International Journal of Food, Agriculture and Veterinary Sciences ISSN: 2277-209X (Online)
An Open Access, Online International Journal Available at http://www.cibtech.org/jfav.htm
2016 Vol. 6 (2) May-August, pp. 1-5/Pandey and Summarwar
Research Article

LARVICIDAL AND REPELLENT ACTION OF *AZADIRACHTA INDICA* AGAINST *SPODOPTERA LITURA*

***Jyotsana Pandey and Sudha Summarwar**
Department of Zoology, S.D. Government College Beawar, M.D.S University Ajmer (Rajasthan)
**Author for Correspondence*

ABSTRACT
In the present study, we report the results on laboratory bioassays of larvicidal and repellent action of *Azadirachta indica* against *Spodoptera litura*. Third, fourth, fifth and sixth instar larvae of *S.litura* were treated with different concentrations of leaf and seed extracts of *A.indica*. Results of our study show that leaf and seed extract of *A.indica* induced mortality when second instar larvae of *S.litura* were treated at the concentrations ranging from 0.01 to 0.05%. At higher concentration of 0.1 and 0.5%, mortality was quicker and about 34.45 and 36.98 percent death occurred respectively before mid-pupal stages. From the results it becomes evident that seed extract of *A.indica* possess highest larvicidal properties causing high mortality in larvae of *S.litura*.

Keywords: *Azadirachta Indica, Spodoptera Litura, Leaf and Seed Extracts, Larvicidal*

INTRODUCTION
Plants are rich sources of natural substances that can be utilized in the development of environmentally safe methods for insect control (Sadek, 2003). Crude plant extracts often consist of complex mixtures of active compounds, they may show greater overall bioactivity compared to the individual constituents (Berenbam *et al.,* 1991; Chen *et al.,* 1995). The deleterious effects of crude plant extracts on insects are manifested in several ways, including toxicity (Hiremath *et al.,* 1997), feeding inhibition (Klepzig and Schlyter, 1999; Wheeler and Isman, 2001). The development of insects' growth regulators (IGR) has received considerable attention for selective control of insect for medical and veterinary importance and has produced mortality due to their high neurotoxic effects (Senthil Nathan *et al.,* 2006). Neem (*Azadirachta indica* A.) is well known as plant for its insecticidal property (Lowery and Isman, 1995), and is reported to be effective against *Spodoptera litura* F. (Deota and Upadhyay, 2005). Azadirachtin, a limonoid from seeds of the neem tree possesses strong antifeedant and growth inhibitory effects against various insect pests (Isman, 1997).
The lepidopteran pest *Spodoptera litura* (Fabricius) is a serious pest on tobacco. It also has been recorded on several other crops like cauliflower, castor, cotton, banana, groundnut, mulberry, etc. The full grown caterpillars are the most voracious feeders and cause extensive damage by defoliation. Use of insecticides for controlling this pest is on the rise and it has the ability to develop resistance to many insecticides (Murugesan and Dhingra, 1995). Chemicals of botanical origin used in pest control programmes may prevent several adverse effects caused due to synthetic insecticides (Gayatri *et al.,* 2003). In the present study, we report the results on laboratory bioassays of larvicidal and repellent action of *Azadirachta indica* against *Spodoptera litura*.

MATERIALS & METHODS
Freshly emerged 3 rd, 4th, 5th and 6th instar larvae of uniform size and age were collected from the mass culture maintained in the laboratory. Each instar larvae were treated separately with the leaf and seed extracts of *Azadirachta indica.*
The oral or systemic toxicity of the plant extracts was investigated against 3rd, 4th, 5th, and 6th instar larvae through no-choice bioassay using leaf discs (6 cm in diameter) prepared from cabbage leaves. Test formulation was prepared by dissolving the extract in distilled water and adding Tween-80 as an emulsifier. For treatment, each leaf disc was dipped for 1 minute in the extract solution at each concentration, air dried to evaporate solvent and then placed in a plastic container. A moist filter paper

was kept below the leaf disc to prevent it from drying. The plastic container was covered with fine muslin cloth held with rubber band. Three replicates each with 10 larvae were maintained for each treatment. Larval mortality was observed after 48 hours of treatment and percent mortality was corrected by Abbott's formula (1925).

RESULTS AND DISCUSSION

Results

Leaf Extract:

Third Instar Larvae: Leaf extract of *Azadirachta indica* showed significant larval mortality at all the concentrations tested ranging from 0.1 to 2.0% (Table 1). Highest mortality of 100 percent was observed at 2% concentration when larvae were treated by topical application method. At same concentration, 94.66 percent mortality was recorded in larvae treated by leaf-disc application method. At 0.1% extract mortality recorded was 27.00 and 33.33 percent in larvae treated by leaf-disc and topical application experiments respectively. In control, mortality observed was 4.5 and 4.45 percent in leaf-disc and topical treatment experiments respectively.

Fourth Instar Larvae: Maximum mortality of 88.00 and 90.66 percent was observed in larvae treated at 2% by leaf-disc and topical application methods respectively (Table 1). At 0.1% concentration larval mortality observed was 17.33 and 29.30 percent in leaf-disc treatment and topical application methods respectively. Mortality in control experiments was recorded as 3.35 and 3.53 percent in leaf-disc and topical application experiments respectively.

Fifth Instar Larvae: Fifth instar larvae were observed to be slightly less susceptible in comparison to earlier instars. At 2% concentration, mortality of 86.66 and 87.33 percent was recorded when larvae were treated by leaf-disc application and topical application methods respectively (Table 1). Minimum mortality observed was 15.33 and 22.66 percent at the concentration of 0.1% in leaf-disc and topical application methods respectively. Control mortality observed was 3.35 percent in both leaf-disc and topical application experiments respectively.

Sixth Instar Larvae: Percent larval mortality recorded was 85.33 and 78.65 at the concentration of 2% when treated by topical and leaf-disc application methods respectively (Table 1). At 0.1% concentration mortality observed was 21.33 and 12.33% in topical treatment and leaf-disc treatments respectively. Mortality recorded in control was 2.05 and 2.15 percent in topical application and leaf-disc treatment experiments respectively.

Seed Extract:

Third Instar Larvae: A maximum mortality of 100 percent was observed when larvae were treated by topical and leaf-disc application methods at 2% concentration (Table 2). At 0.1% extract mortality recorded was 41.33 and 37.33 percent in larvae treated by topical and leaf-disc application methods repectively. In control 4.45 and 4.50 percent mortality was observed in topical and leaf-disc applications respectively.

Fourth Instar Larvae: Percent mortality at 2% concentration was recorded as 97.33 when larvae were treated by both leaf-disc and topical treatments (Table 2). Mortality at 0.1% concentration was 35.35 and 33.33 percent in larvae treated by topical and leaf-disc applications respectively. Larval mortality in control experiments was 3.35 and 3.50 in topical and leaf-disc experiments respectively.

Fifth Instar Larvae: 94.66 and 93.33 percent mortality was observed at highest concentration of 2% when larvae were treated by topical and leaf-disc methods respectively (Table 2). At 0.1% concentration mortality recorded was 30.66 and 30.65 percent in larvae treated by topical and leaf-disc application methods respectively. Control mortality was 3.05 and 3.15 in topical and leaf-disc treatments respectively.

Sixth Instar Larvae: Maximum mortality of 93.33 and 90.66 percent was recorded at 2% concentration in larvae treated by topical and leaf-disc treatments respectively (Table 2). At 0.1% mortality induced was minimum of 26.65 and 17.38 percent in topical and leaf-disc treatments respectively. In control percent mortality recorded was 2.05 and 2.20 in topical and leaf-disc treatments respectively.

Table 1: Toxicity of *Azadirachta Indica* Leaf Extract against Different Larval Instars of *Spodoptera Litura*

Doses in %	Percent Mortality during Larval Instars															
	III Instar Larvae				IV Instar Larvae				V Instar Larvae				VI Instar Larvae			
	Leaf-Disc Application		Topical Application		Leaf-Disc Application		Topical Application		Leaf-Disc Application		Topical Application		Leaf-Disc Application		Topical Application	
	Percent Mortality	Corrected Mortality	Percent Mortality	Corrected Mortality	Percent Mortality	Corrected Mortality	Percent Mortality	Corrected Mortality	Percent Mortality	Corrected Mortality	Percent Mortality	Corrected Mortality	Percent Mortality	Corrected Mortality	Percent Mortality	Corrected Mortality
0.1	27	23.56	33.33	30.22	17.33	14.46	29.3	26.71	15.33	12.2	22.66	19.85	12.33	10.44	21.33	19.68
0.5	38	35.07	46.66	44.17	31	28.6	41.29	39.14	31	28.45	38.66	36.43	28.66	27.12	34.66	33.29
1	50	47.64	59.33	57.43	47	45.16	50.6	48.79	45	42.96	46.6	44.66	41	39.73	44	42.82
1.5	70.66	69.27	80	79.06	68.66	67.57	68	66.82	61.33	59.9	67.58	66.4	57.3	56.38	64.33	63.58
2	94.66	94.4	100	100	88	87.58	90.66	90.31	86.66	86.66	87.33	86.87	78.65	78.19	85.33	85.02
Control	4.5		4.45		3.35		3.53		3.35		3.35		2.1		2.05	
F-Value	117.25		213.45		128.33		125.66		109.66		224.44		214		99.55	
CV at 5%	3.66		3.61		2.88		3.55		3.61		3.61		3.34		3.61	

Table 2: Toxicity of *Azadirachta Indica* Seed Extract against Different Larval Instars of *Spodoptera Litura*

Doses in %	Percent Mortality during Larval Instars															
	III Instar Larvae				IV Instar Larvae				V Instar Larvae				VI Instar Larvae			
	Leaf-Disc Application		Topical Application		Leaf-Disc Application		Topical Application		Leaf-Disc Application		Topical Application		Leaf-Disc Application		Topical Application	
	Percent Mortality	Corrected Mortality	Percent Mortality	Corrected Mortality	Percent Mortality	Corrected Mortality	Percent Mortality	Corrected Mortality	Percent Mortality	Corrected Mortality	Percent Mortality	Corrected Mortality	Percent Mortality	Corrected Mortality	Percent Mortality	Corrected Mortality
0.1	37.33	34.37	41.33	38.59	33.33	30.91	35.35	33.1	30.65	28.39	30.66	28.47	17.38	15.52	26.65	25.11
0.5	50.65	48.32	50.65	48.35	46.65	44.71	47.66	45.84	45.3	43.52	40	38.11	37.4	35.99	34	32.61
1	62.68	60.92	69.33	67.9	58.59	57.08	62.66	61.36	54.66	53.18	54.68	53.25	50.59	49.47	44	42.82
1.5	82.59	81.76	86.66	86.03	74.66	73.74	78.66	77.92	70.59	69.63	77.33	76.61	58.66	57.73	73.38	72.82
2	100	100	100	100	97.33	97.23	97.33	97.23	93.33	93.11	94.66	94.49	90.66	90.44	93.33	93.19
Control	4.5	-	4.45		3.50		3.35		3.15		3.05		2.2		2.05	
F-Value	176.14		117.94		425		108.59		173.24		550		176.14		215.11	
CV at 5%	3.61		3.34		3.61		3.61		3.61		3.61		3.61		3.61	

Discussion

Mortality in larvae may be due to general toxicity of the chemical compounds present in the plant extracts. Highest larvicidal and pupicidal activity was shown by seed extract of *A.indica* followed by leaf extracts of *A.indica*. A complex secondary metabolite, azadirachtin isolated from seeds of *A.indica* have been reported to affect several physiological processes of insects and also have direct toxic effects on different tissues (Schluter *et al.,* 1985). Larvicidal and pupicidal effects are dose-dependant and at higher concentrations mortality induced was high. Similar dose dependant effects were reported by Martinez and Van Emden (2001).

REFERENCES

Abbott WS (1925). A method of computing the effectiveness of an insecticide. *Journal of Economic Entomology* **18** 265-267.

Berenbaum MR, Niato JK and Zangerl AR (1991). Adaptive variation in the furanocoumarin composition of *Pastinaca sativa* (Apiaceae). *Journal Chemical Ecology* **17** 207–215.

Chen W, Isman MB and Chiu SF (1995). Antifeedant and growth inhibitory effects of the limonoid toosendanin and *Melia toosendan* extracts on the variegated cutworm, *Peridroma saucia*. *Journal Applied Entomology* **119** 367–370.

Deota PT and Upadhyay PR (2005). Biological studies of azadirachtin and its derivatives against polyphagous pest, *Spodoptera litura. Natural Product Research* **19** 529 - 539.

Gayatri G, Jesudasan A and Wesley D (2003). Effects of certain plant derived compounds on feeding and growth regulation of *Spodoptera litura* F. *Journal of Applied Zoological Researches* **14** 121-124.

Hiremath IG, Young Joon A, Kim-Soon I and Kim SI (1997). Insecticidal activity of Indian plant extracts against *Nilaparvata lugens* (Homoptera: Delphacidae). *Applied Entomology and Zoology* **32** 159–166.

Isman MB (1997). Neem and related natural products. In: *Methods in Biotechnology* **5** Biopesticides: Use and Delivery. (Hall, F. R., Menn, J. J. and Totowa edition) (NJ: Humana Press Inc, Totowa) 139 – 153.

Klepzig KD and Schlyter F (1999). Laboratory evaluation of plant derived antifeedants against European pine weevil, *Hylobius abietis*. *Journal of Economic Entomology* **92** 644-650.

Lowery DT and Isman MB (1995). Toxicity of neem to natural enemies of aphids. *Phytoparasitica* **23** 297– 306.

Murugesan K and Dhingra S (1995). Variability in resistance pattern of various groups of insecticides evaluated against *Spodoptera litura* F during a period spreading over three decades. *Journal of the Entomological Research* **19** 313-316.

Sadek MM (2003). Antifeedant and toxic activity of *Adhatoda vasica* leaf extract against *Spodoptera littorallis* (Lepi: Noctuidae). *Journal of Applied Entomology* **27** 396-404.

Schluter U, Bidmon HJ and Grewe S (1985). Azadirachtin affects growth and endocrine events of tobacco hornworm *Manduca sexta*. *Journal of Insect Physiology* **31** 773-777.

Senthil Nathan S, Kalavani K, Sehoon K and Murugan K (2006). The toxicity and behavioral effects of neem limonoids on *Cnaphalocorocis medinalis* (Guenee), the leaffolder. *Chemosphere* **62** 1381-1387.

Wheeler DA and Isman MB (2001). Antifeedant and toxic activity of *Trichilia americana* extract against the larvae of *Spodoptera litura*. *Entomologia Experimentalis et Applicata* **98** 9-16.