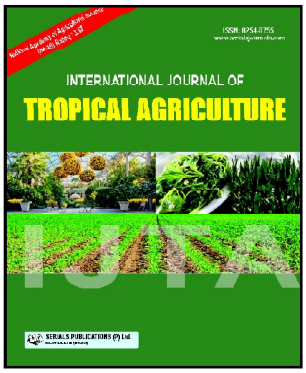

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Management of Ground Beetle, *Mesomorphus villiger* (Blanchard) in Virginia Tobacco

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Abstract: Tobacco ground beetle, *Mesomorphus villiger* is one of the important insect pests of tobacco. It causes damage by gnawing the tender stem of the seedlings immediately after transplanting, resulting in death and thereby creating gaps in the field, sometimes to an extent of 50-60% of the area. In view of the problems in its control, new insecticides and methods of application for management of the pest were evaluated in a field experiment for two seasons. The results indicated that at 30 days after planting (DAP), the treatment T5- comprising seedling root dip in imidacloprid 70 AF @ 0.14% before transplanting + foliar spray (FS) of imidacloprid 200 SL @ 0.005% at 5 days after planting recorded the least plant mortality (3.5%) followed by (T2)- Seedling root dip in imidacloprid 70 AF @ 0.14% (7.01%) and T3-Imidaclorpid 200 SL @ 0.005% in transplant water (8.49 & 11.99%). Data on yield parameters showed that T5 (T2 + FS of imidacloprid 200 SL @ 0.005% at 5 DAP) recorded the highest mean cured leaf yield (2465 kg/ha) followed by T2-Seedling root dip in imidacloprid 70 AF @ 0.14% before transplanting (2420kg) and T3 imidaclorpid 200 SL @ 0.005% in transplant water (2388 kg/ha). The experimental results indicated that ground beetle *M. villiger* could be managed in Virginia tobacco with seedling root dip in imidacloprid 70 AF @ 0.14% before transplanting + foliar spray (FS) of imidacloprid 200 SL 0.005% at 5 days after planting or seedling root dip in imidacloprid 70 AF @ 0.14% or transplant water treatment with imidacloprid 200 SL @ 0.005%.

Key words: Tobacco, *Nicotiana tabacum, Mesomorphus villiger*, management, insecticides, seedling root dip, imidacloprid.

Short title: Management of *ground beetle in tobacco.*

INTRODUCTION

Tobacco an important commercial crop of India plays a vital role in the country's agricultural economy. India is producing 750 M kg of cured leaf from an area of 0.45 M ha. India exports 225 M kg of tobacco and its products to about 100 countries earning foreign exchange to the tune of ₹ 6012 crores and an internal revenue generation of about ₹ 21,463 crores. It is the life line for 6 million farmers besides supporting 30 million workers. Among the tobacco production constraints identified, increasing incidence of insect pests and diseases are economically important and the losses incurred are substantially high in terms of both quantity and quality. Ground beetle, *Mesomorphus villiger* is one of the important insect pests of tobacco. The beetle damage newly transplanted tobacco seedlings. It causes damage by gnawing the tender stem of the seedlings, resulting in death and thereby creating gaps in the field, sometimes to an extent of 50-60% of the area [3]. As a consequence, replanting has to be done, which not only increases the cost of transplanting, but reduces the yield and quality of the crop as there is variation in crop growth. These beetles are controlled by use of insecticides [1&2] and the indiscriminate use of insecticides result in several adverse effects. Also, the registered insecticides that provide adequate control of the pest continued to decrease [3]. In view of these problems it is essential to evaluate new effective insecticide and method of application for management of the pest.

MATERIALS AND METHODS

A replicated field trial was conducted for two seasons in planted flue cured Virginia tobacco cv. *Siri* at the institute research farm, during 2013-15. The experiment was laid out in randomized block design with 3 replications in plots measuring 5.6 × 7.9 m with a row to row and plant to plant distance of 70 cm to evaluate the efficacy of eight treatments *viz.,* T1-Foliar spray (FS) of imidacloprid 200 SL @ 0.005% on the seed bed 1 day before transplanting, T2-Seedling root dip in imidacloprid 70 AF @ 0.14% for 30 minutes just before transplanting, T3 Imidaclorpid 200 SL 0.005% in transplant water, T4-Foliar spray of imidacloprid 200 SL 0.005% a day after transplanting (DAP), T5 – T2 + FS of imidacloprid 200 SL 0.005% 5 DAT, T6- T1 + T5, T7-Neem cake application @ 5g/plant, T8 – FS of tray seedlings 1 day before transplanting with imidacloprid 200 SL @ 0.005% and Untreated Control. Virginia tobacco seedlings were raised as per the recommended package of practices and sixty days old, healthy seedlings were used for transplanting in the main filed. Observations on plant mortality due to beetle damage were recorded at 7, 15 and 30 days after planting (DAP). The data on plant mortality were used to work out per cent plant mortality/plot and subjected to statistical analysis of variance (ANOVA) after appropriate transformation. Yield data on cured leaf, bright leaf and grade index were collected and subjected to ANOVA [4].

RESULTS AND DISCUSSION

Plant Mortality

During 2013-14, the results indicated that at 7 DAP, the least plant mortality (1.00%) was recorded in T2-Seedling root dip in imidacloprid 70 AF @ 0.14% before transpalnting and T5 – T2 + FS of imidacloprid 200 SL @ 0.005% at 5 DAP (Table 1). However, T3-Imidaclorpid 200 SL @ 0.005% in transplant water (3.50%) remained on par with these two treatments as shown by per cent transplant mortality. These three treatments gave significantly higher protection than all other treatments. Rest of the treatments remained on par with each other and also to that of untreated control. At 15 DAP, T5 – T2 + FS of imidacloprid 200 SL @ 0.005% at 5 DAP recorded cent per cent protection and significantly superior to all other treatments. T2-Seedling root dip in imidacloprid 70 AF @ 0.14% before transplanting, T3-Imidacloprid 200 SL @ 0.005% in transplant water were the next best treatments, they remained

Table 1
Management of ground beetle, *Mesomorphus villiger*, in FCV tobacco

	Mean per cent plant mortality					
	7 DAP		*15 DAP*		*30 DAP*	
Treatment	*2013-14*	*2014-15*	*2013-14*	*2014-15*	*2013-14*	*2014-15*
T1 = FS of imidacloprid 200 SL @ 0.005% on the seed bed 1 day before transplanting	16.11 (7.70)	19.42 (11.06)	20.17 (12.46)	23.19 (15.52)	22.30 (14.40)	24.90 (17.75)
T2 = Seedling rootdip in imidacloprid 70 AF @ 0.14%	1.00 (0.00)	1.00 (0.00)	7.01 (1.49)	7.00 (1.49)	7.01 (1.49)	7.01 (1.49)
T3 = Imidacloprid 200 SL @ 0.005% in transplant water	3.50 (0.37)	3.50 (0.37)	8.49 (2.18)	11.99 (4.32)	8.49 (2.18)	11.99 (4.32)
T4 = FS of imidacloprid 200 SL @ 0.005% -1DAP	13.47 (5.43)	19.42 (11.06)	19.42 (11.06)	22.30 (14.40)	21.40 (13.33)	23.19 (15.52)
T5 = T2 + FS of imidacloprid 200 SL @ 0.005% - 5 DAP	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	3.50 (0.37)	3.50 (0.37)
T6 = T1 + T5	11.99 (4.32)	16.12 (7.70)	18.43 (10.00)	20.41 (12.17)	19.42 (11.06)	21.40 (13.33)
T7 = Neem cake application @ 5g/plant	13.47 (5.43)	13.47 (5.43)	17.27 (8.82)	17.27 (8.82)	20.41 (12.17)	17.27 (8.82)
T8 = FS of tray seedlings 1 day before transplanting with imidacloprid 200 SL @ 0.005%	13.47 (5.43)	11.99 (4.32)	18.27 (9.83)	16.12 (7.70)	19.42 (11.06)	17.10 (8.65)
Control	16.11 (7.04)	31.05 (26.62)	22.30 (14.40)	33.17 (29.96)	24.01 (16.57)	34.56 (32.21)
S.Em ±	1.58	1.58	1.90	1.51	2.19	1.95
CD (p = 0.05)	4.74	4.74	5.70	4.54	6.56	5.87

*Figures in parentheses are retransformed means

DAS = days after spray, DAP = Day(s) after planting, FS = Foliar spray.

on par with each other and significantly superior to the rest. All other treatments remained on par with untreated control. At 30 DAP T5 – T2 + FS of imidacloprid 200 SL @ 0.005% at 5 DAP recorded least plant mortality (3.5%) followed by T2-Seedling root dip in imidacloprid 70 AF @ 0.14% before transplanting (7.01%) and T3-Imidaclorpid 200 SL @ 0.005% in transplant water (8.49%). Rest of the treatments remained on par with untreated control (24.01%).

During 2014-15 at 7 DAP, least per cent plant mortality (1.00%) was recorded in T2-Seedling root dip in imidacloprid 70 AF @ 0.14% before transplanting and T5 – T2 + FS of imidacloprid 200 SL @ 0.005% at 5 DAP (Table 1). However, T3-Imidacloprid 200 SL @ 0.005% in transplant water remained on par (3.50%) with these two treatments as shown by plant mortality. These three treatments gave significantly higher protection than all other treatments. Among the rest, T8-FS of tray seedlings 1 day before transplanting with imidacloprid 200 SL @ 0.005% (11.99), T7- Neem cake application @ 5g/plant ((13.47%) and T6 – (T1 + T5) remained on par (16.12%) and were better than the rest. At 15 DAP, T5- T2 + FS of Imidacloprid 200 SL @ 0.005% at 5 DAP recorded

cent per cent protection and significantly superior to all other treatments. T2-Seedling root dip in imidacloprid 70 AF @ 0.14% before transplanting (7.00%), T3-Imidaclorpid 200 SL 0.005% in transplant water were the next best treatments and significantly superior to the rest. At 30 DAP, T5 – T2 + FS of imidacloprid 200 SL @ 0.005% at 5 DAP recorded least plant mortality (3.5%) followed by T2-Seedling root dip in imidacloprid 70 AF @ 0.14% before transplanting (7.01%) and T3-Imidaclorpid 200 SL @ 0.005% in transplant water (11.99%). T3 also remained on par with T8 (17.10%) and T7 (17.27%). Seedling root dip in insecticide solutions for control of insect pests was reported to be highly effective in several crops against a range of insect pests [5, 6, 7, 8, 9, 10, 11]. Similarly transplant water treatment with neonicotinoids particularly imidacloprid was found highly effective against a number of insect pests in tobacco and other crops [12, 13, 14, 15, 16]. Superiority of the combination treatment of seedling root dip and foliar spray was in conformity with similar studies against insect pest on onion [17]. Application of insecticides either as seedling root dip or in transplant water was not only effective in minimising the pest infestation but also help in conservation of natural enemies [18, 19].

Tobacco Yield

Data on yield parameters during 2013-14 showed that T5 – T2 + FS of imidacloprid 200 SL @ 0.005% at 5 DAP recorded the highest cured leaf yield (2040 kg/ha) followed by T2-Seedling root dip in imidacloprid 70 AF @ 0.14% before transplanting (2010 kg) and T3-Imidaclorpid 200 SL @ 0.005% in transplant water (1980 kg/ha) which were on par with each other (Table 2). T1-Foliar spray (FS) of imidacloprid 200 SL @ 0.005% on the seed bed 1 day before transplanting and T4-Foliar spray of imidacloprid 200 SL @ 0.005% at 1 DAP recorded less cured leaf yield than other treatments and was on par with untreated control. Similar trend was

Table 2
Efficacy of management practices on yield parameters of Virginia tobacco

	kg/ ha					
	Cured leaf		*Bright leaf*		*Grade Index*	
Treatment	*2013-14*	*2014-15*	*2013-14*	*2014-15*	*2013-14*	*2014-15*
T1 = FS of imidacloprid 200 SL @ 0.005% on the seed bed 1 day before transplanting	1760	2586	790	1040	1296	1350
T2 = Seedling root dip in imidacloprid 70 AF @ 0.14%	2010	2830	1080	1270	1690	1656
T3 = Imidacloprid 200 SL @ 0.005% in transplant wáter	1980	2796	1040	1200	1590	1570
T4 = FS of imidacloprid 200 SL @ 0.005% 1 DAP	1750	2580	776	1020	1284	1320
T5=T2 + FS of imidacloprid 200 SL @ 0.005% 5 DAP	2040	2890	1110	1300	1710	1690
T6 = T1 + T5	1810	2650	840	1050	1360	1382
T7 = Neem cake application @ 5g/plant	1860	2680	926	1090	1410	1428
T8 = FS of tray seedlings 1 day before transplanting with imidacloprid 200 SL @ 0.005%	1830	2700	864	1120	1384	1476
Control	1520	2290	730	900	1150	1170
S.Em ±	59	80	28	34	43	71
CD *(p=0.05)*	177	241	84	103	128	214

observed as regards bright leaf yield and grade index. During 2014-15, T5 – T2 + FS of imidacloprid 200 SL @ 0.005% at 5 DAP recorded the highest cured leaf yield (2890 kg/ha) followed by T2-Seedling root dip in imidacloprid 70 AF @ 0.14% before transplanting (2830 kg) and T3-Imidaclorpid 200 SL 0.005% in transplant water (2796 kg/ha) which were on par with all the treatments except T1-Foliar spray (FS) of imidacloprid 200 SL @ 0.005% on the seed bed 1 day before transplanting and T4-Foliar spray of imidaclorpid 200 SL @ 0.005% at 1 DAP, which recorded less cured leaf yield than other treatments. As regards bright leaf yield T5 recorded the highest (1300 kg/ha) followed by T2 (1270) and T3 (1200). Similar trend was observed for grade index except that T8 remained on par with the best treatments *i.e.*, T5, T2 and T3.

Based on the two seasons data on plant mortality due to the beetle damage and yield parameters, it can be inferred that ground beetle *M. villiger* could be managed in Virginia tobacco with seedling root dip in imidacloprid 70 AF @ 0.14% before transplanting + foliar spray (FS) of imidacloprid 200 SL 0.005% at 5 days after planting or seedling root dip in imidacloprid 70 AF @ 0.14% or transplant water treatment with imidacloprid 200 SL @ 0.005%.

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