

The Parasitism Rate of *Diglyphus isaea* (Hymenoptera: Eulophidae) on *Liriomyza sativae* Blanchard (Diptera: Agromyzidae) in Mugla Province

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Abstract

Liriomyza sativae Blanchard (Diptera: Agromyzidae) Blanchard is an important pest on bean in Turkey. *Diglyphus isaea* (Walker) (Hymenoptera: Eulophidae) is one of the most common parasitoid of *L. sativae*. The aim of this study was to determine the natural parasitism rate of *D. isaea* on *L. sativae*. This study was carried out during autumn seasons of 2006 and 2007 in six bean fields in Mugla province. No insecticide treatment was applied in all experimental fields throughout the production period in all experimental fields. The emerging leafminers and parasitoid adults were obtained and counted in the weekly sample leaves at laboratory. The parasitism rates were 32.01% for 2006 and 32.97% for 2007. The correlation coefficient was significantly positive between *L. sativae* and *D. isaea* population in both years ($P < 0.01$).

Keywords : *Liriomyza sativae*, *Diglyphus isaea*, parasitoid, parasitism ratio.

INTRODUCTION

In Turkey, a total of 474.039 da is under vegetable production in greenhouses, of which 10.359 da are given to bean production (Anonymous [1]). Serpentine leafminer flies, *Liriomyza sativae* Blanchard (Diptera: Agromyzidae) are polyphagous pests of world-wide importance (Parrella [2]). Murphy and LaSalle [3] stated that all *Liriomyza* species adopted to vegetable and ornamental crops. Female adults puncture the leaf surface with their ovipositors, feed on the leaf tissue and insert their eggs into the leaves. This behavior results in reduction of both plant yield and quality (Trumble et al. [4]; Yıldırım et al. [5]) and the spreading of various plant diseases (Miranda et al. [6]). Different *Liriomyza* species significantly caused to yield reduction. It was obtained that these yield reductions were 70% in tomato (Waterhouse and Norris [7]) and 100% in potato (Shepard and Braun [8]). Nowadays, the greenhouse bean farmer intensively applies insecticides against leafminer damage attack. For that reason, increased insect resistance to pesticides have developed public fears about chemical residues for food. Therefore, natural enemies have been used for *L. sativae* control in greenhouses (Johnson et al. [9]; Chen et al. [10]). *D. isaea* is used against *Liriomyza* spp. in many countries (Weintraub [11]). It feeds externally on the developing leafminer larvae within the leafminer tunnels (Minkenberg [12]). This study was carried out to observe and determine the natural parasitism rates of *D. isaea* on *L. sativae* in insecticide-free bean growing fields to support more environmental friendly bean production in Mugla province, Turkey.

MATERIALS AND METHODS

Experiment Area

The experiment was conducted 2006 and 2007 in Mugla province southwest Turkey under six bean fields in Ortaca, Koyceğiz, Ula, Yerkesik, Yatagan and Kavaklıdere towns. In this study, bean cultivar, Alman Ayse, were planted simultaneously on 10 May and 14 August during 2006 and on 14 May and 20 August, 2007. The experiment was conducted six fields, average 4000 m², each in given intervals of a few kilometers. There were no application insecticide throughout the production period.

Sampling

The experimental areas were controlled to determine the leafminer infestation once a week during production period. During the fourth week when leafminer infestation first occurred, and each week thereafter 50 infested bean leaves were removed randomly from each field, were brought to the laboratory, and maintained at 25± 2 °C and 65 % relative humidity. The bean leaves were placed in plastic insect cages to allow leafminers and parasitoids to emerge. The sampled each leaf was put into place a sheet of absorbant paper in order to prevent contact and mould (Çıkman et al. [13]). As the immature stage of the leafminers cycle lasts 10-17 days the infested leaves were kept in the containers for 3 weeks. Parasitism was calculated by dividing the number of *D. isaea* parasitoids by the total number of parasitoids and leafminers collected (Çıkman et al. [13]).

Data Analysis

The correlation between number of *D.isaea* and *L. sativae* were analyzed by using SPSS 11.0 software programs. All tests were conducted at the 0.01 probability level.

RESULTS AND DISCUSSION

The total individual numbers of *L. Sativae* and *D. isaea* and parasitism for *D. isaea* is shown in Table 1. In all fields production period of 2006, *L. sativae* population density in the initial 2nd and 9th weeks was higher than the other remaining 7 weeks, whereas, the most density population of leafminer was recorded in 2nd, 3th, 4th, 9th and 10th weeks in 2007. *D. isaea* population density was higher in 2nd and 10th weeks than the other 8 weeks in 2006, while the highest values were recorded in 3th and 10th weeks in 2007. The total density was higher in the 2007 than that in 2006 with 1413 and 1297 number adults respectively which was similar to *L. sativae* (Table 1).

As for the parasitism, the highest rates were determined in 10th week with 65.51 % and 2nd week with 46.15 % in 2006. In 2007, were determined in 6th week 43.35 % and 1st week with 38.18 %. Furthermore, the population of *L. sativae* and *D. isaea* were almost similar, fluctuating with paralel curves throughout the entire study period in both years. In 2006 and 2007, the average parasitism rates were found to be 32.01 % and 32.97 % in 2006 and 2007, respectively. The correlation coefficients between the population of *L. sativae* and *D. isaea* were significant to be $r = 0.628$ and $r = 0.921$ in 2006 and 2007, respectively.

The density of *L. sativae* was higher in the 2007 than 2006 with 1988 and 3038 adults respectively (Figure 1). Given the

number of mines per leaf, 1.65 mines per leaf were observed during the production of 2006, whereas 2.23 mines per leaf were observed in 2007. It could be concluded that the yearly differences in increased population densities were due to climatic factors. The high temperature has been observed since 1967 in Mugla (40.8 ° C by 27. VI. 2007 and 41.6 ° C by 27.VII. 2007) according to Turkish State Meteorological Service (Anonymous [14]).

As seen in previous studies, *D.isaea* is the most common parasitoids of leafminers. Çıkman [15] indicates that the natural parasitism rate of *D. isaea* is % 56.17 for *L. sativae*, but according to Keçeci et al. [16], this rate has reached to % 67. In our study the natural parasitism rate we found was %32.01 and %32.97 in year 2006 and 2007, respectively. On both years, the correlation between *L. sativae* and *D. isaea* populations was found to be significant. It can be considered that *L. sativae* population was under the economic treshold resulted from *D. isae*'s effective natural parasitism rate in the years of the study. If *D. isae* considered to be developed very fast, and could get the leafminer population under pressure in a short time then it can also be effective on high pest populations (Patel and Schuster [17]). Considering the use of pesticides may cause problems such as environmental pollution and pesticide residue as well as resistance problems against pests, biological control practices are getting more important (Parrella and Trumble [18]; Weintraub [19]; Saito [20]).

D. isaea population certainly should not be ignored when struggling with *L. sativae*. Measures to control with pest must increase the effectiveness of natural enemy *D. isae*'s population rather to decrease the population.

Table 1. Total number of *Liriomyza sativae* and *Diglyphus isaea* (percent parasitism) was reared from bean leaves from six fields for two years

Season	Week	Number of leaves	<i>Liriomyza sativae</i>	<i>Diglyphus isaea</i>	%
2006	1	200	300	179	37.37
	2	200	622	533	46.15
	3	200	94	32	25.40
	4	200	81	44	35.20
	5	200	163	15	8.43
	6	200	21	15	41.66
	7	200	105	40	27.59
	8	200	88	26	22.81
	9	200	315	35	10.00
	10	200	199	378	65.51
2007	1	200	134	85	38.81
	2	200	345	154	30.86
	3	200	639	321	33.44
	4	200	331	119	26.44
	5	200	126	68	35.05
	6	200	115	88	43.35
	7	200	187	96	33.92
	8	200	217	90	29.32
	9	200	422	163	27.86
	10	200	520	230	30.66

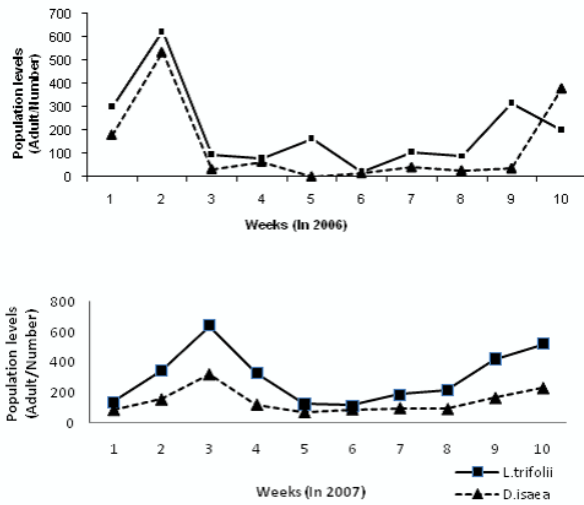


Fig.1. Average number of *Diglyphus isaea* and *Liriomyza sativae* recovered from the first week were observed (4th week from planting) in six fields of bean in 2006 and 2007.

CONCLUSION

As a result of the study, *D. isaea* was found to be the most important parasitoid of *L. sativae*. The average rate of natural parasitism was found 32.49% for both years. If the correlation between *D. isaea* population and *L. sativae* population is considered to be positive, then *D. isaea* population would show an elevated effect on high pest populations. Therefore, it is extremely important to not harm *D. isaea* but to increase the effectiveness of measures when controlling against pests.

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