

## Efficiency of *Trissolcus* spp. (Hymenoptera: Scelionidae) as Egg Parasitoids of *Eurygaster integriceps* Puton (Hemiptera: Scutelleridae) in Iran

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### Abstract

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The natural control exerted by egg parasitoids of Sunn Pest, *Eurygaster integriceps* Puton, in wheat fields in Varamin, Iran from 1997-1998 was assessed. A total of 306 egg masses were collected and 70 of them (22%) were parasitized by *Trissolcus grandis* Thomson, *T. vassilievi* Mayer, *T. semisteriatus* Nees or *T. basalis* Wholaston. Parasitism efficiency was >90% for all species. The impact of these parasitoids on Sunn Pest populations was 22.30% and 23.43% for 1997 and 1998, respectively.

**Keywords:** *Trissolcus grandis*, *T. vassilievi*, *T. semisteriatus*, *T. basalis*, *Eurygaster integriceps*, Sunn Pest, discovery efficiency, exploitation efficiency, parasitoid impact, biological control

### Introduction

The Sunn Pest, *Eurygaster integriceps* Puton, is a major pest of wheat and barley throughout many areas of Iran. The ecology, behavior and life cycle of this insect have been studied by a number of workers in different parts of West and Central Asia (3). Field surveys in wheat fields to assess the parasitoid complex and its impact on Sunn Pest populations in Iran have been done previously (1, 10, 12, 14, 16). From egg masses a wide range of parasitoid species have been recorded, most belonging to the family Scelionidae but also represented were species belonging to the families Encyrtidae and Eupelmidae (13).

The level of parasitism in wheat fields can be very high, sometimes above 90% (5, 12, 17, 18) but often it is much lower [26 to 66%] (6, 8, 9). There is a general impression in the scientific community that parasitism is often high in areas where Sunn Pest is not a major problem. This suggests that a positive correlation exists between egg parasitism and abundance of the pest. Radjabi (11) provided direct evidence of such observations from his studies in Iran which showed that pest populations were lowest in years and fields where egg parasitism was highest.

We suggest that it is likely that over-estimating egg parasitism has led to an over-estimation of their impact on Sunn Pest populations. One reason is that parasitized eggs are more apparent and more persistent in the field than unparasitized eggs. This error source is most significant when absolute levels of mortality are measured. If parasitism is compared in different areas or treatments within the field the estimations will be less affected because the error will apply to all samples.

The study reported herein was undertaken to determine variations in levels of natural control exerted by egg parasitoids on Sunn Pest populations in wheat fields in Iran.

### Materials and Methods

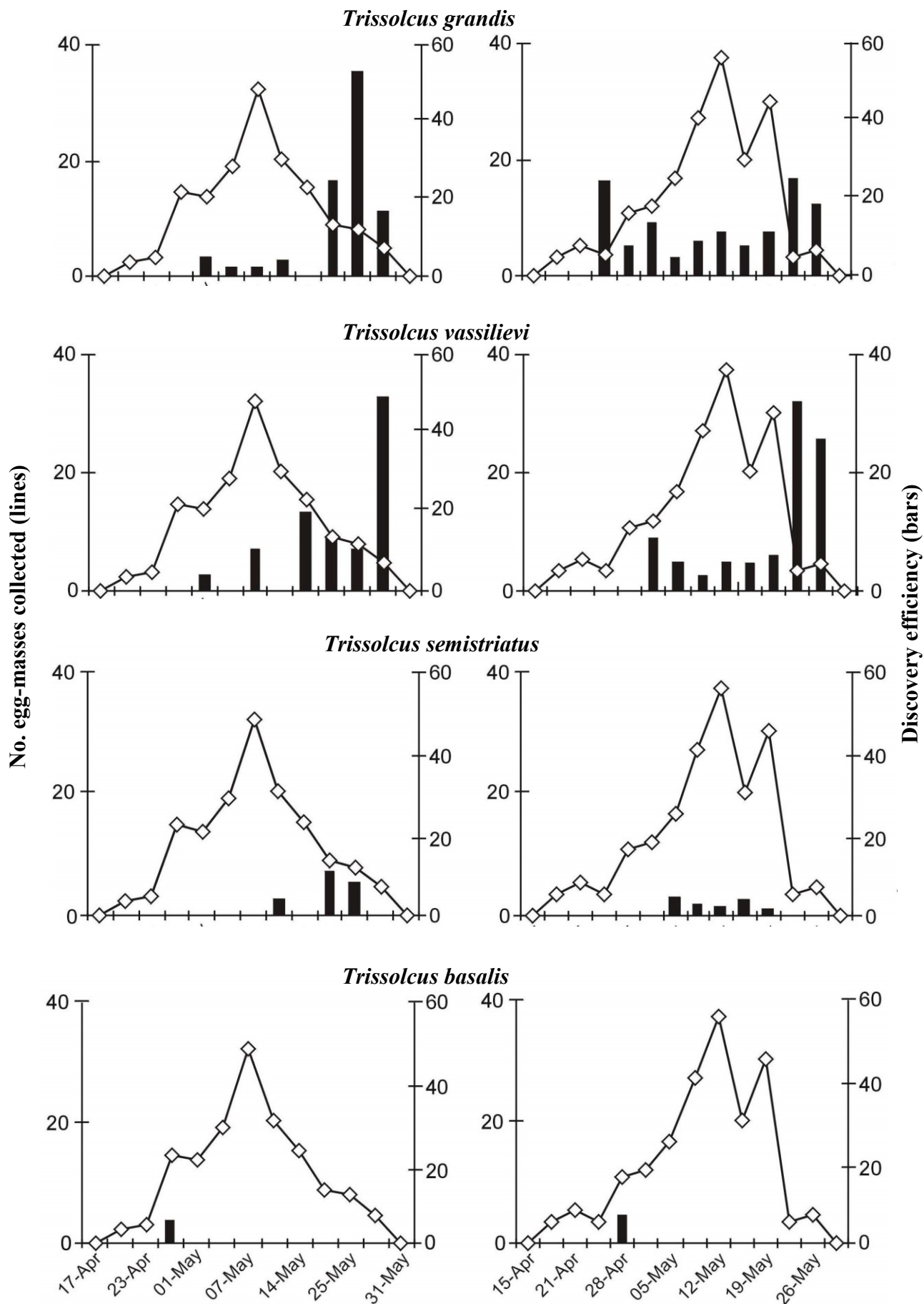
Six insecticide-free wheat fields (variety Mahdavi) were randomly selected for study. Each field, which was approximately 1 ha in size, was divided into 5 blocks (each 2000 sq. m) and each block was subdivided into 5 (400 x 400 m.) plots. Using a standard 1 x 1 m quadrat we took one sample in each plot twice a week from mid-April to the end

of May during the 1997 and 1998 growing seasons. The sample consisted of collecting all Sunn Pest egg masses in each quadrat. Each egg mass was placed in a polyethylene tube (10 cm height) and held for parasite emergence in an incubator at 25±1°C, 50±5% RH and 16:8 LD. The number of eggs parasitized by each *Trissolcus* sp. and their sex was recorded, collected and labeled individually. The impact of Sunn Pest egg parasitoids was assessed using the variables proposed by Bin and Vinson (2). The discovery efficiency is expressed as the number of discovered egg masses divided by the total egg masses sampled, the parasitism efficiency as the number of parasitized eggs divided by the total number of eggs of the discovered egg masses (excluding eggs that failed to hatch) and the parasitoid impact as the number of exploited eggs divided by the total number of eggs sampled (all expressed as percentages).

### Results and Discussion

The species and seasonal population dynamics of Sunn Pest egg parasitoids as determined by their emergence from eggs collected from wheat fields are shown in Fig.1. Four *Trissolcus* spp. were present between late-April and late-May. During the two growing seasons 306 egg masses were collected and 70 (22.78%) were parasitized (Table 1). The discovery efficiency of *Trissolcus grandis* Thomson, *T. vassilievi* Mayer, *T. semisteriatus* Nees and *T. basalis* Wholaston was 8.57, 10.71, 2.86 and 0.71 in 1997, and 13.25, 6.02, 3.01 and 0.60 in 1998, respectively. Results of the season-long collections of egg masses are shown in Fig. 1. Sunn Pest migrate to wheat fields in early April to feed and locate a suitable mate. In 1997 and 1998 Sunn Pest arrived in the fields around 5 April and oviposition occurred around 20 April and lasted 41 days. Female egg parasitoids were not present in wheat fields when Sunn Pest began ovipositing. Parasitized egg mass were not found until late April or early May. This is different from the information reported by Popov and Paulian (7). They noted that female egg parasitoids were already present in wheat fields when Sunn Pest began ovipositing.

In this study we only measured mortality due to egg parasitization because other parasitoid-induced mortality was difficult to determine. Parasitism efficiency was about the same in the two years of this study (Table 2).



**Figure 1.** Seasonal abundance of Sunn Pest, *Eurygaster integriceps* Puton, egg masses (lines) collected in wheat fields and the discovery efficiency of egg parasitoids (bars). 1997 graphs are in the left column and 1998 in the right column.

**Table 1.** Sunn pest egg parasitoid discovery efficiency in wheat fields in Iran.

Year	Collected	Total number of Sunn Pest egg masses				Discovery efficiency of (%)			
		Discovered by							
		<i>Trissolcus grandis</i>	<i>Trissolcus vassilievi</i>	<i>Trissolcus semisteriatus</i>	<i>Trissolcus basalis</i>	<i>Trissolcus grandis</i>	<i>Trissolcus vassilievi</i>	<i>Trissolcus semisteriatus</i>	<i>Trissolcus basalis</i>
1997	140	12	15	4	1	8.57	10.71	2.86	0.71
1998	166	22	10	5	1	13.25	6.02	3.01	0.60
<b>Total</b>	<b>306</b>	<b>34</b>	<b>25</b>	<b>9</b>	<b>2</b>	<b>11.11</b>	<b>8.17</b>	<b>2.94</b>	<b>0.65</b>

**Table 2.** The efficiency of egg parasitoids of Sunn Pest in wheat fields in Iran.

Species	1997				1998			
	No. of egg masses discovered	Total no. of eggs		% Parasitoid efficiency	No. of egg masses discovered	Total no. of eggs		% Parasitoid efficiency
		Collected	Exploited			Collected	Exploited	
<i>Trissolcus grandis</i>	12	150	132	88.0	22	308	294	95.5
<i>T. vassilievi</i>	15	207	189	91.3	10	140	138	98.6
<i>T. semisteriatus</i>	4	56	52	92.9	5	70	66	94.3
<i>T. basalis</i>	1	14	14	100.0	1	14	13	92.9
<b>Total</b>	<b>32</b>	<b>427</b>	<b>387</b>	<b>90.6</b>	<b>38</b>	<b>532</b>	<b>511</b>	<b>96.1</b>

*T. grandis*, *T. vassilievi*, *T. semisteriatus* and *T. basalis* parasitized 88.0, 91.3, 92.9 and 100.0 in 1997, and 95.5, 98.6, 94.3 and 92.9% in 1998 of the eggs of the discovered egg masses, respectively. We observed that egg parasitoids generally were able to fully parasitize discovered egg masses. This is likely because Sunn Pest egg masses usually contain relatively few eggs (14 eggs/mass).

The mean (field) sex ratio of Sunn Pest egg parasitoids is given in Table 3. Field populations of *T. vassilievi* and *T. semisteriatus* were more male-biased in this two year study than populations of *T. grandis* and *T. basalis*. It has been shown that Sunn Pest egg parasitoids respond to the presence of conspecific females and to their traces by adjusting their sex ratio as predicted by local mate competition theories (1). Therefore, the high male-biased sex ratio recorded in this study for *T. vassilievi* and *T. semisteriatus* may be an indirect indication of a high parasitoid population. Also, sex ratio (male-biased) could be influenced by temperature and humidity (15) and Sunn Pest egg quality (1, 4).

**Table 3.** Field ratio of male Sunn Pest egg parasitoids in wheat fields in Iran.

Year	Minimum	Maximum	Mean
<i>Trissolcus grandis</i>			
1997	0	0.22	0.08
1998	0	0.21	0.13
<i>Trissolcus vassilievi</i>			
1997	0.08	1.0	0.24
1998	0.07	1.0	0.27
<i>Trissolcus semisteriatus</i>			
1997	0.07	1.0	0.31
1998	0.05	1.0	0.27
<i>Trissolcus basalis</i>			
1997	0.14	0.14	0.14
1998	0.08	0.08	0.08

To determine the impact of egg parasitoids on Sunn Pest populations, the assessing procedure must take into account all of the egg masses collected. The total parasitoid impact was 22.3% in 1997 and 23.43% in 1998 (Table 4.). During the two growing seasons studied *T. grandis*, *T. vassilievi*, *T. semisteriatus* and *T. basalis* were the parasitoids that emerged from Sunn Pest egg masses collected from wheat fields. These parasitoids were the main biological control agents acting on populations of this destructive pest.

**Table 4.** The impact of Sunn Pest egg parasitoids on Sunn Pest populations in wheat fields in Iran.

	Year	
	1997	1998
Egg masses collected	140.00	166.00
Total number of eggs	1780.00	2181.00
<i>Trissolcus grandis</i>		
No. of parasitized eggs	132.00	294.00
% Impact	7.42	13.48
<i>Trissolcus vassilievi</i>		
No. of parasitized eggs	189.00	138.00
% Impact	10.62	6.33
<i>Trissolcus semisteriatus</i>		
No. of parasitized eggs	52.00	66.00
% Impact	2.92	3.03
<i>Trissolcus basalis</i>		
No. of parasitized eggs	14.00	13.00
% Impact	0.79	0.60
<b>Total number of parasitized eggs</b>	<b>397.00</b>	<b>511.00</b>
<b>% Impact</b>	<b>22.30</b>	<b>23.43</b>

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أمير-مافي، مسعود وبروس باركر. 2003. فاعلية أنواع من *Trissolcus* spp. كمطفلات بيض لحشرة السونة *Eurygaster integriceps* Puton (Hemiptera: Scutelleridae) في إيران. مجلة وقاية النبات العربية. 21: 69-72.

تم تقويم المكافحة الطبيعية التي يديرها متطفل البيض على حشرة السونة *Eurygaster integriceps* Puton في حقول القمح بمنطقة فارمين الإيرانية في الفترة ما بين 1997-1998. وتم جمع 306 كتلة بيض وتبين أن 70 منها (22%) كانت مصابة بالمتطفل *Trissolcus grandis* Thomson، *T. vassilievi* Mayer، *T. basalis* Wholaston أو *T. semisteriatus* Nees. وكانت كفاءة التطفل لكافة الأنواع أعلى من 90%. وكان تأثير هذه المتطفلات على عشائر السونة بنسبة 22.20% عام 1997 و 23.43% عام 1998.

**كلمات مفتاحية:** *Trissolcus grandis*، *T. vassilievi*، *T. semisteriatus*، *T. basalis*، *Eurygaster integriceps*، أفة السونة، كفاءة الاكتشاف، كفاءة الاستثمار، تأثير المتطفل، المكافحة الحيوية.

**عنوان المراسلة:** مسعود أمير-مافي، قسم بحوث آفة السونة، معهد بحوث أمراض وأفات النبات، ص.ب. 33715/719، فارامين، إيران.

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