e-ISSN: 2455-667X

Annals of Natural Sciences
(Peer Reviewed and UGC Approved International Journal)
Vol. 3(2), June 2017: 123-127
Journal's URL: http://www.crsdIndia.com/ans.html
Email: crsdIndia@gmail.com

Annals of Natural Sciences

ORIGINAL ARTICLE

Effect of Insect Growth Regulator Chlorfluazuron on Biomass Accumulation in *Antigastra catalaunalis* Duponchel, Pupae and Adult

Vivek Kumar Verma
Department of Zoology, J.M.V., Ajitmal, Auraiya
Email: vermavk65@gmail.com

ABSTRACT

Crop protection has become an indispensable component in the latest technology of crop production and much emphasis has been given to chemical insecticides for the control of noxious crop pests. This has posed a burning and alarming situation due to the indiscriminate use of chemicals on various agricultural commodities, resulting resistance in insects to insecticides and adverse effects on beneficial insects and human beings through food chain.

***Key words**: Insect growth regulator, Antigastra catalaunalis, Biomass*

Received: 18th April 2017, Revised: 25th May 2017, Accepted: 27th May 2017

How to cite this article:
Verma V.K. (2016): Effect of Insect Growth Regulator Chlorfluazuron on Biomass Accumulation in *Antigastra catalaunalis* Duponchel Pupae and Adult. Annals of Natural Sciences, Vol. 3[2]: June, 2017: 123-127.

INTRODUCTION

The insect selected for this research work, *Antigastra cataunalis* Duponchel is a major pest of oil crop (*Sesamum indicum*) and causing great loss to oil crop which having great economic value for mankind. Now a days sesame crop is cultivated in Africa, Burma, China, Cyprus, France, Japan, Pakistan, USSR, Sri Lanka, Syria, and India (Menon *et.al.,* 1960). India produced about 27% sesame of the world's production (Anonymous, 1991). In India, the main sesame producing states are Uttar Pradesh, Karnataka, Andhra Pradesh Gujarat and West Bengal. In Uttar Pradesh and West Bengal sesame is cultivated in more than 11000 ha. area.

Inducing sexual sterility by employing insecticides in large populations of insects has a promising scope in the control of abnoxious pests. The insecticides employed for the purpose, aim at controlling the reproduction by causing far reduction in the fecundity and fertility and this leads to the minimization of the population. Since the reproduction is conditioned by the accretion and development, while exploring influences of the sterility inducing insecticides (chemosterilants and insect growth regulators) on the repropotential or behaviour of pests, it is desirable to investigate their impacts on the growth and development too. Therefore, within its frame-work, this investigation has aimed at exploring biological effects of two insect growth regulators (fourth generation insecticides) namely novaluron, and chlorfluazuron on the performance (growth, larval feeding, development and reproduction) in leaf webber and capsule borer, *Antigastra catalaunalis* Dup. with special consideration for its sterility.

MATERIALS AND METHODS

Test Insect: *Antigastra catalaunalis* Duponchel

Systematic Position:

- Phylum-Arthropoda
- Class-Insecta
- Order-Lepidoptera
- Family-Pyralidae
- Genus-*Antigastra*
- Species-*catalaunalis*

Sources:

Male and Female, *Antigastra catalaunalis* Dup. were collected in second week of July, 2009 from sesame field. Their large population and swarms may be seen during rainy season (July-September). To collect the larvae the sesame crop was inspected time to time.

Laboratory Stock of the Insect:

The insect was reared and maintained in the laboratory in order to ensure regular supply of the insect and its developmental stages during whole tenure of the present investigation as described below. To begin with, the stock was established with the help of field collected moths. These moths were maintained on 10 per cent sugar solution in glass chimneys with tender sesame leaves (*Sesamum indicum*). Eggs obtained from them were kept as such for hatching. Larvae hatched from eggs were transferred on tender sesame leaves in petridishes (15 cm dia) and reared on them till pupation. The food supply to larvae was renewed twice a day in view of evaporation of water, which proceeds fast when leaves are detached from plants. The sesame leaves were treated with KM_nO_4 solution for five minutes followed by washing in running water. These leaves were dried under shade and provided to the experimental larvae. The larval period lasted for about 15.25 days. All possible precautions were taken to save larvae from bacterial and fungal infections. The first and second instars were reared in pertidishes but from third instar to pupations they were reared in pneumatic troughs (25 cm dia.) in small groups. When larvae acquired full growth and stopped feeding, they were transferred in separate pneumatic troughs having 6 inches thick moist soil layer on their bottoms. The larvae pupated in leaves made coverings. Pupae, thus obtained were kept as such for eclosion. Moths emerged from pupae were reared in pneumatic troughs as described above. In this way the progeny of moths of succeeding generations were reared generation after generation continuously till the tenure of the investigation. The laboratory reared insects and larvae were maintained throughout the tenure of investigation into the Department of Zoology, D.V. (P.G.) College, Orai, Jalaun by the technique described above with slight modifications as when found necessary.

Insect Growth Regulators Used and application:

The following fourth generation insecticides whose efficacy as insecticides has already been proved in different crop pests employed against *Antigastra catalaunalis* in this investigation- Chlorflua zuron.

The different concentrations of insect growth regulators mentioned above were applied against *A. catalaunalis*. The concentrations considered in this work included 0.0001, 0.001, 0.01, 0.10, 0.50 and 1.00 per cent. These concentrations were obtained by dissolving the desired quantity of insect growth regulator in acetone or methanol.

The insect was treated with different concentrations of insect growth regulators used in this investigation by two methods namely- Adult feeding method and Residue film method. Detail of both methods are mentioned below:

(i) Residue Film Method (RFM): In this method of treatment 1 to 2hr old adults were exposes to a thin film of residue of a concentration of a particular insect growth regulator. For obtaining the thin film of the chemical as residue, about 10 ml of a concentration of a chemical was poured in a petridish (10 cm dia.) and the petridish was tilted in different

ways to spread the chemical on the whole floor area of the petridish and its raised periphery. Thereafter, the petridish was kept in the air for the evaporation of the solvent. This led to the formation of a thin film of a concentration of a insect growth regulator in the petridish as residue. Adults were left in petridishes having thin film of the insect growth regulator for 24 hours. The petridishes were covered by thin muslin cloth to prevent the escape of the adults. Such treated adults were employed in the different experiments as described later on. This method of treatment will be designated as RFM in the text from here onwards.

(ii) Adult Feeding Method (AFM): In this method of treatment a concentration of a particular insect growth regulator was mixed in 20 per cent sugar solution which was supplied to adults for feeding. From here onwards this method of treatment will be referred as AFM in the text.

The biomass is estimated as per standard laboratory methods and guidelines. The data obtained from the studies were subjected to statistical analysis. Various statistical techniques mentioned below have been applied to study the nature and relationship between variables to know the reliability and precision test the significant difference between the observed and corresponding expected values and to predict the estimated values of effectiveness for a given value of concentration.

RESULTS AND DISCUSSION

Chlorfluazuron on Acquisition of Biomass in Pupae and Adults under A.F.M.:

The pupa of the untreated parent moths acquired more weight than that of the parent's treated with any concentration of the chlorfluazuron (P<.01). In response to the parent moth's treatment with the different concentrations of the chlorfluazuron, the pupal biomass, decreasing with the increasing concentration, varied from 102.45 to 149.63 mg and it depended on the concentration of the chlorfluazuron (P<.01).

The male and female adults of the untreated parent moths, acquiring 104.43 and 110.12 mg. biomass respectively, were heavier than those of the parents treated with any concentration of the chlorfluazuron (P<.01). In response to their parent's treatment by feeding method with different concentrations of this fourth generation insecticide, the biomasses of male and female adults, varying from 57.38 to 102.6 mg and from 63.12 to 107.82 mg. respectively and the both decreasing with the increasing concentration, were found to be strongly affected by the concentration of insecticide (P<.01).

Effect of Chlorfluazuron on Biomass Acquisition In Pupae and Adults under R.F.M.:

The pupa of the untreated adults acquired more biomass (153.62 mg) than that of the adults treated with the residue film of the chlorfluazuron of any concentration (P<.01). In response to its parent adults treated with residue films of different concentrations of this insect growth regulator, the pupa obtained 106.60 to 154.82 mg. biomass, falling with the rising concentration and the pupal biomass, as per Anova test, was found to differ strongly with the concentration of this insecticide (P<.01).

The male of the untreated parent adults was considerably heavier (104.43 mg) than that of the parent adults treated with the residue film of any concentration of chlorfluazuron (P<.01). In response to its parents adult treatment with the residue film of different concentrations of this insect growth regulator, the biomass of the male adult varied from 64.14 to 103.21 mg decreasing with the increasing concentration and as per analysis of variance, it depended strongly on the concentration of the chlorfluazuron (P<.01).

The female adult of the adults treated with the residue film of the chlorfluazuron of any concentration acquired less biomass as compared to that of the untreated adults (P<.01). As regards the effect of the parent adults treated with the residue films of the different concentrations of this insect growth regulator on the biomass of the adult female, the

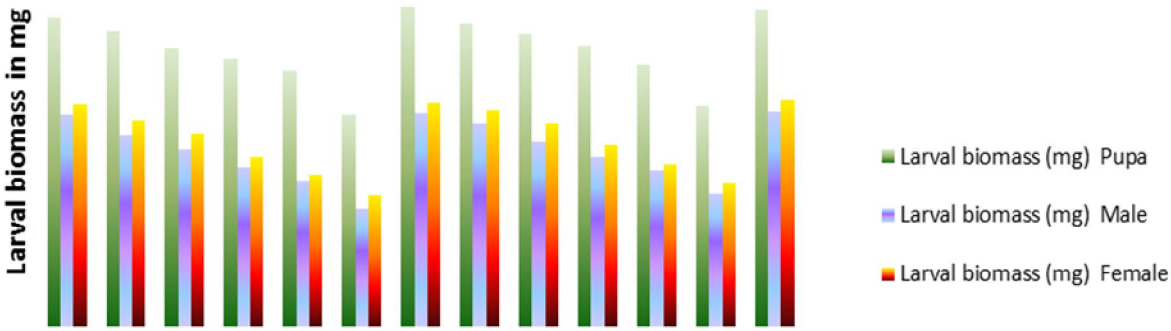
weight of the female adult varied from 68.86 to 108.62 mg, tending to decrease with the rise in the concentration and it was affected differently by the different concentrations of chlorfluazuron (P<.01).

Table 1: Effect of Chlorfluazuron at different concentrations under different modes of treatment on biomass accumulation by pupa and adults in *Antigastra catalaunalis* Dup.

(Values are means ± S.E.)

Mode of treatment	Concentration%	Larval biomass (mg) ± S.E. on		
		Pupa	Male	Female
AFM	.0001	149.63±1.14	102.86±0.82	107.82±1.04
	.001	143.64±0.96	92.42±0.96	100.10±0.96
	.01	134.64±0.82	85.66±0.78	93.44±0.88
	.10	129.46±0.16	76.92±0.84	82.00±0.69
	.50	124.25±0.83	70.64±0.62	73.66±0.64
	1.00	102.45±0.94	57.38±0.72	63.12±0.64
RFM	.0001	154.82±0.95	103.21±0.84	108.62±0.84
	.001	147.14±0.94	98.08±0.62	104.74±0.92
	.01	142.17±0.82	89.14±0.70	98.12±0.93
	.10	136.12±0.84	82.06±0.82	87.64±0.92
	.50	126.64±0.71	75.86.0.84	78.12±0.88
	1.00	106.60±0.94	64.14±0.63	68.86±0.62
	Control	153.62±0.92	104.43±1.22	110.12±0.94

Fig-1: Effect of Chlorfluazuron at different conentrations under both nodes of treatment on biomass accumulation by pupa and adults in *Antigastra catalaunadis Dup.*



As regards the influence of the insect growth regulators on biomass accumulation in *Antigastra catalaunalis* larva, the related results have shown that both insect growth regulators considered under this investigation has potential to reduce the growth in *Antigastra catalaunalis* even at a very low concentration. Chattoraj and Singh (1972), Chattoraj & Dwivedi (1980), Sharma (1993), Tembhare and Shinde (1998), Nakano and Romano (2002), Gupta *et.al*. (2005) and Gupta and Khattri (2012) have also observed similar influence of insect growth regulators in other insects. The effect of the different concentrations of insect growth regulators on the accumulation of the biomass in the larva, which may not be graded in early larval life, becomes quite distinct in the late larva,

the biomass reducing potential of fourth generation insecticide increases with the increase in its concentration.

Furthermore, in respect of the influence of insect growth regulators on the biomass accumulation in *Antigastra catalaunalis* under different modes of their application to this insect, the related results indicate that both insect growth regulators tested during this investigation proved effective. The insecticides, chlorfluazuron reduce the larval biomass almost identically in early larval life. The identical decline in the larval biomass at a corresponding concentration under both modes of their application only up to the mid-larval life but thereafter, their corresponding concentration exert different biomass curtailing influence under both modes of their application.

The chlorfluazuron applied by the adult feeding method reduced the biomass of the late larva more than when it is applied as residue film; this chemosterilants's different concentrations are equally effective in reducing the larval biomass under the both modes of the treatment. Like the a concentration of the chlorfluazuron also becomes more effective in reducing the larval biomass under the adult feeding method as compared the application of the same as the residue film to the *Antigastra catalaunalis*. However, contrary to the, a concentration of the chlorfluazuron potent in declining the biomass of the late larva when it is administered orally than when it is applied as residue film; with the adult feeding method, it becomes more effective than as the residue film applied to the adult.

The chlorfluazuron are not equally efficient under both methods of their application suggest that the former insect growth regulator is equally translocated to the sites of their action under the both methods of their application to the *Antigastra catalaunalis*. Since adequate growth is an attribute of proper nutritional metabolism, it may be presumed that the chlorfluazuron, the insect growth regulators interfere this aspect of physiology in *Antigastra catalaunalis* hence they reduce the accumulation of the biomass in larvae of this insect. Abid (1978) has reported that the apholate accepts amino acids as ligands, binding to NH_2 site and consequently, inhibiting formation of the linkage, it reduces the synthesis of some proteins in *Diaphania nilidalis* which owing to the same, exhibits poor growth. In *Antigastra catalaunalis* also, the insect growth regulators used in this work may hinder the protein synthesis causing consequent reduction in the larval biomass but this needs confirmation.

REFERENCES

1. Abid M.K., Ghobrial A El. Haideri H.S. and Abbs S.A. (1978): Dimilin (TH 60-40): Effect on the spiny boll worm, *Earias insulana* Boisd. *Zeitsch.Angew, Ent.* 85(3): 321-324.
2. Chattoraj A.N. and D.R. Singh (1972): Studies on weight and water loss in the larvae of *P.ricini* with certain insecticides. *Proc. Natl. Acad. Sci. India.* 42(B) Parts 11', 169-172.
3. Chattoraj A.N. and S. Dwivedi (1980): Effect of penfluron on the sterility and mortality of *Spodoptera litura* (Boisd.) *Comp. Phys. Ecol.* 5(4): 310-313.
4. Gupta L. and Khattri S.N. (2012): Effect of DIPEL on the growth and development *Diacrisia obliqua* Walker (Lepidoptera: Arctiidae). Of Seminar held at Janta college, Bakewar, Etawah", Nov.20-30 pp. 103.
5. Gupta L., A. Kumar and Shukla G.S. (2005): Effect of bacterial preparations on the growth of *Diacrisia obliqua* Walker (Lepidoptera: Arctiidae). National Seminar on "New Horizons in Biosciences", Nov.20-30 pp. 103.
6. Nakano O. and Romano F.C.B. (2002): Use of insect growth regulator on fruit fly, *Ceratitis capitata* (Wield.) (Diptera : Tephritidae) *Sterilization.* 23(1): 115-125.
7. Sharma M. (1993): Effect of certain insect growth regulators on the growth and development of *Utetheisa pulchella* L. (Lep.: Arctiidae). A thesis submitted for the Ph.D. Degree to Kanpur - University, Kanpur.
8. Tiwari L.D. (1985): Effect of Dimilin on consumption and utilization of dry matter and dietary constitution of castor, *Ricinus communis* Linn. *Ind. J.Ent.* 47(1): 9-13.
9. Wright J.E., Roberson J. and Dawson J.R. (1980): Boll weevil: Effect of diflubenzuron on sperm transfer, mortality and sterility. *J. Eco .Ent, .*73(6): 803-805.
10. Zepp D.B., Dierks A.Z. and Saunders D.J. (1979): Effects of diflubenzuron on black vine weevil as oviposition, egg. viability and adult longevity, *J. Kans. Ent. Soc.* 52: 662-666.