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Efficacy of The Some Insecticide Used in The Sunn Pest Eurygaster Spp. (Het; Scutelleridae) Struggle On the Adults of G. Monspeliensis (Picard) (Hymenoptera: Scelionidae) Parasitoid

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ABSTRACT

Sunn pest (Eurygaster integriceps Put.) (Heteroptera: Scutelleridae) is the most important harmful insect of wheat in Turkey. Within the Gramineae family, Sunn pest feeds and makes damage especially in different phenological periods of wheat. It has been indicated that natural enemies have a great effect on the factors suppressing the sunn pest. The most important ones of these natural enemies are the species included in the Scelione family of Hymenoptera. There exist site-specific secondary species apart from the common species suppressing the sunn pest populations. Their spreading and availability rates are relatively lower, but they are important in some regions and years. At the results of some studies, it has been seen that Gryon monspelensis (Picard) (Hymenoptera: Scelionidae) is occasionally effective on the eggs of sunn pest in some regions of Gaziantep Province. The effects of application dosages of today's most commonly used 4 insecticides (Alpha-cypermethrin, Deltamethrin, Lambda-cyhalothrin, and Dimethoate) on G. monspelensis, egg parasitoids were investigated in this study. According to the obtained data, In the dry film method; it was determined that 100 % of the parasitoids were died in the first 24 hours in the counting carried out on the 1st, 3rd, 5th and 14th days after insecticides application; however, in the controls 89% of the adult parasitoids were alive. In the statistical analysis, it was determined that the effects of insecticides in different times after application were not changed according to the survival rate, in other words, the interaction of insecticide x time was not statistically significant. It was determined that insecticides application affected the survival rates of the adults (P=0.00), and while controls took place in the first group, all applied insecticides were determined to be in another group in the statistical grouping. In the Dipping method; the effects of insecticides were determined as Lambda-cyhalothrin 100%, Alphacypermethrin 95, Deltamethrin 93 and Dimethoate 35, respectively. It was determined that dimethoate was present in a group while other insecticides Alphacypermethrin, Deltamethrin, and Deltamethrin were found in another group.

Keywords: Gryon Monspeliensis, Insecticides, Side-Effect, Wheat

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INTRODUCTION

With 81.034 million hectares of plantations and 19 674 tons of annual production wheat ranks first in Turkey among the field crops [1]. Wheat, as it was in the past, is also the basic food source of mankind today and since it is a cheap and valuable nutrient source, its importance will increase more and more in the future [2]. Sunn pest (Eurygaster integriceps Put.) (Heteroptera: Scutelleridae) is the most important pests of wheat in Turkey. Overwintered adults of the sunn pest attack the leaves and stems of young, succulent wheat and barley plants, causing them to wither and die before spike formation [3]. They also suck the base of the spike during the early growing period, resulting in whitish spikes without kernels, producing white spikes. Yield losses are estimated at 50% to 90% in wheat and 20% to 30% in barley [3,4]. Apart from the direct yield reduction, during feeding, the insect injects digestive enzymes that reduce the baking quality of the dough [5]. If as little as 2% to 3% of the grain is fed, the entire grain lot may become unacceptable for baking purposes

because of poor-quality flour [6,7,8]. Various natural enemies attack Sunn pest in Turkey. It was found that natural enemies have the greatest effect among the factors restraining SP population [3,4,9]. The egg parasitoid, Trissolcus semistriatus Nees (Hymenoptera: Scelionidae), is an important natural enemy of the Sunn pest in Southern Turkey [10]. Apart from these common species suppressing the Sunn pest population, there also exists site-specific secondary species. Their spreading and availability rates are relatively lower, but they are important in some regions and years. In order to increase the effectiveness of natural enemy composition of Sunn pest, one of the most important pests of Turkey, it is very important to know the biological properties of these natural enemies in detail. As a result, the applied surveys it was observed that the effectiveness of G. monspeliensis reached up to 10% in Oğuzeli, Islahiye and Nurdağı [10]. However, no study has been conducted on the efficacy of the insecticide used in the Sunn pest struggle against the adults of G.monspeliensis. For that reason, with this study the effect of Alpha - Cypermethrin, Cypermethrin, Deltamethrin, Lambda - Cyhalothrin and Dimethoate used effectively in Sunn pest strrugle on the adults of G. monspeliensis was identified under the laboratory conditions.

MATERIAL AND METHOD

Creation of Gryon monspeliensis (Picard) culture

Parasitoid cultures were obtained from the Sunn pest eggs collected from Oguzeli county of Gaziantep province (37º 09' N 37º 07' E). The collected eggs were separated according to their presence or absence of parasitism, the parasitic eggs were kept at 60 ± 5% humidity at 26 ± 1 ° C temperature and the parasitoids were incubated for 16 hours in illuminated incubators. The adults of G. monspeliensis were placed in cotton-plugged glass tubes and a diluted honey (10% distilled water) is applied as a food source. Adult Sunn pests collected from the field were cultured in plastic jars at 26±1 °C temperature, 60± 5% humidity and 16 hours in illuminated conditions. The cultures were checked every 2 days, their nutrients were changed, and eggs were collected. Then, these eggs were sticked with two packages of non-egg-smelling glue on 0.5 x5–7 cm sized carton strips and stored in jars in the fridge until they were submitted to the parasitoid. Sunn pest eggs were submitted to G. monspilensis (1 male and 3 females) for parasitization. These were kept in an illuminated incubator at 26±1 °C, 65±5 % RH and a L: D 16:8 hours. By this way, the parasitoid culture was created.

Dry Film Method

The effect of some insecticides used in the struggle against Eurygaster spp. in Turkey on G. monspeliensis was determined by dry film method. [11,12]. A thin film layer was formed by spraying 2 mg / cm2 preparation on 12 cm glass plate with a pressure of 10 bar (Figure 1b) with the application doses of the drugs taken in the experiment (Table 1), the spray tower (Spray Tower, Figure 1a). The applied surfaces were dried at room temperature. As a trial unit, a 13 cm diameter and 2 cm height of special mechanism was prepared from circular fiberglass on which there are 0,5 cm diameter of 10 ventilation holes closed with a thin braided net in order to provide air input/output at the edge opposite to each other and also 1 cm diameter of two holes opposite to each other. One of the holes with 1 cm diameter was filled with honey-impregnated cotton to feed parasitoids, while the other 10 parasitoid adults were released. Before the parasitoids were released, they were taken into the test tubes and allowed to stay in the refrigerator (4±1°C) and the movement of parasitoids were slowed down [13]. Afterwards, in order to provide air to the unit, an air hose was attached to the hole which adult parasitoids were released. Insecticide-treated plates were placed above and under the trial unit as the insecticide-treated surfaces face into each other. (Figure. 1c and 1d). Thus, parasitoid adults were provided to tocuh with the insecticide-treated surfaces for 24 hours [11,12,14]. The first counts were made at the end of 24 hours and alive and dead individuals were identified. In addition, the trial was daily checked and adult deaths were detected and recorded and counts continued until all adults died. Works in the laboratory were carried out in four replicates [13] under a temperature of 26±6 °C, 65± 5% relative humidity and 16: 8 lighting time. The trial was repeated after 1, 3, 5 and 14 days after spraying, and alive and dead individuals were recorded [12, 13]. The effects of insecticides on adult parasitoids were calculated by the Non-percentage Abbott Formula over the numbers of alive adults [15]. The obtained results were evaluated according to IOBC class values (Table 2) [16]. Arc-square square root transformations were applied to the percentile death values and one-way variance analysis (ANOVA) was performed on these transformed values using the SPSS package program (P = 0.05).

Table 1. Formulation of active insecticides and their commercial names and dosage values

Active substance	Commercial name	Formulation	Dose
Alpha - Cypermethrin	İzolalfa	E.C.	15 ml/da
Cypermethrin	Arrivo	E.C.	30 ml/da
Deltamethrin	Demond	E.C.	30 ml/da
Lambda -Cyhalothrin	Karete	E.C.	20 ml/da
Dimethoate	Poligor	E.C.	150 ml/100 lt su
Control	Saf su	-	-

Table 2. Classification of insecticides according to IOBC in laboratory conditions [16]

Class Value	Effect (%)	Degree of Harmfulness
N	< 30	Harmless or slightly harmful
M	30 - 79	Moderately harmful
T	> 80	Harmful

When the distinction between applications is important, the Duncan test, one of the multiple comparison tests, is used and grouped [17]. Effects of insecticides on parasitoids and class values were determined according to [11] and [14] (Table 2).

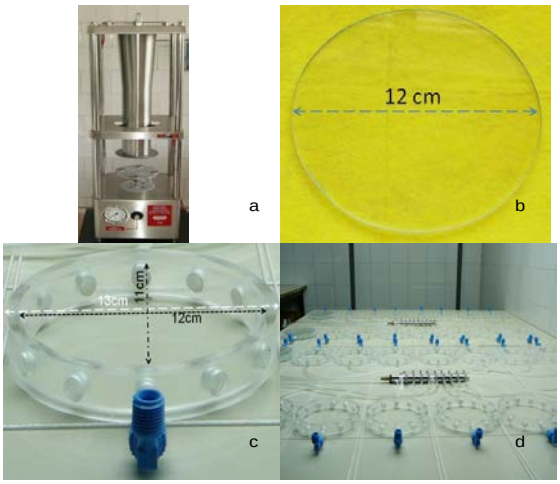

Figure 1. a) Sprey Tower, b) glass plate c) and d) trial unit.

Dipping method

The parasitized eggs were kept in the incubator for 3 days to determine whether they parasitized with G. monspeliensis. The parasitized eggs were submerged in 1 liter concentrations prepared in the field application dose for 3 seconds with the help of a pens. Then, these eggs were placed on blotting paper for drying and left for a while. The trial was conducted in 5 replicates for each insecticide. In controls, pure water is used. After the application, the egg packages were stored at 26±6 °C, and 65± 5% humidity until parasitoids emerged. Adults who emerged were counted and recorded. In addition, eggs which eggs without adult output were opened and the development status of parasitoid was checked. The counting was continued until the adult exits were completed at the controls. The effects of insecticides on adults were calculated by the Non-percentage Abbott Formula [15].

RESULTS AND DISCUSSION

Dry Film Method

The effects of Alpha - Cypermethrin, Deltamethrin, Lambda - Cyhalothrin and Dimethoate on G. monspeliensis in laboratory conditions are presented in Table 3.

Table 3. The survival rates of Gryon monspeliensis adult treated with Alpha - Cypermethrin, Deltamethrin, Lambda - Cyhalothrin and Dimethoate in laboratory conditions

Effective Substance	Live Stay Rate (%) Average ± Standart Eror (Min - Max) Group Release Time (Day)			
	1. Day	3. Day	5. Day	14. Day
Alpha - Cypermethrin	0.00± 0.00 b* (0.00-0.00)	0.00 ±0.00 b (0.00-0.00)	0.00 ±0.00 b (0.00-0.00)	0.00 ±0.00 b (0.00-0.00)
Deltamethrin	0.00± 0.00 b* (0.00-0.00)	0.00 ±0.00 b (0.00-0.00)	0.00 ±0.00 b (0.00-0.00)	0.00 ±0.00 b (0.00-0.00)
Lambda-Cyhalothrin	0.00± 0.00 b* (0.00-0.00)	0.00 ±0.00 b (0.00-0.00)	0.00 ±0.00 b (0.00-0.00)	0.00 ±0.00 b (0.00-0.00)
Dimethoate	0.00± 0.00 b* (0.00-0.00)	0.00 ±0.00 b (0.00-0.00)	0.00 ±0.00 b (0.00-0.00)	0.00 ±0.00 b (0.00-0.00)
Control	92.50± 4.78 a (80.0-100.0)	90.00 ±4.18 a (80.0-100.0)	90.00 ±4.07 a (70.0-100.0)	80.00 ±4.08 a (70.0-90.0)

* The different small letter values in the same column are statistically different.

When Table 3 is analyzed, we can see that 100% of the parasitoids released into the cages 1, 3, 5 and 14 days after the application of the insecticides had died. In controls, it was determined that on the 1st day 92.50%, on the 3rd day and 5th day 90.00% and on the 14th day 80.00 % of adult parasitoids released into cages were alive. As a result of the statistical analysis, it was determined that the survival rate of adult parasitoids did not change with insecticides at different times, in other words, insecticide x time interaction was not significant (df: 12, F:

0.733, P: 0.714). On the other hand, it was determined that insecticide application had a significant effect on adult parasitoids (P = 0.00). As a result of analysis of variance, it was found that all insecticides used in the study constituted the first group (a) while the control group constituted the second group (b).

Insecticides Alpha - Cypermethrin, Deltamethrin, Lambda - Cyhalothrin and Dimethoate were found to kill whole parasitoids released after 1, 3, 5 and 14 days after spraying. For this reason, these insecticides were found to enter the harmful group by taking the "T" class value at all the release times.

Dipping method

Insecticide application was made on the 3rd day of parasitization of the eggs parasitized with G. monspeliensis. After the application of insecticide, it was determined that the development of G. monspeliensis continued and the parasitoids became adult. However, it has been determined that the adult emergence rates differ from insecticides. The parasitoid exits of G. monspeliensis started on the 10th day after the parasitism and were completed on the 14th day. The adult exit rates of G. monspeliensis were determined as Lambda-cyhalothrin 0.0%, Alphacypermethrin 5%, Deltamethrin 7% Dimethoate 65%, and control 89 (Figure 2).

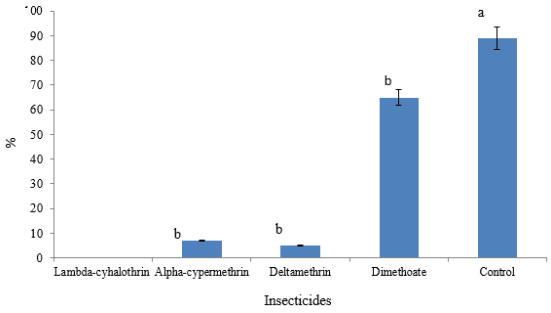

Figure 2. Exit rates of G. monspeliensis at Lambda-cyhalothrin, Alpha Cypermethrin,Deltamethrin, Dimethoate, and Control

Accordingly, the effects of insecticides were determined as Lambda-cyhalothrin 100%, Alphacypermethrin 95, Deltamethrin 93 and Dimethoate 35, respectively (Figure 3). It was determined that dimethoate (b) was present in a group while other insecticides (Alphacypermethrin, Deltamethrin, Deltamethrin) were found in another group (c) (df: 12, F: 12, P: 0.02).

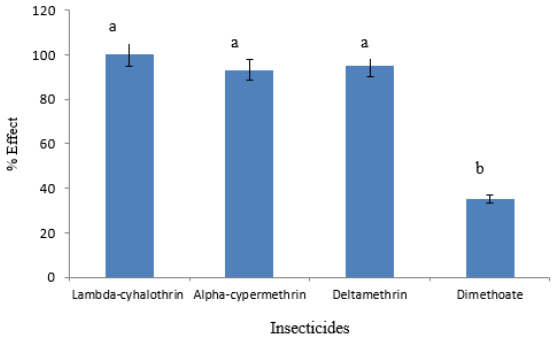

Figure 3. Lambda-cyhalothrin, Alphacypermethrin, Deltamethrin and Dimethoate of effects on G. monspeliensis

When Figures 2 and 3 are examined together, it has been determined that the effect of organic phosphate insecticides on the removal of Dimethoate is lower than that of other insecticides. It has been determined that synthetic pyrethroid insecticides (Alphacypermethrin, Lambda-cyhalothrin and Deltamethrin) enter the "Harmful" group (T) while Dimethoate is in the group of "Mild to moderate" group (M) according to the IOBC classification of the insecticides in laboratory conditions.

Obtained findings are compatible with other studies with the egg parasitoids. Babaroğlu and Uğur (2011) investigated the effects of Fenitrothion and Zetacypermethrin insecticides on T. semistriatus under laboratory conditions. It was determined that 100% of the parasitoids released after 1, 3, 8 and 14 days had died, whereas 95.71% of the parasitoids remained alive in controls. As a result of the statistical analysis, they found that the survival rate of adult parasitoids did not depend on the insecticides during different time periods. They determined that the insecticides are in the "T" class. [13]. Rosca and Popov (1983) reported that adults of T. grandis and Telenomus chloropus were susceptible to insecticides used in the Sunn pest struggle [18]. Saber et al. (2001) reported that field application doses of fenitrothion 50 EC and deltamethrin 2.5 EC caused 100% mortality in T. semistriatus and T grandis adults within 24 hours and were very harmful [19]. In another study, it was found that all of the T. semistriatus adults in the laboratory conditions of the insecticides named Arrivo 25 EC, Lannate 90 SP, Dipterex 80 WP, Seedox 50 WP, Komithion 50 EC, Lebaycid 50 EM, Actellic 50 EC and Sumicidin 20 EC killed at the end of 270 minutes. This insecticide entered very harmful group with 100% effect ratio [20] (Şimşek et al., 1986). Zeren et al. (1994) report that the adults of T. semistriatus died within 24

hours with fenthion 50 EC, cypermethrin 2.5 EC, cyfluthrin 2.5 EC, cyhalothrin 5 EC and deltamethrin 2.5 EC, and these insecticides entered very harmful groups [21].

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