INTERNATIONAL JOURNAL OF ADVANCED BIOLOGICAL RESEARCH

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BIOLOGY AND FEEDING POTENTIAL OF LADY BIRD BEETLE *CRYPTOLAEMUS MONTROUZIERI MULS.* ON NEW INVASIVE PEST OF INDIA COCONUT RUGOSE SPIRALLING WHITEFLY *ALEURODICUS RUGIOPERCULATUS* MARTIN

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ABSTRACT
Biology and feeding potential of *Cryptolaemus montrouzieri* Muls. on a new invasive pest of India coconut rugose spiralling whitefly *Aleurodicus rugioperculatus* was studied in the Department of Agricultural Entomology, TNAU, Coimbatore during the year 2018-2019. Coconut rugose spiralling whitefly served as a suitable host for above Australian lady bird beetle predator. *Cryptolaemus montrouzieri* it's having total developmental period 23.05 ±1.51 in days with 12.95 ±0.72 days grub period and adult longevity of 27.70 ±2.34 days. In the laboratory experiment all the larval stages of the predators were found to feed on *A. rugioperculatus*. It was observed that the fourth instar grub of *Cryptolaemus montrouzieri* with the developmental period of 3.95 ±0.89 days had consumed a maximum of 207.2 whiteflies followed by third, second and first instar grubs of the predator which consumed 184.0, 145.8 and 103.0 of whiteflies during their development period of 3.75 ±0.85 days, 2.75 ±1.84 days and 2.50 ±0.69 days respectively. In case of single grub was found to consume a total of 640.0 whiteflies both eggs and nymphs during its total larval 12.95 ±0.72 period of days. The results obtained indicate the potential of *C. montrouzieri* was an effective predator of coconut rugose spiralling whitefly.

KEYWORDS: *Cryptolaemus montrouzieri*, pest, coconut, whitefly.

INTRODUCTION

A new addition on the list of whitefly species found in Florida, *Aleurodicus rugioperculatus* Martin, was originally called the gumbo limbo spiralling whitefly, but it is now named the rugose spiralling whitefly. It is an introduced pest, endemic to Central America, and was reported for the first time in Florida from Miami-Dade County in 2009. It is naturally distributed in Belize, Guatemala, Mexico (Martin, 2004) and subsequently, it has spread to 22 other countries in Central and South America, including Florida, USA. The rugose spiralling whitefly, *Aleurodicus rugioperculatus* Martin (Hemiptera: Sternorrhyncha: Aleyrodidae) has been recently reported from India (Selvaraj *et al.*, 2016) from Tamil Nadu, Karnataka, Kerala and Andhra Pradesh. It is an invasive pest that attacks a wide range of host plants including palms, woody ornamentals and fruits. Coconut and banana are among the most preferred host plants. Whitefly feeding causes stress to the host plant by removing water and nutrients and also by producing honeydew, which covers the upper surface of the lower leaves and results in the growth of sooty mold. Although sooty mold is not a plant disease, its presence on the upper surface of the leaf can potentially reduce photosynthesis of the plant (Capinera, 2008). In India the coccinellid beetle *Cryptolaemus montrouzieri* Mulsant (Coleoptera: Coccinellidae) has provided spectacular control of heavy infestations of sucking pests, especially mealybugs (Mani 1990; Mani and Krishnamoorthy, 2008) and some soft scales (Kumar and Prakasam, 1984; Mani and Krishnamoorthy, 1990). The predator was also reported to feed on citrus mealybug, *Planococcus citri* and pink mealybug, *Maconellicoccus hirsutus* (Green) (Reddy and Narayan 1986). *C. montrouzieri* was found to be a most efficient predator among coccinellids, *Hyperaspis maindroni*, *Scymnus coccivora* and *Nephus regularis* for *P. solenopsis* in New Delhi, India (Fandi *et al.*, 2010). Moore (1988) also stated that despite the frequent use of predators, only the coccinellid *C. montrouzieri* can be considered successful. Keeping in mind the efficacy of *C. montrouzieri* on whitefly species, the present study was conducted with the objective to estimate the predation capacity of *C. montrouzieri* on different stages of *Aleurodicus rugioperculatus*, a newly introduced pest of coconut in India.

MATERIALS AND METHODS

Source of test insects

Cryptolaemus montrouzieri Muls were collected from coconut field and then mass culture was maintained in biological control laboratory. Tamil Nadu Agricultural University, Coimbatore

Biology of *Cryptolaemus montrozieri* on *A. rugioperculatus*

Thirty eggs of *Cryptolaemus montrouzieri* were kept in a small container. As soon as the egg hatched, the larvae were provided with the known quantity of *A. rugioperculatus* nymphs for the feed till they entered into

pupation. Biological parameters egg incubation period, larval and pupal period (days) were recorded daily. After the adult emergence, 5 pairs of adults collected and maintained in the adult rearing cage. Reproductive parameters such as adult survival, the longevity of male and female, pre and post-oviposition period (days) and fecundity per female were recorded daily. The experiment was conducted in a Completely Randomized design (CRD) with five replications.

Foraging potential of *C. montrouzieri* against *A. rugioperculatus*

Laboratory experiments were conducted to study the foraging potential and longevity of *C. montrouzieri* on *A. rugioperculatus.*

The predators were placed individually in small plastic containers (20 x 10cm) covered with Khada cloth (Fig 1). Study was conducted for fifteen individuals for each predator, using the egg and nymphal instars of *A. rugioperculatus* separately. Each instar of grub stage was considered as one treatment and there were three treatments replicated five times maintained to assess the predatory potential of grub. Based on the length width and the size of the grub, the instars of the grub were fixed. The predators were examined daily and fresh leaves with *A. rugioperculatus* population were provided in alternate days to ensure that the predators always had an excess of prey. The leaves used in the experiment were examined under microscope and the number of *A. rugioperculatus* population fed by the predator was counted. The study was continued till the mortality of the predator and the longevity was worked out. The fecundity, incubation period, first, second, third, fourth instar grub period, pre-pupal, pupal and total developmental period along with adult longevity were studied for both the predators.

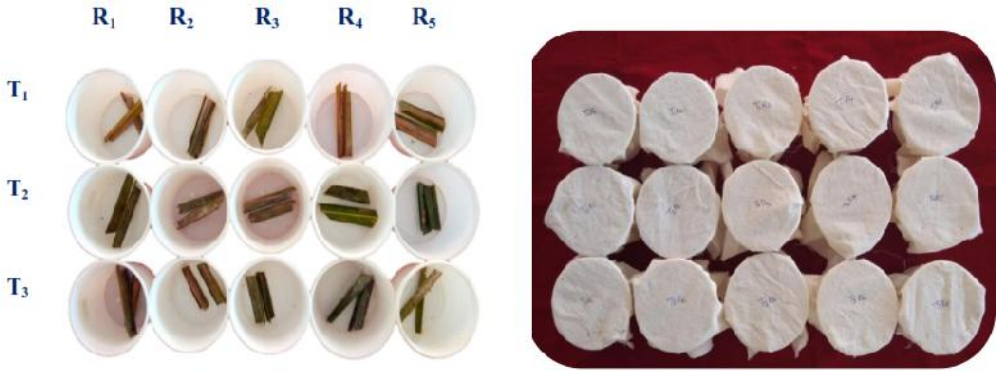
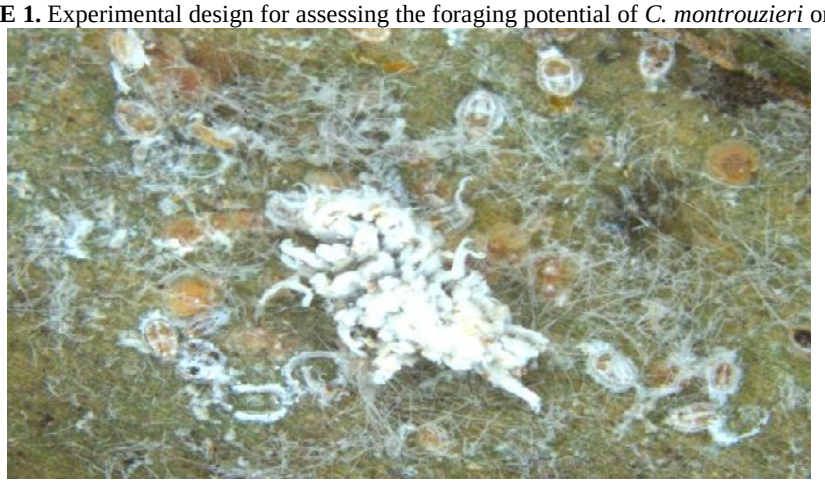


FIGURE 1. Experimental design for assessing the foraging potential of *C. montrouzieri* on RSW



a. Lady bird beetle, *C. montrouzieri* (IV instar grub) feeding on RSW nymphs

Statistical Analysis

The data were subjected to statistical analysis adopting completely randomized block design with 3 treatments and 5 replications and the mean values of treatments were separated by Least Significant Difference (LSD) (Gomez and Gomez, 1984) using AGRES ver. (7.01), Pascal International Solutions.

RESULTS AND DISCUSSION

Biology of *C. montrouzieri*

Biology of *C. montrouzieri* on *A. rugioperculatus* were given in (Table 1) Maximum egg incubation period was recorded in *C. montrouzieri* 3.4 ±0.50 days, when it is reared on *A. rugioperculatus* the total grub period of *C. montrouzieri* is 12.95±0.72 days which includes first instar (2.50 ±0.69), Second instar (2.75±1.84), third instar (3.75 ±0.85) and fourth instar (3.95 ±0.89) days respectively.

TABLE 1. Biology of *Cryptolaemus montrouzieri Muls.* on *Aleurodicus rugioperculatus* Martin

Life stages	Duration (Days± SD*)	Range (days)
Egg	3.4±0.50	3-4
I Instar	2.50±0.69	2-4
II Instar	2.75±1.84	2-5
III Instar	3.75±0.85	3-6
IV Instar	3.95±0.89	3-6
Total grub period	12.95± 0.72	9-13
Pre pupal period	1.3 ± 0.48	1-2
Pupal peiod	6.70±0.73	6-8
Total development period	23.05 ± 1.51	18-24
Adult longevity	27.70±2.34	22-31

TABLE 2. Feeding potential of *Cryptolaemus montrouzieri Muls.* on RSW

Stages of *C.montrouzieri*	Number of *A. rugioperculatus* consumed by *Cryptolaemus montrouzieri* per stage*					
	Eggs	I instar	II instar	III instar	IV instar	Total
I instar	16.4 (4.04)	26.8 (5.21)	23.2 (5.40)	21.8 (4.66)	14.8 (3.84)	103.0
II instar	27.2 (5.17)	32.8 (5.72)	28.8 (5.36)	33.2 (5.76)	23.8 (4.87)	145.8
III instar	34.8 (5.89)	42.0 (6.48)	38 (6.16)	43.6 (6.60)	25.6 (5.05)	184.0
IV instar	37.2 (6.09)	52.0 (7.21)	54.6 (7.38)	34.2 (5.84)	29.2 (5.40)	207.2
Total	115.6	153.6	144.6	132.8	93.4	640.0
SEd	2.5475	2.6439	2.6589	2.0833	1.9849	-
CD (P = 0.05)	5.4006	5.6048	5.6368	4.4164	4.2079	-

*Mean of five replications; significant at 1%; figures in parentheses are square root transformed values; in a column, means followed by a common letter(s) are not significantly different by DMRT (P = 0.05)

All the instars of grub were effectively feeding on *A. rugioperculatus* and turned into pupa. Pupal period for the predator are around 6.70 ±0.73 days respectively. Adult longevity is high 27.70 ±2.34 days in *C. montrouzieri.* Siddhapara *et al.* (2013) also reported that the total larval developmental period of *C. montrouzieri* varied from 11 to 14 days with an average of 12.62 ±1.67 days when reared on *P. solenopsis.* Gautam (2008) reported the longevity of male and female was 30 and 50 days on *F. virgata* and 40 and 53 days on *M. hirsutus*, respectively

Foraging potential of *C. montrouzieri* against *A. rugioperculatus*

The data on foraging potential of *C. montrouzieri* is presented in Table 2. It was observed that the fourth instar grub of *C. montrouzieri* with the developmental period of 3.95 ±0.89 days had consumed a maximum of 207.2 whiteflies stages followed by third, second and first instar grubs of the predator which consumed a maximum of 184.0, 145.8 and 103.0 eggs and nymphs of whiteflies during their development period. Further, single *C. montrouzieri* grub was found to consume a total of 640.0 whitefly stages during its total larval period of 12.95± 0.72 days. In general, fourth instar coccinellids are known to consume greater quantities of prey than other stages (Fandi *et al*., 2010; Lucas *et al*., 2004).

ACKNOWLEDGEMENT

The authors are grateful to Dean, School of Post Graduate Study (SPGS), Director, Professor and Head, Department of Entomology and Central for Plant Protection Studies and Tamil Nadu Agricultural University for giving assistance during my research period.

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