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SCREEN OUT THE LESS PREFERRED VARIETY OF CHICKPEA AGAINST PULSE BEETLE ON THE BASIS OF ORIENTATION AND OVIPOSITION

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Abstract

The egg deposition on different varieties under free choice condition ranged from 13.0 to 21.0 eggs with significant differences among different varieties. Minimum egg deposition on varieties JG-11 and JG-16 and under forced condition ranged from 45.0 to 115.3 eggs with significant differences among them. The minimum egg was deposition on variety RVS-201. The egg deposition on variety JG-16 under forced condition was significantly higher, whereas under free choice condition the egg deposition was significantly less, this indicated that JG-16 was most preferred for oviposition and less preferred for orientation. The survival percentage of pulse beetle on different varieties ranged from 26.3 to 44.6% and the minimum survival percentage in variety JG-6 indicated less suitability.

Key words: *Callosobruchus maculatus,* orientation and oviposition.

INTRODUCTION

The seed-beetles in the genus *Callosobruchus* (Coleoptera: Bruchidae) are economically important pests of stored pulse crops (Weigand, 1990; Clement *et al.,* 2004; Demanyk *et al.*, 2007 and Sharma *et al.*, 2007). The genus *Callosobruchus* includes approximately 20 species, about three quarters of which are from Asia (Borowiec 1987). The pulse beetle, *Callosobruchus maculatus* F. (Coleoptera: Bruchidae), is an economically important pest of stored chickpeas, which produces losses up to 30% in a short period of two months (Yadav 1997). Its oviposition and growth are continuous. Females cement eggs to the surface of the host seeds. When eggs hatch, larvae burrow into the seeds where their entire development (four instars plus the pupal stage) is completed. Larvae cannot move among seeds and are thus restricted to the seed on which the female oviposited. Beetles emerge from seeds reproductively mature. Emerging adults are well adapted to storage conditions, requiring neither food nor water to reproduce (Messina 1991). Infestation with the seed beetle was reported to be up to 100% in many stored chickpea (Weigand and Pimpert 1993). When an infestation of 40–60% in chickpea occurs, the seeds are no longer edible (Van der Maesen, 1972). Because infestation by beetles most commonly occurs in stored seed, laboratory conditions do not significantly differ from their natural conditions (Southgate, 1979).

Most of the pulse beetle infests the pods and grains from the field and hidden infestation is not detected before storing of the pulses. So, the heavy amount of stored produce is lost by the beetles. Therefore, it is essential to know the factors responsible for causing this damage (Arora and Singh 1970 and Shehnaz and Theophillus 1975).

Pulse beetle *C. chinensis* is one of the serious storage pests of Chickpea. *C. chinensis* has been reported to cause serious damage to pulses in India and

many countries of the globe. It is cosmopolitan in distribution found in the countries where tropical and subtropical conditions prevail. It has a capability to infest not only cultivated host plants in the field but also in storage (Fahad, 2011). It is recorded that 55- 60% loss in seed weight and 45.50 to 66.30% loss in protein content of pulses is due to infestation caused by this beetle (Faruk *et al.,* 2011). In case of heavy infestation of grains by pulse beetle the grains lose their germination capacity and become unfit for human consumption. To reduce storage losses in pulses, usually some chemicals or fumigants are applied. The use of these chemicals not only increase input cost but also is health hazardous. Therefore, there is a need to search for some non-chemical methods. Investigating resistance source in the cultivable varieties is the best option in this regard.

Materials and methods

A research experiment was carried out in the Laboratory of Department of Entomology, College of Agriculture, Gwalior. Pulse beetle (*Callosobruchus maculatus*) (Fab.) was reared in the laboratory to raise experimental culture of the insect. The orientation and ovipositional preference were assessed under free choice conditions. Fifty seeds of each variety were kept in open petridishes and arranged randomly in glass trough. Fifty pairs of freshly emerged beetles were released in the centre of the trough and the glass trough was then covered with muslin cloth. The adults oriented in every variety were counted at 72 hours after their release and then were removed. The experiment was replicated three times. Seven days after removing the adult, the eggs laid in each genotype were counted to note the ovipositional preference.

Results and Discussion

Studies on the screen out the less preferred variety of chickpea against pulse beetle on the basis of orientation and oviposition were conducted under laboratory conditions in the Department of Entomology, College of Agriculture, Gwalior (M.P.) during 2013–14. They were studies under:

Response under free Choice condition

The number of adults was oriented on different varieties showed significant differences among different varieties (table-1). Minimum number of adults (6.0) was oriented on JG-16 which was found significantly less than the adults oriented on varieties JGK-43, JG-11, RVS-201, JKG-3, JG-130 and JG-322, but was at par with rest of the varieties. The maximum adult orientation (10.3) was observed in varieties JG-6, which was found significantly higher than the adults oriented on varieties RVS-203, JGK1, JGG-1, RVS-202, JG-322and JG-130, but was at par with rest of the varieties. Shafique and Ahmad (2005) screened grains of 22 chickpea genotypes for resistance to pulse beetle (*C. analis*) under laboratory conditions in free choice of oviposition by the beetle, adult progeny development, grain damage and weight loss varied.

There existed significant differences in the egg deposition on different varieties (table-2). Significantly lower number of eggs (13.0) was laid on genotypes JG-11 and JG-16 than rest of the varieties, except JGK-43,

Table 1: Number of adults oriented on different varieties of chickpea.

S.No.	Varieties	Number of adults oriented
1	RVS-201	7.0 (2.64)
2	RVS-202	9.0 (3.00)
3	RVS-203	10.0 (3.16)
4	JG-6	10.3 (3.21)
5	JG-11	6.7 (2.57)
6	JG-16	6.0 (2.43)
7	JG-130	8.0 (2.83)
8	JG-322	8.3 (2.87)
9	JGK-1	9.3 (3.05)
10	JKG-3	7.0 (2.64)
11	JGK-43	6.3 (2.51)
12	JGG-1	9.3 (3.05)
SE(m)±		**(0.15)**
CD at 5%		**(0.45)**

* Figures in parentheses are $\sqrt{n}$ transformed values

Table 2: Number of eggs laid on different varieties under free choice condition

S.No.	Varieties	Number of eggs laid
1	RVS-201	15.0 (3.87)
2	RVS-202	18.3 (4.28)
3	RVS-203	21.0 (4.57)
4	JG-6	21.0 (4.57)
5	JG-11	13.0 (3.60)
6	JG-16	13.0 (3.60)
7	JG-130	16.7 (4.08)
8	JG-322	17.0 (4.11)
9	JGK-1	20.0 (4.45)
10	JKG-3	15.0 (3.87)
11	JGK-43	13.7 (3.68)
12	JGG-1	20.0 (4.47)
SE(m)±		**(0.19)**
CD at 5%		**(0.56)**

* Figures in parentheses are $\sqrt{n}$ transformed values

Table 3: Number of eggs laid on different varieties under forced condition

S.No.	Varieties	Number of eggs laid
1	RVS-201	45.0 (6.68)
2	RVS-202	84.0 (9.12)
3	RVS-203	77.3 (8.79)
4	JG-6	91.7 (9.57)
5	JG-11	82.7 (9.05)
6	JG-16	115.3 (10.72)
7	JG-130	83.0 (9.11)
8	JG-322	77.3 (8.79)
9	JGK-1	103.0 (10.15)
10	JKG-3	76.7 (8.75)
11	JGK-43	64.7 (8.03)
12	JGG-1	98.0 (9.90)
SE(m)±		**(0.36)**
CD at 5%		**(1.05)**

* Figures in parentheses are $\sqrt{n}$ transformed values

Table 4: Number of adults emerged on different varieties under forced condition

S.No.	Varieties	Number of adult emerged
1	RVS-201	22.0 (4.67)
2	RVS-202	43.7 (6.60)
3	RVS-203	36.3 (6.01)
4	JG-6	23.7 (4.85)
5	JG-11	37.3 (6.07)
6	JG-16	41.3 (6.40)
7	JG-130	34.7 (5.88)
8	JG-322	32.3 (5.68)
9	JGK-1	40.0 (6.32)
10	JKG-3	30.7 (5.53)
11	JGK-43	30.7 (5.53)
12	JGG-1	43.3 (6.58)
SE(m)±		**(0.28)**
CD at 5%		**(0.82)**

* Figures in parentheses are $\sqrt{n}$ transformed values

Table 5: Total development period (in days) on different varieties under forced condition

S.No.	Varieties	Total developmental period (in days)
1	RVS-201	30.0
2	RVS-202	31.1
3	RVS-203	29.0
4	JG-6	28.2
5	JG-11	32.0
6	JG-16	30.3
7	JG-130	29.4
8	JG-322	30.3
9	JGK-1	31.6
10	JKG-3	29.5
11	JGK-43	28.0
12	JGG-1	30.9
SE(m)±		**2.07**
CD at 5%		**NS**

Table 6: Survival percentage of pulse beetle on different varieties of chickpea

S.No.	Varieties	Survival percentage
1	RVS-201	34.08 (35.73)
2	RVS-202	35.31 (36.12)
3	RVS-203	44.29 (41.71)
4	JG-6	26.33 (30.75)
5	JG-11	37.05 (37.50)
6	JG-16	35.98 (36.85)
7	JG-130	41.99 (40.39)
8	JG-322	41.95 (40.38)
9	JGK-1	39.20 (38.76)
10	JKG-3	40.14 (39.31)
11	JGK-43	29.15 (32.68)
12	JGG-1	44.64 (41.92)
SE(m)±		**(1.21)**
CD at 5%		**(3.55)**

* Figures in parentheses are angulartrans formed values

RVS-201, JKG-3, JG-130 and JG-322. Whereas, maximum number of eggs (21.0) were laid in varieties RVS-203 and JG-6, which was found significantly higher than the number of eggs laid on varieties JGG-1, JGK-1, RVS-202, JG-322 and JG-130, but was at par with rest of the varieties.

Response under Forced condition

Data recorded on number of eggs laid on different genotypes showed significant differences among different varieties (table -3). Minimum number of eggs (45.0) was laid on varieties RVS-201, which was found significantly less than the eggs laid on varieties JGK-43, JKG-3, RVS-203 and JG-322. On the other hand, maximum number of eggs (115.3) was laid on varieties JG-16, which was found significantly higher than the eggs laid on rest of the varieties, except JGK-1 and JGG-1.

Significant difference was observed among different varieties with regards to number of adult emerged from different varieties of chickpea under forced condition (table-4) Minimum number of adults (22.0) was emerged from RVS-201, which was found significantly less than the adult emerged from varieties JG-6, but was at par

with rest of the varieties. Whereas, maximum number of adult (43.7) was emerged in varieties RVS-202, which was found significantly higher than the number of adult emerged from rest of the varieties, except JGG-1, JG-16, JGK-1, JG-11, RVS-203 and JG-130.

Development period of pulse beetle (table-5) on different varieties of chickpea showed that there were no significant differences among different varieties. However, the total developmental period ranged from 28.0 days in JGK-43 to 32.0 days in JG-11.

Significant differences with survival percentage were observed among different varieties with regards to pulse beetle (table-6). The survival percentage in variety 'JG-6' was significantly low (26.33%) than rest of the varieties, except JGK-43. Whereas, significantly high survival percentage (44.64%) was recorded in varieties JGG-1 than rest of the varieties, except RVS-203, JG-130,JG-322, JKG-3 and JGK-1.

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