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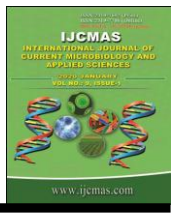

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Biology and Predatory Potential of *Coccinella septempunctata* Linn. on *Aphis craccivora* under Controlled Condition

Ipsita Mishra*, B. K. Sontakke and B. K. Mishra

Department of Entomology, College of Agriculture, Odisha University of Agriculture and Technolgy, Bhubaneswar, Odisha, India

**Corresponding author*

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A B S T R A C T

Biology and feeding potential of *Coccinella septempunctata* was studied in the laboratory condition during 2013 in different months pertaining to different temperature regimes on Cowpea aphid, *Aphis craccivora*. During the cooler months of January and November, the life stages are prolonged and in the warmer months of March and May the life stages are shorter for the coccinellid. In January, when the mean temperature was 21.7ºC, the total developmental period from egg to adult stage, took 22.4±0.67 days whereas, in May, at 32.7ºC, the total developmental periods was 15.2±0.01days, again when temperature increased in September, the total developmental periods increased to 16.7±0.64 days. Similar trends were observed in fecundity and egg viability. During the larval stage, the beetle consumed 582.2±39.19 aphids whereas, the male and female consumed 1575.2±80.33 and 1589.3±68.17 aphids respectively.

Introduction

Cowpea (*Vigna unguiculata* Linn.) is one of the most important legume crop, also known as Lobia, belonging to family Leguminaceae. It is used as a green legume, fodder, vegetable as well as green manure crop. It is an important source of energy, minerals, vitamins and roughages. The aphid, *A. craccivora* Koch, causes considerable damage to the crop and is reported as one of the important, major and economic pests of cowpea (El-Ghareeb *et al.*, 2002). Choudhary *et al.*, (2017) reported that the cowpea aphid, *Aphis craccivora* Koch is the most serious pest of this crop, causing 20-40 percent yield loss. The aphid causes both qualitative and quantitative losses in the seed yield and crop production by nutrient drain which cause direct reduction of plant productivity, transmission of viruses, phytotoxicity as a result of saliva toxins and excretion of honeydew leading to the development of black sooty mold and leaf shedding (Kotadia

and Bhalani, 1992). A number of insecticides have so far being recommended to control this pest but consequences of these insecticides lead to the development of resistance, resurgence and do not ensure safety to non target organisms (Patel *et al.,* 1998; Sonkar and Desai, 1998). Shukla *et al.,* (1990) reported that, the bio-control agents like coccinellids, chrysopids and syrphids were effective for controlling the aphid, *Lipaphis erysinri* (Kalt.). The ladybird beetle, *Coccinella septempunctata* Linn. (Coccinellidae: Coleoptera) is well known and diverse group of predatory beetle feeding on soft bodied insect pests. It is found in many habitats, including fields, gardens, forests, sea coast, mountains and cities (Ali and Rizvi, 2009). Seven-spotted ladybird beetles are predaceous on various types of aphids like rose aphid, green peach aphid, green bug aphid and green mustard aphid (Shepard, 1998).Therefore, present study was conducted to investigate the biological parameters and predatory potential of *C.septempunctata* on *A.craccivora* under controlled condition

Materials and Methods

The aphid, *A. craccivora* was reared in the laboratory for maintaining uninterrupted supply to the different life stages of the predator *C. septempunctata* of throughout the period of study. Stock culture of *A. craccivora* was maintained on cowpea seedlings. Good quality seeds of cowpea (*Vigna sinensis*) were soaked for 24 hrs. The seeds were sown in plastic glasses of 8 cm x 4 cm. When the seedlings were at 2 leaves stage, gravid aphids from the stock culture were released at the leaf axils of each seedling. The seedlings, such inoculated with aphids along with the plastic glass were kept inside a plastic jar (30 cm x 10 cm), the mouth of which was closed with muslin cloth .A series of such jars were maintained throughout the study period. In about one week, the internodes and leaf petioles became full with aphid colonies. Adults of *Coccinella septempunctata* collected from the field and were released on the infested cowpea seedlings in the laboratory @ 10 beetles/ jar and were observed for presence of males and females. Five mated females were released in the jar containing aphid infested seedlings, for egg laying. Next day, the beetles were removed to separate jars and the previous jars were examined for eggs. Eggs were usually laid on under surface of leaves and sometimes on inner wall of the jars. Eggs were removed carefully along with the leaves and were kept in petridishes for hatching. Ten freshly laid eggs were separated out and kept in petridishes (10 cm x 1.5 cm) for hatching and further rearing. Thirty replications were maintained. The early instar grubs were provided with early instar nymphs of *A. craccivora* on cowpea twigs. Each grub was provided with sufficient number of aphids every 24 hours, after removing it to a new petridish, so that there was no dearth of food. Observations were recorded on the duration of different instars. This procedure was followed till the lady bird grubs pupated. Developmental period of different stages and measurement of egg and larval instars were recorded. Ten prepupa of each species were separated out and kept in petridishes. Thirty replications were maintained. Prepupal and pupal periods of each species and their measurements were recorded.

Ten freshly emerged adult mating pairs of each species were removed from the stock culture and were reared individually in petridishes on *A craccivora.* Fresh cowpea twigs were provided inside the petridish for egg laying. Eggs laid every day were calculated. This was also replicated 30 times. Observations on fecundity, longevity of females and male coccinellid beetles were also recorded. The biology of all the species

of lady birds was studied during the months of January, March, May, July, September and November during 2013 and January, March, May, July, September and October month of 2014, pertaining to different climatic regimes of the year in the laboratory. In case of natural death of any individual in the experimental stages, the same was replaced with an individual of the same age simultaneously maintained in the stock culture of lady birds.

Results and Discussion

Duration of different life stages of *C.septempunctata* is depicted in Table 1.The eggs were laid in clusters of 4-8 adhered to each other. The egg period lasted for 2.1±0.13 days in May to 5.5±0.13 days in January during 2013.There were four larval instars. The average duration of the first, second, third and fourth instars were 1.2±0.01-2.3±0.11, 1.1±0.02-2.0±0.00, 3.0±0.01-3.6±0.31, 3.9±0.00-3.7±0.41 days during the month of May to January 2013. The total larval period varied from 8.2+0.07 to 11.9±2.34 days during 2013. The pre-pupal and pupal period varied from 1.0±0.00-1.9±0.01 and 3.8±0.01-6.2+1.37days during 2013. The longevity of male and female during 2013 was 26.3±0.43-38.2±2.91, 32.7±0.07-44.2±1.9 days.

The fecundity per female was 220.6±13.2-487.6±11.23 eggs during 2013 in different months of the year. It was observed that during the cooler months of January and November, the life stages are prolonged and in the warmer months of March and May the life stages are shorter for the coccinellid. In the month of January, when the mean temperature was 21.7^{O}C, the total developmental period, *i.e*., from egg to adult stage, took 22.4±0.67 days in *C.septempunctata*, When temperature increased in May (Mean temperature 32.7^{O}C) the total developmental periods was 15.2±0.01days, Again when temperature increased in September, the total developmental periods increased to 16.7±0.64 days, Adult longevity also exhibited the same trend, *i.e*., lower temperature contributed to longer life periods and higher temperature resulted in lower life periods. At 21.7^{O}C, the adult males and females of *C.septempunctata* lived for 38.2 and 44.2 days respectively. At 32.7ºC, in May the adult males and females of the three coccinellids lived for 26.3 and 32.7 days. Temperature again decreased in November and it was evidenced from the results that the adults lived for longer time. In their study on the biology of *C.septempunctata*, Rauf *et al.*, (2013) reported that with increasing temperature, developmental duration decreases significantly. Our findings are in conformity to the above authors. The fecundity also indicated the same trend, more eggs being laid in cooler months of November and January and less eggs being laid in warmer months of March and May. Similarly, more eggs were viable in the cooler months than in the warmer months. Krengel *et al.*, (2012), in their study on *C.septempunctata* feeding on the grain aphid *Sitobion avenae* found that compared to the normal temperatures, elevated temperatures resulted in significant decrease of the life stages of the coccinellid. Our observation is in agreement to their observation. Balikai *et al.,* (2000) and Shukla and Jadav (2014) have recorded similar observations on different coccinellid beetles.

The rate of consumption of aphids by the larval instars and adults are given in the Table2. During their development, the first, second, third and fourth instar grubs consumed 42.1±3.35, 62.2±13.36, 159.5±24.93, 258.2±27.25 aphids respectively. The mean consumption during the entire larval period was 582.2±39.19 aphids per grub. The different feeding potentiality may be attributed to the different host species of the predator.

Table.1 Duration of life stages of *C. septempunctata* on *A. craccivora*

Stage of development	*Developmental period in days (Mean±S.E.)					
	Jan. (21.2^{O}C)	**Mar.**(28.3^{O}C)	**May**(32.7^{O}C)	**July**(27.6^{O}C)	**Sept.**(29.2^{O}C)	**Nov.**(25.3^{O}C)
Egg	5.5±0.13	4.9±0.37	2.1±0.13	3.1±0.19	2.7±0.31	3.2±0.53
Grub						
I instar	2.3±0.11	1.8±0.01	1.2±0.01	2.6±0.06	2.7±0.32	2.1±0.31
II instar	2.0±0.00	1.8±0.03	1.1±0.02	2.5±0.02	1.6±0.07	2.0±0.00
III instar	3.6±0.31	3.1±0.03	3.0±0.01	3.9±0.43	1.9±0.04	3.4±0.19
IV instar	3.7±0.41	3.2±0.17	3.9±0.00	2.4±0.19	3.0±0.00	3.6±0.04
Total larval period	11.9±2.34	10.8±0.94	8.2±0.07	11.9±1.36	10.6±0.32	11.0±0.00
Pre-pupa	1.9±0.01	1.4±0.06	1.0±0.00	1.7±0.03	1.3±0.23	1.2±0.07
Pupa	6.2±1.37	4.7±0.03	3.8±0.01	4.9±0.09	4.3±0.31	3.1±0.98
Total Development	22.4±0.67	20.1±0.21	15.2±0.01	17.3±0.09	16.7±0.64	17.5±0.34
Adult male	38.2±2.91	35.2±0.91	26.3±0.43	36.4±1.43	34.8±0.09	37.3±1.86
Adult female	44.2±1.9	40.2±3.2	32.7±0.07	41.9±0.97	39.9±0.87	43.4±2.7
Fecundity	487.6±19.6	442.1±16.3	320.6±16.7	467.7±18.8	420.7±12.6	480.2±15.8
Egg Viability	96.7±6.9	86.6±5.3	78.2±4.9	91.1±6.2	87.9±5.6	94.2±6.1

Table.2 Consumption of aphids (*A. craccivora*) by *Coccinella septempunctata* (Linn.) under laboratory condition

Stage of the insect	Duration of the stage (Mean±S.E.)	*Average number of aphids consumed per day per individual (Mean±S.E.)	*Average number of aphids consumed per stage per individual (Mean ± S.E.)
I instar	2.4±0.31	13.3±2.39	42.1±3.35
II instar	2.01±0.10	29.7±7.01	62.2±13.36
III instar	2.21±0.42	35.2±4.08	159.5±24.93
IV instar	2.22±0.13	49.7±5.10	258.2±27.25
I-IV instar	9.25±0.03	59.5±5.23	582.2±39.19
Adult male	16.2±0.58	115.4±12.71	1575.2±80.33
Adult female	27.3±0.02	121.5±7.31	1589.3±68.17
Total life period		165.30±19.25	2628.5±167.13

The mean daily consumption of first, second, third and fourth larval instars was 13.3±2.39, 29.7±7.01, 35.2±4.08, 49.7±5.10 aphids of *A. craccivora*. The mean daily consumption of adult males was 115.4±12.71 whereas those of the females were 121.5±7.31 aphids. Earlier workers have similar observations on the feeding potentiality of *C.septempunctata* (Khursheed, *et al.*, 2006; Mishra and Kanwat, 2017).

References

Ali, A. and P.Q. Rizvi (2009). Age and stage specific life-table of Coccinella transversalis with regards to various temperatures. *Tunisian J. Plant Prot*., 4(1): 211- 219.

Balikai, R. A. 2000. Activity of Coccinellid predator and its hyperparasitoid in rabi sorghum ecosystem of Northern Karnataka. *Agricultural Science Digest*, 20(2): 118-119.

Choudhary, A. L., A. Hussain, M. D. Choudhary, R. Samota and S. Jat. (2017) Bioefficacy of newer insecticides against aphid, Aphis craccivora Koch on cowpea. *Journal of Pharmacognosy and Phytochemistry*, 6: 1788-1792.

El-Ghareeb, A. M., M. A. K. Nasser, A. M. K. El-Sayed and G. A. Mohamed. (2002) Possible mechanisms of insecticide resistance in the cowpea aphid *Aphis craccivora* Koch, the role of general estrase and oxidase enzymes in insecticide resistance of cowpea aphid. Nepal's First Conference on Agriculture: 635-649.

Khursheed, R, Hussain, B, Ahmad, S.B and Ashraf, M. (2006) Biology and Feeding Potential of *Coccinella septumpunctata* on Mustard Aphid, *Lipaphis erysimi*. *International Journal of Zoological Research* 2(1): 30-33, 2006

Kotadia, V.S. and P.A. Bhalani (1992) Residual toxicity of some insecticides against *Aphis craccivora* Koch on cowpea crop. *Gujarat Agricultural University Research Journal*, 17: 161-164

Mishra, S.K. and Kanwat, P.M. (2017). Biology and predatory potential of *Coccinella septempunctata* Linn. on *Lipaphis erysimi* Kalt. Under controlled conditions. *Plant Archives*17 (2) 1099-1104

Patel, N.C., J.J. Patel and J.R. Patel, 1998. Bioefficacy of some new insecticides against mustard aphid *Lipahis erysimi*

(Kaltenbach) infesting cabbage. *Indian J. Entomol*., 60: 100-101.

Rauf M, Haq E.U, Khan J, Rehman A, Gillani W.A and Ali A (2013).Biology and predatory potential of *Coccinella septempunctata* Linn. On *Schizaphis graminum* aphid under controlled condition. *Pakistan J. Agric. Res.* 26 (2).

Shepard, B.M. (1998). Insects and their natural enemies associated with vegetables and soybean in Southeast Asia. Quality Printing Co. Orangeburg, South Carolina, U.S.A.p. 22-24.

Shukla, A and Jadav, D.S. (2014) Bio ecology of *Coccinella transversalis* (Fab.) on different aphid species. *The bioscan*.9(1):17-22

Singh, C.P. and G.C.Sachan, 1994. Assessment of yield losses in yellow sarson due to the mustard aphid *Lipahis erysimi* (Kaltenbach). *J. Oilseed Res*., 11: 179-184.

Sonkar, U.B. and B.P. Desai, 1998. Bioefficacy of some insecticides against *Lipaphis erysimi* (Kaltenbach) on mustard and their toxicity on ladybird beetle. *Shashpa*, 5: 233-234.

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