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Growth regulating action of Leaf extract of Ocimum sanctum on development stages of Spodoptera litura

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Abstract
Feeding deterrents or antifeedant chemicals are those chemicals which inhibit feeding of insect on a treated food material without necessarily killing or repelling them. Plants with ant feeding properties are increasingly being used against phytophagous insect pests for protection of crops. In the present study of growth regulating action of Leaf extract of *Ocimum sanctum* on development stages of *Spodoptera litura*. Results show that leaf extract of *O.sanctum* was 28.34 percent mortality when 2nd instar larvae were treated at the highest concentration of 0.5% extract (13.10 percent in control). At 0.01, 0.05 and 0.1% total mortality induced was 10.65, 18.65 and 21.98 percent respectively. Percent reduction in adult emergence was maximum of 28.00 at 0.5% extract. 13.33, 18.00 and 22.00 percent reduction in adult emergence was reported at 0.01, 0.05 and 0.1% extract respectively.

Keywords: Spodoptera litura, Plant extract growth regulating action, Leaf extract, Ocimum sanctum.

1. 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 (Ramana *et al*. 1988, Dhir *et al*. 1992) [1, 2]. *Spodoptera litura* has shown resistance against all the insecticidal groups (Murugan and Dhingra 1995, Armes *et al*. 1997, Kranthi *et al*. 2002) [3, 4, 5]. including the newly synthesized lufenuron (Sudhakaran 2002) [8].

Plants are the storehouse of a wide array of bioactive chemicals that are used in defense against herbivores. These photochemical, which are mainly terrenes, 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.

Basker *et al*. (2011) [7]. evaluated the bioefficacy of leaf extracts of two plants, *Blumea mollis* and *Hygrophila auriculata* against *Spodoptera litura* to assess their antifeedant, larvicidal and

growth regulating action. Larvicidal activity of some plants was observed by Chauhan *et al*. (2011) [8]. Against *Spodoptera litura*.

In the present studt, second instar larvae of *Spodoptera litura* were treated with sublethal doses of leaf extracts of *Ocimum sanctum* by leaf application methods. The parameters observed were mortality in larvae and pupae, duration of larval and pupal stages and adult emergence.

2. Methodology

2.1 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* were procured from Agricultural Research Station, Durgapura, Jaipur. Rearing was done at the temperature of 27 ± 2^0C, 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.

2.2 experimental Plant Material

Extraction of leaves

Fresh leaves of the plant, *Ocimum sanctum* was plucked and chopped into small pieces and Allowed to dry naturally in the shade. Thereafter the dried leaves were powdered in domestic hand grinder to get 40 mesh powders. Leaves of plants were extracted by Soxhlet-extraction method. Acetone was used as solvent. 30 gms. Of 40 mesh leaf powder was extracted with 300 ml of solvent for 8 hours over a mantle heater at 50 ^{o}C. The extract was filtered through Whatman filter paper no.1 and concentrated on a water bath. Concentrated extract was weighed on electronic balance and it represented 6% of the total dry weight of powdered leaves. The dried extracts were stored in refrigerator.

3. Result

Leaf Extract

Leaf Application Method

Mortality*:* Results show that leaf extract of *O.sanctum* was 28.34 percent mortality when 2nd instar larvae were treated at the highest concentration of 0.5% extract (13.10 percent in control). At 0.01, 0.05 and 0.1% total mortality induced was 10.65, 18.65 and 21.98 percent respectively (Table 1).

Table 1: Effect of leaf extract of *Ocimum sanctum* on development of *Spodoptera litura* following leaf application treatment on early second instar larvae.

Doses	Percent Larval (II,III,IV,V,VI instar) Mortality	Percent Pre-pupal (shrunken stage) Mortality	Percent Mid-pupal (Larval-Pupal intermediate) Mortality	Percent Pupal Mortality	Percent Adult Mortality	Percent Total Mortality
	Mean±SE	Mean± SE	Mean± SE	Mean±SE	Mean±SE	Mean±SE
0.01	5.00± 0.76	1.50 ±0.00	1.66 ±0.65	1.66 ±0.33	1.50±0.84	10.65±1.06
0.05	7.00 ±0.83	5.00±0.52	3.33 ±0.33	1.66±0.38	1.66± 0.32	18.65±1.01
0.1	8.33± 0.33	5.00±0.33	4.66±0.41	2.33 ±0.25	1.66 ± 0.26	21.98±0.98
0.5	11.66±1.05	6.66± 0.76	5.00±0.83	2.86±0.56	2.16±0.22	28.34 ±1.00
Control	5.05±0.33	3.00 ±0.25	1.05± 0.15	3.00±0.00	1.00±0.18	13.10± 0.38
F-Value	249	305.46	101.5	276	72.1	256.6
CV at 5%	3.34	3.34	3.34	3.34	3.34	3.34

Maximum larval mortality of 11.66 percent was observed at the concentration of 0.5%. At lower doses larval mortality caused was less than 8.33 percent. Percent mortality in control experiment was 5.05.

Percent mortality in pre-pupal stage was comparatively higher than in mid-pupal and pupal stages. When treated at 0.5%, pre-pupal mortality was 6.66 percent whereas at lower concentration of 0.01, 0.05 and 0.1% mortality was 1.50, 5.00 and 5.00 percent respectively. In control experiment pre-pupal mortality was only 3.00 percent. Mortality in larval-pupal intermediate stage was 5.00 percent at 0.5% extract. At lower concentrations of 0.01, 0.05 and 0.1% mortality observed was 1.66, 3.33 and 4.66 percent respectively. Pupal mortality observed was maximum of 2.86 percent at 0.5% and at lower concentrations of 0.01, 0.05 and 0.1% it was 1.66, 1.66 and 2.33 percent respectively.

Adult mortality was recorded as 2.16 percent at 0.5% extract. At lower concentrations mortality was less than 1.66 percent.

Larval and Pupal Periods: Developmental period was prolonged to 26.89 days when 2nd instar larvae were treated with leaf extract of *O. sanctum* at the concentration of 0.5%. Development was completed in 18.11, 19.86 and 23.61 days at the concentrations of 0.01, 0.05 and 0.1% respectively.

Larval period showed a prolongation to 17.82 and 15.60 days in larvae treated with 0.5 and 0.1% extracts respectively. Larval period at 0.01 and 0.05% concentrations (11.80 and 12.86 days) was same as in control experiment (12.05 days)

Pupal period was reported to be 9.06 days in larvae treated with the extract at 0.5%. At 0.01, 0.05 and 0.1% extract the period was 6.31, 7.00 and 8.05 days respectively. In control experiment pupal development was completed in 6.15 days.

Adult Emergence: Percent reduction in adult emergence was maximum of 28.00 at 0.5% extract. 13.33, 18.00 and 22.00 percent reduction in adult emergence was reported at 0.01, 0.05 and 0.1% extract respectively (Table 2). In control reduction in adult emergence was only 8.00 percent and 92.00 percent adults emerged.

Table 2: Growth regulating action of Leaf extract of *Ocimum sanctum* on development of *Spodoptera litura* following leaf application treatment.

Doses%	Average Larval Period (II to VI instar)	Average Pupal Period (Pre-pupa to Adult emergence)	Average Development Period (II instar to Adult) (b)	Percent Adult Emergence (a)	Percent reduction in Adult Emergence	Growth Index a/b
	Mean±SE	Mean ±SE	Mean±SE	Mean±SE	Mean±SE	
0.01	11.80±0.26	6.31±0.27	18.11±0.24	88.33±2.88	13.33±2.88	4.87
0.05	12.86±0.19	7.00±0.15	19.86±0.25	82.00±5.19	18.00±5.19	4.12
0.1	15.60±0.52	8.05±0.08	23.61±0.54	78.33±1.52	22.00±1.52	3.31
0.5	17.82±0.28	9.06±0.07	26.89±0.21	72.33±2.51	28.00±2.51	2.68
Control	12.05 ±0.22	6.15±0.33	18.20±0.38	92.00 ±1.30	8.00±1.05	5.05
F-Value	177.56	86.5	178.56	207.6	108.35	-
CV at 5 %	3.34	3.34	3.34	2.98	3.31	-

4. Discussion

Results show that leaf extract of *O. sanctum* possess moderate activity against *S. litura* and a total of 29.98 percent mortality was observed at the concentration of 0.5%. Mortality observed was uniformely distributed and occurred at larval, pre-pupal, mid-pupal, pupal and adult stages. At 0.01% only 12.31 percent mortality was observed during development from 2nd instar to the adult emergence. From the results it is evident that *O. sanctum* possess very little growth regulating activity against *S. litura*. Death during moulting were few and few morphological abnormalities were observed in the treated larval and pupal stages. Also, the growth retardation was not significant. Maximum prolongation of larval and pupal periods was of 18.28 and 9.55 days respectively at the concentration of 0.5 % extract (compared to 11.85 and 6.55 days in larvae and pupae respectively in control).

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