An Attractive Trap to Capture *Diabrotica speciosa* (Ger.) and *Cerotoma arcuata tingomariana* Bechyné

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An. Soc. Entomol. Brasil 25(3): 529-535 (1996)

Armadilha Atrativa para *Diabrotica speciosa* (Ger.) e *Cerotoma arcuata tingomariana* Bechiné

RESUMO - O trabalho foi realizado com o objetivo de testar a atratividade de armadilha para a captura de *Diabrotica speciosa* (Ger.) e *Cerotoma arcuata tingomariana* Bechiné em lavoura de feijão *Phaseolus vulgaris*. A armadilha, de cor amarela, continha pó seco de purungo *Lagenaria vulgaris* e inseticida Carbaril. Foi instalada no campo em 11 semanas, durante o ciclo fenológico da cultura. A percentagem de insetos capturados pelas armadilhas e em contagens nas plantas, nas diferentes semanas do desenvolvimento fenológico do feijão, foram semelhantes. A armadilha mostrou-se adequada para estudos de monitoramento de *D. speciosa* e *C. arcuata tingomariana*.

PALAVRAS-CHAVE: Insecta, *Phaseolus vulgaris*, atraentes.

ABSTRACT - The attractiveness of a trap for *Diabrotica speciosa* (Ger.) and *Cerotoma arcuata tingomariana* Bechyné in common bean *Phaseolus vulgaris* fields was evaluated. Dry powder of *Lagenaria vulgaris* and Carbaril insecticide were placed inside a yellow-colored trap that remained in the field for 11 weeks, during the crop phenologic cycle. Adults of the two species were attracted to the trap in a number proportionally similar to that observed visually on the plants. The trap used showed to be suitable for monitoring studies of *D. speciosa* and *C. arcuata tingomariana*.

KEY WORDS: Insecta, *Phaseolus vulgaris*, attractive substances.

The leaf beetles *Diabrotica speciosa* (Ger.) and *Cerotoma arcuata tingomariana* Bechyné (Coleoptera: Chrysomelidae) cause great damage to common bean *Phaseolus* vulgaris crops mainly when attacks occur at the seedling stage (Hohman & Carvalho 1989).

The visual assessment of their number in the field is difficult since these beetles are agile and fly away quickly when the observer approaches. The level of control can be established in the common bean plant by visual assessment of leaf consumption or the number of adults on the plants (Hohman & Carvalho 1989). However, in maize *Zea mays*, wheat *Triticum aestivum* and potatoes *Solanum tuberosum*, the larvae cause great damage and there is no practical method to monitor them.

The curcubitacins attract and hunger-stimulate some Chrysomelidae and, therefore, may be used for monitoring, as parts of poisoned traps and as trap cultures (Rhodes *et al.* 1980). Adults are able to detect curcubitacins in very small quantities (nanograms) through specific sensorial receptors located in the maxillary palpi (Metcalf *et al.* 1987). This substance is a triterpenoid biosynthesized by the plants, principally from the Curcubitaceae family (Metcalf & Metcalf 1992). It gives an extremely bitter taste to many wild species of this botanic family (Metcalf & Lampman 1989). Thus, it is possible to select plants rich in curcubitacins by taste.

The greatest difficulty in using this kairomone is the cultivation of these plants that frequently require special conditions for development. Also, it is not always possible to synchronize the presence of fruits or tubers, rich in curcurbitacins, with the presence of the insect pest in the field. Curcubitacins can be stored after the vegetable organs containing them have been dried in a drying oven (Shaw *et al.* 1984, Metcalf *et al.* 1987). Yokoyama *et al.* (1982) found that the yellow color, especially when associated with *Cayaponia tayuya* tubers, is also quite attractive to the *D. speciosa.*

This study was carried out to assess the attractiveness of yellow-colored traps, containing dry "purungo" *Lagenaria vulgaris* fruit powder, for *D. speciosa* and *C. arcuata tingomariana.*

Material and Methods

The experiments were set up in a common bean field of 0.5 ha on the Training Farm at Londrina State University (UEL). Cultivar IAPAR-14 was sown on March 3, 1995. There were several host plants for the pest in nearby fields. Those include soybean *Glycine max*, maize, and cotton *Gossypium hirsutum,* in adjacent areas. The common bean field was chosen because the populational dynamics of the *D. speciosa* and the *C. arcuata tingomariana* are known in this crop (Hohmman & Carvalho 1989), so the experiment could be carried out in periods when the pest population was sufficient to make assessments.

The trap consisted of a plastic flask, 10.5 cm long and 2.8 cm in diameter, painted yellow, with several 5 mm diameter perfurations. The perfurations were large enough to allow the insects to enter. A strip of transparent film used in overhead projectors was placed inside the flask. This strip was sprayed with a 0.8% Carbaril (Sevin 480 SC) solution and dusted with powder of dry *L. vulgaris* fruits, which then adhere to the film. The fruits were obtained from plants grown on the Training Farm at UEL. These materials were collected in Ortigueira, PR. The fruits were dried in a drying oven at 70° C and then ground in a blender.

The duration of the trap attractiveness was assessed in the first experiment. A week after germination, ten traps were put around the borders of the field, spaced at 6 m, on wooden poles at 20 cm from soil surface level. Dead insects were collected every two days.

Four traps were set up in another experiment. They stayed in the field for two days a week until the end of the crop cycle. After 2 d of collection period, the traps were brought to the laboratory and the number of captured and dead insects was counted. In these areas the number of insects in 30 randomly sampled plants was also counted. A space of 10 m was left between these two sample units. As it was not possible to visually differentiate the two species under study, the total number of insects in the two sample units was counted.

A regression analysis between the number of insects observed on the plants and the number of insects captured in the traps was done. An analysis to compare the regression lines of the two sample units, according to methodology suggested by Snedecor & Cochran (1967) was also carried out. Data transformation to percentage of the insect total, in the eleven weeks of observation, was used because of the lack of homogenity of the residual variances in the original data.

Results and Discussion

The trap allowed the capture of both *D. speciosa* and *C. arcuata tingomariana* (Fig. 1). The curcubitacins present in the fruits, even when dried and ground, continued to exercise their attractive and hunger-stimulating effect on certain Chrysomelidae, as described by Rhodes *et al.* (1980) and Metcalf & Lampman (1989). After eight days, the ground fruit powder began to detach from the transparent film, probably due to the movement and feeding of a large quantity of adults gradually detached it. Thus the traps were retrieved, and considered attractive for one week. Shaw *et al.* (1984) kept similar traps for a period of 12 days. However, the number of adults (*D. barbieri* Smith and Lawrence and *D. virgifera virgifera* Le Conte) captured by these authors was lower than observed in this study. Roel & Zatarin (1989) used *L. vulgaris* fruit together with Carbaril insecticide to control *D. speciosa* and found that these remained attractive up to 20 days after installation in the field.

There was a gradual increase in the number of insects captured for *C. arcuata tingomariana*, with a very reduced number of dead insects in the first collections. Eight days after the installation of the traps, there was almost the same quantity of adults of this species as *D. speciosa* (Fig. 1). The gradual increase in captures may reflect dispersion of the insects in the field coming from other hosts, such as soybean, maize and cotton, abundant in adjacent areas and at the end of the phenological cycle.

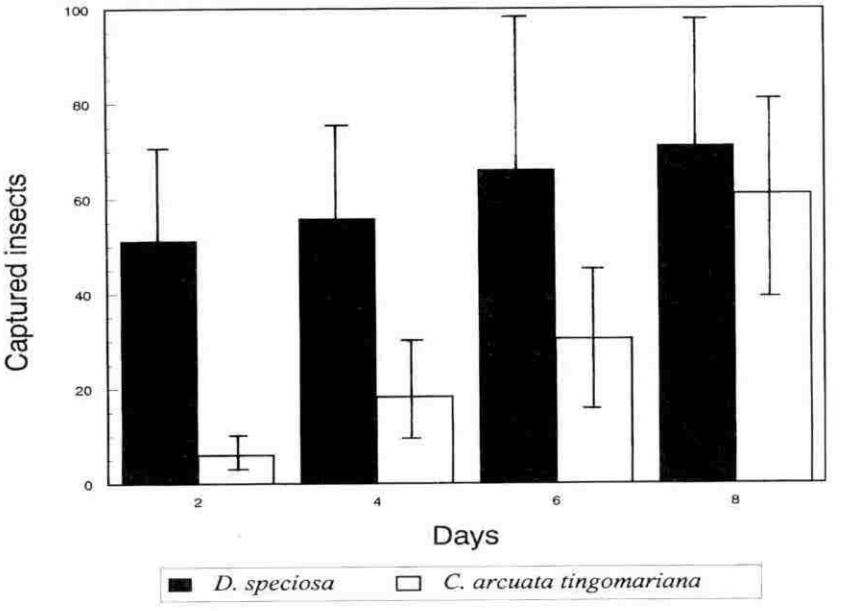

Figure 1. Mean (± SD) number of adult *Diabrotica speciosa* and *Cerotoma arcuata tingomariana* captured with an attractive trap in common bean field after two, four, six, and eight days of the installation. Londrina, March 1995.

The total results from the collections in the traps and counted in the plants for these species are showed in Table 1.

The relationship between the number of insects captured in the traps (x_1) and visually

Table 1. Mean (± SD) number of *Diabrotica speciosa* + *Cerotoma arcuata tingomariana* adults, captured in attractive traps and visually sampled in 30 common bean plants, Londrina, PR., March to June 1995.

Week	Insects captured in traps[1]	% [2]	Insects visually counted [1]	% [2]
I	22.9 ± 2.2	19.1	35.1 ± 3.3	13.3
II	15.3 ± 1.3	12.6	37.1 ± 3.2	14.1
III	15.9 ± 1.6	13.1	43.0 ± 3.1	16.3
IV	16.9 ± 1.9	14.0	27.1 ± 2.8	10.3
V	15.9 ± 1.7	13.2	30.9 ± 1.9	11.7
VI	13.9 ± 1.2	11.5	33.9 ± 1.7	12.9
VII	8.0 ± 0.9	6.6	18.0 ± 1.9	6.8
VIII	4.1 ± 0.3	3.2	14.0 ± 1.6	5.3
IX	2.1 ± 0.5	1.7	11.9 ± 1.3	4.5
X	3.0 ± 0.6	2.5	6.0 ± 1.1	2.3
XI	2.9 ± 0.7	2.5	6.0 ± 0.9	2.3
Total	121.0	≅ 100.00	263.0	≅ 100.00

[1]Means of four replications.
[2]Percentual values in relation to insect total in 11 weeks.

counted in the plants (Y_1) (Fig. 2) with the equation obtained $Y_1 = 6.08 + 1.62\ x_1$, with $R^2 = 0.89$, indicates that the variation observed in the traps satisfactorily explained the visual observations data.

In the comparision of the regression lines

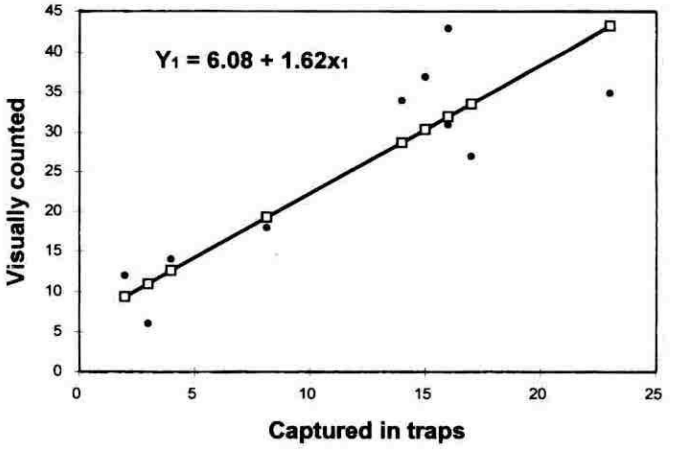

Figure 2. Relationship between the average number of adults of *Diabrotica speciosa* + *Cerotoma arcuata tingomariana,* captured in traps and visually counted in bean plants. Londrina, March to May, 1995.

analysis of the percentages of insect totals in the two sample units the residual variances due to the regression deviations were not significant (ns) ($F = 4,9977/4,4188 = 1.131$ns) (Table 2). The comparison of the "slopes" ($F = 4,8463/4,7083 = 1.0293$ ns) and the constant (means) ($0/4,7155 = 0$ ns) were also not significant. This suggests that the percentage of insects in the traps in the different weeks of the common beanplant development were similar to the measurements obtained in the 30 plants.

The regression equation of the insects captured in the trap was $Y_2 = 19.9 - 1.68\ x_2$ and of insects visually counted was $Y_3 = 17.41 - 1.39\ x_2$ (x_2 = weeks). Regression explains 87% of the variation ($R^2 = 0.87$) measured for the variable insects captured in the traps and 84% ($R^2 = 0.84$) for the variable insects observed in 30 plants; these values considered satisfactory. The regression lines of the variables analysed were similar (Fig. 3).

Table 2. Comparison of the regression lines of the percentage of the total number of adult *Diabrotica speciosa* + *Cerotoma arcuata tingomariana* captured in traps and visually sampled in plants in different weeks during common bean plant development.

Source of Variation	Regression coefficient	Freedom Degrees	Deviation from regression	
			Square sum	Medium square
Inside the trap	0.87	9	44.9800	4.9977
Inside the plants	0.84	9	39.7700	4.4188
		18	84.7490	4.7083
Global, W	0.85	19	89.5950	4.7155
Slop differences				
		1	4.8463	4.8463
Among B				
W + B		2	89.5950	
Among adjusted means		1	0	0

Comparison of residual variances $F = 4.9977/4.4188 = 1.1310$ ns.

Slop comparison $F = 4.8463/4.7083 = 1.0293$ ns.

Constants comparison $\alpha = 0/4.7155 = 0$ ns.

Shaw *et al.* (1984) used a similar trap to estimate *D. barbieri* and *D. virgifera virgifera* populations in maize, which captured and killed the two species.

The attractiveness of the traps used allowed the estimation of the proportion of insects observed in the plants. Thus it is possible to test this trap in larger areas, to establish the practicality of its use and evaluate factors such as distance between traps and number of traps/area. As it is a very simple, low cost apparatus a methodology to monitor these Chrysomelidae could be developed. The use of dry vegetable material also gave greater

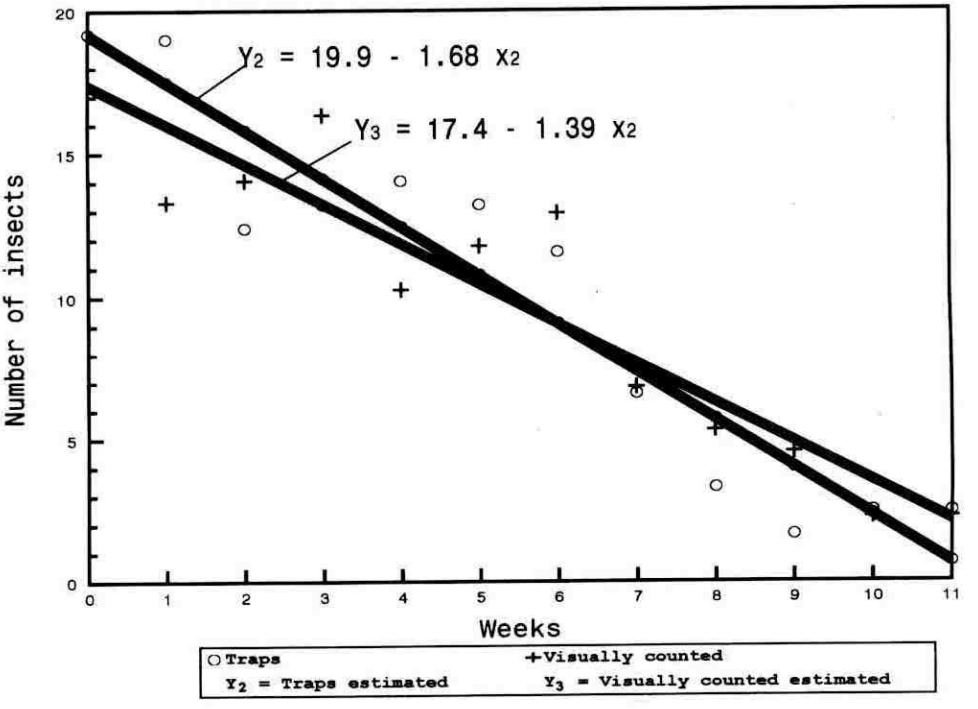

Figure 3. *Diabrotica speciosa* + *Cerotoma arcuata tingomariana* adults captured in traps (Y_2) and visually counted in plants (Y_3) over several weeks (x_2). Londrina, March to May 1995.

flexibility in the practical use of this kairomone in the control of the leaf beetles especially in small areas.

From the results obtained, it may be inferred that the type of trap used is suitable for monitoring studies of *D. speciosa* and *C. arcuata tingomariana* and that the number of insects found in the traps represents, proportionally, the frequency of those observed visually in the plants.

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Received 24/V/96. Accepted 26/XI/96.