INVESTIGATING LETHAL EFFECT OF DIFFERENT BOTANICALS AGAINST OXYCARENUS LAETUS KIRBY UNDER LABORATORY CONDITIONS

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ABSTRACT

For last few years, dusky cotton bug, Oxyacrenus laetus (Hemiptera: Lygaeidae) has become an emerging pest of cotton crop production in Pakistan. Onset of insecticidal resistance demands the use the alternate approaches for the control of O. laetus. Plant-based botanicals have the potential to suppress O. laetus at different concentrations. The findings of present study showed that highest mortality (53.13%, 70.83% and 96.91%) of O. laetus was recorded at 1.5%, 2.5% and 5% concentrations after 72h of treatment with N. tabacum. However, O. sanctum harbored lowest mortality (38.10%, 37.50% and 52.91%) at all tested concentrations. Consequently, Nicotiana tabacum was proved as exhibiting competent insecticidal properties for the control of O. laetus.

Keywords: Dusky cotton bug, Oxyacrenus laetus, Botanicals, Concentrations

INTRODUCTION

Cotton (Gossypium hirsutum L.), the king of natural fibres is known as white gold [1] and important cash crop worldwide [2]. Pakistan stands fourth in ranking among top cotton producing countries after China, India and USA [3]. It drives the economy of Pakistan as a backbone, provides raw material for textile mills, fiber as export items, edible oil and food of animals [4]. Cotton is grown in larger area of Pakistan after wheat and contributes 1.0% in GDP and around 5.1% in agriculture [5]. The production was reduced up to 27.83% with 10.1 million cotton bales during the year 2015-16 as compared to previous year’s (13.96 million bales production) [5]. Annual production of cotton is below its potential due to shortage of water, improper application of fertilizer, weeds, diseases and insect pests [6, 7]. The losses are recorded 30-40% due the activity of different insect pests [8, 9].

Dusky cotton bug Oxyacrenus laetus (Hemiptera: Lygaeidae) has become an economic insect pest of cotton crop with worldwide spread. It results in reduced cotton seed germination, weight loss and oil quality [10], staining of the lint during ginning process. Both quality and quantity of cotton is compromised due to the attack of O. laetus [11, 12]. In case of severe attack, O. laetus adult produce unpleasant odor in cotton, as a result seed quality is affected [13, 14]. It remains present on different host plants other than cotton and okra [15] and cause damage to guava, mango, lemon, moringa, chillies [16]. With 6-7 generations per year under field conditions, it generally completes its life cycle in 33 to 49 d [17, 18]. Female prefer young bolls for egg laying [19, 20] and may lay up to 110 eggs in whole life cycle. It may damage 96% cotton bolls towards the end season of cotton season causing economic losses [21, 22].

Farmers generally rely on chemical, cultural and biological approaches with chemical control as preferred choice [23]. However, pesticides are loudly criticized for the past years for their environmental and health concerns [24, 25]. outbreak of secondary pests [26]. Botanicals are very effective agent for insect pest management [27] because of their non-toxic nature and biodegradability [28]. Most of the plants has been reported for their insecticidal properties including Azadirachta indica, Cassia fistula, Chrysanthemum coronarium, Lantana camara, Calotropis procera, Marruga koenigii and Punica granatun [29].

Considering the importance of eco-friendly approaches for the control of insect pests, the present research was conducted to evaluate efficacy of different natural plant extracts against O. laetus under the laboratory conditions.

MATERIALS AND METHODS

Rearing of Oxyacrenus laetus

The Adult of the O. laetus used in the present research were collected from cotton field from Multan during 2017 and reared in Insect Rearing Lab, Department of Entomology, MNS University of Agriculture, Multan. The adults were maintained on natural diet (Soaked cotton fuzzy seeds) in plastic cages (30×60×60 cm), closed with a hermetic cover provided with a hole plugged with a metallic mesh. Rearing conditions were maintained at 25±2 °C, and 65±5% R. H.
**Table 1: Source of botanicals used and herbivory response of *O. laetus***

<table>
<thead>
<tr>
<th>Botanicals</th>
<th>Plant part used</th>
<th>Preference/Non-preference for <em>O. laetus</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Azadirachta indica</em></td>
<td>Leaves</td>
<td>Repellent in action</td>
</tr>
<tr>
<td><em>Tagetes marigolds</em></td>
<td>Flowers</td>
<td>Non-preferred for feeding</td>
</tr>
<tr>
<td><em>Eucalyptus camaldulensis</em></td>
<td>Leaves</td>
<td>Repellent in action</td>
</tr>
<tr>
<td><em>Nicotiana tabacum</em></td>
<td>Leaves</td>
<td>Non-preferred for feeding</td>
</tr>
<tr>
<td><em>Ocimum sanctum</em></td>
<td>Leaves</td>
<td>Non-preferred for feeding</td>
</tr>
</tbody>
</table>

**Preparation of botanical mixtures**

Five different botanicals *Azadirachta indica*, *Eucalyptus camaldulensis*, *Nicotiana tabacum*, *Ocimum basilicum* and *Tagetes arigolds* were tested against the *O. laetus* (Table 1). Specific plants parts were shade dried for 15-20 d and dried samples were ground with grinder (Anex AG-639). The botanical powder of 50 g was mixed in 1 liter of distilled water to make up a 5% concentration. Serial dilutions (1.5% and 2.5%) were made from stock solution.

**Bioassays**

Insecticidal properties of five botanicals were tested against adult *O. laetus*. The cotton leaves were dipped in botanical solutions for 10 min and dried for one hour on filter paper. Twenty five adults *O. laetus* were transferred in each petri dish and provided with treated leaves. For control, adults were released on leaves treated with distilled water only. The entire experiment was repeated twice with four replications. Mortality was recorded at 24 h, 48 h and 72 h after application.

**Statistical analysis**

Mortality of adults were corrected using Abbott’s formula [30]. The percent mortality data was subjected to analysis of variance in Analytical software, “Statistix v8.1 [31] and the means were separated by Tukey’s HSD test at α=5 [32].

**RESULTS AND DISCUSSION**

Five different plants extract were tested at three concentrations (@ 1.5%, 2.5% and 5%) against *O. laetus* under laboratory conditions. A dose dependent increase in mortality was observed for all tested botanicals with significant results (Table 2). Highest mortality (96.91% and 85.70%) was observed in *O. laetus* at 5% concentration after 72 h of treatments with *N. tabacum* and *A. indica*, while *O. sanctum* caused lowest mortality (52.91%) (Table 3).

Similar trend was recorded for all botanicals at 24h and 48h at 1.5% and 2.5% concentration. Among all tested botanicals, *N. tabacum* extract at 5% was found superior in insecticidal action against *O. laetus*. While choosing for suitable management agent, one should consider the time of kill, route of action and level of mortality encountered and safety to non-target insects and environment. Generally, the bio-pesticides applications are smooth, safe and effective approach for the control of different insect pests as well as there are no harmful effects on human life. Many plants contain different chemical substance such as, alkaloids, terpenoids and phenolics that may be helpful for plants to protect against insect pests [33]. Hence, the research was carried out to examine the efficacy of different plant based products against the *O. laetus*.

In light of the present investigations, our finding helps to conclude that *N. tabacum* and *A. indica* are better choice in managing *O. laetus*. The *A. indica* gave>83% mortality at high (5%) concentrations. However, the *N. tabacum* showed highest mortality at different concentrations. The cumulative mortality was recorded maximum (>96%) at 72h after treatments with 5% concentration. *N. tabacum* might have some insecticidal properties which suppress the *O. laetus* populations under laboratory conditions. Our results agreed with [18] who reported that *N. tabacum* possess sufficient insecticidal properties against *O. laetus*, which is dependent on applied concentration. Similar results were also documented by [34] who examined larvicidal effects of *Moringa oleifera*, *Annona squamosal* and *E. globulus*. According to [35] observation *Sitophilus zeamais* adult mortality was 100% on maize with *N. tabacum* powder application. *N. tabacum* leaf powder tested against *Tribolium castaneum* gave 100% mortality after 7 d of treatment [36]. Another researcher tested *Aqueous leaf extract of N. tabacum* against *Callosobrachus maculatus* which showed some insecticidal effects [37].

**Table 2: Factorial analysis of variance for mortality of *O. laetus* treated different botanicals at 24h, 48h and 72h after application**

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>DF</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replication</td>
<td>3</td>
<td>244.98</td>
<td>0.0000</td>
</tr>
<tr>
<td>Concentration</td>
<td>2</td>
<td>214.66</td>
<td>0.0000</td>
</tr>
<tr>
<td>Treatment</td>
<td>5</td>
<td>286.12</td>
<td>0.0000</td>
</tr>
<tr>
<td>Interval</td>
<td>2</td>
<td>16.58</td>
<td>0.0000</td>
</tr>
<tr>
<td>Concentration x Treatment</td>
<td>10</td>
<td>10.45</td>
<td>0.0000</td>
</tr>
<tr>
<td>Concentration x Interval</td>
<td>4</td>
<td>9.64</td>
<td>0.0000</td>
</tr>
<tr>
<td>Treatment x Interval</td>
<td>10</td>
<td>0.45</td>
<td>0.0000</td>
</tr>
<tr>
<td>Concentration x Treatment x Interval</td>
<td>20</td>
<td>244.98</td>
<td>0.9795</td>
</tr>
<tr>
<td>Error</td>
<td>159</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>215</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Our findings suggest that use of all plant extracts especially *N. tabacum, A. indica* as they have been found to be very effective bio-pesticides against the insect pests. Similar results were found by [38] who reported that *N. tabacum* extract caused maximum mortality (98.60%) of mealy bug, *A. indica* was gave effective results after *N. tabacum* causing 89.32% mortality. Although, *N. tabacum* provided highest mortality as compared to other botanicals. Biopesticides are eco-friendly, safe for humans and environments as compared to synthetic insecticides. Owing to hazardous problems in nature, synthetic insecticides cannot be preferred over safe alternates [39,40]. Future belongs to organic farming and eco-friendly options like plant based botanicals would be a wise choice by farmers.

**CONCLUSION**

Botanicals are environment friendly choice with sufficient insecticidal properties to offer a comprehensive control of *O. laetus* in cotton. It is helpful and promising approach in integrated pest management and reduce the risk of exposing pest's natural enemies to chemicals.

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**REFERENCES**