EVALUATION OF BIO INTENSIVE PEST MANAGEMENT MODULE (BIPM) AGAINST SHOOT AND FRUIT BORER, *EARIAS VITTELLA* FAB. ON BHENDI

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Abstract

A present investigation was carried out farmer field at C. Mutlur, Chidambaram to study efficiency of different Bio Intensive Pest Management (BIPM) Modules against shoot and fruit borer (*Earias vittella* fab.) on bhendi and their impact on natural enemies like spider and coccinellids and crop yield during kharif 2017 and rabi 2018. The results of present investigations revealed that Module III proved most effective treatment and it was recorded the lowest shoot and fruit infestation (12.90 & 16.66%, 11.08 & 12.54%) followed by module IV (13.76 & 18.67%, 12.69 & 13.46%) during kharif 2017 and rabi 2018, respectively. The Moderate shoot and fruit damage was observed in module II and module I compared to untreated check. Among the different modules the maximum fruit yield and the highest benefit cost ratio was recorded in module III (10.95 & 11.35 t/ha) followed by module IV (10.55 & 11.03 t/ha). Maximum mean number of coccinellids and spiders were encountered in Module-III also which might be an excellent option for sustainable management of major insect pests of bhendi. The Module III was recorded as best module controlling of shoot and fruit borer on bhendi compared to farmer’s practices.

**Keyword:** BIPM, shoot and fruit damage, natural enemies, benefit cost ratio, bhendi

1. Introduction

Bhendi *Abelmoschus esculentus* (L.) Moench is one of the most important vegetable crops in India. It is commonly known as okra or lady’s finger belongs to the family Malvaceae and the origin of bhendi is Africa. In India ranks first in the world with 5,784.0 thousand tones (72% of the total world production) of bhendi (FAO, 2015). It is a short duration crop and widely cultivated different season such as February-March, June-July and October-November. Among the various biotic and abiotic stresses that constrained the successful cultivation of okra crop, one of the important limiting factors in the cultivation of okra is insect pests. More than one hundred insect species have been reported as pests of bhendi (Santoshkumar et al., 2013). There are a few insect pests such as leaf hopper, aphid, white fly, shoot & fruit borer and spider mite, which are important in bhendi. Among them, shoot and fruit borer, *Earias vittella* Fab. considered a major pest which cause severe damage to crop (Shitole and Patel, 2009) and notorious noctuid pest causing more than 50% loss in cotton and bhendi crops (Mahapatro and Gupta 1998) and 69% on bhendi alone (Rawat and Sahu, 1973) in various parts of India. *E. vittella* alone is reported to cause 13.8 to 41.6 per cent net yield loss in bhendi (Rai et al., 2010).

Besides, the use of chemical insecticides is not advisable in bhendi crops which might lead to serious problems of residue deposition in fruits. Therefore it has now become necessary to develop the BIPM modules for the management of *E. vittella*.

2. Materials and Methods

A field trial was carried out at C. Mutlur, Chidambaram during season kharif (Aug-sep, 2017) and rabi (Jan.-April, 2018) by raising the variety of Arka anamika at spacing 45x30 cm and an area for 0.5 acre to evaluate the efficacy of certain IPM modules against *E. vittella*. Five IPM modules were formulated mentioned below and tested along with the control.

**Module I**

- Summer ploughing
- Application of farm yard manure @ 12.5 tones/ha
- Hand picking of mature larva and pupa
- Spraying of pungam oil @ 3% @ 45 DAS

**Module II**

- Soil incorporation of vermicompost @ 1.5 tones/ha
- Spray of NSKE @ 5% at 25 DAS
- Spray of neem oil @ 3% in 35 DAS
- Spraying of pungam oil 3% + panchagavya 3% in 45 DAS
- Spraying of *B. thuringiensis* (dipel) @ 0.2% in 60 DAS

**Module III**

- Soil incorporation of neem cake @ 250kg/ha
- Grow maize as a border crop
- Spraying of NSKE 5% + panchagavya 3% in 35 DAS
- Spraying of *B. thuringiensis* (dipel) @ 0.3% in 45 DAS
- Spraying of spinosad 45% SC @ 120 ml/ha in 55 DAS
- *Trichogramma chilonis* egg card @ 2.5 lakhs/ha releasing of 60 DAS and 75 DAS
- Pheromone funnel traps @ 15/ha

**Module IV**

- Seed treatment with imidacloprid 70 WP @ 5 g/kg of seed
- Spraying of imidacloprid 17.8 SL @ 0.5 ml/lit of water at 35 DAS
- Flubendiamide 39.35% SC @ 120 ml/ha in 55 DAS
- Emamectin benzoate 5% SG @ 250 g/ha at 65 DAS

**Module IV**

Untreated check
Distance between the module up to 500 m to following all the modules. Three replications were followed for each module to evaluate under Randomized Block Design (RBD) (Pazhanisamy, 2015).

Twenty plants were randomly selected for recording data in each replication once in 15 days interval after 30 DAS and continued till the end of the cropping period. Knapack sprayer was used for spraying botanicals, entomopathogens and insecticides. Periodically tender bhendi yield was recorded. Damage recorded at regular intervals was pooled and overall mean per cent damage was worked out and natural enemy populations counted regular interval upto end of the crop period. The common practices which followed for all the modules.

\[
\text{Per cent of shoot infestation} = \frac{\text{Number of infected shoot}}{\text{Total number of shoot}} \times 100
\]

\[
\text{Per cent of fruit infestation} = \frac{\text{Number of infected fruit}}{\text{Total number of fruit}} \times 100
\]

3. Results and Discussions

3.1. Kharif season 2017

The data on the incidence of *E. vittella* under different BIPM modules conducted during kharif 2017 and rabi 2018 have presented in Table 1 & 2. In kharif 2017 the per cent shoot damage by *E. vittella* was differed significantly among differs from the BIPM modules. In 30 DAS only shoot infestation was observed in M-I (7.55%) and M-II (5.14%). Highest per cent shoot damage was observed in M-I (28.97%) but lowest per cent shoot damage was noticed in M-III (12.62%) which was significantly superior over M-IV (13.42%) at 45 DAS. The module M-III (14.48%) superior by registering lowest per cent shoot damage followed by M-IV (15.28%) and M-II (19.63%) at 60 DAS. Similar trends were followed at 75 and 90 DAS also. In overall mean less per cent shoot damage was obtained in M-III (12.90%) indicated superiority over M-IV (13.76 %) and M-II (18.03%).

The lowest per cent fruit damage by *E. vittella* was observed M-III (18.89%) followed by module M-IV (19.63%) and M-II (22.41%). However, highest per cent fruit damage was noticed module M-I (28.97%). Similar trends were followed by 60, 75 and 90 DAS. In overall mean per cent fruit damage of *E. vittella* on module M-III indicated superiority over module M-IV (18.67%) and M-II (22.13%). The module M-I was considered to be the next best (25.16%) when compared to the untreated check.

The confirmatory field experiments were conducted to study the effective of BIPM modules against *E. vittella* on bhendi during rabi season 2018 present in Table 25. The moderate per cent of shoot infestation by *E. vittella* was noticed in M-I with 7.96% per plant followed by M-II (3.53%) at 30 DAS. At 45th DAS the higher per cent infestation of shoot by *E. vittella* was observed in M-II with 15.28% per plant. The lowest per cent of shoot damage was recorded in M-III (11.57%) followed by M –IV (14.02%) and M-I at (14.48%). In 60 DAS the lowest per cent of fruit damage was observed on M-III (11.57%) followed by M –IV (13.43%) and M-II at (17.79%). The module M-III, M-IV and M-II were equally superior by registering lowest per cent damage at 60 DAS. Similar trends were followed at 75 and 90 DAS also. In overall mean per cent shoot damage 11.08% was obtained in M-III indicated superiority over M-IV (12.69%) and M-II (15.69%). The module M-I was considered to be the next best (18.83%) when compared to the untreated check.

Among them different module lowest per cent fruit damage by *E. vittella* was noticed on M-III (11.57%) with on par on M-IV (12.17%) followed by M-II (17.72%) at 45 DAS. The highest per cent fruit damage was shown in M-I (21.29%). The per cent of fruit damage with similar trends followed at 60, 75 and 90 DAS also. In the overall mean per cent fruit damage M-III (12.54%) to be considered as a best module compared to other module.

3.3. Population of natural enemies in different BIPM modules

The table 3 showed that highest mean number of coccinellids observed in module-V (untreated check) (0.53 grubs/plant) followed modules-III (0.46 grubs/plants) and M-II (0.41 grubs/plant). Whereas the lowest coccinellids population was recorded in M-IV (0.14 grub/plant) (farmer’s practices) on bhendi field during rabi season 2018 (Plate 17). Similar trend in present of coocinellids was noticed at bhendi field during the kharif season 2017.

The highest spider population was observed in module-V (untreated check) (0.45 spider per plant) followed modules-III (0.35 spider/plants) and M-II (0.27 spider/plant), however the lowest coccinellids population was recorded in M-IV (0.09 grub/plant) (farmer’s practices) on bhendi field during rabi season 2018. Similar trend in present of spider was recorded at bhendi field during the kharif season 2017 (Table 3).

The present finding are in accordance with Mishra and Mishra (2002) reported that maximum activity of predatory coccinellids were seen in bio-pesticides (*B.t., NSKE, neem* oil) treated plants and in untreated plants. Similarly, Rosaih (2001) reported that NSKE and other botanicals were found safer to predator, *viz.* coryphoid, coccinellids, spider and Apanteles in bhendi ecosystem.

3.4. Economics of IPM module

From the result it is evident that damage indicated inversely proportional relationship to the yield. The highest fresh tender bhendi yield recorded under module- III (10.95 & 11.35 t/ha) was significantly higher over module I, II, IV and V (Table 4). However all the modules were recorded higher yield than the untreated check. The application of IPM module generated higher return values present in M- III (Rs. 1,31,400 per ha) compared to less for M- IV farmer practice (Rs. 1,26,600 per ha). The total IPM input cost was Rs.
The maximum cost benefit ratio was recorded with M-III (1:3.54) followed by M-II (1:3.28), M-IV (1:3.12), M-I (1:2.62) (Fig. 20). The results of present finding are in line with Rajashekar et al. (2016) who envisaged the higher benefit cost ratio was observed in NCIPM recommended Module (M5) with 3.91 followed by Bio intensive Module (M2) with 2.15, Insecticide Module (M7) and Bio intensive Module + Insecticide Module (M6). Similarly, Singh et al. (2012) observed IPM modules net return was also higher in module (M1) which was Rs. 1,82,340 and Rs. 1,65,060/ha. Further, Preetha and Nadarajan (2006) reported Biointensive module (M2) which has the potential to reduce the fruit borer attack registered the maximum yield, BC ratio and was followed by existing recommendation module (M5). The results conclude that adoption of BIPM practices proved the potential to provide higher yields and substitute synthetic vulnerable insecticides without any enhancement in cost of cultivation.

**Conclusion**

The result concluded that components of module III effectively suppression of *E. vitellla* infestation and economically feasible to the farmer.

**Table 1:** Effectiveness of BIPM modules against *E. vitellla* in bhendi during kharif season 2017 location: C. Mutlur (Preliminary)

<table>
<thead>
<tr>
<th>Modules</th>
<th>Mean per cent shoot infestation</th>
<th>Mean per cent fruit damage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 DAS</td>
<td>45 DAS</td>
</tr>
<tr>
<td>M1</td>
<td>7.55</td>
<td>0.07</td>
</tr>
<tr>
<td>M2</td>
<td>5.14</td>
<td>(10.83)</td>
</tr>
<tr>
<td>M3</td>
<td>0</td>
<td>(0.29)</td>
</tr>
<tr>
<td>M4</td>
<td>0</td>
<td>(0.29)</td>
</tr>
<tr>
<td>M5</td>
<td>16.67</td>
<td>(24.09)</td>
</tr>
<tr>
<td>SE(d)</td>
<td>3.445</td>
<td></td>
</tr>
<tr>
<td>CD (0.05%)</td>
<td>7.944</td>
<td>5.79</td>
</tr>
</tbody>
</table>

*DAS= DAYS After Sowing*

*Mean of three replications, Figures in parentheses are arcsine (x + 0.5) transformed values, means in column followed by a common letter are not significantly different at the 5 per cent level (DMRT)*

**Table 2:** Effectiveness of BIPM modules against *E. vitellla* in bhendi during rabi season 2018 location: C. Mutlur (Confirmatory)

<table>
<thead>
<tr>
<th>Modules</th>
<th>Mean per cent shoot infestation</th>
<th>Mean per cent fruit damage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 DAS</td>
<td>45 DAS</td>
</tr>
<tr>
<td>M2</td>
<td>3.53</td>
<td>(6.52)</td>
</tr>
<tr>
<td>M3</td>
<td>0</td>
<td>(0.29)</td>
</tr>
<tr>
<td>M4</td>
<td>0</td>
<td>(0.29)</td>
</tr>
<tr>
<td>M5</td>
<td>13.10</td>
<td>(21.20)</td>
</tr>
<tr>
<td>SE(d)</td>
<td>4.098</td>
<td></td>
</tr>
<tr>
<td>CD (0.05%)</td>
<td>9.451</td>
<td>4.733</td>
</tr>
</tbody>
</table>

*DAS= Days After Sowing*

*Mean of three replications, Figures in parentheses are arcsine (x + 0.5) transformed values, means in column followed by a common letter are not significantly different*

**Table 3:** Impact of different IPM modules on the predatory activity of coccinellids in bhendi during rabi 2018 and kharif 2017

<table>
<thead>
<tr>
<th>Modules</th>
<th>Mean Population of Coccinellids/plant</th>
<th>Mean Population of Spider/plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-I</td>
<td>0.38</td>
<td>0.43</td>
</tr>
<tr>
<td>M-II</td>
<td>0.41</td>
<td>0.47</td>
</tr>
<tr>
<td>M-III</td>
<td>0.46</td>
<td>0.55</td>
</tr>
<tr>
<td>M-IV</td>
<td>0.14</td>
<td>0.14</td>
</tr>
<tr>
<td>M-V</td>
<td>0.53</td>
<td>0.68</td>
</tr>
</tbody>
</table>

Rabi 2018 | Kharif 2017 | Rabi 2018 | Kharif 2017
Table 4: Yield of tender marketable fruits and economics employed under different modules of bhendi during kharif 2017 and rabi 2018

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rabi 2018</th>
<th>Kharif 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average tender fruit yield t/ha</td>
<td>Gross income for tender fruit yield (Rs)</td>
</tr>
<tr>
<td>Module I</td>
<td>7.16</td>
<td>85,920</td>
</tr>
<tr>
<td>Module II</td>
<td>9.54</td>
<td>1,14,480</td>
</tr>
<tr>
<td>Module III</td>
<td>10.95</td>
<td>1,31,400</td>
</tr>
<tr>
<td>Module IV</td>
<td>10.55</td>
<td>1,26,600</td>
</tr>
<tr>
<td>Module V (Untreated)</td>
<td>4.13</td>
<td>49,560</td>
</tr>
</tbody>
</table>

Average cost of marketable fruit – Rs. 12.00, labour charges Rs.250 (men), 150 (women), pheromone funnel trap- Rs. 45, neem cake- Rs.12/kg, vermicompost- Rs. 4/kg, pheromone lure- Rs. 25, T. chilonis egg card- Rs. 30/ card, B. thuringensis (dipel)- Rs. 1200/ lit, spinosad 45% SC (tracer)- Rs. 1300/100ml, imidacloprid 70 WP- Rs. 680/100g, imidacloprid 17.8% SL- Rs. 145/100ml, Flubendiamide 39.35% SC (Fluid)- Rs. 840/100ml, Emamectin benzoate 5% SG (Missile)- 700/100g.
Fig. 1: Evaluation different modules against incidence of *E. vittella* on bhendi during rabi 2018

Fig. 2: Evaluation different modules against incidence of *E. vittella* on bhendi during kharif 2017

**References**


Evaluation of bio intensive pest management module (BIPM) against shoot and fruit borer, *Earias vittella* Fab. on bhendi