Bio-Control Potential of *Sycanus Reclinatus* Distant (Hemiptera: Reduviidae) On the *Euproctis Fraterna* Moore (Lepidoptera: Lymantriidae).

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Abstract

Sycanus reclinatus (Hemiptera: Reduviidae) is a reduviid predator of many agricultural crop pests. A laboratory experiment was conducted to evaluate the bioefficacy of this predator using functional response as a tool. *Sycanus reclinatus* third, fourth, and fifth instar nymphs and adults on *Euproctis fraterna* Moore *were* evaluated. The predatory rate gradually increased from the third instar nymph to adults. *S. reclinatus* killed and consumed more prey in high densities (4.5, 4.6, 6.0, and 4.5 prey/predator). The rate of discovery gradually diminished when the predator grew older. Handling time also decreased when the predator grew older. *S. reclinatus* showed an exponential (Type II) functional response when *E. fraterna* was exposed to it. Type II functional response is more pronounced in pests. Such different patterns show that the predator needs to adapt distinct strategies according to the kind of prey available in the field. The biological control potential of *S. reclinatus* concerning the pest *E. fraterna* shows that the searching time, handling time, and number of prey killed depended upon the prey densities and predator life stages. Hence, the predator S. reclinatus can be utilized to control and manage the selected lepidopteran pest.

Key words: *Euproctis fraterna,* Functional response, *Sycanus. reclinatus,* Bioefficacy.

Introduction

Reduviid predators are potential biocontrol agents against many insect pests and hence, they have the potential for an even greater role in Integrated Pest Management (Ambrose, 2000; Grundy and Maelzer 2000). In biological control program, the reduviid predator has been widely used worldwide under laboratory and field conditions. Reduviids have been recorded as important natural enemies in suppressing several pests especially orthopteran, hemipteran, and lepidopteran insects (Sahayaraj 2006, Grundy 2007). Reduviid predators are frequently recorded as effective regulators of insect populations (Ambrose *et al*., 2009; Ambrose and Claver, 2009; Chandral *et al*., 2009). *Sycanus reclinatus* (Hemiptera: Reduviidae) is a multivoltine, voracious harpactorine reduviid predator (Ambrose *et al*., 2003). It has been recorded as an efficient predator of pests of the cotton. Presently, biological control is considered advantageous for pest management through integrated approaches and also helps to avoid insecticidal application and its ill effects in different crop ecosystems. *Sycanus* is a genus of assassin bugs (family Reduviidae), in the subfamily Harpactorinae (Biolib 2019).

Euproctis fraterna identification

- **Larva**: Reddish brown hairy caterpillar, head red in colour surrounded by white hairs. Abdomen has tufts of hairs all over the body and a long pre anal tuft.
- **Adult**: yellow moth with pale transverse lines and black spots on the forewing

The hairy caterpillar *Euproctis fraterna* (Lepidoptera: Lymantriidae) (plate 1c) is an important forest pest that feeds on the foliage of many dicotyledonous tree species. Larvae of *E. fraterna* were found defoliating one of the important forest trees *Terminalia arjuna* in Mysore (Karnataka). Suresh Chand and Sanjayan (2010) have reported the feeding efficiency of the caterpillar *E. fraterna.* The following two species of hymenopteran parasitoids, viz. *Apanteles prodiniae [A. prodeniae]* (Braconidae) and *Euplectrus* sp. (Eulophidae) were recorded.

Understanding predator-prey interaction has been the purpose of numerous studies, especially for predator use in biological control in agroforestry ecosystems. Furthermore, the feeding rate of an individual predator as a function of prey density is termed a functional response (Holling, 1959). The knowledge of functional response is a pre-requisite for

understanding the predator – prey interaction and to evolve strategies for mass rearing, large scale release and utilization in biological control programs.

Arjuna is the large size deciduous tree. The height of the Arjuna tree reaches upto 60 -85 feet. It is the evergreen tree with the yellow flowers and conical leaves. It has a smooth gray bark. Fruit is 2.5 -3.5 cm long, fibrous woody, glabrous with 5 hard wings, striated with numerous curved veins. It has a buttressed trunk and a vast spreading crown from which the branches drop downwards. Its leaves are dull green above and pale brown beneath. Arjuna flowers (plate 1) between March to June and fruits between September to November.Arjuna is the large size deciduous tree. The height of the Arjuna tree reaches upto 60 -85 feet. It is the evergreen tree with the yellow flowers and conical leaves. It has a smooth gray bark. Fruit is 2.5 -3.5 cm long, fibrous woody, glabrous with 5 hard wings, striated with numerous curved veins. It has a buttressed trunk and a vast spreading crown from which the branches drop downwards. Its leaves are dull green above and pale brown beneath. Arjuna flowers between March to June and fruits between September to November (Biswas *et al.*,2011).

***erminalia arjuna* systamatics**

Kingdom :	Plantae
Division	Magnoliophyta
Class:	Magnoliopsida
Order :	Myrtales
Family :	Combretaceae
Genus :	Terminalia
Species:	T. arjuna
Zoological name :	Terminalia arjuna

Materials and methods

Insect collection and maintenance

The reduviid predator (Plate 5d) and the pests (plate 1c) were collected from agroforestry ecosystems in and around Tirunelveli and Kanyakumari districts, Tamil Nadu, India. The collected insects were maintained under the laboratory conditions (31±1° C, 75±5% RH and 11-13 hours (L: D) in plastic containers of 20 cm diameter). They were initially fed with *C. cephalonica* larvae for predator. Castor leaves for pest larvae.

Plate 1.a. *Terminalia arjuna* twick
Source: Pinterest

Plate1.b. .*Terminalia arjuna* twick flowers

Plate*1.c. Euproctis fraterna 3rd Instar*

Bioefficacy of reduviid on forest pest's *E. fraterna*

Stage preference

Stage preference studies of the third, fourth, and fifth nymphal instars and adult of *S. reclinatus* on *E. fraterna* were performed under laboratory conditions by providing all the life stages except the first instars of *E. fraterna.* Preys (plate 5a, 5b, 5c,5d.) were introduced into the Petri dish along with cotton leaves and were left undisturbed for 10 minutes. Each nymphal instar and adult of the predator was introduced into the Petri dishes separately and successful killing of the prey by the predator and percentage of consumption were recorded.

Functional response

To evaluate the functional response, 10 newly emerged (24 h starved) third instar nymphs of *S. reclinatus (*plate 3,c*)* were used in each one of the densities (1, 2, 4, 8, 10) of preferred life stages of *E. fraterna* (1, 5, 10, 20, 40,60). After 15 minutes, the predators were individually released into the Petri dish (9cm diameter). To mimic the natural condition, a cotton leaf was placed inside the experimental setup. Predatory behavior such as approaching time and handling time were recorded for 3 hours continuously by visual observation. The numbers of ingested or killed and remaining prey were recorded after

24 h (T). The predator search efficacy was calculated from the number of dead and offered prey. The linear regression graphs were plotted for the feeding efficacy of the predator.

Results

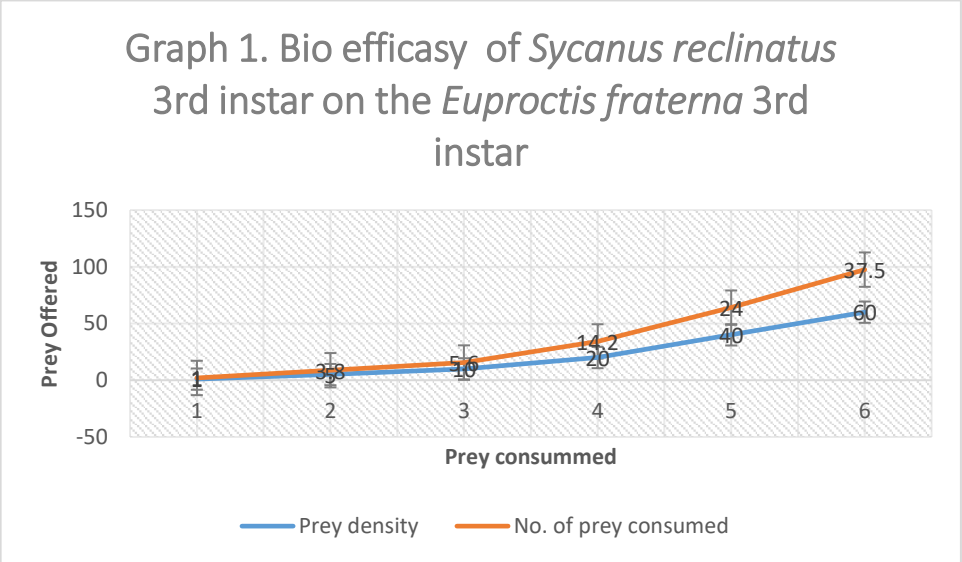
Stage preference

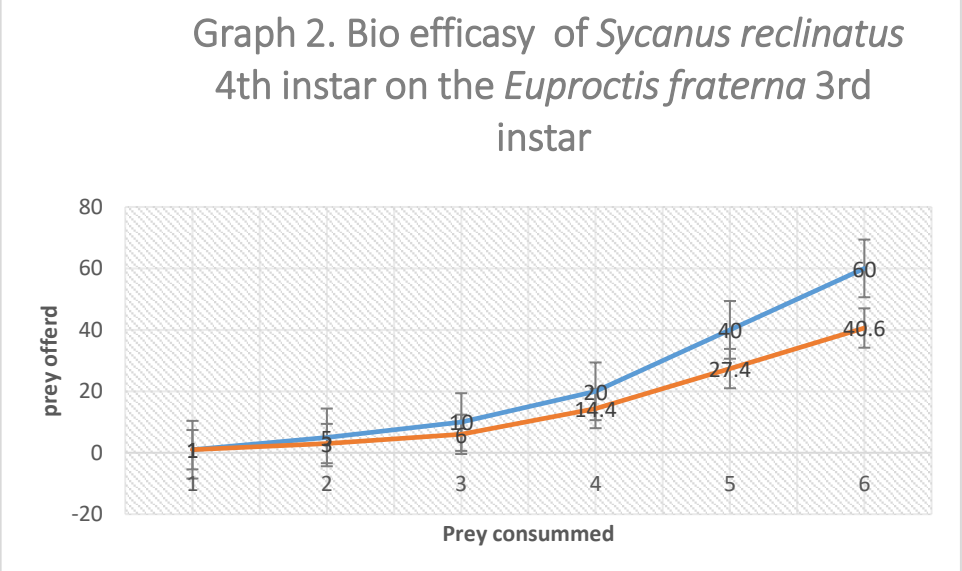
The third instars of *S. reclinatus* were preferred by III and IV instars of the *E. fraterna*. The V instars of the predator fed maximum on the fourth instars of the pest and adults of the predator preferred fifth instars of *E. fraterna*. These results show that the life stages of *S. reclinatus* preferred different stages of the tested pest. The results also suggest that both fifth instar and adult predators were more successful in encountering the large-sized *E. fraterna* 3rd instar (Graph. 1 to 4).

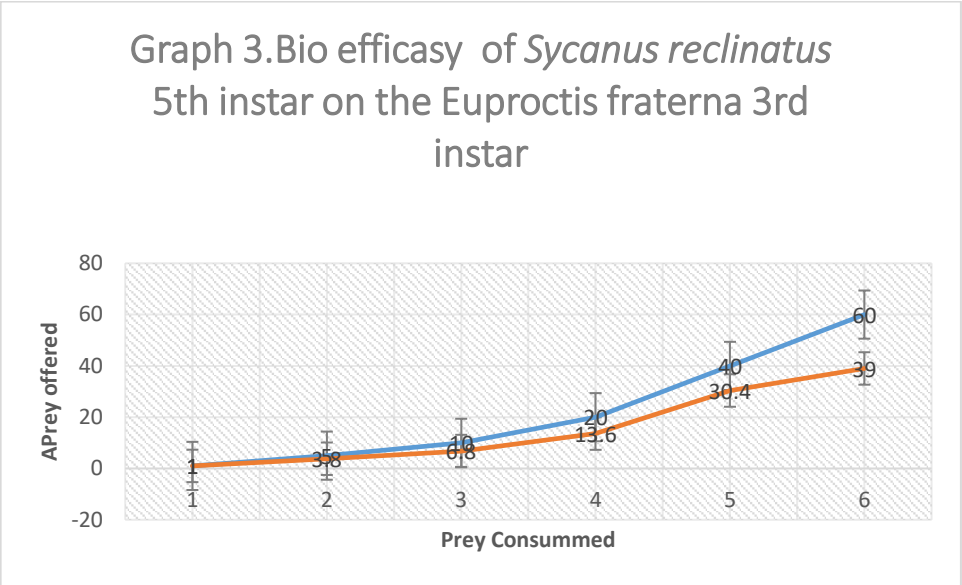
Functional response

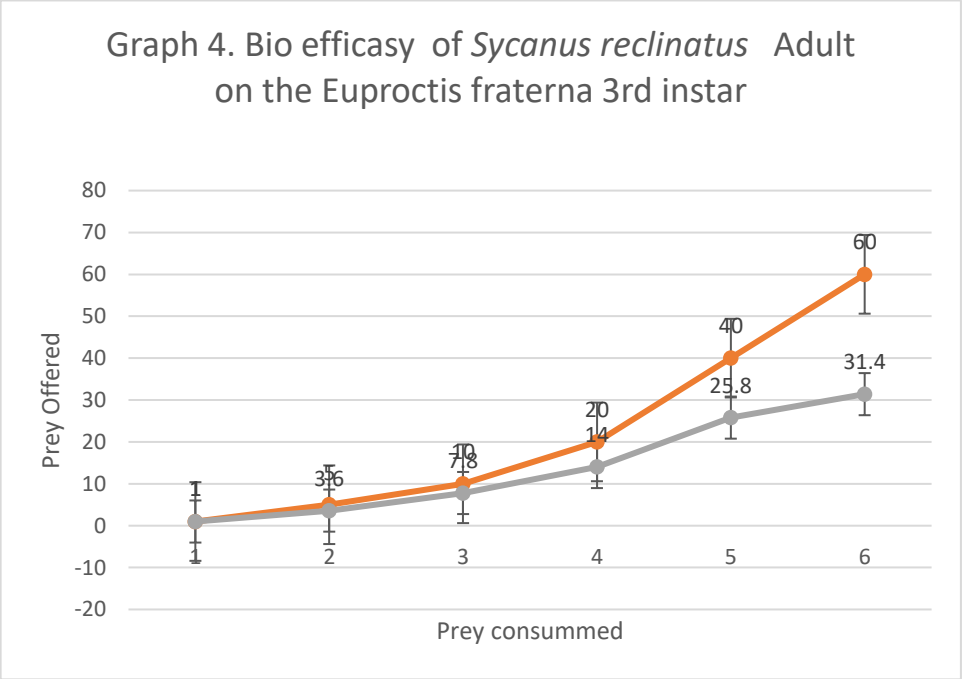
It is a density-dependent function of the tested predator's response to the increasing prey density by killing more prey than it killed at lower prey densities *i.e.*, its predatory rate was increased with an increase in prey density. The functional response of third, fourth, fifth, and adult *S. reclinatus* was recorded, and the results revealed that the attack ratio decreased with an increase in prey density. Handling time seemed to decrease with increasing prey density in both fifth nymphal instars and adults, but this relation was not defined in the third and fourth nymphal instars of *S. reclinatus* while provided with *E. fraterna*. The predators exhibited a typical functional response and thus established the applicability of the second model of Holling's 'disc' equation.

The third, fourth and fifth nymphal instars and adult of *S. reclinatus* on *E. fraterna* showed maximum Na values (3.33, 3.96, 4.23 and 4.41) at 60 prey densities respectively (y=1.24+0.22x, r=0.921; y=0.89+0.32x; r=0.99; y=0.96+0.34x; r=0.98; y=0.92+0.36x; r=0.98). The consumption ratio was significantly high when offered density is high in number 0.78 in 60 density of adult predator *S. reclinatus*









Discussion

The efficacy of the predator under controlled conditions depends upon the type and number of prey consumed. Moreover, before utilizing a natural enemy for biological control, it is important to assess its ability to capture and consume relevant stages of the targeted insect pests. The biocontrol potential of *S. reclinatus* on *E. fraterna* was recorded in this study. The result revealed that particular stages of the predator preferred certain specific stages of the pests. Moreover, younger reduviids preferred younger prey and vice versa. Stage preference exhibited by the life stages of *S. reclinatus* could be attributed to the dynamics of prey – predator interaction which is governed by the size of both predator and prey (Sahayaraj and Ambrose, 1994). In early instars larvae feeds by scraping the chlorophyll content of the leaves and later instars are voracious feeders and known to cause the skeletonising the leaves by feeding the whole leaf except mid rib and veins of the leaves (Hanamant *et al*., 2021) The potentiality of *S. reclinatus* was previously analyzed on *Riptortus clavatus* (Ambrose and Claver 1995), *Spodoptera litura* (Ambrose and Claver 1997; Ambrose and Maran 2000). The feeding efficacy of the predators increased while the prey density increased. This exhibits a typical type II model holling's disc equation. The feeding efficacy was positively correlated with prey density but the attack ratio was higher in low prey densities. This experiment clearly revealed that different stages of the predator can be utilized in pest management program. However, before recommending this reduviid for biological control programs, it is essential to evaluate its potentiality at augmentation level.

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