FEEDING POTENTIAL OF LADY BIRD BEETLE, *BRUMUS SUTURALIS* FABRICIUS (COLEOPTERA: COCCINELLIDAE) ON COTTON MEALY BUG *PHENACOCUS SOLENOPSIS* (TINSLEY) IN LABORATORY AND FIELD

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ABSTRACT

An experiment was conducted to determine the feeding potential of lady bird beetle, *Brumus suturalis* (Fab.) on cotton Mealy bug, *Phenacoccus solenopsis* in the laboratory and field conditions in Department of Entomology, Sindh Agricultural University, Tandojam, Pakistan during July – August, 2007. The laboratory results revealed that *B. suturalis* was voracious feeder of Mealy bugs. The fourth instar devoured maximum mean number of Mealy bugs (55.11±1.38) /day/larva followed by third instar (32.51±1.09), second instar (32.5±0.08) and first instar (25.1±1.41) Mealy bug and the adults female devoured more number of Mealy bug (131.51±2.10) than male (129.57±1.14) per day under laboratory conditions (26+2°C). The field results showed that, fourth instar devoured more mean number of Mealy bugs / day / larva of (34.6±1.41), followed by third instar (25.0±0.63), second instar (23.7±0.47) and first instar (19.0±0.16) Mealy bug/larva/day) and the adults female devoured more mean number (72.03±6.16) than male (69.9±6.31) per day. The lower consumption rate in the field may be attributed to the additional time required by the predators in searching of prey.

Key Words: Feeding Potential, Ladybird beetle, Cotton Mealy bug, Laboratory, Development stage.

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INTRODUCTION

The Cotton crop is attacked by both sucking and chewing type insects. The sucking type including, white fly, aphid, thrips, mealy bugs and mites and chewing type including, grass hopper, termite, weevils and lepidopteron insects. Among these mealy bug is the serious pest of cotton and has resulted in severe damage during the last few years (Solangi *et al.*, 2008; Lohar and Khuhro, 2005).

A new mealy bug (*P. solenopsis*) appeared recently and has attained the status of a serious pest on a wide rang of host plants. It was recorded from 154 plant species including field crops, vegetables, ornamentals, weeds, bushes and trees. The economical loss was recorded on cotton, brinjal, okra, tomato, sesame, sunflower and China rose with plant death in severe conditions (Arif *et al.*, 2002).

In Pakistan many species of Coccinellid predators, (Coleoptera: Coccinellidae) are very effective to control many insect-pests, particularly on small and soft body insects. According to Michaud, (2001), there are more than 4000 species of Coccinellids around the world. Among these common species in Sindh, Pakistan are 7-spotted beetle, *Coccinella septempunctata* (L), Transverse beetle, *Coccinella transversalis*, (F) 11-spotted beetle, *Coccinella undecimpunctata* (L), striped beetle, *Brumus suturalis* (F), Zigzag beetle, *Menochilus sexmaculatus* (F), 13- spotted beetle *Hippodamia convergens*, 9- spotted beetle, *Hippodamia variegate*, *Scymnus spp*, *Stethorus punctum* and many others are common predators of different sucking insect pests of several crops (Hashmi, 1994; Lohar, 2001).

The three-striped beetle, *Brumus suturalis* belonging to the Subfamily Coccinellinae, order Coleoptera is important and most voracious predator of mature and immature stages of mealy bug on different field and vegetable crops in Sindh, Pakistan (Lohar, 2001).

Keeping in view the above facts and importance of biological control of cotton mealy bug, the study on feeding potential of *B. suturalis* against cotton mealy bug in laboratory and field conditions was undertaken.
MATERIALS AND METHODS

Feeding Potential B. suturalis in Laboratory Conditions

In order to study the feeding potential of lady bird beetle, B. suturalis the cotton mealy bug was collected from different field crops surroundings the Tandojam and predator was reared in the laboratory at 25 ± 2°C. The feeding preference of larval instars and adults (male and female) on cotton Mealy bug was determined during their life period under laboratory conditions.

Feeding Potential of Larval Instars

After hatching from eggs, the first instars larvae of B. suturalis were transferred into petri dishes (9 cm dia.) with the help of camel hairbrush. For feeding potential, a single larva (per petri dish) was introduced with known number of mealy bug crawlers (on daily basis) along with the leaves of cotton crop from which the mealy bugs were collected and replicated five times. The Mealy bug consumption of each larval instars of predator was observed at 24 hrs intervals daily until the larvae entered into next developmental stage. The experiment was continued upto pupation. This was repeated in 1st, 2nd, 3rd and 4th instars larvae of the predator. The feeding longevity of instars was also recorded.

Feeding Potential of Adults

Newly emerged adults of lady bird beetle, B. suturalis (male and female) were kept separate in petri dishes and same experiment was repeated by providing known number of Mealy bug crawlers to both sexes of adult beetles. The consumption of Mealy bugs was recorded at 24 hrs intervals daily by counting the number of live Mealy bugs. The feeding longevity of adults was also recorded.

Feeding Potential of B. suturalis under Field Condition

Feeding Potential of Larval (grub) Instars

For assessing the field potential of predator in field of Plant Protection Faculty, Sindh Agriculture University, Tandojam, five cotton plants were planted in earthen pots and caged in the experimental field. After hatching from eggs, the first instar coccinellid larva was transferred into field cages by camel hairbrush in the cotton field. For feeding potential a single larva was assessed with known number of hosts along with the leaves of host crop on which the prey were collected and replicated five times. This was repeated in 1st, 2nd, 3rd and 4th instars larvae.

The hosts/prey consumption of each larval instars of each predator was observed after 24 hours daily until the larvae entered into next developmental stage. The experiment was continued upto pupation. The feeding longevity of instars was also recorded.

Feeding Potential of Adults

Newly emerged adults of predator were selected from pupal culture at random for feeding potential. The male and female adults were kept separate in field cages in cotton field and same experimental procedure like larvae was repeated by providing different density of hosts/prey to each adult beetle. The consumption of hosts/prey was recorded after 24 hrs daily by counting the number of live hosts/prey. The feeding longevity of adults was also recorded. The experiment was repeated five times. The statistical analysis of means and standard error was carried out by software Student Statistics 1.8.

RESULTS AND DISCUSSION

Feeding Rate and Development Period of B. suturalis Reared on Cotton Mealy Bug, Phenacoccus solenopsis in Laboratory

Feeding Potential of Larval Instars

The results (Fig.1) represent the comparative feeding rate and development period (days) of different larval (grub) instars and adults of B. suturalis reared on cotton Mealy bug, from August to September 2006 in laboratory at 26 ± 2°C and R.H. 65 ± 5%. The feeding rate of larval instars increased with age and as they underwent successive moultling to the next instar. The results (Fig. 1) revealed that all larval instars of B. suturalis were voracious feeders, however the fourth instar devoured more number of Mealy bug / day / larva of (55.11±1.38) followed by third instar (32.51±1.09), second instar (32.5±0.08) and first instar (25.1±1.41 Mealy bug/larva/day). The statistical data show that 4th stage of B. suturalis consumed significantly (P<0.01) more mealy bugs than other larval stages. The results thus
suggested that after the fourth stage the larvae entered into pupal stage at 11\textsuperscript{th} day of larval life. The duration (days) of first, second, third and fourth instar larvae were 2.0, 2.0, 3.0 and 3.0 days, respectively on Mealy bug. The results agreed with Saikia and Balasubramanian, (2002) who found that grub period was prolonged when reared on nymphs of aphids as compared to Mealy bug nymphs. The Coccinellid grubs consumed a total of (239.60) mealy bugs during their first, second, third and fourth instars. The female beetle consumed significantly more mealy bug than the male.

The data in Fig. 2 further indicated the feeding rate of different larval instars. The first instar consumed (50.2±2.33) Mealy bug, second instar (65.0±2.03), third instar (97.53±3.41) and fourth instar (165.33±8.25) per stage/larva. The consumption rate of different larval instar indicates that fourth instar consumed significantly (P<0.01) more food as compared to other instars. The data agreed with Lohar and Khuhro, (2006) which *Brumus suturalis* fourth instar larvae devoured Mealy bugs/life/larva of (57.80), followed by third instar (40.0), second instar (31.6) and first instar (9.4). Earlier Ferran and Larroque, (1977) reported that the quantity of food consumed by predators depend on increase in larval size. As a consequence, the consumption per unit weight and proportion of food assimilated varied little between the instars. Khuhro et al. (2008) reported that the 3\textsuperscript{rd} and 4\textsuperscript{th} instars were more voracious as compare to 1\textsuperscript{st} and 2\textsuperscript{nd} instars.

**Feeding Potential of Adults**

The result in Fig. 1 further showed the feeding potential of adult male and female of *B. suturalis* on Mealy bug in laboratory under similar conditions. The data show that adult female consumed significantly (P<0.01) more mealy bugs (131.51±2.10 bug/day) than adult male (129.57±3.14) per day. The data in Fig.2 regarding the feeding rate of adults further indicate that the adult female consumed significantly (P<0.01) more mealy bugs (4076.81±30.24 Mealy bugs/stage) than male adult (3887.1±28.12 per stage). However, adult male of *B. suturalis* devoured (46.07 Mealy bugs per day) as compared to adult female (55.36) per day reported by Lohar and Khuhro (2006). However, Hodek and Honek (1996) reported that the amount of food consumed is strongly determined by predator size. Khuhro et al. (2008) reported that the 3\textsuperscript{rd} and 4\textsuperscript{th} instars were more voracious as compare to 1\textsuperscript{st} and 2\textsuperscript{nd} instars.

**Longevity Period of Larvae and Adults**

The results in Fig.3 suggested that after fourth instar the larvae entered in pupal stage at 13\textsuperscript{th} day of larval life. The longevity (days) of first, second, third was non significant (3 days each) however, fourth instars lived for 4 days to transform into next life stage. The adult female lived significantly (P<0.01) more days (37) than the male (34) days on *P. solenopsis* in laboratory.
Feeding Potential of Larval Instars

The feeding rate of larval instars increased with age and as they underwent successive moulting to the next instar. The results in Fig.4 further indicate the feeding rate per day of different larval instars. The first instar consumed (19.0±0.16) mealy bug, second instar (23.7±0.47), third instar (25.0±0.63) and fourth instar (34.6±1.41) per day/larva. Further results revealed that all larval instars of *B. suturalis* were voracious feeders, however the fourth instar significantly (P<0.01) devoured more number of Mealy bug/day/larva. Similarly, Lohar and Khuhro (2007) reported that the feeding of *B. suturalis* larvae consumed on Mealy bug was first instar (6.0), second instar (21.5), third instar (33.8) and fourth instar (42.3) per day/larva. Similarly, the data in Fig.5 further indicates the feeding rate per stage of 4th instar consumed maximum (104.3±1.71), followed by third instar (75.2±2.88), second instar (47.5±1.30) and first instar (38.0±0.24) Mealy bug/larva/stage. The consumption rate of different larval instar indicates that fourth instar consumed significantly (P<0.01) more mealy bugs as compared to other instars. Similarly, Lohar and Khuhro (2007) reported that the *B. suturalis* larvae consumed on Mealy bug was first instar (2.0), second instar (7.16), third instar (8.45) and fourth instar (10.58) per day/larva. Gautam and Tesfaye (2002) found the predatory potential of the predator was high in the older instars than the younger ones.
Feeding Potential of Adults

The results in Fig. 4 further show the feeding potential of adult male and female of *B. suturalis* on Mealy bug in laboratory under similar conditions. The perusal of data showed that male adult devoured (69.9±6.31 Mealy bug/day) as compared to female adult (72.03 ± 6.16 Mealy bug/day). The data in Fig. 5 further indicate the feeding rate of adults that the male adult devoured (2196.9±20.10 Mealy bug/stage) as compared to female adult (2304.9±23.15 Mealy bug/stage). The statistical data show that adult female consumed significantly (P<0.01) more mealy bugs than adult male. Our results are different with Lohar and Khuhro, (2006) that adult male of *B. suturalis* devoured mean numbers (1566.38 Mealy bugs per life) as compared to adult female (2048.0 per life). Some ladybirds do better when they feed on certain species of prey (Dixon, 2000). Khuhro *et al.*, (2008) reported that adult emergence was greater in female as compared to male beetles and thus the sex ratio was also higher in females as compared to males when reared on cotton Mealy bug.

Longevity Period of Larvae and Adults

The results in Fig. 6 suggested that after fourth instar the larvae entered in pupal stage at 14th day of larval life. The longevity (days) of first, second larval instars was non significant (3 days each) however, third and fourth instars lived for 4 days each to transform into next life stage. The adult female lived significantly (P<0.01) more days (37) than the male (34) days on *P. solenopsis* in laboratory.

![Graph 1](image1.png)

*Fig. 4. Feeding potential (per day) of larval and adult stages of B. suturalis on cotton Mealy bug in field.*

![Graph 2](image2.png)

*Fig. 5 Feeding potential (per stage) of larval and adult stages of B. suturalis on cotton Mealy bug in field.*
On the basis of present studies, it is concluded that the 3rd and 4th instars were found more voracious as compared to 1st and 2nd instars. Adult female consumed more number of Mealy bugs as compared to male. It is also concluded that adults and larvae of predatory beetle prefer the crawlers of Mealy bugs. Adults consumed more Mealy bugs than larvae.

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