larger number of males were caught 0.40 m above ground level, but there was no significant difference among them. A significantly higher number of males were collected at the same height when the average height of the crop was 0.20 m. For plants with average heights from 1.10 m (flowering stage) to 2.20 m (final stage of harvest) the optimum height of traps appeared to be 1.20 m above ground level. Nevertheless, exceptions did occur. In one case, experiments with plants with average heights of 1.60 m, the traps at 40 cm had significantly heavier *S. absoluta* male catches. In another case, when plants had an average height of 2.20 m (final bioassay), there was no

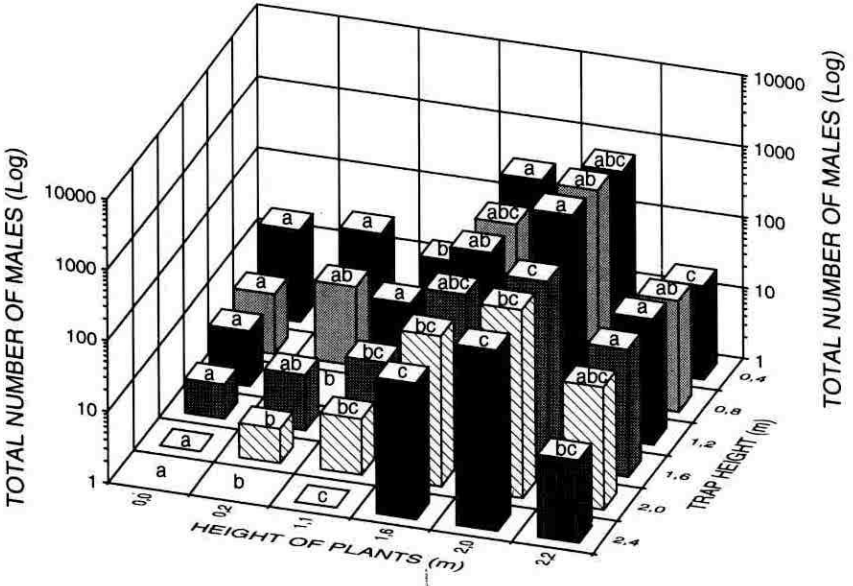

Figure 1. Total number of male *Scrobipalpuloides absoluta* captured in Pherocon^R traps baited with virgin females, at different heights in a fresh-tomato plantation at various stages of plant growth. (Indaiatuba and Salto, SP, Brazil, 1990). Numbers followed by at least one common letter on each height of plants do not differ significantly (Duncan's test, 5% level of probability).

significant difference in the numbers of male *S. absoluta* caught in traps at 0.80 m to 2.00 m.

Trap Color. Fig. 2 shows no significant differences between the treatments in tests I and IV.

Trap Design. The results are summarised in Fig. 3. They indicate that model "PVC 200" and the commercial model Pherocon 1C[R] were superior to the other models.

Results indicated that in fresh-market tomatoes, traps with attractants to capture male *S. absoluta* must be placed at a height of 0.40 m above the soil level from soil preparation to the time when plants are 0.20 m high. When plants are taller than 1.10m, the traps must be positioned at 1.20m above ground level.

The influence of height on the efficiency of capture for other Gelechiidae species using sex pheromone traps has been described in the literature. Sharma *et al.* (1973) reported that in the USA the number of males *Pectinophora gossypiella* (Saunders) captured in traps positioned in the upper part of cotton plants, was significantly higher than those captured in traps positioned lower down. Kennedy (1975) found that the highest male catches of *P. operculella* in potato crops in the USA, were obtained in traps positioned at a height of 0.30 m rather than those at 1.0 m above ground level.

Adults *S. absoluta* appear to have considerable capacity for dispersal. Traps placed in a recently plowed area, planted previously with sugar cane, distant 250 m from the nearest

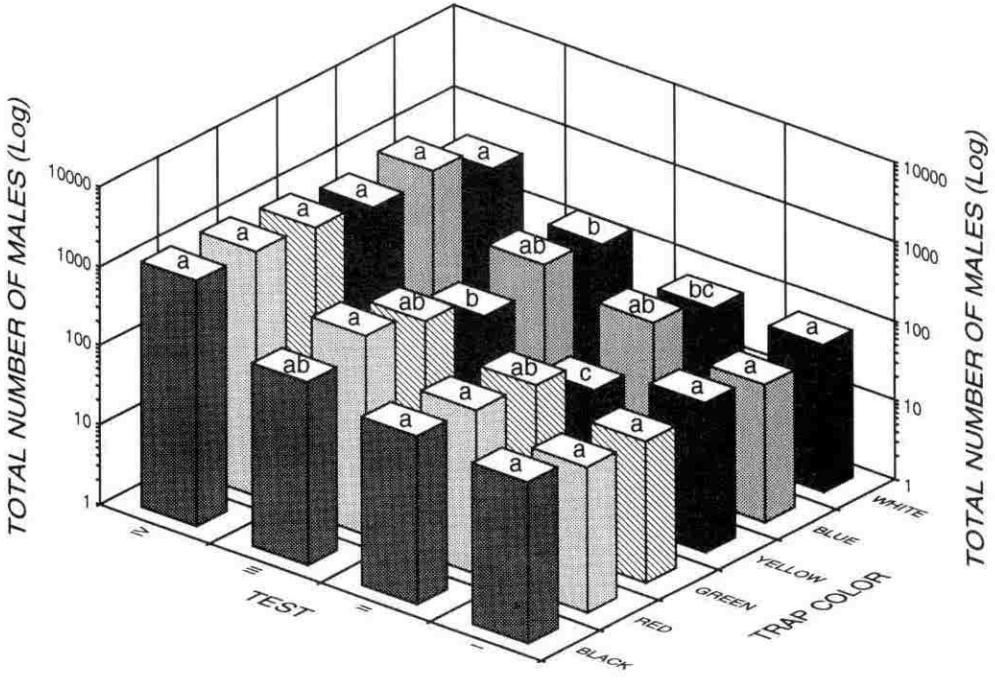

Figure 2. Total number of male *Scrobipalpuloides absoluta* captured in Pherocon traps of different colours baited with virgin females in fresh-market tomatoes (Indaiatuba, SP, Brazil, 1990). Numbers followed by at least one common letter on each test do not differ significantly (Duncan's test, 5% level of probability).

tomato plantation, caught *S. absoluta* male (unpublished data).

The results summarized in Fig. 2 suggest that dark colours (black, red, green and blue) have a higher tendency to catch male *S. absoluta*. Sexual communication in this and other species of moths is essentially chemically mediated. Nevertheless, at short range it is possible that factors, such as reflection of light, contrast of colours or retention of heat on the surface of the traps, influence the behavior of males, stimulating them either to land or evade. Similar results were obtained by Timmons & Potter (1981) with *Podesia syringae* (Harris) (Lepidoptera: Sesiidae), who observe that number of males caught in black, brown or red colored pheromone-baited traps was higher than in traps of lighter colors. Uchoa-Fernandes (1992) observed that

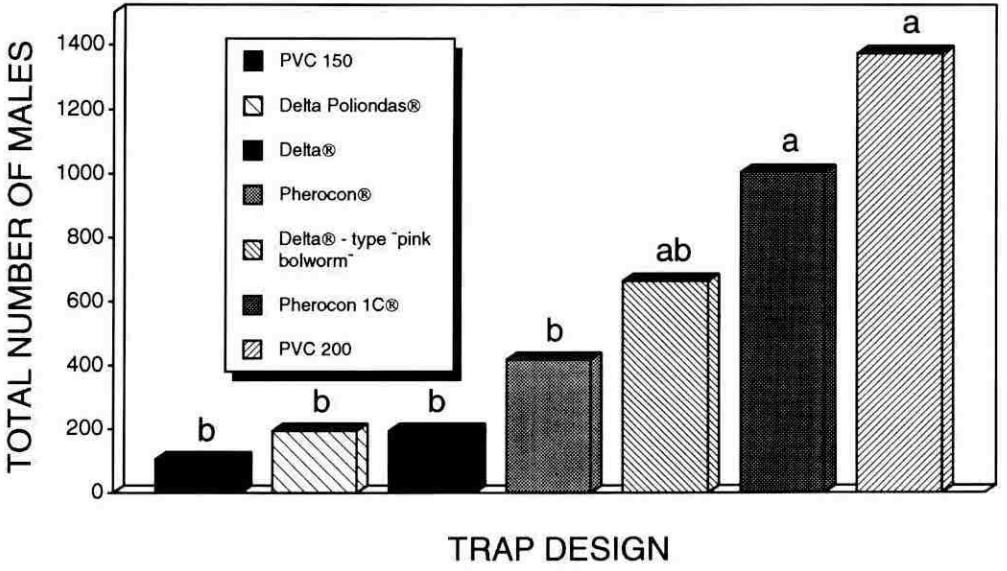

Figure 3. Total number of male *Scrobipalpuloides absoluta* captured in traps of different design baited with virgin females in fresh-market tomatoes (Indaiatuba, SP, Brazil, 1990). Numbers followed by at least one common letter do not differ significantly (Duncan's test, 5% level of probability).

yellow traps caught large number of *Lyriomiza* spp. (Diptera: Agromyzidae), which did not occur in traps of other colors.

The traps "PVC 200" (homemade) and Pherocon 1C^{R} (commercial) were the most efficient; other designs were relatively inefficient. This low efficiency could be due to their design, since all of them had openings that were directed at the same angle in relation to the prevailing wind. These results are similar to those obtained by other authors for other Gelechiidae. For example, Kennedy (1975) tested the efficiency of traps for *P. operculella* in potatoes. This species is phylogenetically close to *S. absoluta* and has similar behaviour patterns. Kennedy found that the trap model Pherocon 1C^{R} was superior to all the traps he tested. Wyman (1979) investigated the influence of trap design on capture of *Keiferia lycopersicella* (Walsingham), a key pest of tomato and the ecological equivalent of *S. absoluta* in the USA. He found that Delta traps captured low numbers of *K lycopersicella.*

"PVC 200", made from unexpensive materials readily available and simple to assemble, is an alternative to commercial models.

ACKNOWLEDGMENTS

We thank CNPq for funding the project and Prof. Terezinha M.C. Della Lucia, Prof. Eraldo R. Lima and two anonymous reviewers for helpful comments on the manuscript. This research fulfilled part of the requeirements for the MS degree for Mr. M.A. Uchoa-Fernandes.

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