Supression of F1 Generation through Ovicidal Action of some Plant Extract against *Spodoptera Littura*

Deepali Lall, Sudha Summarwar, Jyotsana Pandey, and Arti Prasad

***Abstract*—**In the present investigation, three plants viz. *Azadirachta indica*, *Catharanthus roseus* and *Ocimum sanctum* were tested against ovicidal action of *Spodoptera litura* . All the three plants possess strong ovicidal activity against *S.litura*, however *A.indica* was the most effective plant showing high potency followed by *O.sanctum* and *C.roseus*. Seed extract of *A.indica* showed higher activity compared to leaf extract due to higher concentration of active compounds in the seed including azadirachtin Leaf and seed extracts evaluated in the present study caused mortality in the newly emerged larvae. Highest mortality within 48 hours of hatching was observed in larvae emerged from eggs treated with leaf and seed extracts of *A.indica* at the concentration of 2 %(83.82 and 100 percent respectively). *Catharanthus roseus* extract also caused high mortality in larvae hatching from treated eggs (91.66 percent mortality at 2.5 % concentration. *Ocimum sanctum* showed moderate mortality in hatched larvae. Death in newly emerged larvae may be due to feebly sclerotised cuticle which leads to penetration of extract in larval body leading to toxicity and also results in aborted hatching . Azadirachtin blocks the micropyle region of the eggs therefore preventing the exchange of gases that will ultimately kill the developing embryo in the eghg itself which is noticed as black spot stage in treated eggs.

***Keywords*—**Eggs, leaf extracts, vails, jars, cotton, etc.

I. Introduction

INDIA is basically an agriculture based country and more than 80% of Indian population depends on it. Agricultural productivity influences the Indian economy. Insect pests are known to cause significant damage to crops. *Spodoptera litura* (Fabricius) the common cutworm is an economically important noctuid moth which is a polyphagous pest causing considerable economic loss to many vegetables and field crops the major ones being tobacco, cotton, rice, maize, cabbage, lettuce, tea etc. It is able to destroy a vegetable crop and particularly prefers vegetables within cabbage family.

Management of *Spodoptera litura* (Fabricius) population using synthetic insecticides has proved futile as it has developed resistance to several classes of insecticides. Moreover an increased awareness of potential dangers of synthetic pesticides as well as a permanent increase in pest resistance, resurgence, residual toxicity, and environment deterioration etc. during past three decades has led the scientists to examine the possibility of using less persistent, biodegradable, and economical and ecofriendly alternatives including plant-derived insecticides.

The tobacco cutworm can quickly spread throughout the crop if it has a suitable environment. *Spodoptera litura* has been reported to attack 112 plant species belonging to 44 families, of which 40 species are known from India [1], [2]. *Spodoptera litura* has shown resistance against all the insecticidal groups [3], [4], [5]. including the newly synthesized lufenuron [6].

Plants are the storehouse of a wide array of bioactive chemicals that are used in defence against herbivores. These phytochemicals, which are mainly terpenes, alkaloids, steroids, phenolics, tannins etc can control pest due to their multiple modes of action. These compounds are deleterious to insects in multiple ways, such as through acute toxicity, affecting insect behavior, disrupting growth and development of insects and acting as repellents, anti-feedants and oviposition deterrents. The use of botanical pesticides for protecting crops from insect pests has assumed great importance in recent years. Numerous plant species have been reported to possess pest control properties but only a few of them have been successfully registered as an insecticide in recent years. The plant-derived insecticides show variable effect against different insect species. Thus in the present scenario, the finding of specific plant-derived pesticides is inevitable and is need of the hour. [7]

In the present study the ovicidal effect of leaf extracts of *A.indica*, *C.roseus* and *O.sanctum* and seed extract of *A.indica* was evaluated against *Spodoptera litura*.

II. Materials and Method

A. Experimental Insect

***S**podoptera litura* (Fabricius) (Lepidoptera: Noctuidae) commonly called tobacco caterpillar or cutworm was selected for the proposed investigation. *Spodoptera litura* is a polyphagus pest of large host range including tobacco, cotton, cabbage, groundnut, maize, jute, lettuce etc.

For laboratory rearing the egg masses of *Spodoptera litura*

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were procured from Agricultural Research Station, Durgapura, and Jaipur. Rearing was done at the temperature of 27 ± 20C, 75 ± 5% RH and 10: 14 hrs of Light: Dark period. The eggs were surface sterilized with 0.02% sodium hypochloride solution, dried and allowed to hatch.

B. *Experimental Plant Material*

Three plants namely, *Azadirachta indica, Catharanthus roseus* and *Ocimum sanctum* were selected for the evaluation of their insecticidal, growth regulating and behaviour disrupting activities against developmental stages and adults of *Spodoptera litura*.

III. Result

The ovicidal action of plants was evaluated by treating the eggs of *Spodoptera litura* with leaf extracts of *Azadirachta indica*, *Catharanthus roseus* and *Ocimum sanctum* and seed extract of *Azadirachta indica*. Observations were taken daily till the larvae hatched out from the eggs.

A. *Azadirachta indica*

Leaf Extract

A significant reduction in egg hatching was observed in eggs treated with the leaf extract of *Azadirachta indica* by both contact and egg-dipping methods (Table 1). Reduction in hatching was highest of 87.08 percent and lowest of 16.27 percent when eggs were treated by egg-dipping method at 2% and 0.1% concentrations respectively. When treated by contact method eggs showed highest reduction of 86.36 percent and lowest of 17.59 percent at 2% and 0.1% concentrations respectively.

Mortality in newly hatched larvae was recorded as 11.42, 15.33, 30.48, 58.18 and 66.66 percent when eggs were treated by contact method and 16.98, 23.33, 33.23, 69.83 and 83.83 percent when eggs were treated by dipping method at the concentrations of 0.1, 0.5, 1.0, 1.5 and 2.0% respectively.

Seed Extract

Maximum reduction in egg hatching was observed when eggs were treated by dipping method at the concentration of 2% (90.74) (Table 2). This was followed by a reduction of 88.02 percent at 2% when eggs were treated by contact method. Minimum reduction of 33.65 and 25.02 percent in hatching was recorded at 0.1% concentration when eggs were treated by egg-dipping and contact methods respectively.

Mortality in the newly emerged larvae from treated eggs was highest of 100% at 2% concentration in both types of treatments. At 0.1 % of extract mortality in larvae was recorded as 46.90 and 21.93 percent in egg-dipping and contact treatments respectively.

B. *Catharanthus* roseus

Leaf extract

Percent reduction in egg hatching was maximum of 85.52 and 86.36 at the concentration of 2.5% when eggs were treated by contact and dipping methods respectivel (Table 3). At 0.1% the reduction in hatching was only 8.70 and 12.13% in contact and egg-dipping methods of treatments respectively.

Maximum mortality (91.66%) in newly hatched larvae occurred when eggs were treated by dipping method at the concentration of 2.5%. In control experiment mortality in 1st instar larvae was recorded as 8.70% in both type of treatments.

C. *Ocimum sanctum*

Leaf Extract

Maximum reduction of 88.35% in egg hatching was observed when eggs were treated at the dose of 2.5% by egg-dipping method and 87.33% reduction in hatching of eggs occurred when treated by contact method (Table 4). Percent reduction was 15.23 and 14.33 in eggs exposed to the concentration of 0.1% by contact and egg-dipping methods respectively.

Percent mortality in newly hatched larvae was 68.00 and 72.22 at 2.5% extract when eggs were treated by contact and dipping methods of treatment respectively.

IV. Discussion

The results show that all the three plants induced mortality in the eggs, however the efficacy of plants varied. Results obtained in present investigation show that seed extract of *Azadirachta indica* was most effective and caused highest mortality in treated eggs. Leaf extract of *A.indica* was also effective,although the ovicidal effect was slightly less than the seed extract. The study observed that extracts of neem and bakain caused maximum adverse effects on fecundity and hatching when the adults were fed on extract containing sucrose diets [9]. Their results showed that egg laying was completely inhibited at the concentrations of 6, 8 and 10% neem extract concentrations. Similar results were obtained in the present work where 2 % seed extract of *A.indica* caused 94.66 percent egg mortality.

Catharanthus roseus and *Ocimum sanctum* showed moderate ovicidal activity against *S.litura*. Leaf and seed extracts evaluated in the present study caused mortality in the newly emerged larvae. Highest mortality within 48 hours of hatching was observed in larvae emerged from eggs treated with leaf and seed extracts of *A.indica* at the concentration of 2 %(83.82 and 100 percent respectively). *Catharanthus roseus* extract also caused high mortality in larvae hatching from treated eggs (91.66 percent mortality at 2.5 % concentration. *Ocimum sanctum* showed moderate mortality in hatched larvae. Death in newly emerged larvae may be due to feebly sclerotised cuticle which leads to penetration of extract in larval body leading to toxicity and also results in aborted hatching.

V. Conclusion

From the results it is evident that crude extracts of plants *A. indica, C.roseus* and *O.sanctum* are highly effective against *S.litura,*an important agricultural pest. Although azadirachtin, the active compound isolated from *A.indica* have been successfully commercialized as an insecticide, but

several factors such as short supply of raw material of neem fruits, high cost of isolation, possibility of ressistance development due to continuous use , difficulty in its synthesis due to its complex structure etc. make it economically less desirable. High potency shown by crude extract suggest that although azadirachtin content is low in crude extract but other chemical compounds present show cumulative effect and show high insecticidal, growth regulating and behaviour disrupting activities.

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TABLE I

EFFECT OF LEAF EXTRACT OF *AZADIRACHTA INDICA* ON EGGS OF *SPODOPTERA LITURA*

Doses %	Percent Egg Mortality		Percent Egg Hatching		Percent Reduction in Egg Hatching		Percent Mortality in 1st Instar Larvae within 48 hrs	
	Treated Substrate	dipping Method	Treated Substrate	dipping Method	Treated Substrate	dipping Method	Treated Substrate	dipping Method
	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE			Mean ± SE	Mean ± SE
0.1	18.66 ± 0 .33	29.33± 0.22	81.33± 0.31	70.33± .66	17.59	16.27	11.42±0 .47	16.98 ± .38
0.5	30.66 ± 0.25	34.99 ± 0.33	66.66 ± 0.3	65.33 ±0 .4	21.22	23.98	15.33 ±0 .55	23.33± 0.33
1	48.00 ± 0.33	56.00 ± 0.25	52.00 ± 0.33	44.00 ± 0..33	40.9	46.6	30.48 ± 0.33	33.23 ±0 .41
1.5	58.66 ± 0.42	73.33 ± 0.33	41.33 ± 0.25	26.66 ± 0 .25	53.04	67.66	58.18 ±0 .38	69.83 ±0 .33
2	88.00 ± 0 .33	89.33 ±0 .25	11.00 ± 0 .33	12.00 ± 0 .33	86.36	87.08	66.66 ±0 .35	83.83 ±0 .38
Control	12.33 ± 0 .15	10.58 ± 0.33	87.67 ± 0.21	89.62 ±0 .15	Nil	Nil	8.33 ±0 .25	1.55 ± 0.25
F-Value	233.38	333.64	238.68	252.5	238.52	330.64	252.4	258.3
CV at 5%	3.61	3.61	3.61	3.62	3.58	3.61	3.61	3.61

TABLE II

EFFECT OF SEED EXTRACT OF *AZADIRACHTA INDICA* ON EGGS OF *SPODOPTERA LITURA*

Doses %	Percent Egg Mortality		Percent Egg Hatching		Percent Reduction in Egg Hatching		Percent Mortality in 1st Instar Larvae within 48 hrs	
	Treated Substrate	dipping Method	Treated Substrate	dipping Method	Treated Substrate	dipping Method	Treated Substrate	dipping Method
	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE			Mean ± SE	Mean± SE
0.1	33.33 ±0.25	41.33 ± 0.33	66.66 ± 0.33	58.33 ± 0.35	25.02	33.65	21.93 ± 0.38	46.90 ± 0.43
0.5	41.33 ± 0.22	49.33 ± 0.32	58.66 ±0.22	50.66 ± 0.33	34.02	41.38	34.91 ± 0.33	44.65 ± 0.65
1	65.33 ± 0.33	62.66 ± 0.33	34.66 ± 0.35	37.33 ± 0.42	61.02	59.98	42.12 ± 0.42	53.70 ± 0.33
1.5	77.33 ± 0.38	81.33± 0.38	22.66 ± 0.22	18.66 ± 0.51	74.52	78.42	71.18 ± 0.52	84.20 ± 0.32
2	90.66 ± 0.33	94.66± 0.41	9.33 ± 0.33	5.33 ± 0.26	88.02	90.74	100.00 ± 0.33	100.00 ± 0.00
Control	13.33 ± 0.21	10.32± 0.25	86.67 ± 1.65	99.68 ± 0.33	Nil	Nil	9.02 ±0.33	8.04 ± 0.25
F-value	288.38	284.28	128.96	321.78	253.15	320.15	425.38	259.38
CV at 5%	3.61	3.61	3.61	3.61	3.61	3.61	3.61	3.61

TABLE III
EFFECT OF LEAF EXTRACT OF *CATHARANTHUS ROSEUS* ON EGGS OF *SPODOPTERA LITURA*

Doses %	Percent Egg Mortality		Percent Egg Hatching		Percent Reduction in Egg Hatching		Percent Mortality in 1st Instar Larvae within 48 hrs	
	Treated Substrate	dipping Method	Treated Substrate	dipping Method	Treated Substrate	dipping Method	Treated Substrate	dipping Method
	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE			Mean ± SE	Mean ± SE
0.1	16.00	22.66	84	77.66	8.7	12.13	44.35	43.06
0.5	30.66	33.33	69.33	66.66	24.65	24.27	48.03	51.96
1	38.66	41.33	61.33	58.66	33.34	33.36	64.08	68.09
1.5	60.00	62.66	40	37.33	52.52	57.59	79.86	82.58
2	70.33	80	26.66	18.33	71.04	80.31	84.91	88.66
2.5	86.66	88	13.33	12	85.52	86.36	88.22	91.66
Control	8	12	92	88	Nil	Nil	8.7	8.7
F-Value	255.2	290.38	203.4	287.37	228.3	329.6	229.2	230.8
CV at 5%	3.61	3.93	3.81	3.61	3.81	3.61	3.84	3.61

TABLE IV
EFFECT OF LEAF EXTRACT OF *OCIMUM SANCTUM* ON EGGS OF *SPODOPTERA LITURA*

Doses %	Percent Egg Mortality		Percent Egg Hatching		Percent Reduction in Egg Hatching		Percent Mortality in 1st Instar Larvae within 48 hrs	
	Treated Substrate	dipping Method	Treated Substrate	dipping Method	Treated Substrate	dipping Method	Treated Substrate	dipping Method
0.1	17.33	24.66	82.67	75.34	15.23	14.33	31.66	34.41
0.5	44	46.66	53.33	54.66	33.33	31.7	43.00	46.32
1	52	52.66	42.66	41.33	42.23	45.35	5.66	51.54
1.5	65.33	66.66	34.66	33.33	51.76	58.35	61.33	63.88
2	84	81.33	16	13.33	80.95	83.35	66.00	69.44
2.5	88	89.8	10.66	9.33	87.33	88.35	68.00	72.22
Control	12	12	88	88	nil	nil	14.28	13.65
F-Value	145.8	189.38	262.04	186.9	262.04	303.36	405.3	190.38
CV at 5%	3.61	3.61	3.84	3.84	3.84	3.61	3.61	3.84