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Research Article

EFFICTIVENESS OF NEEM EXTRACTS AGAINST XANTHOPIMPLA PREDATOR INFESTATION ON ANTHEREAE MYLITTA DRURY (DABA T.V) COCOONS

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ABSTRACT

Present study focus on the potential use of neem extracts in controlling *Xanthopimpla predator*infestation on *Anthereae mylitta drury(Daba T.V)*cocoons. Effectiveness of neem extracts against *Xanthopimpla predator*infestation was studied during first, second and third crops of *Anthereae mylitta drury (Daba T.V)*. Neem leaf and neem seed extracts were evaluated against *Xanthopimpla predator* under field conditions. Spraying of neem seed extract (T3) increased the effective rate of rearing in all the three crops compared to neem leaf extract (T2) and the control batch (T1). It was found that in all the three batches the infestation % was high in third crop. The maximum *Xanthopimpla* infestation was observed in control cocoons (without any spray). The neem leaf extract sprayed on *Daba T.V* cocoons had reduced 51.42-73.18 of *Xanthopimpla* infestation in all the three crops while neem seed extract reduced 71.43-82.93% of *Xanthopimpla predator* infestation during the three crops. It is also found that in T1, T2 and T3 batches, the percentage of female cocoons infested was less than the male cocoons in all the three crops Present results also show that, the pupa of 4, 5 and 6 days old were selected for maximum infestation in all the three batches. Meteorological data pertaining to the rearing field report the peak period of Ichneumon fly incidence as November, December and January (Third crop).

INTRODUCTION

The tasar silk is produced by *Anthereae mylitta Drury* (Lepidoptera: Saturnidae), a wild polyphagous tropical sericigenous insect distributed over central India. The species has wide distribution over diverse ecological niche as forty four ecoraces but only a few are semi-domesticated and applied commercially for seed (egg) and silk production (Lakshmi, 2011). The life performance of the insect is always challenged by abundance of food and its quality, various abiotic factors, presence of predators, parasites and diseases which affect the cocoon yield. The predators of tasar silkworm are natural enemies in abundance in the rearing field and cause crop loss up to 20-25% (Singh *et al*., 1992). Tasar rearing being out door, there is a certain extent of cocoon loss due to parasites, predators and vagaries of nature. It has been estimated that in hibernating stock about 20-30% loss of seed cocoons due to pupal mortality and unseasonal emergence which in turn reduces the multiplication rate of tasar cocoons. Ichneumons are important endoparasitoids of insect hosts mainly larvae and pupae of Lepidoptera. Among that, *Xanthopimpla* (hymenoptera), *Blepharipa* (diptera) are pupal and larval parasites of silkworm (Sabine *et al*., 2004).

In every stage of insects, the environmental factors such as temperature, humidity, rainfall etc. play an important role in growth and development (Dabhiand Koshiya, 2014).These factors compelled the insects to adapt themselves to the changing climatic conditions or perish (Jamshaid *et al*., 2010). Among the various physical factors, temperature, humidity and rainfall are considered to be the most important cause of insect population fluctuations.

The neem tree, Azadirachtin indica, a source of several insecticidal alkaloids and main pesticidal component is Azadirachtin (Saha *et al*., 2006). Insecticides may cause physiological changes by affecting the nervous and hormonal balance of insects. The natural enemies may reduce the probability of finding their hosts for oviposition because of the indirect disturbance caused by the repellent effect of insecticides Keeping in view of the above factors, present study was taken up to record the incidence of *Xanthopimpla predator* in different crops, to know the influence of abiotic factors on *Xanthopimpla* prevalence and the potential use of neem extracts in controlling *Xanthopimpla predator* infestation on *Anthereae mylitta drury (Daba T.V)*cocoons.

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MATERIALS AND METHODS

Newly hatched larvae of *Anthereae mylitta drury (Daba TV)* were reared on the *Terminalia arjuna* plantation. 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 the second and third crops cocoons were preserved in the cages made up of wire mesh of size 2ftx2ftx2ft under temperature of 29±1ºC and humidity 70±1percent. The emerged moths were tested for pebrine by a method (Pasteur, 1870).The eggs laid by healthy moths were collected and incubated for hatching.

Preparation of neem leaf extract*:* 5 Kgs of fresh neem leaves were mashed by using grinder. Than mixed with 25 lts of water and kept in container with tight lid for three days before use. Using the strainer the leaves from the mixture was separated and the clear filtrate was used. Before every application 1 ltr of concentrate was diluted with 8 ltr of water. Remaining concentrate was stored in a dark bottle in refrigerator.

Preparation of neem seed extract*:* 5 kgs of dried neem seeds were collected and crushed into pieces. These pieces were tied in muslin cloth and immersed in a tub containing 25 ltr of water for 3 days. The muslin cloth was taken out and squeezed. Before every application 1 ltr of concentrate was diluted with 8 ltr of water. Remaining concentrate was stored in a dark bottle in refrigerator.

Spraying is done from the fifth instar larvae to cocoon formation at an interval of 3 days by using Gorilla spraye. To estimate the effect of neem extract in controlling *Xanthopimpla predator* infestation on *Daba TV* cocoons, healthy fifth instar larvae were divided into three groups. One group containing 600 larvae reared on untreated *Terminalia arjuna* plants (T1-Control), second group containing 600 larvae reared on *Terminalia arjuna* plants sprayed with neem leaf extract till cocooning (T2)and third group sprayed with neem seed extract (T3). 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.

ERR% = Total number of cocoons produced / Total number of larvae brushed X 100.

The incidence of ichneumon fly was identified by randomly observing the symptoms of fly emergence in 500 cocoons and the percent pest incidence was calculated using the following formulae:

Percentage incidence of Ichneumonan fly = Number of ichneumon fly emerged from cocoons/number of cocoons observed X 100.

Statistical Analysis

Each assay was replicated 3 times. Values were expressed as mean.

RESULTS AND DISCUSSION

Table 1 explains that *Daba T.V*. larvae reared on untreated(T1), neem leaf extract treated (T2) and neem seed extract treated (T3) host plants during first, second and third crops. In each crop 600 fifth instar larvae were reared on tasar plants in separate fields. In T1 batch out of 600 fifth instar larvae reared during first, second and third crops the effective rate of rearing (ERR) recorded was 84.16, 83 and 80. In T2 batch out of 600 fifth instar larvae reared during first, second and third crops the effective rate of rearing(ERR) recorded was 92.16, 91.33 and 89.66 respectively. Whereas in T3 the effective rate of rearing (ERR) recorded was 94.66, 92 and 90.16 in the respective three crops. Number of cocoons harvested decreased from first crop to the third crop and so the effective rate of rearing also decreased.

The data pertaining to crop and incidence of *Xanthopimpla predator* in relation to temperature, relative humidity and rainfall were collected and presented in Table 2. In the first crop the maximum temperatures recorded was 40.2 ^{o}C and minimum was 25.5 ^{o}C during rearing period. In the second crop 31.5 ^{o}C and 20.6 ^{o}C were the maximum and minimum temperatures recorded whereas in third crop it was 25.6 ^{o}C and 18.5 ^{o}C respectively. Compared to all the three crops the maximum percentage of relative humidity was recorded in third crop and minimum percent was also recorded in the third crop. Highest rainfall was recorded in the second crop followed by first crop and least was noted in the third crop. In the third crop the production of healthy cocoons decreased and percentage of infestation increased in both T1 (Control) and T2 batch (fifth instar larvae reared on neem treated tasar plants). The pest shows significant negative correlation with maximum temperature and minimum temperature (Sidhaiah *etal*., 2014). Variations in temperature can affect the biology, later searching ability and rate of parasitism and predation (Mack *et al*., 1981; Flinn, 1991) and the functional response (Messenger, 1989). The incidence of *Xanthopimpla predator* infestation was high during third crop might be due to prolongation of larval duration in winter. The result of present study is in accordance with previous observation made by Shaffer (1983) reported that in parasitoid *A. calandrae* females, longevity was longer at lower temperature and shortest at higher temperature and so the appearance of these parasitoids is high in low temperatures. Increase in temperature reduces the development period in *Dinarmusbasalis* (Islam *et al*., (2005). According to Thies *et al*., 2005 and Etienne *et al*., 1990 rainfall is detrimental to immature aphids and thrips and decreases the number.

Table 1 *Daba T.V*. larvae reared on untreated and treated host plants during first, second and third crops

Crop	Untreated tasar plants (T1)			Tasar plants treated with neem leaf extract (T2)			Tasar plants treated with neem seed extract (T3)		
	No. fifth instar larva reared	No. cocoons formed	ERR (%)	No. fifth instar larvae reared	No. cocoonsformed	ERR (%)	No. fifth instar larvae reared	No. cocoons formed	ERR (%)
First	600	505	84.1	600	553	92.16	600	568	94.66
Second	600	498	83	600	548	91.33	600	552	92
Third	600	480	80	600	538	89.66	600	541	90.16

Table 2 Meteorological data pertaining to the rearing field

Weather parameter	First crop (June-July)	Second crop (August-September)	Third crop (November-January)
Max temp(◦ C)	40.2	31.5	25.6
Mintemp(◦C)	25.5	20.6	18.5
Max RH(%)	83	88	89
Min RH(%)	68	69	49
Rainfall(mm)	530	580	175
% of *Xanthopimpla* infestation	8.75(T1) 4.5(T2) 2.5(T3)	17(T1) 5.0(T2) 3.25(T3)	20.5(T1) 5.5(T2) 3.5(T3)

The ichneumon fly belongs to the order Hymenoptera, family ichneumonidae. The female fly has nearly 1 cm long prominent needle like ovipositor with two long stylets. The female fly lays eggs inside the pre-pupal body by inserting its ovipositor through freshly formed / flimsy cocoon shell (Wang, 2008). Only one egg is deposited in each host. The maggot after hatching consumes the entire pupal content except the skin and pupates. The adult fly emerges from the cocoon by piercing the cocoon which renders the cocoon unfit for reeling.

Table 3 shows the infestation of cocoons by *Xanthopimpla predator*. The number of cocoons infested with *Xanthopimpla predator* was high in larvae reared on tasar plantatation without any spray (T1) than in larvae reared on Tasar plants sprayed with neem leaf and seed extract.

The body mass and longevity decreased with prolonged development time of the *Braconidae, Chelonus oculator* was observed when subjected to azadirachtin at LC50 and LC25 values (Simmonds *et al*., 2002). Azadirachtin reduces the infestation rates of *V. canescens* in parasitized *Ephestia* larvae compared with the control (Tunca *et al*., 2012). Neem extracts reduces the infestation in mustardaphid(Biswas, 2013). In T1 batch, the percentage of cocoons infested by *Xanthopimpla* was high (20.5%) in third crop compared to second (17%) and first crops (8.75%). In T2 batch also the percentage of cocoon infestation was high in third crop (5.5%) followed by second crop (5%) and first crop (4.5%). Whereas in T3 batch, the percentage of cocoons infested by *Xanthopimpla* was high in third crop (3.5%) compared to second (3.25%) and first crops (2.5%). So, the peak period of Ichneumon fly incidence was observed in the months of November, December and January (Third crop). In the summer season the weather conditions are better for both hosts and parasitoids and parasitoids have accumulated from generation to generation resulting in high frequency of parasitoids (Al-Rubeai *et al.,*2005). It is observed that the percentage of infestation was reduced in all the three crops with neem seed extract treatment. It is also found that in T1, T2 and T3 batches, the percentage of female cocoons infested was less than the male cocoons in all the three crops. *Xanthopimpla* has sexual preference for males in parasitism of hosts (Singh *et al*., 2010).

Table 3 Influence of neem extracts on *Xanthopimpla predator* infestation

Crop	No. cocoons observed in all the batches	Untreated tasar plants (T1)			Tasar plants treated with neem leaf extract (T2)			Tasar plants treated with neem seed extract (T3)		
		No. cocoons infested	No. male cocoons infested	No. Female cocoons infested	No. cocoons infested	No. male cocoon infested	No. Female cocoon infested	No. cocoon infested	No. male cocoon infested	No. Female cocoon infested
First	400	35	32	3	18	15	3	10	10	0
Second	400	68	65	3	20	18	2	13	11	2
Third	400	82	80	2	22	20	2	14	13	1

Table 4 Impact of pupa age on *Xanthopimpla predator* infestation

Crop	Untreated tasar plants (T1)			Tasar plants treated with Neem leaf extract (T2)			Tasar plants treated with Neem Seed extract (T3)		
	No. cocoons	Pupa age (Days)	Infestation (%)	No. cocoons	Pupa age (Days)	Infestation (%)	No. cocoons	Puapa Age (Days)	Infestation (%)
First	50	2	4	50	2	0	50	2	0
	50	3	6	50	3	2	50	3	2
	50	4	20	50	4	8	50	4	6
	50	5	14	50	5	6	50	5	6
	50	6	10	50	6	2	50	6	2
	50	7	4	50	7	2	50	7	2
	50	8	2	50	8	0	50	8	0
Second	50	2	10	50	2	0	50	2	2
	50	3	14	50	3	2	50	3	2
	50	4	35	50	4	8	50	4	10
	50	5	26	50	5	6	50	5	8
	50	6	22	50	6	4	50	6	2
	50	7	12	50	7	2	50	7	0
	50	8	2	50	8	0	50	8	0
Third	50	2	14	50	2	2	50	2	0
	50	3	20	50	3	6	50	3	2
	50	4	36	50	4	8	50	4	12
	50	5	30	50	5	6	50	5	10
	50	6	24	50	6	2	50	6	2
	50	7	16	50	7	0	50	7	0
	50	8	4	50	8	0	50	8	0

The malformation in development of the natural enemies caused by botanical pesticides may result into decrease in their parasitism and predation efficiency (Fernandes *et al*., 2010).

Data pertaining to the preference of host age by *Xanthopimpla predator* for infestation was recorded and presented in Table 4. In the development of parasitoids host age plays an important role. The appropriate age of the host is an important factor in

the development and vigor of parasitoid (Bradleigh, 1976). It was found that in T1 batch, T2 batch and T3 batch the infestation % was high in third crop. The pupa of 4, 5 and 6 days old selected for infestation was maximum in all the three batches and prior to these days in T1, T2 and T3 batches was less selected. Preference of younger hosts for parasisitization might be based on the ease to oviposit, resulting in shorter duration of oviposition which is critical for time limited parasitoids (Harvey and Thompson,1994). Pupa of 8th day has least preference for parasitisation by *Xanthopimpla.* The parasitoids can discriminate the 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. In parasitoid *P.vindemmiae* the most suitable age of host for parasitization is 3 day old pupae followed by 5 and 7 days (Hai-Yan Zhao, 2013). *Asobara tabida* is more successful in attacking younger than older larvae of *Drosophila* (Alphen and Drijver, 1982). In case of *E.argenteopilosus* the parasitization and further emergence of this parasitoid is high in early instar larvae as smaller hosts defending themselves against parasitization probably cause lesser injury to the parasitoid than older ones (Leonardo *et al.,* 2004). Hosts attained large size with age can defend themselves better than smaller hosts (Kouame and Mackauer, 1991).

CONCLUSION

Thus in conclusion spraying of neem seed extract increased the effective rate of rearing and decreased the infestation percentage in all the three crops compared to neem leaf extract. Also can be concluded that, older pupa have maximum infestation in all the three crops with a peak infestation in third crop.

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