

Studies on Adult Longevity of *Callosobruchus chinensis* (L.) Developing in Different Pulses

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Abstract

Adult longevity for mated and unmated individuals of *Callosobruchus chinensis* L. (both male and female) was studied separately with adults emerging from nine different pulses at both controlled temperature ($28\pm 2^{\circ}\text{C}$) and room temperature ($23.8\text{--}31.5^{\circ}\text{C}$) in the laboratory. Further, the longevity for mated females was also studied separately providing food for oviposition and without providing food for oviposition. At both controlled and room temperature, the males developing in green gram and chickpea (*deshi*) had the longest average longevity (11.83 and 11.33 days, respectively), while the males developing in soybean had the shortest average longevity (7.50 and 7.00 days, respectively). Similarly, at both controlled and room temperature, the females developing in green gram and chickpea (*deshi*) had the longest average longevity (10.00 and 9.56 days, respectively), while the females developing in soybean had the shortest average longevity (6.56 and 6.11 days, respectively). The unmated males lived longer (avg. 11.24 days) than mated ones (avg. 8.79 days). The longevity for mated female increased when they were provided food for oviposition as compared to those without providing food for oviposition. The unmated females lived longer (avg. 9.83 days) than mated females with food and without food (avg. 8.04 and 7.69 days, respectively).

1. Introduction

Callosobruchus chinensis (L.) (Coleoptera: Bruchidae) is a serious pest of stored pulses which is widely distributed throughout the tropical and sub-tropical area (Giga and Smith, 1983). This species is very commonly found to infest stored pulses like green gram, lentil, cowpea, chickpea, pigeon pea, pea etc. Substantial work has been done on biology of *C. chinensis* and its differential preference for various host pulses (Chavan et al., 1997; Pandey and Singh, 1997; Singh and Kumari, 2000; Singh and Borah, 2001; Patel et al., 2003; Meghwal and Singh, 2005; Jha et al., 2009). The effect of different hosts on the oviposition, growth and development of this pest has been extensively investigated. However, the information regarding longevity of adult *C. chinensis* developing in different pulses in different conditions like mated adult (with food and without food) and unmated adult are very scanty. Hence, the present investigation was carried out to study the longevity of the pest developing from eleven different pulses in different conditions.

2. Materials and Methods

Laboratory experiments were conducted at both controlled temperature of $28\pm 2^{\circ}\text{C}$ in a BOD incubator and room temperature ($23.8\text{--}31.5^{\circ}\text{C}$) in the laboratory, Department of Entomology, School of Agricultural Sciences and Rural Development, Nagaland University, Medziphema, Nagaland during July-August of 2005-2006. Stock culture of the experimental insect, *C. chinensis* was maintained on green gram seeds at room temperature of $9.1\text{--}31.5^{\circ}\text{C}$ and relative humidity of 70.9-92.6%. Eleven commonly used pulses viz., green gram, black gram, lentil, chickpea (*deshi*), chickpea (*kabuli*), French bean, pea, pigeon pea, cowpea, soybean and rice bean were obtained from the local market. These were heated in an oven at 60°C for 1 hr to eliminate any hidden insect infestation before use. All the experiments were replicated thrice.

To study the adult longevity of *C. chinensis*, 10 g seeds of each pulse were taken in $7.5 \times 2.5 \text{ cm}^2$ glass vials covered with muslin cloth. Into each vial 4 pairs of mated adults were released. After 10 days all the adults were removed from the

vials and observed regularly for first emergence of adult. The average longevity for mated and unmated individuals (both male and female) was studied separately with adults emerging from different pulses. Further, the longevity for mated females was studied separately providing food for oviposition and without providing food for oviposition.

2.1. Longevity for mated adult (with food)

For this purpose, one mated pair of freshly emerged adults from each host pulse was kept in glass vials containing 100 healthy seeds of green gram and their mouth tied with muslin cloth. The vials were observed regularly for death of any insect. The experiment was replicated thrice in the CRD. The adult longevity (both male and female) was recorded for each vial, the data were analysed statistically and the means were compared by DMRT.

2.2. Longevity for mated adult (without food)

Similar experiment was conducted as above, except there were no green gram seeds (food) in the vials for oviposition.

2.3. Longevity for unmated adult

To test longevity for unmated adult, one male and one female was collected from each vial containing different pulses on the day of emergence and was kept separately in empty glass vials with their mouth tied with muslin cloth. The vials were observed regularly for death of any insect. The experiment was replicated thrice in the CRD. The adult longevity (both male and female) was recorded for each vial, the data were analysed statistically and the means were compared by DMRT.

2.4. Comparison of longevity for mated and unmated adult of *C. chinensis*

The longevity for mated and unmated adult (both male and female) of *C. chinensis* developing in different pulses were compared by paired 't' test. Further comparison was also made between longevity for mated female provided food for oviposition and without food for oviposition.

3. Results and Discussion

Adult emergence of *C. chinensis* was not observed in black gram and French bean. The data pertaining to the variations in the longevity for mated and unmated adult of the insect developing in the remaining nine different pulses are presented in Table 1.

3.1. Longevity for mated male

At controlled temperature, the mated male developing in green gram lived for the longest (10.33 days) duration, but it did not differ significantly from chickpea (*deshi*) (10.00 days),

chickpea (*kabuli*) (9.67 days), lentil (9.33 days), rice bean (9.33 days) and pigeon pea (9.00 days). The shortest longevity recorded in soybean (7.00 days) differed significantly from rest of the pulses. Further, pea and cowpea recorded almost similar longevity of 8.33 and 8.67 days, respectively. At room temperature also, it varied from 6.33 to 9.67 days, being the longest in green gram and the shortest in soybean.

3.2. Longevity for unmated male

At controlled temperature, the longevity for unmated male was the longest in chickpea (*deshi*) (13.67 days) followed by green gram (13.33 days), chickpea (*kabuli*) (13.00 days) and rice bean (11.67 days) having non-significant variation among them. The shortest longevity recorded in soybean (8.00 days) differed significantly from rest of the pulses. The remaining pulses exhibited statistically similar longevity of 10.00 to 11.33 days. Similarly at room temperature, it varied from 7.67 to 13.33 days, being the longest in chickpea (*deshi*) and the shortest in soybean.

3.3. Longevity for mated female with food

At controlled temperature, the longest longevity for mated female with food was recorded in green gram (9.33 days) which did not differ significantly from chickpea (*deshi*) (9.00 days), chickpea (*kabuli*) (9.00 days), pigeon pea (8.67 days), rice bean (8.67 days), cow pea (8.33 days) and lentil (8.00 days). The shortest longevity was recorded in soybean (6.67 days) followed by pea (7.33 days) which were also at par with each other. A similar trend on longevity for mated female with food was also found at room temperature which varied from 6.00 to 8.67 days.

3.4. Longevity for mated female without food

Among all the pulses, green gram recorded the longest duration (9.00 days) for mated female without food at controlled temperature. However, it did not differ significantly from rest of the pulses, except soybean and pea which recorded significantly shorter longevity of 6.00 and 7.00 days, respectively. Further these two hosts were at par with each other. In the same way, it varied from 5.67 to 8.67 days, being the shortest in soybean and the longest in green gram among the different pulses at room temperature.

3.5. Longevity for unmated female

The unmated female developing in chickpea (*deshi*) lived for the longest (12.33 days) duration followed by chickpea (*kabuli*) (12.00 days) and green gram (11.67 days) having no significant variation among them at controlled temperature. The shortest longevity recorded in soybean (7.00 days) differed significantly from rest of the pulses except pea (8.33 days). In the remaining pulses, the longevity varied from 9.33

Table 1: Variation in longevity for mated and unmated adult of *C. chinensis* in different pulses

Pulses	Longevity of male (days)						Longevity of female (days)							
	Mated		Unmated		Average		Mated with food		Mated without food		Unmated		Average	
	CT	RM	CT	RM	CT	RM	CT	RM	CT	RM	CT	RM	CT	RM
Green gram	10.33 ^a	9.67 ^a	13.33 ^a	13.00 ^a	11.83	11.33	9.33 ^a	8.67 ^a	9.00 ^a	8.67 ^a	11.67 ^{ab}	11.33 ^a	10.00	9.56
Lentil	9.33 ^a	9.00 ^{ab}	11.00 ^b	10.67 ^c	10.16	9.83	8.00 ^{ab}	7.67 ^{ab}	8.00 ^a	7.67 ^{ab}	9.67 ^c	9.33 ^b	8.56	8.22
Chick-pea (deshi)	10.00 ^a	9.33 ^a	13.67 ^a	13.33 ^a	11.83	11.33	9.00 ^a	8.33 ^a	8.67 ^a	8.33 ^a	12.33 ^a	12.00 ^a	10.00	9.56
Chick-pea (kabuli)	9.67 ^a	9.33 ^a	13.00 ^a	12.67 ^{ab}	11.33	11.00	9.00 ^a	8.67 ^a	8.33 ^a	8.00 ^a	12.00 ^a	11.67 ^a	9.78	9.45
Pea	8.33 ^b	7.67 ^c	10.00 ^b	9.67 ^c	9.16	8.67	7.33 ^b	6.67 ^{bc}	7.00 ^{bc}	6.67 ^{bc}	8.33 ^{cd}	8.00 ^{cd}	7.55	7.11
Pigeon pea	9.00 ^{ab}	8.33 ^b	11.33 ^b	11.00 ^c	10.16	9.66	8.67 ^a	8.00 ^a	8.00 ^a	7.67 ^{ab}	10.00 ^{bc}	9.67 ^b	8.89	8.45
Cow pea	8.67 ^b	8.00 ^{bc}	10.67 ^b	10.33 ^c	9.67	9.16	8.33 ^a	7.67 ^{ab}	7.67 ^{ab}	7.33 ^b	9.33 ^c	9.00 ^{bc}	8.44	8.00
Soy-bean	7.00 ^c	6.33 ^d	8.00 ^c	7.67 ^d	7.50	7.00	6.67 ^b	6.00 ^c	6.00 ^c	5.67 ^c	7.00 ^d	6.67 ^d	6.56	6.11
Rice bean	9.33 ^a	9.00 ^{ab}	11.67 ^{ab}	11.33 ^{bc}	10.50	10.16	8.67 ^a	8.00 ^a	8.00 ^a	7.67 ^{ab}	9.67 ^c	9.33 ^b	8.78	8.33
SEm±	0.43	0.38	0.66	0.52	-	-	0.47	0.43	0.47	0.37	0.64	0.51	-	-

CT- At controlled temperature of 28±2 °C; RM- At room temperature; Within in a column, means followed by the same letter are not significantly different at the 0.05 level of probability by Duncan's Multiple Range Test (DMRT)

to 10.00 days which were at par with each other. Similarly at room temperature, it varied from 6.67 to 12.00 days among the different pulses.

3.6. Average longevity

In the present investigation, the average male longevity of *C. chinensis* developing in different pulses was found within the range of 7.50 to 11.83 days at controlled temperature and 7.00 to 11.33 days at room temperature, where as the average female longevity was found within the range of 6.56 to 10.00 days at controlled temperature and 6.11 to 9.56 days at room temperature. The maximum adult longevity was observed in case of green gram and chickpea (*deshi*), while the minimum was found in case of soybean. The variation in the mean adult longevity of *C. chinensis* developing in different pulses was also reported by Sharma (1999), being the maximum in case of chickpea (*deshi*) and green gram (15.22 and 15.11 days, respectively) and the minimum in case of pea (9.66 days).

Further, the adult longevity (both male and female) at controlled temperature was slightly higher than those at room temperature indicating the influence of temperature. This

might be due to fluctuation of temperature at room condition. The effect of temperature on female longevity was reported by Giga and Smith (1983). They found that the average longevity of female *C. chinensis* at 25°C was 7.3 days, whereas at 35°C it was 4.8 days only.

3.7. Comparison of longevity for mated and unmated adult of *C. chinensis*

The comparisons of longevity for mated and unmated adult of *C. chinensis* developing in the nine different pulses are presented in Table 2. The paired 't' test of longevity showed significantly higher values for unmated males than mated ones. On an average the unmated males lived for 11.24 days, while the mated males lived for 8.79 days. Similarly, the unmated females also lived longer than mated females. Further the longevity for mated females increased significantly when they were provided food for oviposition as compared to those without providing food for oviposition. The average longevity for unmated female was 9.83 days as against 8.04 days for mated female with food and 7.69 days for mated females without food. No comparison with earlier workers

Table 2: Comparison of longevity for mated and unmated adult of *C. chinensis* in different pulses

Pulses	*Longevity of male (days)		*Longevity of female (days)					
	Mated	Unmated	Mated with food	Mated without food	Mated with food	Unmated	Mated without food	Unmated
Green gram	10.00	13.16	9.00	8.83	9.00	11.50	8.83	11.50
Lentil	9.16	10.83	7.83	7.83	7.83	9.50	7.83	9.50
Chickpea (deshi)	9.66	13.50	8.66	8.50	8.66	12.16	8.50	12.16
Chickpea (kabuli)	9.50	12.83	8.83	8.16	8.83	11.83	8.16	11.83
Pea	8.00	9.83	7.00	6.83	7.00	8.16	6.83	8.16
Pigeon pea	8.66	11.16	8.33	7.83	8.33	9.83	7.83	9.83
Cow pea	8.33	10.50	8.00	7.50	8.00	9.16	7.50	9.16
Soybean	6.66	7.83	6.33	5.83	6.33	6.83	5.83	6.83
Rice bean	9.16	11.50	8.33	7.83	8.33	9.50	7.83	9.50
Mean	8.79	11.24	8.04	7.69	8.04	9.83	7.69	9.83
't' calculated	**8.52		**4.62		**5.44		**6.61	

*Average of controlled and room temperature; **Significant at 1% probability level

could be made in support of the present findings due to scanty of literatures.

4. Conclusion

Differential adult longevity of *C. chinensis* developing in different pulse seeds indicates the host suitability of the pest. Based on this parameter, green gram and chickpea (*deshi*) was the best preferred host, while soybean was preferred the least. Further the results of the present investigations revealed the information regarding longevity of adult developing in different pulses in different conditions like mated (with food and without food) and unmated.

5. References

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