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Arab Univ.
J. Agric. Sci.,
Ain Shams Univ.,
Cairo, 17(1), 193-197, 2009

TENDENCY OF CERTAIN PULSE SEEDS TO *CALLOSOBRUCHUS MACULATUS* (F.) AND *CALLOSOBRUCHUS CHINENSIS* (L.) INFESTATION

[16]

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Keywords: Pulse seeds, *Callosobruchus maculatus*, *C. chinensis*, Leguminous seeds, Host preference

ABSTRACT

The seeds of six different species of common pulses were examined as hosts of two bruchid beetles, *Callosobruchus maculatus* (F.) and *C. chinensis* L. under controlled conditions of 30±2°C and 65±5% R.H. Deposited eggs, Hatched eggs, numbers and weights of emerged adults and also the total developmental period from the deposited eggs to adults emergence were estimated. Results obtained indicated that cowpea seeds were the most favorable for feeding the two tested bruchid beetles, followed by faba bean seeds, while insect infestation was not observed on common bean and soybean seeds for either bruchid species.Results also revealed that *C.maculatus* deposited more eggs on all tested leguminous seeds and gave more emerged adults with heavier weights than *C. chinensis*.

INTRODUCTION

Pulses are grains grown as important food crops in many countries of the world. Their seeds are considered a main source of protein for human and animal nutrition **(Smartt, 1976)**. These seeds are widely grown in Egypt and attacked by bruchid beetles, on which they lay eggs on the pods or on the stored seeds and their larvae are developing in the cotyledons causing considerable damage.

Bruchid beetles are the most important post–harvest pests on legume seeds in Egypt. These beetles cause appreciable losses every year. Genus *Callosobruchus* involves the largest number of pest species which cause the greatest damage to many economically important legume seeds. *Callosobruchus maculatus* and *Callosobruchus chinensis* are considered cosmopolitan pests which attack pulses in stores and cause serious damage (**Bohoduri *et al* 1990**).

C. chinensis and C.maculatus develop on many kinds of bean; however, they are unable to develop on common beans (*Phaseolus vulgaris* L.) because the seeds contained a growth inhibitor **(Honda and Ohsawa, 1990). Mannan and Bhuiyah (1994)** reported that adult females of *C. maculatus* showed a clear preference to oviposit the maximum number of eggs on *Phaseolus vulgaris* in no choice tests .The order of *C. maculatus*' preference on the basis of seed weight loss was green mung> blackeye pea> pea> kidney bean > lentil **(Sadozai *et al* 2003)**.

The present study aimed to evaluate the ability of the two bruchid beetles (*Callosobruchus maculatus* (F.) and *C.chinensis* L.) to infest and develop on the seeds of six different species of common pulses: cowpea, faba bean, lentil, chickpea, common bean and soybean in order to find out the most favorable host seeds for laboratory rearing of the two beetles.

MATERIALS AND METHODS

Callosobruchus maculatus and *C.chinensis* (Coleoptera: Bruchidae) were reared for several generations on faba bean (*Vicia faba* L.) seeds under local ambient laboratory conditions of about 30± 2°C and 65±5% relative humidity according to the method described by **Utida (1971)**.

(Received September 3, 2008)
(Accepted September 14, 2008)

Seeds of six different species of common pulses, namely cowpea (*Vigna unguiculata* (L.)), faba bean (*Vicia faba* L.), lentil (*Lens culinaris* Medic), chickpea (*Cicer arietinum* L.), common bean (*Phaseolus vulgaris* L.) and soybean (*Glycine max* Merrill), were obtained from the Agricultural Research Center (ARC). Seeds were frozen at –20°C for 48 hours in order to kill and eliminate any previous infestation, then kept under laboratory conditions for two weeks to regain hygroscopic balance (**Huignard, 1985**).

Evaluation of infestation with *C. maculatus* and *C. chinensis* was conducted by putting 100g of each kind of pulse seeds in clean glass jars of 250 ml (volume), and offered to five pairs of each bruchid species as oviposition sites and sources of food for their progeny. The jars were covered with muslin tied round the neck, labeled and kept in an incubator under experimental conditions (30± 2 °C and 65± 5 % R.H.). Each treatment was replicated four times.

After five days, when the majority of eggs were laid, adults were removed, seeds were examined and number of eggs laid was counted. Subsequently, hatched eggs, numbers and weights of emerged adults were estimated.

The total number of eggs laid in each replicate was divided by the number of females to obtain the number of eggs laid per female. Hatchability % was determined as:

No. of hatched eggs/ No. of eggs x100

The number of adults that emerged later (after 25 days) in each replicate was divided by the number of females to obtain the number of adults' progeny per female. The weight (mg) of 10 adults of each bruchid species that emerged from the seeds of each leguminous plant species was determined.

RESULTS AND DISCUSSION

The obtained data **(Table 1)** show that the cowpea beetle *C. maculatus* laid significantly more eggs on cowpea (58.25eggs/ female) and less number on lentil (5.00 eggs/female) in comparison to the remaining tested seeds. Seeds of faba bean were the second favorable (29.50 egg/ female) followed by common bean seeds, soybean seeds and chickpea seeds with mean numbers of 15.25, 12.00 and 10.50 egg /female, respectively. The differences between those three means were not significant. The trend of the produced number of adults per female was, generally, similar to that observed earlier, except for common bean and soybean from which no adult emerged. The percentages of hatching were always above 50.00% and the highest percentage 85.71% occurred on chickpea, followed by 71.18% on faba bean, but it decreased to 58.33% on soybean and 52.45% on common bean. The mean numbers of produced adults were 19.75, 11.00, 1.75 and 5.75 adult/female from cowpea, faba bean, lentil and chickpea, respectively. Heaviest adults emerged when larvae fed in cowpea seeds (2.31 mg/adult) followed by those came out from faba bean seeds (2.23 mg/adult), chickpea seeds (1.98 mg/adult). However, lightest adults emerged from lentil seeds as they recorded an average of 1.89 mg/adult. The mean total developmental period from the deposited egg to adult emergence was significantly shortest when the larvae fed on cowpea (30.00 days) followed by faba beans (32.00 days) then lentil seeds (34.00 days). The longest period was 36.00 days when the larvae fed on chickpea. The preceeding results agree more or less with those of **Giga and Smith (1987)** who observed *C. maculatus'* highest number of deposited eggs on cowpea seeds, and with **Wijeratne (1998)** who found that cowpea seeds were the most suitable food substrate for adult production of *C.maculatus* and those of **Salem *et al* 1994** who reported that cowpea was the most preferable seeds for development of *C. maculatus*.

The results in **Table (2)** indicated that *C. chinensis* the female oviposited significantly more eggs on cowpea followed by faba bean seeds (22.75 and 15.50 eggs/ female) compared to chickpea, common bean, soybean and lentil where the female deposited its eggs without substantially differential preference (3.75, 3.25, 2.75 and 1.75 eggs/ female, respectively). The highest percentage of hatched eggs (61.53%) occurred on common bean seeds and the lowest one was 36.36% on soybean while 57.14%, 53.33%, 52.74% and 45.16% hatched on lentil, chickpea, cowpea and faba bean, respectively. The trend of the number of produced adults per female was, generally, similar to that observed earlier with female's mean number of eggs, but no adult emerged from common bean and soybean seeds. Again, significantly higher numbers of adults emerged from cowpea seeds followed by faba bean seeds (8.25 and 3.50 adults/ female), while lentil seeds were drastically least favorable for adult production (0.50 adult/ female). Emerged adults from cowpea seeds were significantly the heaviest (1.60 mg/ adult), while

Table 1. The changes in certain biological aspects of *Callosobruchus maculatus* when fed on six pulse seeds

Parameters	Cowpea	Faba bean	Lentil	Chickpea	Common bean	Soybean
Mean No. of eggs/female	58.25*±5.56a	29.50*±2.64b	5.00±0.81d	10.50*±3.69c	15.25*±3.09c	12.00*±4.96c
Mean No. of hatched eggs	39.300*±0.81a	21.00*±1.63b	3.00±0.40d	9.00*±0.61c	8.00*±1.22c	7.00*±1.63c
% Hatched eggs (fertility)	66.95	71.18	60.00	85.71	52.45	58.33
Mean No. of emerged adults/female	19.75*±4.99a	11.00*±2.16b	1.75±0.95d	5.75*±1.50c	0.00±0.00d	0.00±0.00d
Mean adult weight	2.31*±0.07a	2.23*±0.05b	1.89*±0.08d	1.98*±0.01c	0.00±0.00e	0.00±0.00e
Mean developmental period	30.00*±1.63c	32.00±0.81b,c	34.00±2.44a,b	36.00*±3.26a	0.00d±0.00	0.00±0.00d

*. The least significant difference (LSD) is significant at the .05 level ($P>0.05$).
Means of the same smaller letter belong to the same category.
"F" value = 107.47 (Mean No. of eggs).
"F" value = 108.42 (Mean hatched eggs).
"F" value = 44.46 (Mean emerged adults).
"F" value = 8.65 (Mean adult weight).
"F" value = 353.28 (Mean developmental period).

Table 2. The changes in certain biological aspects of *Callosubrucs chinensis* when fed on six pulse seeds

Parameters	Cowpea	Faba bean	Lentil	Chickpea	Common bean	Soybean
Mean No. of eggs/female	22.75*±3.09a	15.50*±1.29b	1.75±0.95c	3.75±1.50c	3.25±1.70c	2.75±0.50c
Mean No. of hatched eggs	12.00*±0.81a	7.00*±1.63b	1.00±0.81c	2.00±1.63c	2.00±0.81c	1.00±0.81c
% Hatched eggs (fertility)	52.74	45.16	57.14	53.33	61.33	36.36
Mean No. of emerged adults/female	8.25*±1.25a	3.50*±1.00b	0.50±0.57c	0.75±0.95c	0.00±0.00c	0.00±0.00c
Mean adult weight	1.60*±0.08a	1.59*±0.17b	1.50*±0.09d	1.57**±0.02c	0.00±0.00e	0.00±0.00e
Mean developmental period	26.00*±1.63c	27.00±0.81b,c	29.00*±2.44b	33.00*±3.26a	0.00±0.00d	0.00±0.00d

*. The least significant difference (LSD) is significant at the .05 level ($P>0.05$).
Means of the same smaller letter belong to the same category.
"F" value = 103.88 (Mean No. of eggs).
"F" value = 118.60 (Mean hatched eggs).
"F" value = 66.31 (Mean emerged adults).
"F" value = 1.4 (Mean adult weight).
"F" value = 271.40 (Mean developmental period).

those came out of lentil seeds were the lightest weight (1.50 mg/ adult).The mean total developmental period from the deposited egg to adult emergence was significantly the shortest when the larvae fed on cowpea (26.00 day) followed by faba bean (27.00 day) then lentil seed (29.00 day). The longest period was 33.00 day when the larvae fed on chickpea. **Bhattacharya and Banerjee (2000)** found that the hatching rates and biomass of *C. chinensis* were higher when the larvae fed on garden pea (*Pisum sativum* L.) seeds than those fed on lentil (*Lens culinaris*) seeds. **Honda and Ohsawa (1990)** reported that common bean (*P. vulgaris*) seeds contained 0.6 % of the growth inhibitor which showed alpha-amylase inhibitory activity and this was probably the reason why *C. maculatus* and *C. chinensis* were unable to develop on kidney bean seeds, as they did develop on many other kinds of bean.

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مجلد(١٧)، عدد (١)، ١٩٣-١٩٧، ٢٠٠٩

ميل بعض أنواع البذور البقولية للإصابة بخنفساء اللوبيا والخنفساء الصينية

[١٦]

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تم تقييم بذور ستة أنواع مختلفة مـن البقوليـات للاصابة بنوعين من خنافس البقول، خنفساء اللوبيـا والخنفساء الصينية تحت شـروط المختبـر (درجـة حـرارة ٣٠ ±٢ درجـة مئويـة ورطوبـة نـسبية ٦٥ ±٥ %) . تم تقدير كل من معدل وضع البيض، معدل فقس البيض معدل انتاج الأفراد البالغة و معدل وزن الأفراد البالغة وكـذلك متوسـط الفتـرة التـي تستغرقها الأطوار الحشرية من وضع البيض حتـى خروج الحشرات الكاملة . أظهرت النتائج أن بـذور اللوبيا كانت الأكثر ملاءمة يليها بذور الفـول ، فـي حين لم تلاحظ الاصابة الحشرية على بذور الفاصوليا وفول الصويا في كـلا النـوعين الحـشريين تحـت الدراسة. كما أظهرت النتائج أن أنثى خنفساء اللوبيـا وضعت عددا" أكبرمن البيض على الأنواع المختلفـة للبذور تحت الدراسة ، كماأعطت عددا" أكبـر مـن الخنافس الخارجة من الحبوب وكانت ذات وزن أعلى من الخنفساءالصينية.

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