Laboratory Evaluation of Different Botanicals Against the Red Cotton Bug, *Dysdercus cingulatus* (Fabricius) and Cotton Mealy Bug, *Phenacoccus solenopsis* (Tinsley) in Okra

Uzma Manzoor, Masarrat Haseeb

Department of Plant Protection, Faculty of Agricultural Sciences, Aligarh Muslim University, Aligarh, India

Abstract: **The efficacy of some locally available botanicals against the 2nd instar red cotton bug, *Dysdercus cingulatus* and cotton mealy bug, *Phenacoccus solenopsis* has been investigated under ambient laboratory conditions using leaf and surface treatment. The data on the mortality of the 2nd instar red cotton bugs and mealy bugs show that all the treatments were highly significant over control. At 24 hours, the per cent mortality ranged between 2.20 to 45.40 and 1.80 to 87.80 for *D. cingulatus* and *P. solenopsis*, respectively. The highest per cent mortality was observed in neem excel at 0.3 per cent concentration compared to other treatments for both the insects.**

Keywords: Botanicals, Dysdercus cingulatus, Efficacy, Extracts, Phenacoccus solenopsis

I. INTRODUCTION

Okra, *Albelmoschus esculentus* L. Moench. is an economically important vegetable grown especially in tropical and subtropical regions of the world. It is found all around the world from Mediterranean to equatorial areas. In India, Okra has occupied a prominent position among the export oriented vegetables because of its high nutritive value, palatability and good post- harvest life. It has an enormous potential as one of the foreign exchange earner crops and accounts for 70 per cent of the export of fresh vegetables [1].

Incidence of insect pests is one of the major limiting factors responsible for decrease in the production of the crop. Many pests have been reported to attack the crop at different stages of growth [2] - [5].

The red cotton bug, *Dysdercus cingulatus* (Fabricius) is a most important damaging pest of okra in many regions of India. Both the adults and nymphs feed on the developing fruits, feeding as such on the developing fruit seriously affect the crop yield and quality of fruits thereby reducing its market value [2], [6].

The cotton mealy bug, *Phenacoccus solenopsis* Tinsley has been described as a serious and invasive polyphagous pest with a vast host range. The pest causes significant economic damage on cotton, brinjal, okra, tomato, sesame, sunflower and china rose [7] - [9]. The sucking of sap by the pest results in the yellowing of leaves which lead to loss of plant vigour, foliage and fruit drop [10] - [11].

Chemical control is generally practiced by farmers for higher yield. Over-reliance and non judicious use of insecticides over the last four to five decades has resulted in cropping up of many negative consequences mainly the infamous 3 R's viz. resurgence, resistance and residue aspects [12] – [14], besides the health hazards. Furthermore, their chaotic use has resulted in diminution of biodiversity of natural enemies [15], outburst of secondary pests [16], contamination of food [17] and breakdown of food webs in ecosystem [18]. Therefore, among the various possible substitutes to combat these problems without harming soil, water and living organisms including the human beings, biopesticides are now emerging as viable components of insect pest management strategies on all crops in view of the their pesticidal potency as well as safety to parasitoids and predators [19] – [20]. Considering the importance of eco-friendly approaches for the management of insect pests, the present study was conducted in the laboratory to evaluate efficacy of some botanicals against pests of okra.

II. MATERIAL AND METHODS

The study was conducted in the laboratory of Department of Plant Protection, Faculty of Agricultural Sciences, Aligarh Muslim University, Aligarh during the period of 2012-2013 with eight treatments and five replications. The red cotton bugs and mealy bugs were collected from the experimental field, mass reared and the culture was maintained on okra at 27±5°C and 60±10 RH.

Collection of botanicals

The botanicals used in the experiment, *viz.*, Custard Apple, *Annona squamosa*; Garlic, *Allium sativum*; Neem excel were obtained from the local market; Neem, *Azadirachta indica*; Tulsi, *Ocimum sanctum* and Milk weed, *Calotropis gigantea* were collected from the home gardens (Table I).

Table I: List of Botanicals Used in the Management of Dysdercus Cingulatus and Phenacoccus Solenopsis on Okra

S.No	Botanicals	Concentration (%)	Plant part used
T1	*Annona squamosa*	5.0	Seeds
T2	Neemexcel	0.3	Seeds
T3	*Calotropis gigantea*	5.0	Leaves
T4	*Allium sativum*	5.0	Bulb
T5	Neem cake	5.0	Seeds
T6	Neem leaf	5.0	Leaves
T7	*Ocimum tenuiflorum*	5.0	Leaves
T8	Control		

Preparation of the crude extracts of botanicals

Extracts of Azadirachta, Ocimum and Calotropis

One kilogram of fresh, tender leaves were plucked and put in a glass jar and one litre of lukewarm water was added. The leaves were soaked in water for 12 hours and then macerated in a mixer-grinder. The extract was filtered through a muslin cloth and collected in a glass jar. This extract was considered as 100 per cent solution from which desired concentrations were made [21].

Extract of Allium sativum

Two garlic bulbs were soaked in water for 12 hours. These were ground into a paste. The paste was put in a muslin cloth and squeezed. The suspension was collected and water was added to make desirable concentration [22].

Neem cake extract

100 gram of neem cake was put in a muslin cloth and soaked in 1 litre of water for 12 hours. The suspension was filtered and an emulsifier (soap solution) was added at the rate of 1 ml to 1 litre of suspension (http://somphyto.com).

Annona squamosa extract

Seeds were taken and dried under shade. The seed coat was removed and they were ground in a mixer grinder. Powdered *Annona* seeds were soaked in water. Stirring was done frequently. The suspension was filtered through a muslin cloth and the filtrate thus obtained was considered as 100 per cent and mixed with water to make desirable concentration [23].

Contact action of the botanicals

To investigate the contact action of different botanicals, the desired concentration of the botanicals was prepared. The petriplates and leaves of okra were sprayed from all sides with a hand atomizer to the point of runoff and dried for 30 minutes. Fifty 2nd instar red cotton bugs were transferred in each petriplate and were provided with treated leaves. Similarly, hundred 2nd instar mealy bugs were placed on treated leaves and transferred to the treated petriplates using a camel brush and hand lens. The petriplates treated with distilled water served as a positive control. Observations on mortality were recorded after 24 hours.

Statistical analysis

The per cent mortality was worked out and data were subjected to analysis of variance and the means were separated by Duncan's Multiple Range Test (DMRT) [24].

III. RESULTS

Efficacy of different botanicals against Dysdercus cingulatus

Table II: Per cent Mortality of Dysdercus cingulatus by Different Botanicals after 24 Hours of Treatment

S.No	Treatment	Concentration	Mean % mortality after 24 hours ± S.E in hours
T1	*Annona squamosa*	5.0	31.40±1.75^{c}
T2	Neemexcel	0.3	45.40±0.51^{a}
T3	*Calotropis gigantea*	5.0	32.40±1.81^{c}
T4	*Allium sativum*	5.0	33.80±1.77^{c}
T5	Neem cake	5.0	38.80±0.86^{b}
T6	Neem leaf	5.0	39.80±0.86^{b}
T7	*Ocimum sanctum*	5.0	28.80±0.66^{d}
T8	Control		2.20±1.02^{e}

Note: Each value is the mean± standard error of 5 replicates. Mean followed by the same letters within the same column are not significantly (P <.0001) different from each other using Duncans Multiple Range Test

Results of the experiment are summarized in Table II. The data on the mortality of the 2nd instar bugs show that all the treatments were highly significant over control. At 24 hours, the per cent mortality ranged between 2.20 to 45.40 and a higher per cent mortality was observed in the treatment with neem excel at 0.3 per cent concentration compared to other treatments. Results also revealed that neem leaf and neem cake at 5 per cent concentration gave a good kill and proved significantly superior over other treatments. In decreasing order of efficacy, the various treatments were neem excel (0.3%), neem leaf (5%), neem cake (5%), *Allium sativum* (5%), *Calotropis gigantea* (5%), *Annona squamosa* (5%) and lastly *Ocimum sanctum* (5%) (Fig I).

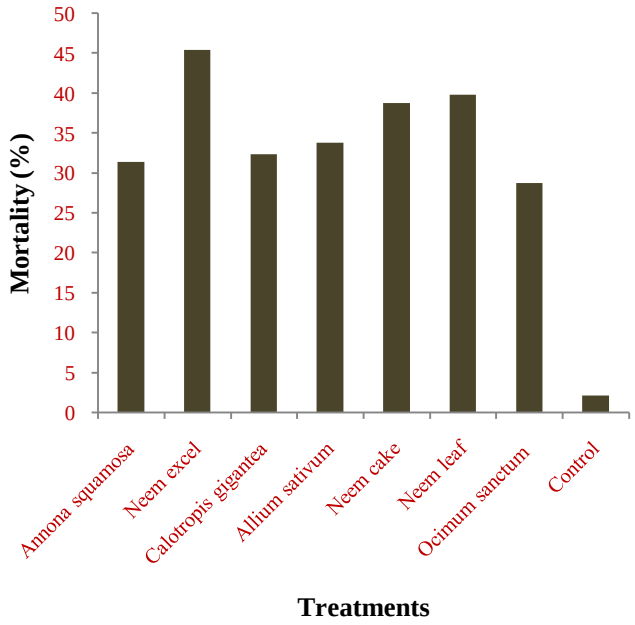

Fig I: Comparative efficacy of some botanicals on the mortality of 2nd instar nymphs of Dysdercus cingulatus on okra

Efficacy of different botanicals against Phenacoccus solenopsis

Table III: Per cent Mortality of *Phenacoccus solenopsis* by Different Botanicals after 24 Hours of Treatment

S.No	Treatment	Concentration	Mean % mortality after 24 hours ± S.E in hours
T1	*Annona squamosa*	5.0	41.60±1.75[d]
T2	Neemexcel	0.3	87.80±1.07[a]
T3	*Calotropis gigantea*	5.0	58.00±1.92[c]
T4	*Allium sativum*	5.0	62.00±1.87[c]
T5	Neem cake	5.0	75.20±2.35[b]
T6	Neem leaf	5.0	80.00±1.22[b]
T7	*Ocimum sanctum*	5.0	57.00±2.70[c]
T8	Control		1.80±0.80[e]

Note: Each value is the mean± standard error of 5 replicates. Mean followed by the same letters within the same column are not significantly (P <.0001) different from each other using Duncans Multiple Range Test

Results of the experiment are summarized in Table III. The data on the mortality of the mealy bug nymphs show that all the treatments were highly significant over control. At 24 hours, the per cent mortality ranged between 1.80 to 87.80. The highest per cent mortality was observed in neem excel at 0.3 per cent concentration compared to other treatments. Results also conclude that neem leaf and neem cake at 5 per cent concentration were not significantly different over each other. In decreasing order of efficacy, the various treatments were neem excel (0.3%), neem leaf (5%), neem cake (5%), *Allium sativum* (5%), *Calotropis gigantea* (5%), (*Ocimum sanctum* (5%) and lastly *Annona squamosa* (5%) (Fig II).

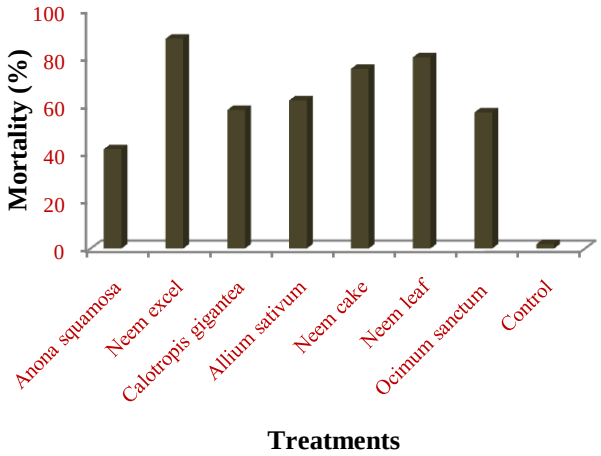

Fig II: Comparative efficacy of some botanicals on the mortality of nymphs of *Phenococcus solenopsis* on okra

IV. DISCUSSION

The studies on the efficacy of different botanicals revealed that all the plant products were effective in causing mortality of red cotton bug and mealy bug, though not as effective as that of neem products. A variety of plant species carry chemical substances including terpenoids, alkaloids and phenolics etc which may contribute to the protection of plants against herbivores [25]. Several workers have demonstrated the effectiveness of neem against sucking pests of okra [26] – [29]. It has been reported that a prolonged developmental period, wing lobes, the development of wingless adults and larval mortality is due to application of neem on various stages of *Dysdercus koenigii* [30]. High mortality of cotton mealy bug due to neem has been reported by many workers [31] – [32].

High mortality due to neem when compared to other plant products could be attributed to the presence of azadirachtin, one of the most active triterpenoids and other bitter compounds responsible for anti feeding activity that result into the starvation and death of insects. Neem products such as leaf and bark extracts, neem seed kernel extract, neem cake and neem oil have been reported to be effective against over 200 species of insects and is considered safe for human health and environment [33] – [35]. Azadirachtin is also responsible for inhibition of release of morphogenetic peptide hormones, resulting in disruption of ecdysteroid or juvenile hormone concentration in the haemolymph which in turn affect moulting, metamorphosis and reproduction [36]. Besides, neem seed kernel extract can be stored at high temperature for at least five months without significant reduction in its efficacy [37].

Based on these results it can be concluded that different combinations of plant extracts can be produced and applied for the management of various insect pests. Use of botanicals in pest management programme can help the farmers to reduce the sole reliance on synthetic pesticides and reduce the risk of exposing pest's natural enemies to chemicals.

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