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The Host Preference of Overwintered Trissolcus semistriatus Nees (Hymenoptera: Scelionidae) on Some Host Eggs

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Abstract: *The host preferences of Trissolcus semistriatus (Nees) were studied under laboratory conditions. For this purpose eggs of E. integriceps, Dolycoris baccarum (L.), Aelia rostrata (Boh.) and, Eurydema ornate (L.) were submitted to overwintered T. semistriatus. Eggs were grouped, firstly in two (E. integriceps x A. rostrata, E. integriceps x D.baccarum, E. integriceps x E.ornatum A. rostrata x D. baccarum, A. rostrata x E. ornatum D. baccarum x E.ornatum) later in three (E. integriceps x A. rostrata x D. baccarum, E. integriceps x A.rostrata x E. ornatum, E. integriceps x D. baccarum x E. ornatum, A. rostrata x D.baccarum, E. ornatum) final in four (E. integriceps x A. rostrata x D. baccarum x E. ornatum) host egg groups were submitted to T. semistriatus. According to the results of parasitised eggs, it was concluded that E. integriceps was the most preferred species and then followed by D. baccarum and A.rostrata. The lowest preference on the host eggs was detected on E. ornatum eggs.*

Keyword: *Biological control,Trissolcussemistriatus, egg parasitoid,Sunn pest, Eurygasterintegriceps*

I. Introduction

The Sunn pests, *Eurygaster integriceps* Puton (Hemiptera: Scutelleridae), are the most important harmful insect pests on wheat in Turkey. They are distributed on 75% of wheat fields and their chemical control is carried out over an average of 1.2million hectares every year. Both nymphs and adults of Sunn pests cause plant damage, feeding on leaves, stems, and grains (Critchely, 1998).Yield losses were estimated by 50 to 90% in wheat and 20 to 30% in barley (Lodos, 1986). Apart from the direct yield reduction, the insect injects digestive enzymes during feeding which reduce the baking quality of the dough. If as little as 2 to 3% of the grain has been fed on, the entire grain lot may be rendered unacceptable for baking purposes because of poor-quality flour (Lodos, 1986).

To suppress Sunn pests population to acceptable levels in Turkey, chemical control by areal application has been carried out from 1954 to 2004. This method had negative impact on human health and environment. Therefore, chemical control by ground equipment started in 2005.

The egg parasitoid, *Trissolcus semistriatus* Nees (Hymenoptera: Scelionidae), is an important natural enemy of the Sunn pests in Southern Turkey. The species of scelionid parasitoids have been used against Sunn pests in both releases and classical biological control programs in Iran, Morocco and the former USSR (Voegelé, 1961; Laraichi and Voegele, 1975 and Shumakov, 1978). Mass rearing and releases of the egg parasitoids attempts in Turkey started in 1990 and continued until 1997. However, it could not succeed because of the timing of releases (Akıncı and Soysal, 1996). Afterwards, new releasing studies started in 2001 and have been continued up to the present (İslamoglu, 2012).

In this study, the host preferences of overwintered *T.semistriatus*, an egg parasitoid of *E. integriceps* were studied under laboratory conditions. Thus, formed of culture *T. semistriatus* in early spring and choice of host eggs form as production of *T. semistriatus* was researched. Obtained data will contribute prospectively for biological management studies of Sunn pest.

II. Materials and Methods

1- Obtaining of Overwintered *Trissolcus semistriatus*

To form *T. semistriatus* culture, when the temperature reached at 13ºC in early spring, the Scelionid parasitoids were collected by a sweeping net from newly planted wheat fields or from the plants around those wheat fields at Adana Provinces, Karaisalı district of Kuzgun village (37º 08' N 35º 05' E). The parasitoid adults were transferred to Adana Plant Protection Research Institute Entomology laboratory in plastic bags and then were separated for species. The parasitoids were placed in cotton-plugged glass tubes and streaked inside with a diluted honey (10% distilled water) as a food source. *T. semistriatus* were kept in an incubator at 26±1 °C, 65±10% RH and L: D 14:10 hours. When enough parasitoid numbers were available, the experiments were started.

2- Obtaining of host and host eggs

The *E. integricep* was obtained from infested wheat fields in provinces of Gaziantep, (36º 56' N 37º 27' E), *Dolycoris baccarum* (L.) was collected from overwintering of Mountain Nemrut in Adıyaman (37º 58' N 38º 48' E). While *Aelia rostrata* (Boh.) was obtained from overwintering in province of Ereğli in Konya (37º 32' N 34º 23' E), and *Eurydema ornate* (L.) was collected from *Sinapsis arvensis* (L.) in district of Karaisalı in Adana (37 º 15 N; 35 º 03' E). Adults were collected by hand picking and sweeping and then transferred in ice box to the laboratory of Adana Plant Protection Research Institute. Collected adults were placed in an ice box and transferred to climatic rooms. The pest species were placed in boxes containing different types of foods. *E. integricep*, *D. baccarum* and *A. rostrata* were fed on wheat plants, *E. ornatum* were fed on *S. arvensis*. All boxes were placed at 25±2°C, 65±10% relative humidity (RH) and a light: dark (L: D) of 14:10 hours for at least 48 hours in climatic rooms. Afterwards, the temperature was increased to 26±2ºC. The boxes were provided daily by food and eggs. Insect eggs were collected every day and transferred to a deep freeze at +4 ºC and then stored in jars in the fridge until they were used.

3- The Host Preference of Overwintered *T. semistriatus* on Some Host eggs

To determine the egg pereferenceof overwintered *T. semistriatus*, firstly two (*E. integriceps* x *A. rostrata*, *E. integriceps* x *D.baccarum*, *E. integriceps* x *E.ornatum A. rostrata* x *D. baccarum*, *A. rostrata* x *E. ornatum D. baccarum* x *E.ornatum*) later three (*E. integriceps* x *A. rostrata* x *D. baccarum*, *E. integriceps* x *A.rostrata* x *E. ornatum*, *E. integriceps* x *D. baccarum* x *E. ornatum*, *A. rostrata* x *D.baccarum*, *E. ornatum*) final four (*E. integriceps* x *A. rostrata* x *D. baccarum* x *E. ornatum*) host egg groups were submitted to *T. semistriatus.*

Each of host eggs (25 pieces) was located in dishes in which there are 180 degrees between each mass egg in two groups, 120 degrees in three groups and 90 degrees in four groups and then the petri dish was closed by placing a female individual.

After standing for 150 minutes on 16 hours light conditions and 26 °C temperature, parasitoids were removed from petri dishes (PlukeveLeibee, 2006). To enable petri dish to have full of light overhead, great care was shown and if parasitoid died, experiment was renewed.

Eggs in petri dishes were collected and they were taken to the incubator at 26 °C with humidity of 65% and they were kept here until hatched. Each egg which obtains parasitoids or nymph was counted and recorded. Also, eggs that did not open were checked through the microscope in terms of parasitism or non-parasitism. Experiment was set to 10 repetitions for each host.

Statistical analysis

Data of the two groups were tested using analysis of T-test and other data were tested using analysis of variance (one- way ANOVA). Statistical differences were separated by using the Tukey test (P= 0.05). The software SPSS 18.0 for Windows (SPSS 16.0, SPSS Inc., Chicago, IL) was used for statistical analysis.

III. Results And Discussion

To determine the egg preference of overwintered, firstly two-host egg groups were submitted to *T. semistriatus*. The data obtained from two-host egg groups shown in Figure 1.

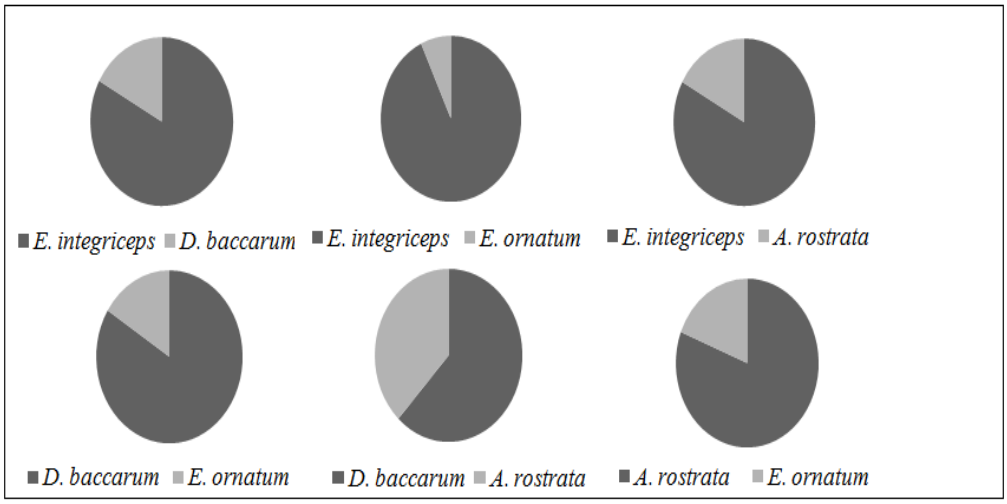

Figure 1. Parasitism rate of *E. integriceps* x *A. rostrata*, *E. integriceps* x *D.baccarum*, *E. integriceps* x *E.ornatum A. rostrata* x *D. baccarum*, *A. rostrata* x *E. ornatum D. baccarum* x *E.ornatum*

When Figure 1 is examined, in the egg groups of *E. integriceps* x *D. baccarum*, the most parasitism were observed in *E. integriceps* eggs. While 136 (%83) of *E. integriceps* eggs were parasitized by *T. semistriatus*, only 28 (%17) eggs of *D. baccarum* were parasitized by *T. semistriatus*. In the *E. integriceps* x *E. ornatum* egg groups of two, 93% of eggs of *E. integriceps* and 7% of *E. ornatum* eggs were parasitized by *T. semistriatus* 83% of *E. integriceps* eggs were determined in the eggs group of *E. integriceps* x *A. rostrata* and only 17% parasitism were determined on *A. rostrata* eggs. *D. baccarum* x *E. oranatum* of egg groups, parasitism rate 84% and 16% were observed in *D. baccarum* eggs and *E. oranatum* eggs respectively. In the egg groups of *D. baccarum* x *A. rostrata*, while 62% parasitism rate of eggs *D. baccarum* were observed, 38% of parasitism rate of eggs *A. rostrata* were observed. In the last egg group, parasitism rate of eggs *A. rostrata*81%, prasitisim rate of eggs *E. oranatum* 19% were detected.

At the statistical evaluation, *E. integriceps* x *A. rostrata* (t-test: t_{18}=7.083, P= 0.000) *E. integriceps* x *D.baccarum* (t-test: t_{18}=1.193, P=0.000), *E. integriceps* x *E.ornatum* (t-test: t_{18}=14.194, P=0.000) *A. rostrata* x *D. baccarum* (t-test: t_{18}=0.620, P=0.002), *A. rostrata* x *E. ornatum* (t-test: t18=4.191, P=0.000) *D. baccarum* x *E.ornatum* (t-test: t_{18}=11.953, P=0.000) parasitized egg numbers between in these groups were found different and this difference statistically to be significant. At the statistical grouping, It was determined that all of them located different groups.

To determine the egg preference of overwintered, firstly three-host egg groups were submited to *T. semistriatus*. The data obtained from two-host egg groups are shown in Figure 2. (*E. integriceps* x *A. rostrata* x *D. baccarum*, *E. integriceps* x *A.rostrata* x *E. ornatum*, *E. integriceps* x *D. baccarum* x *E. ornatum*, *A. rostrata* x *D.baccarum*, *E. ornatum*)

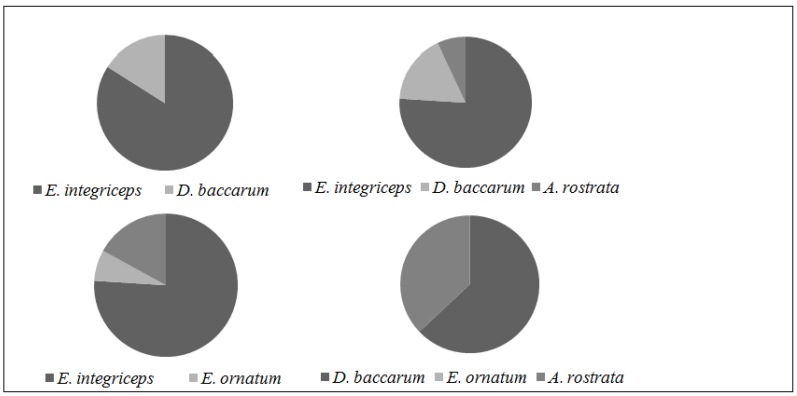

Figure 2. Parasitism rate of *E. integriceps*x *A. rostrata*x *D. baccarum*, *E. integriceps*x *A.rostrata*x *E. ornatum*, *E. integriceps*x *D. baccarum*x *E. ornatum*, *A. rostrata*x *D.baccarum*, *E. ornatum*

According to Figure 2, in the first egg group of three egg groups (*E. integriceps* x *D. baccarum* x *E. ornatum*),while 84% of *E. integriceps* eggs and 16% of *D. baccarum* eggs were parasitized by *T. semistriatus*, none of *E. ornatum* eggs was parasitized by *T. semistriatus*. In the second group of three egg groups were *E. integriceps* x *D. baccarum* x *A. rostrata*. At this group the highest parasitism rate 76% was observed on *E. integriceps* eggs. Parasitism rate of *D. baccarum* eggs followed with 17%. The lowest parasitism rate observed with 7% on *E. ornatum* eggs. In the *E. integriceps* x *E. ornatum* x *A. rostrata* egg group, *E. integriceps*, *E. ornatum* and *A. rostrata* parasitism rate was detected as 76%, 17% and 7% respectively. The latest group of three egg groups, while parasitism rate of *D. baccarum* 63% and *A. rostrata* 37% was determined, No parasitism was determined in *E. ornatum* eggs.

At the statistical evaluation, numbers of parasitism between *E. integriceps*, *D. baccarum* and *E. orantum* were found differentand this difference statistically to be significant was found ($F_{2,29}$=254.781 P= 0.000) and at the statistical grouping each egg species was located in different groups.

In the *E. integriceps* x *D. baccarum* x *E. orantum* egg group, each egg species of parasitism was determined different and this different statistically was detected significant ($F_{2,29}$=254.781 P= 0.000). At the statistical grouping each egg species was located in different groups.

In the *E.integricep*, *D.baccarum* and *A. rostrata* of egg groups, *E. integricep*, *D. baccarum* and *A. rostrata* parasitized by *T. semistriatus* differently and this parasitism was detected statistically significant ($F_{2,29}$=44.454 P= 0.000). At the grouping, while *D. baccarum* and *A. rostrata* in the same group, *E. integricep was* located in another group.

At the statistical evaluation, numbers of parasitism between *E. integriceps*, *E. ornatum* and *A. rostrata* were found different and this difference statistically was found to be significant ($F_{2,29}$=95.375 P= 0.000) and at the statistical grouping *E. integriceps* in the same group, *E. ornatum* and *A. rostrata* were determined to be located in another group .

In the last group of three groups, *D. baccarum* x *E. ornatum* x *A. rostrata* egg groups, each egg species of parasitism was determined different and this difference statistically was detected as significant (($F_{2,29}$=74.535 P= 0.000). At the statistical grouping, While *D. baccarum* and *A. rostrata* were located in the same group, *E. ornatum* in another group

In the parasitism rate of egg groups, *E. integriceps* x *E. ornatum* x *A. rostrata* and *D. baccarum* were given Figure 3.

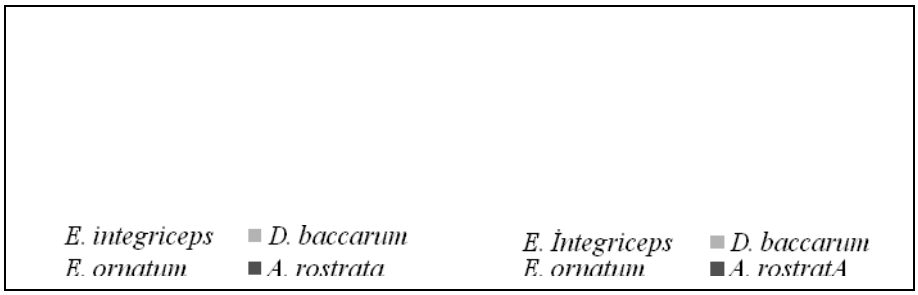

Figure 3. Parasitism rate of *E. integriceps* x *A. rostrata* x *D. baccarum* x *E. ornatum*

Figure 4. Number of parasitized eggs of *E. integriceps* , *A. rostrata*, *D. baccarum* and *E. ornatum*

When Figure 3 was examined, while the most parasitism of all eggs with 74%(115 eggs) was determined in *E. integriceps* eggs, Eggs of *E. ornatum* wasn't determined. Parasitisim rate of *D. baccarum* and *E. ornatum* eggs were detected 19% (29 eggs) and 7% (11 eggs) respectively.

In the group of *E. integriceps*, *D. baccarum*, *A. rostrata*ve*E. ornatum*parasitism rates were determined to be different. And this difference was detected statically significant ($F_{3,36}$=159.019 P= 0.000). At the grouping, while *D. baccarum* and *A. rostrata* in the same group, *E. integricep* and D. *baccarum* were located in different group.

If we take into accountall the parasitised eggs, we can see that all ofparasitised eggs of 55%. *E.integriceps*, 25% of *D. baccarum* , 16% of *A. rostrata*, 4% of *E. ornatum* were determined (Figure 4). Each egg species of parasitism was determined different and this difference was detected satistically significant (($F_{2,29}$=74.535 P= 0.000).

When we evaluate preference of different host eggs of overwintered *T. semistriatus* collected from the nature, both parasitism rate and statically analysis showed that the most parasitism rate were detected in the *E. integriceps* eggs. Parasitism rate of *D. baccarum* eggs less than parasitism rate of *E. integriceps* eggs, but their parasitism rates were determined more than parasitism rate of *A. rostrata*. Similarly, Parasitism rate of *A. rostrata* eggs less than parasitism rate of *E. integriceps* and *D. baccarum* eggs, but their parasitism rates were determined more than parasitism rate of *E. ornatum*. But, in the experiment, the lowest parasitism rate in all the eggs was determined on *E. ornatum* eggs.

Similar results were also obtained from other studies conducted in our country.Kıvan and Kılıc (2002) reported that, *E. integriceps*, *D. baccarum*, *Graphosoma lineatum* (L.) *Carpocoris pudicus* (Poda) and *Holcostethus vernalis* (Fab.) were parasited of different rate by *T. semistriatus* and parasitism rate were detected 88%, 83.6%, 94.8%, 87.3% and 88.0% respectively. While in *E. ornatum* eggs parasitism rate was detected to be 24%, No parasitism rate was detected in *Nezeraviridula*(L.) eggs.In the study made by Gözüaçık and atc,, declaration was done that, *T. semistriatus* preferred the most of the eggs of *E. integriceps* and then *D. baccarum*, *H. vernalis*, *E. ornata*ve*P. lituratus* were detected most preference respectively. In another study, *E. integriceps*was the most preferred species, followed by *D. baccarum*. They also emphasized that taking environmental precautions to maintain natural populations of these species, *H. vernalis*, *E. ornata*and *P. lituratus* would be in favor of sustaining bio-control of Sunn pest (Gözüaçık and Yiğit, 2012).

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