Field and store survey of Bruchinea individuals on Fabaceae in Basrah province with environmental isolation test for southern cowpea beetle Callosoruchus maculates Fab. L

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Abstract. Bruchinea individuals were found in few and varying numbers within the Basrah Governorate areas and on different plants during the winter season 2020-2021, during November, December, and February. Insects were found in separate stores in most of Basrah Governorate, with a high density, as the presence *Callosoruchus maculates*, the field experiment showed the infection absence by Bruchinea individuals in the varieties of *Vicia faba* during the winter season. The experiment of the environmental isolation test of the *C. maculates* showed that the insect infects the *Vicia faba* in the field when combined with the grain, as the infection severity was higher on the local *Vicia faba* cultivar compared to the Egyptian and Holland variety .(45.83, 24.67, and 24.17) insects per of ten infested *Vicia faba* , respectively. The highest infestation rate was on the local *Vicia faba* cultivar compared to the Egyptian and Hollande cultivars (51.58, 27.92, and 27.92), respectively, but it was isolated in nature and infecting the grains in the store, indicating that the insect is isolated in appear and reproduction in the store environment, not the field.

Keywords: Bruchinea subfamily: *Vicia faba, cowpea beetle*

INTRODUCTION

The Fabaceae family is one of the largest and most distributed plant families, as it includes more than 18,000 species [1], it plants have a main role in human food, Where it the second place after rice and rice crops, *Vicia faba* is considered one of the winter crops of the Fabaceae family, their seeds contain a high percentage of protein, estimated at about 25-40%, and this increases the importance of the crop due to its high nutritional value in addition to the carbohydrates contained, which reach 56% [2-4] showed the *Vicia faba* gave 5 tons\1 hectare of dry seeds approximately, the importance of the *Vicia faba* crop is also due to its ability to improve soil characteristics by fixing atmospheric nitrogen in the soil through root nodules in coexistence with root nodule bacteria, the estimated atmospheric nitrogen in the soil by growing the crop is about 222 kg/hectare per year ,the *Vicia faba* crop adapts to a wide range of soil pH 4.5-8.3, but when the soil pH decreases, the rate of root nodule formation decreases, Therefore, the efficiency of atmospheric nitrogen fixation [5].

Iron is an important component in legumes in the synthesis of the nitrogenous enzyme responsible for fixing atmospheric nitrogen in the legume hemoglobin in the root nodes [6]. Alghamdi [7] mentioned in evaluating six cultivars of barley that there are differences between the cultivars for all the traits that were studied except for the height of the plant, it enters into the transforming succession (agricultural cycle) to improve the properties of the soil and increase the productivity of the crops with which it enters the agricultural cycle. Falling leaves and the inability of the ovaries to produce seeds are two difficulties that plague the *Vicia faba* crop, resulting in low yield. Some growth regulators, nutrients, and vitamins are used [8].

Agricultural pests in the world are one of the causes of the food gap, and vigorous efforts have been made to highlight its problem, the stored foodstuffs and grains and Fabaceae are of great importance, all countries are keen to maintain a strategic stock of them sufficient for several months to face natural disasters or the lack of annual production, and the stored materials are exposed to damage by many organisms such as insects, rodents and microorganisms, Umeozor [9] found that one insect consumes approximately 0.026 of the weight of the cowpea seed. The insect is a major and economically important pest of cowpea [10-13]. Infection with it causes a loss in the protein content of seeds equivalent to 10.6% and from carbohydrates 11.4% [14].

The difficulty of controlling these insects lies in their presence with stored foodstuffs, which hinders the use of pesticides that lead to contamination of foodstuffs, and the repeated use of them leads to the emergence of strains resistant

to the action of pesticides [15], so, the use of some powders and plant extracts [16], [17], alkaloid extracts and biological agents [18]. Organisms tend to live in the environments that they prefer following their structure, and as members of the family Brichidae, can behave in ecological isolation, that is, they choose the environment of the stores over the environment of the field in terms of infecting grains and breeding in the store without infecting the grains and breeding in the field in a natural way, if some animals are characterized by the tendency to be in environments that you choose, adapt and tend to live in and reproduce better than other environments, if a species separates from members of its kind as a result of its exposure to environmental conditions different from its ancestors, and separate species are promised in a long evolutionary period, but when they are collected in one environment with branches of their ancestral species, we find that they mate and produce fertile individuals [19].

MATERIALS AND METHODS

1- Field survey to locate Bruchinea members in stores and fields.

1-1- Field survey of the presence of members of the Bruchinea subfamily in the areas of Basrah Governorate.

A field survey was conducted for different areas of Basrah, including Shatt Al-Arab, Al-Faw, Al-Qurna and AL-Midaina districts, by visiting the fields planted with different plants, in addition to the Fabaceae family and the bush using a sweeper net. by collecting samples from the field axes, the samples were transferred to the laboratory, and the examination to identify the species of Bruchinea

1-2-store survey of the adults of subfamily: Bruchinea in the areas of Basrah Governorate

The inventory survey was conducted for different areas of Basrah Governorate, including Shatt Al-Arab, Al-Faw, Al-Qurna, AL-Midaina, Basrah, and Al-Zubair, samples of infected legumes were taken and transferred to the laboratory and examination to identify the species of Bruchinea, where, the samples were taken and transferred to the laboratory and classified by Dr. Ali Dharb Shaban / College of Education Qurna, Biology Department.

2- A study of the susceptibility to field infection of some cultivars of *Vicia faba* to members of the Bruchinea subfamily.

The experiment was carried out on 10/12/2020 in the fields of the College of Agriculture, for the winter season of the year 2020-2021, to examine the susceptibility of infecting *Vicia faba* plants by members of the Bruchineae subfamily of three varieties of the *Vicia faba* was tested (local, Hollande, and Egyptian), the experiment was planned according to the design of randomized complete sectors, at a rate of three sectors in 12 experimental units for each sector, represented by a lane of length 5 m, width 30 cm, and the distance between one lane and the other is approximately half a meter . Three seeds were planted for each pit, the distance between one pit and another 20 cm. Irrigation was immediately after planting by a drip system, with agricultural operations being carried out two weeks after planting from fertilizers such as phosphate fertilizer before planting and at the rate of two batches and nitrogen fertilizer, the first batch when planting and the second batch primitive to flowering in 11/2020. [20], all service operations were carried out, including irrigation and weeding, as needed, with a weekly follow-up of the presence of insects after the flowering process, with a direct follow-up to the stage of maturity in the first week of May.

3- Infection test of the *Vicia faba* pods of the southern cowpea beetle when combined with the *Vicia faba* plant in the field (environmental isolation test of an insect in the storeroom).

To test the infestation of barley pods of the southern cowpea beetle *Callosoruchus maculatus* in the field, a field experiment was carried out on 12/4/2021 by selecting 12 treatments of the local type of barley and adding three pairs of the southern cowpea beetle *Callosoruchus maculatus* to them, the raise in the incubator in the College of Agriculture at the end of the season 4/27/2021 were randomly collected pods at a rate of 20 pods from each replicate, and the infection rate was calculated through the number of infected grains to the number of intact grains (from 20 seeds selected randomly from the above pods).

The severity of infestation was calculated by the number of larvae per ten infested grains chosen randomly. The data were analyzed statistically according to the complete random block design, and the arithmetic means of the transactions were compared using the least significant difference (L.S.D) at a significant level of 0.05.

$$\frac{\text{The infection rate is the number of infected grains}}{2} \times 100$$

RESULTS AND DISCUSSION

3-1- Field survey to locate Bruchinea members in stores and fields

3-1-1- Field survey the presence of members of the Bruchinea subfamily in the areas of Basrah Governorate.

The results of table (1), it was the presence of members of the Bruchinae family varied in the areas of Basrah province and on different plants, including economic plants such as *Vicia faba*, leafy vegetable crops, barley crops and other jungle, the presence of the insect in the December, Al-Nashwa, Al-Zariji, Ktaiban, Al-Qurnah, Al-Sharsh, AL-Midaina, and Shatt Al-Arab Al-Houta in February.

The following types were recorded:

1- Southern cowpea beetle, *Callosobruchus maculatus*

2- Cowpea beetle, *Callosobruchus sp*

The most common *Callosobruchus maculatus*, and the survey results showed that the insect is scarce, and if it is found, it is in very few numbers and it is in the spring period, which indicates that there is no generation of the insect in the field, but individuals may have appeared from the pupal stage of the residues of infected legume grains left outside the store and housing, it is attracted to plants in the fields during the flowering period, as the adult insect has two appearances: The first is the active form and can fly and spread in the field, and the second: the normal or resident form and cannot fly if it is used to living and recreation in stores [21], [22].

[9] Found that one insect consumes approximately 0.026 of the weight of the cowpea seed. It is found with the presence of grains in dark locations, as it is adopted in selecting the low-light environment. The insect found stores suitable habitats in terms of activity far from light and providing food for growth and reproduction, and it became a dangerous pest. A major economic function of cowpeas [10-13].

TABLE 1. Field survey of members of the subfamily Bruchidae found in the fields of Basrah.

No.	Region	Date	Presence of Bruchidae Family(N*)	Plants
1	Al-Zubair	27\10\2020	Non	Tomato, broad *Vicia faba* , potatoes and cabbage
2	Shatt al-Arab(al-Hawtah)	31\10\2020	Non	Chard, radish, and cress
3	Zubair	7\11\2020	*Callosobruchus sp* (1)	Tomato, broad *Vicia faba* , potatoes and cabbage
4	AL-Midaina	7\11\2020	*Callosobruchus maculatus* (1)	Radish, chard alfalfa, barley, and thicket
5	South Qurna(Qumaeg)	7/11/2020	*Callosobruchus maculatus* (1)	Barley, thicket, and cynanchum
6	Al-Zubair	9\12\2020	Non	Tomato, broad *Vicia faba* , potatoes and cabbage
7	Shatt al-Arab(al- Al-Houta)	10\12\2020	*Callosobruchus sp*(1)	Chard, radish, and broad *Vicia faba* .
8	Shatt al-Arab(al- Al-Houta)	25\12\2020	Non	Broad *Vicia faba*
9	Abu Al-Khaseeb	13\12\2020	Non	Chard, radish, and broad *Vicia faba* .

10	Shatt al-Arab(al- Al-Houta(	2\2\2021	Non	Chard, Celery ,radish, and broad *Vicia faba* .
11	Nashwa	10\2\2021	*Callosobruchus sp* (1)	Melilotus,, Alfalfa, cress and and Barley
12	Zariji	10\2\2021	*Callosobruchus sp* (1)	Radish, Alfalfa, cress and Melilotus and Barley
13	Ktaiban	10\2\2021	*Callosobruchus sp*	,Alfalfa and Barley
14	Qurna	17/2/2021	*Callosobruchus maculatus*(2)	Alfalfa and Barley
15	Qurna (sharsh)	17l2l2021	*Callosobruchus maculatus* (1)	Radish, Chard, Alfalfa, and *Melilotus*
16	AL-Midaina	17/2/2021	*Callosobruchus sp*(1)	Barley, radish, and thicket
17	Shatt al-Arab al- Al-Houta	25/2/2021	*Callosobruchus sp* (1)	Broad *Vicia faba* , barley, char, and dill
18	Shatt al-Arab al- Al-Houta	3/3/2021	*Callosobruchus sp*	Broad *Vicia faba* , char, and dill
19	Shatt al-Arab al- Al-Houta	10/3/2021	Non	Broad *Vicia faba* , char, and dill
20	Shatt al-Arab al- Al-Houta	16/3/2021	Non	Broad *Vicia faba* , char, and dill

*number of insects

3-1-2- A stores survey for the presence of members of the Bruchinea subfamily in Basrahh Governorate regions.

Through table (2), it was found that the presence of the insect in the stores of Basrah regions, such as Al-Ashar, Al-Zubair, Qurna, and AL-Midaina on the seeds of chickpea, cowpeas, and mung *Vicia faba*, whereas, where recorded following species:

1- *Acanthoscelides obtectus* on *Vicia faba*

2.Callosobruchus maculatus on cowpeas, and mung *Vicia faba*

3.Callosobruch chinensis on chickpea

4.Callosobruchus sp on cowpeas

Through the current study, it was found that the most common species found in the southern cowpea, which was found on cowpea plants and mung *Vicia faba* plants, represent the individuals that selected the environment of the stores and acclimatized to it and became do not tend to fly, so it used stores as a region of living. [21-23].

As the infection begins in the field and completes its life cycle and reproduction in the stores. The importance of this insect comes due to the feeding and development of its larvae inside the seeds and the consumption of all its contents, thus increasing the percentage of seed spoilage and decreasing their nutritional value, as it was found that it causes a seed loss of up to 62%, on the other hand, the danger of this insect is due to its lack of specialization on a fixed host. Were, its larvae can grow and develop on about 35 types of seeds. The insect prefers to lay large numbers of eggs on the smooth seeds, this insect prefers the shell-containing seeds for laying eggs compared to the uncoated seeds [24].

Moreover, there are differences between the varieties due to the genetic variation represented by the genetic composition of the same varieties [25-28]. El-Nabaraw and Zayod [29] Explained that the weight of seeds for any plant is a function of the rate of photosynthesis, the transfer of its products, and the transport of products in the developing seeds, which are all reflected in the weight of the seed [30].

TABLE 2. Survey of the members of the subfamily Bruchinae found in stores and the regions of Basrahh Governorate.

No.	Region	Date	Presence of Bruchinae Family	Plants
1	Basrah stores(Al-Ashar)	17\10\2020	*Callosobruchus chinensis*	chickpea
2	Basrah stores	17/10/2020	*Acanthoscelides obtectus*	*Vicia faba*
3	food markets(Basrah center)	17/10/2020	*Callosobruchus maculatus*	cowpeas
4	AL-Midaina stores	14\11\2020	*Callosobruchus chinensis*	chickpea
5	AL-Midaina stores	14\11\2020	*Callosobruchus chinensis*	nuts
6	AL-Qurna stores	14\11\2020	*Callosobruchus chinensis*	chickpea
7	food markets(Basrah center)	20\11\2020	*Callosobruchus sp*	cowpeas
8	food markets(Al-Zubair)	1\11\2020	*Callosobruchus chinensis*	chickpea
9	food markets (AL-Qurna)	13\2\2021	*Callosobruchus maculatus*	cowpeas
10	food markets(Basrah center)	9\3\2021	*Callosobruchus chinensis*	chickpea
11	AL-Midaina stores	28\11\2021	*Callosobruchus maculatus*	mung *Vicia faba*

3-2- A field study of the infection of the broad *Vicia faba* plant by members Bruchinea subfamily.

Through table (3), it was found that there were no Bruchinea members in the field on the varieties of Broad *Vicia faba* during the winter season 2020-2021 from the beginning of planting until the maturity of the crop in the first week of May, and no symptoms of infection appeared on the pods and flowers of the three varieties.

The absence of infection in the field of broad *Vicia faba* plants may be due to the fact that their members are a tendency to prefer the environment of stores over the environment of the field in a natural state. Moreover, studies have shown that beetles choose their host depending on the geographical area in which they live [31]. It was also found that the beetle often changes host if a new host becomes available to it [32], Abdel Salam [33] showed the economic importance of Brchinae individuals, which is divided into two parts, one that affects the green pods during the period of plant growth in the field and does not infect dry grains such as broad *Vicia faba* beetle. The infection is transmitted to the stores by the dry grain in the form of larvae that grow inside the grain until becoming a complete insect that remains dormant inside the dry grain and does not come out except when the grain is replanted ,while the second part, it feeds on dry grains in stores and continues to reproduction whenever the conditions are appropriate, such as the cowpea beetle which causes heavy losses, and this may be considered an indication of the insect differing in behavior and reproductive characteristics, the inactive form and the active form [34]. The latter is formed under inappropriate conditions and does not appear in dry seeds whose moisture content is less than 12.4% [35].

TABLE 3. Presence of Bruchinea members on broad *Vicia faba* in the field.

No.	Date	Varieties	individuals	No.	Date	Varieties	individuals
1	11/11/2020	Local	Non	16	7/2/2021	Local	Non
		Egyptian	Non			Egyptian	Non
		Holland	Non			Holland	Non
2	17/11/2020	Local	Non	17	11/2/2021	Local	Non
		Egyptian	Non			Egyptian	Non
		Holland	Non			Holland	Non
3	22/11/2020	Local	Non	18	18/2/2021	Local	Non
		Egyptian	Non			Egyptian	Non
		Holland	Non			Holland	Non

4	25/11/2020	Local	Non	19	23/2/2021	Local	Non
		Egyptian	Non			Egyptian	Non
		Holland	Non			Holland	Non
5	30/11/2020	Local	Non	20	25/332/20	Local	Non
		Egyptian	Non		21	Egyptian	Non
		Holland	Non			Holland	Non
6	7/12/2020	Local	Non	21	26/2/2021	Local	Non
		Egyptian	Non			Egyptian	Non
		Holland	Non			Holland	Non
7	14/12/2020	Local	Non	22	2/3/2021	Local	Non
		Egyptian	Non			Egyptian	Non
		Holland	Non			Holland	Non
8	17/12/2020	Local	Non	23	4/3/2021	Local	Non
		Egyptian	Non			Egyptian	Non
		Holland	Non			Holland	Non
9	30/12/2020	Local	Non	24	7/3l2021	Local	Non
		Egyptian	Non			Egyptian	Non
		Holland	Non			Holland	Non
10	7/1/2021	Local	Non	25	19/3/2021	Local	Non
		Egyptian	Non			Egyptian	Non
		Holland	Non			Holland	Non
11	14l/1/2021	Local	Non	26	31/3/2021	Local	Non
		Egyptian	Non			Egyptian	Non
		Holland	Non			Holland	Non
12	18/1/2021	Local	Non	27	1/4/2021	Local	Non
		Egyptian	Non			Egyptian	Non
		Holland	Non			Holland	Non
13	20/1/2021	Local	Non	28	27/4/2021	Local	Non
		Egyptian	Non			Egyptian	Non
		Holland	Non			Holland	Non
14	24/1/2021	Local	Non	29	4/5/2021	Local	Non
		Egyptian	Non			Egyptian	Non
		Holland	Non			Holland	Non
15	1/2/2021	Local	Non	30	7/2/2021	Local	Non
		Egyptian	Non			Egyptian	Non
		Holland	Non			Holland	Non

3-3-Test of infection of broad *Vicia faba* pods by the southern cowpea beetle when combined with the broad *Vicia faba* plant in the field.

Through table (4), it was found that the southern cowpea beetle can infect the field of broad *Vicia faba* plant, as well as the severity of the infestation of broad *Vicia faba* (Egyptian, Holland, and local) also varied, the highest mean severity of infection was for the local species compared with the Egyptian and Holland, which amounted to (45.83, 24.67, *and* 24.17) larvae per ten infected grains, respectively. While the highest rate of infection was on local barley, compared to the Egyptian and Holland, which amounted to (51.58, 27.92, and 27.92 %), respectively.

The infestation of broad *Vicia faba* plants in the field indicates that the members of the family Brichidae are characterized by the ability to behave in environmental isolation, that is, they choose the environment of the stores over the environment of the field to infect the grains and reproduce in the store compared to not infecting the grains and breeding in the field naturally. Where, studies have shown that beetles will choose their host depending on the geographical area in which they live [31], some animals are distinguished by the tendency to exist in environments they choose and adapt and tend to live in and reproduce in better than other environments if species separate from others as a result if they are exposed to environmental conditions different, but when collected in one environment with members of their species can produce new individuals [19].

TABLE 4. Severity and percentage of infection broad *Vicia faba* plants by *Callosoruchus maculatus* Fab.

Varieties of broad *Vicia faba*	Average infection severity	Average infection percentage	Average effect
Egyptian	24.67	27.92	26.30
Holland	24.17	27.92	26.05
Local	45.83	51.58	48.71
Mean of infection	31.56	35.81	

LSD:11.18 infection intensity, LSD:6.51 infection percentage.

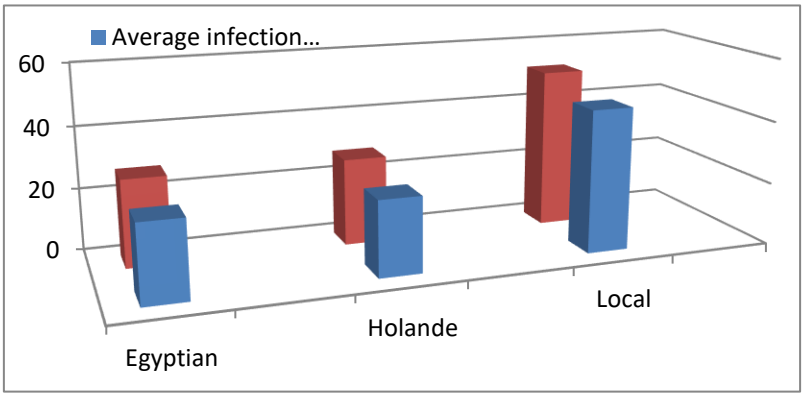

FIGURE 1. Severity and percentage of infection of broad *Vicia faba* plants by *Callosoruchus maculatus* Fab.

CONCLUSION

Individuals Bruchinea subfamily are isolation in reproduction and activity in the storage environment on legumes and some other stored materials. They may be present in the field during the spring season, accidentally, during the flowering period on some economic plants and bushes**.** when transferring individuals to the *Vicia faba* plant in the field during the ripening period of the pods, it was found that the adults infect the grains by laying eggs and feeding the larvae on them in the field.

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