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Toxicological studies on the red cotton bug, *Dysdercus koenigii* due to chemical Lufenuron

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Abstract - An experiment was conducted to explore the chemical control of this important pest of cotton in India. Seed dip method was used to find out the efficacy of lufenuron toxicity on *Dysdercus koenigii*. Four different concentration of lufenuron i.e 100µg/ml, 50µg/ml, 25µg/ml, 5µg/ml were used against 4th and 5th instar of *D. koenigii* after rearing in the laboratory. Maximum mortality was observed at the highest concentration after 24hr., which gradually and correspondingly increased with the increase in span of hours seeds were dipped. LC 50 was also calculated for effective use of chemical for the control of pest, Red Cotton Bud, *D. koenigii*.

Keywords:- Toxicological studies, Red cotton Bug.

I. INTRODUCTION

The struggle between the man and insects has been going on since the early days of history. Insects not only transmit serious disease pathogens among man and animals but also eat a considerable portion of our crops. The Red cotton bug, ***Dysdercus koenigii*** is a well known pest of cotton in India. Both the nymphs and adults suck the sap from the leaves and green cotton bolls and when the later open, they attack the young oily seeds rendering them unfit for sowing. Due to their peculiar mode of feeding i.e. puncturing the developing flowers, buds or cotton bolls reduces the size; or the fruiting body may abort and drop the ground (Schaefer and Ahmad,2000;Jamal,2014). While sucking the sap, it inserts the fungi and causes slimy wet rot to dry and feeds interior portion of the bolls (Shah, 2014; Whitfield, 1933).

Various strategies have been proposed to control the pest using insecticides/ chemicals and even use of multiple insecticides to manage resistance (Sparks and Byford, 1988). In the present

studies efforts were made to study the use of chemicals lufenuron to evaluate the efficacy of this against different larva instar of D***. koenigii***.

II. MATERIAL AND METHODS

Study Area: Adult ***D. koenigii*** were collected from cotton fields of Tabieji Government Farms situated 15km from Ajmer (Rajasthan, India). Collection was done from opened, unopened bolls and leaves in glass jars at the end of August.

Techniques for Rearing:-

Method of rearing with necessary modifications was adopted for rearing the pest (Kamble,1971;Kohno and Ngan,2004; Jaleel,et.al,2013) . Fifty mated pairs were placed separately in glass jars of 4"x4" and goblets 3" in diameter and 4"in height under laboratory condition (26.2^0C ,70-75%RH). The pots were half filled with sterilized soil for providing natural medium for ovipositor. Base of soil was partly covered by moistened filter paper in order to keep the soil at moderate moisture level; filter paper was changed on daily basis. Twenty to twenty five soaked cotton seed provided in each jar every day considering them adequate feed for one pair of adults for getting their eggs batches. After hatching, nymphs were also provided with cotton seeds. Rearing was done till fourth generation for bio-assaying. Bioassay was performed on uniform fourth and fifth in star population (Butter et.al, 2003) of ***D. koenigii*** achieved then evaluation of toxicity with four different concentrations was performed.

Procedure:-

Dip seed method was performed for this procedure (Kodandarm et.al.,2008) .First of all four different concentrations of lufenuron i.e. 100µg/ml (microgram per millilitre), 50µg/ml, 25µg/ml,5µg/ml and control (0.00µg/ml) were made in four different beakers (500 ml capacity Beakers) using 100 ml of distilled water in each beaker to make enough solution for dipping the cotton seeds. After making the solution, beakers were labelled according to the concentration Fuzzy cotton seeds were soaked in each beaker for 6hrs. After dipping the seeds, seeds were allowed to dry in air under laboratory conditions. Treated seeds were transferred petri-dishes labelled according to the concentration. So, 25 treated seeds per petri-dishes considering it adequate as food for nymph. Five Petri dishes were used for one concentration and five 4^{th} in star nymphs were placed in one petri-dish . Same procedure was adopted for toxicity of lufenuron to 5^{th} in star nymph.

Present mortality was recorded after 24, 48 and 72 hrs according to the nature of insecticides under laboratory condition (26.2^0C ,70-75%RH).

Table-1: Mortality of *D.koenigii* (4^{th} in star) against different concentration of Lufenuron 5.4 EC

Dose (µg/ml)	**Total Population**	**Mortality % after (hrs.)**		
		24	**48**	**72**
100.00	50	16.00	52.00	87.00
50.00	50	8.00	43.00	77.00
25.00	50	0.00	40.00	69.00
5.00	50	0.00	38.00	57.00
0.00	50	0.00	0.00	0.00

Table-2: Mortality of *D.koenigii* (5th instar) against different concentration of Lufenuron 5.4 EC

Dose (µg/ml)	Total Population	Mortality % after (hrs.)		
		24	48	72
100.00	50	20.00	64.00	91.00
50.00	50	16.00	52.00	83.00
25.00	50	8.00	48.00	71.00
5.00	50	4.00	41.00	68.00
0.00	50	0.00	0.00	0.00

Table-3 : LC 50 of Lufenuron 5.4 EC against 4th and 5th instar of *D. knoeginii*

Hours	Total Numbers	LC 50 and 95% Condicence limit (µg/ml)		Chi-square		Order of toxicity	
		4th instar	5th instar	4th instar	5th instar	4th instar	5th instar
24	125	229.013	612.315	0.470	0.912	8	9
48	125	311.910	411.305	0.415	0.335	7	6
72	125	8.613	21.051	0.109	0.172	3	4

III. Results

Fourth instar of *D. koenigii* -

In 4th larva of ***D. koenigii*** maximum mortality was observed at 72hrs which is 87% when 100µg/ml of concentration was given through dip seed method. At 24 hrs the mortality was 16% which increased at 48 hrs to 52% . At concentration of 50 µg/ml after 24hrs , the mortality was 8% which increased to 43% at 48 hrs and 77% at 72hrs(Table-1).
At 25 µg/ml concentration no mortality was reported at 24 hrs but it was 40% at 48 hrs and 69% at 72 hrs. At 5µg/ml of concentration also there was no mortality at 24 hrs but it increased 38% at 48 hrs and 57% at 72 hrs (Table-1) . The LC50 was calculated to be 229.013,311.910 and 8.613µg/ml concentration after 24,48 and 72 hrs respectively(Table-3). The order of toxicity at 24, 48 and 72 hrs was respectively 8,7 and 3 (Table-3).

Fifth instar of *D.koenigii* -

The maximum mortality i.e 20% was observed in fifth instar of ***D. koenigii*** at highest concentration (100 µg/ml) after 24 hrs which was increased to 64% after 48 hrs and finally 91% after 72 hrs.(Table-1).

At the concentration of 50 µg/ml the mortality was 16% at 24 hrs; 52% at 48 hrs and 83% at 72 hrs. At 52 µg/ml concentration the mortality is low at 24 hrs i.e 8% but it increased to 48% at 48 hrs and 71% at 72 hrs . The mortality was very low, only 4% at 24 hrs at concentration 5 µg/ml which increased to 41% at 48 hrs and 68% at 72 hrs.

The LC50 calculated was 612.312,411.305 and 21.051 concentration (µg/ml) after 24,48 and 72 hrs respectively. The order of toxicity was 9,6 and 4 at 24,48 and 72 hrs respectively.

IV. Discussion

Lufenuron, a benzoylurea pesticide, inhibits the production of chitin in insects. Its IUPAC name is 1-[2,5-Dichloro-4-(1,1,2,3,3,3-hexafluoropropoxy)phenyl]-3-(2,6-difluorobenzoyl)urea. Without chitin, a larval instar can never develop a hard outer shell (exoskeleton). With its inner organs exposed to air, the insect dies from dehydration soon after hatching or moulting. Susceptibility decreases with the increase in size or in later instars(Butter et. Al.,2003).

Lufenuron is also used to fight fungal infections, since fungus cell walls are about one third chitin(Ben-Ziony et.al,2000). Higher concentration of this chemical have anti fungal effects(Gelbic et.al.,2011). In the present studies it was found effective. These results were found comparable to findings of S.Saeed et.al.,2016 and Kodandaram et.al.,2008.

Lufenuron is also sold as an agricultural pesticide for use against lepidopterans, eriophyid mites, and western flower thrips. It is an effective antifungal in plants (Paranjape et.al.,2014). According to WHO, lufenuron is a class III toxin (slightly hazardous). It is safe on mammals, since it is not broken down by liver or kidney.(Paranjape et.al.,2018).

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