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Management of Uzi fly, *Exorista bombycis* (*Louis*) with Botanical Insecticides

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A study was conducted to evaluate the effect of leaf extracts as ovipositional deterrents, ovicide and maggoticide against uzi fly, *Exorista bombycis* (Louis) at three concentrations *viz.,* 0.2, 0.4 and 0.8 per cent. Among the treatments, 0.8 per cent of *Eucalyptus citriodora* recorded reduced oviposition (54.50 %), egg hatchability (63.85 %) and maggot recovery (74.00 %) followed by *Tridax procumbens* (55.00, 64.73 and 75.00 %, respectively) and was statistically superior than distilled water (97.95 %) and absolute control (100.00 %). Significantly higher maggot mortality was registered at 0.8 per cent *Eucalyptus citriodora* (46.00 %) followed by *T. procumbens* (45.00 %) compared to distilled water (3.85 %) and absolute control (0.00 %). Spraying leaf extracts *of E. citriodora* and *T. procumbens,* also drastically reduced the pupation rate, adult emergence and fecundity of uzi fly.

Key words: Silkworm, botanicals, *Exorista bombycis*, *Eucalyptus*, management.

Indian uzi fly, *Exorista bombycis* (Louis) is an endoparasitoid of *Bombyx mori* L. larvae. Ever since its introduction to South India, the loss due to uzi damage varied from 9 to 40 per cent (Jolly, 1967), 20 to 40 per cent (Kumar *et al.,* 1989; Narayanaswamy and Devaiah, 1998). Management of this key pest through chemical application is not feasible due to its adverse consequences on growth and development of *B. mori* L. Research workers in the past suggested different approaches such as destruction of infested silkworms and maggots (Siddappaji, 1985), providing fly proof wire mesh and nylon net (Kumar, 1987), spraying of uzicide and use of uzitrap (Kumar, 1987) and releasing natural enemies (Kumar *et al*., 1993).

In spite of adoption of management methods by farmers, uzi infestation is still prevailing. Hence, search has become imperative to find an alternative strategy to manage this pest. In this context, an approach of uzi fly management using plant products has been studied.

Material and Methods

Culturing uzi fly

Uzi maggots were kept in dark for pupation and after adult emergence, flies were provided with 10 per cent sucrose solution as diet in the insect rearing cage. Silkworm larvae were introduced into the rearing cage for oviposition and thus the pure culture of uzi fly was maintained.

Preparation of plant extracts

Leaves of eight selected botanicals (Table 1) were washed in running water. Ten grams of plant material was ground using pestle and mortar and filtered through double layered muslin cloth. Then, the volume was made upto 100 ml by adding sterile distilled water. This was maintained as 10 per cent (weight/ volume) stock solution. From stock solution different concentrations *viz.,* 0.2, 0.4 and 0.8 per cent were prepared through serial dilution with sterile distilled water. Fresh extract was prepared for every spray.

Method of botanical application

Ovipositional deterrency

A batch of 50 fifth instar silk worm larvae was maintained in an insect rearing cage after treating with 10 ml of leaf extract and then a pair of two day old uzi fly was released into the cage and allowed for oviposition for 48 h in three replications. A fresh batch of 50 treated fifth instar larvae was provided once in 48 h and maintained separately, replication wise. The number of eggs laid and eggs hatched from each larva were recorded, and the per cent oviposition and egg hatchability were worked out.

Ovicidal action

A batch of 50 fifth instar larvae was placed in an insect rearing cage. One pair of two day old uzi fly was released into the cage and allowed for 48 hours for oviposition. Likewise, a fresh batch of 50 fifth instar larvae was provided once in 48 hours. After oviposition, each batch was sprayed with 10 ml of leaf extract and maintained separately for three replications. The egg hatchability percentage and maggot recovery were calculated.

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Maggoticidal activity

The post parasitic third instar maggots were collected from bivoltine cocoon market. A batch of 50 (4 h old) maggots per replication was sprayed with leaf extract and maintained separately, replication wise. Maggot mortality, pupation rate, fly emergence and fecundity were recorded.

Results and Discussion

Ovipositional deterrent activity

Per cent oviposition: Oviposition behaviour of the uzi fly was very much affected due to spraying of plant products (Table 1). Oviposition with plant products ranged from 59.53 to 79.32 per cent. *E. citriodora* exhibited least oviposition of 59.53 per cent and was on par with *T. procumbens* (60.34 %) and *Parthenium hysterophorus* (62.03 %). Further, the per cent reduction in oviposition due to these botanicals was 39.22, 38.39 and 36.67, respectively. *Tribulus terrestris* (66.80 %) and *Tagetes erecta* (67.89 %) were on par with each other. All the treatments were superior over treatment with distilled water (97.95 %) and absolute control (100.00 %). Barman *et al.* (1990) reported that eucalyptus oil possessed deterrent effect on oviposition of *E. bombycis*. Veeranna and Nirmala (2001) reported significant repellent activity of *P. glabra* against adult uzi fly, when 20 per cent leaf powder of was dusted with kaolin on silk worm body.

Table.1 Effect of botanicals on per cent oviposition and egg hatchability of uzi fly

	Per cent oviposition				Egg hatchability (%)			
Botanical	0.20%	0.40%	0.80%	Mean	0.20%	0.40%	0.80%	Mean
Eucalyptus citriodora	67.90	56.19	54.50	59.53	79.40	74.50	73.93	75.94
Tridax procumbens	68.81	57.22	55.00	60.34	80.05	75.00	74.00	76.35
Tribulus terrestris	73.72	64.42	62.25	66.80	82.20	78.05	77.60	79.28
Parthenium hysterophorus	68.90	59.19	58.00	62.03	81.23	79.25	80.16	80.21
Bougainvillea spectabilis	81.21	79.88	76.86	79.32	88.00	85.43	82.39	85.27
Mentha arvensis	78.96	74.40	71.00	74.79	84.06	79.00	76.30	79.79
Tagetes erecta	75.95	63.5	64.23	67.89	82.16	76.60	77.59	78.78
Pongamia glabra	79.00	77.79	75.12	77.30	86.45	82.15	84.17	84.26
Distilled water	97.95	97.95	97.95	97.95	90.95	90.95	90.95	90.95
Absolute control	100.00	100.00	100.00	100.00	91.82	91.82	91.82	91.82
Mean	79.24	73.05	71.49	74.60	84.63	81.28	80.89	82.27
F-test	S. Em±	CD (0.05)		F-test	S. Em±	CD (0.05)		
Botanical	*	1.06	2.997		*	0.536	1.516	
Concentrations	*	0.581	1.642		*	0.294	0.831	
Interaction	NS	1.836	-		NS	0.929	-	

Egg hatchability: *E. citriodora* recorded reduced egg hatchability of 75.94 per cent and was on par with *T. procumbens* (76.35 %). These were followed by *T. erecta* (78.78 %), *T. terrestris* (79.28 %), *M. arvensis* (79.79 %) and *P. hysterophorus* (80.21 %) (Table 1). All the botanicals were found to effectively reduce the egg hatchability and were statistically superior over distilled water (90.95 %) and absolute control (91.82 %) Narayanaswamy (1998) reported that exposure of eggs of *E. bombycis* to volatiles of *E. citriodora* resulted in significantly lesser hatchability of 0.90 and 2.00 per cent when exposed for 72 and 64 h, respectively. Significant reduction in egg hatchability was observed when eggs were exposed to volatiles emitted by the bulb of garlic,

Table 2. Effect of botanicals on egg hatchability and maggot recovery of uzi fly

	Egg hatchability (%)				Maggot recovery (%)			
Botanical	0.20%	0.40%	0.80%	Mean	0.20%	0.40%	0.80%	Mean
E. citriodora	74.00	64.98	63.85	67.61	79.80	75.05	74.00	76.28
T. procumbens	74.15	66.00	64.73	68.29	81.00	76.05	75.00	77.35
T. terrestris	75.00	67.75	67.00	69.92	82.60	76.90	75.80	78.43
P. hysterophorus	74.93	66.40	65.63	68.99	82.10	75.20	74.75	77.35
B. spectabilis	82.67	75.99	74.10	77.59	87.00	82.45	80.00	83.15
M. arvensis	79.15	73.15	72.12	74.81	84.45	80.00	78.00	80.82
T. erecta	77.09	72.00	70.00	73.03	83.75	78.30	77.00	79.68
P. glabra	92.75	88.46	86.93	89.38	95.20	93.00	91.74	93.31
Distilled water	80.00	80.00	80.00	80.00	84.30	84.30	84.30	84.30
Absolute control	89.72	89.72	89.72	89.72	95.40	95.40	95.40	95.40
Mean	79.95	74.45	73.41	75.93	85.56	81.67	80.60	82.61
	F-test	S. Em±	CD (0.05)		F-test	S. Em±	CD (0.05)	
Botanical	*	0.348	0.984		*	0.330	0.934	
Concentrations	*	0.191	0.539		*	0.181	0.512	
Interaction	*	0.602	1.704		*	0.572	1.618	

Allium sativum for 72 h (4.42 %) and 64 h (6.62 %) due to the diffusion of biochemical constituents into the eggs (Narayanaswamy and Dandin, 1998). These two findings are in line with the present observation.

Ovicidal action

Egg hatchability (%): The lowest egg hatchability was recorded when larvae were sprayed with *E. citriodora* (67.61 %) and was on par with *T. procumbens* (68.29 %) and *P. hysterophorus* (68.99

Table 3. Effect of botanicals on maggot mortality and pupation rate of uzi fly

	Maggot mortality (%)				Pupation rate (%)			
Botanical	0.20%	0.40%	0.80%	Mean	0.20%	0.40%	0.80%	Mean
E. citriodora	30.00	45.24	46.00	40.41	82.50	76.82	75.20	78.17
T. procumbens	29.33	44.00	45.00	39.44	84.00	78.29	76.50	79.60
T. terrestris	28.00	42.00	43.92	37.97	86.99	81.67	77.00	81.89
P. hysterophorus	28.67	42.00	43.60	38.09	85.79	80.06	78.05	81.30
B. spectabilis	20.67	24.67	28.00	24.45	90.44	86.29	83.00	86.58
M. arvensis	24.00	34.67	37.00	31.89	90.96	85.34	82.80	86.37
T. erecta	25.33	42.00	42.50	36.61	87.44	83.85	81.00	84.10
P. glabra	21.33	27.33	31.00	26.55	95.10	93.94	93.00	94.01
Distilled water	3.85	3.85	3.85	3.85	89.08	89.08	89.08	89.08
Absolute control	0.00	0.00	0.00	0.00	95.91	95.91	95.91	95.91
Mean	21.12	30.58	32.09	27.93	88.71	85.24	83.15	85.70
	F-test	S. Em±	CD (0.05)		F-test	S. Em±	CD (0.05)	
Botanical	*	0.311	0.880		*	0.513	1.451	
Concentrations	*	0.170	0.482		*	0.281	0.795	
Interaction	*	0.539	1.524		*	0.889	2.513	

%). The reduction over distilled water was 15.49, 14.63 and 13.77 per cent, respectively. All the botanicals were significantly superior over the treatment with distilled water (80.00 %) and absolute control (89.72 %) (Table 2). According to Narayanaswamy (1998) the aqueous extracts of plant products from flowers of *Melia azedarach* and seeds of *Azadirachta indica* induced 69.27 to 80.00 per cent egg mortality when sprayed on 24 h old eggs of *E. bombycis*. Patil (1989) also indicated that 0.44 per cent of cold extract of *P. hysterophorus* was required to bring 50 per cent mortality of *Spodoptera litura* eggs. Present findings are in line with the above results.

Maggot recovery (%): The maggot recovery from uzi infested larvae was the least in *E. citriodora* (76.28 %) followed by *T. procumbens* (77.35 %), *P. hysterophorus* (77.35 %) and *T. terrestris* (78.43 %) and these observations were significantly superior over distilled water (84.30 %) and absolute control (95.40 %) (Table 2). This observation was in line with the finding of Holihosur *et al*. (1996), who reported that the petroleum ether extract from the leaves of *Clerodendron inerme* and stem of *Bougainvillea glabra* contained highest ovicide constituent against *Achaea janata* causing failure of 85 per cent egg hatching leading to lower maggot recovery.

Maggoticidal activity

Maggot mortality : Maximum maggot mortality was found in the lots sprayed with *E. citriodora* and *T. procumbens* as they recorded mortality of 40.41

Table 4. Effect of botanicals on adult emergence and fecundity of uzi fly

	Adult emergence (%)				Fecundity (Nos)			
Botanical	0.20%	0.40%	0.80%	Mean	0.20%	0.40%	0.80%	Mean
E. citriodora	83.21	75.00	73.00	77.07	245.00	228.00	220.00	231.00
T. procumbens	84.42	76.15	74.00	78.19	260.00	241.33	226.67	242.67
T. terrestris	83.14	77.18	74.80	78.37	259.00	240.00	224.00	241.00
P. hysterophorus	86.71	80.61	77.60	81.64	270.33	252.00	234.00	252.11
B. spectabilis	91.96	87.44	85.20	88.20	319.33	301.67	286.33	302.44
M. arvensis	89.41	83.07	80.00	84.16	262.67	253.00	247.00	254.22
T. erecta	87.74	81.69	79.00	82.81	265.00	245.67	230.00	246.89
P. glabra	93.27	91.33	90.33	91.64	336.67	320.00	306.67	321.11
Distilled water	90.53	90.53	90.53	90.53	365.00	365.00	365.00	365.00
Absolute control	94.48	94.48	94.48	94.48	376.00	376.00	376.00	376.00
Mean	88.49	83.75	81.89	84.71	295.90	282.27	271.57	283.24
	F-test	S. Em±	CD (0.05)		F-test	S. Em±	CD (0.05)	
Botanical	*	0.640	1.811		*	4.501	12.727	
Concentrations	*	0.351	0.992		*	2.465	6.971	
Interaction	*	1.109	3.136		NS	7.795	-	

and 39.44 per cent, respectively and statistically superior over distilled water (3.85 %) and absolute control (0.00 %) (Table 3). These observations are in line with Nakanishi (1975), who observed that the Azadirachtin inhibits the synthesis of insect moulting hormone, thus leading to mortality at maggot and pupal stages of *Exorista bombycis* L. Zebitz (1986) reported that neem seed kernal extract strongly inhibited the pupal development in uzi fly, *Blepharipa zebina.* Maggots treated with the same recorded reduced weight due to loss of water from the body and became immobile and body colour changed to dull black.

Pupation rate : Number of pupae formed was the least in the lot treated with *E. citriodora* (78.17 %) and did not differ significantly from *T. procumbens* (79.60 %). All the treatments responded well and caused more reduction in pupation (2.81 to 12.24 % respectively) over distilled water control (89.08 %) (Table 3). However, *E. citrioda* recorded 75.20 per cent pupation, which was more effective in bringing down the pupation rate than other botanicals. This is in line with the observations of Barman *et al.* (1990) and Veeranna and Nirmala (2001).

Adult emergence : Adult emergence ranged from 77.07 to 91.64 per cent. *E. citriodora*, *T. procumbens* and *T. terrestris* recorded 77.07, 78.19 and 78.37 per cent adult emergence and showed superiority over distilled water (90.53 %) and absolute control (94.48 %) (Table 4). Gupta *et al.* (1998) also registered only 30 per cent adult emergence of *Heliothis armigera* from the pupae, when soil was treated with neem seed powder (6 %).

Fecundity (Number): *E. citriodora* (231.00) *and T. terrestris* (241.00) had significant difference over the distilled water (365.00) and absolute control (376.00) (Table 4). This observation was strengthened by the findings of Kumar (1987) and Patil (1989). From the present study, it is concluded that spraying of leaf extracts of*, E. citriodora* and *T. procumbens* would help in effectively managing the uzi fly by interfering with the life cycle of pest.

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