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Effect of Neem oil Extractive (NOE) on Repellency, Mortality, Fecundity, Development and Biochemical Analysis of *Pericallia ricini* (Lepidoptera:Arctidae)

S.Mala and S.Muthalagi

ABSTRACT

Investigations carried out on the Biological effects of neem oil extractive were assessed against *Pericallia ricini*, revealed that NOE affects both feeding and growth rates of *Pericallia ricini*. The biochemical studies showed that larvae carbohydrate and protein content get reduced in the treated larvae and this reduction is found to be dosage dependent. NOE also influences the number of eggs laid. The hatchability was totally suppressed. The extractive produced malformations in adult and pupae of *P.ricini*.

Key Words: - Castor, *Pericallia ricini*, neem oil extractive, azadirachtin.

INTRODUCTION

Interest in the use of biopesticides with selectivity against phytophagous insects has increased in recent years, particularly in cropping systems that rely on natural enemies as a major component of integrated pest management (Rausell *et. al.*, 2000). Use of these natural compounds in the place of conventional insecticides can reduce environmental pollution, preserve non-target organisms, and avert insecticide, induced pest resurgence. The neem tree, *Azadirachta indica* produces the biodegradable and insecticidal liminoid, azadirachtin (Isman, 1999). The compound can be efficiently extracted from neem seeds where its concentration is greatest (Butter Worth and Morgan 1968). The insecticidal activity of azadirachtin has been demonstrated against numerous insect pests and its various modes of activity include, disruption of feeding, reproduction, or development (Walter, 1999). As azadirachtin is selective towards phytophagous insect with minimal toxicity to beneficial insects increases its potential value to pest management (Lowery and Isman, 1995). With all these in view, the present investigation was undertaken to study the effects of a Neem Oil Extractive (NOE) on *Percallia ricini*, a pest of castor.

MATERIALS AND METHODS

Biopesticide Source

Neem oil extractive used in the present investigation was obtained from the Directorate of Khadi and Village industries Commission, Pune, Maharashtra. It is a by product of neem oil and it has 10 percent fraction of crude oil. The product was screened at four concentrations viz., 0.2, 0.4, 0.6 and 0.8 percent to evaluate a range of biological effects on *P. ricini*.

Insect Source and Rearing

P. ricini is a phytophagous insect. The larvae are serious pests on many economically important crops, larvae were collected from the castor (*Riccinus Communis*) and a general culture was maintained to obtain third and fourth instar larvae.

Newly moulted third and fourth instar larvae were introduced in separate containers and were fed with the leaves soaked in different concentrations of the extractive. Distilled water mixed with 2 ml of alcohol forms the control solution. Both the treated and control larvae were maintained under identical conditions till pupation. The duration of larval period was recorded. Feeding budget of both fourth and fifth instar larvae were also calculated following Waldbauer (1968) and Petrusewicz and Macfadyen, (1970). The efficiencies were calculated relating the quantities of food consumed, assimilated and converted.

Other feeding parameters calculated were : CR = Consumption rate (mg / gm / day), AR = Assimilation rate (mg / gm / day), PR = Production rate (mg / gm / day), MR = Metabolic rate (mg / gm / day),AD = Approximate digestibility (%) ECD = Gross Conversion efficiency (%), and ECI = Net Conversion efficiency (%).

Total (carbohydrate), protein and lipid content of the final instar larvae which fed with the leaves soaked in the different concentrations of the NOE were estimated following (Seifter *et al.,* (1950), total protein by method of Lowery et al., (1951) and Bragdon (1951) Standard methods. taking 5 mg of dry samples, from each treatment. Carbohydrate was estimated following the method described by Seifter *et al.*, (1950), total protein by method of Lowery et al., (1951) and lipid by the method of Bragdon (1951).

Table 1.Larval duration (In days) of various instars treated with various concentrations of NOE

Larval instar	NOE Concentration (%)				
	Control	0.2	0.4	0.6	0.8
III	3.5 ± 1.290	3.5 ± 2.03	3.5 ± 4.92	3.5 ± 0.871	3.5 ±1.46
IV	8.4 ± 2.07	8.4 ± 7.08	8.4 ± 4.71	8.4 ± 7.92	8.4 ± 8.0
V	15.4 ± 2.30	15.4 ± 4.76	16.0 ± 6.07	16.0 ± 7.11	17.5 ± 8.4

Results obtained in the present investigation were subjected to statistical analysis. Statistical tools used in this study were S.D, correlation co-efficient, Regression analysis etc.

RESULT AND DISCUSSION

The larval duration of various instars treated with various concentration of NOE was given in Table 1. The larval duration is prolonged by two days (15.4 ±2.30 to 17.5 ± 8.4) when the larvae were fed with 0.8 % NOE treated leaves.

Feeding budget of IV and V instar larvae treated with various concentration of NOE were given in table 2 and table 3 respectively. The relationship between various feeding parameters with the concentrations of the extractive. furnished in table IV. It is clearly seen from the table that the feeding activity is much influenced by this extractive. As the dosages are raised consumption, assimilation, production and their respective rates all found to decline. Consumption decreases from 3673.27 mg in the control to 1464.76 mg in the 0.8 % concentration. Similarly production decreases to about 75 % when the larvae were treated with 0.8 % NOE, assimilation rate is 119.99 mg / gm / day in the 0.2 % concentration which declines to 39.14 mg / gm / day in the final concentration. The assimilation efficiency is also found to be reduced. The declining trends observed in the feeding parameters are in accordance with the works of Ladd *et al.,* (1978). Wartlen (1979) reported that NOE acts as feeding inhibitor for many insect pests.

Figure 1. shows the effect of different concentrations of NOE on bio-chemical constituents of treated larvae. The total carbohydrate and protein contents found to decrease when the dosage increases, and the decline is found to be statistically significant. However, a slight increase in the lipid content was seen. Beck (1950) has reported that the insufficient amount of carbohydrate resulted in sub-optimal growth of *Pyrausta nubilelis*. Similarly lack of protein caused retardation of many physiological processes in insects, and adult insects require protein to promote ovulation and egg development (House, 1963).

The treated larvae were allowed to metamorphose into adult and the egg laid by these moths were calculated. At higher concentration the egg laid was totally suppressed. None of the eggs laid by treated insects hatched out. The extract was also effective in producing malformed adults. At higher doses the adults were unable to extricate from pupal skin. The malformed adults were shorter in length with crumpled wings. The fifth instar larvae was also crumpled and the hairs were found to be lost when treated with 0.8 % concentration of the extractive. The reduction in fecundity in the treated insect may be due to the derangement in the protein metabolism in the insects. In the present study, NOE might have affected the hormonal metabolism resulting in receipt of wrong code by cells inducing to perform wrong functions. This disturbed hormonal metabolism induced by the extractive may be attributed to the malformations seen in the adult. The observed reduction in growth, low fecundity and suppression in hatchability will definitely have a drastic effect on the population density of *Pericallia ricini*.

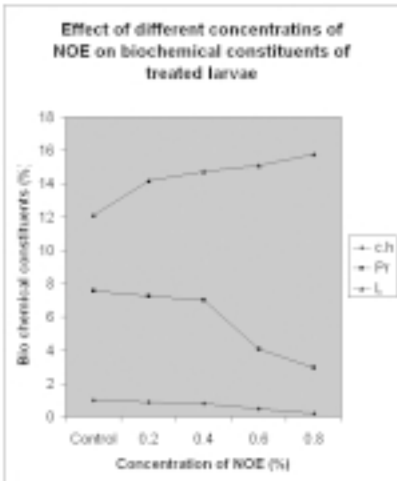

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Table 2. Feeding Budget Of IV Instar Larvae Treated With Various Concentration Of NOE

NOE (%)	C (mg /g/d)	A(mg/ g/d)	P (mg/ g/d)	M (mg/g/d)	CR (mg/g/d)	AR (%)	PR (%)	MR	AD	ECI	ECD
Control	741.98 ± 0.4744	278.97 ± 45.13	15.49 ± 0.05	266.57 ± 0.50	472.82 ± 0.302	177.7 ± 0.03	9.33 ± 0.23	171.87 ± 7.28	56.79 ± 3.03	1.959 ± 5.81	5.36 ± 0.09
0.2	729.97 ± 0.4998	266.98 ± 0.5015	14.30 ± 0.51	252.67 ± 0.06	467.66 ± 0.316	170.98 ± 0.03	9.16 ± 0.03	160.6 ± ± 0.03	36.66 ± ± 4.50	2.08 ± 5.47	5.55 ± 0.08
0.4	669.45 ± 0.4151	169.45 ± 0.057	14.304 ± 0.05	156.93 ± 0.50	369.23 ± 0.276	101.9 ± 0.03	7.93 ± 0.023	92.3 ± 0.03	37.58 ± 4.82	2.13 ± 6.37	7.58 ± 7.58
0.6	289.65 ± 0.5015	164.53 ± 0.515	12.516 ± 0.051	149.15 ± 0.58	179.46 ± 0.31	93.4 ± 0.029	7.87 ± 0.03	86.5 ± 0.02	25.30 ± 5.83	4.31 ± 0.01	8.44 ± 0.05
0.8	201.23 ± 0.515	108.23 ± 0.051	12.376 ± 0.05	93.92 ± 0.05	127.89 ± 0.35	68.7 ± 0.02	7.75 ± 0.039	59.69 ± 23.2	53.76 ± 0.01	6.15 ± 0.01	11.45 ± 0.04

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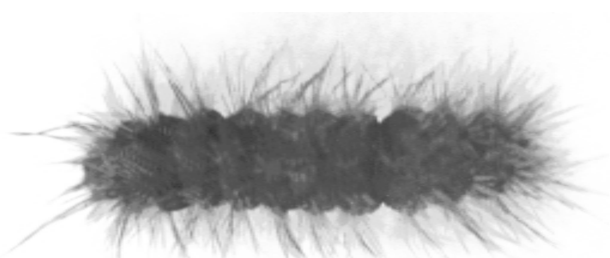
1. 0.8% NOE treated third instar larva. Size of the Larva is highly reduced



2. Supernumerary larva darker in colour with abnormally developed hairs. obtained on 0.8% NDE treatment.

Table 3. Feeding Budget Of V Instar Larvae Treated With Various Concentration Of NOE

NOE%	C(mg)	A(mg)	F(mg)	M(mg)	CR (mg g/d)	AR (mg /g/d)	PR(mg/ /g/d)	MR(mg /g/d)	AD(%)	ECI(%)	ECD(%)
Control	2930.29 ± 0.5014	956.29 ± 0.50	94.37 ± 0.50	634.87 ± 0.51	2629.19± ± 0.45	857.9 ± 0.04	84.67 ± 1.05	585.43 ± 0.04	32.9 ± 0.1	36.39 ± 3.88	0.976 ± 0.10
0.2	2120.78 ± 0.5012	698.78 ± 0.49	63.91 ± 0.51	537.43 ± 0.55	1982.35 ± 0.82	644.3 ± 0.05	58.93 ± 0.46	557.1 ± 0.05	31.77 ± 2.5	64.91 ± 2.16	1.09 ± 0.03
0.4	1813.28 ± 0.520	576.28 ± 0.52	38.84 ± 0.59	298.92 ± 0.47	1955.62 ± 0.46	597.4± ± 0.07	40.26± ± 0.53	312.5 ± 0.07	16.90 ± ±3.4	67.40 ± 1.04	2.141 ± 0.02
0.6	1484.18 ± 0.523	398.18 ± 0.52	14.49 ± 0.61	201.91 ± 0.59	1880.02 ± 0.53	401.0± ± 0.05	21.76 ± 0.77	301.12 ± 0.04	26.8 ± 0.05	91.46 ± 0.82	3.01 ± 0.02
0.8	1280.40 ± 0.530	216.40 ± 0.53	14.06 ± 0.57	181.72 ± 0.52	1495.24 ± 0.52	335.0 ± 0.08	14.59 ± 1.54	101.70 ± 0.10	32.63 ± 1.22	98.71 ± 0.47	3.22 ± 1.01

TABLE 4. Relationship Between Various Feeding Parameters With The Concentrations Of The Extractive

Parameter	Correlation Coefficient (r)
Consumption	- 0.9872**
Assimilation	- 0.9986**
Production	- 0.8728**
Consumption rate	- 0.9598**
Assimilation rate	- 1.0003
Production rate	- 0.9782**
Assimilation efficiency	- 0.8460*
Cross Conversion efficiency	- 0.9360**
Net Conversion efficiency	- 0.9066**

** = Indicate Significant at 10% level

* = Indicate Significant at 5% level


3. Deformed pupa with abnormaly developed thorax compared with that of control pupa. (0.6% NDEtreatment)


4. Adult moth developed from NDE treated third instar larva.

S.Mala and S.Muthalagi,
Department of Advanced Zoology and Bio-Technology, Govindammal Aditanar College,Tiruchendur-628215.