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Evaluation of drek, *Melia azadirach* for the management of fruitflies, *Bactrocera tau* in tomato

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ABSTRACT

Fruitfly, *Bactrocera tau* Walker, a devastating pest of tomato. lays eggs inside the fruits rendering them inaccessible to be targeted by insecticides. A study on effectiveness of drek seed kernels extract (DSKE) baits viz; bait I (0.25%DSKE +diet), bait II (0.50%DSKE +diet), bait III (1.0%DSKE +diet) was undertaken under laboratory conditions and compared with conventional poison baits *viz*; bait IV (0.05%malathion +diet) and bait V (0.1%malathion +diet) being practiced to manage this pest on tomato. The diet constituted of protinex:jaggury (1:1), yeast (5%) and ammonium acetate (0.1%). The bait III was most effective in reducing the egg laying (62.3eggs/10females) followed by bait II and bait I being, 74.1 and 90.3eggs/10females, respectively, as against 165eggs/10females in the control. However, in poison baits V (0.1%malathion +diet) and IV (0.05%malathion +diet), the egg laying recorded was 72.7 and 84.7eggs/10females, respectively. In another set of experiment, the ovipositional deterrency was observed to decrease with the decrease in concentrations of DSKE (aqueous). As drek seed kernels extract reduced the fecundity and deterred oviposion, it can be utilized as one of the biorational components for the management of fruit fly on tomato under field conditions.

Key words: Drek, *Melia azadirach*, fruitflies, *Bactrocera tau*, poison baits, deterrence, fecundity, tomato

INTRODUCTION

Fruit flies (Diptera:Tephritidae) are among the most destructive agricultural pests and are known to occur throughout the world except in Arctic and Antarctic regions (Kapoor *et al*., 1980). Perhaps no other pest causes damage as varied and severe as the fruit flies. Their attack on fruit not only reduces the yield but also affects the quality of fruit and as a result the marketability of the crop is reduced and the vegetable growing enterprise is rendered unprofitable.

Fruit flies, *Bactrocera tau* Walker, a devastating pest of tomato, *Lycopersicon esculentum* Mill lay eggs inside the fruits thereby renders the maggots inaccessible to be controlled by contact insecticides. Once the eggs are laid, no control is possible therafter, except removal and destruction of infested fruits. Their appearance with the onset of monsoon makes insecticidal spray ineffective due to the surface washing of the fruit by frequent rains. The entomologists around the world are of the view that control methods should be applied during pre-ovipositional period when fruit fly requires plenty of water to drink and proteins for egg maturation. Previously Mahmoud and Shoeib (2008) recorded the sterilant and oviposition deterrent activity of neem formulation on peach fruit fly, *Bactrocera zonata* (Saunders) (Diptera: Tephritidae). Recently Ravi *et al.* (2008) suggested the management of tomato fruit borer, *Helicoverpa armigera* Hubner with biopesticides. No information is available regarding the impact of neem on *Bactrocera tau* Walker under laboratary or field conditions.

This particular stage of the insect, therefore, can be exploited for applying management strategies. In the present investigation, different baits of drek, *Melia azadirach* seed kernels extract have been employed to study their effectiveness and compared with standard insecticide baits against fruit fly, *Bactrocera tau* (Walker).

MATERIAL AND METHODS

Laboratory studies

The culture of fruit fly, *B.tau* was raised in the rearing cages (90X45X45 cm). The adults were provided with their natural host as well as a mixture of glucose and protinex in the ratio of 1:1 in a petridish. The seeds of drek, *M. azadirach* were collected locally, dried and kernels were separated from seeds. The aqueous extract of seed kernels was prepared as per the method of Gahukar (1996) and Sharma *et al*. (1997). The dried kernels were ground to fine powder. Thereafter, 20g fine powder was mixed with 80 ml of water and kept overnight. Next day material was filtered through Whatman filter paper No.1 and filterate was designated as stock solution of 20 per cent, from which further serial dilutions were made.

Preparation of poison baits

Five baits were tested against 10 days old adult fruit flies by making them to feed on cotton swab containing baits and thereafter, effect on egg laying was observed in tomato fruits. Baits were prepared by using drek seed kernels extract (DSKE), malathion and diet. The diet constituted of protinex:jaggury (1:1), yeast (5 %) and ammonium acetate (0.1 %). Composition of baits was: 0.25%DSKE +diet (Bait I), 0.50 % DSKE +diet (Bait II), 1.0 % DSKE +diet (Bait III), 0.05 % malathion +diet (Bait IV) and 0.1 % malathion +diet (Bait V). Each treatment was replicated thrice. For each treatment, 10 females alongwith males were kept in cages (20 x 20 x 20 cm) and fed with bait mixture in cotton swabs for 24 hr. The cotton swabs were removed and bait treated tomato fruits were kept as such to record observations on egg laying. The fruits were removed daily with new fruits till 96 hr. The observations were recorded on the number of eggs laid and hatchability in each treatment.

Ovipositional deterrency was evaluated by dipping ripened tomato fruits in the drek seed kernels extract solutions of 4, 5 and 6 per cent concentrations. Treated fruits were shade dried and 5 fruits from each concentration were exposed to 10 female fruit flies. Each treatment was replicated thrice. Number of eggs laid and eggs hatched were recorded up to 120 hours after a regular interval of 24 hours. The per cent deterrency was calculated by using the formula: Per cent deterrency = {(No. of eggs laid in control – No. of eggs laid in treatment)/ No. of eggs laid in control} X 100.

Field studies

The tomato crop grown on experimental farm was sprayed with Bait I (1 % DSKE + diet), Bait II (0.1 % malathion+diet) and 6 % aqueous DSKE. Spray was repeated at 10 days interval. The data on per cent infestation and yield of tomato were recorded and analyzed using RBD.

RESULTS AND DISCUSSION

The study explored the possibility of using management tactics where before egg laying fruit flies require plenty of water to drink and protein for the development of eggs. This habit creates in them an urge and attraction for baits. Different baits containing protein, sugar and toxicant were tested in the laboratory as well as in the field.

Laboratory studies

Exposing of fruit flies to tomato fruits treated with different poison baits viz. Bait I, Bait II, Bait III, Bait IV and Bait V caused significant reduction to the tune of 45.43, 55.23, 62.36, 48.82 and 56.07 per cent respectively, in egg laying over control (Table1). The Bait III was most effective in reducing the egg laying (62.3eggs/10females) followed by Bait II and Bait I (Table 1). However, in poison Baits V and IV, the egg laying recorded was 72.7 and 84.7eggs/10females, respectively. The mixing of neem solutions in the rearing diet of adult also results in reduced fecundity (Ilio *et al.*, 1999; Verma, 2002). Meliatoxins, meliacarpins and other liminoids present in drek interfere with endocrine regulation of juvenile hormone and molting titres which ultimately affect the growth including egg hatching in a similar way, azadirachtin present in neem reduces egg hatching (Musabyimana *et al.*, 2001). Feeding of poison baits also affected the hatchability in comparison to control but among DSKE and malathion baits, the egg hatchability was less in Bait III containing 1.0% DSKE (Table 2).

The volatile and non volatile compounds in the DSKE may cause reduction in egg laying. The ovipositional deterrency was increased significantly to 45.9, 59.0 and 62.5 per cent with the increased in concentration of DSKE at 4, 5 and 6 per

Table 1. Effect of different poison baits on egg laying by *B. tau*

Treatment	Mean oviposition (eggs/10 females) after indicated hours of treatment				Total eggs laid/10 females
	24	48	72	96	
Bait I (0.25%DSKE +diet)	34.0	27.0	18.3	11.0	90.3
Bait II (0.50%DSKE +diet)	28.7	20.7	16.0	8.7	74.1
Bait III (1.0%DSKE +diet)	24.0	19.0	14.3	5.0	62.3
Bait IV (0.05%malathion +diet)	32.0	26.0	18.0	8.7	84.7
Bait V (0.1%malathion +diet)	28.0	23.0	15.0	6.7	72.7
Control	47.7	44.3	41.3	1.7	165.0
Mean	32.4	26.7	20.5	1.9	

CDp=0.05 Treatment (T) = 1.27
Hours (H) = 1.04
TXH = 2.54

Table 2. Effect of different poison baits on per cent hatching of *B. tau*

Treatment	Per cent hatching after indicated hours of treatment				Mean
	24	48	72	96	
Bait I (0.25%DSKE +diet)	63.1	60.8	57.8	55.7	59.3
Bait II (0.50%DSKE +diet)	66.6	62.9	62.5	61.3	63.3
Bait III (1.0%DSKE +diet)	61.1	59.7	58.3	53.3	58.1
Bait IV (0.05%malathion +diet)	63.5	61.6	61.0	57.6	60.9
Bait V (0.1%malathion +diet)	63.1	60.8	57.8	55.7	59.3
Control	71.3	71.4	69.5	67.4	69.9
Mean	65.9	64.1	62.4	59.8	

CDp=0.05 Treatment (T) = 2.38
Hours (H) = 1.94
TXH = NS

Table 3. Ovipositional deterrent effect of drek seed kernels extracts (aqueous) against *B.*

Conc. %	Per cent ovipositional deterrency after the indicated hours of treatment					Mean
	24	48	72	96	120	
4	52.3	48.5	46.0	45.9	36.8	45.9
5	63.5	60.3	60.1	59.1	52.0	59.0
6	67.0	65.9	63.0	62.5	54.0	62.5
Mean	60.9	58.2	56.4	55.8	47.6	

CDp=0.05 Treatment (T) = 2.97
Hours (H) = 3.42
TXH = NS

cent respectively (Table 3). Singh and Singh (1998) found non volatile compounds like salanin in azadirachtin responsible for reduction of egg laying in *B. cucurbitae* and *B. dorsalis*. At the same concentrations of DSKE aqueous extract, there was also a significant reduction (59.5, 58.1 and 56.4 per cent) in egg hatchability (Table 4). Gajmer *et al.* (2002) reported that methanolic of neem and drek seeds at 2,4,6,8 and 10 % concentrations exhibited marked reduction in egg hatching of *Erias vittella* (Fab.) when eggs were laid on extract treated oviposition substrate as compared to control. This could be attributed to the fact that oil extracted from plant material has the ability to penetrate the chorion of egg thus causing the death of developing embryo (Singh *et al.*, 1978).

Field studies

The effectiveness of malathion+bait results in more control than malathion alone as malathion bait helps in attracting

Table 4. Effect of drek seed kernels extracts (aqueous) on per cent hatching against *B. tau*

Conc. %	Per cent hatching after the indicated hours of treatment					Mean
	24	48	72	96	120	
4	57.1	58.4	59.5	60.4	62.1	59.5
5	56.3	57.9	58.1	58.5	59.7	58.1
6	53.5	55.2	56.5	57.4	59.4	56.4
Control	70.0	69.2	69.1	67.9	64.3	68.1
Mean	59.2	60.2	60.8	61.1	61.4	

CDp=0.05 Treatment (T) = 1.33
Hours (H) = 1.33
TXH = NS

Table 5. Effect of different bait sprays and drek seed kernels extracts (aqueous) on per cent infestation of tomato by *B. tau*

Treatment	Per cent fruit infestation in the indicated days after treatment			Mean
	17 August	27 August	6 September	
Bait III (DSKE 1%+ diet)	40.3	38.6	35.4	38.3
Bait IV (Malathion 0.1%+ diet)	41.3	38.2	31.4	37.0
Aqueous drek seed kernels extracts (6%)	41.2	37.6	35.7	38.1
Control	41.2	39.7	36.9	39.3
Mean	41.0	38.5	34.9	

CDp=0.05 Treatment (T) = 1.41
Days (D) = 1.22
TXD = 2.43

Table 6. Effect of different bait sprays and drek seed kernels extract (aqueous) on yield of tomato

Treatment	Yield (kg/ha) on the indicaed days			Total yield (kg/ha)
	17 August	27 August	6 September	
Bait III (DSKE 1%+ Diet)	6888.8	10000.0	7796.3	24685.1
Bait IV (Malathion 0.1%+ Diet)	7647.5	10296.3	8443.8	26387.3
Aqueous drek seed kernels extracts (6%)	7370.0	9741.3	7646.3	24757.6
Control	8073.8	9315.0	6778.8	24131.6
Mean	7495.0	9838.1	7666.3	

CDp=0.05 Treatment (T) = 346.56
Days (D) = 300.13
TXD = NS

fruit flies and also acts as stomach poison beside contact poison. Slight reduction in crop infestation may result in significant increase in yield. The same trend has been observed in the present study. The per cent fruit infestation and yield were significantly lower and higher, respectively in case of Bait II (Malathion 0.1%+ diet) whereas, in case of Bait I (DSKE 1 % + diet) and aqueous drek seed kernels extract (6 %) the fruit infestation was statistically at par with control but yield was significantly high (Table 5 and 6). Ranganath *et al*. (1997) evaluated a number of botanicals and chemical insecticides against *B. cucurbitae* on cucumber and ridge gourd and found that neem oil at 1.2 per cent concentration was most effective in reducing damage to cucumber (6.2 % as against 39% in control) while neem cake at 4 per cent and DDVP at 0.2 per cent were effective against *B. cucurbitae* on ridge gourd thus reduced the damage to 9.1 to 9.5 per cent as compared to control.

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