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Relative Toxicity Of Selected Insecticides To Cotton Aphid, *Aphis Gossypii* Glover

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ABSTRACT

The experiments were conducted in laboratory to evaluate the relative toxicity of some commonly used selected insecticides viz. Acephate 75 SP, Acetamiprid 20 SP, Dimethoate 30 EC and Spinosad 45 SC against cotton aphid, Aphis gossypii Glover. On the basis of the LC_{50} values the acetamiprid was the most toxic whereas the spinosad was the least toxic insecticide to cotton aphid. The order of relative toxicity of insecticides over spinosad was acetamiprid > acephate > dimethoate with their relative toxicity values being 95.50, 21.22 and 1.72, respectively. However, at LC_{90} it is variable and the order of toxicity is acetamiprid > acephate > spinosad > dimethoate.

KEY WORDS- *Cotton aphid, Aphis gossypii Glover, LC_{50} and relative toxicity*

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INTRODUCTION

Cotton (*Gossypium* spp.) is one of the most important fiber crop which is also known as "The White Gold" all over the world commercially grown in many countries including India. The cotton aphids, *Aphis gossypii* Glover is an important sucking pest of cotton which reported to cause 19-20 % of yield loss (Schwartz, 1983 and Dande, 2015). The *Aphis gossypii* Glover is small, yellow to dark green, adaptable, easily spread, with a rapid mostly asexual type of reproduction, extremely polyphagous and has the ability to cause serious plant injury in isolated communities. When environmental conditions become favorable, it sporadically becomes serious in different parts of India (Powar *et al*., 2015). The adults and nymphs of the cotton aphids affect the yield by direct feeding and reduce the quality of lint by excreting honeydew. Recently, highly efficacious insecticides with novel mode of action are available which are becoming increasingly important in agriculture as a component of integrated pest management for management of aphids (Awasthi *et al*., 2013). Thus, an attempt was made to determine the relative toxicity of selected insecticides to cotton aphid. The outcomes of present investigation will be very much useful to cultivators for the management of the sucking pests of any crop from the point of view of IPM. It will be also useful to research workers for carrying out further research work on this aspect.

MATERIALS AND METHOADS

Insects

The field population of cotton aphid, *A. gossypii* was collected from unsprayed plots of Cotton Research Farm of M.P.K.V., Rahuri. The aphids were directly collected from field during the early cotton growth period, when there was peak aphid pest infestation on cotton. The heavily infested leaves and shoots of cotton plants along with aphid colonies were picked and brought in laboratory in sample bags and used on same day for the bioassay studies.

Preparation of insecticide concentration

The insecticide (treatment) solutions with desired concentrations were prepared using commercial formulations of selected insecticides as a base line. The insecticides *viz.*, acetamiprid 20 SP, acephate 75 SP, dimethoate 30 EC, spinosad 45 SC were measured using accupipette and weighting balance and mixed in distilled water in conical flask to prepare required concentrations and shake well in vials with lid. Different concentrations of treatments were prepared in specific geometric regression using distilled water (Asrar *et al*., 2013). Every time fresh solutions were prepared and used for bioassay studies. The doses were computed using following formula (Powar *et al*., 2015):

$$V = \frac{C \times A}{a.i.}$$

Where,

V = Vol. of insecticides to be added (mL)

C= Conc. of insecticides (in per cent)

A= Required quantity of solution (mL or L)

a.i.= Active ingredient (gm) (in the insecticide formulation)

Bioassay on aphid (Leaf dip method)

Cleaned non-infested cotton leaves were dipped in different concentrations of insecticides, one leaf per concentration. Five concentrations were tested for each insecticide with four replications. Leaf dipped in distilled water served as control. Surface water from leaves allowed for drying and leaves then placed in petri plates individually. Field collected apterous cotton aphids were placed on each leaf at the rate 20 aphids per leaf with the help of pointed camel hair brush. Damped cotton wool was placed around petiole of each leaf. The petri plates were maintained at 27±1ºC.

Recording of Observations

The mortality of aphids was recorded every at 24 hrs interval up to 72 hrs after treatments using hand lens. The aphids which are unable to right themselves within 10 seconds once turned on their back were considered as dead. In the event of doubt, the suspected individuals were gently touched using fine camel hair brush and mortality was recorded accordingly. The mortality in the control (untreated) plates was also recorded. Whenever the mortality in control exceeded (>20%) the trail was repeated. Accordingly the dose mortality table was constructed. The treatment mortality data were collected using Abbott's formula (Abbott, 1925). The LC_{50} and LC_{90} values were worked out for each test insecticide after subjecting the corrected mortality data of each test insecticide to Probit analysis (Finney, 1971). Based on these values, the toxicity of the selected insecticides to *A. gossypii* was determined.

Statistical Analysis

The LC_{50} values of insecticides for cotton aphid were estimated. Dose-mortality response data obtained was subjected to probit analysis (Finney, 1971) for calculating LC_{50} in ppm by using Statplus software.

Evaluation of relative toxicity of insecticides

The values of relative toxicity of different insecticides to cotton aphids were calculated by formula,

$$\text{Relative Toxicity} = \frac{LC_{50} \text{ of less toxic compound}}{LC_{50} \text{ of more toxic compound}}$$

RESULTS AND DISCUSSION

Relative toxicity of selected insecticides to cotton aphids, *A. gossypii*

The LC_{50}, LC_{90} and relative toxicity of insecticides to cotton aphid were given in table 1. The maximum LC_{50} value was recorded in the treatment with spinosad (0.573 ppm) and found relatively less toxic to cotton aphids, followed by dimethoate (0.333 ppm) and acephate (0.027 ppm) which showed moderate to higher toxicity. The minimum LC_{50} value was recorded in treatment with acetamiprid (0.006 ppm) and found relatively more toxic to cotton aphids, *A. gossypii*. On the other hand, the maximum LC_{90} value was recorded in treatment with dimethoate (35.957 ppm) followed by spinosad (15.738 ppm) and acephate (1.971 ppm). The minimum LC_{90} was recorded in treatment with acetamiprid (0.293 ppm).

The relative toxicity of different insecticides was calculated on the basis of respective LC_{50} values by taking the LC_{50} value of spinosad as unity. Considering the relative toxicity, acetamiprid, acephate and dimethoate were 95.500, 21.222 and 1.72 times, respectively more toxic than spinosad (Table 1).

On the basis of LC_{50} values, the descending order of toxicity of insecticides was acetamiprid > acephate > dimethoate > spinosad for the cotton aphids, *A. gossypii*. In order of toxicity, spinosad was the least and acetamiprid was the most toxic compound to the test insects.

Table 1: Relative toxicity of selected insecticides to cotton aphid, *A. gossypii*

Sr. No	Insecticide	LC_{50} (ppm	95% Fiducial Limi		LC_{90} (ppm	Heterogeneit (x^2)	Slop	Relative Toxicit
			Lower	Upper				
1.	Acetamipric	0.006	0.004	0.009	0.293	0.590	0.769	95.500
2.	Acephate	0.027	0.011	0.041	1.971	0.373	0.687	21.222
3.	Dimethoate	0.333	0.143	0.580	35.957	0.030	0.63(	1.720
4.	Spinosad	0.573	0.400	0.818	15.738	0.570	0.891	1.000

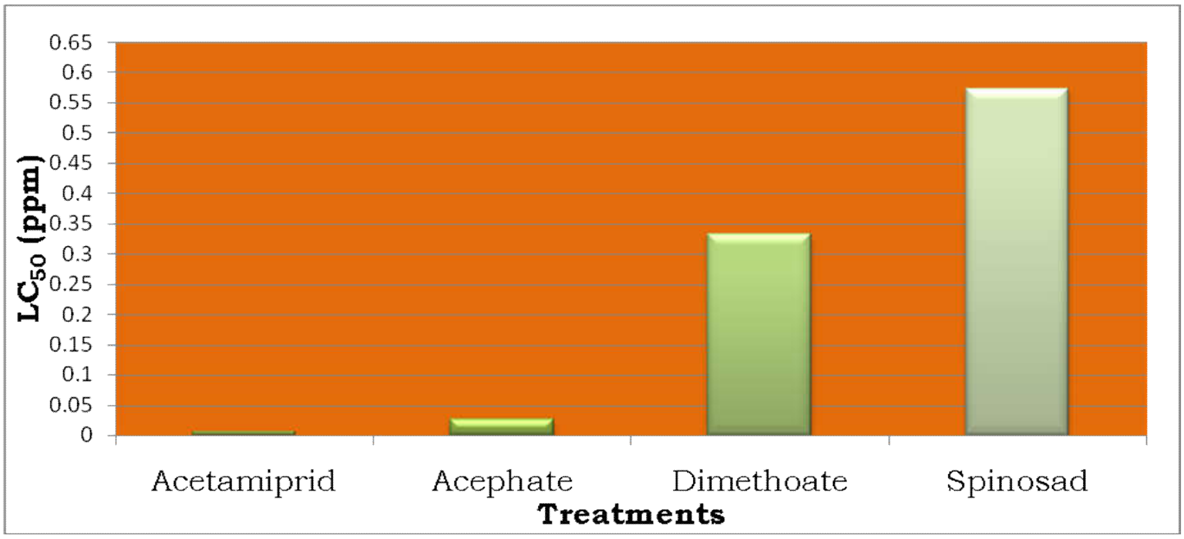

Fig. 1 The LC_{50} of selected insecticides to cotton aphid, *A. gossypii*

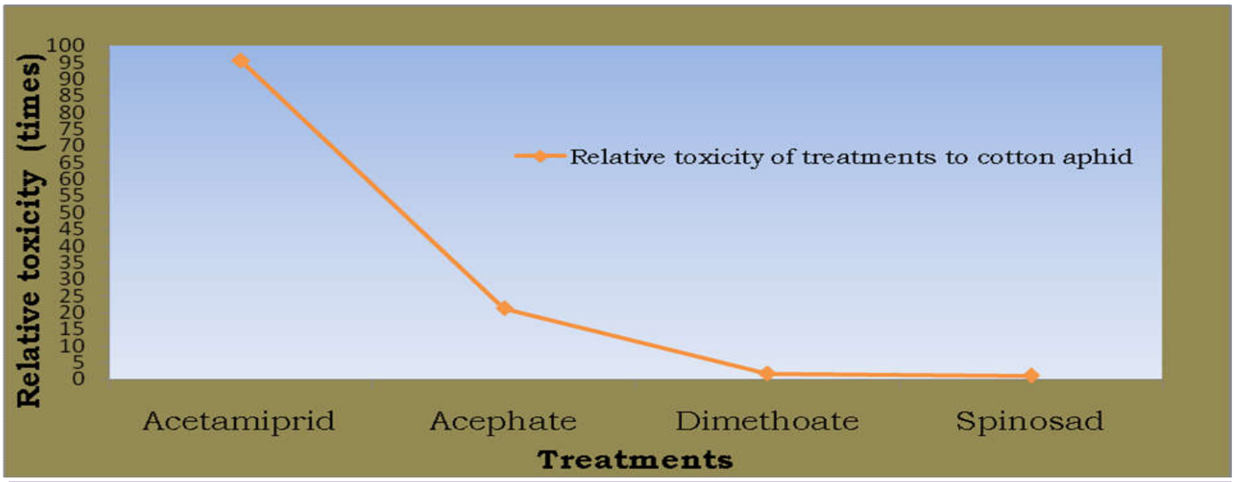

Fig. 2 Relative toxicity of selected insecticides to cotton aphid

In the present investigation acetamiprid was found most toxic to cotton aphids followed by acephate and dimethoate. Spinosad was found to be least toxic to cotton aphids. These results are in accordance with the findings of Awasthi *et al*. (2013) who reported that when aphid population exposed to acetamiprid, survival rate was lower than that of acephate and spinosad. The values of LC_{50} they found were 0.007, 0.025 and 0.576 ppm for acetamiprid, acephate and spinosad, respectively. The findings of present investigations were on par with the findings of Ghosal *et al*. (2013) who reported that acetamiprid (1.0) showed better result than acephate (1.32), dimethoate (2.01) and spinosad (4.01) in management of cotton aphid population.
Present results were corroborated with the findings of Dhaka *et al*. (2009) and Khedkar *et al*. (2012) who reported that acetamiprid proved as best insecticide followed by acephate and dimethoate for management of aphids. The findings of Patil *et al*. (2014) revealed that acetamiprid 20 SP was proved to be most effective

insecticide against aphids and dimethoate was found to be least effective in reducing aphid population. Their findings also support the results of present investigation.

CONCLUSIONS

No doubt that cotton aphid has been reported as arising serious pests of cotton and many other crops of agro-ecosystem and so far no rapid and effective alternative means are available to combat this pest except use of insecticides. Those insecticides which are relatively safe to beneficial fauna can be selected for use. This use should be justified, *i.e.* when pest population reaches the ETL. The quantity and quality parameter of insecticides while application should be considered on the basis of bioassay and toxicity studies. In present investigation the spinosad was least toxic and acetamiprid was the most toxic compound to cotton aphid. The order of toxicity of insecticides were acetamiprid > acephate > dimethoate > spinosad. Hence proper judicial use of insecticides in IPM will lead to sustainable development in agriculture.

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