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Relative toxicity of certain neem based formulations against red cotton bug, *Dysdercus koenigii* Fabr.

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ABSTRACT

Six neem based formulations *viz*., Achook, Neemazal, Neemarin, Bioneem, Econeem and Pure neem oil along with most common and extensively used insecticides, Endosulfan and Malathion were tested against last instar of red cotton bug (*D. koenigii*). Endosulfan and Malathion were found more effective and toxic than neem formulations, followed by Bioneem against red cotton bug. The neem formulations i.e. Pure neem oil, Neemazal, Achook and Econeem were also intermediary effective in response when tested for insecticidal values while Neemarin was least effective.

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Key words : Neem formulations, Red cotton bug, *Dysdercus koenigii*

INTRODUCTION

Cotton is one of the important commercial crops grown in India. It plays a dominant role in agrarian and industrial economy. About 60 million peoples depend on its cultivation, processing and export etc. for their livelihood. Among several factors which are responsible for low productivity and quality deterioration of cotton, the sole factor is the attack of various insect pests on it. Severities of pest damage cause a great loss to the growers of cotton. An aggregate losses about 50-60 per cent of cotton has happened by insect pests. For control of insect pests of cotton, huge quantities of synthetic insecticides have been recommended. Indiscriminate application of synthetic insecticides has resulted in build up of pests resistance, degradation of environmental and residual toxicity on cotton seed production. Looking to harmful adverse effects of these chemical pesticides Govt. of India has imposed restriction on the use of some common insecticides especially chlorinated hydrocarbon (Rajak,1992). The present investigation has therefore been undertaken to evaluate the insecticidal efficacy on certain Neem based formulations available in the market along with two conventional insecticides *i.e.* Endosulfan and Malathion against the damage of red cotton bug attacking cotton, under laboratory conditions by bioassay method.

MATERIALS AND METHODS

The present investigation was carried out in laboratory to evaluate the relative toxicity of Neem based formulations against red cotton bug (*Dysdercus koenigii*) by bioassay method. The adults of test insect were collected from the cotton field in the insectry of Department of Entomology, C.S.A.U.A. &T., Kanpur. The adults were transferred to a glass globe, the mouth of which covered with a piece of muslin cloth and tied with a rubber band. Some amounts of sand were also kept in the bottom of the glass globe to facilitate the egg laying of the test insect. Different concentration were prepared from the stock solutions using Acetone as solvent and Triton as emulsifier. The level of solvent and emulsifier were kept constant at 5 and 0.5 per cent respectively, in final spray. The calculated amount of various ingredients required to make different concentrations from their stock solutions i.e. 0.5 per cent of synthetic insecticides, 2.0 per cent Neem oil and neem formulations. All the neem based products, Neem oil and insecticides used in present investigation were tested for their contact toxicity against the adults of red cotton bug (*D. koenigii*) to determine the final concentration, which gave 20 to 85 per cent mortality in bioassay test by Potter's tower using film technique. After testing the preliminary trial of mortality against adult of red cotton bug, six concentrations of Endosulfan and Malathion were selected including one

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control (solvent and emulsifier). For the preparation of film, both lids of Petri dishes (10 cm diameter) were sprayed with 1.0 ml of each extract and insecticide under the Potter's tower at a constant pressure of 4lb/ sq. inch. The sprayed Petri dishes were gently shaken under a electric fan till the liquid phases of both the lid was evaporated leaving behind a uniform dry film of the extract and insecticides on glass surface. There after 20 adults of *D. koenigii* released over the dry film inside each Petri dish and were allowed to remain them in contact with the film for about an hour.

After the exposure, the adults bugs were transferred to clean Petri dishes then the fresh tender leaves and balls of cotton were supplied to treated adult of *D. koenigii* as food. These Petri dishes were kept at a constant temperature of 27±1° C and 75± 5 % relative humidity in the environmental chamber.

Assessment of toxicity:

The mortality data *D. koenigii* were recorded after 24 hour while the moribund adult bugs were also counted as dead. The corrected percentage of mortality was worked out by Abbot's formula (1925) as given below:

$$\text{Corrected mortality} = \frac{\text{T-C x100}}{\text{100-C}}$$

where, T= Observed mortality

C= Mortality in control

The mortality data thus recorded for different concentrations of all the used neem products, Neem oil and insecticides were subjected to Probhit analysis (Finney, 1925) for determining their Lc 50 and Lc 90 values. These values were compared with Lc 50 and Lc 90 values of Neem oil by taking it as unity, so as to work out the toxicity of different neem based products and insecticides used in the present investigation.

RESULTS AND DISCUSSION

Most of the neem formulations were recorded to be toxic to red cotton bug (*D. koenigii*) but all were reported less toxic in comparison to chemical insecticides (Table 1). The most toxic insecticides recorded to be Endosulfan which exhibited the best performance by giving lowest 0.0264 Lc 50 value and its Lc 90 value 0.1736 where as Malathion was slightly higher than Endosulfan which proved that it was slightly less effective than Endosulfan. Gautam (2008) also reported that Endosulfan, Malathion and Quinalphos proved most effective in reducing shoot infestation in brinjal by 90.0, 87.5 and 80 %, respectively.

Among the neem formulations, all were found less effective to Pure neem oil except an exception observed in Bioneem which was found better to Pure neem oil as Bioneem needed 3.5176 to kill 90 % of *D. koenigii* where as Pure neem oil needed 3.5705 to kill 90 % of the test insect. This may be argued by the views of Attri (1975) who had reported that neem extractive was about 40 times less effective than the active ingredient of Neem Kernel Powder to locust. Next in response, Neemazal may be referred which resulted 0.6178 % to kill 50 per cent and 3.6426 per cent to kill 90 % of the *D. koenigii* . Kumar *et al.* (2007) reported that azadirachtin (Neem gold) was found to be better as controlled the pests of cabbage. Achook was next to Neemazal which registered 0.6768 Lc 50 value and 4.2778 of its Lc 90 value. Though it has poor response and three times less toxic than Pure neem oil. Raman *et al.* (1993) evaluated Achook to control various insect pests of different crops and reported that it was toxic against pest of okra, cabbage, paddy, gram and jute. Present results are in corroboration with findings of Gautam *et al.* (2008) who noticed that Neemarin and Achook were significantly at par and effective by 78.5 and 77.5 per cent followed by Bioneem 69.6 per cent respectively, in reducing shoot infestation of *Leucinodes orbonalis*. Econeem proved next to less effective formulation of neem which rated 0.7464 Lc 50 and 4.7878 of its Lc 90 value and ranked 7 th in relative toxicity. The

Table 1: Relative toxicity of insecticides, neem oil and neem formulations

Sr. No.	Insecticide	Heterogeneity	Regression equation	Lc 50	Lc 90	Relative toxicity			
						For L c 50	Rank	For Lc 90	Rank
1.	Neemarin	$X^2(4)=2.2554$	Y=5.1737+1.6103X	0.7801	4.8772	0.7457	VIII	0.7321	VIII
2.	Achook	$X^2(4)=2.9217$	Y=5.2714+1.008X	0.6768	4.2778	0.8595	VI	0.2338	VI
3.	Neemazal	$X^2(4)=2.3364$	Y=5.3479+1.6636X	0.6178	3.6426	0.9416	V	0.9802	V
4.	Bioneem	$X^2(4)=2.6855$	Y=5.3653+1.6779X	0.6057	3.5176	0.9604	IV	1.015	III
5.	Pure neem oil	$X^2(4)=5.2951$	Y=5.3827+1.6267X	0.5817	3.5705	0.1000	III	1.000	IV
6.	Endosulfan	$X^2(4)=2.9313$	Y=7.4741+1.5678X	0.0264	0.1736	2.2034	I	2.056	I
7.	Malathion	$X^2(4)=3.7761$	Y=7.3992+1.5685X	0.0295	0.1939	1.971	II	1.841	II
8.	Econeem	$X^2(4)=3.1178$	Y=5.2018+1.5881X	0.7464	4.7878	0.7793	VII	0.7457	VII

present performance among all the used neem formulations was observed in case of Neemarin which needed 0.7801 to kill 50 per cent and 4.8772 to kill 90 per cent of the tested insect thus proved least effective. The descending order of their relative toxicity at Lc 50 per cent level may be arranged as Endosulfan >Malathion > Pure neem oil > Bioneem > Neemazal > Achook > Econeem and > Neemarin while the descending order at Lc 90 level has slightly being changed as Endosulfan > Malathion > Bioneem > Pure neem oil > Neemazal > Achook > Econeem and > Neemarin. Yadav and Ali (2008) evaluated six neem formulations against *Dasyneura lini* and lowest bud fly infestation was recorded with NSKE followed by Nimbicidine. The different neem based formulations followed the order with regards to bud fly infestation in NSKE > Nimbicidine > Neem oil > Econeem > Neem India. Similar types of results were also reported by Nazussalam *et al*. (2008).

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