Efficacy of Neem and Pungam Based Botanical Pesticides on Sucking Pests of Cotton

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ABSTRACT

A field study was carried out to find out the effect of different botanical pesticides and a chemical pesticide on the sucking pests of cotton, Gossypium hirsutum. In situ count of leafhopper (Amrasca devastans) and aphids (Aphis gossypii) were made prior to the pesticide application and on 1st, 3rd, and 7th day after application of pesticides. Of the different botanicals used, neem seed kernel extract (5%) was found to be effective followed by Pongamia glabra seed kernel extract (5%), neem oil (3%) and Pongamia glabra oil (3%) against the sucking pests (Leafhopper and Aphids) of cotton. Maximum population reduction was noticed on the 3rd day after treatment.

Key words: Botanicals, Neem, Pongamia, Jassids, Aphids.

INTRODUCTION

Cotton, Gossypium hirsutum, a high value crop, occupies about 5% of the total area under cultivation in India and consumes more than 40% of the pesticides produced (Dhawan, 1998). This tendency of injudicious use of pesticides on cotton has culminated in pest outbreaks, development of resistance to insecticides by the insects and ultimately total crop failure. Cotton plant is ravaged by multitude of sucking pests and there is a constant change in pest scenario. Sucking pests like leafhopper (Amrasca devastans), aphid (Aphis gossypii), thrips (Thrips tabaci) and whiteflies (Bemisia tabaci) etc., are responsible for the major threat and destruction of cotton crop (Gahukar, 1997). Most of these insects have developed resistance to many of the conventional insecticides (Tanweer et al., 1998). Majority of the farmers came to realize the attack only after 10 to 15 days of pest emergence. At this stage, it becomes too late and difficult for the farmers to control the spread of sucking pests. In order to reduce the pest population and plant damage, several measures are available but due to easiness in application, availability and apparent results in pest mortality (knockdown and residual effects), farmers prefer to apply synthetic insecticides. The over reliance of pesticides with indiscriminate use has resulted in cropping out of many negative consequences, mainly the 3 ‘R’s Viz., Resurgence, Resistance and Residue aspects (Gupta, 1998). There are frequent reports of resurgence of sucking pests after the advent of synthetic pyrethroids (Ravindran and Xavier, 1997). The physiological changes in the plant system also favours the increased reproduction of insect pests. This inevitably leads to the implementation of integrated Pest Management (IPM).

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Utilization of botanical pesticides is one of the important and major component of cotton IPM. The botanical pesticides possess the advantages of a high degree of specificity for the target pest, no adverse effect on non-target and beneficial organisms or man, absence of pest resistance development and absence of residual build up in the environment (Khachatourians, 1986). Plant Products especially of neem were reported to be one of the best alternatives to synthetic insecticides (Pawar and Singh, 1993). Azadirachtin, the best known neem constituent is a potential antifeeding substance. The azadirachtin one of the major phagorepellents of neem seed has been isolated by Butterworth and Morgan (1968). Now-a-days the neem based pesticides gained an unusual importance commercially and environmentally. These products natural and formulated, are cheaper and easily available in local markets (Kausalya et al., 1997). Research published in the last two decades highlights the role of botanicals or phytochemicals in the control of agricultural pests under laboratory condition. However, the research on the utilization of pungam and neem products for the control of cotton pests under field conditions in India are scanty. Based on the above facts a field study was carried out to determine the comparative efficacy of non-edible oils like neem oil and pungam oil and seed kernel extracts of neem and pungam against sucking pests of cotton.

MATERIALS AND METHODS
Efficacy of the botanical pesticides neem (Azadirachta indica) and pungam (Pongamia glabra or Derris indica) against sucking pests of cotton – aphids (Aphis gossypii) and leafhopper (Amrasca devastans) under field condition was studied at Palaiyanoor village of Madurai district during rabi season in two acre. The experiment was conducted at the Department of Zoology, Thiagarajar College (Autonomous), Madurai, during 2003.

Botanical pesticide Used
3% Pungam oil
5% Pungam seed kernel extract
3% Neem oil
5% Neem seed kernel extract

Preparation of 3% Pungam oil/Neem oil emulsion
Pungam oil/Neem oil emulsion was prepared as per the procedure described by Gahukar (1996). 100 ml of soap oil was added to 100 litre of water which acts as sticker/spreader. 3 litre of pungam oil/neem oil purchased from the local market was added slowly and stirred well with a stick. This makes 3% pungam oil/neem oil emulsion and was sprayed on the cotton field using Hydraulic knapsack sprayer (100 litre spray fluid/acre).

Preparation of 5% Pungam seed kernel/Neem seed kernel extract
Aqueous extract of pungam seed kernel/neem seed kernel was prepared as per the procedure described by Gahukar (1996). The neem/pungam seeds were sun dried and made into powder by using mortar. Five Kg of the powder was soaked in clean and fresh water (10 litre) for overnight with occasional stirring. The extract was filtered through a fine clean muslin cloth and this preparation was repeated at least 3-4 times, so that the contents were fully extracted. Sufficient water was added to make its final volume to 100 litre. Soap oil was added to a final concentration of 0.1% which act as sticker/spreader. This makes 5% pungam seed kernel extract/neem seed kernel extract and was sprayed on the cotton field using Hydraulic knapsack sprayer (100 litre spray fluid / acre).

Chemical pesticide
Rogor 30, a broad spectrum Organophosphorus insecticide based on 0,0 – dimethy-S-(N-Methyl carbamoylmethyl) phosphorodithionate and balance inert ingredients (Rallis India Limited, Mumbai). It is highly effective against sucking pests on cotton. 2 ml of the pesticide was dissolved in 1 litre of water and sprayed on the cotton field using Hydraulic knapsack sprayer (100 litre spray fluid/acre).
Bio assay

A field experiment was carried out in randomized block design with four replications and plot size of 5x4m at Palaiyanoor village of Madurai district during the month of February. The cotton variety LRA-5166 was raised at a spacing of 75x30 cm.

The population of leafhopper and aphid was assessed on 10 randomly selected plants in each plot. Pesticide application and sucking pests count were made 60 days after sowing.

For the sucking pests, count was taken from the leaves, selected one each from top, middle and bottom of each plant. Both adults and nymphs were taken into consideration for counting the pests. Efficacy of the botanical pesticides on the sucking pests of cotton was determined on the first, third and seventh day after spray.

Statistical Analysis

Results obtained in the present study were subjected to statistical analysis viz., standard deviation, standard error and Analysis of variance (ANOVA).

RESULTS AND DISCUSSION

From the data presented in Table-1, it could be seen that, application of Rogor 30 caused 66.72 to 70.66% population reduction, where as it was 31.22 to 42.27% and 32.77 to 48.48% for Pongamia glabra seed kernel extract and neem seed kernel extract respectively. Regarding non-edible oils (NEO’S), Pongamia glabra oil effected least percent population reduction of leafhoppers.

Table 1 : Efficacy of different pesticides (botanical & chemical) against leafhopper (Amrasca devastans) on cotton (Mean value ± S.E).

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Concentration</th>
<th>Pretreatment</th>
<th>I DAT</th>
<th>III DAT</th>
<th>VII DAT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ml/lit</td>
<td>population</td>
<td>population %Reduction</td>
<td>Population</td>
<td>%Reduction</td>
</tr>
<tr>
<td>Pongamia glabra seed kernel extract</td>
<td>50.0</td>
<td>143.66±1.13</td>
<td>82.93±2.14</td>
<td>42.27</td>
<td>84.86±2.49</td>
</tr>
<tr>
<td>Neem seed kernel extract</td>
<td>50.0</td>
<td>145.66±1.52</td>
<td>81.58±1.72</td>
<td>43.99</td>
<td>75.04±1.38</td>
</tr>
<tr>
<td>Pongamia glabra oil 80 EC</td>
<td>3.0</td>
<td>139.00±1.45</td>
<td>89.64±2.56</td>
<td>35.51</td>
<td>83.41±1.26</td>
</tr>
<tr>
<td>Neem oil 80 EC</td>
<td>3.0</td>
<td>138.83±1.08</td>
<td>82.21±2.05</td>
<td>40.57</td>
<td>80.80±2.30</td>
</tr>
<tr>
<td>Rogor 30 EC</td>
<td>2.0</td>
<td>135.33±1.19</td>
<td>40.19±1.35</td>
<td>70.30</td>
<td>39.71±1.04</td>
</tr>
<tr>
<td>Control</td>
<td>-</td>
<td>162.66±1.78</td>
<td>168.33±3.64</td>
<td>0.00</td>
<td>175.00±2.98</td>
</tr>
</tbody>
</table>

(Abbreviation: DAT = Days after treatment, EC= Emulsifying concentration).

Table 2 : Efficacy of different pesticides (botanical & chemical) against Aphid (Aphis gossypii) on cotton (Mean value ± S.E).

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Concentration</th>
<th>Pretreatment</th>
<th>I DAT</th>
<th>III DAT</th>
<th>VII DAT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ml/lit</td>
<td>population</td>
<td>population %Reduction</td>
<td>Population</td>
<td>%Reduction</td>
</tr>
<tr>
<td>Pongamia glabra seed kernel extract</td>
<td>50.0</td>
<td>76.33±1.79</td>
<td>49.73±1.87</td>
<td>34.85</td>
<td>49.06±1.82</td>
</tr>
<tr>
<td>Neem seed kernel extract</td>
<td>50.0</td>
<td>82.00±2.03</td>
<td>53.09±2.56</td>
<td>35.26</td>
<td>52.22±1.73</td>
</tr>
<tr>
<td>Pongamia glabra oil 80 EC</td>
<td>3.0</td>
<td>73.33±1.82</td>
<td>54.74±1.69</td>
<td>25.35</td>
<td>40.58±2.67</td>
</tr>
<tr>
<td>Neem oil 80 EC</td>
<td>3.0</td>
<td>73.66±1.60</td>
<td>52.96±2.30</td>
<td>28.10</td>
<td>51.37±1.72</td>
</tr>
<tr>
<td>Rogor 80 EC</td>
<td>2.0</td>
<td>83.00±0.92</td>
<td>32.42±1.75</td>
<td>60.94</td>
<td>32.10±1.94</td>
</tr>
<tr>
<td>Control</td>
<td>-</td>
<td>79.66±2.40</td>
<td>91.66±2.45</td>
<td>0.00</td>
<td>96.66±3.53</td>
</tr>
</tbody>
</table>
The aphid population (Table-2) per 10 plants prior to imposing the treatments ranged from 73.33 to 83.00%. The effectiveness of the Pongamia glabra seed kernel extract varied between 34.66 to 35.72% and neem seed kernel extract varied between 33.77 to 36.32% in reducing the aphid population, where as 57.72 to 61.32% reduction was effected by Rogor 30. Among aphid population, Pongamia glabra oil recorded population reduction of 25.35%,  28.35% and 24.36% in the I, III and VII day respectively. Similarly neem oil reduced aphid population by 28.10%, 30.26% and 27.21% in the I, III and VII day respectively. Among the non-edible oils (NEO’S) and seed kernel extracts, neem oil and neem seed kernel extract were found to be more effective against the sucking pests of cotton. Possession of anti-feedent property by neem and pungam leaf was proved earlier by several workers (Chocklingam et al., 1983 and Devakumar et al., 1986).

The results obtained in this study revealed that maximum population reduction of all the sucking pests tested was seen on the third day after spray. Patel et al., (1986) reported moderate efficacy of neem products against the cotton whitefly, Bemisia tabaci. Though different botanical pesticides used were less effective, they are safer and less costly alternatives to chemical control. Similar results were reported by many earlier workers (Mastoli et al., 1995; Hofte, 1999). Thus utilization of botanical pesticides possess the advantages of reducing the pollution burden of the environment occurring due to toxic pesticides and also protect the beneficial fauna and biodiversity in the cotton agro-ecosystem.

All the different pesticides used in this study reduced the sucking pests population significantly at both 1% and 5% level.

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**REFERENCES**


