

**LARVAL PARASITIDS OF THE CABBAGE LOOPER,
TRICHOPLUSIA NI (LEPIDOPTERA: NOCTUIDAE), IN FIELD
TOMATO CROPS IN SOUTHWESTERN ONTARIO**

H. MURILLO¹, D. W. A. HUNT², S. L. VANLAERHOVEN³

Department of Biology, University of Windsor,
401 Sunset Avenue, Windsor, ON, Canada N9B 3P4.
email: murilloph@gmail.com

Scientific Note

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The Cabbage Looper, *Trichoplusia ni* Hübner (Lepidoptera: Noctuidae) is a cosmopolitan insect pest that causes damage in more than 160 species of plants (Sutherland and Greene 1984), and has become a chronic pest of Canadian greenhouse vegetable crops (Gillespie et al. 2002). Each spring, the overwintering population of *T. ni* migrates north from the southern United States to establish seasonal populations in Canada (Lafontaine and Poole 1991). In commercial indoor settings, growers rely on Btk (*Bacillus thuringiensis* var. *kurstaki*) products to manage outbreaks of *T. ni*. Outdoors, growers rely on chemical pesticides. Btk appears to be compatible with natural enemies and insect pollinators although the recent development of *T. ni* resistance to Btk is a major concern in the vegetable industry (Janmaat and Myers 2003) and new and effective natural enemies are needed. The objective of this study was to determine the native parasitoid assemblage of larval stages of *T. ni* in tomato fields in southwestern Ontario for the selection of potential biological control agents.

A survey for larval parasitoids of *T. ni* was conducted on field tomato (*Solanum lycopersicum* Mill.) (Solanaceae) crops in 2005 and 2006 in Essex County, Ontario. Three 2000-plant plots of commercial processing tomato were planted with the varieties Heinz Q909, TH4, and an experimental hybrid in 2005. In 2006, Heinz 9478 was used in all three plots. Plots were located on three different farms separated by about 5 km from each other. One hundred tomato plants per plot were sampled weekly beginning on May 20 in 2005 and on June 13 in 2006. Larvae collected from the survey were reared individually on a pinto bean diet (Shorey and Hale 1965) in a growth chamber at 24°C, with a 12:12 photoperiod and 60% RH until emergence of parasitoids or an adult *T. ni* moth. The number of parasitised larvae of each instar of *T. ni* by each parasitoid was recorded and compared using Chi-Square tests.

Nine species of primary parasitoids (eight Hymenoptera and one unidentified Diptera–Tachinidae) were reared from larval stages of *T. ni*, but only 7 of them within each of the two years (Table 1) and one hyperparasitoid, *Trichomalopsis viridescens* (Walsh)

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¹ Author to whom all correspondence should be addressed.

² AAFC – Greenhouse and Processing Crops Research Centre, 2585 County Rd. 20, Harrow, ON, Canada N0R 1G2

³ Same address as first author.

TABLE 1. Number and parasitism rates of larval parasitoids of *Trichoplusia ni* in southwestern Ontario tomato fields.

Year	Date	Larvae (#)	<i>Campoplex sonorensis</i> (Ichneumonidae)	<i>Euplectrus sp.</i> (Eulophidae)	<i>Cotesia marginiventris</i> (Braconidae)	<i>Microplitis alaskensis</i> (Braconidae)	<i>Copidosoma floridanum</i> (Encyrtidae)	<i>Cotesia platyphenae</i> (Braconidae)	Unidentified Braconidae	Unidentified Meteorus sp. (Braconidae)	Tachinidae	
2005	06-Jul	47	13	0	1	0	0	0	0	0	0	
	15-Jul	33	6	1	0	0	0	0	0	0	0	
	23-Jul	40	4	0	0	0	1	0	0	0	0	
	28-Jul	59	14	0	0	0	1	1	0	0	0	
	03-Aug	81	19	0	0	0	2	0	0	0	0	
	10-Aug	69	12	1	0	0	0	0	0	0	0	
	24-Aug	61	3	1	0	1	0	0	1	0	0	
	02-Sep	36	4	0	0	0	0	0	0	0	0	
	Total (#)	426	75	3	0.9	1	4	1	1	1	0	0
	Parasitism(%)		17.6	0.7	0.2	0.2	0.2	1.0	0.2	0.2	0	0
2006	20-Jul	16	7	0	0	0	0	0	0	0	0	
	27-Jul	7	1	0	0	0	1	0	0	0	0	
	02-Aug	28	9	0	0	0	1	0	0	0	0	
	09-Aug	40	19	0	2	0	1	0	0	0	0	
	17-Aug	72	32	0	0	0	0	0	0	0	0	
	24-Aug	71	38	1	0	2	0	0	0	1	0	
	29-Aug	139	54	0	3	0	0	0	0	2	0	
	08-Sep	67	27	2	1	0	0	0	0	1	0	
	15-Sep	57	8	0	0	0	0	0	0	0	3	
	Total (#)	497	195	3	6	2	3	3	0	0	4	3
Parasitism(%)		39.2	0.6	1.2	0.4	0.6	0.6	0.0	0.0	0.8	0.6	

(Hymenoptera: Pteromalidae), was reared from *Campoletis sonorensis* (Cameron). Although Braconidae had the higher number of species, Ichneumonidae had the greatest parasitism rates due to dominance of the solitary larval endoparasitoid *C. sonorensis* (Table 1), which was found parasitising *T. ni* larvae from the collection date of *T. ni* larvae within each year. Other larval parasitoids were rarely found (Table 1). From 400 *T. ni* larvae in 2005 and 365 in 2006 for which we determined the instar at collection, the 2nd instar of *T. ni* was the larval stage with the highest parasitism rates by *C. sonorensis* and by all the other parasitoid species as well (Table 2). The number of parasitised 2nd instars differed significantly from all other parasitised instars combined in both years (2005: $X^2_{1,1} = 43.422$, $P < 0.001$; 2006: $X^2_{1,1} = 59.038$, $P < 0.001$).

In North America, *Copidosoma floridanum* (Ashmead) and *Cotesia marginiventris* (Cresson) are reported as common parasitoids of *T. ni* (Marston et al. 1984; Martin et al. 1984; Godin and Boivin 1998; Waterhouse 1998; Shelton et al. 2002; Wold-Burkness et al. 2005), *C. sonorensis* and *Microplitis alaskensis* (Ashmead) have rarely been collected from *T. ni* (Martin et al. 1984; Waterhouse 1998), *Cotesia plathypenae* (Muesebeck) is a new record for *T. ni*, and *Euplectrus* species are commonly reported but *Meteorus* species are not (Marston et al. 1984; Martin et al. 1984; Waterhouse 1998; Wold-Burkness et al. 2005). The hyperparasitoid *T. viridescens* is associated with several braconid and ichneumonid parasitoids attacking Noctuidae (Lepidoptera) (Gibson and Floate 2001) but our work seems to be the first report on *C. sonorensis* and *T. ni*.

Campoletis sonorensis has been well studied for control of *Helicoverpa* species and *Spodoptera frugiperda* (J.E. Smith) in corn and cotton crops (Lingren 1977; Isenhour 1986) but has been reported on *T. ni* only once in southern California in lettuce (*Lactuca sativa* L., Asteraceae) (Henneberry et al. 1991) and once (as *C. websteri*) in Texas (crop host not reported) (Carlson 1972; Harding 1976). We believe *C. sonorensis* should be evaluated as a biological control agent for *T. ni* in field and greenhouse crops in southwestern Ontario due to its high natural abundance and synchrony with *T. ni* populations (Murillo et al. 2009).

TABLE 2. Overall total percent parasitism of *Trichoplusia ni* larval instars. Numbers in bold indicate significantly higher parasitism rates as compared to other instars (Chi-Square test, $P > 0.05$).

Year	2005			2006		
	Larvae (#)	<i>Campoletis sonorensis</i> (%)	All other parasitoids (%)	Larvae (#)	<i>Campoletis sonorensis</i> (%)	All other parasitoids (%)
1	41	0.0	0.0	7	0.0	0.0
2	210	22.9	3.8	177	31.6	8.5
3	118	2.5	1.7	84	8.3	4.8
4	24	0.0	0.0	54	0.0	1.9
5	7	0.0	0.0	43	0.0	0.0
Total	400	12.75	2.5	365	17.3	5.5

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