BIOLOGY AND FEEDING POTENTIAL OF LADYBIRD BEETLE (*COCCINELLA SEPTEMPUNCTATA*) AGAINST DIFFERENT SPECIES OF APHIDS

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ABSTRACt: *The lady bird beetle (Coccinellidae: Coleoptera) is being exploited as a potential predator for the effective control of aphids besides other insect pests that cause economic losses. The predatory potential and developmental period of ladybird beetle (Coccinella septempunctata Linn.) fed on different species of aphids have been studied under laboratory conditions (18 ±2 ^{o}C with 38 ±5 H/R). The results revealed that the maximum mortality percentage of ladybird beetle was seen on 1st larval instar, while the minimum mortality percentage was found on pupal stage when fed on green aphid. The maximum survival percentage of beetle was observed in the egg stage, while the minimum survival percentage was observed at pupal stage when fed on green aphid. The maximum mean consumption by adult C. septempunctata was observed against green aphid 408.33, whereas, 55.22, 102.66, 172.00 and 315.00 aphids were consumed by 1st, 2nd, 3rd and 4th larval instars as compared to black and yellow aphids. The short larval and pupal durations of C. septempunctata were observed against green aphids 13.33±0.33 and 6.33±0.33 (days) respectively, while a longer time period was noticed by adult stage when fed on green aphids as compared to black and yellow aphids.*

Keywords: Ladybird beetle, *C. septempunctata,* feeding potential, developmental perriods.

INTRODUCTION

The family coccinellidae consists of about 5200 described species in the world and this includes small beetles [1]. *Coccinella septempunctata* Lin. is one of the most popular and well known species among the all British beetles [2]. Lady bird beetle, *C. septempunctata* (Coccinelidae: Coleoptera) plays an important role as a biological control agent because of its extent to control many soft bodied insect pests mainly the aphids on which its larvae as well as adults feed vigorously. Ladybird beetles are very popular cosmopolitan insects, most of which feed on aphids, mealy bugs, scale insects, white flies, thrips, leafhoppers, mites or other small soft bodied insects [3,4]. Nevertheless, the potential of coccinellid beetle as predators of aphids could be improved by the careful selection of coccinelid species that are well adapted to the climatic conditions. Biological control of aphids is the environmentally friendly alternative of very hazardous and toxic insecticides that are frequently applied to protect the plants [5]. *Coccinella septempunctata* showed a close synchronization with their prey species (especially aphids). They reproduce so rapidly when the prey species are increasing in number and become sluggish when the prey population is also declining [6]. Coccinellids have been extensively used for the control of aphid by mass rearing, augmentation by translocation and release [7]. Predaceous lady bird beetle feeds on a wide range of soft bodied insects such as aphids, mealy bugs, scale insects, leaf hoppers and mites. [8,9]. Globally aphids are very severe pest of agriculture [10]. For the last few years, aphid's population has been increasing and gaining the status of the alarming pest of Pakistan. Aphid attacks on a variety of plants and both nymphs and adults suck the cell sap and reduce the plants vigour and growth. Aphids are also called as plant lice because they are important sucking pests of fruits, vegetables and other different field crops. Lady bird beetle has long oviposition period and high reproductive potential. Biological control as an important component of IPM is receiving great attention by policy makers and Entomologists since biological control is an effective means of controlling the pest population [11].

Considering the importance of predator, *C. septempunctata* in agro-ecosystem as an efficient predator of may phytophagous insect pests, the purpose of the present research was to investigate the life table parameters and to find the best natural diet on different species of aphids such as green aphid, *Aphis gossipii*, black aphid, *Aphis fabae* and yellow aphid, *Aphis nerii* for the growth of *C. septempunctata*.

MATERIALS AND METHODS

Ladybird beetles, *C. septempunctata* were collected from the experimental field of Lasbela University of Agriculture, Water and Marine Science, Uthal and reared in the cages under the laboratory conditions (18 ±2 ^{o}C with 38 ±5 H/R). In present experiment three hundred fifty eggs of *C. septempunctata* were taken and kept in rearing cages to observe the survival % of different life stages, its feeding potential and developmental period. To check the feeding potential, ten (10) different instars of larvae and adults were selected for each treatment and each treatment was replicated three times. Total 500 second nymphal instars of aphids were provided to 1st, 2nd, 3rd, 4th instar and adults in each rearing cages. The number of days of larvae, pupae and adults was also counted.

Statistical analysis

Table No: 1 was analyzed for cumulative % by using the following formula.

$$\frac{\text{Total survival number of each stage x 100}}{\text{Total No. reared at first stage}}$$

Data obtained from the biological parameters of *C. septempunctata* and its feeding potential was statistically analyzed using SPSS software.

RESULTS

Table 1: Mortality percentage in different life stages of ladybird beetle (*Coccinella septempunctata*) on green aphid under laboratory conditions

Life stage	No.	Mortality	Mortality %	Survival %
Eggs	350	40	11	89
1st Instar	310	70	22.58	66.42
2nd Instar	240	35	14.58	51.84
3rd Instar	205	22	10.73	41.11
4th Instar	183	12	6.55	34.56
Pupa	171	27	15.78	18.78
Adult	144			

Table 2: Feeding potential of different developmental stages of ladybird beetle (*Coccinella septempunctata*) on different species of aphids

Treatment	1st instar	2nd instar	3rd instar	4th instar	Adults
Green aphid	55.33±2.60a	102.66±1.20a	172.00±4.35a	315.00±13.22a	408.33±10.13a
Black aphid	48.66±2.02ab	84.33±7.44ab	147.00±7.00ab	276.66±6.66ab	360.00±5.77b
Yellow aphid	43.66±2.72b	72.66±4.91b	143.00±4.72b	258.00±9.86b	321.67±7.26c

Mortality percentage and survivorship of *C. septempunctata* was observed in present study. The results revealed that the maximum mortality percentage of *C. septempunctata* was (31.31%) seen on 1st instar of larvae, while the minimum mortality percentage was (4.06%) found on pupal stage. The maximum survival percentage of *C. septempunctata* was (89%) observed at the egg stage, while the minimum survival percentage was (4.64%) observed in pupal stage as indicated in Table. 1.

Values (mean ± SEM) followed by different letters within a column are significantly different by tukey test (P<0.05)

A significantly (F= 5.606, P=0.042) increased aphid consumption was seen in 1st larval instar of *C. septempunctata* on green aphid as compared to yellow aphid, whereas a significantly decreased aphid consumption was noted against yellow aphid by 1st instar larvae of *C. septempunctata*. A significantly (F=8.471, P=0.018) increased aphid consumption was seen by 2nd instar larvae of *C. septempunctata* against green aphid as compared to black and yellow aphid, whereas a significantly decreased aphid consumption was noted against yellow aphid. A significantly (F=8.203, P=0.019) increased aphid consumption was seen by 3rd instar larvae of *C. septempunctata* on green aphid as compared to yellow aphid, whereas a significantly decreased aphid consumption was noted on yellow aphid. A significantly (F=7.998, P=0.020) increased aphid consumption was seen by 4th instar larvae of ladybird beetle on green aphid as compared to yellow aphid, whereas a significantly decreased aphid consumed were noted on yellow aphid 4thinstar larvae of ladybird beetle. In present results, no significant difference was observed on black aphid as compared to green and yellow aphids in larval feeding stages. A significantly (F=29.956, P=0.001) increased aphid consumption was seen by adults of *C. septempunctata* against green aphid as compared to black and yellow aphid, whereas a significantly decreased aphid consumption was noted on yellow aphid as mentioned in Table 2.

Table 3: Developmental periods of ladybird beetle (*Coccinella septempunctata*) against three different species

Treatment	Larvae	Pupa	Adults
Green aphid	13.33±0.33b	6.33±0.33b	33.00±0.57a
Black aphid	16.66±0.66a	9.33±0.88ab	30.66±0.33a
Yellow aphid	16.00±0.57a	9.66±0.88a	26.66±0.88b

Values (mean ± SEM) followed by different letters within a column are significantly different by tukey test (P<0.05)

A significant increase in larval developmental period (F=10.50, P=0.05) was seen on black and yellow aphid, while a significant decrease was observed on green aphid. Similarly, a significantly increase (F=6.06, P=0.05) was noted in pupal developmental period on yellow aphid, whereas a significant decrease was observed on green aphid. A significantly increase (F=25.18, P=0.05) in the adult developmental period was observed against green and black aphid, whereas, a significant decrease was seen on yellow aphid. Statistically, no significantly difference was seen between black and yellow aphid in larval developmental period while, no difference was observed on green aphid as compared to black and yellow aphid in pupal developmental period and also no significant difference was observed between green and black aphids as presented in Table 3.

DISCUSSION

The mortality and survival percentage of ladybird beetle, *C. septempunctata* was observed on green aphid (Table-1) . The results on mortality percentage of *C. septempunctata* were

found accordance with [12]. The table 2 shows the mean consumption of aphids by *C. septempunctata* at different developmental stages such as 1st, 2nd, 3rd, 4thinstars and adult. We observed the highest aphids were consumed by *C. septempunctata* against green aphids and lowest aphids were consumed by *C. septempunctata* on yellow aphids. However, adult stage of *C. septempunctata* consumed more aphids as compared to larval stages. Similar results were reported by [13,14,15], who reported that the number of aphid consumption increased as per the increase in developmental stages of *C. septempunctata*. In Table 3 shows the developmental period of ladybird beetle on three different diets (green aphid, *Aphis gossipii*, black aphid, *Aphis fabae* and yellow aphid, *Aphis nerii*). The larvae took less time to make a pupae on green aphid as compared to black and yellow aphid also significant difference was noted on green aphid, whereas no significantly difference were found between black and yellow aphid. Similarly, results were observed at pupal stages against green aphid, but statistically significant difference was noted between green and yellow aphids. Adult longevity significantly increased were noted in green and followed by black aphid. Thus a significantly decreased adult longevity was observed in yellow aphid. These results are in conformity with [16,17], who reported that incubation period of seven spotted ladybird beetle *C. septempunctata* Linn was 4.3 + 0.81 days and mean duration of 1st, 2nd, 3rd and 4th larval instars were 2.00, 2.00, 3.00 and 5.00 days respectively while pupal period was 6.00 days. These results were also reported by [17,18], who observed that the pupal stage may last from 3-12 days depending upon availability of food and temperature.

CONCLUSION

The present study revealed that the short developmental period of larvae and pupa were found after feeding the green aphids, while a longer time were noticed in adult stage when fed on green aphids as compared to black and yellow aphids, so we observed that the green aphids are more favorable diets to rear the ladybird beetle of *Coccinella septempunctata* as compared to yellow and green aphids.

ACKNOWLEDGEMENT

The authors are very grateful to Dr. Ghulam Jilani and Dr. Ghulam Hussain Abro for their valuable suggestions and critical review of this manuscript.

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