

INFLEUNCE OF *LIPAPHIS ERYSIMI* (KALT.) ON LIFE STAGES OF *HIPPODAMIA CONVERGENS* GUER UNDER LABORATRY CONDITIONS

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ABSTRACT: The influence of fresh, frozen and dried mustard aphid, *Lipaphis erysimi* (Kalt.) on life stages of *Hippodamia convergens* (Guer.) was determine in the laboratory of Department of Plant Protection, SAU, Tandojam Sindh, Pakistan during 2013-2014. The result depicted that the minimum development period of 1st, 2nd, 3rd and 4th instar larvae of the beetle recorded on fresh aphid followed by frozen and dried *L. erysimi*, respectively. Similarly, minimum pre pupal and pupal period was recorded on fresh aphid. The result further revealed that the shortest survivor of adult male and female were obtained on fresh aphid followed by frozen and dried *L. erysimi*, respectively. The female lived longer on fresh, frozen and dried aphids. The result further revealed that maximum morphometric measurements (length and breadth) of larva, pupa and adult (male and female) stages were recorded when these beetle were fed with fresh followed by frozen and dried *L. erysimi*, respectively. The analysis of variance showed that there was significant difference ($P < 0.05$) in development period, length and breadth of immature as well as mature life stages of the predator when fed on fresh, frozen and dried *L. erysimi*.

Keywords: *Lipaphis erysimi*, *Hippodamia convergens*, Development, Morphometric.

INTRODUCTION

Many species of lady bird beetles are predominant to control the small and soft bodied insect pests. Bio-control is basic component of Integrated Pest Management (IPM) that cause reduction in insect pest populations to keep them below economic injury level [1]. Ladybirds are effective bio-control agent and originate in many habitats, comprising forest, gardens, sea, mountain and fields [2]; [3]. Adult and larva devoured on many soft bodied arthropod insect pests i.e. Scale insects, psyllids, mealy bugs whiteflies etc, in the absence of these the coccinellids also feed on fungal spores, pollen and nectar as alternative foods for their survival [4]; [5]. Approximately 4000 species of coccinellids are documented in the world and in Pakistan about 71 species of

lady birds predatory beetle are recorded on insect pests of different crops [6]; [7]. Among these some species of lady beetles are reported in Sindh, Pakistan [8]. The high reproductive rate of predator is more important because its rapid population increase can reduce pest population significantly in the field crops. It is also very significant that the predators must arise at the same time with its prey [9]. Now a day injudicious use of toxic chemicals developed the resistance in insect pests and creates environmental pollution, which is too dangerous for public & animal health. The findings of present results providing comprehensive knowledge for mass rearing of the beetles in the laboratory for augmentation in crop fields.

measurement of body size of each larval instar, pupa and adults were recorded. The newly emerging adults was fed by the same diets to observer impact on their longevity. The collected data was subjected for statistical analysis and statistical differences existed between data sets ($P < 0.05$), Fisher's Least Significant Differences (LSD) were used to separate the differing means [10].

MATERIALS AND METHODS

The experiment was carried out to determine the influence of mustard aphid *Lipaphis erysimi* Kalt. on the life stages of *Hippodamia convergens* Guer. in the laboratory of Plant Protection Department, Sindh Agriculture University, Tando Jam, at $26 \pm 2^\circ\text{C}$ temperature and $65 \pm 5\%$ relative humidity and photoperiod (11 L: 13 D) during 2013-14. The adult beetles were collected from different crops and reared on natural host species in the laboratory for stock culture. There was three treatments including T_1 = Fresh mustard aphid, T_2 = Frozen mustard aphid and T_3 = Dried mustard aphid. Live mustard aphid was collected from respective host plants. These aphids were preserved by two ways. (i) Frozen aphid (ii) Dried aphid. (i) These aphids were placed in the freezer at temperature 0°C in plastic box (20×8 cm) for 24 hrs. (ii) The collected live aphids were killed at low temperature by placing them in freezer for 24 hrs. The dead aphids were placed in the oven at 50°C for 30-40 minutes. The dried aphids were stored by keeping them in a plastic container and kept at 10°C in the refrigerator till the experimentation. The experimental designs was Complete Randomized Design (CRD) with five replicates. After hatching from eggs the grubs was shifted in new petridishes, each grubs was fed by natural diets. The developmental period and morphometric

RESULTS LARVAL PERIOD

The result presented in Table 1 indicated that the minimum development period was recorded 1.5 ± 0.17 days in the 1st instar larvae fed with fresh aphid followed by 1.9 ± 0.23 and 2.4 ± 0.16 days fed with frozen and dried aphid, respectively. Similarly, 2nd instar lasted 1.9 ± 0.23 days on fresh aphid followed by 2.3 ± 0.21 and 2.7 ± 0.26 days reared on frozen and dried aphid, respectively. The minimum development period was observed 2.2 ± 0.25 days in the 3rd instar larvae when fed with fresh aphid followed by frozen and dried aphid 2.9 ± 0.23 and 3.7 ± 0.30 days, respectively. The result indicated that the minimum development period was recorded 2.6 ± 0.22 days in the 4th instar larvae fed on fresh aphid followed by 3.7 ± 0.21 and 4.3 ± 0.30 days fed with frozen

Table.1 Developmental period of *Hippodamia Convergens* Guir reared on Mustard Aphid, *Lipaphis erysimi* under laboratory conditions.

Life stages	Developmental period (days)		
	Fresh aphid	Frozen aphid	Dried aphid
1 st instar	1.5 ± 0.17 c	1.9 ± 0.23 b	2.4 ± 0.16 a
2 nd instar	1.9 ± 0.23 b	2.3 ± 0.21 ab	2.7 ± 0.26 a
3 rd instar	2.2 ± 0.25 b	2.9 ± 0.23 a	3.7 ± 0.30 a
4 th instar	2.6 ± 0.22 b	3.7 ± 0.21 a	4.3 ± 0.30 a
Total larval duration	8.2 ± 0.61 c	10.8 ± 0.49 b	13.1 ± 0.57 a
Pre Pupal Period	1.6 ± 0.16 a	2.2 ± 0.25 a	2.4 ± 0.22 a
Pupal Period	3.8 ± 0.25 b	4.6 ± 0.31 ab	4.8 ± 0.25 a
Adult longevity			
Male	29.3 ± 0.62 b	34.5 ± 0.76 a	41.4 ± 1.77 a
Female	35.6 ± 1.27 c	40.6 ± 0.67 b	47.2 ± 2.0 a

Different letters within a row indicate significant difference (Fisher's Protected LSD test: $P < 0.05$)

Table.2 Measurement of different life stages of *Hippodamia Convergens* Guir reared on Mustard Aphid, *lipaphis erysimi* under laboratory conditions.

Life stages	Fresh aphid		Frozen aphid		Dried aphid	
	Length (mm)	Breadth (mm)	Length (mm)	Breadth (mm)	Length (mm)	Breadth (mm)
1 st instar	1.46 ± 0.12	0.25 ± 0.08	1.16 ± 0.08	0.19 ± 0.02	1.02 ± 0.09	0.15 ± 0.04
2 nd instar	2.56 ± 0.16	0.58 ± 0.06	2.05 ± 0.18	0.41 ± 0.03	1.86 ± 0.12	0.29 ± 0.02
3 rd instar	3.67 ± 0.15	0.85 ± 0.02	3.17 ± 0.19	0.68 ± 0.01	2.98 ± 0.16	0.56 ± 0.09
4 th instar	4.16 ± 0.18	1.04 ± 0.06	3.88 ± 0.12	0.87 ± 0.05	3.48 ± 0.16	0.67 ± 0.04
Pupa	3.85 ± 0.05	1.78 ± 0.19	3.02 ± 0.05	1.02 ± 0.22	2.67 ± 0.09	0.89 ± 0.09
Male	4.85 ± 0.23	2.35 ± 0.18	4.01 ± 0.29	2.02 ± 0.18	3.58 ± 0.24	1.67 ± 0.14
Female	5.05 ± 0.27	2.65 ± 0.22	4.12 ± 0.31	2.29 ± 0.22	3.89 ± 0.29	2.0 ± 0.19

and dried aphid, respectively. The result further revealed that the maximum total larval survival was recorded 13.1 ± 0.57 days when fed on dried aphid followed by 10.8 ± 0.49 and 8.2 ± 0.61 days reared on frozen and fresh aphids, respectively. In the light of above findings it was observed that highest larval developmental period was occurred on dried aphid followed by frozen and fresh aphids. The analysis of variance indicated that there was highly significant difference between the larval development on different diets ($P < 0.05$).

PRE-PUPAL AND PUPAL PERIOD

The result depicted in the Table 1 that the maximum pre pupal and pupal period was recorded 2.4 ± 0.22 and 4.8 ± 0.25 fed on fresh aphid followed by frozen and dried aphids 2.2 ± 0.25 ; 4.6 ± 0.31 and 1.6 ± 0.16 ; 3.8 ± 0.25 days, respectively. There was least significant difference in the duration of pre-pupal and no significant difference in the pupal period on different diets ($P < 0.05$).

ADULT LONGEVITY

The result further indicated that the adult male was lived 29.3 ± 0.62 days on fresh aphid followed by 34.5 ± 0.76 and 41.4 ± 1.77 days when fed on frozen and dried aphids, respectively. Similarly, the adult female was lived 35.6 ± 1.27 days fed with fresh aphid followed by frozen and dried aphid 40.6 ± 0.67 and 47.2 ± 2.0 days, respectively. The shortest survivor recorded on fresh aphid followed by frozen and dried aphid. The female lived longer than male on fresh, frozen and dried aphids. There is highly significant difference in the survival of male and female on different host species ($P < 0.05$).

LARVAL STAGES

The data described in Table 2 showed that the maximum length and breadth was measured 1.46 ± 0.12 and 0.25 ± 0.08 mm in the 1st instar larva on fresh aphid followed by 1.16 ± 0.08 and 0.19 ± 0.02 ; 1.02 ± 0.09 and 0.15 ± 0.04 mm when reared on frozen and dried aphid, respectively. In 2nd instar maximum length and breadth was measured 2.56 ± 0.16 and 0.58 ± 0.06 mm in the 1st instar larva on fresh aphid followed by 2.05 ± 0.18 and 0.41 ± 0.03 ; 1.86 ± 0.12 and 0.29 ± 0.02 mm when reared on frozen and dried aphid, respectively. The maximum length and breadth was measured 3.67 ± 0.15 and 0.85 ± 0.02 mm in the 3rd instar larva on fresh aphid followed by 3.17 ± 0.19 and 0.68 ± 0.01 ; 2.98 ± 0.09 and 0.56 ± 0.09 mm when reared on frozen and dried aphid, respectively. Similarly, 4th instar larva showed maximum length and breadth 4.16 ± 0.18 and 1.04 ± 0.06 mm was measured when fed with fresh aphid followed by 3.88 ± 0.12 and 0.87 ± 0.05 ; 3.48 ± 0.16 and 0.67 ± 0.04 mm was observed on frozen and dried aphid, respectively. The above observations indicated that the maximum morphometric measurements was seen in the all larval instars when fed with fresh aphid followed by frozen and dried aphids. The analysis of variance indicated that there was highly significant difference between the larval development on different diets ($P < 0.05$).

PUPAL STAGE

The result further revealed that maximum length and breadth was measured 3.85 ± 0.05 and 1.78 ± 0.19 mm in the pupal stage on fresh aphid followed by 3.02 ± 0.05 and 1.02 ± 0.22 ; 2.67 ± 0.09 and 0.89 ± 0.09 mm fed on frozen and dried aphids, respectively. The analysis of variance indicated that there was highly significant difference between the larval development on different diets ($P < 0.05$).

ADULT STAGES

The result further revealed that the maximum length and breadth was measured 4.85 ± 0.23 and 2.35 ± 0.18 mm in the adult male fed with fresh aphid followed by 4.01 ± 0.29 and 2.02 ± 0.18 ; 3.58 ± 0.24 and 1.67 ± 0.14 mm reared on frozen and dried aphids, respectively. Similarly, the maximum length and breadth was measured 5.05 ± 0.27 and 2.65 ± 0.22 mm in the adult female fed with fresh aphid followed by 4.12 ± 0.31 and 2.29 ± 0.22 ; 3.89 ± 0.29 and 2.0 ± 0.19 mm reared on frozen and dried aphids, respectively. The maximum length and breadth was recorded on fresh aphid followed by frozen and dried aphid in male and female stages. There is highly significant difference in the survival of male and female on different host species ($P < 0.05$).

DISCUSSION

The findings of our present result revealed that the predatory beetle, *Hippodamia convergens* reared on *Lipaphis erysimi* into three forms fresh, frozen and dry under laboratory conditions. This showed that the highest larval, pre-pupal and pupal period (days) was recorded on dried aphid followed by frozen and fresh aphids. The shortest survivor observed on fresh aphid followed by frozen and dried aphid. The female lived longer than male on fresh, frozen and dried aphids. The maximum morphometric measurements was recorded in the larval and pupal stages on fresh aphid followed by frozen and dried aphids. The maximum length and breadth of adult male and female were measured on fresh aphid followed by frozen and dried aphids. Our findings have the more or less conformity with [11] who reported that the larval duration and adult period of *H. convergens* was highest when fed with eggs of *E. kuehniella* followed by aphids *S. graminum* and *B. schwartzi*. Adult longevity of *H. convergens* showed no significant difference reared on same diets. More or less similar measurements were recorded by [12] and [13]. The larvae measured maximum length and breadth 5.83 ± 0.29 and 0.83 ± 0.05 mm, respectively, which are corroborated by the report of [14] and [13]. Similarly, the overall length and breadth of larvae was measured 7.17 ± 0.20 and 1.29 ± 0.14 mm, respectively. These measurements are in accordance with the finding of [12] and [13]. More or less nearest values of duration of different larval instars have been recorded by [12], [13] and [15]. The total larval period were recorded from 5 to 10 days, whereas, an average of 7.36 ± 1.22 days which is corroborated with the findings of [13]. This is in accordance with the report of [16] reported that pupae measured 3.88 ± 0.19 mm and 2.30 ± 0.45 mm length and breadth, respectively.

CONCLUSIONS

The minimum larval, pre-pupal and pupal period (days) and survivor was recorded on fresh aphid followed by frozen and dried *L. erysimi*. The female lived longer than male on fresh, frozen and dried aphids. The maximum morphometric measurements was recorded in the larval, pupal and adult stages on fresh aphid followed by frozen and dried aphids.

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