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SILENT PROTECTORS: NATURAL ENEMIES ASSOCIATED WITH PESTS OF TASAR HOST PLANTS AND SILKWORM

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ABSTRACT

Biological control is a sustainable alternative to chemical pesticides in tasar culture, targeting pests of silkworms and their host plants, Arjun (*Terminalia arjuna*) and Asan (*Terminalia tomentosa*). Key natural enemies include parasitoids like *Trechnites secundus* and *Aprostocetus niger*, which effectively manage pests such as the gall insect *Trioza fletcheri*. Despite their potential, field application remains limited. Additionally, hyperparasitoids such as *Psix striaticeps*, targeting the stink bug *Canthecona furcellata*, and parasitoids like *Nesolynx thymus* and *Trichomalopsis apanteloctena*, targeting the uzi fly *Blepheripa zebina*, exhibit significant reproductive potential and searching ability. Enhanced utilization of these biocontrol agents could reduce pest-induced losses in tasar culture, promoting sustainable silk production. However, there is a need for further application and study of these natural enemies in field conditions.

Keywords: Natural enemies, Parasitoids, Predators, Biological control and Tasar culture

Introduction

Biological control is a natural phenomenon of pest regulation by their natural enemies. In the case of insect pest control, the major natural enemies are other insects, known as entomophagous insects and other natural enemies of insect pests are microorganism which are known as entomopathogens. The entomophagous group is represented by predators and parasitoids, whereas entomopathogens are represented by fungi, bacteria and viruses. Entomopathogens are not exploited greatly as a biological control of pests of tasar silkworms and their host plants, since many times they act as a pathogen to tasar silkworm as well. The populations of natural enemies and their hosts and prey tend to maintain equilibrium in nature, and the population density of one group depends on the other's density. However, in tasar culture, the characteristic of low vegetative diversity and the continuous cultural operations could be unfavorable for this equilibrium. Once this balance is broken, insect pests tend to reach high population densities, causing losses to the farmers directly by affecting the silkworm or indirectly by affecting the host plants. Although the use of high environmental impact techniques for the control of insect pests, with the use of chemical pesticides, can present high immediate efficacy, they also present collateral detrimental effects. Insecticides, besides being toxic for the pest organisms, are toxic to tasar silkworm and to other non-target organisms. So that unlike in agriculture system insecticides will not play a major role in pest management of tasar culture. So that biological control specially through parasitoids and hyperparasitoids of host plant and silkworm pests can be an alternative option.

Pests of tasar food plants and silkworm

Both host plant and silkworm are affected by variety of insect pests. Host plants arjun (*Terminalia arjuna Bedd*), asan (*Terminalia tomentosa* B.&W.) are majorly infested by Gall fly, Stem borer, Bark eating caterpillar and Defoliating beetles & caterpillars, whereas tasar silkworm is reared under

outdoor condition which is known to attacked by different parasitoids and predators (Singh and Thangavelu, 1991). Major pests of tasar silkworms are uzi fly (*Blepharipa zebina*), Yellow fly *(Xanthopimpla predator*) Stink bug (*Eocanthecona furcellata*) and wasp (*Polistes olivaceous*).Study indicates that these pest populations causes more than 40% loss to silk industry directly or indirectly. Since these pests cannot be controlled by using insecticides due to their toxic effects on silkworms. However biological control will be a better option to manage these pests of tasar culture. Most of the biological control agents are host specific with that advantage we can exploit these bio control agents to bring down the percentage of losses causing by pests and predators in tasar culture without affecting our silkworm.

Presently in the management of pests of tasar culture using a biological control agents is very meager. Even though there are studies and reports on the natural enemies of pests of tasar culture, but they have not been exploited effectively for management of these pests at field level. Here under some of the earlier reports of biological control agents of tasar pests are discussed.

Natural Enemies of tasar food plant pests

Several natural enemies play a crucial role in regulating pest populations associated with tasar host plants (Fig.1). Notably, key parasitoids targeting the gall insect *Trioza fletcheri* minor have been identified, including *Trechnites secundus* (Encystidae) and *Aprostocetus niger* (Eulophidae). The successful development of female *T. secundus* and *A. niger* occurs within the galls of both *Terminalia arjuna* and *Terminalia tomentosa*. Their preference lies in parasitizing 6-day-old galls, with an impressive 80-90 percent emergence of adult parasitoids achieved within an average span of 10-12 days, as reported by Singh and Saratchandra in 2007. Further very recently Kumar and Kumar, 2020 reported a new species of parasitoid on gall fly *Aprostocetus arjunae.* In addition to this Reddy *et al.,* 2021 reported *Trechnites aligharhensis* on *Trioza fletcheri* which is a first report on occurrence of this parasitoid in India. Similarly, Gadad *et al.,* 2023 reported *Baryscapus* sp., *Diolcogaster* sp., *Therophilus* sp. parasitizing leaf webbers infesting tasar food plants. Further some of the tachinids parasitizing bagworms infesting the tasar food plants have been observed.

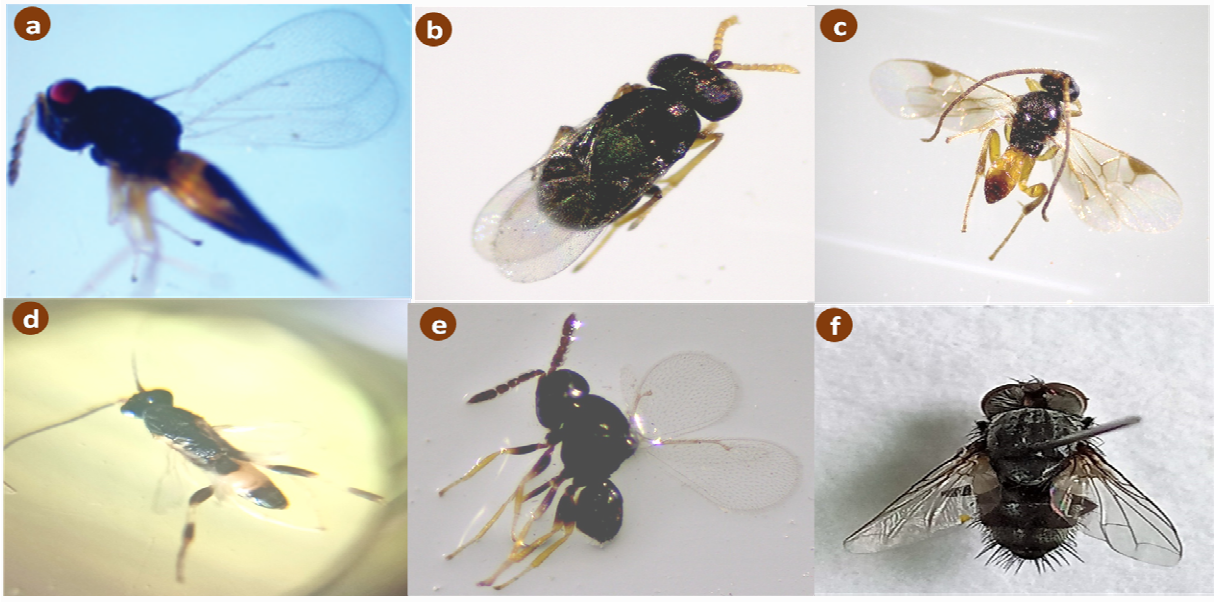

Fig. 1: Parasitoids associated with tasar food plant pests: a-b- parasitoids of gall fly *Trioza fletcheri*; c-e-Parasitoids of leaf Webbers & f- parasitoid of bagworms, a) *Trechnites aligharhensis* b) *Aprostocetus arjunae* c) *Diolcogaster sp.* d) *Therophilus sp.* e) *Baryscapus sp.* f) Tachinid parasitoid of bagworm

Natural Enemies of tasar silkworm pests:

In the realm of silkworm pest management, a diverse array of natural enemies, particularly hyperparasitoids, have been extensively documented (Fig. 2). Thangavelu and Singh (1992) emphasized the crucial role of *Psix striaticeps, P.lucanatus*, and *Trissoculs sp*. as egg parasitoids targeting the stink bug, *Canthecona furcellata* a significant predator during the early stages of tasar silkworm larvae. *Psix striaticeps*, exhibiting a density-dependent

relationship with its host, displayed an impressive capability, attacking 80% of stink bug eggs within a brief 10-minute exposure period. This underscores its high searching capacity, particularly when faced with heightened reproductive potential (Singh *et al.,*1995 and 1996a).

Furthermore, a range of parasitoids, including *Nesolynx thymus*, *Trichomalopsis apanteloctena*, *Brachymeria lasus*, *Spalangia endius*, *Theronia maskeliyae*, *Pediobius sp*., and *Nosonea vitripennis*, have been reported from the uzi fly, *Blepheripa zebina* (Singh and Maheshwari, 2002). Laboratory studies have indicated that these parasitoids of uzi fly possess significant reproductive potential, high searching ability, and a female-biased sex ratio (Singh *et al.,* 1994).

Singh and Thangavelu (1992, 1994, and 1996 b) reported *T. apanteloctena*, *Pediobius sp. and N. thymus* as potential parasitoids in uzi fly attacking tasar silkworm, parasitizing 45.32% of uzi fly pupae. In addition to above mentioned parasitoids, authors of this article have also noticed couple of *Perilampus sp.* parasitizing tasar uzi fly pupae and presently taxonomic studies of these species is being done. Similarly, *Podagrion sp.* is known to parasitize the ootheca of praying mantis. Given that praying mantis is a general predator with a wide range of prey, including tasar silkworms, it can lead to crop losses. *Podagrion sp*., sharing similar ecological requirements with the praying mantis, is expected to have better compatibility in controlling the praying mantis.

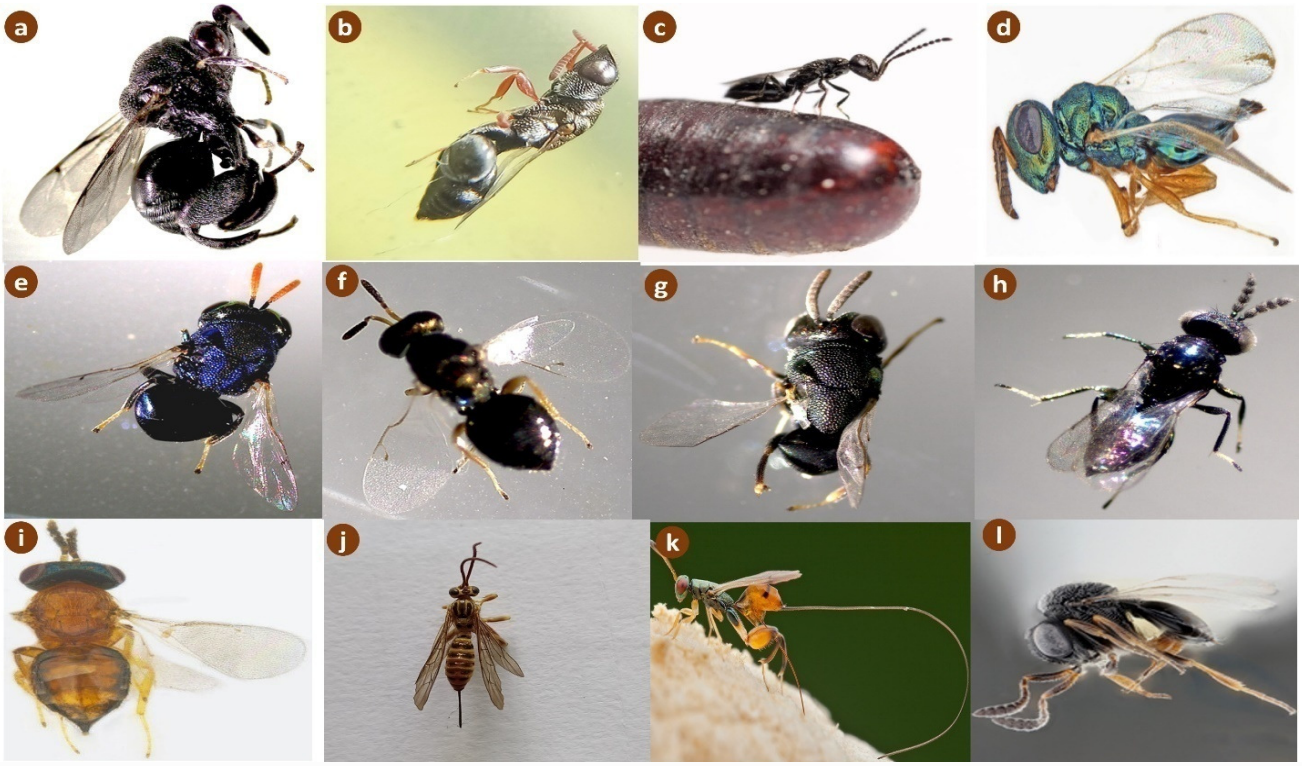

Fig. 2: Parasitoids associated with tasar silkworm pests: a-i parasitoids of uzi fly; j-hyperparasitoid of *Xanthopimpla pedator* k-parasiotoid of praying mantis l- egg parasitoid of stink bug, a) *Brachymeria lasus b) Dirhinus anthracia c) Spalangia endius* d) *Trichomalopsis apanteloctena e) Perilampus sp.* f) *Trichomalopsis sp*. g) *Perilampus sp.* h) *Pediobius sp*. i) *Nesolynx thymus* j) *Theronia karthiki* k) *Podagrion sp.* l) *Psix striaticeps*

Conclusion

In conclusion, the findings from various reports highlighting the presence of parasitoids targeting both food plants and silkworm pests in Tasar sericulture point towards a promising avenue for biological pest control. This underscores the feasibility of implementing biological control strategies within Tasar culture. By introducing, augmenting, and conserving natural enemies, such as parasitoids, it is possible to effectively manage pests in Tasar sericulture. This approach offers a sustainable and environmentally friendly alternative to chemical

pesticides, aligning with the principles of integrated pest management. Therefore, further research and practical implementation of biological control methods hold significant potential for enhancing the resilience and productivity of Tasar sericulture while minimizing ecological impacts.

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