Effect of *Withania somnifera* extracts on the mortality of *Callosobruchus chinensis* L.

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ABSTRACT

The present study was undertaken to study the effect of different extracts (agueous suspension, ether and water) of various parts of *Withania somnifera* (Solanaceae) against *Callosobruchus chinensis* L. A maximum of 63.33% adult mortality was observed in *C.chinensis* treated with 10% ether extracts of *W. somnifera* root.

Keywords: *Withania somnifera*, plantextracts, *Callosobruchus chinensis*, mortality.

INTRODUCTION

The secondary metabolites produced for the self- defense by the plants which can repel or kill insects. Plants and plant products have been traditionally used by people all over the world and today emphasis is again shifting to this option in view of hazards of chemical pesticides in agriculture. *Callosobruchus chinensis* L. (Coleoptera: Bruchidae) is one of the major pests infesting stored pulses. Solanaceae is a wide and chemically rich plant family and has been reported to contain gluco-alkaloids *viz*., solanine, solanidine, nicotine, somniferine, somnifernine, somnine, withananine, withanine, withananinine, volatile oil, tannin and considerable amount of potassium nitrate. It has also been reported that the roots contain two saponoids, dulcamaric acid and dulcamaretinic acid and a gluco-alkaloid solaceine. *Withania somnifera* (Solanaceae) found in the Indian desert region was selected to study it's efficacy against *C.chinensis*.

MATERIALS AND METHODS

The pulse beetle, *C.chinensis* was reared on grains of green gram (*Vigna radiata*) in incubator (28 $\pm$ 2^0C and 70% RH). *W somnifera* was collected from Bikaner (20° N and 73° 17" E, 28m) and its vicinity, cleaned and shade dried after separating different parts *viz*., roots, stems, leaves and fruits, selected for the study. The plant derivatives were applied in three forms namely aqueous suspension, soxhleted aqueous extract and ether (Assay 74.12) extracts of 10, 5, 2.5 and 1% dose concentrations. Normal and control sets were kept under observation for comparison. Ten adult insect pairs were released in muslin cloth covered beakers containing weighed green gram grains and treated with different dose concentrations (w/v).After treatment the grains were first shade dried before the release of insects. Five replications were maintained. Observations were recorded on third day of treatment.The observations were subjected to statistical analysis, the ANOVA and t-test.

RESULTS

The results of various formulations on the adult mortality have been presented in Table 1. Many of the treatments resulted in significantly ($p<0.01$) higher mortality. Maximum mortality was observed in sets treated with 10% ether extracts of root. A significantly high mortality of 50 per cent was noted in the sets treated with 10% aq. suspension and 10% aqueous extracts of root, 5% ether extract of root, 5% and 10% ether extracts of leaf, 5% and 10% aqueous suspension of leaf. Overall, among different extracts, the sets treated with ether extracts recorded more mortality followed by aqueous suspension and aqueous extract. Moreover, in the sets treated with 5 and 10 per cent ether extracts of root still higher mortality of 56.66 and 63.33 per cent respectively was noted. Minimum mortality (10 per cent) was found to occur in sets treated with 1% aqueous extracts of stem and fruit. The adult mortality was observed to have a direct relationship with the concentration of formulations, being maximum when treated with extract of 10% concentration, extracts from the roots of the plant caused higher mortality followed by the treatments of leaves, stem and fruits although in certain cases the mortality with 5% treatments was at par with 10% concentration.

DISCUSSION

This difference observed in mortality due to extracts from different plant parts might be because of the variation in the concentration of the chemical constituents in different plant parts. It could be suggested that root in this case consists of more toxic compounds as compared to other plant parts, but needs further investigation.

Table 1. Effect of *Withania somnifera* extracts on adult mortality (%) of *C.chinensis*

Plant parts	concentrations (in %)	Aqueous Extract	Aqueous suspension	Ether extract
Leaf	1	13.33±5.77	23.33±5.77	20.00±0.00
	2.5	33.33±5.77	26.66±5.77	40.00±0.00
	5	36.66±5.77	50.00±0.00	50.00±0.00
	10	46.66±5.77	50.00±0.00	50.00±0.00
Stem	1	10.00±0.00	30.00±0.00	26.66±5.77
	2.5	13.33±5.77	40.00±0.00	36.66±5.77
	5	16.66±5.77	40.00±0.00	40.00±0.00
	10	26.66±5.77	40.00±0.00	46.66±5.77
Fruit	1	10.00±0.00	26.66±5.77	20.00±0.00
	2.5	13.33±5.77	30.00±0.00	23.33±5.77
	5	16.66±5.77	33.33±5.77	30.00±0.00
	10	26.66±5.77	40.00±0.00	40.00±0.00
Root	1	23.33±5.77	23.33±5.77	20.00±0.00
	2.5	26.66.±5.77	40.00±0.00	46.66 ±5.77
	5	36.66±5.77	46.66±5.77	56.66±5.77
	10	50.00.±0.00	50.00±0.00	63.33±5.77
Control	00	3.33±5.77	3.33±5.77	3.33±5.77

The ether extract resulted in higher adult mortality followed by aqueous suspension and aqueous extract suggesting that solvent plays an important role in dissolving the plant constituents and is therefore of great significance. The mortality was also found to be co-related with dose concentration being highest at 10%. Plant extracts can form a film covering the surface of the pulse which causes a reduction in respiration and gas exchange between the seeds and their environment. The toxicity of compounds penetrating the seed or the accumulation of the toxic metabolites also kills insects.

The present findings are in conformation with earlier works of Rajendran and Gopalan (1979) who evaluated the insecticidal effects of topical and oral application of acetone extracts of *Datura stramonium* on nymphs of *Spodoptera litura* and *Pericallia richi* and observed significant mortality by these treatments. The plant extracts of *Solanum xanthocarpum* were tested for their deterrent activity against *Spodoptera litura* by Madhusudan and Gopalan (1979). Pandey *et al*. (1980) evaluated extracts of shade dried leaves of *S.xanthocarpum* at concentrations of 0.5,1.0,2.0 per cent against painted bug *Bagrada crucifera* Kirk and recorded 60.00,70.00 and 83.33 per cent mortality after 24h and 26.66,53.33 and 63.33 per cent after 72h respectively. Chander and Ahmed (1982) earlier evaluated petroleum ether extracts of leaves of *Cestrum nocturnum* and roots of *Withania somnifera* against *C.chinensis* and recoreded the effectiveness upto 90 days which was in conformation with the present findings. Maximum mortality with the extracts of seeds of *Solanum dulcamara* as compared to other plant products was reported by Chandel *et al*. (1984). Verma and Srivastava (1988) reported that alcohol extract (4%) of fruits of *Solanum indicum* was most effective against aphid *Macrosiphum rosae*. Morallo-Rejesus *et al*. (1990) found that fruits of *Capsicum frutescens* showed contact toxicity and also had an effect on development of *C.chinensis*. Niber *et al*. (1992) tested the toxicity of ethanol extracts of *Datura metel*, *D.stramonium*, and S. *nigrum* against storage beetles and reported that *S. nigrum* was most toxic. An earlier study conducted by Srivastava and Mann (1998) using plant *Peganum harmala* against *C.chinensis* also showed that ether extract at highest concentration of 10% was most effective in causing adult mortality.

The present findings therefore suggest that the plant *W.somnifera* possesses certain chemicals, especially in the root, which result in the mortality of the pest insect and, therefore, could be a potent source for checking the population build up by *C.chinensis*.

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