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ACTIVITIES OF PEST AND PREDATOR ASSOCIATED WITH TROPICAL TASAR SILKWORM *ANTHERAEA MYLITTA*: A STUDY IN LITTIPARA REGION (JHARKHAND)

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ABSTRACT

The present study was conducted in the block plantation of *Terminalia arjuna* during the month of November and December, 2022 in Littipara region of Pakur district in Santhal Pargana, Jharkhand. During the study host-seeking behavior of the following predators were studied: *Sycanus collaris*, *Polistes* spp., *Eocanthecona furcellata*, *Hierodula* spp. and small dipterans (*Forcipomyia fuliginosa* and *Forcipomyia esakiana*). The diel activity of the aforementioned following species were quantified and qualified. Further in this study we redesigned and fabricated a device: FLYCATCH which is a mechanical trap for catching the insects. The abundance and prevalence data of all the pests were documented during the study.

Keywords: Host-seeking activity, *Sycanus collaris*, *Eocanthecona furcellata*, *Hierodula* spp., *Polistes* spp., small dipterans

Introduction

Tropical tasar silkworm, *Antheraea* mylitta Drury rearing is a prime occupation for several tribal people in Central India. Many of these farmers depends on departmental farms for seed crop rearing and forest based *Terminalia arjuna* (L.) and *Terminalia tomentosa Roxb (ex DC)* Weight and Arn (Combretaceae) for commercial rearing of silkworm in coordination with the State sericulture and Forest Department. Since, tasar silkworm rearing is being conducted under outdoor conditions on host plants; the success is highly influenced by both biotic and abiotic factors. In resent times, the improved production practices along with the climate change (delayed monsoon and prolonged dry spells) have drastically escalated the sucking insect-pests problem on host plants of tasar silk worm in a subtle and obvious fashion. Due to the prevailing restrictions for spraying of synthetic chemicals within the forest areas, the management of several insect pests is becoming a serious concern.

Among the several insect pests, the sucking insect-pests are highly harmful, posing great threats for quality leaf production. Major sucking pests are *Rhiphiphoraothrips cruentatus* Hood (Thysanoptera: Thripidae), *Trioza fletcheri minor* Crawford (Hemiptera: Psyllidae), *Clovia* sp.(Hemiptera: Arthrophoridae), *Hishimonus indicus* (Sohi) and *H. viraktamathi* Knight (Hemiptera : Ciradellidae) (Chandrashekharaiah *et al*., 2018). Management of these sucking pest are highly cumbersome due to their specific survival behavior, reproductive adoption, resistance to chemicals, shorter life-cycle and feeding behavior (Lu *et al*., 2016, Chakravarthy 2015). Sap feeding pests slurp the nutrient content in the leaves of host plant prior to the rearing of silkworm and affect

quality of leaves during rearing and result in poor quality cocoons.

Among these these sucking pests, the gall fly/psyllid *trioza fletcheri minor* Crawford (Hemiptera: Psyllidae) is an endemic pest in the major tasar sericulture practicing states and inflict damage on the leaves of host plants up to 40-50% by sucking sap and forming galls on the leaves (Thangavelu and Singh, 1991). Presently dimethoate (Rogoer 30 EC) @ 0.09% application followed during pre-monsoon season to check the multiplication of *Psyllid* population on *T. arjuna* and *T. tomentosa* as a preventive measures. However, *T. fletcheri minor* from the unprotected plants of forest/avenue trees disperse to silkworm rearing seasons. Hence, there is much scope for management of *Psyllids* using potential natural enemies on tasar silkworm host plants. Therefore, this study was intended to study the *T.f minor* population during silkworm rearing seasons and identification of its major natural enemies in the major tasar sericulture practicing districts in Jharkhand state.

In the present study *Sycanus collaris, Polistes* spp. *Eocanthecona furcellata*, *Hierodula* spp. and small dipterans were evaluated for their diurnal activity. Occurrences of pests on *A. mylitta* on the basis of feeding behaviour and damage caused by parasites and/or predators to *A. mylitta*, the larval and pupal parasites includes the following aforementioned species. In addition, predation by birds, lizard, squirrel, monkey and rat was also recorded. The occurrence of these parasites and predators fluctuates considerably during each crop, depending on the habitat and climatic conditions, for e.g. rainy, winter and summer seasons.

The carnivorous stink bug *E. furcellata* (Hemiptera: Pentatomidae) is a harmful predator on *A. mylitta*. Both the nymphs and adults attack the early stages of tasar silkworm (usually first to third instar), with the rate of predation being high during moulting. The rostrum or proboscis is pierced into the larval integument and hemolymph is sucked from the host larva. Sometimes, the bugs suck the haemolymph from the spinning larva through the moist and thin network of silk thread of cocoon.

The wasps commonly known as yellow jacket were observed to cause havoc in the fields where tasar silkworm has been reared. The damage by wasp is humongous in Orissa, West Bengal and in parts of Jharkhand (near around Santhal pargana) and Bihar (Banka districts). The wasp usually fed on the 3rd instar larva with attack incidence decreasing as the silkworm progress to more mature instars. However absolute escape of 4th and 5th instar of silkworm larva is not warranted. The loss often may result to almost 90-95% of total damage in tasar silkworms. The species commonly observed is *Polistes* spp.

One of the most notorious of the predators of tasar silkworm is praying mantis (*Hierodula* spp.). The preying adaptability of the insects makes it an effective and fearful predator of tasar silkworm. Although mass predation and humongous loss rearing in tasar silkworms is yet to be observed, however the insect (mantis) cannot be ignored as far as tasar sericulture is concerned.

In the present study following objectives were accomplished:

Objectives

- Designing and fabrication of FLYCATCH.
- Abundance of pest and predator associated with Tasar silkworms (*Antheraea mylitta*).
- Diurnal activity of and predator associated with Tasar silkworms (*Antheraea mylitta*).

Materials and Methods

Study sites

The study was undertaken at Litipara 24.780466 (lat) and 87.51138 (lon) at plantation under Pilot Project Centre at Litipara (DoS, Jharkhand). The plantion was a block plantation containing maximum of *Terminalia arjuna* and very few *Terminalia tomentosa.* The plantaton was 4' x 4' pattern over 10 acre of land. The silkworm belonging to Daba Bivoltine ecorace (DBV) during second crop rearing were selected for this study. The observational trial was conducted in the month November and December, 2022.

Collection methods

The collection was done for non-consecutive 12 days during the daytime in the aforesaid months. The time interval was split into 2 hours each: TI (6 AM- 8 AM); T2 (8 AM-10 AM); T3 (10 AM-12 AM); T4 (1PM-3 PM); T5 (3 PM-5 PM). The common known predators of *Antheraea mylitta* Drury were sampled from around the close vicinity of the silkworms with help of indigenously fabricated and designed fly catcher (FLYCATCH). Samplings during rainy days were prevented to avoid any form of biaseness in sampling. The field was divided into two blocks each containing 20 plants. Block A- was considered as treatment where silkworm rearing was done and BLOCK B was considered as control where no silkworm rearing was ongoing.

Results

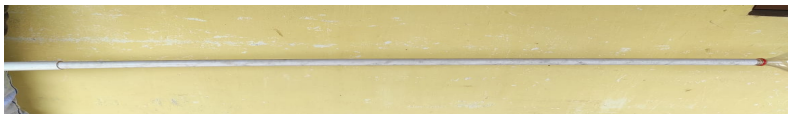
1. Designing and Fabrication of FLYCATCH

The FLYCATCH was a local device designed and fabricated by Shri Vivek Pratap Bharti (PGDS student (2021-22) and Dr. S.M. Mazumdar (Scientist-C, BSM&TC Kathikund). It consisted of 3 parts: (a) a collecting bottle (b) handle (c) and a sliding puller.

Sl. No. **Particulars**

A 

Collecting bottle (Length: 1.5 feet): It is located in the top most apex of the FLYCATCH. It is designed from leftover plastic bottle. The terminal portion of the bottle is slit to make it open like arms of octopus. The opening and closing of the bottle was regulated by a string which ran through the entire length of handle and is connected to a sliding puller at the base of FLYCATCH.

b. 

Handle (Length: 5.5 feet): The long handle of the FLYCATCH provides support to the device and enables one to sample from various height of canopy of rearing silkworms.

c. 

Sliding puller (Length: 1 feet): The sliding puller at base acts as trigger to regulate the opening and closing of the collecting bottle at the apex.

Figure 1. Brief elaborative account of FLYCATCH fabricated for mechanical trapping of insects

Surveillance of pest and predator associated with Tasar silkworms (*Antheraea mylitta*).

During the study, the diversifications of the following pest and predator associated with Tasar silkworm were observed in the rearing field of Litipara. The predators and prey observed were enlisted: Reduviid bug (*Sycanus collaris*), Paper wasp (yellow jacket) (*Polistes* spp.), Stink bug (*Eocanthecona furcellata*), Praying mantis (*Hierodula* spp.), small dipterans, yellow ant and black ants. During the collection a total of 206 *S. collaris*, 82 *Polistes* spp., 18 *Eocanthecona furcellata*, 10 *Hierodula* spp. and 3 small dipterans were collected over a period of 12 days sampling. From the control 6 *S. collaris*, 6 *Polistes* spp., 2 *Eocanthecona furcellata*, 1 *Hierodula* spp. and no small dipterans were collected.

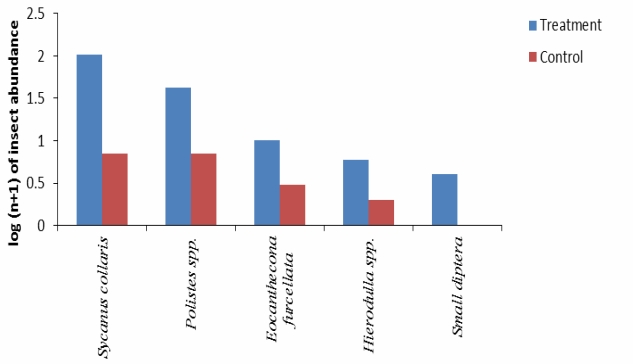


Figure 2. Mean abundance (log(n+1)) of following pest and predator associated with tasar silkworms as observed in rearing fields of Litipara (Pakur) Jharkhand. Treatment = collection of pest predator from vicinity of silkworms; Control= collection of pest predator from regions where rearing was absent.

Diurnal activity of and predator associated with Tasar silkworms (*Antheraea mylitta*).

Diurnal activities of the following insects were assessed in the plantation of Tasar silkworm rearing at Litipara: *Sycanus collaris*, *Polistes* spp., *Eocanthecona furcellata*, *Hierodula* spp. and small dipterans. For *Sycanus collaris* the activity time was as observed 6am-8am> 8am-10 am> 10am-12 pm> 3 pm-5 pm > 1pm -3 pm. For yellow jacket or *Polistes* spp. maximum activity as mentioned in decreasing order: 10 am-12 pm>1 pm- 3 pm>8 am-10 am> 6am – 8 am>3 pm-5 pm. For *Eocanthecona furcellata* maximum activity observed was at 8 am-10am> 6am-8am> 10 am-12 pm. For *Hierodula* spp. maximum activity was observed at 8am-10 am rest it was almost of equal abundance. The small dipterans were observed to be active in the early morning hours 6 am-8am followed by 8 am- 10 am.

Table 1: Mean log (n+1) of abundance of following pest and predator as observed in the fields of Litipara, (Pakur) Jharkhand during the months of November and December, 2022

Time	6am-8am	8am-10am	10am-12pm	1pm-3pm	3pm-5pm
Sycanus collaris	1.544068	1.39794	1.255273	1.146128	1.20412
***Polistes* spp.**	0.69897	0.90309	1.20412	1.113943	0.60206
Eocanthecona furcellata	0.60206	0.69897	0.477121	0	0
***Hierodula* spp.**	0.30103	0.477121	0.30103	0	0.30103
Small diptera	0.477121	0.30103	0	0	0

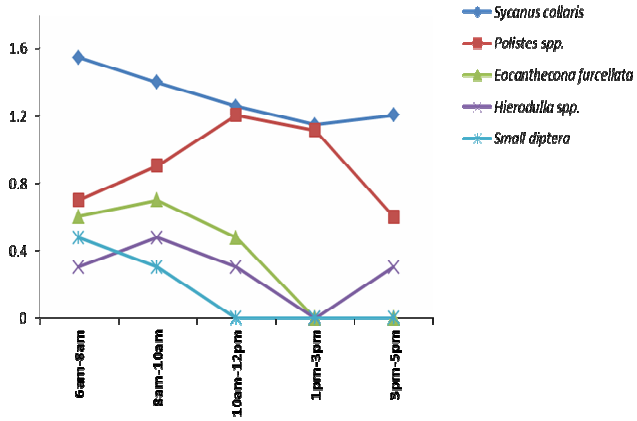


Figure 3. Diurnal activity of the following pest and predator as observed in the fields of Litipara (Pakur), Jharkhand.

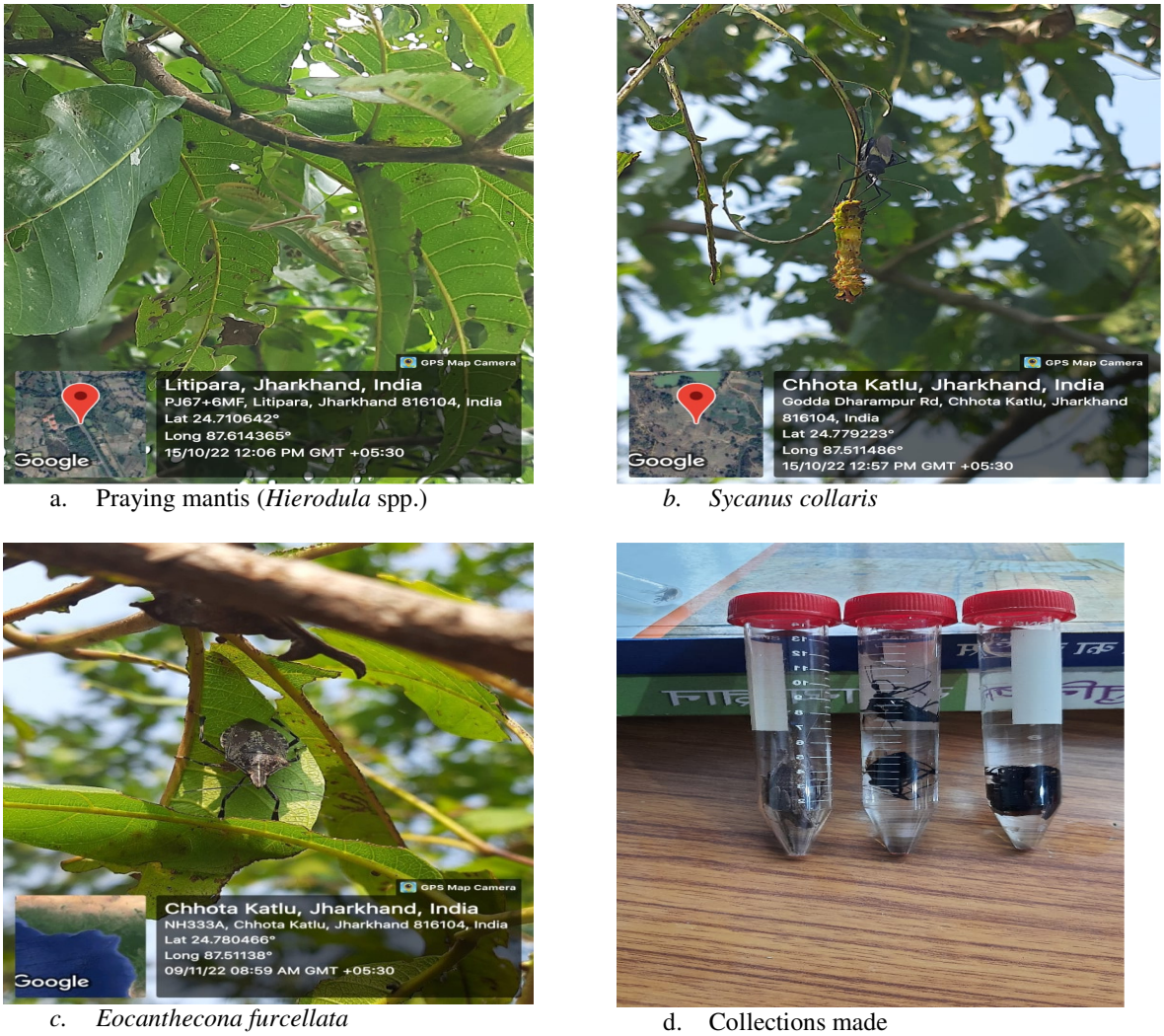
Discussion

The present study enumerates the prey and predator makeup of *Antheraea mylitta* D in the tasar rearing fields of Litipara, Santhal Pargana, Jharkhand. The main prey and predator observed here comprised of *Sycanus, Eocanthecona furcellata*, Yellow jacket, *Hierodula* spp. and small dipterans (identified as *Forcipomyia fuliginosa* and *Forcipomyia esakiana*, Mazumdar *et al.*, 2024). The most abundant pest observed here was *Sycanus* followed by Yellow jacket, *Eocanthecona furcellata*, *Hierodula* spp and few small dipterans. Most of the available pest and predators were known or established. Assessment of diurnal activity reflected that most of the mentioned pest and predator were active during 6 am to 5 pm with maximum activity observed between 6 am to 10 am thereafter gradually decreasing except Yellow jacket which showed maximum activity between 10 am and 12 pm. The large makeup of diverse pest and predator makes the situation alarming which risk the incursion of disease to the silkworm rearing thereby affecting the crop resulting into loss of cocoons.

The pilot study or the case study appears to be first of its kind in the Litipara region of Santhal Pargana, Jharkhand. Although the study is of a very short duration, yet the observations made in the field were significant. It summarized the abundance, diversity, diurnal activity of prey, predator and pest associated with Tasar silkworms in the field of Litipara. Moreover a known concept was re-interpreted to develop a FLYCATCH, an indigenous device for trapping the insect predators at BSM&TC, Kathikund during the program. *Sycanus collaris*, *Polistes* spp., *Eocanthecona furcellata*, *Hierodula* spp. and small dipterans were observed during the study. In addition to that small yellow ants, black ant were also observed.

However it was not presented in result as it was not quantified. Moreover no report of yellow fly (*Xanthopimpla pedator*) and Uzi fly were made during the study.

The presence of predator and prey in the fields accounted to loss in rearing of tasar silkworm. Maximum incidence of *Sycanus collaris* was observed followed by *Polistes* spp and *Eocanthecona furcellata*. Incidence of *Hierodula* spp and small dipterans were negligible. The maximum damage caused and expected to be caused in this region is due to *Sycanus collaris*. Although pest and predators were known, but systematic assessment to quantify the numbers of the pest attracted to the Tasar silkworm were presented for the first time. The time of peak activity has potent implication in disease management. Since Tasar silkworm is reared under field condition owing to its' wild nature, a specific time for attack of the pest would be in convenience to disease management.



a. Praying mantis (*Hierodula* spp.) b. *Sycanus collaris*

c. *Eocanthecona furcellata* d. Collections made

Figure 4. Pest and predator at rearing field of tasar silkworm in Litipara, Santhal Pargana, Jharkhand

Conflict of interest

The authors' declare no conflict of interest.

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