Biolife
AN INTERNATIONAL QUARTERLY JOURNAL OF BIOLOGY & LIFE SCIENCES
4(1):88-93
ISSN (online): 2320-4257
www.biolifejournals.com
BIOLIFE RESEARCH ARTICLE

Host preference by Uzifly *Exorista bombycis* L. in pure line bivoltine breeds FC1 and FC2 (*Bombyx mori* L.) and Economical loss in seed cocoon production

A. D. Jadhav[1]* and T. V. Sathe[2]

[1,2] *Division of Sericulture, Dept. of Zoology, Shivaji University, Kolhapur - 416 004, India*

**Email: dradjadhav@yahoo.co.in, profdrtvsathe@rediffmail.com*

ABSTRACT

Host preference by Uzifly *Exorista bombycis* L. (Diptera : Tachinidae) to pure line bivoltine breeds FC1 and FC2 (*Bombyx mori* L.) and economical loss in seed cocoon production have been studied. The result indicated that FC1 produced more yield and was less susceptible to uzifly attack (10%) while FC2 was more susceptible to uzify attack (30%) FC1 x FC2 (double hybrid) was very interestingly, also found least susceptible to uzifly attack (6%). The net gross income reduction noted in FC1 x FC2, FC1 and FC2 was Rs.600.00, Rs.4200.00 and Rs.12,600 per hundred dfls respectively. A total of 40 farmers belonging to the districts Kolhapur, Sangli, Satara and Pune were involved in silkworm rearing on which the results are based.

Keywords: Uzifly *Exorista bombycis* L., bivoltine breeds (*B.mori*.L.), economic loss

INTRODUCTION

Research on Kairomones, both from chemical point of view, as well as from behavioral point has been far less intensive than studies on other aspects of host parasitoid models. Semiochemicals and various other stimuli such as visual, audio and shape and size of hosts play an important role in helping entamophagous insects in finding and recognizing their hosts (Salt, 1937; Arthur, 1966; Herrebout, 1969; Vinson, 1976, 1977; Sathe & Jadhav 2001). For a successful parasitization by a parasitoid, the following sequence of events comes into picture : host-habitat location, host location, host acceptance, host suitability and host regulation. The parasitoid must have the capacity to locate the habitat. Apart from physical stimuli like light, colours, semiochemicals play an important role in host habitat selection (Vinson, 1980). Once a parasitoid located an appropriate habitat, it must be able to find a suitable host. Chemicals released from the host plays important role in host location (Sathe & Margaj, 2001). Once the parasitoid has located its host by means of airborne volatiles acting over relatively long distances, a new group of semiochemicals start playing the role. Sometimes, the same compounds that attract the parasitoid from a distance induce oviposition behavior. Again host suitability is dependant on size, shape, colour, age and texture of the hosts (Sathe & Margaj, 2001). Review of literature indicates that Roland *et al*. (1989), Tilden & Ferkavich (1988), Heath *et al*., (1990), Nordlund *et al*., (1987), Shenggiang shu *et al*., (1990), Jadhav & Sathe (2000), Persoons *et al*., (1993), Ngi - song & Overholt (1997), Weseloh (1974), Vinson (1968), Spreadberry (1970), Richerson & Borden (1972), Jadhav et al., (2014), Kavane & Sathe (2015), etc. attempted host parasitoid selection interactions.

Indian uzifly *Exorista bombycis* L. is very potential parasitoid of silk worm races of *Bombyx mori* L. including multi and bivoltine and their cross breeds and is serious threat to silk production in India and in other sericultural countries of the world. Silk worm hybrids such as FC_1 x FC_2, and Pure Lines FC_1 and FC_2 are potentially practiced in Maharashtra for production of Commercial and seed cocoons respectively. However, expected yield of the cocoon production quality and quantity wise is not achieved so far because of the damage caused by uzifly *E. bombycis* by parasitism in silkworm larvae. The present work will be helpful for assessment of silk worm races in Maharashtra and finding suitable

How to cite this article:

A. D. Jadhav and T. V. Sathe (2016). Host preference by Uzifly *Exorista bombycis* L. in pure line bivoltine breeds FC1 and FC2 (*Bombyx mori* L.) and Economical loss in seed cocoon production. Biolife, 4(1), pp 88-93.

solution for the crop yield and financial loss. Particularly in rearing of potential bivoltine for commercial and seed cocoon production.

Material and Methods

For studying infestation of *E. bombycis* to silk worm breeds FC_1 x FC_2 (hybrid), FC1, FC2 (pure line) in sericultural farms of 10 farmers of four districts namely Kolhapur, Sangli, Satara and Pune were selected.

The observations were made on silkworms (Fig. 9) parasitized by *E. bombysis* (Fig. 8)at evening and morning. The parasitized silkworm larvae were characterized by having black scars on the body of worms. The percent parasitism was recorded by counting parasitized larvae out of 100 worms collected from five spots of 1 sq.ft. located one at centre and 4 at four sides on rearing bed of silkworms. Similarly, observations were also made on oviposition of uzifly on hosts of different instars. Single cocoon wt. was noted by weighing one cocoon with digital balance. Average economical loss was considered by taking into account of sale value and wt. loss of cocoons. Average income was calculated by knowing the total inputs and net gain obtained per 100 dfls.

Results

Results are recorded in Table-1 & 2 and Figures1 to 9. FC1 produced better cocoon yield and is cross breed of (CSR2 x CSR27) and was less susceptible to uzifly *E. bombycis* infestation. While FC2 was cross breed of (CSR6 and CSR26) was found more susceptible to uzifly *E. bombycis* attack (Table 1 and 2).

The hybrid FC1 x FC2 have also been tested for uzifly infestation and economic loss study as this hybrid is also more popular among the farmers of this region. More than 40 farmers were involved in rearing of above said silkworm breeds. Sericulture was practiced in this belt for 10-15 years, sugarcane, soybean, groundnut etc. are major agricultural crops of the region but sericulture found to be more income generative. Silkworm rearing was found throughout the year hence, uzifly has established in Western Maharashtra. Sericultural farmers have taken commercial crops as well as seed crops of silkworm. For commercial crops, double hybrids, kolar gold races are used. The rate of cocoons sold in Karnataka was at Rs. 300-450 / kg. for commercial hybrids whereas for seed batches FC1 and FC2 breeds were used, seed cocoons were sold at the rate of Rs. 650-950 / kg. Uzifly infestation generally observed from July to November and February to May causing about 5 - 30% loss in cocoon production. It was also found that, uzifly was more dominant in FC2 breed (plain larva) Vs. FC1 (Marked or black marking on body of larva). This may be due to non-marking and marking in FC2 and FC1 respectively. The results indicated that loss of cocoon yield, gross and net income reduced substantially. Addl. Investment by farmers to protect from uzifly infestation by providing nylon net inside the rearing

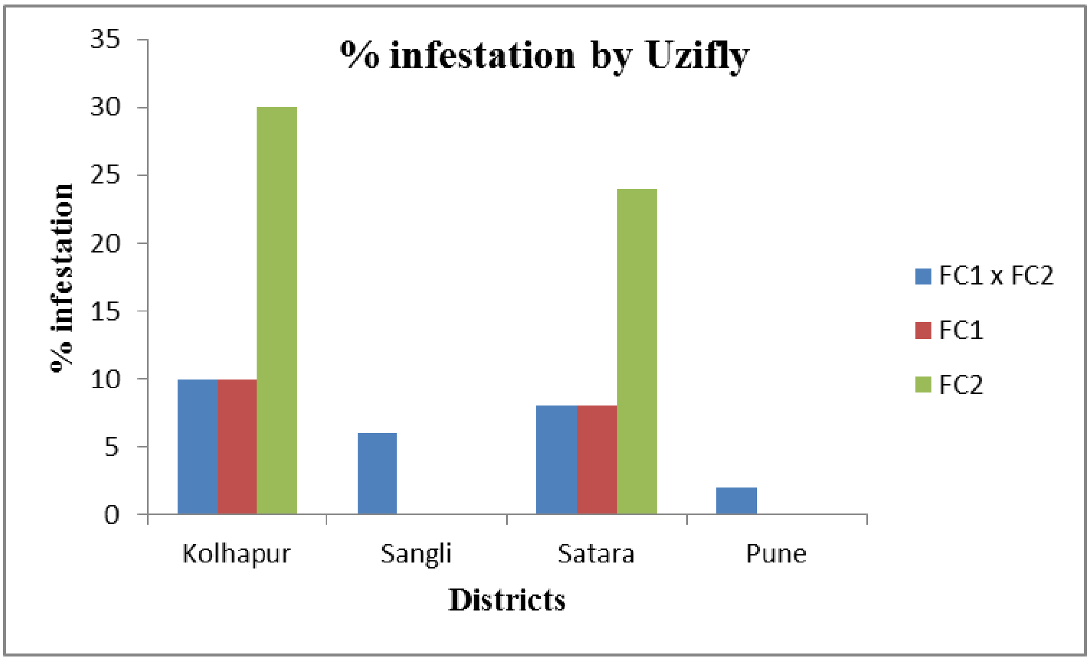
Table-1. District wise % infestation by uzifly *E.bombycis* L. in some breeds of *B.mori.* L.

Sr.No.	District	% infestation by Uzifly		
		FC1 x FC2 (Hybrid)	FC1	FC2
1	Kolhapur	10	10	30
2	Sangli	06	--	--
3	Satara	08	08	24
4	Pune	02	--	--

Table-2. Breed wise % infestation by uzifly *E.bombycis* L in *B.mori.* L. and economical loss in cocoon crops

Sr. No.	Name of the Breed	Avg. % infestation by Uzifly	Host stage attacked	Avg. single cocoon wt. gms.		Avg. economical loss / 100 dfls.		Gross income reduced Rs. / 100 dfls.
				Control	Uzi infested	Cocoons (Kg.)	Rate (Loss) Rs./ kg.	
1	FC1 x FC2 (Double Hybrid)	06	4-5th	1.7	0.92	4.0	150/Kg.	600/-
2	FC1 (Marked) Seed Crop	10	4-5th	1.8	0.8	7.0	600/Kg.	4200/-
3	FC2(Plain) Seed Crop	30	4-5th	1.92	0.74	21	600/Kg.	12,600/-

Figure-1. District wise % infestation by Uzifly *E. bombycis* L. in some breeds of *B. mori* L.



house was about Rs. 5,000 - 10,000. Farmers are under stress to fetch good price in cocoon market particularly for seed cocoons and having fear of rejection of batch as seed purchase due to heavy uzifly infestation percent.

Figure-2. FC 1 Larva

Figure-3. FC 2 Larva

Figure-4. FC 1 Cocoons

Figure-5. FC 2 Cocoons

Figure-6. Uzi infested FC1 Cocoons

Figure-7. Uzi Pupae collected from cocoons

Figure-8. Uzi fly adult

Figure-9. Silkworms rearing bed

To sale cocoons as a seed 90% or more live pupation is required. Due to uzifly infestation in later stages silkworm pupae dies hence, there will not be moth emergence which result in loss of silkworm seed production. In present study with many seed rearers of the region it was observed that FC2 breed is most preferred by uzifly Vs. FC1.

Discussion

According to Roland *et al*., (1989) the tachinid fly *Cyzenis albicans* was attracted to its host by airborne volatiles released by the host plant (oak) but stimulation of oviposition was induced by contact clues, that were also released from the host plants. In other insects it has proven that host haemolymph contains fly ovipositional Kairomones (Tilden and Ferkovich, 1988; Health *et al*., 1990). According to Nordlund *et al*., (1987) the insect probing and drilling inducing material could be recovered from host accessory gland section for bringing oviposition and selection of host larva.

Hendry *et al*., (1976) proved by feeding studies with chemically labeled kairomones that these cues were concentrated and released unaltered by the host insect. In the host parasitoid model, *Heliothis zea– Trichogramma evanescens,* they demonstrated that tricosane ($C_{23}H_{48}$), the most intense host-searching inducing compound was present in both host eggs and host plant. For host parasitoid complex, *Phthorimaea operculella - Orliglus lepidus* (they also demonstrated that) the most intense host - seeking inducing compound, heptanoic acid, was present in both the host plant and in the frass produced by the larvae of the host.

Kairomones are relatively less identified but they differs width from each other's. A series of normal hydro carbons and normal aliphatic acids (Hendry *et al*., 1976), dialkul-tetrahydrofurans (Takabayashi & Takahashv, 1986), acylcyclohexane - diones (Nemoto *et al*., 1987) and many of dimethylnonatriacontanes have been identified chemicals which have important role in host parasitoid plant interactions and selections.

It has been proven beyond any doubt that in many occasions host location by parasitoids is mediated by chemical stimuli, although physical factors may be involved in certain cases as well. The compounds that are produced specifically by the larvae can only be obtained by rinsing the larvae with an organic solvent. The compounds isolated in this way are mainly normal alkynes and alkenes, probably originating from the cuticular wax layer of the larvae. Emphasis should be given on identification of such compounds and their utilization understanding mechanisms involved in host parasitoid interactions. According to Richerson & Borden (1972) some species of parasitoids detect their host by perception of the sound or vibrations produced by host larvae however, recent work has disproved this hypothesis that host produced sound or vibration sound produced by the parasitoid or odour are obligatory host finding stimuli.

In *Cardiochiles nigriceps* Vieteck, a habitual parasitoid of *Heliothis* Virescens (F.) (Vinson, 1968) and *Microplitis crocepes* Viereck, a parasitoid of *Heliothis* sp., mandibular gland secretion of host larva elicited searching behaviour (Vinson, 1968).

Vinson (1976) reported parasitoids respond to both short range and contact clues and to long range volatile chemical clues during host selection. The use of semio-chemicals for manipulating parasitoids seems to hold considerable potential as a technique for incorporation in pest management strategies. The timing and mode of application have also critical factors for success (Vinson, 1977). According to Weseloh (1974) dead larvae and exuviae were quite acceptable for *Cotesia melanoscelus* Ratz., females. The chemicals within or on the integument of the host were responsible for less acceptability Arthur says that the females of *Itoplectis conquisitor* (Say) were attracted to artificial host shelters such as paper tubes and oviposited in the moving hosts while Spradberry (1970) reported that host frass played a main role in attracting an Ichneumonid parasitoid *Rhyssa persuasoria* (L.) towards its host. The same situation was noted by Ngi-Song & Overholt (1997) in a host parasitoid model, *Cotesia flavipes* Cameron - African graminaceous stem borers (Lepidoptera). Females of *C. flavipes* and *C. sesamae* were attracted in a T tube olfactometer to volatile kairomones from frass produced by *Chilo partellus* (Swin.), *Chilo orichaleociliellus* Strand, *Sesamia calamistis* Hampson and *Busseola fusca* (Fuller) fed on maize (*Zea mays* L.), Sorghum (*Sorghum bicolor* L.) and napier grass. In dual choice test, *C. flavipes* and *C. sesamae* were generally unable to discriminate between volatiles from frass produced by any of the four different stem borers fed on maize stalk. When larvae of *C. partellus* and *S. calamistis* were washed in distilled water their acceptance by both parasitoids was reduced.

In a dipterous fly *Exorista sorbillans* Beck, a parasitoid of *B. mori* it has been demonstrated that semiochemicals played significant role in attracting this parasitoid towards silk worm (*B. mori*) larvae (Persoons *et al*., 1993). The physical factors such as color of crop has also found attractive to the parasitoid towards its host (Sathe, 2014 &T. V. Sathe, et al, 2015). Persoons *et al*. (1993) reported that the leaf material does not play a significant role in host finding behaviour of uzifly unless it acts as a source from which larvae accumulate certain compounds that served as intermediates for the Kairomone synthesis or that are excreted by insects.

Host parasitoid plant interactions have been studied by Jadhav & Sathe (2000) and Sathe & Jadhav (2001) in the models *Antheraea mylitta* - *Apanteles angaleti* - Ain and *Bombyx mori* - *Cotesia flavipes* mulberry respectively. In both cases they found that olfactory and visual stumili were involved in attracting parasitoids towards plant and then towards hosts. In the present study three silkworms breeds namely FC_1 x FC_2 (hybrid), FC1, (pure line) and FC2 (pure lines) were studied with respect to infestation (parasitism) by uzifly *E. bombycis* and it has been noted that the FC_1 x FC_2 silkworm breed was less susceptible than others. The order of preference for parasitism to silkworm breeds by *E. bombycis* was $FC_2 > FC_1 > FC_1$ x FC_2 similarly, other parameters of cocoon such as single cocoon wt, economic loss of cocoon rate per kg/100 dfls and actual economic loss were also in the same order.

Conflict of Interests

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

References

1. Arthur, A.P. Associative learning in *Itoplectis conquisitor* (Say) (Hymenoptera: Ichneumonidae) *Can. Ent.* 98, 213-223, 1966.
2. Heath, R.R.; Ferkovich, S.M.; Greamy P.D., Elier F.J.; Dueben, B.D. and R.L. Tilden progress in the isolation and characterization of a hose haemolymph ovipositional kairomone for the endoparasitoid *Microplitis croceipes* Arch. *Ins. Brochem* and *Physiol*, 13, 255-265, 1990.
3. Hemoto, T.; Shibuya, M.; Kuwahara, Y. and T. Suzuki. New 2 - acylcykhlohexame - 1,3-diones : Kairomone components against a parasitic wasp, *Ventura canescens,* hom faceces of the almond moth, *Cadra cantella* and the Indian med moth, *Plodia interpunetella. Agril. Biol. Chem.*; 51, 1805-1810, 1987.
4. Hendry, L.B.; Whichmann, J.K., Hindenlang, D.M.; Weaver K.M. and S.H. Korzeniowski. Plants - The origin of Kairomones utilized by parasitoids of phytophagous insects. *J.Chem.Ecol.* 2, 271-283, 1976.
5. Herrbout, W.M. Some aspects of host selection in *Eucarcelia rutilla* VIII. (Diptera : Tachinidae) Neth. J. & Zool., 19, 1-104, 1996.
6. Jadhav, A.D. & T.V. Sathe. Host parasitoid plant interactions in a model, *Antheraea mylitta* - *Apanteles angaleti* - Ain. *Riv. di parassitologia,* XVII (LXI) (3), 365-373, 2000.
7. Jadhav ,A.D. Desai A.S.& T.V. Sathe. Distribution and Economic Status of Uzi fly *Exorista bombycis* Louis. A parasitoid of Mulberry silkworm *Bombyx mori* L. GJRA-Global Journal for Research Analysis 3,7 3-5, 2014.
8. Kavane ,R.P. & T. V. Sathe. Rearing technique for a wild silkworm *Actias selene* Hubner (Lepidoptera : Saturnidae). *Biolife,* 3(1), 1-6, 2015.
9. Ngi-Song, A. J. & Overholt W.A. Host location and acceptance by *Cotesia flavipes* Cameron and *C. sesamiae* (Camaron) (Hymenoptera, Braconidae), parasitoids of African gramineous stem borers, Role of

the grass of the host cues. *Biological Control*, **9**, 136-142, 1997.
10. Nordland, D.A.; Stromd M.R.; Lewis, W.J. and S.B.Vinson. Role of Kairomones hom host accessory gland secretion in host recognition by *Telenomus remus* and *Trichogramma pretiosum*, with partial characterization. *Entomol. Exp.appl.,* 44, 37-43, 1987.
11. Persoons, C.J., Veeranna G., Vos J.D. & Nagesundara K.R. The role of the semiochemicals in the host finding behaviour of parasitoids with special reference to uzi fly, *Exorista sorbillans* (Tachinidae). "Recent advances in uzi fly research". Proceeding of National Seminar on uzi fly and its control.Eds. G.P. ChannaBasavvanna, G.Veeranna & S.B.Dandin, 167-189, 1992.
12. Roland, J., Evans, W.G. and Myers, J.H. Manipulation of oivposition patterns of the parasitoid *Cyzenis albicans* (Tachinidae) in the field using plant extracts. *J. Ins. Ben.;* 2, 487-503, 1989.
13. Salt, G., Experimental studies in insect parasitization V. The sense used by *Trichogrammato* distinguish between parasitized and non-parasitized host. *Proc. Roy. Soc. London* (B), 122, 57-75, 1937.
14. Sathe ,T.V. & A.D. Jadhav. Host plant attractivity in a model, *Cotesia glomeratus* - *Bombyx mori* - Mulberry *Sericologia,* 41(3), 459-470, 2001.
15. Sathe ,T.V. & G.S.Miraj. Cotton pests and biocontrol agents. Daya Publishing House, Delhi. Pp.1-147,2001.
16. Sathe, T.V. & Shanthakumar M.V. Host finding behavior by *Cotesiadiurnii* Rao & Nikam (Hymenoptera, Braconidae), a parasitoid of *Exelastisatomosa* Walsingham (Lepidoptera, Pterophoridae). Utter Pradesh I. Zool., 8, 105-113, 1988.
17. Sathe, T.V. Recent trends in biological pest control. Astral International Pvt. Ltd., New Delhi. Pp. 1-204, 2014.
18. Spreadberry, J.P. A technique for artificial culturing Ichneumonid parasites of wood wasp. Ent. Exp. & App. 11, 257-260, 1970.
19. Tilden, R.L. and Ferkovich S.M. Kairomonal stimulation of oviposition into a artificial substrate by the endoparasitoid *Microplatis croceipes* (Hymenoptera-Braconidae), *An. Ent. Soc. Am.*; 81, 152-156, 1988.
20. T. V. Sathe, S. S. Patil, A. G. Khamkar and Khairmode P.V. (2015). Biology, ecology and control of weevils (Curculionidae: Coleoptera) on Mango *Mangnifera indica* Linn. from western Maharashtra. Biolife, 3(4), pp 783-787. doi:10.17812/blj.2015.344
21. Tokabayashi, J. AND Takohashi, S. Effect of Kairomones in the host searching behaviour of *Apanteles kariyai* Watanabe (Hymenoptera-Braconidae), a parasitoid of common armyworm *Psendoletia separate* Walker (Lepidoptera : Noctuidae). II. Isolation and Identification of arrestants produced by the host larvae. *App. Ent. Zool.*; 21, 114-118, 1986.
22. Vinson, S.B. Habitat location in Semiochemicals. Their role in pest control. D.A. Nordlund, R.L. Jones and W.J. Lewis, Eds. J. Wiley and Sons, New York, USA pp. 51-57, 1980.
23. Vinsons, S.B. Behavioural chemicals in the augmentation of natural enemies, In "Biological Control by Augmentation Natural Enemies", R.L. Ridyway & S.B. Vinson eds. Plenum, New York, pp.237-279, 1977.
24. Vinsons, S.B. Host selection by insect parasitoids. *Ann. Rev. Ent*., 21, 109-134, 1976.
25. Vinsons, S.B. Source of substance in *Heliothisvirescens* that elicits a searching response in its habitual parasite, *Cardiochilesnigriceps*. *Ann. Ent. Soc. Am.* 61, 8-10, 1968.
26. Weseloh, R.M. Host-related microhabitat performance of gypsy moth larval parasitoid, *Parasetigenaagillis.* Environ. *Entomol.*, 3, 363-364, 1974.

DOI: https://dx.doi.org/10.5281/zenodo.7310231
Received: 6 January 2016;
Accepted; 22 February 2016;
Available online : 4 March 2016