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MANAGEMENT OF SEED CAPSULE BORER, *HELICOVERPA ARMIGERA* IN TOBACCO

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The seed capsule borer, *Helicoverpa armigera* Hubner is a serious pest of tobacco. Field experiments were conducted for two seasons (2014-16) to evaluate three different modules viz., bio intensive integrated pest management (BIPM), chemical control (CC) and IPM module along with untreated control for management of *H.armigera* in chewing tobacco. It was observed that the damage to the seed capsules was significantly less in all the modules compared to untreated control (21.25 - 28.40%). The capsule damage was least in chemical control module (4.50 - 9.70%) followed by IPM module (5.02 - 10.81%) both of which were superior to BIPM module (12.67 - 20.68%). The data on per cent plants infested with the pest also showed similar trend. The activity of the predator mired bug, *Nesidiocoris tenuis* was the highest in untreated control module followed by BIPM and IPM modules. The highest mean seed yield of 679 kg/ha was recorded in chemical control plot followed by IPM module (658 kg/ha) as against 569 kg/ha in BIPM module and 520 kg/ha in untreated check during the experimental period. The pest incidence, capsule damage and the seed yield was at par in chemical control and IPM modules. However, the population of predator, *Nesidiocoris tenuis* was more in IPM compared to CC module. Hence, IPM module can be adopted for management of the seed capsule borer, *H.armigera* in tobacco.

INTRODUCTION

Tobacco is known for its ability to produce seed oil with an oil yield ranging from 30 - 40 % of seed dry weight. Annually, about 1300-1500 tonnes of tobacco seed oil is expelled and exported to other countries from India. Tobacco seed oil is extensively used in paint and soap industry. Refined tobacco oil is being used as edible oil in Bulgaria, Tunisia, Turkey and Greece. With the increasing importance of research on alternative uses of tobacco, the potential of tobacco as an oil seed crop has been recognised (Chakraborty, 1998). Good quality tobacco seed is the key resource for production of quality tobacco in an area of 4.20 lakh hectares with an annual production of 760 million kg of tobacco leaf in the country. Also, in the context of identifying alternative uses, tobacco as a source of edible oil has been gaining importance (Singh and Jain, 2005). The capsule borer, *Helicoverpa armigera* is a serious pest of seed crop of tobacco during later stages of crop growth and infests almost all types of tobaccos. The larvae feed on the flowers and seed capsules. The larvae bores into the seed capsule and feed on the developing seed by thrusting its head inside while the body remains outside. The average seed loss due to this pest was estimated to be 88.5 kg/ha in chewing tobacco (Chari, *et al.*, 1983). In the years of severe incidence and during its outbreaks, seed production was severely affected, resulting in huge losses. The need for managing the capsule borer has been steadily felt to protect the seed crop. Sole dependence and indiscriminate use of synthetic pesticides for pest control is beset with problems galore. Excessive use of insecticides to protect the crop leads to elimination of natural enemies, contamination of seed oil with pesticide residues, environmental pollution and development of insecticide resistance. Availability of alternate hosts such as chickpea, cotton, pigeon pea, sunflower and chillies, in tobacco growing areas possibly results in its outbreaks on tobacco. During the epidemics, 43 eggs/plant were recorded compared with 8 eggs/plant in normal seasons (Chari *et al.*, 1993). Hence, studies were conducted to evaluate management modules to find out the most promising method for management of the pest in chewing tobacco. The mirid bug *Nesidiocoris tenuis* Reuter (Hemiptera: Miridae) as an omnivore and an important predator in tobacco ecosystem. The activity of the bug reaches its peak during flowering

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and early capsule formation and coincides with the activity of *H.armigera*. It was reported to be predating on eggs and neonate larvae of *H.armigera* in tobacco (Prasad *et al.*, 2010). Hence, activity of *N.tenuis* was also studied in different management modules to understand their impact on the predator.

MATERIALS AND METHODS

Field experiments were conducted for two seasons (2014-16) to evaluate three different modules viz., bio intensive IPM (BIPM), chemical control module (CC) and IPM module (IPM) along with untreated control for management of seed capsule borer, *H.armigera* Hub. in tobacco. *Bidi* tobacco cv. A119 was planted and all recommended agronomic practices were followed. The components of BIPM module were NSKE 2% spray at flowering when the moths were observed in the trap. Two sprays of Ha NPV @ 3 x 10^{12} PIBs/ha when the 1st and 2nd instar larvae were observed on the inflorescence and the capsules. The chemical control module consisted of three sprays of flubendiamide 48 SC @ 0.012% and chlorantraniliprole 18.5 SC @ 0.005% at flowering, capsule formation and seed filling stages alternately. The components of IPM module were spray of NSKE2% and Ha NPV @ 3 x 10^{12} PIBs/ha at flowering and capsule formation, and need based spray of flubendiamide 48 SC @ 0.012% and novaluron 10 EC @ 0.01%. Pheromone traps @10/ ha were installed to monitor the activity of the pest. Observations were recorded on per cent seed capsules damaged, per cent plants infested with the pest, activity of the predatory mirid bug, *N.tenuis* a predator in tobacco crop ecosystem and the seed yield.

RESULTS AND DISCUSSION

The results indicated that the damage (Table 1) to the seed capsules as well as plant infestation (Table 2) was significantly less in all the modules as compared to untreated control during both the seasons. During 2014-15 the capsule damage was least in chemical control module (4.50, 4.65 and 6.81%) followed by that in IPM module (5.02, 5.13, 6.13%) during 10 days after first spray (DAIS), 10 days after second spray (DAIIS) and 10 days after third spray (DAIIIS) respectively, both of which were on a par with each other and significantly superior to BIPM module (12.67, 12.81 and 17.72%). The data on per cent plants infested with

Table 1: Impact of Management modules on seed capsule damage and *Nesidiocoris tenuis* in tobacco 2014-16

Treatment	Per cent Seed Capsules damaged						Mean No. of *N.tenuis*/plant					
	10 DAIS		10 DAIIS		10 DAIIIS		10 DAIS		10 DAIIS		10 DAIIIS	
	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16
BIPM	12.67 (4.81)	15.79 (7.41)	12.81 (4.92)	18.12 (9.68)	17.72 (9.27)	20.68 (12.48)	9.36	9.7	8.26	10.6	8.14	8.80
Chemical Control	4.50 (0.61)	5.86 (1.04)	4.65 (0.66)	7.78 (1.84)	6.81 (1.41)	9.70 (2.84)	4.54	6.24	4.30	6.03	3.66	4.0
IPM	5.02 (0.77)	7.13 (1.54)	5.13 (0.8)	9.01 (2.46)	6.13 (1.14)	10.81 (3.52)	8.94	8.82	7.72	8.88	6.00	6.60
Control	21.25 (13.14)	22.10 (14.16)	23.82 (16.33)	25.40 (18.82)	26.22 (19.53)	28.40 (22.63)	10.02	10.8	8.86	12.26	8.22	10.02
S.Em ±	2.29	2.13	2.52	1.28	2.12	1.18	0.54	0.45	0.46	0.60	0.38	0.45
CD (*p=0.05*)	6.63	6.20	7.31	3.71	6.14	3.42	1.58	1.32	1.33	1.77	1.10	1.30

Figures in parentheses are retransformed means DAS= Days after Spray

Table 2: Impact of management modules on capsule borer infestation and tobacco seed yield 2014-16

Treatment	Per cent plants infested								Seed Yield (kg/ha)		
	Before Spray		10 DA I S		10 DA II S		10 DA III S				
	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	(Pooled)
BIPM	13.08	14.29	15.43	16.56	17.47	17.21	18.37	18.57	458	680	569
	(5.13)	(6.19)	(7.09)	(8.13)	(9.02)	8.76	(9.94)	(10.15)			
Chemical	11.40	14.78	11.37	14.78	11.37	14.78	12.78	15.04	560	798	679
Control	(4.0)	(6.51)	(3.89)	(6.52)	(3.89)	6.52	(4.90)	(6.74)			
IPM	11.96	15.04	11.91	15.04	14.28	15.22	14.02	15.42	546	770	658
	(4.30)	(6.74)	(4.26)	(6.74)	(6.17)	6.90	(5.88)	(7.07)			
Control	12.87	14.02	18.31	19.11	20.10	20.58	21.87	22.49	434	606	520
	(5.00)	(5.88)	(9.87)	(10.73)	(11.82)	12.37	(13.88)	(14.64)			
S.Em ±	0.38	0.56	0.85	0.55	0.96	0.96	0.80	0.67	30.97	29.77	21.48
CD (*p=0.05*)	1.14	NS	2.58	1.67	2.91	2.90	2.41	2.03	93.34	89.71	62.03

Figures in parentheses are retransformed means, DAS= Days after Spray

the pest showed that all the plots recorded more or less same level of damage before spray (BS). Subsequently, all the management modules recorded significantly less infestation compared to untreated control at all the observations. At 10 DAIS the CC module recorded least infestation (11.37%) followed by IPM module (11.91%) both of which are on a par with each other and recorded significantly less infestation than BIPM module (15.43%). Similar trend continued at 10 DAIIS and 10 DAIIIS (Table 2). The activity of the predator, *N.tenuis* was highest in untreated control plot (10.02, 8.86, 8.22/plant) at all the three observations, followed by BIPM (9.36, 8.26, 8.14/ plant) and IPM plots (8.94, 7.72, 6.00/plant). The population of the predatory bug was significantly less in CC plots (4.54, 4.30, 3.66/plant) compared to BIPM and IPM plots at 10 DAIS, 10 DAIIS and 10 DAIIS respectively. At 10 DAIIIS the population of the predatory bug showed a reduction in all the plots. The population was at par only in BIPM and control plots. It is evident that the IPM module and BIPM modules supported and conserved the predatory bug, whereas application of insecticides had adverse impact on the predatory bug, *N.tenuis*.

During 2015-16 also the capsule damage was found to be least in chemical control module (5.86, 7.78 and 9.70%) followed by that in IPM module (7.13, 9.01 and 10.81%) respectively during 10 DAIS, 10 DAIIS and 10 DAIIIS, both of which are at par with each other and significantly superior to BIPM module (15.79, 18.12 and 20.69 % respectively). As regards plant infestation, at 10 DAIS it was 14.78 % in CC module, which remained on a par with IPM module (15.04%), was significantly less than that in BIPM module (16.56%). While IPM and BIPM modules remained on a par with each other. At 10 DAIIS the infestation in all the three modules was at par. However, at 10 DAIIIS the infestation in CC (15.04%) and IPM modules (15.42%) remained on a par with each other and recorded significantly less than that in BIPM module (18.57%). The two seasons data on capsule damage and the plant infestation indicated that CC module though recorded relatively less, it remained at par with IPM module (Table 1 and 2). BIPM module was found to be less effective in minimizing the damage due to capsule borer compared to CC and IPM modules. Nikoshe *et al.*, (2015) reported effectiveness of scheduled application of insecticides against *H.armigera* on chickpea. Effectiveness of chemical control module and IPM module and inferiority of biological control module against *H.armigera* was reported in various other crops also (Singh *et al.*, 2009; Babar *et al.*, 2011; Chavan *et al.*, 2012; Rathod and Bhosle, 2014; Yadav *et al.*, 2020). The present studies are in conformity with the earlier studies.

The population of *N.tenuis* was highest in untreated control plot (10.8, 12.26 and 10.02/ plant) at 10 DAIS, 10 DAIIS and 10DAIIIS respectively followed by BIPM (9.70, 10.6 and 8.80/ plant) and IPM modules (8.82, 8.88 and 6.60/plant) and all the three modules were on a par with each other. The CC module recorded significantly less predatory bug population (6.24, 6.03 and 4.0/ plant) at 10 DAIS, 10 DAIIS and 10 DAIIS respectively compared to the other three modules. Adverse effect of chemical control on the natural enemies of *H.armigera* was reported in other crops (Babar *et al.*, 2011; Kavitha *et al.*, 2013; Bhede *et al.,* 2014). Pooled analysis of two season's data (Table 2) on seed yield showed that all the three modules recorded significantly higher yield than untreated control (520 kg/ha). The highest seed yield of 679 kg/ha was recorded in chemical control module followed by IPM module (658 kg/ha) both of which were at par with each other and significantly higher than BIPM module (569 kg/ ha).

Though the pest incidence, as well as capsule damage and the seed yield was on a par with each other in CC and IPM modules, due to the known deleterious effects of chemical control, the IPM module is preferable as it was found to be equally effective in protecting the seed crop of tobacco from capsule borer damage, also supported the activity of the predator *N.tenuis* and helped in its conservation in tobacco eco system. Hence, IPM module can be adopted for management of the seed capsule borer *H.armigera* in tobacco.

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