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Abhilasa Kousik BorthakurKrishi Vigyan Kendra, Assam
Agricultural University,
Darrang, Assam, India**Inee Gogoi**Department of Entomology,
Assam Agricultural University,
Jorhat, Assam, India**Dilip Kr Saikia**Department of Entomology,
Assam Agricultural University,
Jorhat, Assam, India**Palash Deb Nath**Department of Plant Pathology,
Assam Agricultural University,
Jorhat, Assam, India**Hemanta Saikia**Department of Agricultural
Statistics, Assam Agricultural
University, Jorhat, Assam, India**Corresponding Author:****Abhilasa Kousik Borthakur**Krishi Vigyan Kendra, Assam
Agricultural University,
Darrang, Assam, India

Ovipositional preference of *Callosobruchus chinensis* (L.) on pods of different host plants

Abhilasa Kousik Borthakur, Inee Gogoi, Dilip Kr Saikia, Palash Deb Nath and Hemanta Saikia

Abstract

An experiment was conducted to study the Ovipositional preference of *Callosobruchus chinensis* (L.) on pods of different host plants under laboratory conditions. From the present investigation, it was seen that the maximum number of eggs laid by *Callosobruchus chinensis* (L.) was in green gram pods (17.50) followed by chickpea pods (14.33) and cowpea (11.50) and black gram pods (8.50). Maximum percentage of hatched eggs was in green gram pods (90.55%) and the minimum hatchability percentage was in cowpea pods (81.80%). The total adult emergence was maximum in green gram (79.16%) followed by cowpea (76.55%), chickpea (75.53%) and black gram (64.82%). The reproductive success was highest on the green gram pods (65.52%) and lowest on the black gram pods (42.32%). The developmental period was highest in black gram (33.12) followed by chickpea (32.12), green gram (31.05 days) and cowpea (28.13 days). Growth Index was maximum on cowpea (2.73) and minimum on black gram (1.96). Thus green gram was found to be the most favourable host plant for oviposition by *Callosobruchus chinensis* (L.) while cowpea was most suitable host for development of the pest.

Keywords: *Callosobruchus chinensis*, pulses, reproductive success, growth index

Introduction

Pulses are the most vital source of nutrition throughout the world. As a crop they enrich the soil quality by its unique properties like biological nitrogen fixation. Green gram is one such pulse crop with myriad purposes. Black gram, *Vigna mungo* (L.) is another outstanding pulse crop which is suitable for dryland agriculture and suits well as an intercrop. Apart from the nutritional benefits, black gram is also a nutritive green fodder crop. Cowpea, *Vigna unguiculata* (L.) is a multipurpose legume, it can be used a pulse, as a vegetable and also as fodder. Another potential pulse crop is Chickpea in India it is cultivated in an area of 9.53 million hectare and the total production was 9.07 million tonnes Anonymous 2016 [1].

Pulse crop is vulnerable to insect infestation both in field and storage and among the insect pest of pulses, the family bruchidae is the most destructive one. In India 117 species of bruchids have been reported which belong to 11 genera and out of these, *Callosobruchus* is very prominent with regard to its incidence Hill 1990 [8]. Among these *Callosobruchus chinensis* is the most destructive Gowda and Kaul 1982 [7]. *C. chinensis* is a cosmopolitan pest, having a wide array of host. In order to bring out an appropriate pest management strategy a sheer knowledge on host preference of the pest is essential and hence an effort was taken to study the ovipositional preference of *C. Chinensis* on four of its host plants viz. Green gram, black gram, chickpea and cowpea.

Materials and Method

The experiment was conducted at the Department of Entomology, Assam Agricultural University, Jorhat in Assam, India. Green gram (variety-Pratap), black gram (variety-KU301), cowpea (variety-Green fall) and chickpea (variety-JG16) were used as host plants under CRD with six replications. These plants were grown in pots of 1kg capacity and all other agronomic practices were followed to raise the crop. Pesticide use was totally restricted. After pod formation, 4 mature pods were selected from each replication and enclosed by a cloth bag. A single pair of 0-24 hour old adult beetle was released inside each of the cloth bags which enclosed the pods. Observation on egg laying was recorded up to 5 days and the beetles were removed thereafter. Data on total number of eggs laid, hatching percentage and adult emergence were recorded.

Growth parameters *viz.* reproductive success, total developmental period and growth index were also recorded. The Growth Index was calculated out by the following formula Dhawan *et al.*, 1988 [6].

$$\text{Growth Index} = \frac{\text{Adult emergence \%}}{\text{Mean total developmental period (Days)}}$$

The data obtained was analyzed using SPSS-16 software.

Results and Discussion

The results pertaining to Ovipositional preference of *C. Chinensis* comprising the ovipositional parameters and growth parameters are presented in Table 1 and Table 2 respectively.

Total number of eggs laid by *Callosobruchus chinensis* (L.) on different host plants

The eggs were oval, transparent, smooth and shiny in appearance. But in due course of time the eggs turned white due to accumulation of frass inside the egg shell. The eggs were glued firmly to the pod surface. It is evident from the table 1 that the total number of eggs laid ranged from 8.50 to 17.50 and a significant difference was observed among the four host plants. The minimum number of eggs laid were in black gram pods (8.50) and the maximum number of eggs laid were in green gram pods (17.50) followed by chickpea pods (14.33) and cowpea pods (11.50). These results are in conformity with Nandini and Ashokan, 2013 [10] who reported that *Callosobruchus maculatus* (F.) preferred pods of green gram over blackgram to lay eggs. The results are also in agreement with Bhaduria and Jakhmola, 2006 [3] who reported that black gram seeds were less preferred for oviposition. Qazi, 2007 [11] reported that highest number of eggs was laid on green gram followed by chickpea, black gram and cowpea. But Hosamanni, 2016 [9] reported that the highest number of eggs laid by *C. chinensis* (L.) was on the seeds of cowpea (110.33) followed by green gram (103), chickpea (90) and black gram (75.33). Shivanna *et al.*, 2011 [15] reported that cowpea and green gram was the most preferred host for *C. maculatus* (F.). These variations may result from the pod physical parameters like trichomes and pod texture.

Percentage of hatching on the pods of different host plants of *Callosobruchus chinensis* (L.)

It is evident from the table 1 that the maximum hatchability percentage was in green gram pods (90.55%) and the minimum hatchability percentage was in cowpea pods (81.80%) which are in conformity with the findings of Sharma *et al.*, 2016 [13] who also reported maximum hatchability percentage of *C. maculatus* (F.) in green gram seeds and minimum in cowpea seeds. Hatchability percentage in chickpea pods was found to be 86.24% and 82.86% in black gram.

Percentage of adult emergence on the pods of different host plants of *Callosobruchus chinensis* (L.)

The adult emergence was marked by the presence of a neat circular hole on the seeds as well as on the pods. The total adult emergence was maximum in green gram (79.16%) followed by cowpea (76.55%) and chickpea (75.53%). The least adult emergence was shown in black gram (64.82%). Sharma *et al.*, 2016 [13] also found that adult emergence was the least in black gram. The result are in somewhat contrary to

Hosamanni, 2016 [9] who found that adult emergence of *C. chinensis* (L.) was maximum in cowpea seeds (90.33%) followed by green gram (86%), chickpea (84.33%) and black gram (81%). The variations in the results may be due to the morphological characters of the pods which differs from that of seeds. Sharma and Thakur, 2014 [14] reported that adult emergence of *C. maculatus* (Fab.) was highest in cowpea genotypes followed by chickpea genotypes. Chakraborty *et al.*, 2014 [5] reported that cowpea seeds was the most preferred host for egg laying and had the highest adult emergence (93.23%) followed by green gram (90.61%) and black gram (71.69%). These contradictions may result from the difference in the species of *Callosobruchus*.

Growth parameters of *Callosobruchus chinensis* (L.) on the pods of different host plants

Reproductive success of *Callosobruchus chinensis* (L.) on different host plants

The data on reproductive success of *C. chinensis* (L.) on the four host plants has been depicted in the table 2. It was seen that the maximum reproductive success was achieved on the green gram pods (65.52%) followed by cowpea pods (55.91%). The lowest reproductive success was in the black gram pods (42.32%). The reproductive success in chickpea was 54.56% and a significant difference was seen among the four host plants. The results are in conformity to that of Shivanna *et al.*, 2011 [15] who found that green gram had the highest adult survival while black gram the least.

Total developmental period of *Callosobruchus chinensis* (L.) on different host plants

The total developmental period was calculated as the period between oviposition to the first day of adult emergence. As evident from table 2, the total developmental period of *C. chinensis* (L.) on the four host plants ranged from 28.13 days to 33.12 days. A significant difference was seen in the total developmental period of *C. chinensis* (L.) on the four host plants. The maximum developmental period was shown in black gram (33.12) followed by chickpea (32.12). The least developmental period was in cowpea with a mean developmental period of 28.13 days. The mean developmental period in green gram was 31.05 days. These findings are in agreement with that of Hosamanni, 2016 [9]. Shivanna *et al.*, 2011 [15] also found that the maximum developmental period was in black gram (32.67) followed by chickpea (31.33), green gram (29.67) and the least in cowpea (29.33). Sharma *et al.*, 2016 [13] also found that the maximum developmental period was in black gram followed by chickpea, green gram and cowpea. Bajya, 2009 [2] also reported that minimum developmental period was in the seeds of cowpea and maximum in black gram.

Growth index of *callosobruchus chinensis* (L.) on different host plants

The growth and development of the insect on the four different host plant was determined on the basis of Growth Index. The developmental suitability of the genotype is based on Growth Index, which is used as a criterion for comparing the growth responses of insects to different plants (Saxena, 1969) [12]. The Growth Index significantly differed from each other and it is evident from the table 2 that the maximum Growth Index was exhibited on cowpea (2.73) followed by green gram (2.56). The minimum Growth Index was on black gram (1.96). The growth index on chickpea was 2.35. Sharma

and Thakur (2014) [13, 14] also found that the Growth Index of *C. maculatus* (F.) on cowpea was 2.08-3.04 and 1.29-2.03 in chickpea. Chakraborty et.al. (2014) also found that the Growth Index of *C. chinensis* (L.) on green gram was 0.87-2.47. Thus from the present findings, cowpea was found to be

the most susceptible host for infestation by *C. chinensis* (L.) followed by green gram, chickpea and black gram. The results are in conformity with that of Bajiya, 2009 [2] who also found that cowpea was the most susceptible host followed by green gram, chickpea and black gram

Table 1: Ovipositional parameters of *Callosobruchus chinensis* (L.) on the pods of its host plants

Treatments	Number of eggs laid/4 pods	Percentage of egg hatching	Percentage of adult emergence inside the pod	Percentage of adult emergence outside the pod	Percentage of total adult emergence
Greengram	17.50	90.55 (72.26)	42.45 (40.65)	36.71 (37.25)	79.16(62.83)
Blackgram	8.50	82.86 (65.83)	35.72 (36.70)	29.10 (32.57)	64.82(53.62)
Chickpea	14.33	86.24 (68.43)	38.99 (38.63)	36.54 (37.10)	75.53(60.35)
Cowpea	11.50	81.80 (64.78)	44.26 (41.70)	32.29 (34.17)	76.55(61.03)
S.Ed±	1.22	2.01	0.53	3.01	0.56
CD (P=0.05)	2.55	4.19	1.12	NS	1.18

NS = Non significant, Data represent mean of 6 replications each with 4 observations, Figures within parentheses are transformed angular values

Table 2: Growth parameters of *Callosobruchus chinensis* (L.) on the pods of different host plants

Treatments	Percentage of reproductive success	Total developmental period (Days)	Growth index
Greengram	65.52 (54.04)	31.05	2.56
Blackgram	42.32 (40.58)	33.12	1.96
Chickpea	54.56 (47.61)	32.12	2.35
Cowpea	55.91 (48.38)	28.13	2.73
SEd (±)	3.81	0.38	0.14
CD (P=0.05)	7.96	0.81	0.31

Data are mean of 6 replications with 4 pods each. Figures within parentheses are transformed angular values

Conclusion

The egg laying behaviour of *C. chinensis* (L.) showed that green gram was the most preferred host followed by chickpea and cowpea. Black gram was the least preferred host for oviposition. This might be due to the trichomes present on the pods of blackgram. While data on Growth Index shows that cowpea is the most suitable host for development of the pest making it susceptible for infestation. However these findings can be further studied to make a proper management programme of the pest by considering both the chemical aspect as well as morphological aspects of the pods of host plants.

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