Effect of some Host Plants on Susceptibility of American Bollworm, *Helicoverpa armigera* (Hübner) for some Insecticides

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ABSTRACT

Effect of host plants pea, okra and lettuce on the efficacy of emamectin benzoate SC 1.5% + indoxacarb EC 7.5% (Penny), Thiomethoxam WG25% (Actara) and lufenuron EC 5% (Match) against the 1st instar larvae of *Helicoverpa armigera* (Hübner) were studied under laboratory conditions. Results showed that the larvae fed on pea treated with penny were more susceptible followed by okra, lettuce and finally diet. The LC₅₀ values were 0.032, 0.040, 0.072 and 0.274 ppm, respectively. While, the larvae fed on pea treated with Actara was most susceptible followed by okra, lettuce and diet. The LC₅₀ values were 0.074, 0.571, 1.951 and 6.010 ppm, respectively. In case of Match, the larvae fed on okra was most susceptibility and the LC₅₀ values were 0.068 ppm. The order of relative toxicity of different insecticides against *H. armigera* was maximum in larvae fed on lettuce (27.094), diet (21.934), okra (14.275) and pea (2.813) with Penny, respectively. The larvae fed on treated lettuce with three insecticides was less susceptibility than other two host plants. The used host plants were affected the susceptibility of 1st instar larvae of *H. armigera* against different insecticides.

Keywords: *Helicoverpa armigera*, host plants, susceptibility, emamectin benzoate, indoxacarb, thiomethoxam, lufenuron

INTRODUCTION

The cotton bollworm, *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae), is a highly destructive polyphagous pest causing severe loss to many economically important crops, such as cotton, maize, tobacco, pigeonpea, chickpea, soybean, okra and tomato (Talekar et al. 2006). Effect of different hosts viz. cotton, pigeonpea and chickpea of *H. armigera* on the induction of carboxylesterase and cytochrome p-450 enzymes were studied. The variability in toxicity was observed, and the strain reared on pigeonpea showed tolerance against indoxacarb, spinosad and emamectin benzoate, whereas, strain reared on pigeonpea showed higher LC₅₀ for lambdacyhalothrin. Larvae fed on cotton was found to be comparatively susceptible Ugale et al. (2011). Indoxacarb and spinosad were most toxic against *S. littoralis* reared on castor and soybean host plants, followed by emamectin benzoate on soybean and castor Deshmukh et al. (2016). Imidaclopride and thiamethoxam in particular very high relative toxicity values indicating less stomach to *S. littoralis* as compared to indoxacarb and methomyl Ramanagouda and Srivastava (2009). Relative toxicity after 24 h of exposure the 3rd instar larvae of *S. littoralis* was indoxacarb > novaluron > lufenuron > methoxyfenozide Ghosh et al. (2008). Spinosad showed variable degree of toxicity against 4th instar larvae of *S. littoralis* when different host plants were used feeding Mohamed et al. (2015). LC₅₀ values for emamectin benzoate was 2.783 and 1.656 ppm against the second larval instar of *S. littoralis* and first larval instar of *Pectinophora gossypiella*, respectively. Charmillot et al. 2007. The efficiency of Abamectin for dipping technique was attained 24 h after the 4th larval instar of the American bollworm *H. armigera* was LC₅₀ , LC₉₀ and slope 93.51 , 236.71 and 2.08, respectively Adly (2015).

The aim of this work is to study the effect of some host plants on susceptibility of some insecticides against *H. armigera*

MATERIALS AND METHODS

1-Laboratory rearing of *H. armigera*:

The full grown larvae were collected from Pea plants during November and December. The larvae were transferred to the laboratory, the newly hatched larvae of the American bollworm were obtained from the mass rearing culture of Bollworms Research Department, Plant Protection Research Institute, (Sharkia, Branch). The larvae were reared on artificial diet described previously by Amer (2015) in glass tubes individually in the laboratory under constant conditions at 26± 1°C and 70± 5 % RH. The emergence moths were reared as five pears in glass cage (male and female). Larvae were reared for one generation on different host plants lettuce, okra , pea and diet. Commercially available insecticide formulations of Penny, Actara and Match were used in the present study for toxicity assay against 1st instar larvae of *H. armigera*.

2-Insecticides used:

<table>
<thead>
<tr>
<th>Common name</th>
<th>Trade name</th>
<th>Formulation and % a.i.</th>
<th>Rate /Feddan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emamectin benzoate+</td>
<td>Penny</td>
<td>SC1.5+EC7.5</td>
<td>150ml</td>
</tr>
<tr>
<td>Indoxacarb</td>
<td></td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Thiomethoxam</td>
<td>Actara</td>
<td>WG -25%</td>
<td>160ml</td>
</tr>
<tr>
<td>Lufenuron</td>
<td>Mach</td>
<td>EC 5 %</td>
<td>120ml</td>
</tr>
</tbody>
</table>

3-Insect Bioassays:

Three host plants Lettuce, (*Lactuca sativa*), Okra, (*Abelmoschus esculentus *) and Pea (*Pisum sativum*) were collected from non-treated fields with pesticides and washed to remove any impurities by water. A series of concentrations of each tested pesticide were prepared as follows: 1.054, 0.263 0.065 and 0.016 ppm for Penny & 12.500, 3.125, 0.781, and 0.195 for Actara & 0.468, 0.117, 0.029 and 0.014 ppm for Match. Immersing centuries pea plants, fruits of Okra and leaf of lettuce in the previous concentrations for 10 seconds and one ml from each concentration were spread on the surface of the diet. The treated host plants and diet were left to dry in the laboratory atmosphere. 25 newly hatched larval of *H. armigera* were transferred to each treated host plants and diet and repeated three times. The treatments were investigated after 24 h of treatment. Numbers of live and dead larvae were recorded.

Data analysis the toxicity values were estimated slope, LC₅₀ and LC₉₀ were calculated by Finney (1971).
The toxicity index and relative toxicity of different insecticides to *H. armigera* larva reared on each host plants was calculated by taking the LC₅₀ of insecticides by using sun’s equation (1950) as follows:

\[
\text{Toxicity index} = \frac{\text{LC}_{50} \text{ of the most effective compound}}{\text{LC}_{50} \text{ of the other tested compound}} \times 100
\]

Relative toxicity (fold) = \[
\frac{\text{LC}_{50} \text{ value of less toxic compound}}{\text{LC}_{50} \text{ value of more toxic compound}}
\]

**RESULTS AND DISCUSSION**

Toxicity studies:
**Influence of host plants on toxicity of some insecticides against 1st instar larvae of *H. armigera***

Results in Tables (2 and 3) were represented on the effect of selected host plants on toxicity of some insecticides. The toxicity of insecticides against 1st instar larvae of the most effective compound was Penny (100.00) on all host plants and diet followed by Match and Actara, respectively. Penny showed variable degree of toxicity against 1st instar larvae of *S. littoralis* when fed on host plants (cotton, castor, lablab, maize and okra) Mohamed et al. (2015).

**Table 2.** LC₅₀, LC₉₀ and slope values of Penny, Actara and Match insecticides on 1st instar larvae of *H. armigera* fed on treated host plants and diet for 24 h.

<table>
<thead>
<tr>
<th>Insecticides</th>
<th>Hosts and diet</th>
<th>LC₅₀</th>
<th>LC₉₀</th>
<th>Slope±SE</th>
<th>X²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penny</td>
<td>Lettuce</td>
<td>0.072</td>
<td>5.444</td>
<td>0.68±0.073</td>
<td>4.366</td>
</tr>
<tr>
<td></td>
<td>Okra</td>
<td>0.040</td>
<td>1.729</td>
<td>0.78±0.104</td>
<td>1.485</td>
</tr>
<tr>
<td></td>
<td>Pea</td>
<td>0.032</td>
<td>3.395</td>
<td>0.63±0.101</td>
<td>0.787</td>
</tr>
<tr>
<td></td>
<td>Diet</td>
<td>0.274</td>
<td>2650.077</td>
<td>0.32±0.094</td>
<td>0.984</td>
</tr>
<tr>
<td>Actara</td>
<td>Lettuce</td>
<td>1.951</td>
<td>57.877</td>
<td>0.86±0.103</td>
<td>0.499</td>
</tr>
<tr>
<td></td>
<td>Okra</td>
<td>0.571</td>
<td>60.586</td>
<td>0.63±0.100</td>
<td>0.768</td>
</tr>
<tr>
<td></td>
<td>Pea</td>
<td>0.074</td>
<td>229.057</td>
<td>0.36±0.070</td>
<td>1.631</td>
</tr>
<tr>
<td></td>
<td>Diet</td>
<td>6.010</td>
<td>8942.969</td>
<td>0.30±0.094</td>
<td>0.398</td>
</tr>
<tr>
<td>Match</td>
<td>Lettuce</td>
<td>0.095</td>
<td>5.375</td>
<td>0.73±0.114</td>
<td>1.555</td>
</tr>
<tr>
<td></td>
<td>Okra</td>
<td>0.068</td>
<td>2.266</td>
<td>0.84±0.116</td>
<td>3.700</td>
</tr>
<tr>
<td></td>
<td>Pea</td>
<td>0.090</td>
<td>16.711</td>
<td>0.56±0.112</td>
<td>3.378</td>
</tr>
<tr>
<td></td>
<td>Diet</td>
<td>0.488</td>
<td>102.109</td>
<td>0.55±0.114</td>
<td>2.068</td>
</tr>
</tbody>
</table>

X² = Chi-square

**Toxicity index**

Data in Table (3) indicated that the most effective toxicant was Penny (100.00) on all host plants and diet followed by Match 75.789 and 58.824, 35.556 and 56.148% for the three host plants and diet, respectively. Toxicity index of Actara was the lowest compared with Penny and Match.

Generally, the host plants was effected the efficacy of insecticides against 1st instar larvae of *H. armigera*. According to LC₅₀ value, the high compound effects were as follows Penny and Actara on pea plant followed by Match on okra plant comparing with diet treatment. In case of the effect of three tested compounds as toxicant was Penny on the host plants and diet treatment followed by Match on lettuce and okra host plants, then Match on pea host plant as comparing with diet treatment.

Deshmukh et al. (2016) they reported Indoxacarb and spinosad were most toxic effect against *S. littoralis* reared on reared on soybean and castor host plants, followed by enamectin benzoate on soybean and castor. The efficiency of Abamectin for dipping technique was attained 24 h against the 4th larval instar of the American bollworm, *H. armigera* was LC₅₀, LC₉₀ and slope 93.51, 236.71 and 2.08, respectively Adly (2015). Spinosad showed variable degree of toxicity against 4th instar larvae of *S. littoralis* when fed on host plants
compound as compared to Actara compound on lettuce. Penny regarded 14,725 fold on okra plant, while the high fold was 2.813 with Penny compound on pea. While the lowest influence was 1.00 fold with Match on pea plant. Also, results showed the high fold record was 21.934 with Penny on diet treatment, but the lowest fold was 1.000 with Actara on diet treatment. The index of relative toxicity variation was maximum in the larvae fed on lettuce host plants (26.097) followed by diet (20.934), okra (13.275) and finally pea host plants (1.813).

Ugale et al. (2011) they stated that the variability in toxicity was observed, and the H. armigera reared on chickpea showed tolerance against indoxacarb, spinosad and emamectin benzoate, whereas, H.armigera larvae reared on pigeonpea showed higher LC50 value for lambdacyhalothrin. Also the larvae fed on cotton plant were found to be comparatively susceptible. Imidacloprid and thiamethoxam in particular very high relative toxicity values indicating less stomach to S. littura as compared to indoxacarb and methomyl Ramanagouda and Srivastava (2009). The relative toxicity for tested compounds were as follows: indoxacarb (93.93) > fibronil (5.41) > novaluron (1.48) > Lufenuron (1.03) > methoxyfenozide (1.00), respectively on 1st instar larvae of S. littura Ghosh et al. (2008).

Thus in the present finding there are differences in the relative toxicity of different insecticides, this because of host plants may be influenced on physiology of H. armigera showing differential susceptibility to insecticides. Deshmukh et al. (2016).

REFERENCES


Tأثير بعض العوامل البيئية على حساسية دودة اللوز الأمريكية لبعض المبيدات

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مهم بهوث وقافة النباتات- مركز البحث الزراعي- الدقي- جزيرة مصر

دراسة تأثير العوامل البيئية (البلدة والبيئة والخص) على حساسية العطر البري الأول لدوة اللوز الأمريكية لمبيدات إيمامكنين بنوؤات 1.5%+إيميكس كار (5% (비정) والثيوزإكس كار (25% (آتارا) في مزارع ريفية 5% (بيتي). أوضحنا النتائج أن الدراسة المعاملة بمبيد بيني كاستن الأعلى حساسية على يوازانت العطر البري الأول لدوة اللوز الأمريكية كبيبي بامية والخص وفي النهاية البيئة وكانت قيم الجرعات الحساسية القائمة (LC50) 0.32 - 0.90 - 0.77 - 27.40 جزء في الليمون على التوالي. بينما البراق في LC50 0.32 - 0.90 - 0.77 - 27.40، حيث كانت الكائنات أعلى حساسية بيبي بامية والخص والبيئة وكانت قيم LC50 هي 0.77 - 0.90 - 27.40 - 6.01 جزء في الليمون على التوالي. أما في حالة مبيد تينس البراق في كانت الكائنات أعلى حساسية كبيبي بامية والخص والبيئة وكانت قيم LC50 هي 0.77 - 0.90 - 27.40 - 6.01 جزء في الليمون.}

 masse de nombreuses substances chimiques Cette étude a montré que la sensibilité de la larve de Spodoptera littoralis à plusieurs insecticides peut être influence par les conditions environnementales. Les résultats montrent que la sensibilité à l'Abamectine est plus importante dans le sol aride. Les auteurs recommandent de continuer à étudier l'effet des conditions environnementales sur la sensibilité des insectes aux insecticides.