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Natural Efficiency of *Caryedon palaestinicus* Southgate (Coleoptera, Bruchidae; Pachymerinae) Feeding on the Seeds of Mesquit, *Prosopis farcta* (Banks and Sol.) Macbride

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Abstract: Mesquit, *Prosopis farcta* (Banks and Sol.) Macbride, has become a serious weed problem in cultivated and non-cultivated areas in the Mediterranean and Southeast Anatolian Regions of Turkey. *Caryedon palaestinicus* Southgate (Coleoptera, Bruchidae; Pachymerinae), a seed feeding insect, has been determined in mesquit growing areas. In this study, *C. palaestinicus* infected seed rates of *P. farcta* were investigated. A thousand pods of *P. farcta* were collected separately from Antakya, Hassa and Kirikhan districts in 2000 and Altinozu, Kumlu and Reyhanli districts in 2001. Collected pods were placed individually: polyethylene bags and kept to the following July. Numbers of damaged seeds and healthy ones were recorded in July. Damaged seed rates for Antakya, Hassa and Kirikhan were 35.4, 34.9, 37.8%, respectively and for Altinozu, Kumlu and Reyhanli were 27.9, 37.2 and 38.0%, respectively. In addition *Rhaconatus major* Tobias (Hymoneptera, Braconidae) a larval parasitoid of *C. palaestinicus* was determined in the survey areas. It is concluded that *C. palaestinicus* was not a promising biological agent for controlling mesquit under field conditions.

Key words: Mesquit, *P. farcta, C. palaestinicus, R. major*, biological control

INTRODUCTION

Mesquit, *Prosopis farcta* (Banks and Sol.) Macbride is a perennial weed that grows in warm and hot climates and is resistant to dry conditions and difficult to control because of its deep reaching roots[1]. *P. farcta* not only reproduces through its seeds but also through its extensive root-system[1-4]. *Prosopis farcta*, having diverse species in North and South America, Africa and Australia, has only one species recorded in Turkish flora[5-8]. However *P. farcta* presents a significant problem in Cyprus, Egypt, Iran, Iraq, Israel, Syria and Turkey[1,9,10].

Caryedon palaestinicus Southgate (Coleoptera, Bruchidae; Pachymerinae), a seed pest, is mostly seen in the regions where *P. farcta* thrives. Yucel[11] points out that the infestation of *P. farcta* with *C. palaestinicus* needs to be studied due to the fact that *P. farcta* and *C. palaestinicus* are abundant in Sanliurfa province, Turkey. Bukun *et al.*[3] reported that the population density of *C. palaestinicus* reached its highest level in August and 6.3-67.3% of *P. farcta* seeds had been infested. However, this low or high infestation level is not important for control of this weed since the plant reproduces through its root-system. In the studies carried out in Iran, Iraq and Israel, Southgate[12] described the samples collected of the *P. farcta* as *C. palaestinicus* and underlined the economic importance of the species. Belinsky and Kugler[13] found out that *C. palaestinicus* prefers *P. farcta* as a host but development of larvae takes more time than on groundnuts. Borowiec[14] reported that *C. palaestinicus*, was recorded for the first time on *P. farcta* in Iraq and the pod of *P. spicigera* as infested with *C. palaestinicus*, the development of the larvae of the *C. palaestinicus* coming to term either in the inside or outside of the pods as a cocoon, which was also recorded for the first time in Iran[15]. Satya *et al.*[16] reported that *Acacia nilatonica* Del. damaged pods varied between 10-30% and damaged seeds varied between 1.2-1.8%.

Biological control that does not disturb the balance of nature is a method expected to replace chemical control and to be effective in the long term[17]. In the biological control of the weeds, the most successful results have been achieved by using insect the most effective one being against the perennial weeds[18].

The objective of this study was to examine the infestation levels of *P. farcta* with *C. palaestinicus* and its effectiveness in the biological control programs in Hatay province, Turkey.

MATERIALS AND METHODS

The pods of *P. farcta* were collected from olive orchards in the districts of Hatay, Antakya, Hassa and Kirikhan in 2000 and in those of Altinozu, Kumlu and

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Reyhanli in 2001. The pods were obtained in September and October in the both years.

The trials were confined to 4 replications and in each replication, 250 pods in total were used by collecting 10 pods from the upper, lower and middle parts of the 25 *P. farcta* plants. The pods collected were placed in plastic bags, each of which contained only one pod. Afterwards, the bags were loosely tied and kept at an average 25°C of room temperature. In both years, the bags were untied in July, with the numbers of adult *C. palaestinicus*, its larval parasitoid *Rhaconotus major* Tobias and the total numbers of damaged pods and seeds were recorded.

The data were analyzed using analysis of variance (ANOVA) technique[19].

RESULTS AND DISCUSSION

Pods of *P. farcta* collected from Altinozu, Antakya, Hassa, Kirikhan, Kumlu and Reyhanli had 1 to 9 seeds per pod and the pods that had no seeds varied between 6.9 and 12.9%. The number of seeds in an individual pod was between 1 and 4 (Table 1).

Moreover, the percentage of pods that *C. palaestinicus* feed on ranged from 33.4 to 46.1% (Table 2).

The highest and the lowest feeding rates were detected in Kumlu and Hassa, respectively. However the feeding rates differences among locations were not significant.

Satya *et al.*[16] reported that the percent of damaged *Acacia nilotanica* Del pods by *C. serratus* ranged from 10 to 30%. Such a result could be described to the method of study employed to probe different plants.

In addition, van Klinken *et al.*[8] noted that climate changes affected biological control agents and the same agent might also present different sorts of action at different regions. Therefore, considering the regions at which the samples have been collected, the differences we have had may be considered usual.

When the percent of damaged seeds is considered, it will be noted that the lowest one has been detected in the samples collected from Altinozu (27.9%), the highest at Reyhanli (38.0%) and there have been no statistical differences among sampling places. It has been found out that *C. palaestinicus* has destroyed all the seeds of pods that it has fed on and as a result, only seed coats have been left over. While Bukun *et al.*[3] reported the percentage of damage caused by *C. palaestinicus* to seeds to be around 6.3-67.3. Zimmerman[20] reported that of damaged caused by *Algarobius prosopis* and *A. bottimeri* to seeds of *Prosopis* spp. to be as much as 90%. Although there were no records on the infestation of mesquite with larval parasitoids in those studies it might be concluded that this may have led to the high level of damage caused by *C. palaestinicus* to seeds.

Where the rate of infestation of a host with a biological control agent is more than 50%, a successful biological control can be accomplished[21]. In this study, it is noted that this rate has remained between 25.4 and 34.3% in respect of the sampling locations (Table 3),

Table 1: Percent of *Prosopis farcta* pods containing 0, 1, 2, ….9 seeds

	Percent of seeds in mesquit pods									
Districts	0	1	2	3	4	5	6	7	8	9
Altinozu	11.2	21.1	18.9	38.9	2.8	3.5	1.8	0.2	1.4	0.2
Antakya	8.9	59.5	19.9	6.5	2.6	0.9	1.1	0.3	0.3	0
Hassa	12.9	55.0	21.8	6.7	1.2	2.1	0.1	0	0.1	0.1
Kirikhan	8.2	54.1	25.1	6.5	2.3	2.3	0.5	0.6	0.1	0.3
Kumlu	6.9	9.1	14.0	35.7	29.2	3.1	0.5	1.5	0	0
Reyhanli	9.4	48.9	8.5	10.8	16.1	1.6	2.0	1.2	0.9	0.6

Table 2: Percent of infested pods and seeds of *Prosopis farcta* by *Caryedon palaestinicus* in Hatay districts in 2000-2001

	Sampling places						
Plant parts	Altinozu	Antakya	Hassa	Kirikhan	Kumlu	Reyhanli	CV
Pods	41.1	39.5	33.4	42.7	46.1	44.6	18.2
Seeds	27.9	35.4	34.9	37.8	37.2	38.0	20.9

Table 3: Infestation rates of pods of *Prosopis farcta* by *Caryedon palaestinicus* in Hatay districts in 2000-2001

	Sampling places					
Infestation rates (%)	Altinozu	Antakya	Hassa	Kirikhan	Kumlu	Reyhanli
0	59.9	60.5	66.6	57.3	53.9	55.4
1-25	3.0	1.5	0.8	1.4	1.8	2.6
26-50	8.7	8.8	7.2	12.6	10.7	7.7
51-75	4.6	2.7	2.0	2.3	4.2	3.1
76-100	24.8	26.5	23.4	26.4	29.4	31.2

Table 4: Percentage of parasitism (%) *Caryedon palaestinicus* by its parasitoid *Rhaconatus major* tobias in Hatay districts in 2000-2001

Sampling places					
Altinozu	Antakya	Hassa	Kirikhan	Kumlu	Reyhanli
62.3±4.1	80.9±7.1	80.5±9.5	67.8±6.8	100.0±29	100.0±14

indicating that *C. palaestinicus* as a biological control agent falls short of the above required criterion.

This may have resulted from the high level parasitism by *Rhaconatus major* Tobias attacking *C. palaestinicus* (Table 4).

When Table 4 is examined, it will be noticed that the percentage of parasitism of *C. palaestinicus* with *R. major* varies from 62.3 to 100% in respect of the sampling places. Cuda and DeLoach[22] reported that although the percentage of parasitism of *Mozene obtusa* in its entire life cycle was no more than 40%, it had turned out to be a successful biological control agent of *Prosopis* spp. and proved to bear no harm to non-target plants.

According to the present results reached in the places where this study has been conducted, it has been concluded that *C. palaestinicus* has not been effective enough to dominate *P. farcta*. With respect to control of *P. farcta*, which proves to be quite difficult to effect either mechanical, chemical or other means of control, biological control programs should nevertheless be continued.

Proliferation of *P. farcta* in Turkey has not yet reached a level that would pose a threat to large areas as in South Africa or Australia. Given the fact that a great many studies on biological control of *P. farcta* has been carried out in these countries, weed species in the said countries are far removed from those in Turkey.

In order for *R. major* – the occurrence of which was for the first time discovered in Turkey as a larval parasitoid of *C. palaestinicus*- to continue its existence in nature, its host ranges from other harmful insects living on plant cultures should be determined and thereby, in a given ecosystem, the possibilities for making use of mesquite as a biological control agent may be dwelt upon. Belinsky and Kugler[13], reported that *C. palaestinicus* fed on groundnut. Thus, after the said insect's other hosts have been determined, it would be the best to conduct preference trials in various ecological areas.

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