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Studies on host age preference of *Xanthopimpla pedator*- A pupal parasitoid

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Abstract
In this study preferences of the parasitoid *Xanthopimpla pedator* toifferent ages of *Antheraea mylitta* Drury (Daba TV) pupae had been studied. The results showed that *Xanthopimpla pedator* parasitized pupae of all ages, and the rate of parasitism was high for 4 to 6 days-old pupae especially during second crop rearing. Emergence % of parasitoid was significantly increased in 4 to 6 days-old host pupae compared with other age groups during second crop rearing when compared to first and third crops. The host mortality decreased with increasing host age. The results suggest that 4 to 6 days-old pupae of *Antheraea mylitta* Drury (Daba TV) were suitable host ages for *Xanthopimpla pedator* and a control over infestation increases the economy in silk reeling sector.

Keywords: *Xanthopimpla pedator, Antheraea mylitta* Drury pupae, host age, parasitism, emergence

1. Introduction
In the life history of insect parasitoid, the female lays its eggs within or on the body of other insects. The reproductive success of a female depends on host species, host age, host nutritional quality, host mortality risks, diet at parasitism, and host physiological condition [4, 15, 17]. This ability of parasitoid helps to decide whether to accept or reject parasitisation in the given host. The ability of an ovipositing female to discriminate between different quality hosts is critically important and directly related to the fitness of the offspring [2]. The ability of a parasitoid to distinguish between different age hosts can enhance its performance by preventing wastage of eggs, by avoiding loss of hosts due to multiple attacks, and by saving time of laying eggs [21]. Host discrimination can be used as an important criterion for evaluation of natural enemies used as biological control agents [13, 23]. Host age affects host preference and host suitability of parasitoids [22]. In addition, host age has a greater effect on sex ratio of their progeny [8, 20].
The tasar silk is produced by *Antheraea mylitta* Drury (Lepidoptera: Saturniidae)), a wild polyphagous tropical sericigenous insect distributed over central India. Rearing of tasar silkworm, *Antheraea Mylitta* on forest grown plantation like *Terminalia arjuna, Terminalia tomentosa and Shorea robusta* results in 80-90% crop loss due to parasites, predators and vagaries of nature [14]. It has been estimated that in hibernating stock about 20 to 30% loss of seed cocoons was due to pupal mortality and unseasonal emergence which in turn reduces the multiplication rate of tasar cocoons. *Ichneumon* fly, *Canthecona bug, reduviid* bug, *Hicrodulla bipapilla*, Praying mantis., are natural enemies in the rearing field which cause maximum crop loss [19]. Among those *Ichneumons, Xanthopimpla* (Hymenoptera) is an important endoparasitoid of tasar pupa [18].The cumulative effect of these pathogens results in 30%-40% of Tasar crop loss. A pupal parasitoid, *Xanthopimpla stemmator*, was recorded from Maharashtra and Andhra Pradesh [5].It was also recorded that *Xanthopimpla* predators have sexual preference for male cocoons in parasitism [11]. Present study focuses on understanding the host-parasitoid relationship, whether *Xanthopimpla* females can discriminate different host ages and also identify its host age preference.

2. Materials and Methods
2.1 Collection and rearing of *Xanthopimpla*: *Xanthopimpla* emerged out of infested *Daba TV* cocoons were collected from the forest patches of Chennur, Adilabad District, Telangana. Male and female *Xanthopimpla pedator* of 200 pairs were kept in a cage of size 2ft×2ft×2ft with water and honey for further mating. Experiments were conducted at a temperature of 26±1 °C, humidity of 70±5% and photoperiod of 14L: 10D.

During the month of April 150 *Daba T.V* cocoons were collected from the forest patches of Chennur, Adilabad District, Telangana as per the standard norms like cocoon color, cocoon shape, cocoon weight and peduncle length. For the first crop, the cocoons were accommodated separately in wire mesh cages of size 2ft x 2ft x2ft. Cages were disinfected with 2% Formaldehyde [9]. From April to May 42±2% relative humidity and 30±2°C room temperature were maintained. In the month of June temperature has been reduced to 29±1°C and relative humidity increased to 72±3 % to get uniform moth emergence. The emerged moths were tested for microsporidiosis [16]. Eggs from healthy moths were prepared and incubated. The hatched larvae were reared on fresh tender leaves of *Terminalia arjuna* till cocooning following standard procedure. The cocoons harvested from first crop and second crop were subjected for selection for second and third crops and repeated the same above process.

To determine the effects of host age on the development of *Xanthopimpla*, 2 days-old mated female *Xanthopimpla* were exposed to *Daba TV* cocoons of all the three crops. Each experiment cage of size 2ft×2ft×2ft contained 50 cocoons containing pupae of a particular age and 10 mated female *Xanthopimpla*. After 24h, the exposed cocoons containing pupae were placed individually in 100 ml bottles until *Xanthopimpla* emerged. Cotton pieces saturated with honey placed on the walls of bottles which provides food to the adult emerged *Xanthopimpla*. The pupae used for the experiment were of 2-9 days old. Experimental trials were replicated thrice.

3. Results and Discussion

In the development of parasitoids host age plays an important role. So it is important for the parasitoid to choose appropriate age of the host for its development and also vigor [3].The parasitoids can discriminate different ages of host pupae, and choose the most suitable host ages for parasitization, and this offers an apparent advantage for the survival of the parasitoid population.

Present results show that *Xanthopimpla pedator* had parasitized host pupae at all stages. However, the rate of parasitism varied significantly among various host age classes. The parasitism was higher in 4 days-old pupae and lowest in 9 days old pupae. Preference of younger hosts for parasitisation might be based on the ease to oviposit, resulting in shorter duration of oviposition which is critical for time limited parasitoids [7]. It was observed that there was no significant variation in parasitisation by *Xanthopimpla* among 4, 5 and 6 days-old age pupae. It was also observed that parasitisation % was highest in second crop rearing in 4th day pupae (58%) followed by first (53%) and third crop rearing (50%). In parasitoid *P. vindemmiae* the most suitable age of host for parasitization is 3 day old pupae followed by 5 and 7 days [6]. *Asobara tabida* is more successful in attacking younger larvae than older larvae of Drosophila [1].

Present results show that emergence % of *Xanthopimpla* varied significantly in different pupal age groups. The emergence % of *Xanthopimpla* was recorded highest in 4th day whereas it was lowest in 9th day old pupae. In case of *E. argenteopilosus* the parasitization and further emergence of the parasitoid is high in early instar larvae as smaller hosts defending themselves against parasitization probably cause lesser injury to the parasitoid than older ones[12]. It was identified that the emergence % was almost similar in 4-6 days old age pupae. It was also observed that emergence % was highest in second crop rearing during 4th day (96%) followed by first (94%) and third crop rearing (88%).

Present results show that mortality of host decreased gradually with increasing host pupa age. Pupa mortality % was recorded highest at its second day and least in 9th day. Least mortality of host can be attributed to its size so larger hosts can defend themselves better than smaller hosts [10]. It was observed that during the second crop the pupa mortality was least and highest was recorded in third crop rearing.

In conclusion *Xanthopimpla pedator* has host age preference in parasitism and the infestation rate on the pupae of *Daba TV* was high in second crop followed by first and second crops. This causes production of damaged cocoons; a control over the infestation will reduce the economy loss in cocoon reeling sector.

Table 1: Effects of host pupal age on parasitism and emergence of *Xanthopimpla pedator* during first crop

Number of cocoons	Number of Mated Female *Xanthopimpla*	Pupal age (Days)	Parasitism (%)	Emergence (%)	Pupal Mortality (%)
50	10	2	15±0.88	65±3.25	21±1.26
50	10	3	28±1.54	78±3.26	19±1.25
50	10	4	53±2.14	94±2.54	18±1.24
50	10	5	52±2.55	92±2.08	17±1.28
50	10	6	51±2.25	91±2.86	15±1.25
50	10	7	16±0.85	73±4.32	14±1.28
50	10	8	12±0.64	72±4.54	12±1.24
50	10	9	11±0.52	62±3.25	8±1.26

Table 2: Effects of host pupal age on parasitism and emergence of *Xanthopimpla pedator* during second crop

Number of cocoons	Number of Mated female *Xanthopimpla*	Pupal age (Days)	Parasitism (%)	Emergence (%)	Pupal Mortality (%)
50	10	2	17±0.78	68±2.28	20±0.98
50	10	3	28±1.63	82±3.42	18±1.12
50	10	4	58±2.78	96±2.12	17±1.05
50	10	5	55±2.24	94±2.42	14±1.16
50	10	6	54±2.36	93±2.75	13±1.12
50	10	7	17±0.54	75±3.16	11±0.58
50	10	8	14±0.78	74±3.42	10±0.85
50	10	9	12±0.55	64±2.45	6±0.68

Table 3: Effects of host pupal age on parasitism and emergence of *Xanthopimpla pedator* during third crop

Number of cocoons	Number of mated female *Xanthopimpla*	Pupal age (Days)	Parasitism (%)	Emergence (%)	Pupal Mortality (%)
50	10	2	14±0.75	64±2.14	25±1.85
50	10	3	26±1.26	68±2.12	24±1.72
50	10	4	50±1.28	88±1.05	21±1.68
50	10	5	49±1.88	84±1.82	19±1.75
50	10	6	48±1.65	82±1.72	16±1.36
50	10	7	14±0.78	71±3.28	15±1.58
50	10	8	11±0.84	69±3.12	14±1.46
50	10	9	10±0.55	58±2.14	10±1.85

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