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REGULAR ARTICLE

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, *Oxycarenus laetus* (Hemiptera: Lygaeidae) has become an emerging pest of cotton crop threatening cotton 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. leatus* 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: Duksy cotton bug, *Oxycarenus 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 *Oxycarenus 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*, *Murraya koenigii* and *Punica granatum* [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 *Oxycarenus 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.

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Table 1: Source of botanicals used and herbivory response of *O. laetus*

Botanicals	Plant part used	Preference/Non-preference for *O. laetus*
Azadirachta indica	Leaves	Repellent in action
Tagetes marigolds	Flowers	Non-preferred for feeding
Eucalyptus camaldulensis	Leaves	Repellent in action
Nicotiana tabacum	Leaves	Repellent in action
Ocimum sanctum	Leaves	Non-preferred for feeding

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 botanicals 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 pets 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 the *Tribolium castaneum* gave 100% mortality after 7 d of treatment [36]. Another researcher tested Aqueous leaf extract of *N. tabacum* against *Callosobruchus maculatus* which showed some insecticidal effects [37].

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

Source of variation	DF	F	P
Replication	3	244.98	0.0000
Concentration	2	214.66	0.0000
Treatment	5	286.12	0.0000
Interval	2	16.58	0.0000
Concentration×Treatment	10	10.45	0.0000
Concentration×Interval	4	9.64	0.0000
Treatment×Interval	10	0.45	0.0000
Concentration×Treatment×Interval	20	244.98	0.9795
Error	159	-	-
Total	215	-	-

Table 3: Percent mortality (%±SE) of *O. laetus* at 24h, 48h and 72 h after application of plant based botanicals at 1.5, 2.5 and 5% concentrations

Treatment	Concentration	Mortality (±SE)		
		24 h	48 h	72 h
Azadirachta indica	1.5%	17.25±3.32 ab	29.54±1.65 ab	40.57±2.28 b
Tagetes marigolds		13.20±1.82 b	23.45±1.86 b	32.32±1.19 bc
Eucalyptus camaldulensis		11.20±0.96 b	21.33±2.81 b	27.97±3.07 c
Nicotiana tabacum		24.45±1.47 a	34.70±1.24 a	53.13±1.81 a
Ocimum sanctum		16.25±2.16 ab	22.37±2.40 b	28.10±3.47 c
Untreated		2.08±1.20 c	2.08±1.20 c	4.25±1.77 d
Azadirachta indica	2.5%	23.41±3.33 ab	35.66±4.29 ab	61.45±2.62 a
Tagetes marigolds		15.29±0.94 bc	27.54±1.86 b	46.87±3.55 a
Eucalyptus camaldulensis		13.20±2.44 c	26.41±3.99 b	40.62±3.94 b
Nicotiana tabacum		29.58±1.90 a	45.95±2.16 a	70.83±1.70 a
Ocimum sanctum		20.37±1.50 abc	28.50±3.10 b	37.50±1.70 b
Untreated		2.08±1.20 d	2.08±1.20 c	4.16±0.00 c
Azadirachta indica	5%	45.45±2.49 b	67.70±2.70 a	85.70±2.68 a
Tagetes marigolds		22.25±2.09 cd	41.37±2.80 b	62.20±2.11 b
Eucalyptus camaldulensis		18.16±1.06 d	40.41±4.34 b	56.25±3.69 b
Nicotiana tabacum		55.58±1.31 a	73.66±2.84 a	96.91±1.98 a
Ocimum sanctum		27.25±1.79 c	44.41±2.09 b	52.91±9.43 b
Untreated		1.04±1.04 e	1.04±1.04 c	2.08±1.20 c

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. Bio-pesticides are eco-friendly, safe for humans and environments as compared to synthetic insecticides. Owing to hazardous problems in nature, synthetic insects 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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