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FLIGHT CAPACITY OF *COPIDOSOMA FLORIDANUM* (HYMENOPTERA: ENCYRTIDAE) IN VEGETABLE GREENHOUSES

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Copidosoma floridanum (Ashmead) (Hymenoptera: Encyrtidae) is a polyembryonic egg-larval endoparasitoid of plusiinae noctuid moths, which is considered one of the major natural enemies of *Trichoplusia ni* (Hübner) (Lepidoptera: Noctuidae) (Martin et al. 1984; Noyes 1988a; Waterhouse 1998)

Trichoplusia ni is a neo-tropical polyphagous insect, which migrates from southern USA to the southern area of Ontario Canada every spring (Lafontaine & Poole 1991). In Canada, *T. ni* is a common insect pest in vegetable greenhouses and is able to overwinter in them because the greenhouse crops overlap (Gillespie et al. 2002).

During the 2010 growing season, *C. floridanum* was found parasitising *T. ni* in a cucumber greenhouse, and thus the idea of starting studies about integrating the use of this parasitoid with the routinely use of *Bacillus thuringiensis* products arose. The purpose of this study was to evaluate how far *C. floridanum* was able to disperse under vegetable greenhouse conditions in southwestern Ontario.

Trichoplusia ni was reared on a bean flour diet following the method of Shorey & Hale (1965), and *C. floridanum* was obtained by parasitizing one-day-old *T. ni* eggs. Larvae that emerged from parasitized eggs were fed with artificial diet in 2-oz (59.1 mL) plastic cups until parasitoid development was completed. Insects were reared under laboratory conditions at 24 °C, 14:10 h L:D, and 60% RH and the mean number of *C. floridanum* offspring obtained per larvae was 1478 individuals. Two fully developed parasitized larvae of *T. ni* were placed in an open Petri dish on top of the substrate grow bags in the space between 2 plants in the mid-point of the length and width dimensions of 5 tomato, 3 cucumber and 2 pepper greenhouse ranges located in Essex county, Ontario (measurements of the greenhouses are in Table 1). Yellow sticky cards (10 × 25 cm) were hung 30 cm above the plants every 5 m from the release-point along the length and the width of the greenhouses. At the time of the experiment the plants, which had been planted inside the greenhouses during the last 2 weeks of Dec 2010, were not more than 1 m high. Outdoors there were no crops and temperatures were under 0 °C. Ten days after the parasitoids had been released, the sticky cards were checked for parasitoids and the distances from the release point and cards with one or more parasitoids were measured.

TABLE 1. VEGETABLE GREENHOUSE DIMENSIONS AND DISPERSION OF *COPIDOSOMA FLORIDANUM*. THESE PARAITOIDS EMERGED FROM PARASITIZED HOST LARVAE PLACED AT THE MID-POINT OF THE LENGTH AND WIDTH OF EACH GREENHOUSE.

Crop	Greenhouse range	Approx. Area (Hectare)	Dimensions (m) Length × Width	Maximum Dispersion distance (m) Length × Width
Tomato	1*	0.40	55.0 × 55.5	27.5 - 27.5
	2	0.81	61.0 × 110.5	30.5 - 55.0
	3*	1.20	203.5 × 55.5	101.5 - 27.5
	4*	1.20	214.5 × 55.5	95.0 - 27.5
	5	2.40	165.0 × 148.0	82.5 - 74.0
Cucumber	1	0.61	73.0 × 55.5	36.5 - 27.5
	2	0.81	43.8 × 88.8	21.9 - 44.4
	3	0.81	43.8 × 88.8	21.9 - 44.4
Pepper	1	2.40	165.0 × 148	82.5 - 70.0
	2	4.0	292.0 × 133.2	146.0 - 66.6

The greenhouse length was the measurement along the greenhouse walkway and the width along the rows.
*In these greenhouses rows were located only on one side of the walkway and in the others, they were located on both sides of the walkway.

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Trichoplusia ni was not present in the vegetable greenhouses during the time of the study.

The longest distance flown by *C. floridanum* was 146 m from the release point of a pepper greenhouse; and in this greenhouse the parasitoids were found on the yellow sticky cards hung above the plants in the last row at both ends of the greenhouse. All distances of the parasitoid dispersion in the different vegetable greenhouse crops are presented in Table 1. From 1 to 9 parasitoids were found on the yellow sticky cards, but not on all of the sticky cards in any of the greenhouses. Parasitoids were always found in at least one of the cards placed at the end and at side wall of each greenhouse. The greatest numbers of parasitoids captured were on those cards located at 5 m from the release point of 2 tomato and 1 cucumber greenhouses.

Based on the results of this study, it can be concluded that the maximum distance at which *C. floridanum* is able to disperse is limited by the size of the greenhouse where the parasitoid was tested and likely the dispersion distance is longer.

Trichoplusia ni larvae parasitized by *C. floridanum* consume 35% more food than unparasitised larvae (Hunter & Stoner 1975). Moreover, *C. floridanum* is not an efficient forager of *T. ni* eggs under artificial laboratory conditions (Stoner & Weeks 1976), and it has not performed well on field crops on which it was released (Elher 1977), although natural populations of *C. floridanum* have been reported as an important factor in the regulation of *T. ni* (Martin et al. 1984; Waterhouse 1998) and other plusiinae insect pests of soybean, such as *Chrysodeixis includens* Walker (Noctuidae) in North America (Burleigh 1971) and *Chrysodeixis chalcites* (ESPER) in New Zealand where the parasitoid was introduced (Noyes 1988b).

Due to the high dispersion of *C. floridanum* inside vegetable greenhouses found in this study, further trials of parasitism levels and the compatibility of the parasitoid release with the use of *B. thuringiensis* commercial formulations for the management of *T. ni* populations should be tested. Finding potential biocontrol agents for the control of *T. ni* is needed because resistance of this pest to *B. thuringiensis* has already been reported in vegetable greenhouses in Canada (Janmaat & Myers 2003).

Acknowledgments

Thanks to the greenhouse owners that allowed me to set up this trial on their properties.

Summary

The dispersion of the egg-larval parasitoid *Copidosoma floridanum* (Ashmead) (Hymenoptera: Encyrtidae) was studied under vegetable greenhouse conditions in southwestern Ontario where *Trichoplusia ni* is a major problem. The parasitoid dispersed up to 146 m, the limit of the greenhouse size, and probably it is able to disperse more than 146 m from the point of release.

Key Words: dispersion, polyembryonic egg-larval parasitoid, plusiinae noctuid moths, *Trichoplusia ni*

Resumen

La dispersión del parasitoide de huevo-larva *Copidosoma floridanum* (Ashmead) (Hymenoptera: Encyrtidae) fue estudiada bajo condiciones de invernaderos de hortalizas en el sur-oeste de Ontario donde *Trichoplusia ni* es una plaga principal. Se encontró que *C. floridanum* es capaz de dispersarse hasta 146 m. Puesto que aparentemente la distancia de dispersión estuvo limitada por el tamaño del invernadero es probable que el parasitoide sea capaz de dispersarse más de 146 m desde el punto de liberación.

Palabras Clave: dispersión, parasitoide polyembrionico de huevo-larva, polillas noctuidae plusiinae, *Trichoplusia ni.*

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