COMPARATIVE STUDIES ON EFFICACY OF AZADIRACHTIN, A PLANT DERIVED PESTICIDE AND CYPERMETHRIN, A SYNTHETIC PESTICIDE ON THE CONTROL OF *PERICALLIA RICINI* [FABRICIUS 1775]

D. Bhavani[1] and Dr. M.S. Nalina Sundari[2]
Department of Zoology, Queen Mary's College (Autonomous), Chennai- 600 004.

ABSTRACT

Insects dominate all terrestrial environments that support human life. They are the most important competitors for food, fiber and other natural resources. They consume or destroy around 10% of gross national product in large industrialized nation and upto 25% of gross national product in some developing countries. Neem botanically known as *Azadirachta indica* belonging to the family Meliaceae, is a plant, well known in India, Pakistan and some African countries for its insect control properties. It is proved to be an important agent for battling insects. *Pericallia ricini* is a major pest of agriculture. The infested plants exhibit severe crumpling of the leaves. Based upon the fact that plant alkaloids leave no residues in the environment, the present study was aimed to investigate the impact of different concentrations of the extract of *Azadirachtin* on the biology of *P. ricini*. Significant reduction in the protein content of the body tissues *P. ricini* was observed due to their exposure to the extract of *Azadirachtin*. Moreover, the extract was mixed with certain synthetic insecticides and the synergistic studies were also carried out.

Keywords: *Pericallia ricini, Azadirachtin* , synthetic insecticides.

INTRODUCTION

Insects are the most destructive agents affecting forest and shade trees in the south. More than 20,000 species of field and insect pests annually destroy approximately one third of the world's food production. Alternative pest control strategies especially those that are efficient and low cost, are thus needed. Crude plant extracts play an important role here[1]. *P. ricini* is a serious pest of many plants in tropical regions and sub tropical regions. They are worldwide in distribution and richly distributed in the tropics [2]. *P. ricini* is a major pest of castor, sesame, cotton, country bean, brinjal, drum stick, coccinia, banana, calotropis, sunflower, oleander, tea, sweet potato, pumkin [3] and vanilla [4]. Among the larval stages the 3rd and 4th instar larvae cause severe damage to plants. *P. ricini* infestation causes severe crumpling of the leaves and heavy infestation can cause defoliation and even death of the plant. When the plant dies the colonies migrate to newer plants. Various mechanical, chemical and botanical control measures have been used to control this pest [5].Today the rapid increase in the population and the demand of food materials has initiated the conventional farming practices which uses chemical methods to kill both useful and harmful life forms indiscriminately, resulting in the malfunctioning of food chain and food web. The use of conventional insecticides has raised some concern about their threat to the environment and development of insecticide resistance in insects [6].

Bio control is the best method to cope with the damages done by chemicals. Our elders used Neem for the management of pests and diseases as a traditional method. Neem produce a limonoid compound called Azadirachtin. It is a naturally occurring substance that belongs to an organic molecule class called tetranortriterpenoids[7]. It is structurally similar to insect hormones called "ecdysones". Azadirachtin seems to be an "ecdysone blocker". It blocks the insect production and release of these hormones. Insects then will not molt, thus breaking their life cycle[8]. In view of the above findings, the present study was aimed to investigate the effectiveness of azadirachtin, a bio-pesticide in the control of the lepidopteran insect pest *P. ricini*.

MATERIALS AND METHODS

Insect Culture:

The insects collected from castor plants and banana trees were introduced on the castor leaves in the cage (50.5 x 41.5 x 55cm) and covered with muslin cloth. They were fed with fresh castor leaves daily till pupation. The adults obtained from the above culture were released in separate cage and were fed with 10% sucrose solution soaked in a piece of cotton. They were checked daily for egg laying and eggs were removed and placed in separate cage on fresh succulent castor leaves for hatching. The neonate larvae were reared on fresh castor leaves to maintain the stock culture of *P. ricini*.

Bio-pesticide-Azadirachtin:

The neem tree is capable of protecting itself from damaging insects by producing a limonoid compound called Azadirachtin[8]. It is very effective in eliminating the pest menace in the field of agriculture and will replace widely used chemical pesticides[9]. A commercial product of Azadirachtin called Neem baan^{TM} supplied by pest control India (Pvt) ltd., was used in this study.

Synthetic pesticide-Cypermethrin:

Cypermethrin is a synthetic pyrethroid used as an insecticide in large scale commercial agricultural applications as well as in consumer products for domestic purposes. It behaves as a fast acting neurotoxin in insects. It inhibits "Gap junctional intracellular communication" [10]. It is found in many household ant and cockroach killers, including rat and ant chalk.

Bioassay:

Newly moulted third instar larvae were isolated from the stock culture and placed in containers (17.5 x 10.5 x 9.5cm) and were fed with castor leaves treated with different concentrations of Azadirachtin and Cypermethrin. They were seperately prepared in distilled water in 1:1 ratio (Water : Pesticide). Three different concentrations were chosen and 20 larvae (in triplicate) were maintained in each concentration. Insects were also fed with fresh castor leaves without any treatment and were maintained as control.

Similarly separate experiments were carried out for the combinations of Azadirachtin and Cypermethrin. For the present study, Azadirachtin, a plant derived biopesticide was mixed with

synthetic insecticide Cypermethrin in 1:1 ratio and tested for its efficacy. The assessment of toxicity was based on the mortality (%) of *P. ricini* against three different concentrations of Azadirachtin and Cypermethrin in three different durations 24, 48 and 72hrs. LC_{50} values were determined.

At the end of 72hrs the treated insects were sacrificed for biochemical analysis.

Biochemical analysis:

Estimation of Protein:

The total protein was estimated in the control and treated insects following the method described by Lowry *et al.*,[11].

Estimation of Chitinase:

The chitinase activity was quantified following the method of Perls[12] and the estimation was done as described by Mitchell *et al.*,[13] and the calculations were done as described by Monreal and Rees[14].

RESULTS

Synergistic studies:

The assessment of toxicity was based on the mortality of the third instar larvae of *P.ricini*. The LC_{50} value of *P. ricini* third instar larvae was found to be 0.83% (Table1), when treated with azadirachtin. Whereas the LC_{50} value of *P. ricini* treated with Cypermethrin was found to be 0.50% (Table 2). However, when Azadirachtin mixed with Cypermethrin in 1:1 ratio, the LC_{50} value was found to be 0.75% (Table 3).

Biochemical constituents:

The total protein quantity in the treated insects were found to decrease when compared with the control. The LC_{50} value of third instar larvae of *P. ricini* reduced from 0.83% (Azadirachtin treated insect) to 0.75% (Synergistic mixture treated insect). However, an increase in the activity of chitinase was observed when insects were fed with Azadirachtin and Cypermethrin mixture. This increase in the activity of chitinase may further accentuate the inhibition of chitin build up. However, this raise in the activity of chitinase, was found to decrease as the days prolonged.

Statistical analysis:

Statistical analysis revealed a significant positive correlation between the dosage of Azadirachtin with the percentage mortality of the insects.

Table 1: Impact of Azadirachtin on the mortality of third instar larvae of *P. ricini*

S.NO	CONCENTRATION OF AZADIRACHTIN %	MORTALITY		
		24 hrs	48 hrs	72 hrs
1.	0.25	10 %	10 %	20 %
2.	0.5	10 %	20 %	30 %
3.	1.0	30 %	40 %	60 %

LC_{50} = 0.83 %

Correlation coefficient for 72 hrs γ =0.994; P<0.001

Table 2: Impact of Cypermethrin on the mortality of third instar larvae of *P. ricini*

S.NO	CONCENTRATION OF CYPERMETHRIN %	MORTALITY		
		24 hrs	48 hrs	72 hrs
1.	0.25	10 %	20 %	30 %
2.	0.5	20 %	30 %	50 %
3.	1.0	30 %	50 %	70 %

LC_{50} = 0.50 %

Correlation coefficient for 72 hrs γ =0.98; P<0.001

Table 3: Impact of Azadirachtin and cypermethrin (1:1) on the mortality of third instar larvae of *P. ricini*

S.NO	CONCENTRATION OF AZADIRACHTIN AND CYPERMETHRIN %	MORTALITY		
		24 hrs	48 hrs	72 hrs
1.	0.25	10 %	20 %	30 %
2.	0.5	20 %	30 %	40 %
3.	1.0	30 %	40 %	60 %

LC_{50} = 0.75 %

Correlation coefficient for 72 hrs γ =1.0; P<0.001

Table 4: Impact of Azadirachtin on the chitinase activity of *P. ricini*.

S.NO	CONCENTRATION OF AZADIRACHTIN %	PROTEIN% (Mean ± S.D)	CHITINASE% (Mean ± S.D)
1	Control	1.92 ± 0.091	2.56 ± 0.03
2	Treated insect (1.5%)	0.89 ± 0.05	11.42 ± 0.10

DISSCUSSION AND CONCLUSION

The results of the toxicity studies showed that Azadirachtin is highly effective even in low concentrations against *P. ricini*. The mortality of the larvae may be due to phagodeterent effect of Azadirachtin[15]. The growth inhibition was also observed in Azadirachtin treated insects. The phagodeterent effect of Azadirachtin causes reduced food consumption and thus caused reduction in growth and finally leads to mortality in insects. However, the plant extracts are not immediately toxic to the invading insects. When we mix azadirachtin with synthetic pesticide the toxicity is more and at the same time the consumption of insecticide will be less. Hence, the present study was focused to get a highly effective synergistic mixture. The biochemical studies recorded a decrease in the total protein quantity of the treated insects when compared to the control. However, an increased activity of chitinase was observed when insects were fed with Azadirachtin and Cypermethrin mixture. Moreover, when the larvae were monitored daily for larval development, pupal formation, and adult emergence, result showed stunted growth in Azadirachtin treated insects.

From this it is suggested that Azadirachtin has a drastic effect on the population density of the insects. Thus a persual of the work reported here indicates that a number of plant derived pesticides can be developed to manage the insects pests. The present study has thrown light for future planning of this type of work in the field of insect pest management.

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