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– Short communication

PESTICIDAL ACTIVITY OF *SMILAX ZEYLANICA* L. EXTRACTS ON *CRYPTOLESTES PUSILLUS* (SCHON.) (COLEOPTERA: CUCUJIDAE)

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ABSTRACT

The chloroform and methanolic extracts of *Smilax zeylanica* L. were assessed for mortality against the adults of flat grain beetle, *Cryptolestes pusillus* (Schon.) under laboratory conditions by the surface film method. The methanolic extracts caused significantly high ($p < 0.001$) mortalities than the chloroform extracts. The calculated LD_{50} values of the chloroform extracts of *S. zeylanica* on *C. pusillus* were 71.20, 67.06 and 62.22 μg/cm^2 for leaf; 14.49, 11.41 and 7.9 μg/cm^2 for stem; and 6.43, 4.67, 2.40 μg/cm^2 for root extracts. But the LD_{50} values of the methanolic extracts were 39.79, 19.39 and 22.06 μg/cm^2 for leaf; 14.27, 12.68 and 10.85 μg/cm^2 for stem; and 12.58, 5.83 and 4.32 μg/cm^2 for root extracts after 24, 48 and 72 hr post-exposure, respectively. Results obtained show the potential of using *S. zeylanica* extracts for *C. pusillus* management.

Key words: *Smilax zeylanica*, Pesticidal activity, *Cryptolestes pusillus*

Residual toxicity, phytotoxicity, vertebrate toxicity, widespread environmental hazards and increasing costs of application of the presently used synthetic pesticides have directed the need for effective, biodegradable pesticides (Zettler and Cuperus 1990, Talukder and Howse 2000).

The red flat grain beetle, *Cryptolestes pusillus* (Schon.) is an important pest of several stored commodities, especially cereals (Hossain *et al*. 1986). The damage is caused both by the larval and adult stages (Cotton 1963).

Smilax zeylanica L. is a large woody climber grows wild in Chittagong and sporadically in other areas throughout the country (Ghani 2003). It is commonly known as 'Kumarilata' in Bangla. The plant contains 1 - 3% steroidal saponins, phytosterols, starch, resin, sarsapic acid and minerals (Chevallier 1996). Leaves and root contain diosgenin (Kar and Sen 1984). The common people of Bangladesh, especially the tribals use the roots and rhizomes of *S. zeylanica* as tonic. The present investigation was carried out to find out the effects of the chloroform and methanolic extracts of leaves, stem and root of S. *zeylanica*, on the adults of *C. pusillus*.

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Smilax zeylanica L. was collected from the Botanical Garden, Rajshahi University. The leaf, stem and root were separated, chopped into small pieces, dried under shade and grounded to powder separately with an electric grinder and stored in stoppered jars under laboratory conditions. Each plant sample of 250 g was extracted with the two solvents, chloroform and methanol separately. The samples were weighed and dissolved in the respective solvents according to the proportion of dry weight of the powder. Various concentrations of the extracts were made and poured on 6 cm Petri dishes with the help of a pipette to cover the whole area of the Petri dish uniformly. Petri dishes were kept in the air at room temperature for drying.

Adults of *C. pusillus* were cultured on a diet of insecticide-free flour medium in a controlled temperature room (CT room) at 30 ± 0.5^0C. The culture population density was approximately 300 pairs per 11.5 cm Petri dish containing the food. Eggs were removed by sieving and incubated. The Petri dishes with neonate larvae were returned to the CT room for the emergence of adults. Insects used were generally 3 - 5 of days adults.

To observe the mortality of adult C. *pusillus* the surface film method was used. The concentrations used were 0.424, 0.848, 1.696, 3.393 and 6.786 $\mu g/cm^2$. The concentrations were calculated by measuring the dry weight of the crude extracts applied in the Petri dish divided by the surface area.

The adult mortality was recorded at 24, 48, and 72 hr after treatments. Three replications were used for each concentration and a control batch was maintained for each treatment where only the solvent was used.

The mortality was corrected using Abbott's formula (Abbott 1925):

$$P_t = \frac{Po - Pc}{100 - Pc} \times 100$$

where,

P_t = corrected mortality, P_0 = observed mortality and P_c = control mortality.

The observed data were then subjected to Probit analysis according to Finney (1974) and Busvine (1971) using a software developed at the Department of Agriculture and Environmental Science, University of Newcastle-upon-Tyne, UK.

The LD_{50} values, 95% confidence limits, regression equation (Y), χ^2 values and probit regression lines are shown in Tables 1 and 2**.**

Table 1. LD_{50}, 95% confidence limits and regression equations of the effects of chloroform extracts of leaf, stem and root of *S. zeylanica* against *C. pusillus* adults.

Extract	Exposure period (h)	LD_{50} µg/cm^2	95 % confidence limits		Regression equations	χ^2 values (df)
			Lower	Upper		
Leaf	24	71.200	3.696	143.061	Y = 2.213 + 977 X	1.680 (3)
	48	67.057	1.651	139.18	Y = 2.9001 + .6599 X	0.696 (3)
	72	62.222	3.151	137.026	Y = 2.803 + .777 X	0.457 (3)
Stem	24	14.487	3.761	55.793	Y = 3.426 + 1.356 X	0.013 (1)
	48	11.415	4.820	27.032	Y = 2.173 + 1.373 X	0.376 (3)
	72	7.924	3.996	15.709	Y = 2.423 + 1.357 X	1.215 (3)
Root	24	6.427	3.215	12.845	Y = 2.8951 + 1.164 X	1.319 (3)
	48	4.672	2.557	8.536	Y = 3.133 + 1.1183 X	2.267 (3)
	72	2.404	1.672	3.455	Y = 3.0393 + 1.4198 X	0.732 (3)

Table 2. LD_{50}, 95% confidence limits and regression equations of the effects of the methanolic extracts of leaf, stem and root of *S. zeylanica* against *C. pusillus* adults.

Extract	Exposure period (h)	LD_{50} µg/cm^2	95 % confidence limits		Regression equation	χ^2 values (df)
			Lower	Upper		
Leaf	24	39.793	1.666	96.496	Y = 3.2859 + 1.0713 X	0.0059 (1)
	48	22.063	5.047	82.120	Y = 2.4305 + 1.0963 X	0.1615 (3)
	72	19.386	4.577	95.209	Y = 2.0531 + 1.2882 X	0.1713 (2)
Stem	24	14.268	4.762	42.757	Y = 1.9858 + 1.399 X	0.635 (2)
	48	12.681	4.917	32.700	Y = 2.1845 + 1.338 X	1.073 (3)
	72	10.848	4.155	28.328	Y = 2.676 + 1.1417 X	1.213 (3)
Root	24	12.577	3.938	40.165	Y = 2.916 + 0 .992 X	1.566 (3)
	48	5.832	3.069	11.080	Y = 2.90117 + 1.1886 X	2.020 (3)
	72	4.322	2.564	7.287	Y = 2.9649 + 1.2441 X	1.363 (3)

The results revealed the contact toxicity of the extracts from all parts of the test plant. The degree of insecticidal properties according to the solvents are MeOH > $CHCl_3$; according to the exposure periods 72 > 48 > 24 hr and according to the plant parts are root > stem > leaf.

The experimental results obtained show that the methanolic extracts of *S. zeylanica* are more toxic to the adults of *C. pussilus* and which could be potent controlling agent against the beetle. However, future comprehensive experiments and isolation and identification of bioactive compounds are needed.

In the last two decades, considerable efforts have been directed at screening plants in order to as alternatives to the existing insecticides. It was reported that when mixed with stored-grains, leaf, bark, seed powder, or oil extracts of plants reduce oviposition rate and suppress adult emergence of bruchids, and also reduced seed damage rate (Talukder and Howse 1994).

The main advantage of plant-derived pesticides is that those may be easily and cheaply produced by farmers and small-scale industries as crude, or partially purified extracts.

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