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Comparative role of Eucalyptus Leaf extract and Garlic extract against *Xanthopimpla pedator* infestation

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ABSTRACT
Present study focus on the potential use of eucalyptus leaf extract and garlic extract in controlling Xanthopimpla pedator infestation on Anthereaemy littadrury (Daba T.V) cocoons. Effectiveness of extracts against Xanthopimpla pedator infestation was studied during first, second and third crops of Anthereaemy littadrury (Daba T.V). Eucalyptus leaf and garlic extracts were evaluated against Xanthopimpla pedator under field conditions. Spraying of Tasar plants with eucalyptus leaf extract along garlic extract (T4)increased the effective rate of rearing in all the three crops compared to garlic extract (T3), eucalyptus leaf extract (T2) and the control batch (T1). It was found that in all the four batches the infestation was high in third crop.The maximum Xanthopimpla infestation was observed in control batch cocoons (T1)(without any spray).The eucalyptus leaf extract sprayed on Daba T.V cocoons had reduced Xanthopimpla infestation to 13.04-8.1% in all the three crops while garlic extract reduced Xanthopimpla pedator infestation to 14.28-7.89%.. The combination of euacalyptus and garlic extract reduced Xanthopimpla pedator infestation to 11.5-5.6 % 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.
KEYWORDS: Effectiveness, eucalyptus leaf extract, garlic extract, Daba T.V Cocoons.

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INTRODUCTION

The tasar silk is produced by *Anthereaemy litta 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[1]**.**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% [2].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 [3].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 [4].

Some plants are known to contain bioactive metabolites, which show antifeedant, repellent and toxic effects on a wide range of insect pests [5]. The consideration for the use of extracts of plants origin is that they are easily biodegradable, effective on some pests and

considered safe in pest control operations as they minimize pesticide residues, ensure safety of the consumers of the treated grains and the environment [6]. Further, the production of organic extracts of plant origin for pest control may be easier and less expensive than the synthesis of some complex chemical formations [7]. In nature, essential oils seems to be important agents of interspecific communication as theyfavor pollination by attracting insects and also play an important role in protection of the plants asantibacterial, antiviral, antifungal, insecticides and also against herbivorous by reducing their appetite for such plants. Subsequently, they have involved in many industrial applications, particularly in perfumery, cosmetics, detergents, pharmacology, fine chemistry as well as aromatics for the food industry and recently in insect pest management [8].

Eucalyptus is one of the most cultivated genera in the world, including more than 700 species belonging to family Myrtaceae. Various biological properties have already been attributed to the genus Eucalyptus, among them larvicidal activity on culicids [9], insecticidal activity against beetles [10], repellent action against *Phlebotomus papatasi* and acaricidal activity against Tetranychusurticae[11].Eucalyptus oils rich in cineole have been shown to be effective against varroa mite, *Varroa jacobsoni*—an important parasite of honeybee [12] Tetranychusurticae and *Phytoseiulus persimilis* [13] and *Dermatophagoides pteronyssinus* [14].

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 [6].

Garlic (Allum sativum) is widely known for its anti-microbial potentials and contains active components, such as Amino acid called alicin and an enzyme called allinase [15]. These compounds are antibiotic, which are effective against some range of bacterial and fungal species and have been a useful plant in food storage to inhibit fungal activities. However, Garlic extract also has insecticidal properties and show considerable toxicity to a number of pest pecies, across all life stages [5].Aphids, ants, termites, white flies, beetles, borers, caterpillars, slugs, and army worms are some of the pests that can be suitably controlled using garlic and makes an excellent economical, non-toxic pesticide for the garden[16].

Keeping in view of the above factors, present study was taken up to record the incidence of *Xanthopimpla pedator* in three different crops and the potential use of eucalyptus and garlic extracts in controlling *Xanthopimpla pedator* infestation on *Anthereaemy littadrury (Daba T.V)*cocoons.

MATERIALS AND METHODS

Newly hatched larvae of *Anthereaemy littadrury (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±1°C and humidity70±1percent. The emerged moths were tested for pebrine by a method [17].The eggs laid by healthy moths were collected and incubated for hatching.

Preparation of eucalyptus leaf extract: 5kgs of fresh leaf samples of eucalyptus were thoroughly washed, cleaned and dried under shade. The dried leaves were pulverized using blender. Then leaf powder was soaked in 25 litres of distilled water and left for 24hrs in rotary shaker for uniform mixing [18]. The mixture was then filtered by muslin cloth. The filtrate was centrifuged for 20 min at 6000 rpm. The crude extract was stored in an air tight bottle at 4°C until use [19].Before every application one litre of filtrate is diluted in 8 liters of water.

Preparation of garlic extract: Cloves were collected from 5 kgsof garlic bulbs. Outer skin is removed, cut to very small bits by garlic press and crushed using a mortar and pestle. The mixture is soaked in 25litre of water for six hours and strained using muslin cloth [20].Before every application one litre of filtrate is diluted in 8 liters of water. Remaining concentrate was stored in a dark bottle in refrigerator.

Spraying is done to *Terminalia arjuna* plantation from the second instar larvae to cocoon formation at an interval of 5 days by using Gorilla sprayer. To estimate the effect of plant extracts in controlling *Xanthopimpla pedator* infestation on *Daba TV* cocoons, healthy first

instar larvae were divided into fourgroups. One group containing 500 larvae reared on untreated *Terminalia arjuna* plants (T1-Control),second group containing 500 larvae reared on *Terminalia arjuna* plants sprayed with eucalyptus leaf extract till cocooning (T2), third group sprayed with garlic extract (T3) and fourth sprayed with eucalyptus and garlic extract combined (T4).

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), eucalyptus leaf extract treated (T2),garlic extract treated (T3) and eucalyptus leaf extract + garlic extract treated (T4) host plants during first, second and third crops. In each crop 500 first instar larvae were reared on tasar plants in separate fields. In T1 batch out of 500 larvae reared during first, second and third crops the effective rate of rearing (ERR) recorded was 81, 77 and 74%. In T2 batch out of 500 larvae reared during first, second and third crops the effective rate of rearing(ERR) recorded was 89,85 and 82% respectively. In T3 the effective rate of rearing (ERR) recorded was 89.6, 86 and 81.6% in the respective three crops. Whereas in T4 batch the effective rate of rearing (ERR) recorded was 92.4, 89.6 and 85.6% respectively. The number of cocoons harvested decreased from first crop to the third crop and so the effective rate of rearing also decreased.

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 [21]. 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 [22].

Table 2 shows the infestation of cocoons by *Xanthopimpla pedator.* The number of cocoons infested with *Xanthopimpla pedator* was high in larvae reared on tasar plantation without any spray (T1) than in larvae reared on Tasar plants sprayed with eucalyptus leaf extract, garlic extract, eucalyptus leaf + garlic extract combination.. The malformation in development of the natural enemies caused by botanical pesticides may result in decrease in their parasitism and predation efficiency [23]. The body mass and longevity decreased with prolonged development time of the *Braconidae, Chelonusoculator* was observed when subjected to bio-pesticide at LC50 and LC25 values [24]. Azadirachtin reduces the infestation rates of *V. canescens* in parasitized *Ephestia* larvae compared with the control. Neem extracts reduces the infestation in mustard aphid[25]. In T1 batch, the percentage of cocoons infested by *Xanthopimpla* was high (24) in third crop compared to second (20.3%) and first crops (11.3%). In T2 batch also the percentage of cocoon infestation was high in third crop (11.7%) followed by second crop (8%) and first crop (5%).Where as in T3 batch, the percentage of cocoons infested by *Xanthopimpla* was high in third crop (11.33%) compared to second (8.33%) and first crops (5.66%). In T4 batch the cocoon infestation was recorded high in third crop (6.33%), followed by second crop (6%) and first crop (4%). So, the peak period of Ichneumon fly incidence was observed in the months of November, December and January (Third crop).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 [6]. The incidence of *Xanthopimpla pedator* infestation was high during third crop might be due to prolongation of larval duration in winter. 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 [26]**.**The result of present study is in accordance this observation. 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 [27]. It

is observed that the percentage of infestation was reduced in all the three crops with eucalyptus leaf extract treatment, garlic extract treatment. Highest reduction in infestation was noticed with combined treatment of eucalyptus leaf extract+ garlic extract. Although the toxicity of eucalyptol against the adults or larvae of flies varied from low to moderate some modes might enhance insecticidal toxicity. The small addition of compounds called synergist enormously increases the toxicity [28]. A combination of eucalyptol with synergist, either from plant extract or commercial products, increases the toxicity of eucalyptus [29].Many authors reported that the aqueous extract of plants has significant effect on insect mortality, their growth and reproduction [30].It also performs a variety of indirect services through essential oil used as insect/pest repellent and as a pesticidal agent [31].In fact, eucalyptus oil has been known for hundreds of years as antibacterial, anti-fungicidal and antiseptic in nature[32].It is also found that in T1, T2, T3 and T4 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 [33].

Data pertaining to the preference of host age by *Xanthopimpla pedator* for infestation was recorded and presented in Table 3. 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 [34]. It was found that in T1 batch, T2 batch, T3 batch and T4 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, T3 and T4 batches was less selected. Preference of younger hosts for parasitization might be based on the ease to oviposit, resulting in shorter duration of oviposition which is critical for time limited parasitoids [35]. Pupa of 8th day has least preference for parasitisation by *Xanthopimpla.*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. In parasitoid *P.vindemmiae* the most suitable age of host for parasitization is 3 day old pupae followed by 5 and 7 days [36]. *Asobaratabida* is more successful in attacking younger than older larvae of *Drosophila*[37].Hosts attained large size with age can defend themselves better than smaller hosts.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 [38].

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

S.No			First crop	Second crop	Third crop
1	Untreated tasar plants (T1)	No. fifth instar larva reared	500	500	500
		No. cocoons formed	405	385	370
		ERR(%)	81	77	74
2	Tasar plants treated with eucalyptus leaf extract (T2)	No. fifth instar larva reared	500	500	500
		No. cocoons formed	445	425	410
		ERR(%)	89	85	82
3	Tasar plants treated with garlic extract (T3)	No. fifth instar larva reared	500	500	500
		No. cocoons formed	448	430	408
		ERR (%)	89.6	86	81.6
4	Tasar plants treated with eucalyptus leaf and garlic extract (T4)	No. fifth instar larva reared	500	500	500
		No. cocoons formed	462	448	428
		ERR(%)	92.4	89.6	85.6

Table 2 Influence of eucalyptus and garlic extracts on *Xanthopimpla pedator* infestation during three crops

S.No			First crop	Second crop	Third crop
1	Untreated Tasar plants (T1)	No. cocoons observed	300	300	300
		Number of cocoons infested	38	61	72
		Number of male cocoons infested	34	55	65
		Number of female cocoons infested	4	6	7
2	Tasar plants treated with eucalyptus leaf extract (T2)	No. cocoons observed	300	300	300
		Number of cocoons infested	15	24	35
		Number of male cocoons infested	12	22	31
		Number of female cocoons infested	3	2	4
3	Tasar plants treated with garlic extract (T3)	No. cocoons observed	300	300	300
		Number of cocoons infested	17	25	34
		Number of male cocoons infested	14	21	31
		Number of female cocoons infested	3	4	3
4	Tasar plants treated with eucalyptus leaf and garlic extract (T4)	No. cocoons observed	300	300	300
		Number of cocoons infested	12	18	19
		Number of male cocoons infested	10	14	13
		Number of female cocoons infested	2	4	3

Table 3: Impact of eucalyptus leaf extracts, garlic extract and pupa age on *Xanthopimpla pedator* infestation during three crops

Crop	No. cocoon in each crop	Untreated tasar plants (T1)		Tasar plants treated with eucalyptus leaf extract (T2)		Tasar plants treated with garlic extract (T3)		Tasar plants treated with eucalyptus leaf and garlic extract (T4)	
		Pupa age	Infesta-tion %	Pupa age	Infesta-tion%	Pupa age	Infesta-tion%	Pupa age	Infesta-tion%
First	25	2	0	2	0	2	0	2	0
	25	3	1	3	0	3	0	3	0
	25	4	3	4	3	4	3	4	2
	25	5	2	5	2	5	2	5	1
	25	6	2	6	1	6	1	6	1
	25	7	0	7	0	7	0	7	0
	25	8	0	8	0	8	0	8	0
Second	25	2	1	2	0	2	0	2	0
	25	3	2	3	1	3	0	3	0
	25	4	4	4	3	4	3	4	2
	25	5	5	5	2	5	2	5	1
	25	6	5	6	2	6	1	6	2
	25	7	1	7	0	7	1	7	0
	25	8	0	8	0	8	0	8	0
Third	25	2	0	2	0	2	0	2	0
	25	3	1	3	1	3	1	3	0
	25	4	5	4	3	4	3	4	2
	25	5	6	5	4	5	3	5	3
	25	6	8	6	2	6	2	6	2
	25	7	1	7	0	7	1	7	1
	25	8	0	8	0	8	0	8	0

CONCLUSION

Thus in conclusion spraying of eucalyptus leaf extract and garlic extract increased the effective rate of rearing and decreased the infestation percentage in all the three crops compared to control group. However, extract made from the combination of eucalyptus and garlic appears to be more effective than extracts of eucalyptus and garlic separately. 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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