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Short Communication

Insecticidal activity of eight plant species on egg laying, larval development and adult emergence of *Callosobruchus maculatus* (F.) in cowpea

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ABSTRACT

Freeze dried powdered leaves of *Cymbopogum citratus* (DC) Stapf, *Cinnamomum camphora* (L.) Nee & Eberm *Ipomoea mauritiana* Jacq. *Tamarandus indicus* L., *Lantana camara* L., *Myroxylon balsumum* (L.) Harm, *Citrus aurantium* L. and *Vitex altisima* L. were tested against *Callosobruchus maculatus* under no-choice and choice situations. Under no-choice situation, *V. altisima* at the rate of 5.0% w/w was highly effective as an ovipositional deterrent while *T. indicus* was effective as a larvicide. *T. indicus* tested under choice situation at the rate of 1.0 % w/w, was effective as an ovipositional deterrent as well as a repellant. *V. altisima* tested at the same rate, was effective only as an ovipositional deterrent.

Key words: *Callosobruchus maculatus* (F.),cowpea, cowpea weevil, *Tamarandus indicus* L.

INTRODUCTION

Cowpea - *Vigna unguiculata* (L.) Walp. is one of the major pulse crops of the tropics, especially in the dry areas where the annual rainfall is around 1500 mm. This crop grows well in the dry areas because of its low water requirement (Anon. 1995). Furthermore, cowpea is useful to bridge the protein gap, as animal proteins in the developing tropical countries are in short supply. Protein content of cowpea seeds is 24.1 % on a dry weight basis (Singh and Singh 1992). However, the damage to seeds by bruchids (*Callosobruchus maculatus* & *Callosobruchus chinensis* - Coleoptera: Bruchidae) is an important constraint and the present recommendation by the Department of Agriculture, Sri Lanka is to spray pirimiphos methyl 50 EC (28 ml per 10 litres of water) on to the gunny bags containing cowpea seeds meant for consumption (Anon. 1990a). However, most of the farmers use highly toxic insecticides in controlling bruchids (Dharmasena 1995). Nevertheless, there are a number of plants with anti-insect properties in the world (Grainage and Ahamed 1987) and some of these plants are found in Sri Lanka (Anon. 1990b). *Piper nigrum* L. (powdered fruits) is effective in controlling *C. maculatus* in greengram (Rajapakse 1996). Ranasinghe and Dharmasena (1987) reported that seed oil of *Besia longifolia* L. could effectively be used to manage *C. maculatus* in cowpea. Therefore, the present study was carried out to explore the possibility of using few more locally available plant species in controlling bruchids.

Eight plant species were evaluated in a completely randomized design with five replications at the Birkbeck Collage, University of London, England in 1993 to study the possibility of using them as surface protectants against *C. maculatus* (IITA strain). Leaves of these plant species (see the list) available at the Royal Botanic Garden, Kew were collected, freeze-dried at -18° C and ground using Fritsch Pulverisette. Powdered leaves were sieved using a 200 mesh sieve (pore size = 0.075 mm). The eight plant species tested in the study were *Cymbopogon citratus* (DC) Staff (Lemon grass), *Cinnamomum camphora* Nee&Ebern (Cinnamon), *Ipomoea mauritiana* Jacq. (Ipomoea), *Tamarindus indicus* L. (Tamarind), *Lantana camara* L.(Lantana), *Myroxylon balsumum* L. (Myroxylon), *Citrus aurantium* L. (Sour orange) and *Vitex altisima* L. (Vitex).

Experiment 1: No-choice bio-assay

The powdered leaves of each plant species was mixed with cowpea seeds (variety California 6), at the rate of 5.0 % w/w. Ten female bruchids (0 - 24 h old) obtained from a mixed culture were introduced into glass vials (dia 2.5 cm, height 7.5 cm) containing ten treated seeds. Females were removed 48 h later and the number of eggs laid was recorded 12 days after removing the adults. White eggs and opaque eggs were counted separately. White eggs were considered as live eggs while the opaque eggs were counted as dead eggs. The number of white eggs per seed was considered as the number of larvae that enter the seed. The adults of F_1 generation

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were counted starting from 24th day after introducing the female bruchids and continued up to 40th day.

Experiment 2: Choice bio-assay

Ten cowpea seeds treated at the rate of 1.0 % w/w were placed in one sector of a two way petri dish and ten untreated seeds were placed in another sector. Two gravid female bruchids were place in the third sector. The position of the bruchids on the treated or untreated seeds was recorded at 15 minute intervals for a period of four hours. The number of eggs laid on the treated and untreated seeds was recorded at the end of the experiment. Leaves of two plant species which had been found to be effective in the experiment 1 namely *Tamarandus indicus* and *Vitex altisimsa* were tested in this experiment.

Table 1. Egg laying, larval development and adult emergence of *C. Maculatus* on cowpea seeds treated with powdered leaves of eight plant species

Plant species	No. of eggs Seed^{-1}±S.E	No. of larvae seed^{-1}±S.E	No. of adults seed^{-1}±S.E.
Cymbopogon citratus	19.1±0.9 a	18.3±0.8 a	7.1±0.2 a
Cinnamomum campora	19.3±0.8 a	18.1±0.8 a	7.4±0.2 a
Ipomoea mauritiana	17.2±1.6 a	16.7±5.1 a	6.7±0.4 a
Tamarandus indicus	16.8±1.0 a	16.7±1.1 a	5.8±0.2 b
Lantana camara	17.3±0.8 a	16.1±0.5 a	7.3±0.3 a
Control	15.9±2.0 a	15.2±1.8 a	7.1±0.2 a
Myroxylon balsumum	15.4±0.9 a	14.4±0.8 a	7.2±0.2 a
Citrus aurantium	15.1±2.3 a	14.3±2.3 a	7.3±0.5 a
Vitex altisima	8.8±0.4 b	7.8±0.8 b	5.8±0.2 b
F value	4.3**	5.3**	2.3*
CV %	19.2	18.6	10.3
S.E.	1.95	1.8	0.45

* Significant at P = 0.05 ** Significant at P = 0.01

Results showed that powdered leaves of *V. altisima* was highly effective in deterring oviposition of *C. maculatus* under no-choice situation with approximately 9 eggs per seed compared to 15 in the untreated seeds (Table 1). All the other plant species were not significantly different from the untreated control in this regard. Similarly, the number of larvae entered the seeds was also low in the seeds treated with *V. altisima* with 8 larvae per seed, compared to 14 larvae in the control. Ranasinghe and Ramanathan (1984) reported that *Vitex negundo* L. (another *Vitex* species endemic to Sri Lanka) was effective in lowering fecundity of *C. maculatus* in cowpea. Although the number of larvae entered per seed in the treatment with *T. indicus* was 17, the number of adults emerged in the same treatment was 5.8 compared to 7.1 in the untreated control. This indicated higher larval mortality (64 %) in the treatment with *T. indicus* compared to 53 % in the control. Both *T. indicus* and *V. altisima* were equally effective in inhibiting the adult emergence with 5.8 adults per seed in each treatment.

According to the results of the choice experiment, powdered leaves of *V. altisima* at the rate of 1.0 % w/w was not effective as a repellant though it was effective as a ovipositional deterrent to *C. maculatus* with no eggs on the treated seeds compared to 2.4 in the untreated control (Table 2). Nevertheless, powdered leaves of *T. indicus* was effective as a ovipositional deterrent as well as a repellent.

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Table 2 a) Ovipositional dete(rrence and (b) Repellency of *C. maculatus* on cowpea seeds treated with powdered leaves of *T. indicus* and *V. Altisima*

a. Ovipositional Deterrence

Plant species	Number of eggs per seed±S.E.		Probability
	Treatment	Control	
T. indicus	0.0±0.0	2.0±0.4	.031
V. altisima	0.0±0.0	2.4±0.1	.031

b. Repellent Action

Plant species	Movement of females at a time*		Probability
	Treatment	Control	
T. indicus	3.3±0.2	6.6±0.2	0.001
V. altisima	3.7±0.1	4.1±0.2	0.151

All figures are means of five replications. The Sign Test was used to compare means. * Means of movements of 10 female bruchids (2 in one replicate) in a total of 16 times. Cowpea seeds were treated at the rate of 1.0% w/w.

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