IMPACT OF PREDATORS AND PARASITES ON THE PRODUCTIVITY OF TROPICAL TASAR SILKWORM ANTHERAEA MYLITTA D.

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Abstract

Tasar silk is produced by the wild silkworm Antheraea mylitta (Drury), the silkworm is exposed to a complex of parasites, predators and diseases that reduce the total silk production. Occurrence and invasion by three parasites and nine predators of A. mylitta are studied here. The Xanthopimpla predator (F.) (Hymenoptera: Ichneumonidae) is the major solitary larval-pupal endoparasitoid of Antheraea mylitta ((Lepidoptera: Saturniidae). The parasitoid puncture the cocoon while laying of its egg on pupa as well as adult emergence and make them unfit for reeling. Further, the parasitoid grub feed on silkworm pupae and kill them, thereby, affects seed production. The parasitoid preferably tend to lay more eggs on male, due to early development and emergence (Protandry) behaviour, which ultimately reduce silkworm seed productivity (Singh et al., 2010). Hence, the parasitoid causes damage directly as well indirectly on cocoon production, which ultimately affected the raw silk production.

Keywords: silkworm Antheraea mylitta, Xanthopimpla pedator , parasite and predator impact on silk.

Introduction

Tasar silk is produced by the wild silkworm Antheraea mylitta (Drury) (Lepidoptera: Saturniidae). Owing to its inherent wild nature, the silkworm is exposed to a complex of parasites, predators and diseases that reduce the total silk production. Occurrence and invasion by three parasites and nine predators of A. mylitta are studied here. Moreover, on the basis of their attack and symptoms of parasitism and/or predation, percentage of crop loss (mortality) of A. mylitta is calculated. The parasites including Xanthopimpla pedator (Fabricius) (Hymenoptera: Ichneumonidae) were observed as a major pupal endoparasitoid of A. mylitta, which affects about 7–12% of tasar cocoon. In addition, the beetle Dermestes ater (De Geer) (Coleoptera: Dermestidae) also affects the pupa/cocoon of A. mylitta, while the Tachnid fly, Blepharipa sp., recognized as a larval-pupal parasite of the silkworm, cause about 1– 2% and 2–3% of tasar crop loss respectively. Consequently, among the predators, Canthecona furcellata (Wolff) (Pentatomidae: Hemiptera), was observed as a major predator of A. mylitta that causes about 6–11% of tasar larval mortality. However, 2–3% and 3–4% of crop mortality occurs due to predation by Hierodula bipapilla (Serville) (Mantidae: Dictyoptera) and Vespa orientalis (Linnaeus) (Vespidae: Hymenoptera) respectively. The predatory ants Oecophylla smaragdina (Fabricius) (Formicidae: Hymenoptera) and Myrmicaria brunnea (Saunders) (Formicidae: Hymenoptera) also contribute to crop

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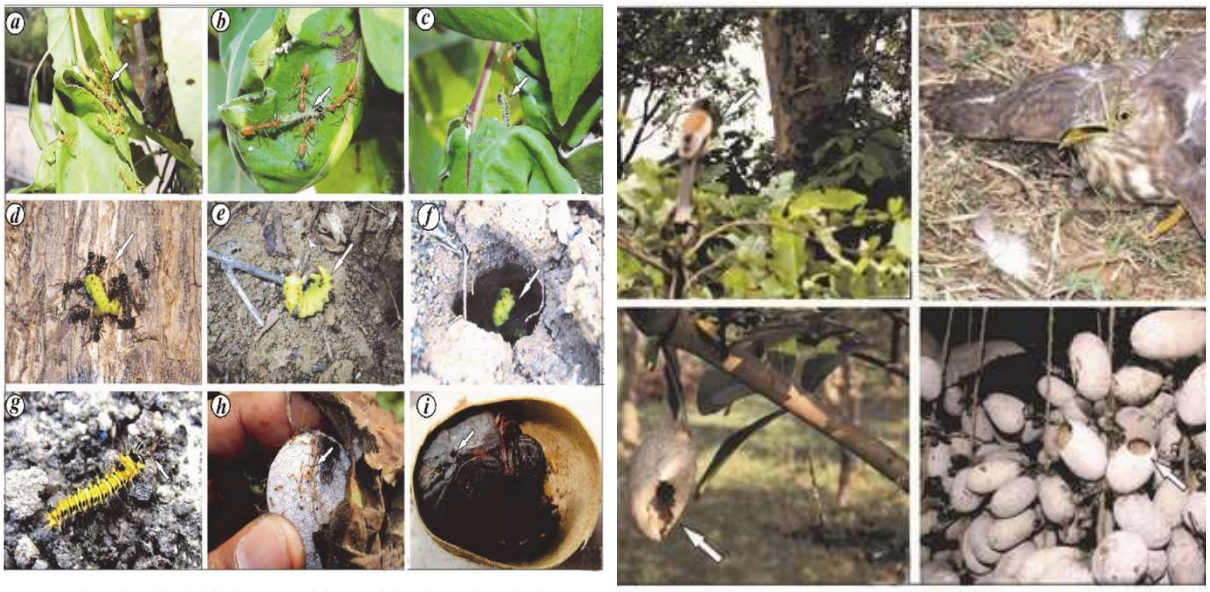
reduction by 4–5% and 3–5% respectively. Similarly, non-insect predators such as birds, lizards, squirrels, rats, etc. also affect the silkworm, which further reduces tasar silk production. Therefore, a survey was undertaken in the tasar rearing fields of Vidarbha, Maharashtra, India and the occurrence of the parasites and predators was studied.

The sericigenous insect, Antheraea mylitta Drury (Lepidoptera: Saturniidae) produces a variety of 'wild tasar silk', commonly known as 'Kosa silk'1 . It primarily feeds on Terminalia tomentosa (Roxb. Wight. & Arn.), T. arjuna (Roxb. Wight. & Arn.) besides several other secondary food plants such as Ziziphus jujuba (Mill). and Ziziphus mauritiana (Lam.) (Ber), etc. It is distributed in tropical deciduous forests of West Bengal, Jharkhand, Bihar, Odisha, Chhattisgarh, Madhya Pradesh, Uttar Pradesh, Andhra Pradesh and Maharashtra in India. There are 44 eco-races of A. mylitta distributed throughout India and one of the eco-races, 'Bhandara' is reared in central E) with varied phenotypic, physiological and behavioural characters2–4″50.7468′4°N, 79″58.6140′8°India (21 . At present, tropical tasar silkworm, A. mylitta, has attained a unique status as an important cash crop for the tribes living in villages of central India. However, in the wild, the larvae are exposed to diverse meteorological conditions such as temperature,



Occurance of predator and parasite

humidity and rainfall. These variations make the larvae vulnerable to microbial diseases such as bacterial (Flacherie), viral (Grasserie), fungal (Microsporidiosis) and protozoan (Pebrine)5–7 . Similarly, parasites and predators also affect the silkworm, A. mylitta, resulting in heavy loss of silk production8–12. The protection of silkworm from various pests is a chronic problem in sericulture10. Due to the attack of a number of insects as well as non-insect pests, the tropical tasar silkworm A. mylitta, is being affected8–10,13. Thus, the prospects of tasar culture in India depends on the condition of pest population14,15. These major and minor threats of silk industry cause heavy loss to the total silk production of India resulting in loss for Indian economy. Therefore, a survey was undertaken in the Vidarbha region of Maharashtra, India to study the occurrence of parasites and predators of tropical tasar silkworm A. mylitta. The damage caused by both the parasites and predators was studied and mortality of tasar silkworm A. mylitta in central zone of India was calculated.

Materials and Methods:

The study was carried out in the tasar research garden and laboratory MU Bodh Gaya , during year 2017 to 2018. The seed crops reared during the months of July- August and September- October and commercial crops during the months of November –January were considered for the study. In each crop attack of different insect pests was recorded. All the meteorological parameters like temperature, relative humidity and rainfall corresponding to different crops were recorded to study the correlation with incidences of different pest attack

Table-A

The common Pests and predators which damage theTasar silk worm, *Antheraea mylitta* D

Common Name (Scientific Name)	Period of Occurrence	Morphological Characters	Nature of the damage
A. Parasites 1. Uzi fly (Blepharipa zebina)	Sept - December	Adult flies are grayish in colour. Size 12-14mm, Number of eggs laid by a female fly is 250-300.	The flies lay eggs on the body of larvae; the eggs hatch and the young maggots bore through the skin into the body of the larvae leaving a black scar on it and derive its food from internal tissues of the larvae.
2.Ichneumon fly (Xanthopim)	July-August. Oct -December	Adult fly is bright yellow in colour with a number of black bands and there is a black spot on each sternum located dorso ventrally. Length of the adult about 2cm with 1cm long ovipositor in female	The female pierces its ovipositor in to the body of the larva through newly formed cocoon shell and lay eggs. The young ones after hatching consume the tissues and pupate inside, metamorphoses into adult fly and comes out by piercing the cocoon shell.
B. Pest and Predators a. Stink bug (Canthecona furcellata)	June-January	It is pentatomid bug. Adult bug is brownish in colour. Body is brownish in colour. Body is triangular. Adult is about 15 mm in length.	Both young and adult suck the blood of the larvae leading to its death.
b. Praying mantis (Hirodula bipapilla)	Throughout the year	Adult is green in colour and is about 5-8 cm in length. It has powerful raptorial forelegs in which tibia works in opposition to the femur works in opposition to the femur like the blades of a scissors and both are partially spined.	Both nymph and adult eat the larvae.
c. Reduvid bug (Sycanus collaris)	Aug-October	Adult bug is black and is about 2.5cm long. Head is long conical and mouth parts are modified into along prominent proboscis which lies in a cross striated groove between front coxae during rest	Both nymph and adult suck the haemolymph of the larvae.
d. Common wasp (Vespa oriantalis)	July- November	Abdomen has yellow and dark brown bands. It has poisonous string and clubbed antennae. The wings are longitudinally folded during rest	Feed on the larvae.

Result and Discussion

The parasite–predator complex of the silkworm A. mylitta results in loss of wild tasar silk production, ultimately affecting the livelihood securityand economic status of the stake holders who are mainly the tribal folk 8–11,16,17. Major threat includes the Ichneumonid, X. pedator(a pu-pal parasitoid) and C. furcellataa major lar val predator of A. mylitta. Being solitary in nature, X. pedatorlays a single egg in

the pupal body cavity by inserting its well developed ovipositor 18 and completes its life cycle in about 20–22days by devouring entire pupal mass. Pupa-tion takes place inside the host pupa and the adult emerges out by leaving only the dead shell full of excreta. Due to the parasitism by X. pedator, the tasar cocoon gets damaged and is seedless, affecting the population in the next generation. It was also observed that one maggot of X. pedatordevelops inside a single host pupa of A. mylitta and similar observations have been made by earlier workers 1,9,1.

The Uzi fly, Blepharipasp. was also observed as a larval endoparasite of A. mylittaand it can result in heavy dam-age if left unchecked 21. The tasar Uzi fly is known to lay eggs directly on the host larvae, A. mylittaand A. proyeli 22. The mature maggotsof Uzi fly come out of the cocoon by making a hole and pupate outside 10,11. Furthermore, the parasite developmental period was significantly extended in larvae parasitized with 5 and 10 developing maggots per larva (mpl) as also observed in B. zebina 23.

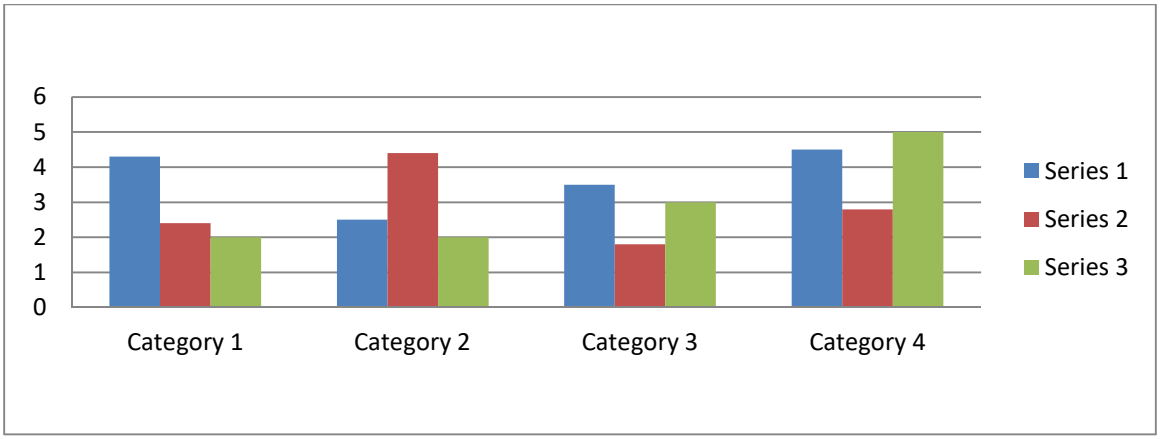
The dermestid beetle, D. ateralso damages the stored cocoons and pupae of A. mylittaduring harvesting. The availability of both bivoltine and trivoltine races may be the primary reason for rapid multiplication of the beetle pest population 8,15. Nine species of dermestid beetles have been reported to cause damage to tasar silkworm 24.

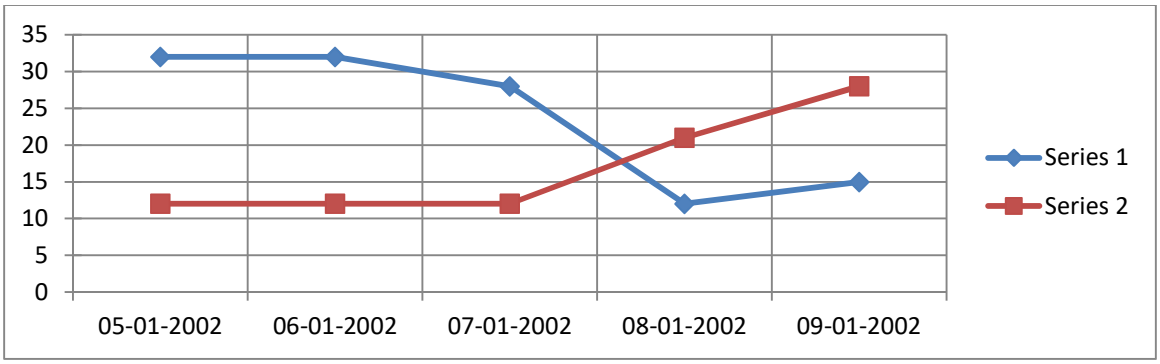
Ants are the most abundant terrestrial carnivorous insects and causea considerable loss to the sericulture industry 39. Ants attack silkworms during resting and/or moulting on trees while the pupae, adult and eggs are primarily affected at grainage.

Table-B

Mortality by parasites ,pest sand rain fall of tasar silk worm,Antheraea mylitta

Crop	Type of loss Rearing	Bacterial	Viral	Fungal	Pebrine	Pests	Rainfall	Loss due to shifting	Total loss	% Loss
1	Outdoor	18	23	3	-	17	12	15	88	44.0
	Indoor	15	19	6	-	2	-	18	60	30.0
2	Outdoor	28	42	5	6	18	10	30	139	46.3
	Indoor	13	34	6	5	-	-	35	93	31.0
3	Outdoor	34	51	16	-	24	27	35	187	46.75
	Indoor	20	42	5	-	2	-	41	110	27.5





Birds, rats, lizards and squirrels were observed to be very common predators of tasar silkworm, as reported in earlier studies 10. Nevertheless, birds withtheir continuous presence and active food searching in rearing fields, pr e-date on large numbers of tasar silkworm larvae. Mammal-ian predators also attack the harvested seed cocoons, where they cut the cocoon shell and feed on the pupae of A. mylittaand similar observation were also made in the field of Muga sericulture

Table-C

Mortality by parasites ,pest sand rain fall of tasar silk worm,Antheraea mylitta

Crop	Typeofloss Rearing	Bacterial	Viral	Fungal	Pebrine	Pests	Rainfall	Lossduetoshifting	Totalloss	% Loss
1	Outdoor	36	50	6	-	41	28	30	201	50.25
	Indoor	44	47	8	-	3	-	55	158	39.5
2	Outdoor	32	51	5	-	25	21	35	169	42.25
	Indoor	35	43	-	-	8	-	42	128	32.0
3	Outdoor	36	47	2	-	25	19	26	155	38.75
	Indoor	20	35	10	-	7	-	37	109	27.25

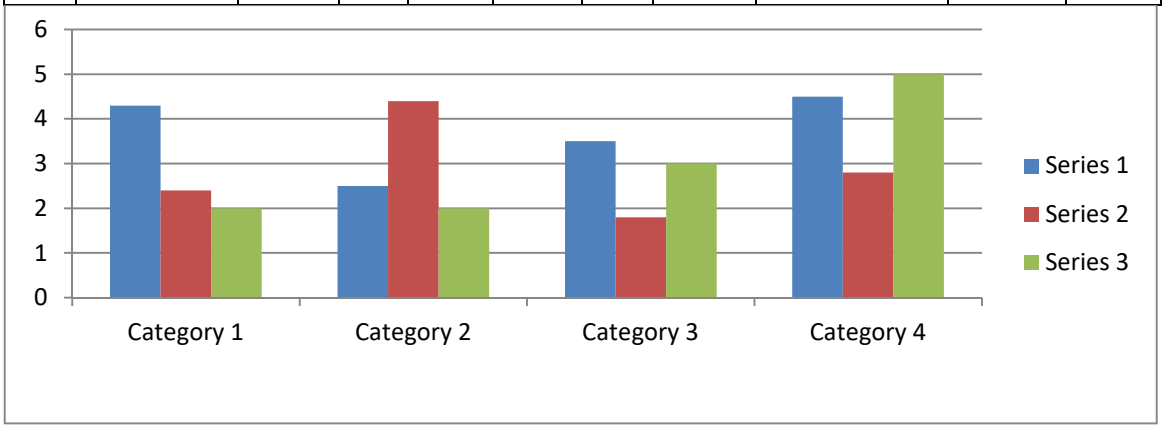
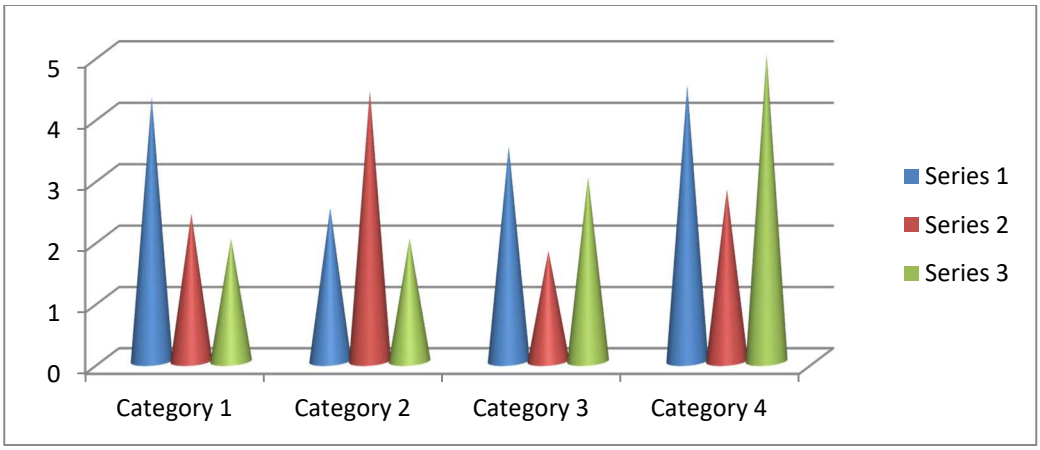
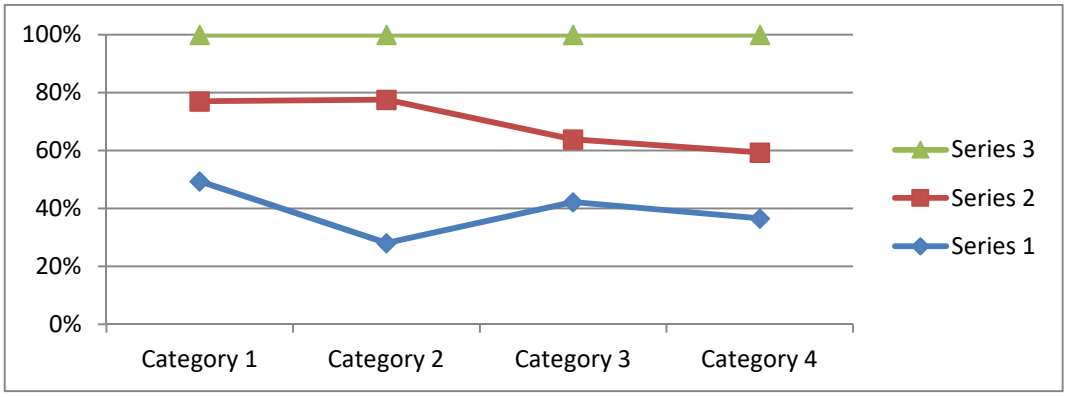


Table-D

Mortality by parasites, pest sand rain fall of tasar silk worm,Antheraea mylitta

Crop	Rearing	Bacterial	Viral	Fungal	Pebrine	Pests	Rainfall	Lossduetoshifting	Totalloss	% Loss
1	Outdoor	38	43	9	-	37	20	23	170	42.5
	Indoor	28	38	12	-	3	-	37	118	29.5
2	Outdoor	35	42	5	6	31	10	30	153	38.25
	Indoor	26	34	6	5	2	-	40	117	29.25
3	Outdoor	34	41	6	-	18	17	25	141	32.25
	Indoor	30	30	5	-	2	-	31	98	24.5





Conclusion

The outcomes of the investigation is the rearing of tasar silkworm, *Antheraea mylitta* D, has resulted in low mortality that could be caused by pests and predators and improved indoor rearing method can be adopted to enhance crop yield and stabilize tasar silk production.

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