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Biocontrol potential of *Cotesia ruficrus* Hal. (Hymenoptera : Braconidae) against different Lepidopterous pests

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ABSTRACT

Cotesia ruficrus Hal. (Hymenoptera : Braconidae) is internal, larval, gregarious and polyphagus parasitoid. Wide host range is desirable attribute of an ideal parasitoid. *Heliocoverpa armigera* (Hubner), *Mythimna separata* Walker, *Agrotis ipsilon* (Hufnagel), *Spodoptera litura* Fab., *S. exigua* (Hubner) and *Exelastis atomosa* Walsingham have been tried for host preference and biocontrol potential of *C. ruficrus*. The order of preference was *P. separata* > *H. armigera* > *A. ipsilon* > *S. litura* > *S. exigua*. The most suitable host for maximum progeny production (55.00) was *M. separata*.

Keywords: *Cotesia ruficrus,* biocontrol potential, pest insects.

INTRODUCTION

Cotesia ruficrus Hal. (Hymenoptera : Braconidae) is endolarval, gregarious and polyphagus parasitoid which acts as good biocontrol agent of Lepidopterous insect pests such as *Mythimna separata* Walker, *Helicoverpa armigera* (Hubner), *Triplusia ni* Hubner, *Pseudoplusia includens* (Wlk.), *Agrotis ipsilon* Rottenberg, *Spodoptera litura* Fab, *S. exigua* (Hubner), *S. exempta* (Walker), *Sesamia cretica* Lederer, *Euro spinifera* Hubner, *Leucania loreyi, Plusia* spp., etc. It is distributed in Afrotropical region, Cameron, Madagascar, Senegal, Somalia, South Africa, Sudan, Uganda, Oriental and Palaeartic regions. Identifying natural enemies and their potentials on control agents is the first step in the development of biological control of insect pests. Parasitic hymenoptera discloses many of the factors that determine whether or not any two given species are to be associated as host and a parasitoid (Vinson, 1976).

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A parasitoid limits its attack to a fraction of the suitable host species that occur in nature, has stimulated investigators to study the behavior of host specificity and host selection patterns in parasitoid host interactions (Sathe, 2014). The host preference in parasitoids is vary with the species (Weshloh, 1976). Wide host range is desirable attribute of an ideal parasitoid. The parasitoids can breed in the laboratory on unnatural hosts, is often of great importance in the mass propagation of parasitoids, their field release against target pest species and their colonization. Therefore, the objective of the present work was to search for new hosts and biocontrol potential on the different insect pests. Review of literature indicates that Hafez (1947), Broodryk (1969), Fisher (1971), Odebiyi and Oatman (1972), Vinson and Guillot (1972), Jackson *et al*. (1979), Hopper and King (1984), Sathe (1987, 1988, 1990), Sathe & Santhakumar (1992), Sathe & Margaj (2001), Sathe *et al*., (2003), Sathe & Oulkar (2010), Sathe (2014), Sathe & Chougale (2014), Sutar and Sathe (2016), Jadhav & Sathe (2016) etc. attempted the studies related to parasitoid host preferences.

MATERIAL AND METHODS

Culture of *C. ruficrus* and its insect hosts *H. armigera, A. ipsiton, M. separata, S. litura, S. exigua* and *Exelastis atomosa* Walsingham were started in the laboratory (27±1ºC, 75-80%, 12 hr photoperiod) by providing respective hosts and host food plants parts to parasitoid and hosts respectively. 6-7 day old larvae of above pests with 20 density were exposed to mated female parasitoid in a glass cage (25 x 25 x 25 cm) for 2 hr for oviposition. The parasitized hosts were reared on their respective host plants in plastic containers individually for screening parasitoids. Records were made on per cent mortality of host species, per cent host emergence and per cent parasitism by *C. ruficrus* to different insect pests used in the experiments. All experiments were replicated for five times for confirmation of results.

RESULTS

Results are recorded in table - 1 and figs 1-4. The results indicated that *C. ruficrus* preferred the host *M. separata* at its maximum biocontrol potential (parasitism) of 55.00%. *H. armigera, A. ipsilon, S. litura, S. exigua* and *E.atomosa* showed 50.00%, 45.00%, 40.00%, 25.00% and 0.00% biocontrol potential respectively.

The order of host preference given by *C. ruficrus* was *M. separata* > *H. armigera* > *A. ipsilon* > *S. litura* > *S. exigua.* The larvae of *E. atomosa* were remained unparasitized by *C. ruficrus.* The host mortality rate was 00.00%, moth emergence was 35.00% and percent parasitism by *C. ruficrus* to *M. separata* was 55.00%. *H. armigera* was also found to be potential host for production of progeny of parasitoid by 50.00% parasitism (Table-1).

DISCUSSION

Biology *C. ruficrus* was studied by McCutcheon *et al.* (1983) by providing hosts *Pseudoplusia includens, T. ni* and *Spodoptera frugiperda*. The development from egg to adult was possible within the range of 16 to 18 days on above said hosts and mated females survived for 18 days and unmated ones for 20 days. Hafez (1947) also studied the biology of *C. ruficrus* by providing *A. ipsilon* larvae wherein the parasitoid completed its life cycle from egg to adult within 14 to 24 days while, in the present study, the life cycle on *H. armigera* was completed within 16-18 days by the parasitoid under

Table-1. Host preference and biocontrol potential of *C. ruficrus* against some lepidopterous pests

Sr. No.	Host species	Host density	% Host mortality	% moth emergence	% parasitism
1	*H. armigera*	20	10.00	40.00	50.00
2	*M. separata*	20	00.00	35.00	55.00
3	*A. ipsilon*	20	10.00	45.00	45.00
4	*S. litura*	20	15.00	45.00	40.00
5	*S. exigua*	20	15.00	60.00	25.00
6	*E. atomosa*	20	10.00	90.00	00.00

Fig. 1: *C. ruficus* (Adults)

Fig. 2: *C. ruficus* (Cacoons)

Fig. 3: *M. separata* (Larvae)

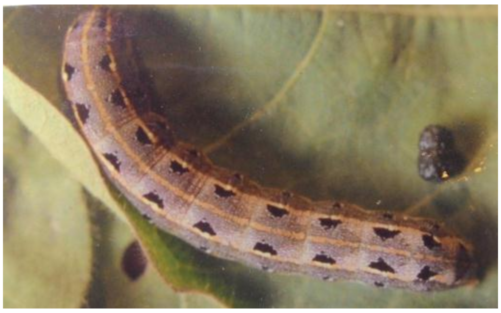

Fig. 4: *A. ipsilon* (Larva)

laboratory conditions (27±1°C, 75-80%, 12 hr photoperiod).

For successful parasitism, discrimination of host suitability for progeny often follows host recognition. Through a long history of random observations, receptors on the antennas, tarsi and ovipositor have been implicated in this phase of a parasitoids behaviour (Fisher, 1971). Some braconids can distinguish host suitability, other species reportedly cannot (Vinson & Guillot, 1972; Sathe, 1988).

According to Broodryk (1969) *Chelonus (Microchelonus) curvimaculatus* Cameron parasitized the lepidopteran hosts such as *Phthorimaca operculella* (Zeller), *Cryptophebia leucotreta* (Meyr.,) *Ephestia cautella* (Wlk.), *E. kuchniella* (Zeller), *S. exempta, S. exigua, S. litura* and *H. armigera*. However, *Bombyx mori* L. was found unsuitable for parasitism. In the present study, the hosts belongs to the family Noctuidae were parasitized but, *E. atomosa* which was from the family Pterophoridae was not parasitized by the parasitoit.

Agathis gibbosa (Say) (Braconidae) showed increased number of progeny production with respect to host density 25, 50, 75, 85, 100 and 125 but the number of parasitoid was decreased after host density 150. The host species exposed by Odebiyi & Oatman (1972) was *P. opercullella.*

Hopper and King (1984) studied the preference of *Microplitis croceipes* (Cresson) (Hymenoptera: Braconidae) towards the instars of *Heliothis zea* (Bodalic) and *H. virescens* (F.) on cotton crop. The wasp preferred third instar larvae of host species most. The order of preference of instars by *M. croceipes* was third instars > fourth instar > second instars. However, the sex ratio of parasitoid was not affected significantly by the instar parasitized.

In an Ichneumonid *Campoletis chlorideae* (Uchida) (Hymenoptera : Ichneumonidae), an internal, larval parasitoid of *H. armigera* host preference was studied by Sathe & Santhakumar (1992) by providing *H. armigera, S. litura, S. exigna* and *E. atomosa*. Wherein *E. atomosa* larvae were rejected by the parasitoid. The order of preference shown by the parasitoid was *H. armigera* > *S. litura* > *S. exigna* with 30.4%, 21.6% and 17.6% parasitism respectively.

According to Sathe & Margaj (2001) *A. arterus* gave preference to only *Erias insulana* while, *A. pusaensis* gave preference to only *Sylepta derogata* when exposed the hosts, *H. armigera, P. gossypiella, S. litura* and *S. derogata.*

According to Jackson *et al*. (1979) suitable hosts for *Chelonus (Microchelus) blackburni* Cameron were *Pectinophora gossypiella* (Saunders), *Heliothis zea* (Boddie), *H. virescens* (F.), *T. ni* and *S. exigua.* However, Salt marsh caterpillars *Estigmene acrea* (Drum) were not accepted for parasitism by *C. blackburni.* A dipterous parasitoid *Exorista bombycis* L. gave more preference to *Bombyx mori* L. Fc_2 pure line breed than Fc_1 (Jadhav & Sathe, 2016).

Investigation of different hosts for biocontrol agents is challenging aspect and is the need of day for strengthening biological pest control programmes as a ecofriendly tool of pest management. The present work will add great relevance for strengthening biological pest control strategies.

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Conflict of Interests

Authors declare that there is no conflict of interests regarding the publication of this paper.

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