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Prey requirement for the biology of *Coccinella septempunctata* (Linn.) on cabbage aphid, *Brevicoryne brassicae* (L.) under laboratory condition

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Abstract

Biology and preying potential of *C. septempunctata* (Linn.) on *B. brassicae* (Linn.) were carried out in Entomological laboratory of T.D.P.G. College, Jaunpur (Uttar Pradesh) in during the year 2020-2021. It was observed that, incubation period, grub period of four instar, pupal period was 3.6 ± 0.44 , 15.8 ± 1.64 , 5.4 ± 0.54 days, respectively. Longevity of female ranged from 42-45 days and male ranged from 33-37 days. The aphids consumption of adult female of *C. septempunctata* increased up to (56.6 aphids/day) with increased densities of test prey. Followed by IVth instar larvae (34.7 aphids/day), adult male (31.4 aphids/day), IIIrd instar larval grub (21.4 aphids/day), second instar (10.8 aphids) and first instar larval grub is (4.2 aphids/day). In During of whole life the four instar of grub, the beetle consumed 268.8 ± 18.8 aphids whereas adult male and female consumed the 1251.50 ± 55.28 , 2398.25 ± 78.42 aphids, respectively. *C. septempunctata* consumed 2093.80 aphids during its total life period from grub to adult.

Keywords: *Coccinella septempunctata*, *Brevicoryne brassicae*, biology, preying potential

Introduction

Coccinella septempunctata is major predatory group of insect which is belongs to the order Coleoptera and family is Coccinellini. They also feed the soft bodied insects like as white flies, aphids and mealy bugs (Prajapati *et al.*, 2022) ^[1]. The ladybird beetle, *Coccinella septempunctata* Linn. (Coccinellidae: Coleoptera) is well known as diverse group of predator beetle feeding on soft bodied insects. It is found in many habitats, including fields, gardens, forests, sea coast, mountain and cities (Ali and Rizvi, 2009, Kundoo and Khan 2017, Dixon 2000 and Khan *et al.* 2009) ^[2, 1, 4, 5, 6]. In the present study complete biology of *Coccinella septempunctata* was studied on Cabbage aphids (*Brevicoryne brassicae*) under laboratory condition. The cabbage aphids, *Brevicoryne brassicae* (Linn.) is one of the most important insect pest of the family Aphididae. They grayish green with waxy covering appearance, and they have one pair of tube like structure (Siphunculi) which is presented on the abdominal region. Adults are present in both wingless and winged form. However, wingless females producing live young (nymphs) are the most common. It is one of the most serious sucking pests of *brassica* plants. The aphid infestation not only deteriorates the quality of the crop, but also decreases the yields. Chaudhary *et al.*, (2017) ^[3] reported that the cowpea aphid, *Aphis craccivora* Koch is the most serious pest of crops causes 20-40 percent yield losses. Direct injury results in loss of plant vigor and stunted growth and indirectly the honey dew excreted by the aphids and sooty mould hinder the growth of the plants.

Materials and Methods

Studies on the biology of *C. septempunctata* on *B. brassicae* were conducted in the laboratory, Department of Entomology Tilak Dhari PG College, Jaunpur during year 2020-2021. Ten newly hatched grubs of *C. septempunctata* were kept individually in petridishes. Cabbage aphids were provided as host for feeding and for completion of their life stages. Emerged adults were paired and kept in different glass chimneys for further detailed life stage studies. Ten such sets were maintained. Eggs laid by the female coccinellids on leaves and surrounding area of jars were collected after 2 to 3 days with the help of fine camel hair brush and kept in petridish to minimize cannibalism among newly emerged grubs. Aphids as food were provided daily in each individual petridish until pupation. Emerged adults were collected separately and transferred to glass chimneys for mating.

Observations were recorded on the total number of instars, duration of each instar, grub period and pupal period. Longevity of male and female were also recorded. Similarly, pre-oviposition, oviposition and post oviposition period of females were also recorded. The time after emergence of adults from pupa and starting of oviposition was considered as pre-oviposition period.

Studies on the predatory potential of grubs of *Coccinella septempunctata* on *Brevicoryne brassicae*

Ten newly hatched grubs of *Coccinella septempunctata* were kept individually in petridishes. The grubs were fed separately in petridish with cabbage aphids (*B. brassicae*) and the experiment was replicated 10 times. Counted numbers of aphids were provided daily in the morning hours i.e. 10, 20, 40, 80 and 160 number of cabbage aphids for 1st, 2nd, 3rd, 4th instars grubs and adult coccinellids, respectively. The number of aphids consumed was recorded daily and new aphids were provided as per their requirement. Feeding potential of grubs were recorded on Instar wise.

Predatory potential of adult beetles of *Coccinella septempunctata* on *Brevicoryne brassicae*.

Under this experiment feeding consumption of newly hatched adult beetles starved for 24 hours, both males and females, collected from stock culture were tested for their predatory potential. Each beetle was kept separately in petridishes and provided with cabbage aphid, *B. brassicae* daily till death of

the beetles and the number of aphids consumed daily were cumulated. The experiment was replicated 10 times.

Results and Discussion

Females start egg laying after 5.6 ± 2.19 days of emergence. A single female lays 353.4 ± 8.73 eggs during oviposition period of 13.8 ± 2.86 days. The incubation period was 3.6 ± 0.44 days. The average duration of Ist instar grub, IInd instar grub, IIIrd instar grub and IVth instar grub were 2.6 ± 0.54 , 2.6 ± 0.44 , 3.4 ± 0.54 and 4.4 ± 0.54 days, respectively. Total average grub period is completed in 15.8 ± 1.64 days. (Table.1) Kumari *et al.* (2020) [7] reported the mean duration of Ist, IInd, IIIrd, IVth larval instar, total larval period and pupal period was 2.24, 3.12, 3.32, 4.10, 13.34 and 3.90 days, respectively. Similarly findings report by Kuldeep and N.N. (2014) [14] recorded the fecundity was 378.00 ± 26.51 eggs/female while ovipositional period, incubation period, larval period, pupal period, and adult longevity were 4.32 ± 0.26 , 4.50 ± 0.29 , 11.15 ± 0.50 , 5.60 ± 0.18 , and 122.93 ± 4.05 days respectively. The present observations showed that the pupal period 5.4 ± 0.54 days. The present observations are in approximation with finding of Kumar *et al.* (2012) [9], Singh and Singh (2013) [13] and Kumar *et al.* (2019) [8] who reported the pupal period of 5.00 ± 0.58 , 5.60 ± 0.18 and 5.67 ± 0.33 days, respectively. Duration of female longevity ranged from 42-45 days and with an average of 42.4 ± 1.81 days, Longevity of male ranged from 33-37 days with an average 35.2 ± 1.48 days.

Table 1: Biology of *C. septempunctata* under laboratory condition on *B. brassicae*

Biology of <i>C. septempunctata</i> under laboratory condition on Cabbage aphid (<i>B.brassicae</i>)		
Stage	Range (Days)	Duration(Mean±SD)
Egg (incubation period)	3-5	3.6 ± 0.44
Grub stage		
I st instar	2-3	2.6 ± 0.54
II nd instar	2-3	2.6 ± 0.44
III rd instar	3-4	3.4 ± 0.54
IV th instar	4-5	4.4 ± 0.54
Complete grub period	14-18	15.8 ± 1.64
Pupal period	5-6	5.4 ± 0.54
Adult Longevity		
Female	42-45	42.4 ± 1.81
Male	33-37	35.2 ± 1.48
Pre-oviposition	4-8	5.6 ± 2.19
Oviposition	10-17	13.8 ± 2.86
Post oviposition	3-5	3.8 ± 0.83
Fecundity of Female	340-362	353.4 ± 8.73

Prey requirement for the biology of *Coccinella septempunctata* on Cabage aphid *B. brassicae*

Studies on preying potential of *C. septempunctata* grubs offered 10, 20, 40, and 80, 160 *B. brassicae* revealed that the mean daily consumption of aphids by their successive instars and adult female & male as 3 to 6, 10 to 12, 18 to 25 and 35 to 42 with average of 4.2 ± 1.30 , 10.8 ± 0.83 , 21.4 ± 2.88 and 34.7 ± 2.86 , 56.1 ± 4.32 and 31.4 ± 2.19 aphids/day, respectively. The aphids consumption of adult female of *C. septempunctata* increased up to (56.1 aphids/day) with increased densities of test prey. Followed by IVth instar larvae (34.7 aphids/day), adult male (31.4aphids/day), IIIrd instar larval grub (21.4 aphids/day), second instar (10.8 aphids) and first instar larval grub is (4.2 aphids/day) (Khan, 2009) [5, 6]. In duration of whole life 3-6 days, first instar of *C. septempunctata* consumed total of 10 to 18 aphids with average of 14.4 ± 3.64 aphids mean while the IInd, IIIrd and IVth instars consumed 33-

38, 72 to 92, 160-192 with average of 35.4 ± 1.51 , 68.6 ± 31.07 and 178.6 ± 11.9 , respectively. Total no. of aphids consumption on grub stage of *C. septempunctata* was 248 to 296 aphids with average of 268.8 ± 18.8 aphids in 14-18 days of grub period. Studies on preying potentiality of *C. septempunctata* adults to provide 160 *B. brassicae* revealed that the per day consumption of aphids is 51 to 62 aphids/day with an average of 56.1 ± 4.32 and total consumption of aphids during adult period of female 42 to 45 days is 2398.25 ± 78.42 and by adult period of male 28 to 36 aphids/day with an average 31.4 ± 2.19 and total consumption of adult male during total life period 33-37 days is 1251.50 ± 55.28 . (Table.2 & fig.1) Similarly findings were reported by Varshney *et al.* (2016) [16] The adult male and female consumed 103.2 ± 1.52 and 116.6 ± 1.46 aphids per day respectively at 27 ± 2 °C in comparison to 65.6 ± 1.02 and 71.8 ± 1.60 at 23 ± 20 °C. Mishra *et al.* (2020) [10] reported that the Average no. of aphids

consumption per day by *Coccinella septempunctata* male & female 115.4, 121.5, respectively. According to Verma *et al.* (2013) [15] the predation potential of *C. septempunctata* was also observed on the aphid, *Aphis gossypii*. The first to fourth instar grubs were found to consume 37.95±8.20, 39.7±15.57, 94.10±17.27 and 262.2±88.83 aphids, respectively during their developmental period. The adult male and female beetles of *C. septempunctata* were found to consume 1490±303.4 and

1880±295.9 aphids during their life span. Similar to the present findings Kuldeep and N.N. (2014) [14] observed that the mean devouring propensity of grubs and adult was 53.11±1.46 and 86.20±1.34 aphids per day per individual, respectively. Shah and Khan (2014) [12] reported the 40-80 aphids per day per predators. Total feeding potential of *C. septempunctata* during its total life cycle of 61-65 days is 2093.80±78.27 aphids.

Table 2: Prey requirement for the biology of *Coccinella septempunctata* on Cabbage aphid *B. brassicae*

Stage	Consumption of Aphids per individual / day			Total consumed of aphids on entire life	
	Prey offered	Aphid Consumed Range	Mean±SD	Range	Mean±SD
Grub Stage					
I st instar	10	3-6	4.2±1.30	10-18	14.4±3.64
II nd instar	20	10-12	10.8±0.83	33-38	35.4±1.51
III rd instar	40	18-25	21.4±2.88	72-92	68.6±31.07
IV th instar	80	31-38	34.7±2.86	160-192	178.6±11.9
Total consumed by I-IV th Grub instar		64-85	76.6±7.82	248-296	268.8±18.8
Adult					
Female	160	51-62	56.1±4.32	2248-2456	2398.25±78.42
Male	160	28-34	31.4±2.19	1178-1325	1251.50±55.28
Total life period grub to adult					2093.80±78.27

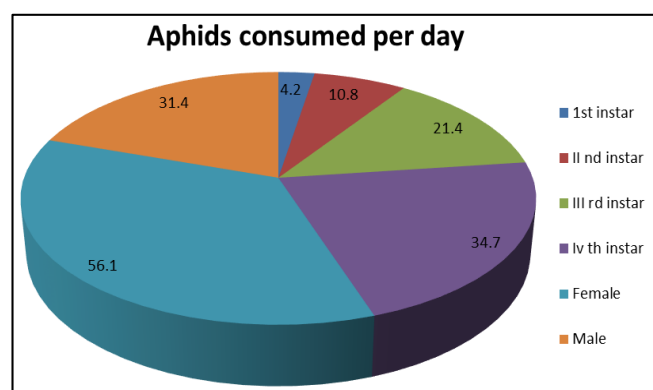


Fig 1: Preying potential of *Coccinella septempunctata* on Cabbage aphids *Brevicoryne brassicae*

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Reference

- Kundoo AA, Khan AA. Coccinellids as biological control agents of soft bodied insects: A review, Journal of Entomology and Zoology Studies. 2017;5(5):1362-1373
- Ali A, Rizvi PQ. Age and stage specific life-table of *Coccinella transversalis* with regards to various temperatures. Tunisian J Plant Proct. 2009;4(1):211-219.
- Chaudhary AL, Hussain A, Choudhary MD, Samota R, Jat S. Bio efficacy of newar insecticides against aphids, *Aphis craccivora* Koch on cowpea. Journal of Pharmacognosy and Phytochemistry. 2017;6:1788-1792.
- Dixon AFG. Insect Predator-Prey Dynamics; Ladybird Beetles and Biological Control. Cambridge University Press, 2000.
- Khan AA. Functional response of *Adalia tetraspilota* (Hope) (Coleoptera: Coccinellidae) on cabbage aphid, *Brevicoryne brassicae* (L.) (Homoptera: Aphididae). J Biol. Control. 2009;23(3):243-248.
- Khan AA, Zaki FA, Khan ZH, Mir RA. Biodiversity of predacious ladybird beetles (Coleoptera: Coccinellidae) in Kashmir. Journal of Biological Control. 2009;23:43-7.
- Kumari D, Verma SC, Sharma PL, Biology. Feeding potential and functional response of *Coccinella septempunctata* L. against *Aphis gossypii* Glover infesting cucumber Journal of Entomology and Zoology Studies. 2020;8(1):631-636.
- Kumar Suraj, Singh R, Kumar Awaneesh, Krishna Hari, Kumar Vinod. Biology of *Coccinella septempunctata* (Linnaeus) on mustard aphids, *Lipaphis erysimi* (Kalt.) Journal of Entomology and Zoology Studies. 2019;7(2):1239-1241
- Kumar A, Prasad CS, Tiwari GN. Biology and feeding potential of *Coccinella septempunctata* on *Aphis craccivora* and *Lipaphis erysimi*. Ann. Pl. Protec. Sci. 2012;20(1):205-269.
- Mishra Ipsita, Sontakke BK, Mishra BK. Biology and Predatory Potential of *Coccinella septempunctata* Linn. on *Aphis craccivora* under Controlled Condition Int. J Curr. Microbiol. App. Sci. 2020;9(1):919-924
- Prajapat S, Tripathi MK, Khan AA. Biodiversity of coccinellids in cabbage crop on various location of Purvanchal Uttar Pradesh. Annals of plant protection sciences. 2022;30(1):65-68.
- Shah MA, Khan AA. Qualitative and quantitative prey requirements of two aphidophagous coccinellids, *Adalia tetraspilota* and *Hippodamia variegata*. Journal of insect Science, 2014, 14(72).
- Singh K, Singh NN. Preying capacity of different established predators of the aphid *Lipaphis erysimi* (Kalt.) infesting rapeseed-mustard crop in laboratory conditions. Plant Protect. Sci. 2013;49(1):84-88.
- Singh, Kuldeep, Singh NN. Biology and devouring propensity of lady bird beetle, *Coccinella septempunctata* Linnaeus on rapeseed-mustard aphid, *Lipaphis erysimi* Kaltenbach African Journal of Agricultural Research 2014;9(1):61-64.
- Varma S, Anandhi P, Srivastava DS. Biological and predatory efficiency of lady bird beetle, *Coccinella septempunctata* Linnaeus (Coleoptera: Coccinellidae) on brinjal aphid, *Aphis gossypii* Glover (Homoptera: Aphididae) Journal of Entomological Research, 2013;37(3):211-214.

16. Varshney R, Rachana RR, Bisht RS. Biology and feeding potential of *Coccinella septempunctata* (Linn.) against *Lipaphis erysimi* (Kalt) at different temperature regimes, Journal of Applied and Natural Science. 2016;8(4):1762-1765.