*http://www.trakya.edu.tr/Enstituler/FenBilimleri/fenbilder/index.php*
*Trakya Univ J Sci, 6(1): 41-44, 2005*
*ISSN 1302 647X*
*DIC: 145MKTT610506050705*

**Research Article/Araştırma Makalesi**

# EFFECTS OF SOME PLANTS ON PARASITIZATION OF *Eurygaster integriceps* EGGS BY *Trissolcus semistriatus*

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Received : 04.04.2004
Accepted : 04.08.2004

**Abstract:** The egg parasitoid *Trissolcus semistriatus* Nees is one of the natural enemies of the sunn pest, *Eurygaster integriceps* Put., which is one of the most destructive pests of wheat in Turkey. This research was conducted to determine whether some plant species have an effect on the parasitism of *T. semistriatus* on *E. integriceps* eggs in the laboratory at 26 $^{o}$C, 60% relative humidity and 16:8 photoperiod conditions.
Wheat (*Triticum vulgare*), cow cockle (*Vaccaria pyramidata* var. *grandiflora*), bifora (*Bifora radians*), common vetch (*Vicia sativa*) and turnipweed (*Rapistrum rugosum*) were tested, because these plants were common in or near the cereal fields in Tekirdag and also hosts of some pentatomids which are secondary host of egg parasitoids. The parasitism rate of *T. semistriatus* on *E. integriceps* eggs was investigated in the presence and absence of plants.
The highest parasitism rate was obtained from common vetch as 94.9 % while the lowest was 68.9 % on cow cockle and also ratio of emergence was lowest in cow cockle as 89.9 %. The presence of plants significantly influenced parasitism rate and adult emergence while development period of males and females were not affected from plants, for this reason it was though several plants appear to be slightly repellant.

***Key words:*** egg parasitoid, *Trissolcus semistriatus*, sunn pest, *Eurygaster integriceps*, plants, parasitism rate.

## *Eurygaster integriceps* Put. yumurtalarının *Trissolcus semistriatus* Nees tarafından parazitlenmesi üzerine bazı bitkilerin etkileri

**Özet:** Yumurta parazitoiti *Trissolcus semistriatus* Nees, Türkiye' de buğdayın en önemli zararlılarından biri olan Süne *Eurygaster integriceps* Put.*'* in doğal düşmanlarından birisidir. Bu deneme bazı bitkilerin *T. semistriatus'* un *E. integriceps* yumurtalarını parazitlemesi üzerine bir etkisinin olup olmadığını saptamak için 26 $^{o}$C sıcaklık, % 60 orantılı nem ve 16:8 fotoperiyot koşullarında yürütülmüştür.
Buğday (*Triticum vulgare*), arapbaklası (*Vaccaria pyramidata* var. *grandiflora*), kokarot (*Bifora radians*), macar fiği (*Vicia sativa*) ve küçük turp (*Rapistrum rugosum*) test edilmiştir, çünkü bu bitkiler Tekirdağ' da hububat tarlalarında veya civarında bulunan ve yumurta parazitoitlerinin sekonder konukçusu bazı Pentatomidlerin de konukçularıdır. Bitkilerin bulunduğu veya bulunmadığı ortamda *E. integriceps* yumurtaları üzerinde *T. semistriatus'* un parazitleme oranı araştırılmıştır.
En yüksek parazitlenme oranı % 95.9 ile adi fiğde,en düşük oran ise % 68.9 ile arap baklasında tespit edilmiştir ve aynı zamanda ergin çıkış oranı % 89.9 ile en düşük arap baklasında bulunmuştur. Bitkinin varlığı belirgin biçimde parazitleme oranını ve ergin çıkış oranını etkilemesine rağmen erkek ve dişilerin gelişme periyotları bitkilerden etkilenmemiştir. Bu nedenle bazı bitkilerin repellent etkiye sahip oldukları düşünülmektedir.

***Anahtar kelimeler:*** Bitkiler, *Eurygaster integriceps*, parazitlenme, Süne, *Trissolcus semistriatus*, yumurta parazitoiti.

## Introduction

Parasitoids comprise very large group within the insects. One of the major problems faced during the behavioral examinations of a parasitoid is how it recognizes and locates its hosts. The host selection behaviour

have been divided into seven steps by Vinson (1985). These include habitat preference, potential host community location, host location, host examination, ovipositor probing, ovipositor drilling and oviposition.

Both the volatiles and physical properties of plants impact on habitat location and host location behavior of parasitoids (Schmidt, 1991;Van Lenteren, 1991; Vinson, 1991). There are a number of reports demonstrating the importance of the plants in parasitoid orientation for some species (Eller et al., 1992; Kaiser & Carde, 1991; Powell & Wright, 1992). However no research have been conducted on our test insect. *Trissolcus semistriatus* Nees (Hymenoptera: Scelionidae) was one of the most effective egg parasitoids of sunn pest, *Eurygaster integriceps* Put. (Heteroptera: Scutelleridae) which causes the most severe losses on wheat in Thrace Region, Southern and Southeast Anatolia in Turkey.

Initially, the role of some plants on host location by *T. semistriatus* was investigated. It was aimed to determine whether the parasitoid parasitizes eggs of *E. integriceps* either alone or on parts of each selected plant species and whether these plants have an important role on the host selection of egg parasitoids. And it was also aimed to determine whether the weeds around the wheat fields could attract or repel parasitoids. Wheat, cow cockle, bifora, common vetch and turnipweed were selected as these plants were common on or near the cereal fields in Tekirdag province, Turkey. Although the plants, excluding wheat, were not host of *E. integriceps*, but whose eggs were found on cow cockle (Lodos, 1981) and a number of secondary host pentatomids of egg parasitoids could feed on bifora, common vetch and turnipweed. Pentatomids naturally feed on cultivated and wild plants; consequently, wild host plants play an impontant role in the increasing of population levels of agricultural pest species. These plants are important food resources for development of nymphs and reproduction of adults (Panizzi, 1997).

In the present paper, the results of parasitism trials show possible influences of the plants on host location of egg parasitoids. Therefore, the parasitism rate, adult emergence, sexual ratio and development period of *T. semistriatus* on *E. integriceps* eggs both with and without parts of chosen plant species were determined.

**Materials and methods**

*Parasitoid and host insect cultures*

*T. semistriatus* was collected from the field and its laboratory generations in *E. integriceps* eggs were used in this study. Parasitoids were then cultured in glass tubes (1.5x16 cm) with cotton lids, supplied with distilled water and sugar solution (30%) absorbed in filter paper (1x5 cm) as food and *E. integriceps* eggs as host. The culture was maintained at 26±2 $^{o}$C, 60±10 % relative humidity and 16:8 hr LD conditions.

For mass production of *E. integriceps* eggs as host, field collected adults of sunn bugs were placed on wheat grown in pots, which were covered with plexiglass cages (20x27cm). The host eggs were collected daily and used immediately after collection or stored in petri dishes at 7 $^{o}$C in a refrigerator.

*Plant species*

Wheat (*Triticum vulgare*) (Gramineae), cow cockle (*Vaccaria pyramidata* var. *grandiflora*) (Caryophyllaceae), bifora (*Bifora radians*) (Umbellifereae), common vetch (*Vicia sativa*) (Leguminaceae) and turnipweed (*Rapistrum rugosum*) (Brassicaceae) were used in this study. The whole plants were collected from fields in Tekirdag. The brunches were cut off from the plants in the laboratory and then dipped into water in small bottles to maintain their liveliness before use in the examinations.

*Parasitization trials*

One or two days-old females, previously mated and fed on water and sugar solution, were used in the examination. The host egg clusters were glued on leaves of each plant brunches with solution of gum arabic 10 % and they put in cages (20x27). It should be have to follow this procedure thanks to the impossibilty of having the sunn pest females naturally lay their eggs on the experiment plants in necessary numbers, modifying the methods of Powell & Wright (1992). Each cluster of fifty eggs per replicate was subjected to five *T. semistriatus* females, for 24 hours. After this parasitism period, the egg masses were collected and placed in glass tubes and kept in the incubators until emergence. The number of males and females emerged from each egg mass were recorded. The parasitism rate, adult emergence, sexual ratio and development period of male-female were calculated. Experimental design was randomized complate block with 5 replicates.

The data from this study were subjected to analysis of variance (oneway ANOVA) and Duncan's Multiple range test. Those data that calculated as percentage were subjected to angle transformation before statistical analysis.

**Results**

When host eggs were on wheat, bifora and common vetch leaves, they were parasitized at the similar rates and at high levels, 93.7, 94.7 and 94.9 %, respectively by *T. semistriatus*. In the absence of plant leaves the mean parasitism rate was somewhat lower than they were in the presence of above plants (Table 1). On the other hand, *T. semistriatus* females parasitized the eggs in the absence of plant leaves and on turnipweed at high rate (91.5 and 87.2 %, respectively), and also they were in the same group according to statistical analysis as can be seen in Table 1.

The parasitism rate of the eggs on the cow cockle leaves was the lowest than those of recorded in the absence of leaves or the other plants (Table 1). So the plants significantly affected the parasitism rate of *T.semistriatus*.

The results obtained from the different treatments on the adult emergence ratio paralled with the results of parasitism. The adult emergence ratios from the eggs on most plants or alone eggs were significantly higher than that of cow cockle (Table 1).

**Table 1.** Mean parasitism, adult emergence, sex ratio and development period of *Trissolcus semistriatus* in *Eurygaster integriceps* eggs on different plant leaves or absence of plant

| Plant species tested | Parasitism rate (%) | Adult emergence ratio (%) | Developmental period (days) | |
|---|---|---|---|---|
| | | | Male | Female |
| Absence of plant | 91.5±3.7 ab* | 98.1±0.9 a | 10.6±0.5 | 12.5±0.4 |
| Bifora | 94.7±4.4 a | 96.4±1.9 a | 10.8±0.8 | 12.4±0.7 |
| Common vetch | 94.9±2.2 a | 97.7±0.7 a | 10.7±0.5 | 12.2±0.8 |
| Cow cockle | 68.9±14.9 b | 89.9±3.9 b | 10.6±0.5 | 12.7±0.5 |
| Turnipweed | 87.2±6.3 ab | 97.9±0.5 a | 11.5±1.1 | 12.7±0.5 |
| Wheat | 93.7±4.5 a | 98.6±0.6 a | 10.5±0.5 | 12.3±0.3 |

*Within columns, means followed by the same letter are not significantly different (P=0.05) by Duncan's multiple range test.

**Discussion**

As a result of this research, it was considered that some plants such experimental plants as cow cockle could arrested the parasitoids, so the parasitism rate was significantly reduced and cow cockle was slighty repellant. No previous study was available on the role of plants on parasitization of pentatomid eggs by *Trissolcus* spp.

Powell & Wright (1992) have proposed that leaves from aphid food plants influenced the attack behavior of *Aphidius ervi* Haliday and *A. rhopalosiphi* De Stefani but appeared to have no effect on *A. picipes* (Nees) and *Ephedrus plagiator* Nees in the laboratory tests. Because *A. picipes* and *E. plagiator* are both polyphagous species, attacking aphids feeding on a variety of food plants. *T. semistriatus* also attacks *E. integriceps* and other alternative pentatomid hosts, such as *Carpocoris fuscispinus* Boh., *C. pudicus* Poda, *Eurydema festivum* L., *Graphosoma lineatum* L., *Dolycoris baccarum* (L.), *Aelia rostrata* Boh., *A. acuminata* L. etc. (Lodos, 1961). But there is certain pattern in the responses of egg parasitoid could be different depending to the plants upon which alternative host pentatomids feed. Of course in this study, the effects of only plants without plant-host combinations on the parasitism were observed. According to this, there were no differences between wheat, bifora, common vetch or turnipweed and alone eggs for parasitism of *T. semistriatus* while the parasitism and the emergence rates were reduced on cow cockle. Turnipweed is a special host of *Eurydema ornatum* (L.) (Lodos, 1981), but *E. ornatum* are not preferred by *T. semistriatus* (Kivan, 1998). Besides commonly known plants as hosts, cow cockle was unknown as host of a pentatomid, but sometimes it was seen that sunn bug laid its eggs on it (Lodos, 1961). As a result , *T. semistriatus* females can orient and recognize the plants whether they were foods of their hosts or not. It was concluded that most of examinated plants are neither attractive or repellant, such as cow cocckle appeared to be slightly repellant for *T. semistriatus*.

Developmental period of male and female were not influenced by plants and did not vary among the different treatments. Males developped within from 10.5 to 11.5 days while females developped in 12.2-12.7 days on all the plants and also alone eggs (Table 1). Correa-Ferreira & Moscardi (1994) determinated that the developmental time varied depending on sex and this period was average 10.8 (10-12) days in males while it was 12.1 (11-14) days in females for *Trissolcus basalis* (Woll.) at 26 $^{o}$C. Table 1 further supports our findings although this species was different from that of ours.

It can be concluded that precence or absence of most plants did not change the parasitism rate, while some plants, such as cow cockle, reduced the parasitism in the laboratory tests. These results suggest, therefore, that parasitoids of sunn pest which are able to utilize a wide range of hosts do not use allelochemical cues from host food plants to aid host location. This further gave us the evidence that host eggs without plants can be easily and effectively used for mass-production of egg parasitoids in the laboratory, because this use do not affect the parasitism. On the other hand, the parasitoid did not prefer the eggs on several plants which probably provided negative cues. In this study, the presence of cow cockle reduced both the parasitism ratio and percentage of adult emergence of *T. semistriatus* against *E. integriceps* eggs, suggesting that plant chemicals may sometimes increase the rejection possibility of hosts. According to the results, it was thought that after improving its effectiveness egg parasitoids could be used in the biological control; while weeds having a repellant effect in the edges of wheat fields can negatively affect parasitism rate. The weeds having no such effect could even be more useful due to the possibility that they could carry pentatomids which can act as a very good host for them. However, the results taken in the laboratory should also be verified in the fields as well and more work should be done on the behavioural responses of *T. semistriatus* to plant semiochemicals which is thought to be highly effective in host recognition.

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