



**IN THE NAME OF ALLAH,
MOST GRACIOUS, MOST MERCIFUL**

Comparative Investigation of Some Biological Parameters of *Bruchidius buettikeri* Decelle (Bruchidae: Coleoptera) on Different *Acacia* Species in Huraimila and Salboukh, Riyadh Region, Saudi Arabia

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Abstract. Bruchid biological parameters in terms of entrance and exit holes on pods of different *Acacia* species/subspecies were studied and compared between different locations in Huraimila and Salboukh. In Huraimila, two species of *Acacia*; *A. gerrardii*, subspecies *A. g. negevensis* (Iraqi) and *A. g. nagednsis* (Najdi); and *A. ehrenbergiana* (Salam) were sampled. In Salboukh, *A. tortilis radiana* (Samar) was sampled. Significant difference between *Acacia* species for entrance and exit holes per pod, and beetles emergence until 45 days after sampling was shown. Significantly greater activities were on Najdi, while lower on Iraqi and Salam. Results did not show any significant difference between sampling locations per species/subspecies. However, greater activities were observed in valley and farm locations in Huraimila and Salboukh, respectively. Moreover, activities were greater on *Acacia* trees with larger seeds. Significantly greater infestation was also recorded on Najdi, and lower on Iraqi and Samar. Bruchid population density peaks on Najdi for Abu Gatada and Al-Yata in Huraimila (valley) were highest in February, while it was in June for Samar in Salboukh farm location. A significant positive correlation between bruchid beetles activities and temperature, number of seeds/pods, and pod length, whereas, a significantly negative correlation with relative humidity and wind speed was shown.

Introduction

The genus *Acacia* constitutes a major tree-component of Saudi Arabian flora. *Acacia* tree is considered a successful survivor of the arid regions because it is provided with most of the features required to endure adverse climatic conditions (Ibrahim and Aref, 2000; Aref, 2000). *Acacia* trees are socio-economically important because they provide high quality animal fodder, firewood, timber, gum and tannins, and improve soil fertility through nitrogen fixation (Fagg and Stewart, 1994). The genus *Acacia* roughly contains 1380 species worldwide (Maslin *et al.*, 2003) and 12 species have been reported from Saudi Arabia (Migahid, 1978).

Most of *Acacia* species, including both indehiscent and dehiscent *Acacia*, are attacked by bruchid beetles (Coe and Coe, 1987). Bruchid beetles attack seeds of almost all *Acacia* species (Miller, 1995; Miller and Coe, 1993). Fifteen species of Bruchidae have been reported from Saudi Arabia,

where six of them are belonging to the genus *Bruchidius* as *Bruchidius arabicus*, *B. asiricus*, *B. baharicus*, *B. buettikeri*, *B. sahelicus*, and *B. saudicus* (Decelle, 1979). In a study of distribution of *Acacia* trees and bruchid seed beetles in the southwestern part of Saudi Arabia, *Acacia* spp. and bruchid beetles were found at a particular range along an altitudinal gradient (Abdullah and Abulfatih, 1995).

In Tunisia, *Bruchidius raddianae* eggs hatch in five to seven weeks (except the first instar that develops inside the seed and then pupates for three weeks) in late summer. After that adults emerge out by making exit holes in the seed (Derbel *et al.*, 2007). In Central America, bruchid beetles *Mimosastes nubigens* and *M. mimosae* developed in 33.6 ± 2.41 days during two fruiting seasons (February and May) of *Acacia farnesiana* that did not differ between the two species, seasons or among females (Traveset, 1991). In another study in Botswana, the life cycle of *Bruchidius uberatus* in seeds of *Acacia nilotica* under field and laboratory conditions showed that eggs

hatched in 15-22 days larvae developed in 3 to 11 months and minimum the lifespan of adult beetles varies between 4-40 days (Ernst *et al.*, 1990a).

In Chile, adult bruchid beetle *Pseudopachymeria spinipes* mate immediately after emergence and explore for appropriate pods for oviposition, and oviposition behavior is inhibited by the presence of flowers on the host plant and is triggered by the presence of pods (Yates and Saiz, 1989). The *P. spinipes* females lay eggs on the remaining pods of the previous season which result in a high bruchid population in the following season (Saiz, 1993).

The female beetles oviposit on the green pods or seeds and the newly hatched larvae bore into the seeds and feed on the embryo and endosperm (Wilson and Janzen, 1972). Bruchid larvae grow inside seeds (Southgate, 1979) and can consume 9-100% of the cotyledons (Ernst, 1992). Bruchid beetles consume endosperm and embryonic portion of *Acacia* seeds resulting into poor seed germination (Al-Jabr, 2008). The impact of the beetle on seed germination depends on the consumption of the embryo and the quantity of cotyledons eaten by the larvae (Lamprey *et al.*, 1974; Coe and Coe, 1987). The infestation of bruchid beetles highly vary between years (Ernst *et al.*, 1989).

The objectives of the present study were to compare the effect of location and different *Acacia* species/subspecies on *Bruchidius buettikeri* Decelle (Bruchidae: Coleoptera) activities in Huraimila and Salboukh, Riyadh Region, Kingdom of Saudi Arabia.

Materials and Methods

Experiments were carried out during 2001 in Huraimila and Salboukh located in the north of Riyadh Region, Saudi Arabia. Samples of *Acacia* pods were collected from three *Acacia* species, *Acacia gerrardii*, with two subspecies *Acacia gerrardii negevensis* (*Acacia* called Iraqi) and *Acacia gerrardii nagednsis* (*Acacia* called Najdi); *Acacia ehrenbergiana* (*Acacia* called Salam); and *Acacia tortilis radiana* (*Acacia* called Samar).

Huraimila was inhabited by two species of *Acacia*, one was *Acacia gerrardii* having two subspecies, Iraqi and Najdi; and the other was Salam, whereas Salboukh contained only one *Acacia* species, Samar.

In Huraimila, the samples were collected from 4 locations including Al-Yata, Abu Gutada, Dam and Farm. Then each location was divided into three sampling units located in the west, center, and east.

Similarly in Salboukh, two locations were selected for sampling comprising of Farm and valley.

Both Farm and valley locations were divided into three sampling units located in the west, center and east.

The samples were collected from 12 and 6 sampling units at Huraimila and Salboukh, respectively. From each sampling unit in Huraimila and Salboukh, one *Acacia* tree of each available *Acacia* species/subspecies was randomly selected for pod sampling. In total, 22 *Acacia* trees were selected including 4 Iraqi, 6 Najdi, and 6 Salam from Huraimila, and 6 Samar from Salboukh. From each *Acacia* tree, 4 samples, each containing 4 fully grown green *Acacia* pods, were collected from all geographical directions (east, west, north and south) i.e., 16 pods/tree. In Huraimila, the flowering of *Acacia gerrardii* started in November and pod formation initiated in the beginning of December. Therefore, the first sampling was made on December 15, 2001 and pods were observed for bruchid entrance and exit hole. But the pods were devoid of any bruchid entrance and exit holes. Therefore, pod sampling was made on January, 19, 2001. Flowering season of Salam started in late April and fruiting began in early May 2001. Therefore, first sampling was made on May 24, 2001. In Salboukh, the flowering of Samar started in late March and fruiting began in early April. Therefore, the first sampling was made on April 8, 2001. All samples were collected in brown paper bags. Samples were collected fortnightly until pods on the trees were fully matured and dry. Samples were transferred to entomological research laboratory in the Department of Plant Protection at the College of Food and Agricultural Sciences, King Saud University, for processing. In the laboratory, each pod was observed for a number of bruchid beetles, namely *Bruchidius buettikeri* Decelle (Bruchidae: Coleoptera), entrance and exit holes. The entrance and exit holes were distinguished based on the presence of small black puncture holes for egg laying as entrance, while exit holes were recognized as big round open holes in the pod. Pod length (cm) and a number of seeds per pod were also recorded. For the least interruption to the developing bruchid beetles inside, the seeds were counted without opening the pod. The pods were stored and a number of beetles emerged were recorded until 45 days after sampling. After 45 days, the pods were opened and the total and number of seeds infested by the bruchid beetles were counted to calculate the infestation percentage.

Population density was calculated by adding up a number of exit holes at sampling time and total a number of beetles emerged out of the stored pods until 45 days.

Ecological data including average temperature, average relative humidity, average wind speed and average rainfall were obtained from the Meteorological Department, King Khalid International Airport, Riyadh, Saudi Arabia. Ecological data was correlated with average number of entrance and exit holes. Pod length and a number of seeds per pod to calculate Pearson correlation coefficient (r) using SAS (SAS, 2002).

The experiments were laid out in complete randomized block design (RCBD), where the locations were taken as blocks and *Acacia* species/subspecies as treatments with 16 replications, each replication containing one *Acacia* pod. Data was analyzed using the analysis of variance (ANOVA) PROC GLM procedure of SAS (SAS, 2002), and means were separated using the Duncan's Multiple Range Test ($P = 0.05$).

Results

General comparison of two *Acacia gerrardii* subspecies: *Acacia gerrardii negevensis* (*Acacia* called Iraqi) and *Acacia gerrardii nagednsis* (*Acacia* called Najdi) for different biological parameters in terms of entrance and exit holes in Huraimila revealed a significant difference between subspecies (Table 1). Average number of entrance ($F = 57.08$; $df = 1$; $P < 0.0001$) and exit holes per pod ($F = 9.98$; $df = 1$; $P < 0.0001$) were significantly greater on Najdi as compared to Iraqi. A similar trend was shown in pods stored to observe a number of beetle emergences until 45 days of collection time. Greater beetle emergence from Najdi ($F = 17.00$; $df = 1$; $P < 0.0001$) was shown as compared to Iraqi. Significantly greater number of seeds per pod ($F = 25.87$; $df = 1$; $P < 0.0001$) and pod length ($F = 77.14$; $df = 1$; $P < 0.0001$) were recorded on Iraqi as compared to Najdi (Table 1).

Location wise comparison showed significantly greater number of entrance ($F = 17.76$; $df = 1$; $P < 0.0001$) and exit holes ($F = 7.63$; $df = 1$; $P < 0.0001$) per pod on Najdi in Al-Yata (valley). Results indicated greater number of average entrance and exit holes per pod collected from the trees in the valley as compared to Dam and Farm locations. There was no significant difference between average entrance (except Abu Gatada and Farm locations) and exit holes per pod collected from the Iraqi trees in the valley, Dam and Farm locations, but more entrance and exit holes were recorded on the pods collected from the trees in the valley. Significantly greater number of seeds per pod ($F = 13.38$; $df = 7$; $P < 0.0001$) and pod length ($F = 46.30$; $df = 7$; $P <$

0.0001) were recorded in Iraqi as compared to Najdi (Table 2).

Overall comparison of entrance and exit holes on Iraqi and Najdi recorded on various dates in Huraimila is presented in Table 3, exhibited a similar trend as observed in Table 1. Pod sampling was carried out in December 2000 without any sign of bruchid entrance and exit holes. Bruchid infestation appeared in January 2001. Significantly greater entrance holes ($F = 20.74$; $df = 1$; $P < 0.0001$, $F = 5.39$; $df = 1$; $P = 0.02$, $F = 21.63$; $df = 1$; $P < 0.0001$ and $F = 12.08$; $df = 1$; $P = 0.0007$ for January 19, February 1, February 16 and March 1, 2001, respectively) were observed on Najdi as compared to Iraqi. A similar trend was shown in pods stored to observe a number of beetle emergences until 45 days of collection time. Greater bruchid emergence was shown on Najdi ($F = 6.67$; $df = 1$; $P = 0.01$, $F = 9.80$; $df = 1$; $P = 0.003$, $F = 6.14$; $df = 1$; $P = 0.02$, $F = 0.03$; $df = 1$; $P = 0.86$ for January 19, February 1, February 16 and March 1, 2001, respectively) as compared to Iraqi.

A. ehrenbergiana (*Acacia* called Salam) was another *Acacia* species in Huraimila with very short flowering and fruiting season. Therefore, samples were collected only for two times, first on May 24, 2001 and second on June 7, 2001, during the entire season. No entrance and exit holes were observed from the pod sampled on the first date, but very few entrance ($F = 4.04$; $df = 2$; $P = 0.02$) and exit holes ($F = 3.32$ $df = 2$; $P = 0.04$) were observed from the second pod sampling. The pods were also stored to observe the beetle emergence until 45 days of collection time no beetles emergence was observed (Table 5).

A similar study was conducted in Salboukh where the first *Acacia tortilis radiana* (*Acacia* called Samar) pod sampling was made in the second week of April without any sign of entrance and exit holes. Infestation appeared on the second sampling on April, 20, 2001 by means of entrance holes in valley location. Greater number of entrance and exit holes and a number of beetles emerged until 45 days on next dates both in the valley and farm locations, but without any significant difference except for sampling carried out during the 2nd week of May, 2001 where significantly higher infestation ($F = 4.31$; $df = 1$; $P = 0.04$) was observed in farm location (Table 5).

Population density of bruchid beetles was also studied on different *Acacia* species in Huraimila and Salboukh. Bruchid population started building up on Najdi at different study locations, from December 15 and the highest peak of the season was observed on

Table 1. Overall comparison of bruchid entrance and exit holes per pod of *Acacia gerrardii negevensis* (Iraqi) and *Acacia gerrardii nagednsis* (Najdi) with a different average number of seeds/pod and average pod length in Huraimila

<i>Acacia</i> Species	Ave. Entrance	Ave. Exit	Ave. Exit 2*	Ave. No. of Seeds/Pod	Ave. Pod Length (cm)
Najdi	0.77 ± 0.04a	0.13 ± 0.02a	0.36 ± 0.04a	6.02 ± 0.14b	9.24 ± 0.13b
Iraqi	0.30 ± 0.04b	0.04 ± 0.01b	0.10 ± 0.03b	7.21 ± 0.19a	11.19 ± 0.18a

* Number of exit openings after 45 days.

Means within a column followed by the same letter are not significantly different, $\alpha = 0.05$.**Table 2. Location wise comparison of average bruchid entrance and exit holes per pod of *Acacia gerrardii negevensis* (Iraqi) and *Acacia gerrardii nagednsis* (Najdi) with different average number of seeds/pod and average pod length in Huraimila.**

Location and Length (cm)	<i>Acacia</i> Species	Entrance	Exit	Exit 2*	No. of Seeds/Pod	Pod
Al-Yata (V)	Najdi	1.30 ± 0.12	0.33 ± 0.07a	0.47 ± 0.07ab	6.48 ± 0.34cd	7.37 ± 0.21d
Abu Gatada (V)	Najdi	0.83 ± 0.11b	0.20 ± 0.06b	0.67 ± 0.16a	7.20 ± 0.37abc	7.38 ± 0.18d
Dam (V)	Najdi	0.37 ± 0.08d	0.02 ± 0.02c	0.11 ± 0.03cd	4.22 ± 0.31e	9.11 ± 0.32c
Farm	Najdi	0.71 ± 0.06bc	0.07 ± 0.02c	0.31 ± 0.05bc	6.06 ± 0.18d	10.52 ± 0.17b
Al-Yata (V)	Iraqi	0.28 ± 0.06d	0.08 ± 0.03c	0.17 ± 0.10cd	8.11 ± 0.44a	13.34 ± 0.46a
Abu Gatada (V)	Iraqi	0.47 ± 0.09cd	0.05 ± 0.03c	0.09 ± 0.04cd	7.72 ± 0.28ab	9.91 ± 0.20b
Dam (V)	Iraqi	0.31 ± 0.07de	0.02 ± 0.02c	0.11 ± 0.05cd	5.91 ± 0.34d	10.66 ± 0.23b
Farm	Iraqi	0.06 ± 0.04e	0.02 ± 0.02c	0.04 ± 0.03d	7.08 ± 0.41bc	10.74 ± 0.35b

* Number of exit openings after 45 days. *(V = Valley)

Means within a column followed by the same letter are not significantly different, $\alpha = 0.05$.**Table 3. Overall comparison of average entrance and exit holes per pod on *Acacia gerrardii negevensis* (Iraqi), *Acacia gerrardii nagednsis* (Najdi) recorded on various dates in Huraimila**

<i>Acacia</i> Species	January 19, 2001			February 1, 2001			February 16, 2001			March 1, 2001		
	Entrance	Exit	Exit 2*	Entrance	Exit	Exit 2*	Entrance	Exit	Exit 2*	Entrance	Exit	Exit 2*
Najdi	1.00 ± 0.13	0.11 ± 0.05a	0.43 ± 0.08a	0.74 ± 0.13a	0.17 ± 0.08a	0.56 ± 0.12a	0.78 ± 0.14a	0.11 ± 0.06a	0.24 ± 0.04a	0.59 ± 0.12a	0.13 ± 0.07a	0.20 ± 0.04a
Iraqi	0.31 ± 0.09b	0.02 ± 0.02a	0.09 ± 0.04b	0.45 ± 0.10b	0.02 ± 0.02b	0.07 ± 0.05b	0.23 ± 0.07b	0.06 ± 0.04a	0.07 ± 0.05b	0.19 ± 0.07b	0.06 ± 0.04a	0.18 ± 0.09a

* No. of exit openings after 45 days.

Means within a column followed by the same letter are not significantly different, $\alpha = 0.05$.**Table 4. Location wise comparison of bruchid activities on *Acacia ehrenbergiana* (Salam) during different dates in Huraimila area**

Location	May 24, 2001			June 7, 2001		
	Ave. Entrance	Ave. Exit	Ave. Exit 2*	Ave. Entrance	Ave. Exit	Ave. Exit 2*
Al-Yata	0.00 ± 0.0a	0.00 ± 0.0a	0.00 ± 0.0a	0.00 ± 0.0b	0.00 ± 0.0b	0.00 ± 0.0a
Dam	0.00 ± 0.0a	0.00 ± 0.0a	0.00 ± 0.0a	0.16 ± 0.1a	0.10 ± 0.1a	0.00 ± 0.0a
Farm	0.00 ± 0.0a	0.00 ± 0.0a	0.00 ± 0.0a	0.00 ± 0.0b	0.00 ± 0.0b	0.00 ± 0.0a

* No. of exit openings after 45-days.

Means within a column followed by the same letter are not significantly different, $\alpha = 0.05$.**Table 5. Location wise comparison of average bruchid activities on *Acacia tortilis radiana* (Samar) during different dates in Salboukh**

Location	April 8, 2001			April 20, 2001			May 8, 2001		
	Entrance	Exit	Exit 2*	Entrance	Exit	Exit 2*	Entrance	Exit	Exit 2*
Valley	0.00±0.0a	0.00±0.0a	0.00±0.0a	0.19±0.1a	0.00±0.0a	0.00±0.0a	0.06±0.0b	0.00±0.0a	0.50±0.3b
Farm	0.00±0.0a	0.00±0.0a	0.00±0.0a	0.00±0.0b	0.00±0.0a	0.00±0.0a	0.46±0.1a	0.00±0.0a	3.33±0.9a

Table 5. Continued

Location	June 1, 2001			June 7, 2001		
	Entrance	Exit	Exit 2*	Entrance	Exit	Exit 2*
Valley	0.44 ± 0.1a	0.46 ± 0.1a	1.25 ± 0.5a	0.63 ± 0.1a	0.60 ± 0.1a	0.67 ± 0.3a
Farm	0.54 ± 0.1a	0.52 ± 0.1a	1.25 ± 0.3a	0.96 ± 0.2a	0.92 ± 0.2a	0.50 ± 0.4a

* Number of beetles emerged until 45 days.

Means within a column followed by the same letter are not significantly different, $\alpha = 0.05$.

February 1, 2001 ($F = 4.76$; $df = 3$; $P = 0.0009$) at Abu Gatada followed by Al-Yata. Bruchid population remained lower at Farm and Dam locations (Fig. 1). Bruchid population also started building up on Iraqi from December 15, but remained lower as compared to Najdi at all locations (Fig. 2).

Salboukh was inhabited by only Samar with flowering season starting from the late March and fruiting began in early April. Therefore, the first sampling was made on April 8, and the second on April 20 which did not show any sign of bruchid infestation. Bruchid infestation appeared from the sampling made on May 8, 2001. Significantly greater ($F = 4.31$; $df = 3$; $P = 0.04$) bruchid population was recorded in farm as compared to valley location. Results indicated a significant progress in bruchid population in subsequent pod samplings dates both in the valley ($F = 7.83$; $df = 3$; $P < 0.0001$) and farm ($F = 7.00$; $df = 3$; $P = 0.0001$). The highest population peak appeared in June both for valley and farm locations (Fig. 3).

Infestation percentage was also calculated and compared for *Acacia* species of the studied areas. In

Huraimila, significantly greater ($F = 6.01$; $df = 7$; $P < 0.0001$) bruchid infestation percentage was observed on Najdi in Abu Gatada and Al-Yata followed by Dam and Farm locations. On Iraqi, the infestation was significantly lower in all locations except bruchid infestation on Najdi in farm location (Fig. 4). In Salboukh, significantly greater ($F = 4.56$; $df = 1$; $P = 0.03$) bruchid infestation was observed on Samar in the farm location (Fig. 5).

Bruchid infestation parameters in terms of average bruchid entrance and exit holes were correlated with abiotic factors such as temperature, relative humidity, wind speed, rainfall and average number of *Acacia* seeds per pod, and average length of *Acacia* pods (Figs. 6-8). The results indicated a significant, positive correlation between bruchid infestation parameters and temperature, number of seeds per pod, and pod length, whereas a significant, negative correlation with average relative humidity and wind speed. Only strong correlation was noticed between number of bruchid entrances and exit holes per pod (Table 6).

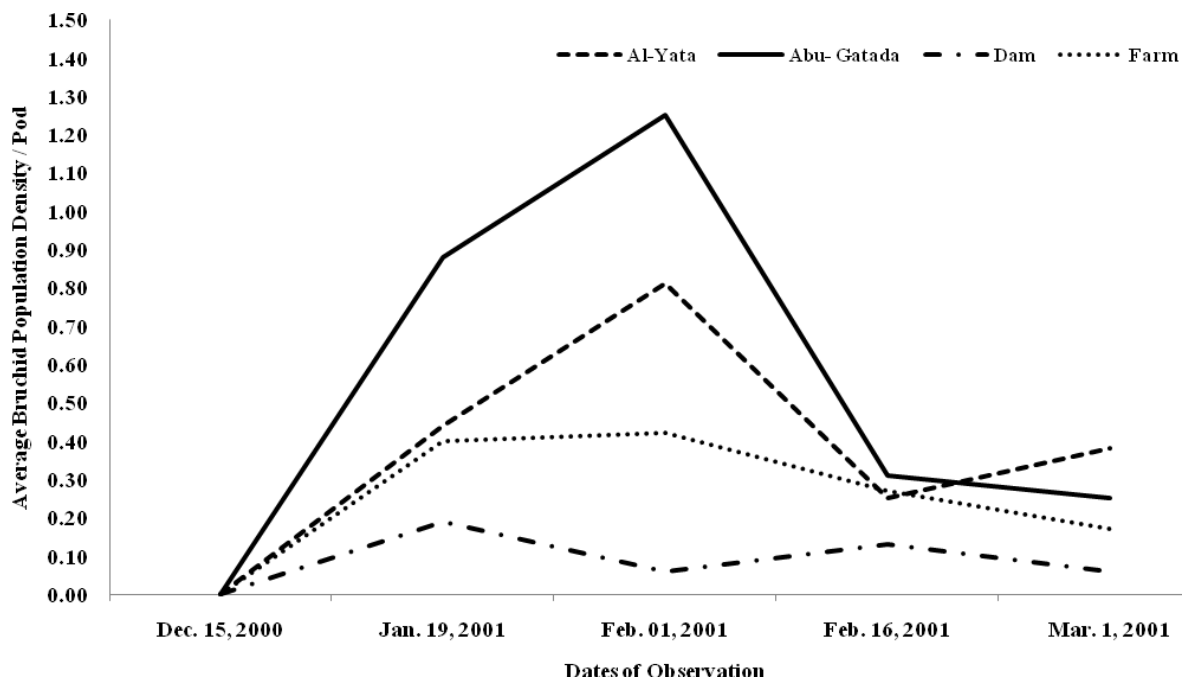


Fig. 1. Average bruchid population density per pod on *Acacia gerrardii nagednsis* (Najdi) at different locations in Huraimila.

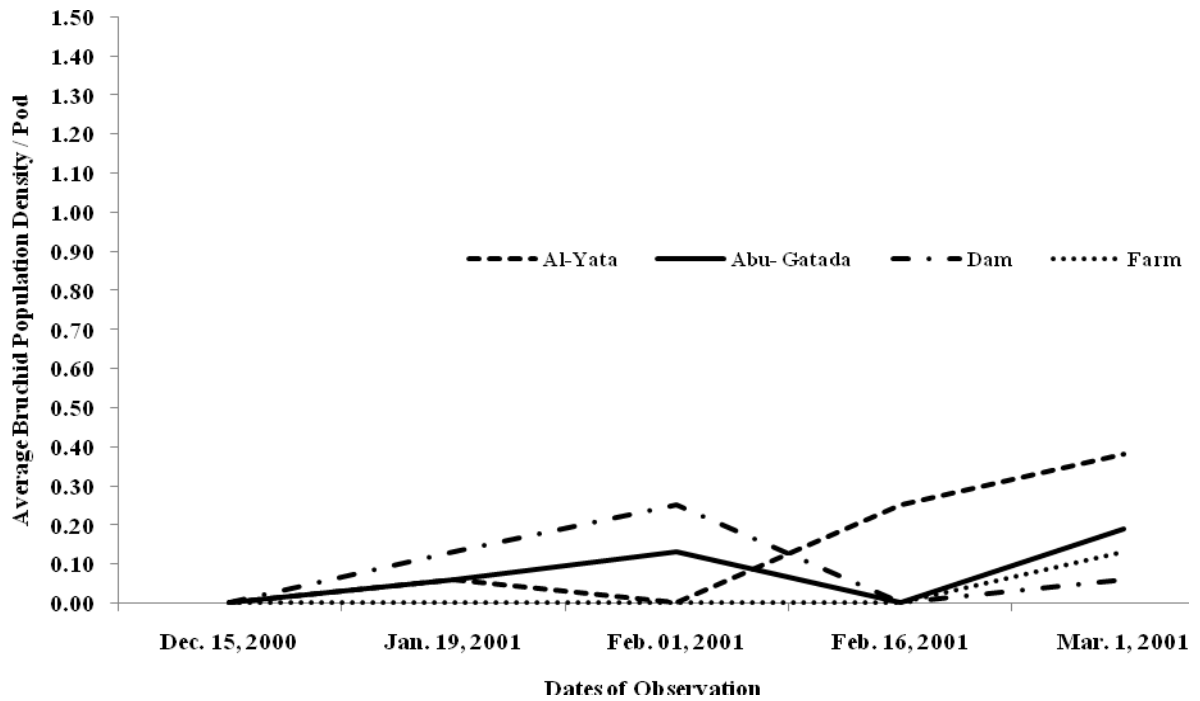


Fig. 2. Average bruchid population density per pod on *Acacia gerrardii negevensis* (Iraqi) at different locations in Huraimila.

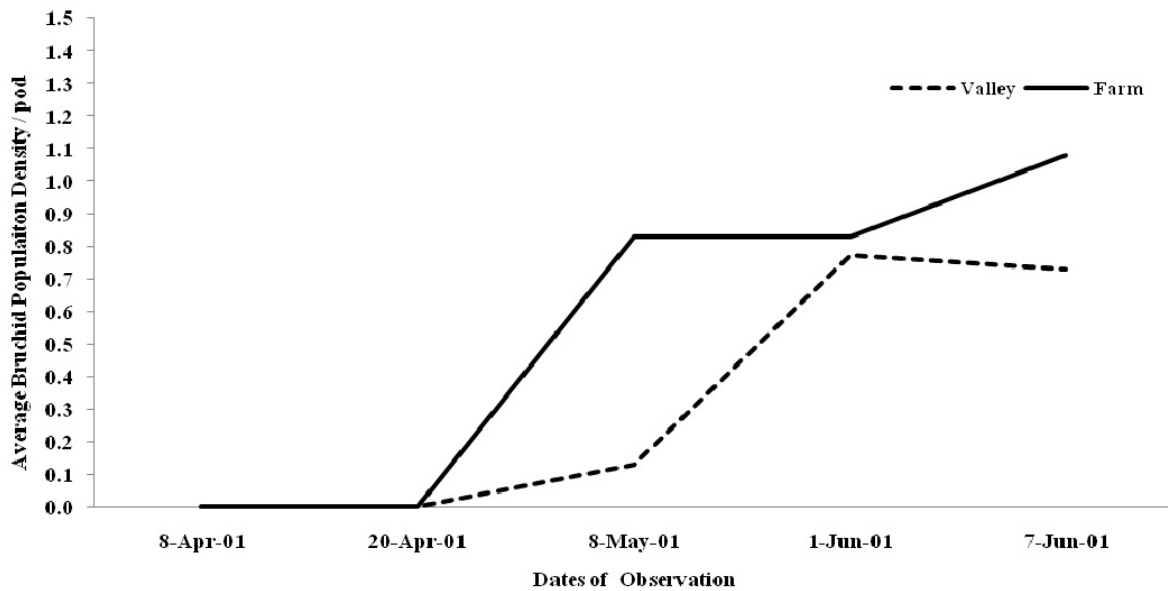


Fig. 3. Average bruchid population density per pod on *Acacia tortilis radiana* (Samar) at different locations in Salboukh.

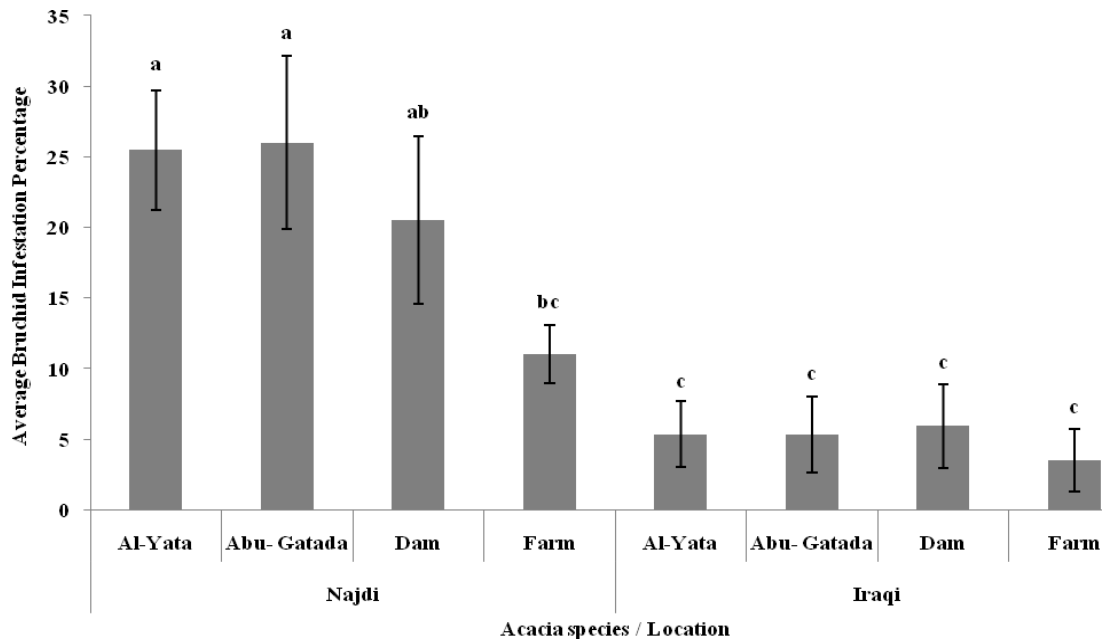


Fig. 4. Average bruchid infestation percentage on *Acacia gerrardii nagednsis* (Najdi) and *Acacia gerrardii negevensis* (Iraqi) at different locations in Huraimila.

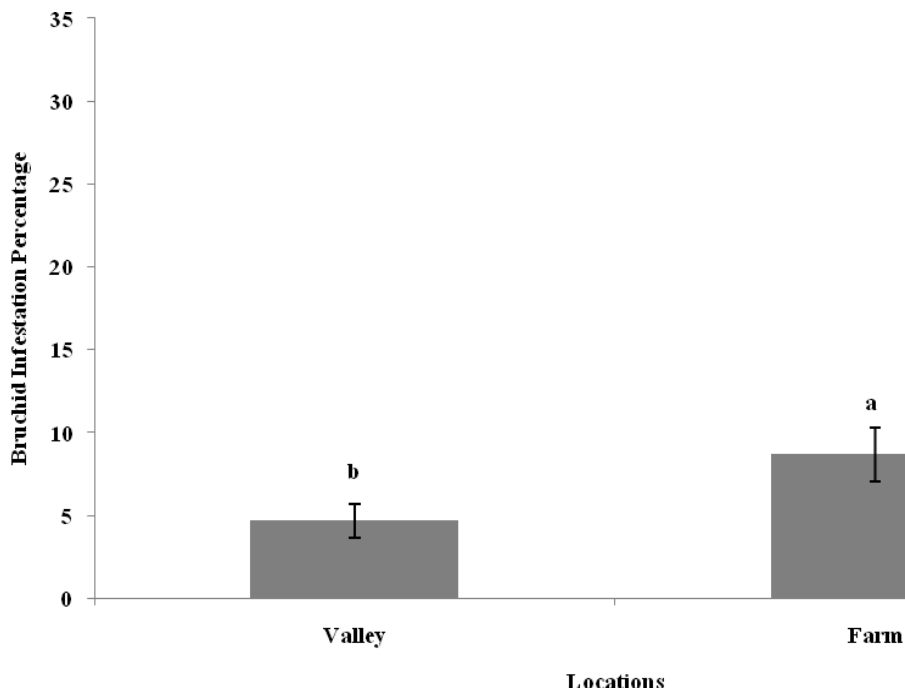


Fig. 5. Average bruchid infestation percentage on *Acacia tortilis radiansa* (Samar) at different locations in Salboukh.

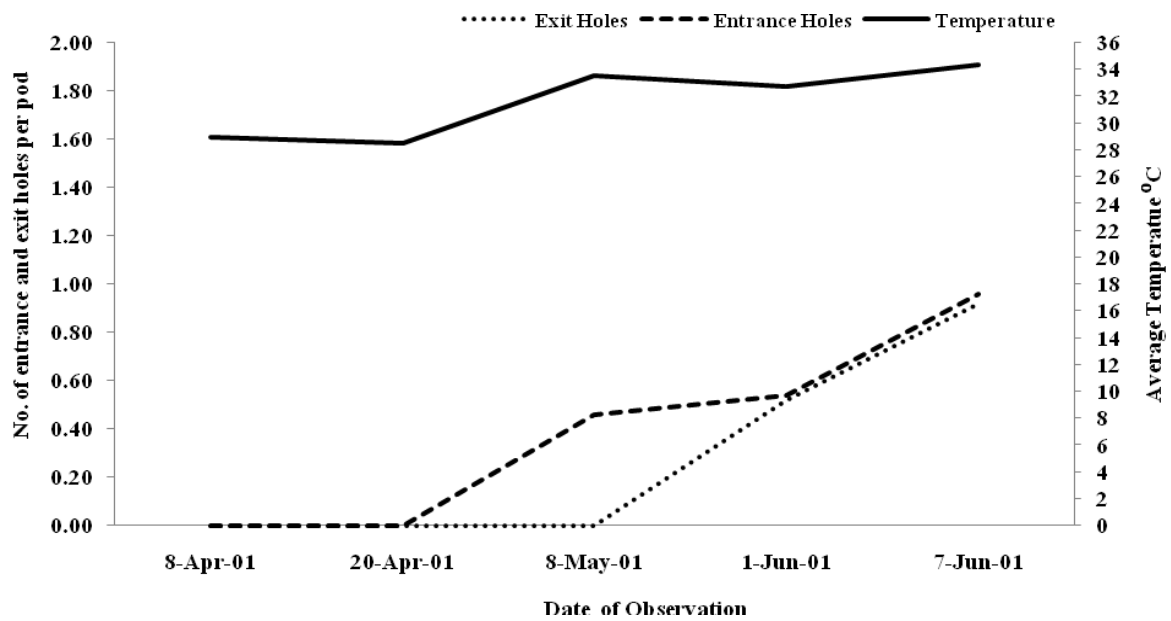


Fig. 6. Relationship between average temperature (°C) and number of bruchid entrance and exit holes per pod.

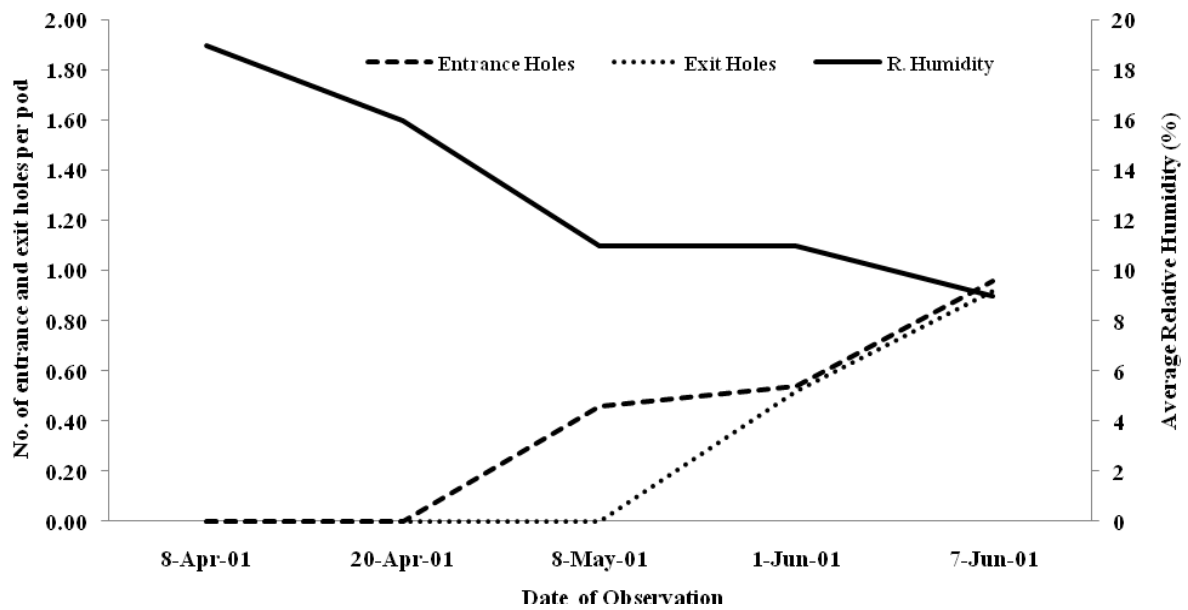


Fig. 7. Relationship between R. humidity (%) and number of bruchid entrance and exit holes per pod.

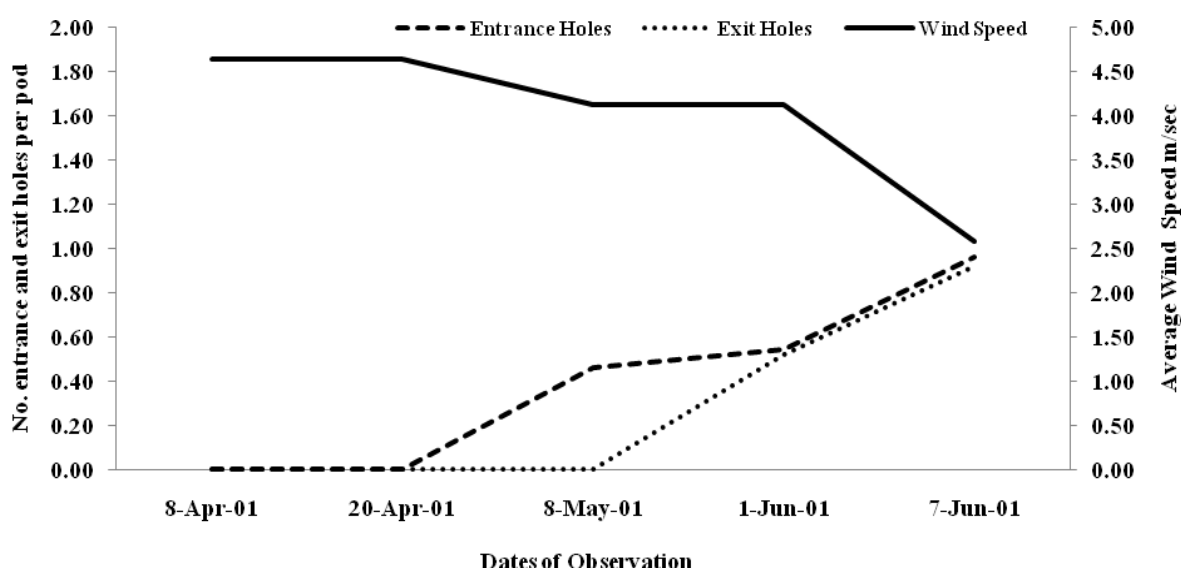


Fig. 8. Relationship between wind speed and number of bruchid entrance and exit holes per pod.

Table 6. Pearson correlation coefficient (r) between average bruchid activities and various abiotic factors and also number of seeds/pod and pod length

Bruchid Infestation Parameters	Pearson Correlation Coefficients (r)						
	Ave. Temp.	Ave. RH	Ave. Wind Speed	Ave. Rainfall	Seeds/Pod	Pod Length	Bruchid Exit Holes
Entrance Hole	0.36**	-0.36**	-0.36**	0.00	0.33**	0.25**	0.84**
Exit Hole	0.30**	-0.33**	-0.42**	0.00	0.28**	0.31**	
Seeds/Pod	0.35**	-0.45**	-0.19*	0.00	----	0.40**	
Pod Length	0.20*	-0.17*	-0.16*	0.00	0.40**	----	

* Indicating significance at $P < 0.05$.

** Indicating significance at $P < 0.001$.

Discussion

The results of the experiments indicated that bruchid beetles activities in terms of entrance and exit holes were affected by the species of the host rather than the location of the host tree. Selecting host for oviposition beetles preferred Najdi trees with large seeds (Aref, 2000) which indicated that female targeted adequate availability of food resources for the successful development of their larvae. Though there was not a significant difference for the number of bruchid entrance and exit holes per subspecies in the valley and farm locations, a trend of more bruchid activities were observed in the valley locations which might be related to the fact that valley locations were undisturbed in terms of pesticide application, irrigation and human activities.

Our results revealed a role of host plant in the population density of bruchid beetle than the host location. In all cases, bruchid population remained lower in the beginning of the season and developed with the maturation of pods. The highest bruchid

population was recorded in the months of February and June, 2001 in Huraimila and Salboukh, respectively. In Salboukh, increasing trend in population density in June might be due to the newly emerged bruchid beetles which oviposited along with old population members, as bruchid development is completed in 33.6 ± 2.41 days (Traveset, 1991).

Infestation percentages results also revealed that bruchid infestation is species specific. Bruchid infestation reported in other studies were 71-90% in Lower Kuiseb and Canyon Area, Namibia (van Wyk *et al.*, 1985), 54-96% in *A. erioloba* in Botswana (Ernst *et al.*, 1990), and 47-52% in Northern Botswana (Barnes, 2001) on *Acacia* which is much higher as compared to the present study. This might be due to the harsh climatic conditions of the study areas as reported by Traveset (1991) that bruchid infestation is restricted by severe weather conditions (Traveset, 1991).

In this study, the correlation of bruchid activities with abiotic factors exhibited positive correlation with average temperature but negative with relative

humidity and wind speed which indicated that windy humid weather have negative impact on bruchid population and subsequently lower infestation. The results showed positive correlation between bruchid activities and number of seeds per pod and pod length. The results also indicated a strong positive correlation between bruchid entrance and exit holes which indicated a successful development of the larvae entering pods.

Conclusion

The results indicated that bruchid infestation is species specific. Bruchid beetles preferred to lay eggs on *Acacia* with larger seeds (Najdi). Beetles populations gradually built up and reached its peak when pods were at mature stage. Bruchid biological parameters were moderately correlated with temperature, number of seeds per pod, and pod length; but negatively correlated with relative humidity and wind speed.

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: خنافس البقول، *Bruchidius buettikeri*، الطلح النجدي، الطلح العراقي، السلم، السم، حشرات الغابة، الحشرات الصحراوية.

. تمت دراسة بعض النشاطات الحيوية (ثقوب الدخول والخروج للقرون وخروج الخنافس منها) لخنافس بروكيدي في مدينتي حريملاء وصلبوح لمواقع الوادي والمواقع الزراعية. في مدينة حريملاء تم جمع عينات الأكاسيات من نوعين هما: *Acacia gerrardii*، ويتبع له تحمي النوع *Acacia gerrardii nagednsis* (Najdi) و *Acacia gerrardii negevensis* (Iraqi)؛ والنوع *Acacia ehrenbergiana* (Salam). أما في مدينة صلبوح فكان الجمع من نوع *Acacia tortilis radiana* (Samar). شوهدت اختلافات معنوية بين أنواع الأكاسيات بالنسبة لمتوسط ثقب الدخول والخروج للقرون وخروج الخنافس حتى شهر ونصف من زمن الجمع. وكان هناك نشاط معنوي عالي ملحوظ في النجدي، ونشاط معنوي منخفض في العراقي وسمر والسلم. لم تبين النتائج أي اختلاف معنوي للنشاطات الحيوية بين مناطق جمع العينات، لكن في حريملاء لوحظ نشاط كبير في موقع الوادي، بينما في حالة صلبوح فإن النشاط كان كبيراً في المواقع الزراعية. علاوة على ذلك فقد كان نشاط الخنافس أكبر على أشجار الأكاسيات ذوات البذور كبيرة الحجم. وكانت النسبة المئوية للإصابة بالخنافس عالية على النجدي وكانت منخفضة للعراقي وللسم في كل المواقع. أوضحت نتائج نسبة الإصابة أن الإصابة بالخنافس ارتبطت بأنواع الأكاسيات وليس بالمنطقة. وكانت قمة الكثافة العددية للنجدي في وادي أبو قتادة بحريملاء الأعلى في شهر فبراير، بينما كانت في شهر يونيو للسم في المواقع الزراعية في صلبوح. وأشارت النتائج أيضاً إلى ارتباط إيجابي بين نشاطات الخنافس ودرجات الحرارة، وعدد البذور للقرن، وطول القرن، بينما كان سلبياً بين الرطوبة النسبية وسرعة الرياح.

