

***Burmodies Suturalis* – A Potential Biological Control Agent of *Maconellicoccus hirsutus* Inmulberry**

By

M.V. Santha Kumar, U.K. Bandyopadyay, N. Lalitha,
A.D. Jadhav and B. Saratchandra

ISSN 2319-3077 Online/Electronic

ISSN 0970-4973 Print

UGC Approved Journal No. 62923

MCI Validated Journal

Index Copernicus International Value

IC Value of Journal 82.43 Poland, Europe (2016)

Journal Impact Factor: 4.275

Global Impact factor of Journal: 0.876

Scientific Journals Impact Factor: 3.285

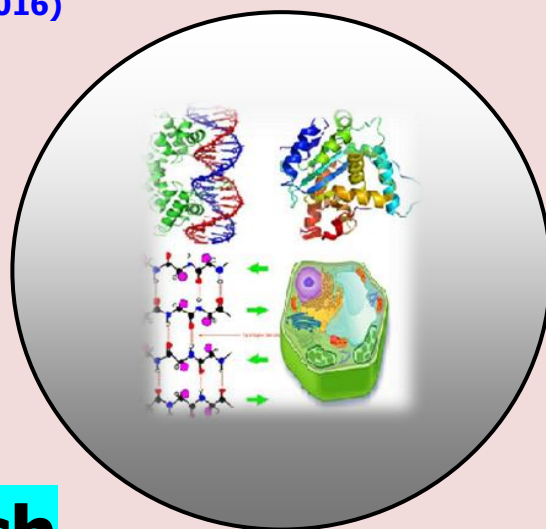
InfoBase Impact Factor: 3.66

J. Biol. Chem. Research

Volume 35 (1) 2018 Pages No. 91-97

Journal of Biological and Chemical Research

An International Peer Reviewed / Referred Journal of Life Sciences and Chemistry



**Indexed, Abstracted and Cited in various International and
National Scientific Databases**

Published by Society for Advancement of Sciences®

J. Biol. Chem. Research. Vol. 35, No. 1: 91-97, 2018

(An International Peer Reviewed / Refereed Journal of Life Sciences and Chemistry)

Ms 35/01/0053/2018

All rights reserved

ISSN 2319-3077 (Online/Electronic)**ISSN 0970-4973 (Print)**

Dr. M.V. Santha Kumar

[http:// www.sasjournals.com](http://www.sasjournals.com)[http:// www.jbcr.co.in](http://www.jbcr.co.in)jbiolchemres@gmail.com**RESEARCH PAPER**

Received: 10/01/2018

Revised: 25/01/2018

Accepted: 27/01/2018

Burmodies Suturalis – A Potential Biological Control Agent of *Maconellicoccus hirsutus* Inmulberry**M.V. Santha Kumar*, U.K. Bandyopadhyay, N. Lalitha,****A.D. Jadhav* and B. Saratchandra**Division of Entomology, Central Sericultural Research and Training Institute,
Berhampore-742 101, India

*Department of Zoology, Shivaji University, Kolhapur – 416 004, Maharashtra, India

ABSTRACT

The pink mealy bug, Maconellicoccus hirsutus (Green) (Hemiptera: Pseudococcidae) regarded as "Head to kill pest" of mulberry plant, Morus alba L. causing "Tukra" with characteristic depletion of quantitative and qualitative values of leaf yield. Thenative predator, Brumodiessuturalis (Fabricius) (Coleoptera: Coccinellidae) was found to be associated with mealy bug colonies and efforts were made to exploit this predator for the biological control of mealy bug in mulberry ecosystem. The biology studies have revealed the presence of egg (4.6 days), four larval instars (2.65 days, 2.4 days, 3.35 days and 3.8 days), a pre-pupal (1 day) and pupal stage (3.45 days). Longevity of male and female predators were recorded as 38 and 64 days. Coitous ranged from 8-32 minutes. Investigations of feeding efficacy have shown that a grub consumed 1137 eggs or 50 nymphs or 13.7 adults of mealybug. Amongst adults, females consumed more life stages of host than a male.

Keywords: Mealy Bug, Biological Control, Native Predator, Biology and Feeding Efficacy.

INTRODUCTION

The Hibiscus mealy bug, *Maconellicoccus hirsutus* (Green) (Hemiptera: Pseudococcidae) (Fig.1) which is commonly called as pink mealy bug attacks the growing region of mulberry shoot causing "Tukra". The characteristic symptoms of this infestation are crinkling, curling and dark green leaves at the apices which show bushy appearance due to arrest of linear growth with thickening and twisting of stems (Fig-2,3,4) leading to loss of leaf yield to the tune of 7.9 to 11.09% in West Bengal (Anonymous, 1995). Tukra affected leaves are inferior in quality due to reduction in non-reducing sugars, total sugars, total soluble starch, water soluble proteins and crude protein content (Bose *et al*, 1992). Feeding silkworm with tukra affected leaves caused adverse effect on rearing performance like decline in larval weight, cocoon weight, shell weight, silk ratio and Effective Rate of Rearing (Pradip Kumar *et al*, 1992).

As the mealy bug secretes waxy filamentous secretion which makes a protective covering and takes shelter on the under surface of the crumpled leaves and at the base of leaf petioles, application of pesticides

only can't be much effective in controlling their population. Moreover continued and indiscriminate use of pesticides may lead to resistance of the pest, killing of non target and beneficial creatures, ecological imbalance, human hazards and residual effects on silkworm rearing. Keeping this in view, biological control programme of mealy bug has been initiated by the present workers. The screening of tukra infested shoots revealed the presence of all life stages of a native predator, *Brumodiessuturalis* (Fabricius) (Coleoptera: Coccinellidae) (Fig.5) feeding on the mealy bug colony. In any biological control programme before deploying the natural enemies in the field, it is highly essential to study the biological aspects of respective predator. Keeping this in view, the present study was carried out.

MATERIALS AND METHODS

Adult meals and females of *B. suturalis* (Fig.5) were collected from tukra infested mulberry shoots and taken to the laboratory for studying its biology under the controlled temperature and Relative humidity conditions at 25-28°C and 65-70% R.H. respectively. Each pair of adult beetles were kept in a separate glass beaker (size: 10x5cm) and provided with egg masses of *M. hirsutus* for oviposition. On laying, 20 eggs were kept individually in cavity blocks (size: 2 x 2 cm). Thus 20 replications were maintained and incubation period was recorded. After hatching the grubs were supplied with fresh eggs of mealy bug collected from mulberry field until pupation. Developmental periods of grub, pre-pupal, pupal, adult longevity, mating period and fecundity were recorded (Santha Kumar et al, 1994). For studying mating and ovipositional behavior, the methods suggested by Santha Kumar (1989) were followed. To determine the rate of consumption of different stages of *M. hirsutus* (eggs, nymphs and adults) by the predatory grubs and adults after hatching, each predatory grub was kept in a glass vial (size: 5.5 x 5.5 x 1.8cm) and provided with a known number of preys. Surviving preys were counted after every 24hrs and removed. Fresh preys were offered to the predatory grubs every day until pupation. Number of preys consumed by the grub in each instar and also the total number consumed by a predatory grub and adult were calculated. The feeding potential was studied by taking 10 predatory grubs, 10 males and 10 females where each individual was considered as one replication (Santha Kumar et al, 1996). The data was analyzed and presented in Table: 1 and 2.

OBSERVATIONS AND DISCUSSION

EGG

Eggs were elliptical in shape (Fig.6) and laid in groups (4 - 34) in the colony of *M. hirsutus*. They were pale yellow in colour measuring 0.98 mm in length and 0.56 mm in breadth (Table-1). Incubation period was 4.06 days, which was in variance with the observations made in *Cryptolaemus montrouzieri* Mulsant, *Scymnus coccivora* Iyer and *Nephus sp.* (Coleoptera : Coccinellidae) where the incubation periods were 4.25, 4.13 and 4.14 days respectively (Mani & Thontadarya, 1987 a& 1987b and Santha Kumar et al, 1994).

GRUB

Newly hatched grub (Fig.7) measured 1.20 mm in length and 0.52 mm in breadth having black colored body with bristles arranged in longitudinal rows. Duration of first instar grub was 2.4 days (Table-1). Second instar grub measured 1.68mm in length and 0.68mm in breadth and its developmental period was 1.5 days (Table-1). The third instar grub measured 3.42 mm in length and 0.98mm in breadth. The duration of third instar was 3.35 days. The fourth instar grub measured 5.21 mm in length and 2.09 mm in breadth. Its developmental period was 3.8 days. The total grub period was 12.2 days which was found to be shorter than *C. montrouzieri* (22.80 days) (Mani & Thontadarya, 1987a), *Nephus sp.* (13days) (Santha Kumar et al. 1994).

PRE – PUPA

The sluggish and non-feeding stage measured 4.62 mm in length and 2.64 mm in breadth (Table-1) and covered with waxy strands. The pre-pupal stage lasted for 1 day. While reviewing the literature it was found that pre-pupal period in *S. coccivora* was 1.25 days, in *Nephus sp.* 1.20 days and in *C. montrouzieri* 2.10 days (Mani & Thontadarya, 1987a & 1987b; Santha Kumar et al. 1994).

PUPA

Pupa was oval in shape, black in colour (Fig.8), measured 4.02 mm in length and 2.88 mm in breadth. The pupal period was 3.45 days as against 8.70, 5.60 and 6.40 days in *C. montrouzieri*, *S. coccivora* and *Nephus sp.* respectively (Main & Thontadarya, 1987a, 1987b and Santha Kumar et al, 1994).

Table 1. Biological and biometrical studies of *Brumoidessuturalis*

Stage of life cycle	Length (mm)	Breadth (mm)	Duration/Longevity (Days)
Egg	0.98	0.56	4.06
Range	(0.92- 1.20)	(0.48 – 0.62)	(4 -5)
Grub			
1 st instar	1.20	0.52	2.65
Range	(1.16 – 1.22)	(0.50 -0.56)	(2-3)
2 nd instar	1.68	0.68	2.4
Range	(1.62-1.70)	(0.64-0.70)	(2-3)
3 rd instar	3.42	0.98	3.35
Range	(3.38 – 3.44)	(0.96-1.00)	(3-4)
4 th instar	5.24	2.09	3.8
Range	(5.22-5.28)	(2.06-2.11)	(3-4)
Pre-pupa	4.62	2.64	1
Range	(4.60-4.64)	(2.06-2.66)	
Pupa	4.02	2.88	3.45
Range	(4-4.04)	(2.86-2.90)	(3-4)
Adult			
Male	2.84	2.20	38
Range	(2.82-2.86)	(2.18-2.22)	(32-40)
Female	3.12	2.46	64
Range	(3.10-3.14)	(2.44-2.48)	(60-72)

ADULT

Adults were black in colour with white longitudinal rows and possess distinct sexual dimorphism. Males were smaller (2.84 x 2.20mm) than females (3.12 x 2.46 mm). Male to female sex ratio was noted to be 1:1. This was in resemblance with the observations made in *Scymnus interruptus*, *C. montrouzieri* and *Nephus sp.* (Tawfik et al, 1974; Mani & Thontadarya, 1987a and Santhakumar et al, 1994). Longevity of female (64) was higher than male (38).

Table 2. Mating and ovipositional behavior of *Brumodiessuturalis*.

Sr.No.	Observation	Duration (days)	
		Mean	Range
1.	Pre-mating period	3.2	3- 4
2.	Mating period	32.8	28 – 34
3.	Coitus (Copulation period)	12.03 minutes	10 – 14
4.	Post- mating period	28	24 – 30
5.	Pre- Ovipositional period	8.42	7 – 10
6.	Ovipositional period	42.6	40 – 44
7.	Fecundity	86.42	80- 90
8.	Post-ovipositional period	12.98	10-14

MATING

The pre-mating, mating and post-mating periods were found to be 3.2, 32.8 and 28 days respectively (Table2). But the pre-mating period in *S. coccivora* and *Nephus sp.* was 4 days and 2.25 days respectively (Mani & Thontadaraya, 1987b and Santha Kumar et al., 1994). The coitus (Fig. 9) lasted for 12.03 minutes and longer than *Nephus sp.* (7.14 minutes)(Santha Kumar et al, 1994).

OVIPOSITION

Pre-ovipositional, ovipositional and post-ovipositional periods were 8.42, 42.6 and 12.98 days respectively. Where as in *Nephus sp.* these periods ranged from 11.20, 54.25 and 11.05 days respectively (Santha Kumar et al., 1994). Fecundity of the present predator was 86.42 (Table-2). *B. suturalis* deposit eggs amongst mealy bug colony, on white muslin cloth and on white cotton. This feature is very economical during mass multiplication of the predator, as eggs can be harvested easily and in the egg stage, the predator can be released in the fields for augmentative biological control of *M. hirsutus*.

FEEDING EFFICACY

Feeding efficacy of grubs and adults of *B.suturalis* on different life stages of *M.hirsutus*, revealed that the number of mealy bug eggs consumed by the grub was 1,137. The present finding is at variance with Whitcomb (1940), Oncuer and Baylan (1982) and Mani and Thontadarya (1987a) who have reported respectively that the grub of *C. montrouzieri* consumed 1,235 and 3,330 eggs of *Planococcuscitri* Risso (Hemiptera : Pseudococcidae) and 881.3 eggs of *M hirsutus*. Mani and Thontadaraya (1987b) worked out the feeding efficacy of grub of *S. coccivora* on the eggs of *M.hirsutus* as 44.10, 40.75, 64.35 and 158.50 during four instars respectively. Where as in the present study the grub of *B. suturalis* fed on 129, 173, 235 and 588 eggs of mealy bug respectively.

Amongst the larval instars, 4th instar grub was voracious by devouring highest number of mealy bug eggs. Similar observations were made by Satyanarayanamurthy (1992) and Mani and Thontadarya (1987a) in *C. montrouzieri*. In the present study, a grub has consumed 50.3 nymphs or 13.7 adults respectively during 4 larval instars. Chakraborty et al., (1999) found that grub of *Nephus sp.* consumed 70.3 nymphs or 13 adults of *M.hirsutus*. Whereas the grub of *Scymnusnubilus* Mulsant (Coleoptera : Coccinellidae) consumed 1320 eggs or 208.2 nymphs or 27.8 adults of *M. hirsutus* (Santha Kumar et al., 1996).

A female beetle of *B. suturalis* consumed 5,168 eggs or 512 nymphs or 42 adults of mealy bug. Whereas a male beetle consumed 4,950 eggs or 228 nymphs or 28 adults. Feeding efficacy studies on *Nephus sp.* revealed that the female beetle devoured 3441.1 eggs or 533.3 nymphs or 112.5 adults and a male consumed 2067.2 eggs or 409.7 nymphs or 66.4 adults (Chakraborty et al., 1999). A female predator of *S. nubilus* consumed 2302 eggs or 326.1 nymphs or 74.9 adults of *M. hirsutus*. Relatively lower feeding efficacy was recorded by the male of *S. nubilus* with 1622 eggs or 212.6 nymphs or 42.5 adults (Santha Kumar et al., 1996).



Fig.1 Mealy bug,
Fig.2 Mealy bug feeding on Mulberry shoot,
Fig.3. Leaf curl,
Fig.4. Twisting of stem.



Fig. 5. Adult of *B.suturalis* (male & female).



Fig.6.Egg of *B.suturalis*.



Fig.7. Grub of *B.suturalis*



Fig.8. Pupa of *B.suturalis*

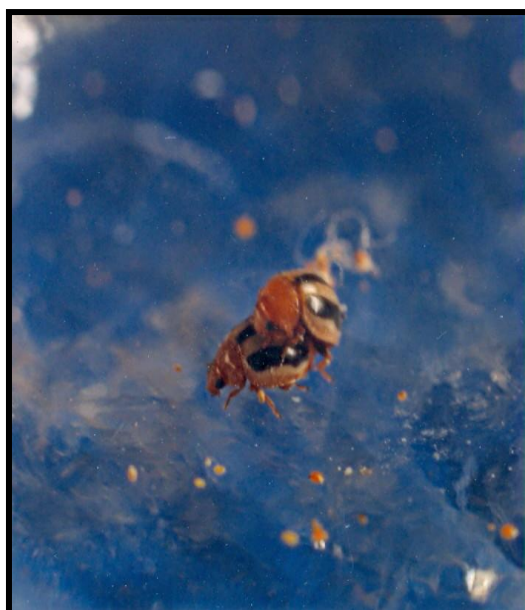


Fig.9. Mating of *B.suturalis*.

The present study will be useful as a tool for studying the standardization of mass multiplication of this native predator and for their field efficacy studies, which are highly essential to determine the number of predators required to be released per unit area of mulberry plantation in order to contain mealy bug population as well as "Tukra" infestation.

ACKNOWLEDGEMENTS

Authors are thankful to the Director, Zoological Survey of India Calcutta for identifying the predator and Mrs. Indira Roy for technical assistance.

REFERENCES

- Anonymous (1995).** Annual Research and Administrative Report of Central Sericultural Research and Training Institute, Berhampore, West Bengal.
- Bose, P. C., Majumdar, S. K. and Sengupta, K. (1992).** Effect of tukra Disease on the nutritional composition of mulberry (*Morus alba* L). 32(2) : 311-316.
- Chakraborty, N., Santha Kumar, M.V. and Sen, S.K. (1999).** Studies on the feeding potential of a Coccinellid predator, *Nephus* sp. on pink mealy bug, *Maconellicoccus hirsutus* (Green). *Sericologia*. 39 (2):193-199.
- Mani, M. and Thontadaraya, T. S. (1987a).** Development and feeding potential of Coccinellid predator, *Cryptolaemus montrouzieri* Mulsant on the grape mealy bug *Maconellicoccus hirsutus* (Green). *J. Biol. Control*. 1(1) : 19-22.
- Mani, M. and Thontadaraya T.S. (1987b).** Biological studies on the *Scymnus coccivora* Ayyar (Coccinellidae: Coleoptera). *J. Biol. Control*. 1(2): 89-92.
- Oncuer, C. and Baylan, N. (1982).** An investigation into the feeding capacity of *Cryptolaemus montrouzieri*. *Turkiye Bitki Koruma Dergisi*. 6 : 85-90.
- Pradip Kumar, P., Ramkishore, Noamani, M.K.P. and Sengupta, K. (1992).** Effect of feeding Tukra affected mulberry leaves on silkworm rearing performance. *Indian J. Seric*. 31(1): 27-29.
- Santha Kumar, M. V. (1989).** Studies on the reproductive behavior of some hymenopteran parasitoids of Lepidopterous pests of chickpea and pigeon pea in relation of reproduction. Ph. D Thesis, Shivaji University, Kolhapur, Maharashtra, India.
- Santh Kumar, M. V., Chakraborty, N. and Saha Kundu, A. K. (1994).** Biology of *Nephus* sp. (Coleoptera: Coccinellidae), the native predator of pink mealy bug *Maconellicoccus hirsutus* (Green) (Hemiptera: Pseudococcidae). *Biol. Control. Ins. Pests*. 8: 91-95.

- Santha Kumar, M. V., Chakraborty, N., Prasad, B. C. and Gupta, S. K. (1996).** Feeding efficacy of *Scymnus nubilus* Mulsant, a native predator of pink mealy bug, *Maconellicoccus hirsutus* (Green). *IPM & Sustain. Agr. an ent. Appl.* 6 : 139-142.
- Satyanarayana Murthy, M. (1982).** Studies on the biology and habits of *Cryptolaemus montrouzieri* Mulsant (Coleoptera: Coccinellidae). M.Sc. (Ag). Thesis, Andhra Pradesh. Agric. Univ. Hyderabad.
- Whitcomb, W. D. (1940).** Biological control of mealy bug in green houses. Bull. Massach. Agric. Expt. Stn., U.S.A. No. 375. 22pp.
- Tawfik, M. F. S., Abdul Nassar, S. and Saad, B. N. (1974).** The biology of *Scymnus interruptus* Goeze (Coleoptera: Coccinellidae) *Bull. Soc. ent. Egypte.* 57:9-26.

Corresponding author: Dr. M.V. Santha Kumar, Department of Zoology, Shivaji University, Kolhapur – 416 004, Maharashtra
Email: mvdrsanthakumar@gmail.com