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Evaluation of different insecticides against tea mosquito bug, *Helopeltis antonii* Sign. (Miridae: Hemiptera) on tamarind

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Abstract
Evaluation of insecticidal spray for control of tea mosquito bug, *Helopeltis antonii* Sign. On tamarind was conducted during 2021 – 22; all treatment combinations are superior over control in suppressing tea mosquito on tamarind. Application of fipronil 5% SC (2ml/l) was the most effective in reduction of tea Mosquito bug population followed by profenofos 50% EC (2 ml/l) and lambda cyhalothrin 5% EC (1.5ml/l). When Incremental benefit cost ratio was considered among different combination of treatments first best treatment is profenofos 50% EC (2 ml/l), resulted in yield of (98 kg) of quality fruits per tree with monetary returns of Rs. (1940 tree^{-1}) and an Incremental benefit cost ratio (IBC) of 1: 9.1.

Keywords: Management, tea mosquito bug, tamarind

Introduction
Tamarind (*Tamarindus indica* L.) is a multipurpose tropical fruit tree abundantly grown in Asian countries apart from being an important tree, is also valued as medicinal and ornamental plant (Little *et al.*, 1964) [2]. It is primarily used for its fruits, which are consumed fresh or processed, it is better known for the pod pulp (40%) which is rich in vitamin C and contains tartaric, malic, and citric acid as well as sugars, has a sweet-sour flavor and is used in drinks, sweet meats, curries, and chutneys. Just like other tropical fruit trees tamarind is ravaged by multitude of pests in both field and storage conditions. Recently adults and nymphs of tea mosquito bug, *Helopeltis antonii* has been reported on tamarind by damaging the fruits. An extensive review has been made on tea mosquito bugs involving different species and different host plants which have been reported by various workers. But the literature pertaining to the tea mosquito bug on tamarind was scanty, so literature related to tea mosquito bug on different hosts like cashew, guava, tea, etc. are reviewed for study. Keeping this in view an evaluation programme was under taken to find out efficacy of insecticides for management of tea mosquito bug.

Materials and Methods
A field experiment was laid out to test the efficacy of insecticides for management of *Helopeltis antonii* on 26 years old tamarind plot of KVK, Chintamani (Karnataka) and the spacing followed was 10m x 10m. To evaluate the relative efficacy of insecticides the experiment was conducted in a randomized complete block design with 10 treatments and 3 replications (Table 1). Each tree formed one treatment. Totally 30 trees were used for the experiment. The treatments are randomly assigned to individual tree. Insecticides applied at the time of severe infestation. Gator sprayer was used for imposing the treatments. The treatments were imposed two times at 15 days interval. Commencing first spray with the incidence of *H. antonii* during the month of September 2020 and the second spray was given at 15 days interval. Observations on the number of insects was recorded in each direction (North, South, East and West) by five sweeps in standard insect collecting hand net. Pre-treatment count was made one day before imposition of treatments. Post treatment counts was taken at an interval of three, seven and fifteen days respectively after treatment. The same was done for second spray of insecticides. Later percent reduction over control was calculated by using following formula:

$$\% \text{ Reduction over control} = \frac{\text{Tea mosquito bug in controlled tree - Tea mosquito bug in treated tree}}{\text{Tea mosquito bug in controlled tree}} \times 100$$

After harvesting, the yield attributes like total yield (number of quality fruits) were recorded per tree. The total yield per hectare was later quantified in the orchard. Percent increment in yield over control was calculated by using following formula:

$$\% \text{ yield increment over control} = \frac{\text{Yield in treated tree - Yield in controlled tree}}{\text{Yield in controlled tree}} \times 100$$

Results and Discussion

The pretreatment population of tea mosquito bug ranges from 14 to 17.33 bugs per 5 sweeps and was found non- significant amongst different treatments. The performance of various treatments presented in table 1. During the first spray all treatments were found to be superior over control. Fipronil 5% SC, profenofos 50% EC and lambda cyhalothrin 5% EC were effective in lowering the population of tea mosquito bug to the level of 4.55, 5.55 and 7.11 bugs/5 sweeps respectively. Remaining treatments were on par with each other except untreated check which recorded significantly higher tea mosquito bug population (19.77 bugs). Computed data of percent reduction over control in first spray indicated that highest percentage of tea mosquito bugs suppression was registered in fipronil 5% SC (76.98%) followed by profenofos 50% EC (71.92%). In other treatments the percent reduction over control varied from 20.78 to 55.08% (Table 1).

Post treatment mean of second spray revealed that fipronil 5% SC (0.88 bugs / 5 sweeps) was effective compared to profenofos 50% EC (1.33 bugs / 5 sweeps). However higher number of bugs were recorded in trees treated with azadirachtin 0.15% EC (5.88 bugs) and azadirachtin 1% EC (5.11 bugs). Computed data of percent reduction over control in second spray indicated that highest percentage of tea mosquito bug suppression was registered in fipronil 5% SC (96.19%) followed by profenofos 50% EC (94.24%). In other treatments the percent reduction over control varied from 74.55 to 90.39 percent.

Yield attributes and yield: Treatment with profenofos 50% EC (2ml/l), resulted in yield of 98 kg of quality fruits per tree with monetary returns of Rs. 1940/tree and an Incremental benefit cost ratio (IBC) of 1: 9.1 (Table 2). The second-best treatment was lambda cyhalothrin 5% EC (1.5 ml/l) gives a yield of (84kg/tree) with monetary returns of Rs. 1492 / tree and IBC ratio of 1: 6.2. Third best was recorded with treatment of Imidacloprid 17.8% SL (0.3ml/l) produced a yield of (78kg/ tree) with monetary returns Rs. 1332/tree and IBC ratio of 1: 6.0. However, fipronil 5% SC stood fourth place when IBC ratio (1: 5.2) was considered.

Present findings are inline with the work of Rahman *et al.* (2007) [4] reported that Profenofos, fenpropathrin and lamdacyhalothrin have maximum ovicidal action against eggs of tea mosquito bugs. Similarly, Patil *et al.* (2010) [3] reported that fipronil 5% SC was effective in mitigating sucking pest problem in cotton. Reports on the evaluation of profenofos against tea mosquito bug, *Helopeltis theivora* Waterhouse on tea was also revealed it to be effective in controlling the pest (Daniel *et al*., 2020) [1].

Table 1: Efficacy of insecticides against *Helopeltis antonii* on tamarind during 2020 - 21.

Treatment details	Dosage (mL/g/L)	Mean population of tea mosquito bug					
		First spray			Second spray		
		Pre-treatment	Post treatment mean	POC	Pre-treatment	Post treatment mean	POC
Imidacloprid 17.8% SL	0.3	16.00 (4.12)	8.88(2.98)	55.08	8.66 (3.10)	2.22 (1.49)	90.39
Thiamethoxam 25%WG	0.3	16.00 (4.12)	10.77 (3.28)	45.52	11.00 (3.46)	2.88 (1.69)	87.53
Profenofos 50%EC	2.0	14.00 (3.87)	5.55 (2.35)	71.92	5.66 (2.58)	1.33 (1.15)	94.24
Acephate 75%SP	1.5	15.66 (4.08)	12.55 (3.54)	36.51	13.00 (3.74)	4.44 (2.10)	80.78
Fipronil 5%SC	2.0	15.66 (4.08)	4.55 (2.13)	76.98	4.66 (2.37)	0.88 (0.94)	96.19
Lambda cyhalothrin 5%EC	1.0	15.33 (4.03)	7.11 (2.66)	64.03	6.66 (2.76)	1.88 (1.37)	91.86
Azadirachtin 0.15%EC	5.0	17.00 (4.24)	15.66 (3.95)	20.78	16.33 (4.16)	5.88 (2.42)	74.55
Azadirachtin 1% EC	2.0	17.33 (4.28)	14.88 (3.85)	24.73	15.33 (4.03)	5.11 (2.26)	77.88
Buprofezin 25% SC	1.25	17.00 (4.24)	11.33 (3.36)	42.69	12.33 (3.64)	3.66 (1.91)	84.16
Control (Untreated)	-	14.00 (3.87)	19.77 (4.44)	-	20.66 (4.65)	23.11 (4.80)	-
S.EM.	-	0.08	0.07	-	0.07	0.08	-
CD (P= 0.05)	-	0.25	0.22	-	0.23	0.26	-

Figures in parenthesis are square root transformed values, POC = Percent reduction over control
CD = Significant @ 5% probability level

Table 2: Economic analysis of insecticides and botanicals against *H. antonii* on tamarind during 2020-21.

Treatments	Mean yield (kg/tree)	Increase in yield over control (kg/tree)	Value of increased yield (Rs.)	Cost of treatment (Rs. /tree)	Incremental returns (Rs.)	IBC ratio
T_1- Imid 17.8% SL	78	46	1380	221	1332	1: 6.0
T_2- Thia 25%WG	63	31	930	203	900	1: 4.4
T_3- Prof 50%EC	98	66	1980	213	1940	1: 9.1
T_4- Ace 75%SP	46	14	420	255.5	337	1: 1.3
T_5- Fipr 5%SC	120	88	2640	453	2360	1: 5.2
T_6- L- cyha 5%EC	84	52	1560	240.5	1492	1: 6.2
T_7- Aza 0.15%EC	38	6	180	273	80	1: 0.2
T_8- Aza 1% EC	40	8	240	373	40	1: 0.1
T_9- Bupr 25% SC	55	23	690	213	650	1: 3.0
T_{10}- Control (check)	32	-	-	-	-	-

Market price of Tamarind pods Rs. 30/kg
IBC ratio = Incremental benefit cost ratio

Conclusion

Evaluation of insecticides for control of tea mosquito bug, *Helopeltis antonii* Sign. on tamarind revealed that application of fipronil 5% SC (2ml/l) was the most effective in reduction of tea mosquito bug population followed by profenofos 50% EC (2 ml/l) and lambda cyhalothrin 5% EC (1.5ml/l). When IBC ratio was considered among different combination of treatments first best treatment is profenofos 50% EC (2 ml/l), resulted in yield of (98 kg) of quality fruits per tree with monetary returns of Rs. (1940 tree^{-1}) and an Incremental benefit cost ratio (IBC) of 1: 9.1.

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