



## The study of food preference of *Callosobruchus maculatus* to five types of fabaceae

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### Abstract

This study showed that pulses are divided into three groups: high, medium and weak attraction. It became clear that beans was preferred by adults to lay eggs as the average number of egg 66.67. While the average number of eggs laid on the red bean and chickpea 56.67 and 53.33 respectively. Faba had lowest average for the number of eggs and the of 13.0 and is considered to faba highest percentage of protein compared to other beans in the study found that infection pulses by insects affect the proportion of protein in article by comparing food before and after the infection.

Key words: *Callosobruchus maculatus*, Eggs, Infection pulses, Fabaceae.

### Introduction

The leguminosae is one of vegetables grown from more than 6,000 years in different places of the world, because the pulses are the most important sources of protein in the food in India and other poor countries and are rich in phosphorus, calcium and iron, and a number of essential vitamins and the necessary fats to absorb vitamin A (Shanmugas, 1988) that the percentage of protein in beans, ranging between 20 - 40% and acids methionine and cystine and sulfur in both there. Dry pulses considered as an important field crops for the content of protein and high health benefits in addition to its role in stabilizing the N in the soil, grains different in shape and size and color (Liebenberg, 2002).

Pulses infect with a number of pests like: *Aphids*, *Thrips*, *Maruca (testolalis) vitata*, *Liriomyza sp.* and other pests. *Callosobruchus maculatus* (coleoptera : bruchiidae ) is a continuous pest from the field to the store (Jiao *et al.*, 2011). infection starts in the field after flowering and during the contract and pursue their reproduction within the store, where the proportion of loss caused by this pest is 25-30% in the field and 80% in store within 6-8 months in temperate zones (Hill, 1990).

Most important characteristic of *Callosobruchus maculatus* from other genus of the same species is the triangular spots in mid sheaths (Borrer *et al.*, 1981), and having a short sharp on the outer edge of the thigh matched the inner edge trailing a large blunt (Al-Azzawi *et al.*,1983) distinction between male and female by note the size and shape of the abdomen , female abdomen larger than the male and the end of the elongated abdomen while in the male abdomen shorter than the female and the final episode of abdominal curved and destined for the bottom (Bandara and Saxana, 1995) . Legume seeds crops are the main host of beetles , have been recorded about 83 species of legumes vegetarian host for these beetles (Southgate, 1979), the larvae nutrition on the contents of the seeds from the inside and do not leave before complete their growth to adult. Seeds infected by beetle cowpea loss large part of the content of food, which negatively affects the germination also leads to high temperatures and provides moisture which encourages the growth of fungus and mold, which reduces the value of food and seed marketing (Ahmadi *et al.*, 1987). The importance of this pest and the wide spread in different regions of the country caused heavy losses and the

different protein content between food. The study of food preference of the pest to five types of beans (beans, red bean and mung bean, faba and chickpeas) the impact of pest infection *C. maculatus* on the protein content of the seeds and food preference to lay eggs.

### Materials and Methods

The experiment was executed in the collage of Sciences, Department of biology, University of Baghdad, the adult obtained by collecting samples of red kidney bean infected from the local markets then reared in plastic cans with cylindrical shape covered with Alaorquenza clothes and added cowpea seeds continuously to obtain the culture for the experiment.

*Callosobruchus maculatus* adult and food preference: To saw adult preference for five different types of beans. Used a wooden board circular diameter 40 cm divided from the center into equal 15 sections in shape and size with central circle radius 4 cm to put the adult pest fig. (1) surrounding this circle wooden barrier circular to prevent exit adult panel study, put five different pulses belonging to the legume family (cecir, beans, red bean, faba, mung bean) in the sections of wood panel above and at equal distances from the center of the circle as 3 randomly section to each puls . Seriously put 20 South beetle cowpea modern emergence in the center of the circle, painting is covered with cloth Aorquenza to prevent the exit of adult an incubate at a temperature of  $25 \pm 5$  and relative humidity  $50 \pm 5\%$ . Adult numbers were calculated, on each seeds after 24 hours of adult exposing them to know the behavior of the insect in the free choice , re-test 7 times and placing a new adult in each time to make sure the integrity of the test.

Experience food preference to lay eggs: Isolated Five pairs of adult (males and females) to South beetle cowpea *C. macullatus* aged one to two days and after the distribution of pulses in the section by 20 seed for each one, put adult in the small central circle incubated at temperature of  $25 \pm 5$  and relative humidity  $50 \pm 5\%$ . Examined daily to calculate the number of eggs that layed by females on each section for 5 days the test were measured daily egg-laying average and the total number of eggs that lay from a single female.

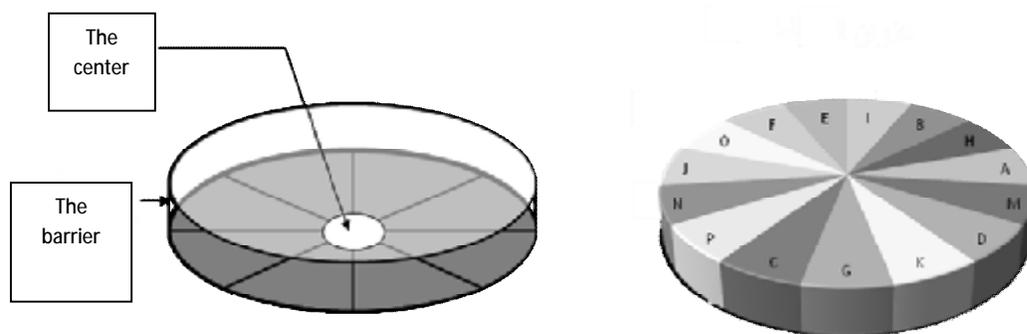
Measure the percentage of protein in infected seed with South beetle cowpea: Random samples taken from infected pulses legumes after a month of infection and compare with samples that not infected by 3 replicates of each sample experiment was conducted using device Kejlidal to estimate the proportion of nitrogen which is used in certain equation to estimate the proportion of protein in a food item. Protein ratio = value nitrogen x 6.25.

Static analysis: Results were analyzed statistically according to C.R.D. and use less significant difference test below to make sure of the moral differences between the average of different treatments and t. test (SPSS, 1998).

### Results and Discussion

Adults insect's preference for pulses: Table (1) showed that the adult insect's preference for various pulses have been mixed when it was free to choose. The proportion of adult attraction to red bean higher than other pulses by (0.84) and became the diminishing attraction for mung bean , beans and cecir ( 0.66, 0.66, 0.63), respectively. When faba was a very little attraction ( 0.49 ). statistical analysis showed the highly significant statistical differences between the five pulses. And that light can be classed pulses on the basis of preference to 3 groups : the first group is a high attraction includes (red bean) , the second group is medium attractions includes (beans , a mung bean and chickpeas). The third group is a weak attraction includes (faba). from that some types of beetles of the family Bruchiidae behave differently in food preference, depending on the nature and value of the food material involved in the content of the material prefer. The test results showed that high protein pulses was a favorite to the adult as faba, and may return different preference food to other reasons, including the form of material, color, the nature of the surface in terms of smoothness and roughness or the presence or absence of material attractive or repellent in food material (Fernandes, 1996), beans contain a high proportion of the tannin which is one of the inhibitory substance for larval growth, making it as not favorite for adults, and this is in line with (plant physiology, 2008) in that some of the proteins used as inhibitor growth of insect larvae.

Experience food preference for adults to lay eggs: Table (2) explain the significant differences by statistical analysis between the average number of



A+ E+ G: read bean.  
 H+ D+ C: bean.  
 B+ F+ J: mung bean.  
 I+ K+ N: cecir . M+O+ P: faba

Fig. (1) the special food preference dish .

Table (1): The effect of type pulses on *Callosobruchus maculatus* adult preference as P<0.05.

Pulses	Days							Average
	3 – 12	4 – 12	5 – 12	6 – 12	7-12	8-12	9-12	
cecire	4 ± 0.57	4.33 ± 0.88	5.67 ± 0.33	2 ±0.57	1.67 ± 0.33	4 ± 0.58	4 ± 1.15	0.63
Mung bean	1 ± 0.57	1 ± 0.57	4 ± 0.57	2 ±0.57	5.33 ± 0.88	4 ±0.58	2.33 ± 0.88	0.66
Red bean	7 ± 0.57	5 ± 0.57	4 ± 1.15	4 ±1.15	4 ± 1.15	9 ± 0.58	4.67 ± 0.88	0.84
Bean	5 ± 0.57	6.33 ± 0.88	3.67 ± 0.88	9 ±0.58	9 ± 0.58	4 ± 0.58	8 ± 0.57	0.66
Faba	1 ±0.57	1 ± 0.57	3 ±0.57	2 ±.57	0.0 ± 0.0	2.0 ±0.58	2.0 ± 0.57	0.49
L.S.D.	1.81	2.25	2.39	2.30	2.25	1.81	2.65	1.56

by adult South beetle cowpea when exposed to different kinds of beans. As a high average was on beans 66.67 eggs per female, while the average number of eggs laid by adult beetle on red bean, chickpeas 56.67 and 53.33 eggs, respectively, while the lowest average of 40.0 and 13.0 eggs per female when feeding on mung bean and beans, respectively. notes from the table different numbers of eggs from pulses to another may be due reason for this disparity in numbers of eggs laid by female to individual differences between them may be due to the size of the seed or the thickness of the cover or the nature of the seed coat (coarse, touch) . insect preference to bean seeds more than red bean and insect prefers broken and infected seeds to lay egg

(Wasserman, 1981). there is control by the genes of seeds on the development of eggs in the insect. as mentioned (Blumer and Beck, 2008) that adult prefer laying eggs on the larger seed surface area. (cope and Charles, 2003) the size of seeds affects in the adult selected to lay their eggs.

Measure the percentage of protein in infected seed with South beetle cowpea: Table (3) showed the significant differences between the average of protein in seeds which not infected used in the experiment, results showed statistically analysis by test Duncan, that high significant differences in average protein found in faba 3.87 compared with chickpeas, beans mung bean and red bean on respectively, Chickpea contain 62.4% of protein.

Faba was more contain of protein compared to

Table (2): The average of eggs number laid by *Callosobruchus maculatus* adults after 5 days .

Pulses	Average of egg number after 5 day
Cecire	53.33 ± 3.33
Mung bean	40.0 ± 5.77
Red bean	56.67 ± 3.33
Bean	66.67 ± 3.33
Faba	13.0 ± 8.50
L.S.D.	16.61

other pulses used in the experiment, (Larralde and Martines, 1991) protein constitutes 25-30% of the faba components, average of prefer faba as food because it contain 28% protein (Dev *et. al.*, 2006 ) The red bean contains protein as (78.8-91.3%).

Table (4) showed the significant differences between the average of protein before and after infection for faba and chickpeas 4.314 , 3.062 respectively. While there were no significant differences between the mung bean, beans, red bean 10.01, 9.16, 11.06, respectively. This indicated the impact of infection with *Callosobruchus maculatus* stored pulses and food content include protein.

Table (3): The average of protein between five select pulses before infection with *Callosobruchus maculatus*.

pulses	average	L.S.R.	cecir	bean	Mung bean	Red bean
Faba	11.4	0.77	3.87	2.24	1.38	0.33
Red bean	11.0	0.76	3.35	1.90	1.05	
Mung bean	10.0	0.74	2.48	0.85		
Bean	9.1	0.71	1.63			
Cecir	7.5					

Table (4): Different between the average of protein after and before infection with *Callosobruchus maculatus* as t test .

pulses	Average of protein before infection	Average of protein after infection	Calculated t	t	result
Faba	11.4	9.24	4.314	4.303	S.
Cecir	7.53	6.84	3.062	4.303	S.
Mung bean	10.01	10.91	2.286	4.303	No.S.
Bean	9.16	10.8	1.56	4.303	No.S.
Red bean	11.06	11.55	0.927	4.303	No.S.

### References

- Ahmadi, A.Z. and Priest, J., 1987. Field crop insects and scientific guidance to know it in the Arab countries, the future Printing House, Damascus, Syria. P 641.
- Al-Azzawi, A. Flaih and Mahdi, M.T., 1983. Insects storages, the University of Baghdad, and the Ministry of Higher Education and Scientific Research, the Republic of Iraq, p 460 .
- Borror, D.J., Delong, D.M. and Triplehorn, C.A., 1981. An introduction to study of insects, Philadelphia: Sounders College. USA.
- Blumer, L.S. and Beck, C.W., 2008. oviposition substrate choice by beanbeetles . *Callosobruchus maculatus*. p. 50-66.
- Bandara, K.A. and Saxena, R.C., 1995. Antequique for handling and sexing . *Callosobruchus maculatus* (F.) adults (Coleoptera: Bruchiidae). J. Stord. Prod. Res. 31: 97-100.
- Cope, M.J. and Charles, W.F., 2003. Oviposition decision in the seed beetle, *Callosobruchus maculatus* (coleoptera: Bruchiidae) : effect of seed size on superparasitism .
- Dev, K.S., Rao, A.S., Singh, R. and Gambunathan, R., 2006. Amino acid composition of storage proteins of promising chickpea (*cicer arietinum* L.). J. Sci. Agric., 43: 373-379.
- Fernandez, M.L., Aranda, P. and Urbano, G., 1996. Nutritional assessment of raw and processed faba bean (*vicia faba* L.) cultivar major in growing rats. J. Agric. Food chem., 44,2766-2772.
- Hill, D.S., 1990. Pests of stored products and their control, CRC press, Boca Raton, 274p.
- Jiao, S., Tang, J.A., Tiwari, J. and Wang, G.S., 2011. Dielectric properties of cowpea weevil, black-eyed peas and mung beans with respect to the development of radio frequency heat treatments. Biosyst. Engine., 280-291.
- Larralde, J., Martinez, J.A., 1991. Nutritional value of faba bean: Effect on nutrient utilization, protein turnover and immunity. 111-117.
- Liebenberg, A.J., 2002 . Dry bean production. South Africa.
- plant physiology, 2000. American Society of plant physiology. 124. 515-522.
- Shanmugas, S., 1988. Leguminous vegetable cultivation and seed production. China.
- Southgate, B.J., 1979. biology of Bruchiidae. Annu. Rev. Entomol., 24:449-472.
- SPSS, 1998. Statistical package for social science, user's guide for statistics.