BIOEFFICACY OF NEW INSECTICIDE MOLECULES AGAINST RICE YELLOW STEM BORER, *SCIRPOPHAGA INCERTULAS* (WALKER)

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**KEYWORDS**

*Bacillus thuringiensis* Bioefficacy
Natural enemies
Rice Yellow stem borer
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The present investigation was conducted in kharif 2011-12 at experimental farm college of agriculture Kolhapur, to evaluate new molecules of insecticides, viz., flubendiamide 480 SC, indoxacarb 14.5 SC, fipronil 5 SC, imidacloprid 17.8 SL, lambda cyhalothrin 5 EC, cartap hydrochloride 50 SP, Metarhizium anisopliae and Bacillus thuringiensis against yellow stem borer, Scirpophaga incertulas infesting rice. The infestation of stem borer was effectively checked due to spray of fipronil 5 SC @ 30 g a.i./ha and proved to be most effective treatment (4.08 per cent). The next best treatment in order of effectiveness were flubendiamide 480 SC @ 30 g a.i./ha, indoxacarb 14.5 SC @ 30 g a.i./ha, cartap hydrochloride 50 SP @ 375 g a.i./ha, lambda cyhalothrin 5 EC @ 25 g a.i./ha, imidacloprid 17.8 SL @ 25 g a.i./ha. The biopesticides viz., M. anisopliae and Bt. were observed to be comparatively least effective. The treatments with M. anisopliae and Bt. were observed to be relatively safe to natural enemies. Whereas flubendiamide 480 SC @ 30 g a.i./ha moderately safe to natural enemies. Thus use of fipronil 5 SC @ 30 g a.i./ha can form cost effective stem borer management option in rice.

ABSTRACT

The present investigation was conducted in kharif 2011-12 at experimental farm college of agriculture Kolhapur, to evaluate new molecules of insecticides, viz., flubendiamide 480 SC, indoxacarb 14.5 SC, fipronil 5 SC, imidacloprid 17.8 SL, lambda cyhalothrin 5 EC, cartap hydrochloride 50 SP, Metarhizium anisopliae and Bacillus thuringiensis against yellow stem borer, Scirpophaga incertulas infesting rice. The infestation of stem borer was effectively checked due to spray of fipronil 5 SC @ 30 g a.i./ha and proved to be most effective treatment (4.08 per cent). The next best treatment in order of effectiveness were flubendiamide 480 SC @ 30 g a.i./ha, indoxacarb 14.5 SC @ 30 g a.i./ha, cartap hydrochloride 50 SP @ 375 g a.i./ha, lambda cyhalothrin 5 EC @ 25 g a.i./ha, imidacloprid 17.8 SL @ 25 g a.i./ha. The biopesticides viz., M. anisopliae and Bt. were observed to be comparatively least effective. The treatments with M. anisopliae and Bt. were observed to be relatively safe to natural enemies. Whereas flubendiamide 480 SC @ 30 g a.i./ha moderately safe to natural enemies. Thus use of fipronil 5 SC @ 30 g a.i./ha can form cost effective stem borer management option in rice.

INTRODUCTION

Rice (Oryza sativa L.) is the most important cereal food crop of the world providing major source of the food energy for more than half of the human population. In world the total production of rice is 463.3 million tonnes (Thawait et al., 2014). India is world’s second largest rice producer and consumer next to China. Total area under rice in India is 45.4 million hectare with annual production of 99.2 million tonnes and productivity is 2.18 tonnes/ha. (Anonymous, 2011). There are more than seventy pest infesting rice crop in India and twenty are of regular occurrence (Pathak, 1975). The stem borer and brown plant hopper are the worst pests which can cause severe damage and yield loss to the rice crop in the later stage. In India, the losses incurred by different insect pests are reported to the tune of 55.12 million rupees which in turn workout to 18.16 per cent of total losses. Out of this, 20 to 30 per cent damage is alone done by yellow stem borer, Scirpophaga incertulas (Walker) (Lal, 1996). The yellow stem borer Scirpophaga incertulas (Walker) has assumed the number one pest status and attacks the rice crop at all stages of its growth (Pasulu et al., 2002). It causes dead hearts at active tilling stage and white ears at harvest stage, which can lead to complete failure of the crop (Karthikeyan and Purushothaman, 2000).

Among the various strategies adopted to combat the pest of rice, insecticides are the first line of defense. Most of the insecticides used on agricultural crops are based on quit limited number of chemically different classes out of them the most important inorganic insecticides that are used against the pest on rice belongs to organophosphate, carbamets and synthetic pyrethroids. Therefore an effort has been made in present investigation to evaluate the new molecules of chemical insecticides such as flubendiamide 480 SC, indoxacarb 14.5 SC, fipronil 5 SC, imidacloprid 17.8 SL, lambda cyhalothrin 5 EC, cartap hydrochloride 50 SP including entomopathogenic fungus Metarhizium anisopliae and Bt endotoxin Bacillus thuringiensis against rice yellow stem borer.

MATERIALS AND METHODS

A field experiment was conducted at experimental farm, college of agriculture, Kolhapur to evaluate new insecticide molecules against rice yellow stem borer in rice variety Bhogawati comprising nine treatments and three replication in randomized block design during kharif 2011. Three rounds of applications were given two at active tilling stage at 15 days interval and third at panicle initiation stage. The efficacy of various insecticides against rice stem borer was judged on the basis of the per cent dead heart at early stage and white earheads at grain filling stage. The per cent incidence (dead heart/white earheads) was calculated as follows

\[
\text{Per cent incidence} = \frac{\text{Number of dead heart / white ears}}{\text{Total number of tillers / panicles}} \times 100
\]

The observations on the dead hearts and white earheads were recorded on ten hills selected randomly for each plot and tagged. Dead hearts were recorded one
day before spraying and 5, 10, 15 days after spraying. While white earheads were recorded 10 days before crop maturity. The data were subjected to analysis of variance. Natural enemy population count was taken simultaneously with regular observation. The number of living predators and parasitoids viz., Lady bird beetle, *Chrysopa* spp. Dragon flies, Damsel flies and spiders was recorded on five tagged plants at 1 day before spraying and 0, 3, 7 and 10 days after each spraying.

**RESULTS AND DISCUSSION**

Overall performance of various insecticidal treatments after first spray based on the mean indicated that treatment with fipronil 5 SC was found to be most effective and significantly superior over all other treatments in reducing the dead hearts to minimum level of 4.08 per cent. flubendiamide 480 SC stood second in order of effectiveness which recorded 4.44 per cent dead hearts. Treatment with indoxacarb 14.5 SC proved next effective treatment by recording 4.75 per cent dead hearts. The treatment with cartap hydrochloride 50 SP recorded 5.06 per cent dead hearts and was found at par with the lambda cyhalothrin 5 EC which 5.34 per cent dead hearts were observed. This was followed by the treatment *B. thuringiensis*, *M. anisopliae* in which 5.67, 6.03 and 6.33 per cent dead hearts noticed as against 8.77 per cent in untreated control. (Table 1.)

**Table 1: Bioefficacy of new insecticide molecules against yellow stem borer (percent dead heart) after first spray**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Insecticides</th>
<th>Dose/ha</th>
<th>Per cent dead hearts</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ADBS</td>
<td>5 DAS</td>
<td>10 DAS</td>
</tr>
<tr>
<td>1.</td>
<td>Flubendiamide 480 SC</td>
<td>30 g a.i.</td>
<td>8.01* (16.43)**</td>
<td>4.78(12.66)</td>
</tr>
<tr>
<td>2.</td>
<td>Indoxacarb 14.5 SC</td>
<td>30 g a.i.</td>
<td>8.02(16.46)</td>
<td>5.41(13.44)</td>
</tr>
<tr>
<td>3.</td>
<td>Fipronil SC</td>
<td>30 g a.i.</td>
<td>7.78(16.25)</td>
<td>4.51(12.29)</td>
</tr>
<tr>
<td>4.</td>
<td>Imidacloprid 17.8 SC</td>
<td>25 g a.i.</td>
<td>8.13(16.57)</td>
<td>6.11(14.30)</td>
</tr>
<tr>
<td>5.</td>
<td>Lambda cyhalothrin 5 EC</td>
<td>25 g a.i.</td>
<td>8.02(16.46)</td>
<td>5.64(13.73)</td>
</tr>
<tr>
<td>6.</td>
<td>Cartap hydrochloride 50 SP</td>
<td>375 g a.i.</td>
<td>8.45(16.88)</td>
<td>5.51(13.50)</td>
</tr>
<tr>
<td>8.</td>
<td><em>Bacillus thuringiensis</em></td>
<td>1000 g</td>
<td>7.24(13.60)</td>
<td>6.42(14.65)</td>
</tr>
<tr>
<td>9.</td>
<td>Untreated control</td>
<td>-</td>
<td>8.32(16.74)</td>
<td>8.23(16.68)</td>
</tr>
</tbody>
</table>

**Table 2: Bioefficacy of new insecticide molecules against yellow stem borer (per cent dead heart) after second spray**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Insecticides</th>
<th>Dose/ha</th>
<th>Per cent dead hearts</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ADBS</td>
<td>5 DAS</td>
<td>10 DAS</td>
</tr>
<tr>
<td>1.</td>
<td>Flubendiamide 480 SC</td>
<td>30 g a.i.</td>
<td>4.23* (11.83)**</td>
<td>3.92(11.39)</td>
</tr>
<tr>
<td>2.</td>
<td>Indoxacarb 14.5 SC</td>
<td>30 g a.i.</td>
<td>4.54(12.30)</td>
<td>4.23(11.85)</td>
</tr>
<tr>
<td>3.</td>
<td>Fipronil SC</td>
<td>30 g a.i.</td>
<td>4.62(12.35)</td>
<td>3.61(10.98)</td>
</tr>
<tr>
<td>4.</td>
<td>Imidacloprid 17.8 SL</td>
<td>25 g a.i.</td>
<td>5.04(12.95)</td>
<td>4.94(12.81)</td>
</tr>
<tr>
<td>5.</td>
<td>Lambda cyhalothrin 5 EC</td>
<td>25 g a.i.</td>
<td>4.89(12.81)</td>
<td>4.69(12.47)</td>
</tr>
<tr>
<td>6.</td>
<td>Cartap hydrochloride 50 SP</td>
<td>375 g a.i.</td>
<td>4.55(12.25)</td>
<td>4.39(12.13)</td>
</tr>
<tr>
<td>7.</td>
<td><em>Metarhizium anisopliae</em> WP</td>
<td>2000 g</td>
<td>5.74(13.80)</td>
<td>5.55(13.60)</td>
</tr>
<tr>
<td>8.</td>
<td><em>Bacillus thuringiensis</em></td>
<td>1000 g</td>
<td>5.75(13.87)</td>
<td>5.22(13.18)</td>
</tr>
<tr>
<td>9.</td>
<td>Untreated control</td>
<td>-</td>
<td>5.84(13.95)</td>
<td>6.44(14.67)</td>
</tr>
</tbody>
</table>

**Table 3: Bioefficacy of new insecticide molecules against yellow stem borer in rice (percent white ear heads) after third spray**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Insecticides</th>
<th>Dose/ha</th>
<th>% White earheads</th>
<th>% Decrease over control</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Flubendiamide 480 SC</td>
<td>30 g a.i.</td>
<td>4.81* (12.65)**</td>
<td>53.93</td>
</tr>
<tr>
<td>2.</td>
<td>Indoxacarb 14.5 SC</td>
<td>30 g a.i.</td>
<td>5.02(12.95)</td>
<td>51.92</td>
</tr>
<tr>
<td>3.</td>
<td>Fipronil SC</td>
<td>30 g a.i.</td>
<td>4.33(11.98)</td>
<td>58.53</td>
</tr>
<tr>
<td>4.</td>
<td>Imidacloprid 17.8 SL</td>
<td>25 g a.i.</td>
<td>7.78(16.25)</td>
<td>25.48</td>
</tr>
<tr>
<td>5.</td>
<td>Lambda cyhalothrin 5 EC</td>
<td>25 g a.i.</td>
<td>7.08(15.45)</td>
<td>32.19</td>
</tr>
<tr>
<td>6.</td>
<td>Cartap hydrochloride 50 SP</td>
<td>375 g a.i.</td>
<td>5.09(13.00)</td>
<td>51.25</td>
</tr>
<tr>
<td>7.</td>
<td><em>Metarhizium anisopliae</em> WP</td>
<td>2000 g</td>
<td>8.92(17.39)</td>
<td>23.04</td>
</tr>
<tr>
<td>8.</td>
<td><em>Bacillus thuringiensis</em></td>
<td>1000 g</td>
<td>8.23(16.64)</td>
<td>15.36</td>
</tr>
<tr>
<td>9.</td>
<td>Untreated control</td>
<td>-</td>
<td>10.45(18.86)</td>
<td>-</td>
</tr>
</tbody>
</table>

**Figures in parenthesis are arsine transformed values. *Mean of three replications**
over all other treatments in reducing the dead hearts to minimum level of 3.13 per cent. flubendiamide 480 SC stood second in order of effectiveness which recorded 3.39 per cent dead hearts. Treatment with indoxacarb 14.5 SC proved next effective treatment by recording 3.67 per cent dead hearts and found at par with cartap hydrochloride 50 SP which recorded 3.92 per cent dead hearts. Lambda cyhalothrin 5 EC and imidacloprid 17.8 SL recorded 4.10 and 4.40 per cent dead hearts respectively. The Bt and M. anisopliae proved least effective in which higher per cent of dead hearts of 4.76 and 5.06 were observed. The untreated control recorded 6.60 per cent dead hearts. (Table 2)

The cumulative effect of various insecticides after third spray revealed that fipronil 5 SC @ 30 g a.i./ha proved to be most effective against rice yellow stem borer recording lower percentage of shoot infestation. The next effective treatment was flubendiamide 480 SC @ 30 g a.i./ha followed by indoxacarb 14.5 SC @ 30 g a.i./ha, cartap hydrochloride 50 SP @ 375 g a.i./ha, lambda cyhalothrin 5 EC @ 25 g a.i./ha and imidacloprid 17.8 SL 25 g a.i./ha also showed better results against S. incertulas. Treatment with Bt and M. anisopliae found least effective against yellow stem borer of rice. (Table 3).

The finding of the investigation in respect of overall influence of insecticides on number of natural enemies in rice ecosystem based on mean population data revealed that the treatment with M. anisopliae (3.58) and Bt (3.35) proved to be safe to natural enemies. The synthetic insecticides viz., flubendiamide (3.27), fipronil (3.15), indoxacarb (3.11), imidacloprid (3.09), lambda cyhalothrin (2.83) and cartap hydrochloride (2.66) found moderately safe to natural enemies. (Table 4).

Among the new molecules of insecticides fipronil 5 SC found to be significantly superior in reducing the per cent dead hearts and white ear heads. These result are in agreement with Dash and Mukherjee (2003) who reported that fipronil 5 SC at 0.075 kg a.i./ha controlled the stem borer and was more effective than lambda cyhalothrin. New chemical molecules were evaluated by Hugar et al. (2007) for the management of S. incertulas and they reported that fipronil 0.3 G @ 7.5 g a.i./ ha found to be most effective insecticide and recorded 3.40 per cent and 2.59 per cent dead heart white earheads, respectively. The bioefficacy of new generation insecticide flubendiamide was also reported against stem borer by Rao et al. (2008). Takumi 20 WG proved to be the most effective treatment in reducing the stem borer population at 35 g a.i./ha and was found to be most effective treatment recording 89.67 per cent control over untreated check. . Mandal et al. (2013) was reported that indoxacarb found moderately toxic to Spilosoma oblique.

The result of the present study for effect of insecticides on natural enemies are in consonance with Sekh et al. (2007) who reported that flubendiamide 480 SC @ 24 and 30 gma.i./ha was soft to egg parasitoids of yellow stem borer and the per cent parasitisation in the treated plots was close to those of the untreated plots.

Similar results were also reported by Tohnishi et al. (2005) Kubendran et al. (2006) and Thilagam et al. (2006) as they found that flubendiamide was proved to be least toxic against beneficial arthropods.

**Table 4: Impact of new insecticide molecules on natural enemies**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Insecticides</th>
<th>Dose/ha</th>
<th>Natural Enemies/ 5 hills</th>
<th>Mean population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1DBS</td>
<td>0 DAS</td>
</tr>
<tr>
<td>1.</td>
<td>Flubendiamide 480 SC</td>
<td>30 g a.i.</td>
<td>4.83(2.31)**</td>
<td>4.79(2.30)</td>
</tr>
<tr>
<td>2.</td>
<td>Indoxacarb 14.5 SC</td>
<td>30 g a.i.</td>
<td>4.47(2.23)</td>
<td>4.56(2.25)</td>
</tr>
<tr>
<td>3.</td>
<td>Fipronil 55C</td>
<td>30 g a.i.</td>
<td>4.74(2.29)</td>
<td>4.74(2.29)</td>
</tr>
<tr>
<td>4.</td>
<td>Imidacloprid 17.8 SL</td>
<td>25 g a.i.</td>
<td>4.25(2.18)</td>
<td>4.56(2.25)</td>
</tr>
<tr>
<td>5.</td>
<td>Lambda cyhalothrin 5 EC</td>
<td>25 g a.i.</td>
<td>4.65(2.27)</td>
<td>4.52(2.24)</td>
</tr>
<tr>
<td>6.</td>
<td>Cartap hydrochloride 50 SP</td>
<td>375 g a.i.</td>
<td>4.38(2.21)</td>
<td>4.34(2.20)</td>
</tr>
<tr>
<td>7.</td>
<td>Metarhizium anisopliae WP</td>
<td>2000 g</td>
<td>4.93(2.33)</td>
<td>4.93(2.33)</td>
</tr>
<tr>
<td>8.</td>
<td>Bacillus thuringiensis</td>
<td>1000 g</td>
<td>4.61(2.26)</td>
<td>4.79(2.30)</td>
</tr>
<tr>
<td>9.</td>
<td>Untreated control -</td>
<td></td>
<td>5.65(2.47)</td>
<td>5.95(2.54)</td>
</tr>
<tr>
<td></td>
<td>S.E.</td>
<td></td>
<td>N.S</td>
<td>N.S</td>
</tr>
<tr>
<td></td>
<td>C.D. @ 5%</td>
<td></td>
<td>N.S</td>
<td>N.S</td>
</tr>
</tbody>
</table>

**Articles**


Rao, B. S., Mallikarjunappa, S., Bhat, G. and Koneripalli, N. 2008. Bioefficacy of new generation insecticide Takumi 20 WG against rice...


