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Natural Parasitism of the Second Generation European Corn Borer Eggs *Ostrinia nubilalis* (Hübner) (Lepidoptera, Pyralidae) by *Trichogramma* spp. in Sweet Corn Fields in Vojvodina, Serbia – Short Communication

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Abstract

Tancik J. (2017): Natural parasitism of the second generation European corn borer eggs *Ostrinia nubilalis* (Hübner) (Lepidoptera, Pyralidae) by *Trichogramma* spp. in sweet corn fields in Vojvodina, Serbia – short communication. Plant Protect. Sci., 53: 50–54.

Natural parasitism of the European corn borer eggs (Hübner) by *Trichogramma* spp. (Hymenoptera, Trichogrammatidae) was assessed in sweet corn field in north-west Serbia, region Vojvodina at the localities of Ruski Krstur, from 2004 till 2007. The rate of egg parasitism in 2004 varied from 35.89% to 73.58%. The parasitism in 2005 was lower than in 2004. On four different sampling dates in 2005 parasitism varied from 28.48% to 57.05% and averaged 39.4%. In 2006 parasitism fluctuated between 9.31 and 62.9%, averaging 32.15%. In 2007 parasitism varied from 36.8% to 54.54% and averaged 43.48%. The egg parasitoid species was identified as *Trichogramma evanescens* (Westwood). The study showed that this natural enemy occurred constantly in sweet corn fields but its number greatly fluctuated from year to year.

Keywords: *O. nubilalis*; *Trichogramma evanescens*; egg parasitoids; sweet maize

Egg parasitoids of the genus *Trichogramma* are considered efficient biological control agents and are widely used commercially for the control of lepidopterous pests on many crops (Pak 1990; Corrigan & Laing 1994; Li 1994). *Trichogramma* spp. are moderately synovigenic (Jervis *et al.* 2001), polyphagous egg parasitoids that are often used in inundative biological control programs (Smith 1996).

The females start to lay their eggs shortly after emergence (Bigler *et al.* 1987; Chassain & Boulétreau 1991). Hosts in which parasitoids develop are variable resources in terms of available food and, as a result, parasitoid adults vary in size with males being generally smaller than females (van den Assem *et al.* 1989). In a host of a given size, females are larger than males and males emerge earlier than females (Charnov *et al.* 1981). The short generation time of *Trichogramma* wasps and the fact that they can be reared on factitious hosts allow these wasps to be produced quickly and affordably, relative to other parasitoids (Li 1994; Smith 1996). Dispersal ability and the parasitisation rate of parasitoid wasps in field and storage conditions are desired characteristics for biological control programs.

In Western Europe, *Trichogramma evanescens* (Westwood) is used commercially for the biological control of the European corn borer (ECB) *Ostrinia nubilalis* (Hübner) (Hassan 1981, 1984; Bigler 1986; Tancik *et al.* 1994, Hluchy *et al.* 2003; Tancik & Cagáň 2004).

The aim of our work was to determine the natural parasitism of ECB eggs at the sweet corn fields of the

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Table 1. Number of observed fields, sowing dates, varieties of sweet maize, and field size

Year	Fields	Varieties	Sowing date	Field size (ha)
2004	1	Empire	1.06.	26
	2	CLX	11.06.	48
2005	1	Royality	2.06.	13
	2	Royality	2.07.	78
	3	Royality	17.07.	15
2006	1	Evita	20.06.	44
	2	Evita	26.06.	20
	3	Elisa	28.06.	10
	4	Elisa	13.07.	18
2007	1	Royality	7.06.	14
	2	Elisa	3.07.	38

locations Ruski Krstur, Serbia during the egg laying period of the second generation of ECB, which was confirmed by Bača *et al*. (1996), and to identify the species of parasitoid comparing with the studies on the localities in Slovakia (Cagáň *et al*. 1998).

MATERIAL AND METHODS

Parasitism of ECB eggs by *Trichogramma* spp. was assessed in sweet corn fields in north-west Serbia, region Vojvodina, at the location Ruski Krstur 80 km north-west of Novi Sad. The number of observed fields, the sowing date, varieties of sweet maize, and field size are given in the Table 1. Large number of eggs collected from the fields in 2004–2007 were placed inside plastic test tubes (10 mm wide and 200 mm long) and monitored under laboratory conditions (25°C and 75% relative humidity (RH)) until parasitoids or ECB larvae emerged from the eggs. The emerged parasitoids were counted and identified to the species level. One egg cluster was placed in one test tube.

RESULTS

Results on the occurrence on *Trichogramma* spp. parasitism of the ECB eggs collected between 2004 and 2007 at the location Ruski Krstur are given in the Table 2. In 2004, 45 ECB egg clusters containing 725 ECB eggs were collected on five different sampling dates (August 16–25); 30 ECB egg clusters (406 eggs) were parasitised, rate of parasitism varied from 35.89% to 73.58% and average rate reached 55.84%.

The parasitism of the ECB eggs in 2005 was lower than that in 2004. At four different sampling dates, 73 ECB egg clusters containing 1274 eggs were collected; rate of parasitism varied from 20.32% to 57.05% and average rate was 39.4%.

In 2006, 96 ECB egg clusters containing 1555 eggs were collected on six different dates (August 12–23). The rate of parasitism in these days was 9.31–62.9% and averaged rate was 32.15%.

In 2007, 18 ECB egg clusters containing 384 eggs were collected at three different dates (August 3–13); parasitism of the ECB eggs varied from 36.84% to 54.54% and average rate was 43.48%.

Compared with other tested years, the highest rate of ECB egg parasitism was detected in 2004 in the second part of egg laying period, after the 45 egg clusters had been collected. In 2005 and 2006, on the other hand, 73 and 96 egg clusters were collected but the rate of parasitism was very low. In 2007 just 18 egg clusters was collected but the parasitism rate was quite high compared with 2005 and 2006. In our experiments *Trichogramma evanescens* was identified as the egg parasitoid species.

DISCUSSION

A similar study which was performed in south-west Slovakia by Cagáň *et al*. (1998) at two localities (Nitra-Janikovce and Nitra-Malanta) confirmed the occurrence of ECB egg parasitoid *Trichogramma evanescencs*. The rate of parasitism was very low and in 1993 even not confirmed. In 1994–1996 *T. evanescence* occurrence was rear, but the parasitism of ECB eggs varied from year to year and achieved maximum of 15.2%.

On the other hand, during our experiments *T. evanescencs* appeared regularly and the rate of parasitism of ECB eggs was quite high for all tested years (32.15–55.84%) if compared with the two Slovak localities, where parasitism was very low over the studied period and achieved maximally 15.2% in 1996.

Results similar to those obtained in Slovakia were confirmed e.g. by Dudich (1928) from Hungary, who did not encounter *Trichogramma* spp. parasitism in ECB eggs. Kania (1962) during 1956–1959 field research in the vicinity of Wroclaw, Poland stated the same results. Similarly, no egg parasitism emerged from ECB egg masses field-collected in North America (Alberta) (Lee 1985).

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Table 2. Natural presence of European corn borer eggs parasitoids *Trichogramma evanescens* at the localities of Ruski Krstur, Vojvodina, Serbia

Date		No. of plants	No. of egg clusters/eggs	No. of parasitised		Rate of parasitism in parasitised cluster (%)	Rate of egg parasitism (%)
				egg cluster	eggs		
2004	16.08	200	9/132	5	71	56.5	53.78
	19.08	200	11/156	5	56	45.45	35.89
	23.08	200	5/106	4	41	80.00	38.67
	24.08	200	10/174	8	121	80.00	69.54
	25.08	200	10/159	8	117	80.00	73.58
	together	1000	45/727	30	406	66.60	55.84
2005	15.08	140	18/312	11	178	61.11	57.05
	17.08	320	28/495	12	141	42.85	28.48
	19.08	160	8/123	2	25	25.00	20.32
	22.08	140	19/344	8	158	42.10	45.93
	together	760	73/1274	33	502	45.20	39.40
2006	9.08	400	26/419	5	39	19.23	9.31
	12.08	310	9/150	2	34	22.22	22.66
	16.08	280	7/134	3	51	42.85	38.06
	18.08	310	6/76	2	24	33.33	31.58
	21.08	310	25/404	14	118	56.00	29.21
	23.08	260	23/372	16	234	69.56	62.90
	together	1870	96/1555	42	500	43.75	32.15
2007	3.08.	200	7/133	3	57	42,85	42,85
	6.08	200	5/99	3	54	60.0	54.54
	13.08	250	6/152	2	56	40.0	36.84
	together	650	18/384	8	167	44.44	43.48

Different studies made by Bírová (1962) in Slovakia confirmed ECB eggs parasitism of 65.4% in 1956, 49% in 1957, and 15.7% in 1958. In 1980, parasitism was considerably high (43.4%), but surprisingly very low (0–11%) between the years 1981 and 1985 (Bírová 1988).

At the same locality, Tancik and Cagáň (2000) found a percentage of parasitised ECB eggs decreasing from 12.1% in 1998 to 4.96% in 2000.

In Cukurova region, Turkey, parasitism by *T. evanescens* in ECB eggs collected in 1987–1990 was 53.34, 48.36, 72.26, and 73.12%, respectively (Ozpinar & Kornosok 1995).

In Serbia, locality Backa Palanka, Manojlovic (1984) recorded that parasitism of ECB eggs varied from 6.00% in 1976 to 3.99% in 1977. Our results showed that the percentage of ECB eggs parasitism in north-west Vojvodina, Serbia at the location Ruski Krstur was generally high. For example in 2004 the number of collected eggs was 727 and 406 of them were parasitised by *T. evanescens* (55.84%). In 2005 the rate of parasitism varied from 28.48 to 57.05% and average rate was 39.4%.

In Canada, Hudon and Leroux (1986) found that parasitism by *Trichogramma* spp. occurred mainly at the end of the egg laying period of the pest. The same results were found in Slovakia in 1994 and 1995, where the highest parasitism of the ECB eggs was encountered by the end of the egg laying period. In contrast, high egg parasitism was observed throughout the whole egg laying period in 1996 (Cagáň *et al*. 1998). In Turkey, Ozpinar and Kornosor (1995) observed that the population development of *T. evanescens* correlated with the number of *O. nubilalis* eggs available. Especially, *T. evanescens* was more efficient when *O. nubilalis* had high eggs population density in August. In our study, the highest parasitism of the ECB eggs in 2004 and 2006 was found at the end of the egg laying period. However, this was not confirmed in 2005 and 2007, when very high parasitism of the eggs was observed throughout the whole egg lying period.

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The results confirm that *T. evanescens* is one of the most abundant parasitoid species in this part of Europe (in Serbia). Manojlovic (1984) recorded parasitism by this species on ECB eggs on different host plants. The same species was identified in ECB eggs in Slovakia (Bírová 1988; Cagáň *et al*. 1998). Hochmut and Martinek (1963) recorded parasitism by this species on another lepidopterous eggs in Slovakia. In northern Moldova researchers found *T. evanescens* parasitism on eggs of *Mamestra brassicae* (Lepidoptera, Noctuidae), *O. nubilalis*, and *Agrostis segetun* (Lepidoptera, Noctuidae) (Pala *et al*. 1995).

The European corn borer is a bivoltine population in Vojvodina and the second generation predominated over the past twenty years (Bača *et al*. 1996). Late sown maize was more attractive for oviposition and also for the damage of corn by the second generation of ECB (Tancik *et al*. 1988): In the period of the second generation of ECB the highest eggs parasitism was found. Therefore, the best alternative for protection of sweet corn against ECB would be the biological control – releasing *Trichogramma evanescens*. High efficiency of parasitism would be ensured by the natural population and released population of *T. evanescens*.

The most important conclusion for us is that *T. evanescens* is a species, which can occur in Serbia in the amount which can be used as a biological agent against numerous numbers of lepidopteran species and can survive there.

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