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**Short Note**

# Potential of Native Predators, *Chrysoperla zastrowi sillemi* (Esben-Petersen) and *Cryptolaemus montrouzieri* (Mulsant) on *Paracoccus marginatus* (Williams and Granara de Willink)

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**Predatory potential of *Chrysoperla zastrowi sillemi* (Esben-Petersen) and *Cryptolaemus montrouzieri* Mulsant on *Paracoccus marginatus* (Williams and Granara de Willink) infesting papaya was studied in the laboratory. Grubs of *C. zastrowi sillemi* required 6.4 ovisacs, 463.6 nymphs and 72.0 adults of *P. marginatus* to complete their life stages. The first instar chrysopid grub consumed 1.4 ovisacs, 85.0 nymphs and 13.2 adults of *P. marginatus*. Among instars of chrysopid the second and third instars were voracious and consumed 1.8 ovisacs, 142.4 nymphs and 23.4 adults and 3.2 ovisacs, 236.2 nymphs and 35.4 adults of *P. marginatus,* respectively. Grubs of *C. montrouzieri* required a total number of 8.4 ovisacs, 164.2 nymphs and 66.8 adults of *P. marginatus* to complete their life stages. Among instars of the coccinellid predator, the third and fourth instars were voracious and consumed 2.6 ovisacs, 47.2 nymphs and 24.8 adults and 2.8 ovisacs, 71.6 nymphs and 28.8 adults of *P. marginatus,* respectively. Adults of *C. montrouzieri* consumed 5.6 ovisacs, 105.4 nymphs and 36.4 adults of *P. marginatus*. *So C. zastrowi sillemi* and *C. montrouzieri* can be effectively employed as candidate predatory insects in the management of papaya mealybug.**

**Key words**: Predatory potential, *Chrysoperla zastrowi sillemi*, *Cryptolaemus montrouzieri, Paracoccus marginatus*, papaya.

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Papaya mealybug *Paracocus marginatus* Williams and Granara de willink is a polyphagous pest of important field crops, tropical and sub-tropical fruits, vegetables and ornamental plants (Ben-Dov, 2008). It caused an estimated loss of about Rs. 300 crores to papaya in Tamil Nadu, India (Revathy, 2010). The papain industry at Coimbatore district was lost due to the severity of the pest on papaya which also spread to tapioca and mulberry in neighbouring states of Tamil Nadu in India. (Suresh *et al.,* 2010). A number of chemical control measures are available. Problems with insecticide resistance render chemical control a less desirable management option to combat this pest. Under these circumstances, biological control is the best alternative. Natural enemies of the papaya mealybug under field conditions include the chrysopid, *Chrysoperla zastrowi sillemi* (Esben-Petersen) (Henry *et al.,* 2010) and the coccinellid, *Cryptolaemus montrouzieri* (Mulsant). These predators have very potential impact on mealybug populations.

The occurrence of *C. zastrowi sillemi* on *Planococcus citri* in citrus orchards was first reported by Mani and Krishnamoorthy (1989). In India, the establishment of *C. montrouzieri* was first reported from Karnataka feeding on Araucaria scale,

*Eriococcus araucariae* Mask., infesting guava, mango, mulberry *etc*., (Puttarudriah *et al*., 1952). *C. montrouzieri* and *Chilocorus nigritus* (Fabricius) were found feeding on *P. marginatus* in Guam (Meyerdirk *et al.,* 2004). Considering the importance of biological control it is highly essential to study the predatory potential of these native predators.

## Materials and Methods

### *Mass culturing of C. zastrowi sillemi*

The prey insect *Corcyra cephalonica* (Stainton) was reared in the laboratory following the procedure of Navarajanpaul (1973) at Biocontrol laboratory, Department of Agricultural Entomology, TNAU, Coimbatore. *C. zastrowi sillemi* was mass cultured using the eggs of *C. cephalonica* as described by Patel *et al.* (1988). Larval rearing was done in round plastic basins (40 cm dia) at 250 larvae per basin covered with *khada* cloth. During adult rearing, on the fifth day, the adults were transferred to fresh G.I. tray, which was already wrapped on inner sides with a brown paper sheet acting as substratum for egg laying. The standard food for the adults prepared by mixing equal parts of fructose, Protinex®, yeast powder, honey and a little quantity of water was placed in the form of a thick paste on the outside of the cover cloth. Cut piece of sponge foam soaked in water was also kept over the top of the cloth to supply water to adults.The trays were kept at room

temperature (27 ± 4°C) with 8 to 10 h. photoperiod. Every day the adults were transferred into fresh rearing trays. The paper sheets containing *C. zastrowi sillemi* eggs were removed daily and used for further studies.

***Mass culturing of C. montrouzieri***

*C. montrouzieri* is the dominant coccidophagous species and was multiplied on pumpkin infested with *Maconellicoccus hirsutus*. One fully infested pumpkin was maintained separately in a wooden cage (1'x1'x 1') size and 50 adults of *C. montrouzieri* (15 day old) comprising both sexes (1:1) were introduced on the infested pumpkin. A vial containing 50 per cent honey solution was kept inside the cage as supplementary food for the mating adults. The cages were kept under dark for mating and oviposition of beetles following the procedure of Mani and Krishnamoorthy (1997). During this period, beetles deposited their eggs either singly or in groups in the ovisacs of female mealybugs. The grubs were visible in such cages with in a week after the introduction of the beetles. Grubs of *C. montrouzieri* pupated on the pumpkin or anywhere inside the breeding cage after a period of 20 days. To facilitate easy removal of pupa, dried guava leaves were kept at the base of the pumpkin in the cages. Emerged adults were collected and introduced into pumpkin with 15 days old mealybugs for further multiplication. Thus the cycle was repeated. Life stages of *C. montrouzieri* were transferred from this laboratory cultures for conducting experiments. The culture of mealybug species, *M. hirsutus* and the predator, *C. montrouzieri* were maintained in the laboratory at 25.5 ± 2.1°C and 69.9 ± 5.5 % RH at the Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore.

***Assessment of predatory potential of C. zastrowi sillemi***

The predatory potential of the larval instars of *C. zastrowi sillemi* against each stage of mealybug *viz.,* ovisac, nymph and adult was studied under laboratory conditions. Sunflower leaf was cut into circular pieces and kept inside Petri plate (9mm dia.) containing agar medium to maintain the turgidity of the leaves. Known numbers of different stages of prey insects were provided separately for the first, second and third instars of *C. zastrowi sillemi*. Each treatment was replicated ten times. The number of prey insects consumed was recorded daily and fresh mealybugs were provided to the predator until they reached the next instar. In this way, the number of prey insects consumed during each larval instar was recorded.

***Assessment of predatory potential of C. montrouzieri***

Laboratory experiments were conducted to determine the rate of consumption of different life stages of mealybugs (ovisacs, nymphs and adults) by *C. montrouzieri* grubs and adults. Mulberry leaf was cut into circular pieces and kept inside Petri plate (9mm dia) containing agar medium to maintain the turgidity of the leaves. Freshly emerged grub of *C. montrouzieri* was provided with known number of ovisacs, nymphs and adults of mealybugs separately. Fresh mealybug ovisacs/ nymphs/ adults were offered to the grubs until they reached the next instar. The number of prey insects consumed by the grub in each instar and the total consumption during grub period was calculated. The number of prey insects consumed by the adult in 24 h was recorded. The feeding potential studies were conducted with ten grubs considering each grub as a replication.

## Results and Discussion

Grubs of *C. zastrowi sillemi* required a total number of 6.4 ± 0.9, 463.6 ± 76.3 and 72.0 ± 11.1 ovisacs, nymphs and adults of *P. marginatus* to complete their life stages (Table 1). Among various instars of the predator, second and third instars were voracious and consumed 1.8 ± 0.4, 142.4 ± 4.4 and 23.4 ± 1.5 number and 3.2 ± 0.4, 236.2 ± 27.0 and 35.4 ± 3.0 numbers of ovisacs, nymphs and adults of *P. marginatus,* respectively. The consumption of first instar was 1.4 ± 0.5, 85.0 ± 7.3 and 13.2 ± 1.3 numbers of ovisacs, nymphs and adults of *P. marginatus,* respectively (Table 1). In the present findings it was observed that the second and third instar grubs of *C. zastrowi sillemi* consumed more number of nymphs than adults. Mahalakshmi (2009) stated that all the three larval instars of *C. zastrowi sillemi* consumed higher numbers of first instar of *Phenococcus solenopsis* Tinsley compared to its second and third instar of mealybugs. Tesfaye and Gautam (2002) opined that the predatory potential was high in late instars than the younger ones. The gradual increase in the feeding rate of older larvae might be due to their increased nutritional requirement. Kamath *et al*. (2001) observed similar predatory efficiency of *C. carnea* as reported in the present study. Sattar *et al*. (2007) reported that *C. zastrowi sillemi* larvae were voracious feeders of cotton mealybugs and the predation efficiency increased tremendously under no choice larval feeding.

Grubs of *C. montrouzeuri* required a total numbers of 8.4 ± 0.7, 164.2 ± 23.9 and 66.8 ± 12.1 ovisacs, nymphs and adults of *P. marginatus* to complete their life stages. The adult of *C. montrouzeuri* was able to consume on an average of 5.6 ± 1.1, 105.4 ± 14.3 and 36.4 ± 8.4 numbers of ovisacs, nymphs and adults of *P. marginatus*. Among various instars of the predator, third and fourth instar were voracious and consumed 2.6 ± 0.5, 47.2 ± 1.9 and 24.8 ± 3.1 numbers and 2.8 ± 0.4, 71.6 ± 3.0 and 28.8 ± 5.1 numbers of ovisacs, nymphs and adults of *P. marginatus,* respectively. The consumption of first and second instars were 1.2 ± 0.4, 16.8 ± 1.6 and 3.0 ± 1.2 numbers and 1.8 ± 0.4, 28.6 ± 3.4 and 10.2 ± 1.9 numbers of ovisacs, nymphs

**Table 1. Feeding potential of predators on life stages of *Paracoccus marginatus***

| Predator | Consumption at life stages of *P. marginatus* | | |
|---|---|---|---|
| | Ovisacs | Nymphs | Adult |
| *C. zastrowi sillemi* | | | |
| I instar grub | 1.4 ± 0.5 | 85.0 ± 7.3 | 13.2 ± 1.3 |
| II instar grub | 1.8 ± 0.4 | 142.4 ± 4.4 | 23.4 ± 1.5 |
| III instar grub | 3.2 ± 0.4 | 236.2 ± 27.0 | 35.4 ± 3.0 |
| Total | 6.4 ± 0.9 | 463.6 ± 76.3 | 72.0 ± 11.1 |
| Adult | Free living | | |
| *C. montrouzieri* | | | |
| I instar grub | 1.2 ± 0.4 | 16.8 ± 1.6 | 3.0 ± 1.2 |
| II instar grub | 1.8 ± 0.4 | 28.6 ± 3.4 | 10.2 ± 1.9 |
| III instar grub | 2.6 ± 0.5 | 47.2 ± 1.9 | 24.8 ± 3.1 |
| IV instar grub | 2.8 ± 0.4 | 71.6 ± 3.0 | 28.8 ± 5.1 |
| Total | 8.4 ± 0.7 | 164.2 ± 23.9 | 66.8 ± 12.1 |
| Adult | 5.6 ± 1.1 | 105.4 ± 14.3 | 36.4 ± 8.4 |

All values are mean of ten replications; All values are Mean ± Standard error

and adults of *P. marginatus,* respectively. In the present investigation, grubs and adults of *C. montrouzieri* consumed more number of nymphs than adults of *P. marginatus.* The gradual increase in the feeding rate of older larvae might be due to their increased nutritional requirement and the present findings are in consonance with Allwin (2007) , who reported that among two life stages, adults of *C. montrouzieri* were more voracious and each adult consumed an average 258.7, 352.1 and 217.3 numbers of *M. hirsutus* while it was 323.8, 715.6 and 328.6 number of eggs, nymphs and adults of *Planococcus citri* Ckll. respectively. The highest feeding rate was observed in the fourth larval instar than other instars which is in concurrence with the findings of Satyanarayanamurthy (1982). According to Mahalakshmi (2009), the grubs of *Scymnus coccivora* Ayyar consumed maximum numbers of cotton mealybugs compared to the grubs of *C. montrouzieri.*

Based on the present investigations, it may be concluded that both, *C. zastrowi sillemi* and *C. montrouzieri* posses very good predatory potential as evident from their feeding rates on the life stages of *P. marginatus*. Since, chrysopids and coccinellds are generalist predators they can play a very important role in any biological control programme. Thus, awareness on the role of these natural enemies needs to be imparted to farmers in order to reduce the pesticidal sprays on a natural enemy-rich ecosystem. Through proper non-insecticidal measures, the chrysopids and coccinellids could be augmented well, resulting in efficient natural control of the invasive *P. marginatus*.

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