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STUDIES ON POPULATION DYNAMICS OF *XANTHOPIMPLA PEDATOR* (F) ON TASAR SILK WORM, *ANTHERAEA MYLITTA* D IN DIFFERENT AGRO CLIMATIC ZONES OF INDIA

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ABSTRACT

Among the insect pests, Xanthopimpla pedator F is the major larval-pupal endoparasitoid of Antheraea mylitta D. and causes enormous damage to the tasar seed production. Present study was intended to assess the occurrence and level of infestation of X. predator on nucleus seed cocoon of A. mylitta during 2010-11 to 2016-17. The available data on X. pedator parasitisation at 23 locations were analysed for levels of infestation over the years on bivoltine and trivoltine crops and to ascertain the population dynamics. Study revealed that the X. pedator infestation varied significantly across place and year. The infestation which was restricted to only four locations during 2010-11, was recorded at all the study locations during 2017-18. The overall percentage of X. pedator parasitization on tasar silkworm was more in trivoltine (TV) crop compared to bivoltine (BV) crop. Similarly, the parasitization was more in the locations where both BV and TV silkworm rearing was in practice simultaneously compared to locations where only bivoltine crop was in practice. Within the BV and TV zone, the infestation between BV and TV crop was not significant. However, slightly higher infestation was recorded on BV compared to TV. The study confirmed that the parasitoid was found in all most all the tasar sericulture belt and infesting severely in the zone where both BV and TV are in practice. Further, various factors influence on the parasitoid occurrence are discussed in this communication.

KEY WORDS: *Antheraea mylitta, Bivoltine, Cocoon, Raw silk, Trivoltine, Xanthopimpla pedator*

INTRODUCTION

The *Xanthopimpla pedator* (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.

The silkworm rearing is usually starts with the TV crop in the month of June followed by BV crop during July. The early crop escapes (TV) from the parasitoids attack, but BV crop is susceptible for early intruding parasitoids towards rearing field due to tri-tropic interaction between host, herbivore and parasitoid. Further, parasitoids population perpetuate in the field due to continues raring of II TV, II BV and III TV in the month of August, September and October, respectively (Singh et al., 2010). Several studies have also indicated higher incidence of *X. pedator* on silkworm during second crop than in the first (Jolly et al., 1976, Bhatia and Yousuf, 2013, Sathe et al., 2014).

In the present study, efforts were made to study the incidence and extent of damage caused by *X. pedator* to nucleus seed cocoon of *A. mylitta*. Further, study was also conducted to ascertain the effect of extensive and intensive rearing of tasar silkworm on occurrence of *X. pedator* on bivoltine (BV) and trivoltine (TV) tasar silkworm in different locations over the years.

MATERIAL AND METHOD

The available data on rearing and grainage of Daba BV and TV at 23 Basic Seed Multiplication & Training Centres (BSM&TCs) and Central Tasar Silkworm Seed Station, Kargi Kota in 10 states were collected (http://btsso.org/organization.php), together with infestation of *X. pedator* in the cocoons. These locations fall in varied agro-ecological situations. Data for eight years (2010-11 to 2016-17) were collected and analyzed for various parameters. The percentage data was subjected to ARCSIN SQRT transformation and analysed by Analysis of Variance (ANOVA) at 5 % level significance.

RESULTS AND DISCUSSIONS

Statistical analysis indicated a significant difference of *X. pedator* infestation across the place ($F = 9.17$; $P<0.001$; df 22,106) as well as the years ($F=5.62$; $P<0.001$; df 22,106). The infestation level was 0.83%, 1.47 %, 1.69 %, 1.72 %, 4.24 %, 1.31 %, 2.26 % and 0.83 during 2010-11, 2011-12, 2012-13, 2013-14, 2014-15, 2015-16, 2016-17 and 2017-18, respectively. However, the extent of infestation recorded during 2010-2017 was 0 to 19.05 %. During 2010-11, the infestation was recorded only in Bastar, Ambikapur, Nowrangpur and RC Varam. Subsequently, the infestation was recorded in all most all the locations by the end of 2017. The recurring infestation was recorded in Pali, Boirdadar, Bilaspur Bastar, Ambikapur, Sundergarh, Nowrangpur, Chinoor and RC Varam. But, the infestation was erratic in other places.

An overall infestation of *X. pedator* was significantly more in TV crop compared to bivoltine crop ($t = 2.07$; $P = 0.02$; $df = 21$). But, in the respective year the parasitization was not significant between BV and TV. The zones where only BV crop is in practice the parasitisation varied significantly across the years ($F=9.79$; $P=0.01$; df 7,79) but not between the area ($P=0.07$). Significant differences in parasitisation was recorded across the locations ($F=8.33$; $P<0.001$; df 13,111) as well as years ($F=2.96$; $P<0.001$; df 7,111) in the zones where both BV and TV crops in practice. Within the BV and TV zone, the infestation between BV and TV crop was not significant. However, slightly higher infestation was recorded on BV as compared to TV (Fig. 5).

This study confirmed the economic importance of *X. pedator* on tasar sericulture. The damage was recorded up to 19.05 % and its infestation varied from place to place and years to year. This results are in conformity with the studies conducted by the Singh et al. (2010), in which, the extent of parasitisation was 0.2 % to 29.5 %. Velide and Bhagavanulu (2012) observed that the *X. pedator* preferably parasitize male pupae. Further, they have recorded the increased infestation from first to third crop and huge seed cocoon loss. Higher infestation of *X. pedator* in second crop can be attributed to continuous rearing of tasar silkworm (BV and TV) during the seasons. Further, in absence of any management measures against the pest, the infestation was increased continuously. The study confirmed that the pest spreaded to new areas where *X. pedator* infestation was low or not prevalent previously. The parasitoid activity was recorded from July to February and the peak infestation was recorded in the month of September and October (Singh et al., 2010). During marketing process, the infested cocoons were transported from the pest-ridden to uninfected areas without proper care or quarantine measures. Further, recurrent and extensive practices of tasar culture without demarcated plans for rearing of BV & TV

crops might have enhanced the pest to multiply and spread in an uncontrolled manner, which is similar to the phenomenon of emergence of minor pests becoming major pests (Berge and Ricroch, 2010 and Pastakia et al., 2015).

In fact, the population density and distribution of insect-pests of tasar-silkworm are still unresolved subject to sericulture-science. The tasar-silkworm life history and the natural mortality rate are extremely indispensable for the improvement of cocoon productivity per unit time and space. A high mortality at larval and pupal stage causes huge loss in terms of cocoon yield and is important researchable issues in the tasar seed sector. The studies have established the fact of parasitization on tasar silkworm. However, parasitization pressure was marginally higher in bivoltine crop compared to trivoltine crop in major seed production area. Continuous availability of host in the area where both bivoltine and trivoltine silkworm rearing was in practice has prompted the *X. pedator* to multiply quickly and caused more damage. In case of bivoltine silkworm areas, availability of only two crops in a year had restricted the continuous availability of host, resulting in discontinuation of life cycle of parasitoids.

The *X. pedator* is considered major pest on tasar silkworm in India, particularly in the area where both BV and TV crops are in practice. The parasitoids thrive on variety of lepidopteran pests in the agriculture and forest fields. But, the *X. pedator* has often reached epizootic proportions on tasar silkworm in central India since several years. In order to develop valid methods of control requires the involvement of the entire community and stringent stage-specific application of the management procedures and quarantine measures. To develop such strategies requires basic knowledge about population biology, reproduction, behavior and host range. BTSSO, Bilaspur is actively engaged in development of rational methods to check this infestation of harmful pest.

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FIGURES

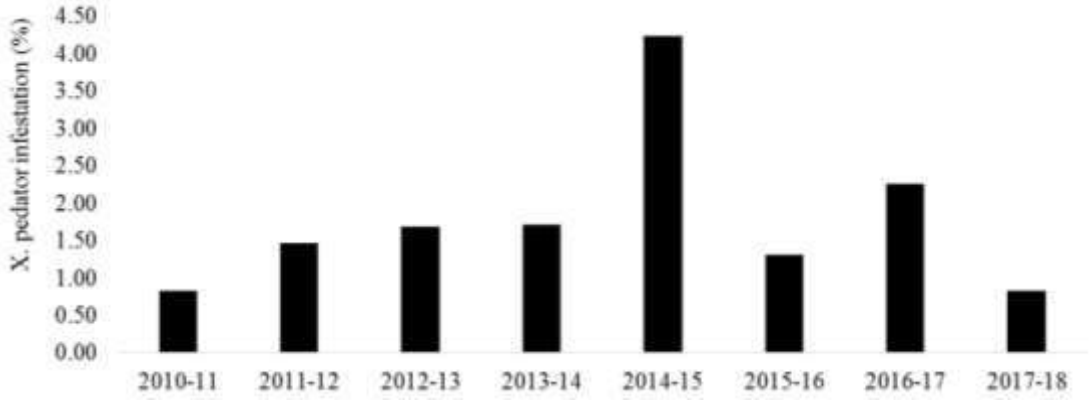


Fig. 1: *X. pedator* infestation (%) over the years on Daba tasar silkworm in the central India.

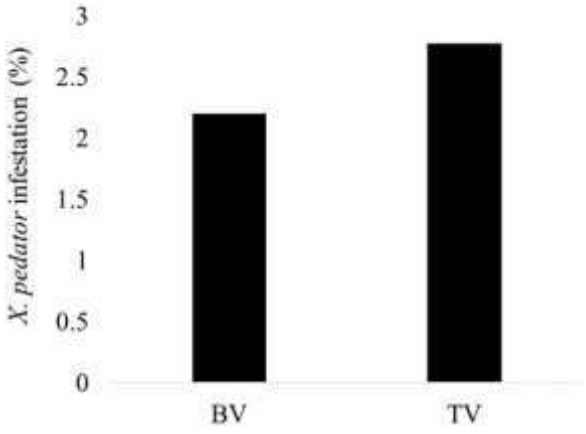


Fig. 2: Average *X. pedator* parasitization on tasar silkwor. (The star indicated the significant difference)

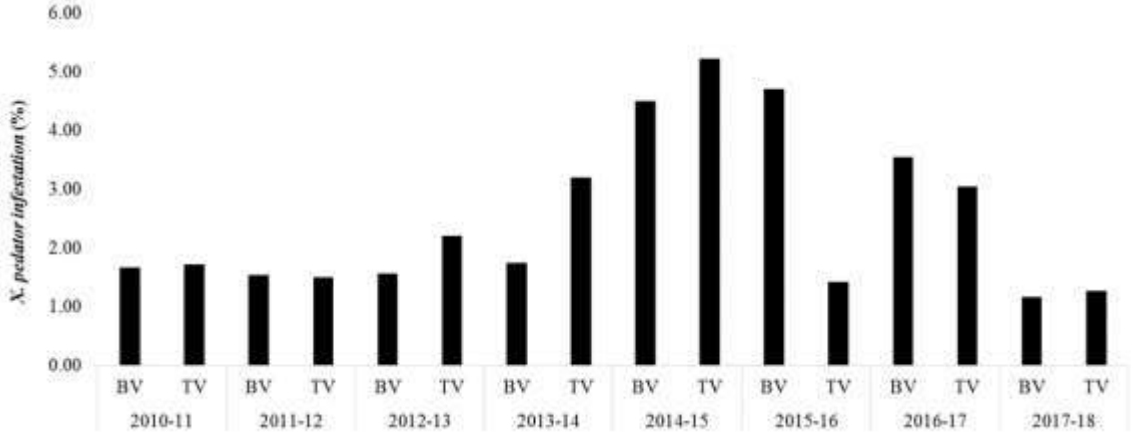


Fig. 3: *X. pedator* parasitization on bivoltine and trivoltine tasar silkworms

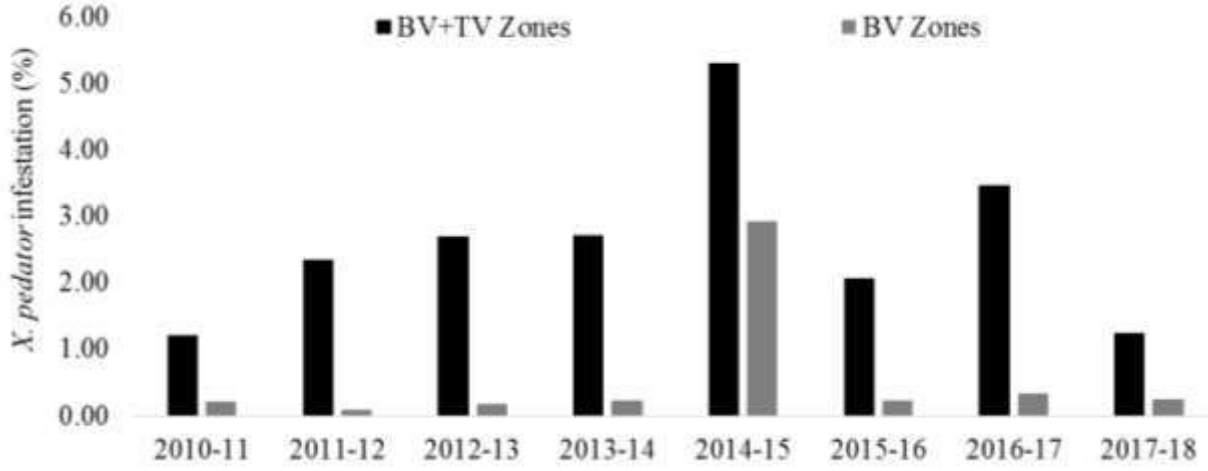
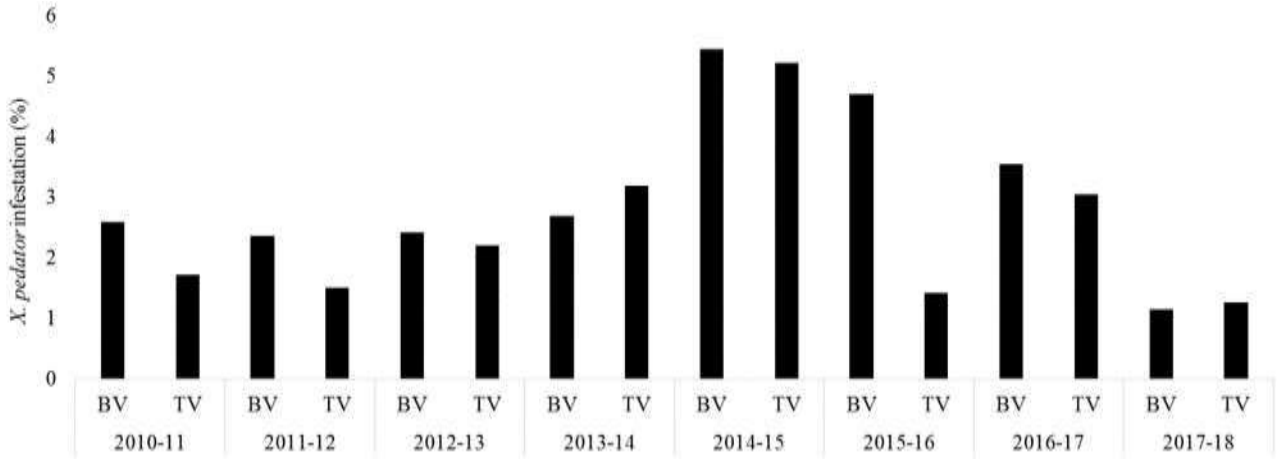


Fig. 4: *X. pedator* parasitization in different locations from 2010 to 2018



X. pedator parasitization on bivoltine and trivoltine tasar silkwormS