Evaluation of effect of Buprofezin on larval growth of 3rd instar larvae of *Euproctis icilia* (Stoll) *& Euproctis fraterna* (Moore).

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Abstract:

Buprofezin a potent Insect growth regulator used to control different pests. IGRs (Insect growth regulators) also called fourth generation insecticides belongs to the benzoyl phenyl urea group they are chitin biosynthesis inhibitor was first synthesized in early1970s in laboratory of Phillips Duphar**.** Buprofezin is applied against 3rd instar larvae of *Euproctis icilia* (*Stoll*) & *Euproctis fraterna* Moore to observe larval growth. Buprofezin is applied to test insect with maximum and minimum concentration of 1.295µg/cm^2 and 0.0000253µg/cm^2 respectively by residual film treatment method and it is also applied with maximum and minimum concentration of 50 ppm and 0.001ppm respectively by larval feeding treatment method. A control experiment is also set to compare the experimental observations. Higher concentration level of Insect growth regulator reduces the maximum growth of the treated larvae while lower concentration level of Insect growth regulator causes less reduction in larval growth by both method of treatment. *Euproctis icilia* (*Stoll*) *& Euproctis fraterna* Moore are the polyphagous pest feeds on cotton, rose pomegranate, mango, pigeon pea and pea. It mainly feeds on the leaves of the castor (*Ricinus communis* L.) and defoliates the complete plant.

Key words: *Euproctis icilia & Euproctis fraternal*, Buprofezin, residual film treatment, larval feeding treatment method.

Introduction:

Many pests have developed resistant to the commonly available insecticides as also as these insecticides create health related issues to non-target organism and human. As a result, there is an increased interest and use of chemical insecticides classified as reduced risk insecticides. Reduced risk insecticides are less toxic to humans, safe for non-target organisms. Insect growth regulators are reduced risk insecticides. (Nayar *et.al.,* 1971).

There are two categories of insect growth regulators juvenile hormone mimics and chitin synthesis inhibitor (Smagghe *et.al.,* 1996, Khafagi & Hegazi 2008). Juvenile hormone mimics arrest the development of insect so insects are unable to complete their life cycle either they fail to get adulthood due death in earlier stages or the mature into sterile adults. Studies on the toxicology of diflubenzuron VII. Influence of diflubenzuron on cuticle protein synthesis series of *Mythimna separata* (Wang- wen Quan *et.al.,* 1995).

Chitin synthesis inhibitors inhibit the biosynthesis of chitin which is the essential component of endoskeleton thus insects are unable to molt from one instar to next instar. Laboratory evaluation of chitin synthesis inhibitor (Diflubenzuron and Buprofezin) against *Aedes aegypti larvae* reported from Lahore by (John *et.al.,* 2011). Insect growth regulators also produce delayed symptoms, in which the adults fail to escape from pupal skin and therefore cannot fly, feed and mate. The bio-efficacy of insect growth regulators is generally manifested during ecdysis as it disturbs the process of chitin deposition, thus effecting growth and development of the insects (Butter *et.al.,* 2003). The insect growth regulators are very potent against important lepidopteran pests such as *Spodoptera littoralis, Pericallia ricini, Bemisia tabaci. Helicoverpa armigera, Utetheisa pulchella, Cryptoblabes gnidiella*. The IGR used in the present investigation is Buprofezin. It belongs to benzoylphenyl urea group. The efficacy of buprofezin has already been evaluated in certain other insects and entomologists obtain valuable results. The pests selected for bioassay assessment were *Euproctis icilia* (*Stoll*) and *Euproctis fraterna* Moore of the family Lymantriidae belong to order Lepidoptera. Both lepidopterans are known as hairy caterpillars. They feed on castor leaves (*Ricinus communis* L.) preferably. They are found in large numbers all over India. The larvae of insects feed voraciously. They eat away the entire leaf leaving only midrib, branches and stem and sometimes the whole plant is defoliated. The objective behind the present study was to establish the interaction of insect growth regulators against selected experimental lepidopterans at lethal as well as sublethal levels. The assessment of larval growth of each pest is taken as parameter by applying different concentrations of Buprofezin on 3^{rd} instar larvae (Ishaaya *et.al,* 1988 and (Saxena 2000).

Materials and Methods:

Euproctis icilia (*Stoll*) is commonly known as castor hairy caterpillars or tussock hairy caterpillars. They feed on castor (*Ricinus communis* L.), an important oil seed crop. The moth is moderately sized and hairy. Tufts of hair are seen at the anal end in the female. The eggs are covered with these hairs. The larvae occur in abundance and feed voraciously. The fully grown larva is about 4 cm long, reddish brown in color, with short brown hairs all over the body. *Euproctis fraterna* Moore is a sporadic pest of castor. Effect of certain insect growth regulators on the growth and development of *Utetheisapulchella* L. (Lep.; Arctiidae). (Sharma 1993).

The larvae are defoliators on castor, cotton, rose pomegranate, mango, pigeon pea and pea etc. The eggs are flat and yellow. Female laid their eggs in masses on the under surface of leaves. Larvae feed gregariously on leaves. These moths were maintained on ten per cent sugar solution in glass chimneys with castor leaves (*Ricinus communis* L.). Eggs obtained from them were kept as such for hatching (Gupta & Shukla 2013). Larvae obtained from eggs were reared on tender castor leaves in large petri dishes to grow up to second instar stage. The IGR used in present investigation is Buprofezin a potential compound for controlling lepidopteran pests and white flies. In the larval feeding treatment, the 3^{rd}instar larvae of *Euproctis icilia* (*Stoll*) and *Euproctis fraternal (Moore)* were separated from the rearing stock and then allowed to feed on a castor leaves which were already dipped in solution of Buprofezin of different concentrations varied from 0.001 – 50 ppm. The larvae were allowed to feed on such (Nayak *et.al*., 1978)

leaves for 24 hours. After the treatment known amount of food was given to the larvae and observation for larval growth was recorded. In the residual film treatment method, a film of insect growth regulator of known concentration is prepared by pouring 1 ml of insect growth regulator in petridish with the help of pipette and now larvae were exposed to the residue film for 24 hours. A control experiment was also set up to evaluate and compare the observation of different experiments of different concentration of insect growth regulator. Application of the insect growth regulators affected the growth of the experimental larvae. Therefore, observations were made to keep track on the weight gained by the larvae after the treatment. For this purpose, the larvae were weighed daily and the maximum weight in each instar was recorded. The final weight i.e., the maximum weight of the last instar was taken into account and after comparing it with control, growth rate of the experimental moth was calculated.

Results and Discussion:

Laboratory and field evaluations of extracts from Rhododendron molle flowers as insect growth regulators to imported cabbage worm, *Pieris rapae* L. (Lepidoptera: Pieridae) (Zhong *et.al*., 2001). Under larval feeding treatment the growth in the larvae of *Euproctis icilia* (*Stoll*) shows a regular reduction with the increase in concentration levels. Maximum reduction was recorded at 50 ppm level and was 42.99 per cent. At lowest level (0.001 ppm) of treatment reduction by 15.98 per cent was observed. Thus, reduction in growth rate was positively correlated with concentration levels in experiment. Since food intake is considerably reduced, reduction in growth is expected (Table-1).Under residual film treatment Reduction in growth of the treated larvae was exhibited. The growth was reduced maximum by 39.72 per cent at 1.295μg/cm^2. It was also observed that increase in treatment level of fourth generation insecticides cause increase in reduction in larval growth. This showed that the growth rate was positively correlated with the treatment levels, Lower levels proved less effective and the minimum reduction recorded was 12.39 per cent at 0.0000253 μg/cm^2 of residual deposits (Table-2). The growth in the larvae of *Euproctis fraternal (Moore)* shows a regular reduction with the increase in concentration levels. Maximum reduction was recorded at 50 ppm level and was 47.95 per cent. At lowest level (0.001 ppm) of treatment reduction by 18.64 per cent was observed. Thus, reduction in growth rate was positively correlated with concentration levels in experiment. Since food intake is considerably reduced, reduction in growth is expected (Table-3). Data reveals significant reduction in growth at all levels of treatment. The growth of the treatment larvae was reduced maximum by 50.78 per cent at 1.295μg/cm^2 when compared with control, minimum being 22.14 per cent at 0.0000253 μg /cm^2 at residual deposits. Since the insecticide acts as a disrupting agent, food intake gets reduced, thereby affecting growth. The efficiency of converted ingested and digested food into body substances was also reduced. This further reduced growth. Experimental observations of fourth generation insecticides reduces the weight of 3rd instar of *Euproctisicilia* Stoll. (Gupta & Gupta 2014). (Table-4).

Table – 1

Effect of Buprofezin on the growth of larvae of *Euproctis icilia* under third instar larval feeding treatment.

S. No.	Concentration (ppm)	Average per larvae weight before treatment (gm)	Average max. per larvae weight in third instar (gm)	Average max. per larvae weight in fourth instar (gm)	Average max. per larvae weight in fifth instar (gm)	Max. reduction in larval growth	
						(gm)	(%)
1.	0.001	0.027	0.125	0.319	0.899	0.171	15.98
2.	0.01	0.027	0.122	0.312	0.817	0.253	23.64
3.	0.1	0.027	0.115	0.351	0.794	0.276	25.79
4.	1.0	0.027	0.103	0.297	0.729	0.341	31.86
5.	50.0	0.027	0.100	0.360	0.610	0.460	42.99
6.	control	0.027	0.101	0.392	1.070	-	-

Table – 2

Effect of Buprofezin on the growth of larvae of *Euproctis icilia* under third instar larval residual treatment.

S. No.	Concentration ($\mu g/cm^2$)	Average per larvae weight before treatment (gm)	Average max. per larvae weight in third instar (gm)	Average max. per larvae weight in fourth instar (gm)	Average max. per larvae weight in fifth instar (gm)	Max. reduction in larval growth	
						(gm)	(%)
1.	0.0000253	0.027	0.087	0.305	0.767	0.114	12.93
2.	0.000253	0.028	0.096	0.332	0.730	0.151	17.13
3.	0.00253	0.028	0.086	0.326	0.676	0.205	23.26
4.	0.0253	0.027	0.111	0.341	0.636	0.245	27.80
5.	1.295	0.028	0.102	0.320	0.531	0.350	39.72
6.	Control	0.028	0.089	0.363	0.881	-	-

Table –3
Effect of Buprofezin on the growth of larvae of *Euproctis fraterna* larvae under third instar larval feeding treatment.

S. No.	Concentration (ppm)	Average per larvae weight before treatment (gm)	Average max. per larvae weight in third instar (gm)	Average max. per larvae weight in fourth instar (gm)	Average max. per larvae weight in fifth instar (gm)	Max. reduction in larval growth	
						(gm)	(%)
1.	0.001	0.023	0.063	0.134	0.397	0.091	18.64
2.	0.01	0.026	0.068	0.143	0.368	0.120	24.59
3.	0.1	0.026	0.089	0.120	0.288	0.200	40.98
4.	1.0	0.024	0.098	0.131	0.278	0.210	43.03
5.	50.0	0.023	0.087	0.157	0.254	0.234	47.95
6.	control	0.023	0.057	0.128	0.488	-	-

Table –4
Effect of Buprofezin on the growth of larvae of *Euproctis fraterna* under third instar larval residual treatment.

S. No.	Concentration ($\mu g/cm^2$)	Average per larvae weight before treatment (gm)	Average max. per larvae weight in third instar (gm)	Average max. per larvae weight in fourth instar (gm)	Average max. per larvae weight in fifth instar (gm)	Max. reduction in larval growth	
						(gm)	(%)
1.	0.0000253	0.024	0.063	0.186	0.348	0.099	22.14
2.	0.000253	0.024	0.083	0.174	0.324	0.123	27.51
3.	0.00253	0.025	0.094	0.176	0.313	0.134	29.97
4.	0.0253	0.024	0.087	0.149	0.285	0.162	36.24
5.	1.295	0.026	0.081	0.112	0.220	0.227	50.78
6.	Control	0.025	0.056	0.213	0.447	-	-

Radwan *et.al*., (1986) reported that when fourth instar larvae of the Noctuid, *Spodoptera littoralis* were fed on castor bean leaves treated with chitin biosynthesis disrupting agents, diflubenzuron and its analogue SIR- 8514 (triflumuron), there was a reduction in the consumption of food. Considerable decrease in growth rate was also recorded. The efficiency of converting ingested and digested food into body substances also showed an obvious reduction specially in larvae fed on diflubenzuron treated leaves. On the other hand, the approximate digestibility co-efficient increased considerably in larvae fed on leaves treated with diflubenzuron and triflumuron. Rao *et.al.*, (1987) studied the feeding behavior of 2nd., 3rd, 4th and 5th instar larvae of the rice pest, *Cnaphalocrosis medinales* after ingestion or topical application or dipping larvae in diflubenzuron at 1,50,100,150,200,250 and 500 ppm. Feeding by larvae was reduced following treatment with one ppm but was stimulated by concentration up to 100 ppm and then decreased. These variation in feeding behavior resulted in variation in value of the ID (50 per cent inhibition dose). Ingestion and topical application of diflubenzuron to 2nd and 3rd instar larvae resulted in less than 50 per cent inhibition even at 500 ppm. For 4th and 5th instar.

The growth efficiency was reduced by 44.54 per cent in oral administration, the highest sublethal dose (2.7 and 1.8 µg/larvae respectively) compared with that of control larvae. In addition to inhibiting the growth of the larvae of *Papilio demoleous* the insect growth regulator produced morphological abnormalities in the adult. (Chockalingam & Krishnan 1984). While studying the effect of oral administration of diflubenzuron on feeding of *Pericallia ricini* Fab, it was found that larvae lost their weight in both conditions of treatment (feeding method or by residual method).The LC_{50} and LD_{50} data showed significant change in either type of treatment (Saxena *et.al.*, 2001, Nakano and Romano 2002 and Cloyd 2003). In the present study also the insect growth regulator, buprofezin, suppressed the larval growth of the treated insects, both in larval feeding as well as residual treatments. Results obtained showed that buprofezin reduced the larval growth in third instar larvae. Reduction in larval growth was greater in *Euproctis fraterna* than in *Euproctis icilia* through feeding treatment but was almost the same in residual treatment on treatment with buprofezin.

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