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Biocontrol Potential of *Diadegma trichoptilus* (Cameron) (Hymenoptera: Ichneumonidae) against Tur Plume Caterpillar *Exelastis atomosa* Walsingham (Lepidoptera : Pterophoridae)

KEYWORDS

D. trichoptilus, E. atomosa, Biocontrol potential, Tur ecosystem.

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ABSTRACT

Diadegma trichoptilus (Cameron) (Hymenotera:Ichneumonidae) is an internal, larval, solitary and endoparasitoid of Tur plume caterpillar *Exelastis atomosa* Walsingham (Lepidoptera : Pterophoridae). In field condition, in agro ecosystems of Tur *Cajanus cajan* (Millusp) of Kolhapur region, it caused 18.00% mortalities in second instar larvae of *E. atomosa. E. atomosa serious* pest of C. *cajanus* and difficult to control with pesticides hence, *D. trichoptilus* is good option as biological pest control tool. The parasitoid cocoon number collected and the mortalities in pest species were related to rainfall of the region.

INTRODUCTION

Diadegma trichoptilus Cameron (Hymenotera :Ichneumonidae) is internal, larval, solitary and endo parasitoid of Tur plume caterpillar *Exelastis atomosa* Walsingham (Lepidoptera : Pterophonidae). *E. atomosa* is serious pest of Tur *Cajanus cajan* Millusp which causes about 30-40% damage to crop by affecting the yield (Atwal, 1976). The caterpillars damage leaves, buds, flowers and developing pods by feeding upon them, especially pods are bored and caterpillar feed on developing seeds. The control of this pest by pesticides is chronic problem and leads many serious problems such as air, water and soil pollution; killing of beneficial insects like pollinators and pest biocontrol agents; pest resurgence, secondary pest outbreak, pest resistance, interruption to ecocycles and food webs, etc. Therefore, ecofriendly control of above pest species is the need of the day. D. *trichoptilus* is good biocontrol agent of *E. atomosa* which kill second instar larvae by parasitism (Sathe, 1986). Keeping in view all above facts, field (mortality) biocontrol potential was studied from Kolhapur district of Maharashtra, India. Review of literature indicates that Nikam and Basarkar (1976), Sathe (1987 a,b,c, 1988 a,b, 2014,2015), Sathe and Nikam (1985 a,b,c) etc. worked on this parasitoid with respect to parasitism and biocontrol aspects.

MATERIALS AND METHODS

Selection of study site-

From Kolhapur district, Maharashtra, India following study spots (tehsils) namely Shirol, Hatkanangale, Karveer, Panhala, Shahuwadi, Radhanagari and Gaganbawda were selected on the basis of rainfall and geographic characters. Kolhapur lies between 15o-17o North latitude and 73o-74o East longitude with rainfall range 500 mm to 6000 mm. (Fig-1).

Experimental setup –

Biocontrol potential of *D. trichoptilus* was studied by collecting the larvae of E. atomosa from above mentioned study spots from the fields of red gram (C. cajan) at weekly interval. The field collected larvae were reared in the laboratory condition (24 +- 1oc, 75-80% RH, 12 hr photoperiod) for screening parasitoids and noting the mortalities caused by this parasitoid. The infected larvae were become yellowish and finally the larvae were converted into elongated cocoons. They were tapered to both the ends. From cocoons parasitoid adults were emerged and were identified by consulting appropriate literature. Percentage was calculated by counting field collected parasitized larvae out of hundred. Biocontrol potential of *D. trichoptilus* was also tested by collecting the number of cocoons from study spots by one man, one hour, one acre search method.

RESULTS

Results are recorded in table- 1 and figures 1 to 4. Out of 7 study spots biocontrol potential of *D. trichoptilus* was progressively increased with decrease rainfall (table 1). Maximum pest mortality (18.00%) was noted in Shirol spot and minimum in Radhanagri. However, no pest mortality due to parasitoid was noted in Gaganbavda which showed highest rainfall (5000-6000 mm) of the district and very less preference given to this pulse crop by the farmers.

D. trichoptilus showed 18.00%, 17.50%, 16.00%, 13.50%, 7.20% and 5.00% mortalities in the Tur field of Shirol, Hatkanagale, Karveer, Panhala, Shahuwadi and Radhanagari respectively. The cocoons collected from the fields of different study spots were related to rainfall. Maximum (69) cocoons were collected from low rainfall study spot, Shirol and minimum (11) from Radhanagri. No cocoons were collected from Gaganbavda (table 2).

DISCUSSION

Sathe (1987c) recorded natural enemies for *S.litura* from Kolhapur region of India for suppression of its population. He noted 60% and 20% mortalities in the second instar larvae of *S.litura* due to *Campoletis chlorideae* (Uchida) and *Diadegma argenteopilosa* (Cameron) respectively. Sathe (1988a) reported *D. trichoptilus* completing its development from egg to adult within 17 days on the host *E. atomosa* when *C. cajan* young pods were provided as food for the host causing 21.00% mortalities in pest species. Nikam and Basarkar (1976) studied the biology of *Diadegma* sp. on second instar larvae of *H. armigera* by providing gram leaves to host. They noted that the parasitoid completed its life cycle from egg to adult within 12 to 13 days.

Sathe and Nikam (1985a) studied the host age selection by *D. trichoptilus,* a larval parasitoid of *E. atomosa.* They noted that emergence was not seen from 9-10 days old hosts. Maximum parasitism, 21.3% was recorded on 2-3 day old host larvae. There exists a significant ($p < 0.05$) correlation between the host age and the percentage of parasitism ($r = -0.6245$). Sathe (1986) studied seasonal mortalities of *D. trichoptilus,* a larval parasitoid of *E. atomosa* due to hyper parasitoids. The mortality in 2421 *D. trichoptilus* cocoons was due to three hyper parasitoids i) *Brachymeria* sp. (Chalcidae), ii) *Eurytoma* sp. braconids group (Eurytomidae), and iii) *Paraphylex* complex (Ichneumonidae). The seasonal mortality averaged 4.94% in November, 33.20% in December and 62.90% in January. The hyper parasitoids appeared 1-2 weeks later than the parasitoids in tur agro ecosystems. The percentage of hyper parasitization increased with increase of parasitization by *D. trichoptilus.*

Sathe and Nikam(1985b) studied the influence of certain dietary combinations on longevity of adults of *D. trichoptilus.* Neither of the sex survived for more than three days without food or water and lived longest when fed with 20% honey with an average of 15 (range 9-18) days for the male and 14 (range 9-17) days for female. The longevity of both the sexes was considerably shorter when only water was given (average, male: 2.36, days Female: 2.18 days). No significant difference was observed in the longevity of adults when fed with 10%

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and 20% glucose and sucrose respectively.

Sathe (1987b) studied the longevity, fecundity and sex ratio of *D. trichoptilus.* There exist a significant ($p < 0.05$) correlatioship between the age of female parasitoid and progeny production capacity/female/day (r=-0.08580). Sathe (1987a) studied life tables and intrinsic rate of natural increase of *D. trichoptilus* population on *E. atomosa.* He noted that the mature larva kills the host and spins a cocoon within the body of host. The longevity of ovipositing females averaged 13.4 days (range 9-17 days). The mated parasitoid had on average ovipositional period of 11.3 days (range 8 to 16 days) and produced an average of 44.6 adult progeny with sex ratio 1: 1.468 (m:f). The average period of immature stage was 17 days. The maximum mean progeny production per day, mx was 5.3. The innate capacity of increase was 0.149 per female per day and population multiplied to 25.63 times in mean generation time of 21.77 days.

Sathe and Nikam (1985c) studied the influence of host density on percentage parasitism by *D. trichoptilus,* a larval parasitoid of *E. atomosa.* They noted that the highest number of parasitoids was obtained when 30 larvae were exposed for oviposition. At this density, the maximum parasitism of 21.66% was obtained. Interspecific relationships between *D. trichoptilus, Cotesia orientalis* and *Cotesia diurnii* on *E. atomosa* was studied by Sathe (1988b). He noted that *C. orientalis* was dominant over others including *D. trichoptilus.* Pesticides never solve the permanent problem of pest occurrence hence biological pest control is the need of the day as eco-friendly tool of pest control.

Table –1. Field mortality by D. trichoptilus in E. atomosa in Kolhapur district

Sr. No	Study spot	Rainfall (mm)	Percent mortality
1	Shirol	750	18.00
2	Hatkanangale	875	17.50
3	Karveer	1000	16.00
4	Panhala	1750	13.50
5	Sahuwadi	2000	7.20
6	Radhanagri	2500	5.00
7	Gaganbawada	5000	0.00

Table- 2 Field cocoons of D. trichoptilus collected from Kolhapur study spots (Nov-Feb 2015-2016)

Sr. No	Study spot	No. of collected cocoons
1	Shirol	69
2	Hatkanangale	48
3	Karveer	49
4	Panhala	22
5	Sahuwadi	17
6	Radhanagri	11
7	Gaganbawada	0.00

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Fig.1: Rainfall of Kolhapur district

Fig .2: *C. cajan* crop plant

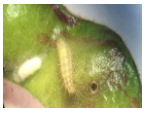

Fig.3: *E. atomosa* larva, pod damage

Fig.4: *E. atomosa* pupa

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