Toxicity and morphogenetic effects of different botanicals on red cotton bug *Dysdercus koenigii* Fab. (Hemiptera : Pyrrhocoridae) in North Eastern Hill (NEH) region of India

M.H. Kodandaram*, N.S.Azad Thakur and A.N. Shylesha

ABSTRACT

Toxicity and morphogenetic effects of various botanicals was evaluated against third instar nymphs of *Dysdercus koenigii* by two bioessay techniques *viz.*, dry film and seed dip methods. Anonin was found to be most toxic and econeem least toxic to the nymphs of *D.koenigii*. The descending order of toxicity of different botanicals for dry film method was anonin > imidacloprid > karanjin > achook > ecomeem, whereas by seed dip method the order was anonin > imidacloprid > achook > karanjin > econeem. All the botanical insecticides initiated dose dependent changes, resulting in delayed metamorphosis with abnormal wing development, no moulting and finally death within 24 - 48 h after treatements. Thus, the toxicity levels of various botanicals would serve as ready reckoner for the selection of various plant - based products for the management of red cotton bugs on okra and other crops in the NEH region.

Keywords: *Dysdercus koenigii*, toxicity, morphogenetic effect, botanicals.

INTRODUCTION

The red cotton bug, *Dysdercus koenigii* Fab (Pyrrhocoridae) is a most important damaging pest of okra in North Eastern Hill (NEH) region. 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. Chemical control of the pest using the insecticides of common use is done many a times, which leaves residues that remain viable for noticeable period. Therefore, development and use of alternative plant protection technology based on neem and other plant based products which have been found to be effective against wide range of pests of important crops (Schmutterer, 1990; Schmutterer and Singh, 1995; Parmar, 1995), become imperative. The present investigation were conducted with a view to evaluate the toxicity of different botanicals and their morphogenetic effects on third instar nymphs of red cotton bug *D. koenigii* under laboratory conditions by two bioassay methods *viz.*, dry film and seed dip methods.

MATERIALS AND METHODS

Adult red cotton bugs *D koenigii* were collected from okra fields and reared under laboratory conditions (24 ± 2 ^{0} C and 65 ± 5 % RH) on fruits of okra. The different botanical and biorational insecticides *viz*., anonin (1 %), karanjin (2 %), achook (0.15%), econeem (1%) and imidacloprid (17.8 %) used in the present studies were obtained as commercially available formulations from their respective sources of supply. Different concentrations (in ppm) of various insecticides were prepared by using distilled water for the dilution of Emulsifiable Concentrate and suspension liquid (EC and SL)

The insecticides were tested by dry film and seed dip methods. In dry film technique, a film of different concentrations (in ppm) of each insecticide was prepared on both the surfaces of petridish by depositing 1 ml of concentration by gentel swiriling and later dried for 10 minutes under electric fan. Ten third instar bugs were introduced into one paired petridish and okra seeds soaked in distilled water for 6 h were given as food. In case of seed dip method, 25 okra seeds were soaked in 10 ml solution of different concentrations (in ppm) of each insecticide for 6 hrs and air dried under room conditions. For control the seeds were dipped in sterile water. The treated seeds were transferred to clean petridishes and ten third instar bugs were released in each petridishes. In both the experiments, each treatment including control was replicated thrice. Observations on mortality was taken 24 h after treatment. The moribund insects were counted as dead. The average per cent mortality in each treatment was corrected by Abbotts Formula (Abbots 1925). The data so obtained was subjected to probit analysis as described by Finney (1971).

Table 1. Toxicity of different botanicals against red cotton bug *D.koenigii*

Treatments	Dry Film Method			Seed Dip Method		
	Slope	LC_{50}	OT	Slope	LC_{50}	OT
Anonin 1 %	4.89	0.0062	1	2.86	0.024	1
Imidacloprid 17.8 %	8.89	0.414	2	3.86	17.80	2
Karanjin 2%	0.22	1.20	3	2.87	283.00	4
Achook 0.15%	8.53	53.00	4	2.33	98.70	3
Econeem 1%	2.65	390.00	5	1.58	586.00	5

OT- Order of toxicity

RESULTS AND DISSCUSSION

Anonin was found to be most toxic and econeem least toxic to the third instar nymphs of *D koenigii*. The LC_{50} values of anonin, karanjin, achook, econeem and imidacloprid were 0.0062, 1.0, 53.0, 390.0 and 0.414 ppm and 0.024, 283, 98.7, 586.0 and 17.8 ppm for dry film and seed dip methods, respectively (Table 1). The descending order of toxicity for dry film method was anonin > imidacloprid > karanjin > achook >ecomeem, whereas, by seed dip method the order was anonin > imidacloprid > achook > karanjin > econeem. On the basis of LC_{50} values the relative susceptibility of third instar nymphs of *D. koenigii* to all the botanicals was high in dry film than seed dip method and there was significant differences in their LC_{50} values.

The morphogenetic defects caused by different formulations of botanicals *viz*, neem, karanjin and anonin was dose dependent. It was observed that at higher dose the incidence of inhibition in the development was most prominent. Also, all the three botanicals when applied by dry film and seed dip methods to third instar nymphs of *D koenigii*, resulted in delayed metamorphosis, induced abnormal forms showing varying degree of wing growth inhibition, no moulting and finally died within 24-48 hrs of treatment (Fig. 1 and 2). While in the control, nymphs moulted into normal adults. The results showed that the action of these botanical insecticides cause physiological disturbances leading to growth abnormalities like prolongation of nymphal stages, incomplete metamorphosis and deformed nymphs and adults. All theses could be due to disturbances in the normal functions of juvenile hormone in the treated insects (Schmutterer, 1990). Recently, Tiwari *et al.*, (2006) noted that topical application of neem based insecticides on *D koenigii* caused prolongation of nymphal period, ecdysial stasis and development of adultoids and imagoes with varied degree of deformities. Azadirachtin treated by contact and topical application methods evoked various specific and nonspecific effects during the course of development in various stages of red cotton bugs (Opender Koul, 1984). RD-9 Repelin at higher concentration prolonged the nymphal period and affected the emergence of adults of *D. koenigii* (Gupta *et al.*, 1997). Various solvent extracts of *Annona squamosa* are reported to be good toxicants, growth inhibitors and feeding deterrents aganist many insects (Michael Grainge and Saleem Ahmed, 1988).

Thus, the toxicity levels and morphogenetic effects of various botanicals evaluated would serve as ready reckoner for the selection of various plant based products for the management of red cotton bugs on okra and other crops in the NEH region.

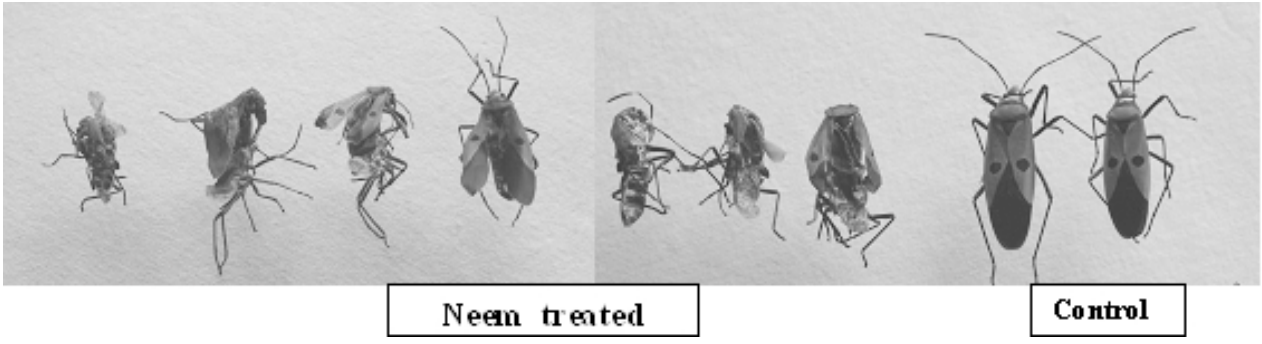

Fig. 1: Neem Induced Growth anomalies

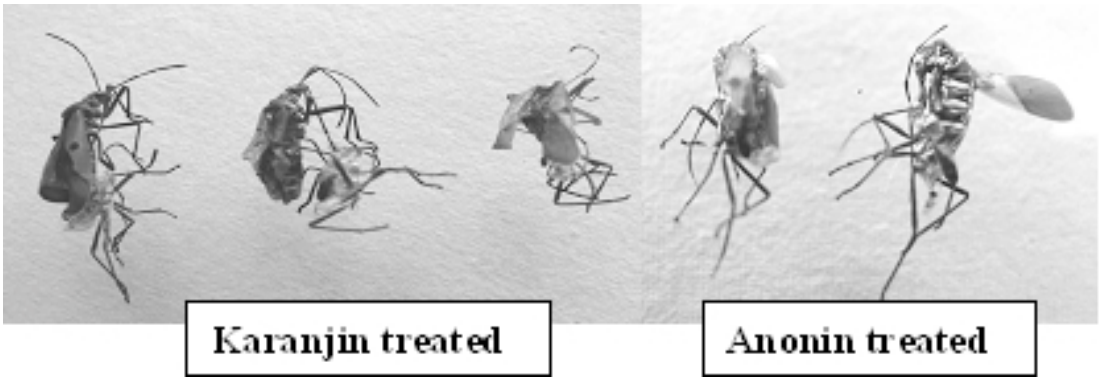

Fig.2 Karanjin and Anonin induced growth anomalies

REFERENCES

Abbotts, W. S. 1925. A method of computing the effectiveness of an insecticide. *Journal of Economic Entomology*, **18:** 265-267.

Finney, D.J. 1971. Probit analysis. Cambridge University, London 333 **PP.**

G. P. Gupta, S.K. Kundu and K. Sharma.1997. Effect of RD-9 Repelin on growth and development of red cotton bug *Dysdercus koenigii*. *Indian Journal of Entomology*, **1**: 54-58

Koul O .1984. Azadirachtin I. Interaction with development of red cotton bug. *Entomologica Experimentalis et Appllicata*, **36** (1) : 85-88.

Michael Grainge and Saleem Ahmed .1988. Handbook of plants with pest control properties. John Wiley and Sons, New York, 27 **PP.**

Parmar, B.S. .1995. Results with commercial neem formulations produced in India. In *The Neem Tree* (Ed. H. Schmutterer) VCH, New York. 453-469 **PP.**

Schmutterer H. 1990. Properties and potential of natural pesticides from neem tree *Azadirachta indica*. *Annual Review of Entomology*, **35:** 271-297.

Schmutterer. H. and Singh. R. P.1995. List of insect pests susceptible to neem products. In *The Neem Tree Source of Unique Natural Products for Integrated Pest Management, Medicine, Industry and other Purposes*. (Ed. H. Schmutterer) VCH, New York. 326-365 **PP.**

Tiwari R.K., Pandey J.P. and Dinesh Kumar. 2006. Effects of neem based insecticides on metamorphosis, haemocytes and reproductive behavoiur in the red cotton bug *Dysdercus koenigii* Fab.(Heteroptera: Pyrrhocoridae). *Entomon*, **31** (4): 267-275.

M.H Kodandaram*, N.S.Azad Thakur and A.N. Shylesha
Division of Entomology, ICAR Research Complex for NEH Region, Umiam, Meghalaya –793103,India,
*Communication author- E-mail: kodanda75@yahoo.co.in