Feeding Potential of *Menochilus sexmaculatus* (Fabricius) Against Sucking Insect Pests

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Abstract: This laboratory experiment was conducted to find out the feeding performance and larval development of *Menochilus sexmaculatus* (Fabricuis) on *Aphis gossypii* (Glov.), *Bemisia tabaci* (Ginn.) and *Amrasca biguttula biguttula* (Distant) at 26 ± 2ºC temperature and 65 ± 5% relative humidity. The result indicated that the 3rd and 4th instar larvae of the beetle consumed 76.20 ± 3.44 and 79.7 ± 0.77 nymphs of *A. gossypii* /day followed by (23.0 ± 0.77) and (23.4 ± 0.75) nymphs of *B. tabaci* and (19.73 ± 1.17) and (21.55 ± 0.77) nymphs of *A. b. biguttula*, respectively as compared to 1st and 2nd instar larvae. Adult female consumed maximum (101.0 ± 0.55) nymphs of *A. gossypii* /day followed by (26.90 ± 0.27) nymphs of *B. tabaci* and (22.16 ± 0.20) nymphsof *A. b. biguttula* as compared to male. The result further revealed that the 4th instar larva consumed highest number 159.4 ± 7.35 of *A. gossypii* nymphs during its life span followed by (93.8 ± 3.02) and (86.2 ± 3.09) nymphs of *B. tabaci* and *A. b. biguttula,* respectively. Similarly, the adult female devoured highest number of nymphs (3040.2 ± 26.4) of *A. gossypii* followed by *B. tabaci* (807.0±8.1) and *A. b. biguttula* (664.98±6.0) during its life span as compare to male. The shortest life span was recorded on *A. gossypii* as compared to *A. b. biguttula* and *B. tabaci,* There was highly significant difference in consumption rate and development period of larvae and adult beetles on different prey species (P<0.05).

Keywords: Feeding efficiency, developmental period, *Menochilus sexmaculatus*, *Aphis gossypii*, *Bemisia tabaci*, *Amrasca biguttula biguttula*.

INTRODUCTION

In agricultural ecosystem there are number of arthropod pests that resulted a serious threat to production. Mostly growers used agro-chemicals on different field and horticultural crops to suppress the pest population [1, 2]. Their injudicious use on different crops has interrupted the natural balance in agro-ecosystem by reducing the population of natural enemies (predator and parasitoid). It is reported that more than 550 insect species have developed resistance against insecticides worldwide [3-5]. However several predators and parasitoids play a significant role in the natural control of many arthropod pests in agro-ecosystem. These natural enemies suppress the insect pest population through their high reproductive rate and faster multiplication [6-8], if the their equilibrium is not disturbed by the other factors, especially with agro-chemicals. Approximately 4000 species of coccinellid are reported throughout the world [9] and many of these are playing major role in the predation of various pests. However, in Pakistan about 71 coccinellid predators are reported on different insect pests [10]. Among these coccinellid, *M. sexmaculatus* (F) is found to be predominant in lower Sindh, Pakistan [11]. Whereas, in South East Asian countries, it is found to be an efficient predator of aphid species [12, 13]. This is mainly fed on aphid species but it also devoured many soft bodied insects, widely distributed worldwide i.e. U.K. India, Pakistan, Indonesia, Philpines, France, Jawa, Sumatra, South Africa and Borneo [14-18]. Biological control agents are considered as the basic component of Integrated Pest Management strategy. Practically 90% of the major arthropod insect pests are controlled under naturally available natural enemies [19]. Primarily coccinellids predators effectively used against variety of insect pests and achieved a significant result in agro-ecosystem [20]. Biological control is effectively suppressing the insect pest population and keeps them below the damage boundary. These measures are mostly preventive but not corrective mode [17]. In Pakistan, a very few reports are available regarding this potential predator. Thus the present study was conducted to evaluate the predatory performance and larval development of *M. sexmacultus* against sucking insect pests.

MATERIAL AND METHODS

Mass Rearing

The experiment was conducted in the laboratory, department of Entomology, Sindh Agriculture University

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Tandojam at 26±2 ºC temperature and 65±5% relative humidity with photoperiod (13L:11D). The adults of *M. sexmaculatus* were collected from cotton crop and brought into the laboratory and confined in cubicular wooden cage (25″×10″×15″cm). The aphids (prey) on fresh young leaves of cotton plant were provided to the adult female for egg laying. The females laid their eggs on green color cloth kept in the cage for egg laying.

Feeding Performance

After hatching, the first instar larva was transferred by camel hair brush into Petri dishes (9 cm. dia.). A given number of nymphs of aphids, whiteflies and jassids on leaf piece of respective crop were provided to them daily in separate petri dishes. There were five replicates for each prey species. This procedure was repeated for all subsequent larval stages. In this way the feeding efficiency per day and per each larval instar on each prey species was calculated.

Newly emerged adults of *M. sexmaculatus* were collected from pupal culture at random. For assessment of feeding performance the adult beetles (male and female) were released into separate Petri dishes with given number of nymphs of aphid, whitefly and jassid on leaf piece of respective crop to each beetle with five replications. The feeding efficiency of adults on each prey species was recorded daily and during their life span as well. The collected data was statistically analyzed by analysis of variance (ANOVA) following Least Significant Differences (LSD) test by using Student statistics (Sxw) statistical software.

RESULTS

Feeding Potential Per Day

The comparative feeding potential and development period (days) of different larval instars and adults of *M. sexmaculatus* fed on *A. gossypii*, *B. tabaci* and *A. b. biguttula* during August to October 2005 revealed that the 4th instar larva devoured maximum number of *A. gossypii* (79.7 ± 0.77 nymphs day^{-1}) followed by *B. tabaci* (23.4 ± 0.75 nymphs day^{-1}) and *A. b. biguttula* (21.55 ± 0.77 nymphs day^{-1}). While the 3rd instar consumed (76.20 ± 3.44), (23.0 ± 0.77) and (19.73 ± 1.17) nymphs of *A. gossypii, B. tabaci* and *A. b. biguttula* day^{-1}, respectively. The 2nd instar devoured (56.4 ± 1.03) nymphs of *A. gossypii* per day followed by *B. tabaci* (14.6 ± 0.67) and *A. b. biguttula* (9.7 ± 0.60) and 1st instar consumed minimum number of nymphs of *A. gossypii* (23.3 ± 1.25 day^{-1}) followed by *B. tabaci* (5.47 ± 0.43) and *A. b. biguttula* (4.27 ± 0.46). There was highly significant difference in consumption rate of larval instars per day on different prey species (P<0.05). The data further depicted that the female consumed maximum number (101.0 ± 0.55) of nymphs day^{-1} of *A. gossypii* followed by *B. tabaci* (26.90 ± 0.27) and *A. b. biguttula* (22.16 ± 0.20), while the adult male devoured (81.4 ± 0.77), (20.12 ± 0.22) and (18.69 ± 0.19) nymphs day^{-1} of *A. gossypii, B. tabaci* and *A. b. biguttula*, respectively. However, there was highly significant difference in consumption rate of adult beetles day^{-1} on different prey species (P<0.05).

Table 1: Feeding Potential Per Day of *M. sexmaculatus* Larval Instars and Adult Against Different Host Species Under Laboratory Conditions

Life stages	*A. gossypii*	*B. tabaci*	*A. b. biguttula*
First instar	23.3 ± 1.25 de (35)	5.47 ± 0.43 i (10)	4.27 ± 0.46 i (10)
Second instar	56.4 ± 1.03 c (75)	14.6 ± 0.67 g (20)	9.7 ± 0.60 h (15)
Third instar	76.2 ± 3.44 b (90)	23.0 ± 0.77 e (30)	19.7 ± 1.17 f (30)
Fourth instar	79.7 ± 3.76 a (100)	23.45 ± 0.75 d (30)	21.55 ± 0.77 ef (30)
Adult male	81.40 ± 0.77 b (100)	20.12 ± 0.22 de (30)	18.69 ± 0.19 e (23)
Adult female	101.0 ± 0.55 a (120)	26.90 ± 0.27 c (30)	22.16 ± 0.20 d (25)

Different letters within a row indicate significant difference (Fisher's Protected LSD test: P< 0.05).
Figures in parenthesis indicate host species provided to the predatory beetle.

Table 2: Feeding Potential of Different Life Stages of *M. sexmaculatus* During their Life Span on Different Prey Species Under Laboratory Conditions

Life stages	*A. gossypii*	*B. tabaci*	*A. b. biguttula*
First instar	46.6 ± 2.50 de (70)	16.4 ± 1.31 fg (30)	12.89 ± 1.39 g (30)
Second instar	56.4 ± 1.03 cd (75)	43.8 ± 2.02 e (60)	19.4 ± 1.21 f (30)
Third instar	152.4 ± 6.89 ab (180)	46.0 ± 1.55 de (60)	59.2 ± 3.53 c (90)
Fourth instar	159.4 ± 7.53 a (200)	93.8 ± 3.02 b (120)	86.2 ± 3.09 bc (120)
Adult male	2444.4±23.1 b (3300)	603.36 ± 6.6 de (1230)	523.8 ± 5.7 e (1040)
Adult female	3040.2±26.4 a (3970)	807.0 ± 8.1 c (1340)	664.98 ± 6.0 d (1280)

Different letters within a row indicate significant difference (Fisher's Protected LSD test: $P< 0.05$).
Figures in parenthesis indicate host species provided to the predatory beetle.

Feeding Potential Per Life Stage

The results given in Table **2** indicated that the 4th instar larva consumed highest number of *A. gossypii* (159.4 ± 7.35) nymphs per stage as compare to *B. tabaci* and *A. b. biguttula* as (93.8 ± 3.02) and (86.2 ± 3.09), respectively. Similarly, third instar larva consumed *A. gossypii* (152.4 ± 6.89) nymphs during its life span *A. b. biguttula* (59.2 ± 3.53) and *B. tabaci* (46.0 ± 1.55), respectively. Whereas, the 2nd and 1st devoured (56.4 ± 1.03) and (46.6 ± 2.50) nymphs of *A. gossypii* during their life span followed by *B. tabaci* (43.8 ± 2.02) and (16.4 ± 1.31) and *A. b. biguttula* (19.4 ± 1.21) and (12.89 ± 1.39), respectively. The result further revealed that the adult female consumed highest number of *A. gossypii* (3040.2 ± 26.4) nymphs diring its life span followed by *B. tabaci* (807.0±8.1) and *A. b. biguttula* (664.98±6.0) as compared to the male that devoured (2444.4 ± 23.1) nymphs of *A. gossypii* followed by *B. tabaci* (603.36 ± 6.6) and *A. b. biguttula* (523.8 ± 5.7). The result further revealed that the third and fourth instar larvae were significantly (P<0.05) more voracious on all prey species than 1st and 2nd instar larvae so as the adult female than the male, however, aphids were highly preferable as compared to whitefly and jassid.

The data in Table **3** indicated the development period (days) of different life stages of *M. sexmaculatus* fed on different pery species. The maximum period (5.6 and 3.4) days were spent by 4th and 1st instar larvae on *A. b. biguttula* followed by *B. tabaci* and *A. gossypii* (4.0 and 3.0) and (3.2 and 2.8), respectively. Similarly, 3rd instars lasted (5.0) days on *A. b. biguttula* followed by *B. tabaci* and *A. gossypii* (4.0) and (3.4), respectively. While the 2nd instar lasted (3.8) days on *A. b. biguttula* followed by (3.0) days each on *B. tabaci*and *A. gossypii*, respectively. The result further revealed that larvae fed on *A. gossypii* took lesser time to be transformed in to pupal stage. The adult female significantly lived longer than male. The result further

Table 3: Developmental Period of *M. sexmaculatus* Fed on Different Host Species Under Laboratory Conditions

Life stages	*A. gossypii*	*B. tabaci*	*A. b. biguttula*
First instar	2.80 e	3.0 de	3.4 d
Second instar	3.0 e	3.0 e	3.8 cd
Third instar	3.4 d	4.0 c	5.0 ab
Fourth instar	3.2 de	4.0 bc	5.6 a
Adult male	34.6 e	53.0 c	57.6 b
Adult female	45.2 d	59.6 b	63.8 a

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

revealed that the female lived longer (63.8) days when fed on *A. b. biguttula* and shoter time on *A. gossypii* (45.2) days, whereas, The male attained the period of (57.6) days on *A. b. biguttula* and the least on *A. gossypii* (34.6). There is highly significant (P<0.05) difference in the larval and adult development period when fed on different prey species.

DISSCUSSION

The findings of present study indicated that the consumption rate were significantly higher of all larval instars of *M. sexmaculatus*on *A. gossypii* as compared to *B. tabaci* and *A. b. biguttula*. This is in accordance with Verma *et al.* [21] reported that the larvae of *M. sexmaculatus* were devoured maximum number of *A. gossypii* in their entire period. Our findings are also in agreement with those of Bhadauria *et al.* [22] who reported that miximum number of nymphs of *H. coriandri* and minimum nymphs of *U. compositae* were consumed by the larvae of *M. sexmaculatus* during larval period. Our result showed that 1^{st} instar consumed minimum and 4^{th} instars consumed maximum pery species. These findings corroborate with those of Ali and Rizvi [23] and Babu [24], they reported that the consumption rate increased with increase in the age of the larvae. The consumption rate of female and male were higher on *A. gossypii*. Agarwala, *et al.* [25] reported that the adult female and male of *M. sexmaculatus* consumed minimum number of *A. carccivora*. These contrary findings are variance in the body size of aphid, because *A. carccivora* bigger in size as compare to *A. gossypii*. Predatory beetle, *M. sexmaculatus* preferred *A. gossypii* as compared to *B. tabaci* and *A. b. biguttula*. Similar results were reported by Gautam, *et al.* [26] that the adult *M. sexmaculatus* preferred *L. erysimi* and *A. gossypii*. The rapid larval and adult development was observed on *A. gossypii*. Females lived longer than males. These findings more or less supported by Verma *et al.* [14], they reported that total larval period lasted 7.4 days and female lived 52 days as compared to male who lived 42.5 days when fed on *A. gossypii.*

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