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INCIDENCE AND NATURE OF DAMAGE OF BAGWORMS ON TASAR SILKWORM FOOD PLANTS

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ABSTRACT

Bagworm species are commonly polyphagous and known as minor pests which damage different tree species by defoliating the leaves. Similarly damage of bagworms on primary food plants of tasar silkworm was observed at CTRTI, Ranchi. Based on this, preliminary experiment was carried out to record seasonal incidence and nature of damage of bagworms infesting *Terminalia arjuna* and *T. tomentosa.* Two years data on seasonal incidence revealed that average peak incidence of bagworms (2.20 to 3.70 larval case/plant) on *T. arjuna* was observed between 18 to 20 Metrological Standard Week (MSW). Similar observation was also made on *T. tomentosa* and it was found that incidence of bagworm was very less as compared to *T.arjuna* with peak incidence 0.20 to 0.30 larval case/plant on first fortnight of June (23rd & 24rd MSW). During the study it was found that incidence of bagworm starts from April, reaches peak during May in *T. arjuna* and June in *T. tomentosa* and its population starts declining from July onwards and it reaches negligible or nil between August to March. Nature of damage was also observed during the study period. Bagworm damaged leaves exhibits irregular hole at the center of leaves and also shows irregular feeding from the leaf margin leaving midrib. These damaging symptoms sometimes overlooked or mistaken for damage caused by other general defoliators like beetles and caterpillars.

Keywords **:** Bagworms, Seasonal incidence, Metrological Standard Week and Nature of damage.

Introduction

Tasar sericulture is a forest-based industry, which involves cultivation of host plants, rearing of silkworms, reeling and spinning of cocoons for quality silk yarn which is performed mostly by tribal inhabitants in India and has achieved a unique status as a key cash crop for the tribes living in villages because of its very low investment and high employment potential. *Antheraea mylitta* (Saturniidae: Lepidoptera) is commercially reared in *Terminalia arjuna* (Arjun), *Terminalia tomentosa* Asan) and *Shorea robusta* (Sal) for seed and commercial cocoon production.Silkworm and its host plants are closely linked with each other for production of quality cocoons.Many attemps have been made to increase the silk productivity but still there are several constraints,which needs an immediate attention for increasing the tasar silk production in India (Thangavelu and Singh, 1994). One of the main reason for low production of silk is the pest problem associated with host plants and silkworms (Thangavelu and Singh, 1991 and Singh *et al.,* 1992).

Food plants of tasar silkworm are known to be attacked by a large number of insect pests. Among them gall fly (*Trioza fletcheri*), stem borers (*Psiloptera fastusa* and *Aeolesthes holocericea*), Tussockmoth (*Notolophus antiqua*), May-June bettle (*Anomala blanchardi*), Termites and Bark eating caterpillar are commonly occuring pests, which have been well studied and documented (Singh and Maheshwari, 2002). However, in recent yearsincidence of bagworms being observed on both Arjun and Asan plants. Case moths or Bagworm are names given to a group of moths (Family Psychidae) whose caterpillars make portable homes from silk, usually attaching plants materials, detritus etc. The bagworm family (Lepidoptera: Psychidae) includes approximately 1000 described species and 300 genera distributed worldwide and most of which share an unusual life history (Heppner, 1991; Fabre 1991; and Leonhardt *et al.,* 1983). Understanding the biology and ecology of bagworms is important from an applied perspective, because several species are economic pests of cultivated crops, especially in tropical regions (Kozhanchikov, 1956). At present information about bagworms as pest on tasar food plants is scanty. Hence this article is first report that highlights about seasonal incidence, nature of damage, pest identification and associated natural enemies.

Materials and Methods

Location of the Study Area

The study area is situated in the Central tasar research and training institute, Piska Nagri Ranchi (Jharkhand) lying between 22º30' and 24º30' N Latitute and between 88º22' and 85º06' E Longitute.

Seasonal incidence: Incidence of the bagworms on tasar food plants have been recorded thought the year during 2021 and 2022. The observation was made by randomly selecting 5 and taking the count of bags per plants on weekly basis.

Pest Identification and Nature of damage: For pest identification both morphological and molecular techniques were used. Morphology of different stages were observed and recorded. Further bagworm specimens were subjected for DNA barcoding. The total genomic DNA of bag worms was isolated with some modification using the Cetyl Trimethyl Ammonium Bromide (CTAB) method as given by Mahadeva Swamy *et al.,* 2020.

Nature of damage was observed by releasing the bagworms on a fresh plant. Diseased and pest attacked leaves were removed from selected plant to avoid confusion. Later few bagworms were handpicked from the infected plant and released in it which was covered from nylon net to avoid attacking of other pests from outside.

Associated natural enemies: Observations on natural enemies were also made by collecting and maintaining the larvae under laboratory. Emerged parasitoids have been documented.

Results

Seasonal Incidence: The results revealed that the infestation typically occurs during the month of April, which is about a month after pruning and pollarding when the tender leaves emerges out. But incidence of bagworms gets unnoticed due to its minute bag size. As the development progresses bag increase in size and start getting visible easily. Average peak incidence of bagworms on *T. arjuna* was between 18 to 20 Metrological Standard Week (MSW), which was ranged between 2.20 to 3.70 larval case/plant during this period (Fig. 1a). Whereas, on *T. tomentosa* it was found that incidence of bagworm was very less as compared to *T. arjuna* with peak incidence 0.20 to 0.30 larval case/plant during first fortnight of June which is on 23rd & 24rd MSW (Fig. 1b).

Pest Identification/Morphological Characters:

Case: The first identification characteristic of pest was observed with the visibility of bags which attached upright at the lower thin branches, side of leaf, Mid rib of leaf, under the branch canopy and abaxial surface between the mid vein (Fig. 2). The bags were constructed with the leaves of host plant one above the other with the help of silk. The silk ejected from the bagworm to create the bag were incredibly tough and very difficult to break open. Fragments of plant material in the cases as opposed to silk only or other materials are characteristics of the macro-moth family Psychidae (Davis, 1964). A recent work has shown that bagworm silk is superior in both strength and flexibility (Yoshioka *et al.,* 2019). The cases were having two small opening at the anterior and posterior end. The caterpillar comes out from the top opening to feed and ejects waste from the bottom end. The bottom opening is also acting as the exit path for the emerging male adult. It was also observed that when the worm feels threatened it shrinks body and hide inside the case without any movement as defensive behavior.

Eggs: eggs were creamish in color, generally eggs are laid within bag and after hatching neonates comes out of bag and starts feeding on host plants and simultaneously prepare the protective case or bag (Fig. 3a).

Larva: The larva was eruciform with a well-developed and scleritonized head and thoracic legs. It was found creamy to light brown in color with body length of 2 – 2.5 cm (Fig. 3b).

Pupa: male pupa was dark brown in color with the size of 1.8 cm in length with clear visibility of wing pads (Fig. 3c). During the study it was observed that just prior to adult emergence the male pupa moves downward and partially emerges from the opening at the end case similar observations were also made by Davis, 1975; Kozhanchikov, 1956 and Neal, 1982. Female pupa was reddish brown in colour measuring 2.3cm in length with no antennae or wing pad formation (Fig. 3d).

Adults: male moths were light brown in color, bigger in size with body length of 1.5 cm, forewings were 1.5 cm horizontally and 0.6 cm vertically. The hind wings were horizontally 1.0 cm and vertically 0.6 cm, antennae were bipectinate and 0.7 cm in length (Fig. 3e).The adult females are sac-like wingless, their eyes, antennae and mouth-parts being atrophied measuring 2.3 cm (Fig. 3f). The pupal skin of the female splits from the anterior end, but the imago remains inside.

In addition to morphological observations we tried to identify the bagworm species by DNA barcoding method but based on the sequence results it was not possible to confirm the species however it has showed 93% similarity with *Mahasena aurea* (Fig. 4).

Nature of damage : Damage symptom sometimes overlooked by other general defoliators like beetles and caterpillars of tasar host plant. However it was notice that larvae only expel the head and thorax part from the bag for eating and moving, while the rest part remain inside the case).The initial appearance of damage mostly appeared at the lower surface of leaves both in *T. arjuna* and *T. tomentosa*, the young larva stick at the centre of the leaves with the help of gluey substance ejected from mouth, feeds on the leaves exhibiting irregular holes at the centre and full grown larvae causes the damage by feeding from the leaf margin irregularly leaving midrib (Fig. 5 a&b).

Natural enemies: During the study larval parasitoid belonging to tachinid family (Unidentified) was observed and it was noticed that there were 3 to 4 puparia were found in single bag (Fig. 6 a &b). This clear that a single parasitoid lay 3 to 4 eggs in one single larva, however detailed study requires about its identification and percent parasitization.

Discussion

The association of bagworm with tasar food plants adds to more number of host plants previously known for this polyphagous species. Our observations on seasonal incidence suggests that peak incidence was noticed during the month of May in *T. arjuna* and June in *T. tomentosa*, however it was observed that population starts declining from July onwards with negligible or nil incidence between August to March. Findings of the present study suggests that bagworm has the potential to become a pest of tasar food plants as it preferred *T. arjuna and T. tomentosa* in in the presence of *Zizipus zuzuba, Lagerstromia speciosa, Shorea robusta* in the study site as these are reported to be damaged by bagworms (Tripathy *et al*., 2022; Asmaliyah *et al*., 2020 and Tavares *et al*., 2011). The incidence of bagworm on tasar food plants in recent years might be probably due to favorable environment conditions and also possibility of adoption to *T. arjuna and*

T. tomentosa under changing climatic conditions. Since it has been reported that climate change known to influence the palatability of pests which helps them to adopt to new host plants (Rhainds *et al*., 2009). However literature on incidence of bagworms on *T. arjuna and T. tomentosa*is not available hence these results cannot be discussed further. Yet, in general incidence of bagworms known to fluctuate from location to location and from season to season due to variation in abiotic conditions or availability of host plants as reported by various researchers (Ameen *et al.,* 1997; Henkel *et al.,* 1932; Howlader 1990; Howlader, 1992; Kuppusamy *et al.,* 1993; Mishra, 1978; Morden, 1971). Observations on nature of damage also clarify that its damaging symptoms are look alike damage made by any other lepidopteran catepillars and beetles. In recent years incidence of defoliators on tasar food plants has increased across major tasar growing regions so bagworms damage is also possibility in these regions in addition to earlier recorded defoliators like may-june beetle, red beetle, ash weevil and vapourer tussuck moth. However it needs to be confirmed by extensive survey covering major tasar growing regions. Further parasitization of tachinid was also observed, similarly Firake *et al.,* 2018 recorded the tachinid parasitoid attacking bagworm *Mahasena corbetti*.

Conclusion

Present study forms bases about incidence, nature of damage, pest identification and associated natural enemies. However further detailed studies on biology, taxonomic identification of bagworm & natural enemies, prevalence of bagworm incidence in different tasar growing regions, extent of foliage loss and possible management practices needs to be studied to have a better knowledge about this emerging pest of tasar food plants.

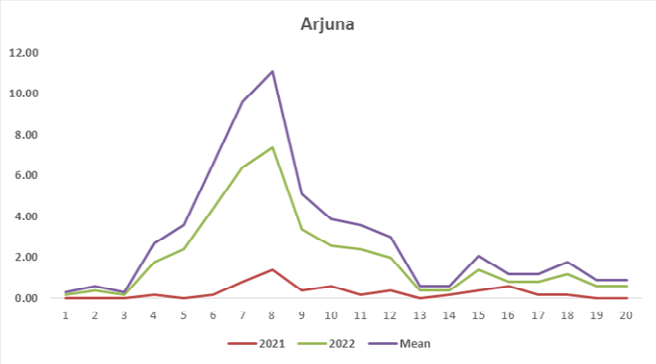

Fig. 1(a) : Seasonal incidence of bagworm on *Terminalia arjuna*

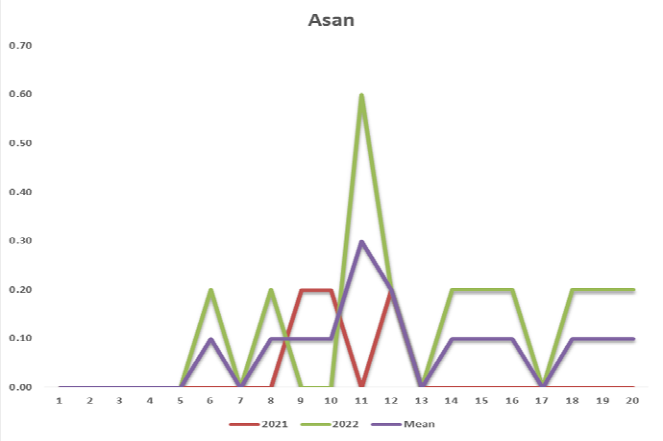

Fig. 1(b) : Seasonal incidence of bagworm on *Terminalia arjuna*

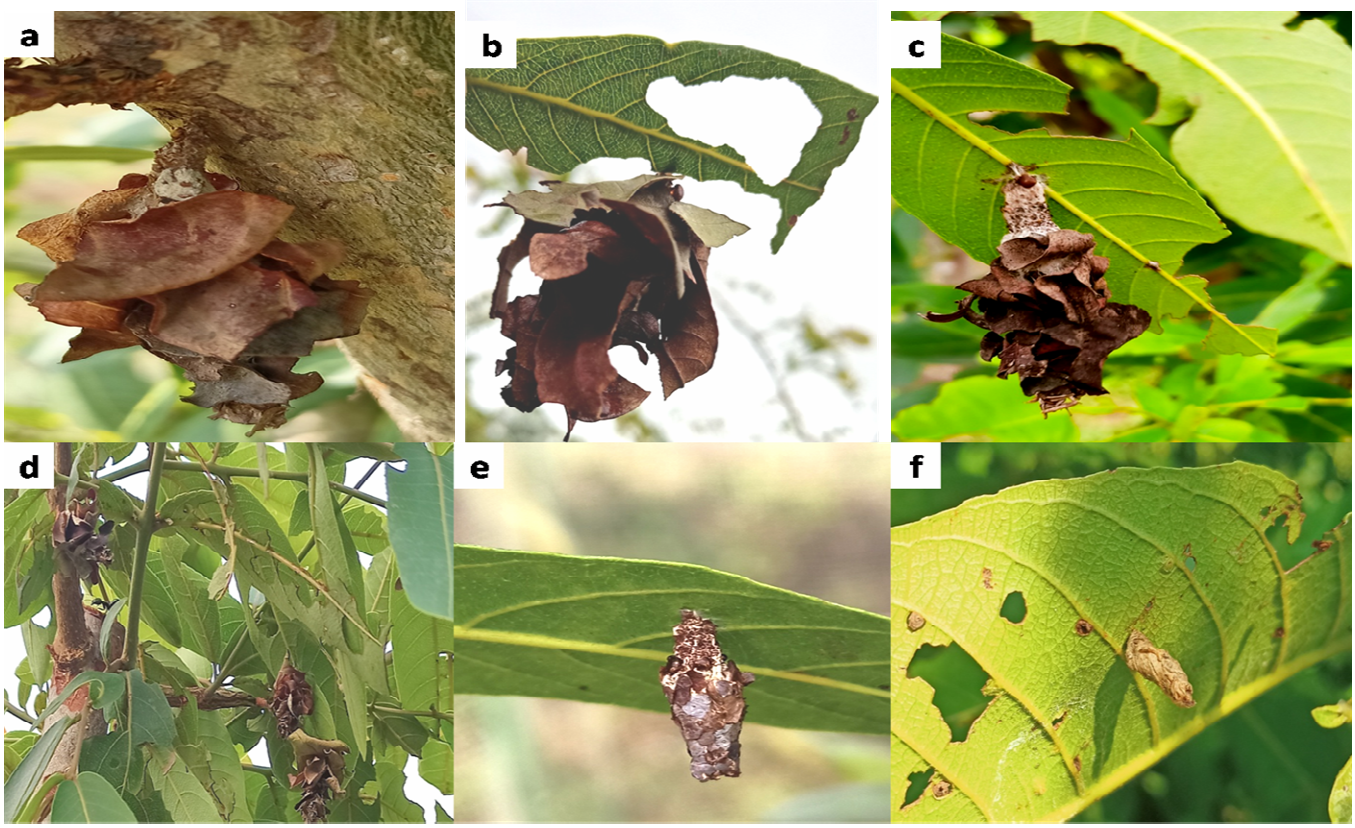

Fig. 2 : Bagworm attached on the surface 2(a) lower thin branches 2(b) side of leaf 2(c) Mid rib of leaf 2(d) under the branch canopy 2(e,f) abaxial surface between the mid vein

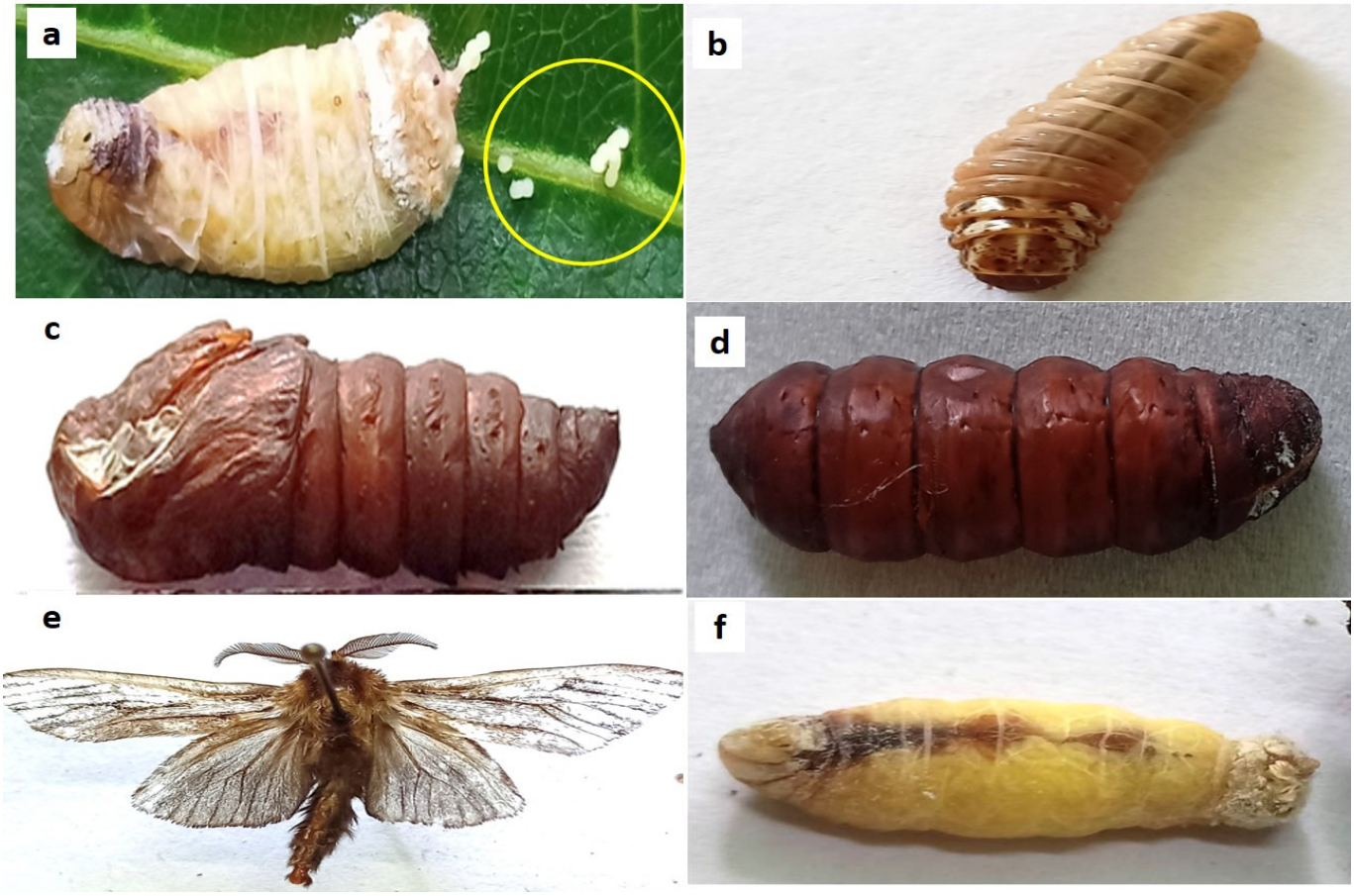

Fig. 3 : a) Eggs b) Larva,c) Male pupa d) Female pupa e) Male adult f) Female adult

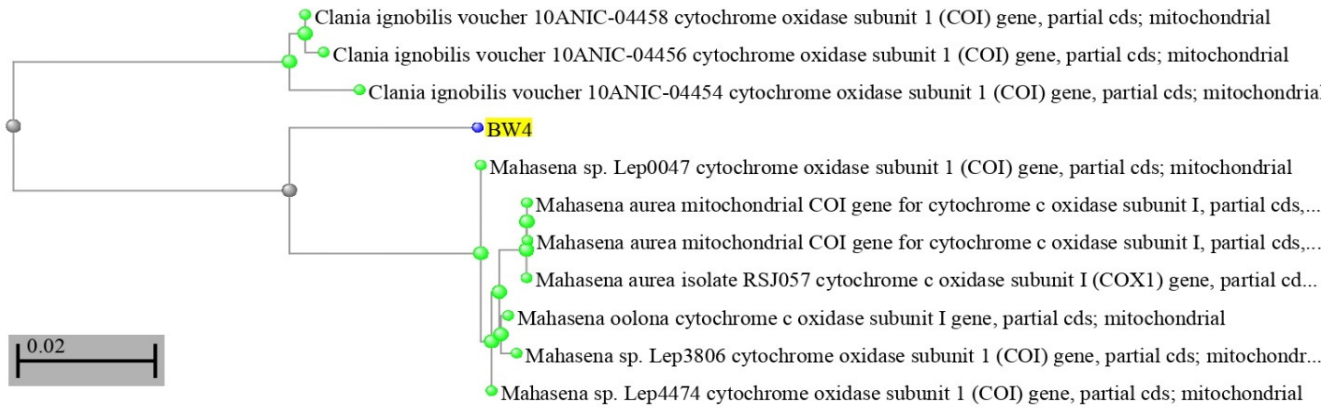

Fig. 4 : Phylogenetic tree of Bagworm (Labelled BW4) Showing Nearest Match to *Mahasena sp.*

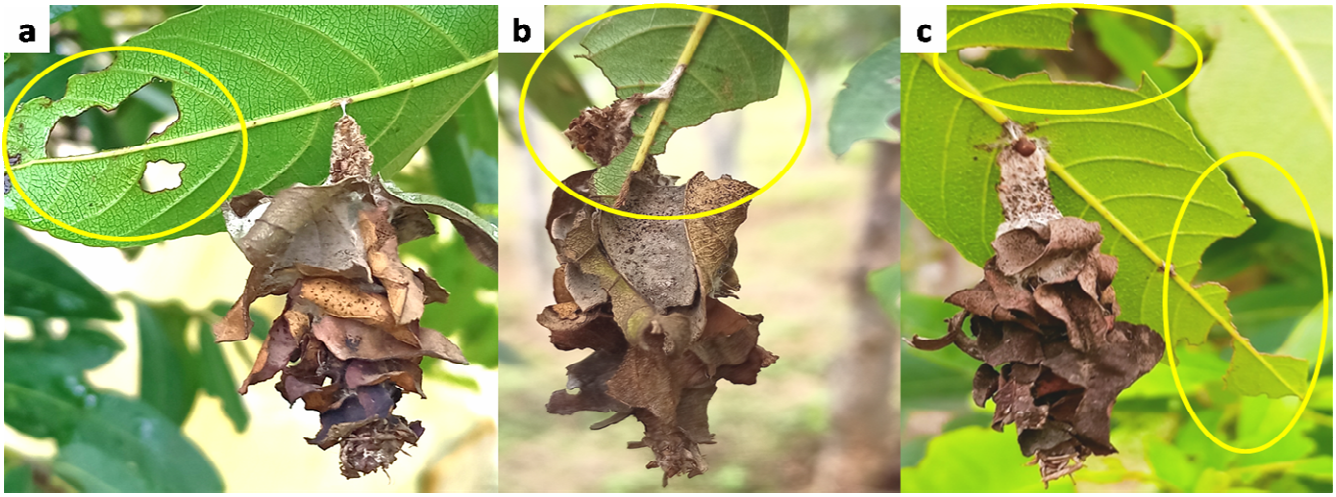

Fig. 5 : Nature of damage a) Irregular feeding holes on leaf b&c) bagworm damage from leaf margin

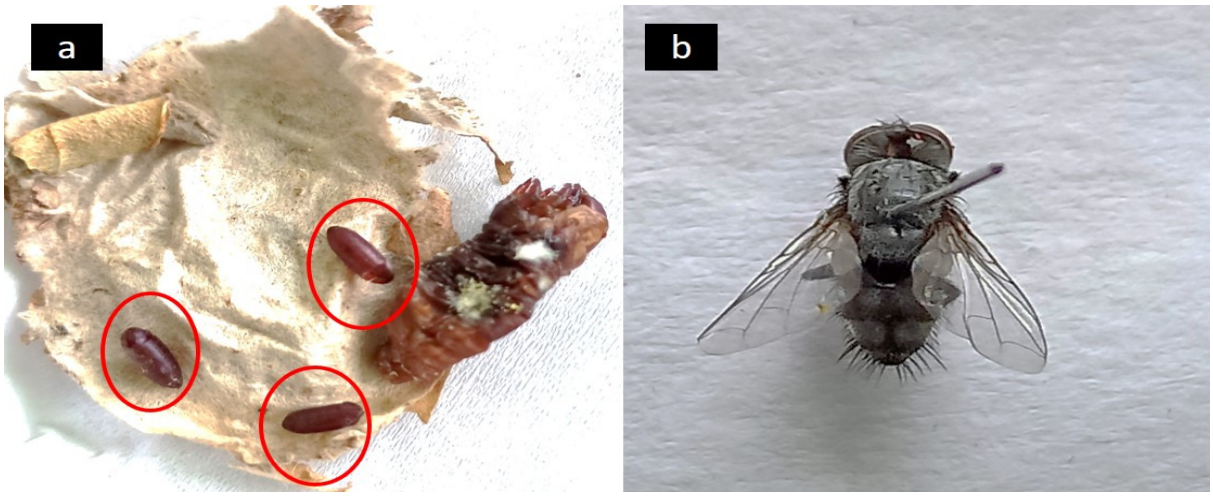

Fig. 6 : Tachinid parasitoid recorded from bagworm infesting tasar food plant a) dead bagworm larvae along with the pupae of parasitoid b) adult tachinid fly

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