COMPARISON OF NEW CHEMISTRY AND CONVENTIONAL INSECTICIDES AGAINST HELICOVERPA ARMIGERA ON SUNFLOWER (HELIANTHUS ANNUUS)

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ABSTRACT

A field experiment was conducted during kharif 2010 and 2011 at Oilseeds Research Institute, AARI, Faisalabad, Pakistan to find out and compare the efficacy of new chemistry (emamectin benzoate, spinosad) and conventional insecticides (bifenthrin, chlorpyriphos, profenophos) against Helicoverpa armigera (Hubner) on sunflower hybrid FH-385. The emamectin benzoate and spinosad proved to be highly effective against H. armigera. After 72 hours of treatment emamectin benzoate showed 95.93% and 93.75%, while, spinosad showed 93.02% and 91.04% mortality in 2010 and 2011, respectively. Whereas, the conventional insecticides i.e. bifenthrin and profenophos showed lesser mortality. Moderately effective response was observed for chlorpyriphos. The new chemistry insecticides have proven better in controlling H. armigera as compared to the conventional ones.

KEYWORDS: Helianthus annuus; sunflower; Helicoverpa armigera; head moth; new chemistry insecticides; Emamectin Benzoate; Spinosad; Pakistan.

INTRODUCTION

Sunflower, Helianthus annuus var. Macaropus; family Asteraceae is a non-traditional oilseed crop successfully grown under different climatic conditions of Pakistan. It has great prospective to reduce the gap between the production and consumption of edible oil (6). Its area is 300,614 hectares in Pakistan and production is 404,391 tons (1). Area and production of sunflower has been increasing since 1960 (4) but per unit productivity is lower than the potential level. Low production is mainly due to threat of pests, seed, marketing problems and post harvest losses as reported by Shah et al. (15).

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Insect pests of sunflower include whitefly, aphids, jassids, sunflower head moth and surface grass hopper (14). Helicoverpa armigera (Noctuidae; Lepidoptera) is a polyphagous insect and a key pest of sunflower. It causes 20-25% yield losses; sometimes the losses go up to 40-70% in severe conditions (10). The larvae feed on leaves, buds and flowers for a short period of time, make a hole in the disc and developing seeds. Sometimes larvae make tunnels over there. After attacking seeds in one head the larvae move to next head, causing losses to the crop. Ranasingh and Mahalik (10) reported that third and fourth instar larvae are more harmful than younger ones. Control of this pest is usually attained by insecticides.

H. armigera of cotton ecosystem, has been a target for more than 75% of insecticides (3). This intense selection pressure led to the development of resistance in H. armigera. It has developed resistance to all the major conventional groups of insecticides (carbamates and organophosphates) as reported by Kranthi et al. (8) and pyrethroids by Arora et al. (2). Conventional insecticides are harmful to the beneficial insects, so it has become necessary to use such insecticides which are ecologically safe for natural enemies. New chemical insecticides are safe for natural enemies of both predators (9) and parasitoids (17). The objective of present experiment was to compare the efficacy of new chemistry with conventional insecticides against head moth larvae of H. armigera on sunflower.

**MATERIALS AND METHODS**

A field experiment was conducted during kharif 2010 and 2011 at Oilseeds Research Institute, AARI, Faisalabad, Pakistan. The experiment was laid out in RCBD with three replications. The plot size was 4.6 m x 1.5 m with row spacing of 75 cm. The sunflower hybrid FH-385, was used for this study. Standard agronomic practices were followed throughout the growing season in all the plots equally.

The treatments were applied using lever operated knapsack sprayer when the head moth larvae population reached the economic threshold level i.e. 1.0 larva/head naturally (Table 1). A control plot was also maintained with no insecticidal application. Five plants were tagged randomly from each treatment including control plot. The pre-treatment data was recorded from the tagged plants. Data regarding mortality of pest recorded at 24, 48 and 72 hours after application of insecticides, by counting the number of head moth larvae from each of the tagged plants.

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Table 1. Detail of different treatments used against *Helicoverpa armigera*.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Trade Name</th>
<th>Source</th>
<th>Formulation</th>
<th>Dose/acre*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emamectin benzoate</td>
<td>Proclaim</td>
<td>Syngenta Pakistan</td>
<td>1.9 EC</td>
<td>200 ml</td>
</tr>
<tr>
<td>Bifenthrin</td>
<td>Talstar</td>
<td>FMC (Pvt.) Ltd.</td>
<td>10 EC</td>
<td>250 ml</td>
</tr>
<tr>
<td>Chlorpyriphos</td>
<td>Larsban</td>
<td>Arysta Life Sciences</td>
<td>40 EC</td>
<td>1000 ml</td>
</tr>
<tr>
<td>Profenophos</td>
<td>Curacron</td>
<td>Syngenta Pakistan</td>
<td>50 EC</td>
<td>1000 ml</td>
</tr>
<tr>
<td>Spinosad</td>
<td>Tracer</td>
<td>Dow Agro. Sciences</td>
<td>240 SC</td>
<td>100 ml</td>
</tr>
</tbody>
</table>

*1 acre = 4047m²

The percentage mortality was calculated by using following formula.

$$ \text{Mortality} \% = \frac{\text{Pre treatment population} - \text{Post treatment population}}{\text{Pre treatment population}} \times 100 $$

Analysis was done by subjecting the data to the analysis of variance (ANOVA) and DMRT at $\alpha=0.05$.

**RESULTS AND DISCUSSION**

All the treatments showed higher mortalities as compared to control. The highest mortality was observed in treatments with emamectin benzoate 1.93 EC (86.17 to 95.93%) and spinosad 240 SC (84.49 to 93.02%) in 2010. Chlorpyriphos 40 EC (75.20 to 81.60%), bifenthrin 10 EC (85.03 to 88.97%) and profenophos 50 EC (73.63 to 77.31%) showed relatively less mortality. The population of *H. armigera* increased in control and the mortality trend remained negative (Table 2). The percentage mortality increased with the increase in time after treatment. The highest mortality was observed after 72 hours of treatment.

In 2011 similar results were observed. Emamectin benzoate 1.9 EC (82.81 to 93.75%) and spinosad 240 SC (82.09 to 91.04%) showing higher mortality percentage followed by chlorpyriphos 40 EC (72.31 to 79.23%). Whereas, profenophos 50 EC (70.16 to 75%) and bifenthrin 10 EC (69.58 to 72.18%) caused relatively less mortality of the pest.

Results of emamectin benzoate 1.9 EC are in accordance with Sahito *et al.* (13) and Razzaq *et al.* (12). Spinosad 240 SC also produced the similar results as reported by Randhawa *et al.* (11) and Khan *et al.* (7). Chlorpyriphos 40 EC proved to be moderately effective (16). Over all the new chemistry insecticides like emamectin benzoate 1.93 EC and spinosad 240 SC proved to be more effective as compared to the conventional insecticides (bifenthrin 10 EC, profenophos 50 EC and chlorpyriphos 40 EC). These results are in accordance with that of Razzaq *et al.* (12).

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Table 2. Percentage mortality of larva *H. armigera* when treated with insecticides on sunflower in 2010 and 2011.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Mortality (%)</th>
<th>After 24 h</th>
<th>After 48 h</th>
<th>After 72 h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>During 2010</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emamectin benzoate 1.93 EC @ 200ml/acre</td>
<td>86.17±1.7084a</td>
<td>94.30±1.7084a</td>
<td>95.93±1.7084a</td>
<td></td>
</tr>
<tr>
<td>Profenofos 50 EC @ 1000ml/acre</td>
<td>73.10±0.9263b</td>
<td>75.63±0.9263c</td>
<td>77.31±0.9263c</td>
<td></td>
</tr>
<tr>
<td>Bifenthrin 10 EC @ 250ml/acre</td>
<td>85.03±0.7180a</td>
<td>88.18±0.7180b</td>
<td>88.97±0.7180b</td>
<td></td>
</tr>
<tr>
<td>Chlorpyriphos 40 EC @ 1000ml/acre</td>
<td>75.20±1.0642b</td>
<td>79.20±1.0642c</td>
<td>81.60±1.0642c</td>
<td></td>
</tr>
<tr>
<td>Spinosad 240 SC @ 100ml/acre</td>
<td>84.49±1.3926a</td>
<td>91.47±1.3926a</td>
<td>93.02±1.3926a</td>
<td></td>
</tr>
<tr>
<td>Control (Unsprayed)</td>
<td>-1.27±0.0140c</td>
<td>-1.33±0.0140d</td>
<td>1.40±0.0140d</td>
<td></td>
</tr>
<tr>
<td><strong>During 2011</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emamectin benzoate 1.93 EC @ 200ml/acre</td>
<td>82.81±1.6765a</td>
<td>91.41±1.6765a</td>
<td>93.75±1.6765a</td>
<td></td>
</tr>
<tr>
<td>Profenofos 50 EC @ 1000ml/acre</td>
<td>70.16±0.7447c</td>
<td>73.39±0.7447d</td>
<td>75.00±0.7447d</td>
<td></td>
</tr>
<tr>
<td>Bifenthrin 10 EC @ 250ml/acre</td>
<td>69.58±0.4386c</td>
<td>71.02±0.4386e</td>
<td>72.18±0.4386e</td>
<td></td>
</tr>
<tr>
<td>Chlorpyriphos 40 EC @ 1000ml/acre</td>
<td>72.31±1.0374b</td>
<td>76.92±1.0374c</td>
<td>79.23±1.0374c</td>
<td></td>
</tr>
<tr>
<td>Spinosad 240 SC @ 100ml/acre</td>
<td>82.09±1.3962a</td>
<td>89.55±1.3962b</td>
<td>91.04±1.3962b</td>
<td></td>
</tr>
<tr>
<td>Control (Unsprayed)</td>
<td>-1.34±0.0437d</td>
<td>-1.40±0.0437f</td>
<td>-1.48±0.0437f</td>
<td></td>
</tr>
</tbody>
</table>

These results indicate that the efficacy of emamectin benzoate may be due to its unique property of penetrating the leaf tissue by translaminar movements (5) which paralysis the Lepidopterous larvae and stops them feeding within hours of ingestion, causing mortality in 2-3 days. Since both of these products i.e. emamectin benzoate 1.93 EC and spinosad 240 SC have been extracted through fermentation of natural soil bacteria, therefore, the resistance of pests have not been reported against these products. This property makes these pesticides distinct and provides them an edge over the conventional ones. Moreover, new chemical group of insecticides are safer to the natural enemies of both predators and parasitoids (9, 17).

REFERENCES


*J. Agric. Res., 2014, 52(4)*
Comparison of new chemistry insecticides against H. armigera