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PREDATORY POTENTIAL OF *CRYPTOLAEMUS MONTROUZIERI* FOR COTTON MEALYBUG UNDER LABORATORY CONDITIONS

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ABSTARCT

An experiment was conducted to study the predatory potential of *Cryptolaemus montrouzieri* on Cotton Mealybug under laboratory conditions (30 ± 1°C and 70 ± 5% R.H), at Cotton Mealybug Entomological laboratory, Ayub Agriculture Research Institute, Faisalabad. The results revealed that this predator feeds voraciously on mealybugs both in larval and adult stages. *Cryptolaemus montrouzieri* having a remarkable predatory potential, can be used to reduce population of mealybug which will result in the enhancement of yield of cotton seed.

Key words: Biological control; *Cryptolaemus montrouzieri;* Mealybug; Faisalabad; Pakistan

INTRODUCTION

Cotton (*Gossypium hirsutum* L.) is one of the most important cash crop in Pakistan and is the source of large amount of foreign exchange, with extensive cultivation of cotton, as a monoculture crop is attacked by many chewing and sucking insects (Saeed *et al*., 2007). Cotton mealybug, *Phenacoccus* spp. (Hemiptera: Pseudococcidae) is a soft-bodied insect that sucks the cell sap of cotton plant and plays havoc with the crop. It emerged as an important pest of cotton in Pakistan recently (Abbass, 2005). It also attacks a number of other crops, ornamentals and fruit trees (Aijun *et al*., 2004).

About 5000 species of mealybug have been recorded from 246 families of plants throughout the world. Among these, 56 species belonging to 15 genera from cotton and many other plants of family Malvaceae have been reported (Ben-Dov, 1994).

The mealybugs attack growing parts, main stems and branches. The growing parts become bunchy and affected plants remain underdeveloped producing fewer flowers and fewer bolls of a smaller size. Black sooty mold grows on parts that are mostly visited by mealybugs. The severely affected plants show blackish symptoms similar to burning of leaves. The mealybugs are not native to India and Pakistan, but might have been introduced into the subcontinent from USA. Initial identification results have shown that the species affecting cotton in Pakistan is *Phenacoccus solani.* The mealybug attack is also the increase in India. It is extremely difficult to control mealybugs due to the presence of waxy skin (International cotton advisory committee, 2008).

Different management strategies like chemical, biological and cultural control have been used to combat this menace, but pesticides lead to many serious problems like air and water pollution, health hazards, killing of beneficial organisms, pest resistance, pest resurgence, secondary pest outbreak, interruption in ecocycles and biodiversity (Bellows, 2001). The biological control is one of the effective means of achieving insect control (Pedigo, 2004).The coccinellid beetles are considered to be of great economic importance in agro-ecosystem as they can be successfully employed in the biological control of many injurious insects (Agarwal *et al.,* 1988).

Cryptolaenus montrouzieri, also known as "Crypts" is a species of ladybird beetle native to Australia known as the mealybug destroyer. This predator is a very efficient natural enemy of mealybugs, with both larvae and adults preying on this pest (Gautam, 1996).

Due to highly efficient predatory potential, the *Cryptolaemus montrouzieri* has recently been imported from USA to Pakistan for the control of cotton mealybug. As sufficient work has not been carried out on the feeding efficiency of *Cryptolaemus montrouzieri*, the present study will pave the way to explore further researches on such lines. The main objective of present study was to determine the feeding efficiency of this potential predator against cotton mealybug.

MATERIALS AND METHODS

The trial on predatory potential of *Cryptolaemus montrouzieri* on 3rd instar and adult of Cotton Mealybug was conducted at Cotton Mealybug Entomological laboratory, Ayub Agriculture Research Institute, Faisalabad. The laboratory temperature was maintained at 30 ±1°C and relative humidity at 70 ± 5%.

The larvae of different instars of the predator were mass reared in the cotton mealybug laboratory and the bug was also mass reared in laboratory on pumpkins, gourd and okra.

In the first trial, a neonate specimen of the predator were separated into a vial with 80 mesh cap, and

counted number of 3rd instar nymphs of the bug were provided to this 1st instar larvae of the predator. The bug consumption per day by larvae of the predator was recorded and continued till its 1st instar was molted into 2nd and 3rd instars and then finally undergone to pupation. After pupation, newly emerged adult of the predator was again fed with counted number of 3rd instar nymphs of the bug. Mealybug consumption per day by adult of the predator was recorded till 40 days. The experiment was replicated 5 times

In the second trial, again a neonate specimen of the predator was separated into a vial with 80 mesh cap, and counted numbers of adults of cotton mealybug were provided to 1st instar larvae of the predator. Mealybug consumption per day by larvae of the predator was recorded and continued till its 1st instar were molted into 2nd and 3rd instars and than finally undergone to pupation. After pupation, newly emerged adult of the predator again fed with counted number of adults of the bug. The bug consumption per day by adults of the predator was recorded. The experiment was replicated 5 times.

The data obtained during this study was subjected to statistical analysis using complete randomized design (CRD) single factor. Though analysis of variance technique.

RESULTS AND DISCUSSION

The results of total consumption on 3rd instar mealybug by the predator showed that total consumption on third instars nymph of mealybug varied significantly (P< 0.05) among different life stages of *C. montrouzieri* (Table-1).

Mean comparison for total consumption on third instar cotton mealybug by *C. montrouzieri* showed that adult *C. montrouzieri* consumed maximum number 467.6 of third instar nymphs of CMB, and which was statistically different from all other predator stages. Third instar of *C. montrouzieri* consumed 66.20 third instar nymphs of cotton mealybug during its nymphal period, and it was statistically different from all other stages of *C. montrouzieri*. Where as, second instar of *C. montrouzieri* consumed 26 third instar cotton mealybugs during its nymphal period, and it was also statistically different from all other stages of *C. montrouzieri*. Minimum consumption on third instar nymph cotton mealybug was by the first instar *C. montrouzieri* during its nymphal period, and was statistically different from all other stages of *C. montrouzieri.* The results of total consumption on adult mealybug by the predator showed that total consumption on adult mealybug varied significantly (P< 0.05) among different life stages of *C. montrouzieri* (Table-2).

Mean comparison for total consumption on adult cotton mealybug by *C. montrouzieri* showed that adult of the *C. montrouzieri* consumed maximum number 142.2 of adult cotton mealybug, and was found statistically different from all other predator stages. Third instar of *C. montrouzieri* consumed 9.20 adult cotton mealybug during its nymphal period which was found statistically at par with second and first instar .where as, second instar of *C. montrouzieri* consumed 12.0 adult of cotton mealybug during its nymphal period, which was found statistically at par with third instar and first instar. While first instar of *C. montrouzieri* did not consumed any adult cotton mealybug, and was found statistically at par with second and third instar.

Mean comparison for per day consumption on third instar mealybug by the predator showed that adult of predator consumed maximum number 11.69 of third instar nymphs of mealybug per day, and was found statistically at par with third instar. Third instar larvae of the predator consumed 13.24 of third instar nymphs of cotton mealybug per day, and was at par with adult of predator. Second instar of the predator consumed 5.20 nymphs of third instar mealybug, and was found statistically at par with first instar. While first instar of the predator consumed 1.50 third instar nymphs of cotton mealybug per day, and was found at par with second instar (table 3).

Mean comparison for per day consumption on adult mealybug by the predator showed that adult of the predator consumed maximum number 3.56 adult of cotton mealybug, and was found statistically at par with third, second and first instar of predator which consumed 1.84, 2.4, and 0 adult cotton mealybug respectively (table 4).

It was observed that *C. montrouzieri* is an important biological control agent against cotton mealybug in cotton fields, and their occurrence croplands with a view to obtain high crop yield is essential. These findings correlates with the work of Jayaraman *et al.* (1988), Gautum (1998), Kario *et al*. (2000), Moses *et al*. (2002), who reported that *C. montrouzieri* is a best biological control agent for hibiscus mealybug, *Maconellicoccus hirsutus.*

It was observed that the adult stage of the predator was the most efficient predatory stage as compared to other developmental stages, consumed 467.6 third instar cotton mealybugs. Third instar larvae showed up to some extent similar predatory efficiency in its total larval period. Second instar larvae of the predator showed predatory efficiency in between the first instar and third instar larvae of the predator in its total larval period. Whereas, first instar larvae preyed on significantly fewer cotton mealybug (Table 1). The reason for lower predatory efficiency of first instar predator was its small size and large size of prey. These findings were in close agreement with the findings of Rosas-Garcia *et al*. (2002), they studied the predatory efficiency of *Cryptolaemus montrouzieri* on mealybug, and concluded that adult stage of the predator was most efficient

predatory stage as compared to the other developmental stages and third instar larvae had a similar predatory efficiency than adult, and first instar larvae preyed on significantly fewer mealybugs.

In the present study, significant variation in feeding efficiency of the predator was observed. These variations depend upon nature of food offered to which stage of predator. When adult cotton mealybug were offered to adult predator, consumed highest number 142.2 of adult cotton mealybug. Third instar larvae of the predator consumed lower number 9.20 of adult cotton mealybug as compared to the second instar of the predator 12 (table 2). First instar larvae of the predator did not consume any adult of the cotton mealybug. Mani and Thontadarya (1987) reported that each larvae of *Cryptolaemus montrouzieri* consumed an average of 27.55 adult females of *Maconellicoccus hirsutus*. The results of their work were up to some extent similar to our work.

It was observed that for per day consumption on third instar nymph of cotton mealybug, adult predator has great consumption 11.68. While third instar predator consumed 13.24 of third instar nymph of cotton mealybug (table 3). These findings were in close agreement with the findings of Garcia and O'Neil (2002), who reported that in 24 hours, third instar larvae of *Cryptolaemus montrouzieri* attack 1 to 16 of third instar mealybug (*Planococcus citri*).

Table 1: Mean comparison of total consumption of third instar cotton mealybug by different stages of *Cryptolaemus montrouzieri* in laboratory

Stages of *Cryptolaemus montrouzieri*	Total consumption
1st	6.0 D
2nd	26.0 C
3rd	66.20 B
Adult	467.6 A

Total consumption of *Cryptolaemus montrouzieri* on adult cotton mealybug

Table 2: Mean comparison of total consumption of adult cotton mealybug by different stages of *Cryptolaemus montrouziri* in laboratory.

Stages of *Cryptolaemus montrouzieri*	Total consumption
1st	0.0 B
2nd	12.0 B
3rd	9.20B
Adult	142.2 A

Per day consumption of *Cryptolaemus montrouzieri* on 3rd instar cotton mealybug

It was further observed that feeding efficiency of the predator varies according to its developmental stages. When adult cotton mealybug were offered to different life stages of predator, adult of the predator consumed 3.56 adult of cotton mealybug per day, and third instar of the predator consumed lower number of adult cotton mealybug 1.84 per day as compared to second instar predator which consumed 5.2 per day.

Table 3: Mean comparison of per day consumption of third instar cotton mealybug by *Cryptolaemus montrouzieri*.

Life stages of *Cryptolaemus montrouzieri*	Total consumption
1st	1.50 B
2nd	5.20 B
3rd	13.24 A
Adult	11.69 A

Total consumption of *Cryptolaemus montrouzieri* on 3rd instar of cotton mealybug

Table 4: Mean comparison of per day consumption of adult cotton mealybug by *Cryptolaemus montrouzieri*.

Life stages of *Cryptolaemus montrouzieri*	Total consumption
1st	0 A
2nd	2.4 A
3rd	1.84 A
Adult	3.56 A

Per day consumption of *Cryptolaemus montrouzieri* on adult cotton mealybug.

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