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STUDIES ON THE REPELLENT ACTIVITY OF SOME INDIGENOUS PLANT OILS AGAINST *TRIBOLIUM CASTANEUM* (HERBST.)

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Oils from 18 local plants were tested for their repellent activity against *Tribolium castaneum* (Herbst). The oils from *Luffa acutangula* (L.), *Eruca sativa* (Miller) and *Ocimum sanctum* (L.) showed appreciable repellent activity (Class IV) for a period of two months. *Lycopersicon esculantum* (Miller.), *Linum usitatissmium (L.), Mangifera indica* (L.) and *Rosa damascena* (Miller.) showed moderate activity (Class III) at the comparable dose. Over a longer exposure (4 months) *Luffa acutangula* and *Eruca sativa* oils maintained class IV repellency, however *Ocimum sanctum* oil lost its activity after two months.

Key words: Repellency, *Tribolium castaneum, Luffa acutangula, Eruca sativa.*

Introduction

The loss of food grains during storage due to insect pests is a serious problem in our country. Conventional pesticides are being discouraged for use on stored grains all over the world because of toxic residues in environments. In recent years attention has been given to control the stored-grain pests with oils and extracts from plants [1-4]. Many such naturally occurring compounds from plants are being explored and identified for practical use[5-8].

The use of antifeedant and repellent compounds from plants seems to offer good prospects for protection of stored grains from insect attacks. So far turmeric, *Curcuma longa* (L.), neem, *Azadirachta indica* (A.Juss) and fenugreek, *Trigonella foenumgraecum* have been extensively studied [9-12], and are currently being used to control the infestation of stored grains.

The present study was undertaken to screen repellent properties of 18 vegetable oils from locally available plants against red flour beetle, *Tribolium castaneum* (Herbst.) with an aim to explore the possibility of some of them for actual use.

Materials and Methods

The seed kernels of plants [1-15] were crushed while the bark and shoots of two plants [16-17] were grinded and extracted with n-hexane. The solvent was removed under reduced pressure. The fresh flowers of plant No. 18 were subjected to steam distillation for its oil (Table 1).

Culturing procedure and repellency method .The culture of the test insect, *Tribolium castaneum* was maintained on wheat flour with 5% yeast at 29 ± 1° and 60 ± 5 % R.H. in glass bottles. Two to three week-old adult beetles were selected for the repellency tests. The

TABLE I. PLANTS INVESTIGATED FOR REPELLENT ACTIVITY AGAINST *TRIBOLIUM CASTANEUM*.

S.No.	Scientific names of plants	Family	Common name	Parts used	% Yield of fixed oil
1.	*Achras sapota* (L.)	Sapotaceae	Chiko	Seeds	13.01
2.	*Bauhinia variegata* (L.)	Caesalpiniaceae	Kachnar	"	14.17
3.	*Cassia fistula* (L.)	"	Amaltas	"	2.00
4.	*Capsicum annuum* (L.)	Solanaceae	Red pepper	"	1.95
5.	*Citrullus lanatus* (Thunb)	Cucurbitaceae	Tarbuz	"	24.74
6.	*Cucumis sativus* (L.)	Cucurbitaceae	cucumber	"	20.80
7.	*Eruca sativa* (Miller)	Cruciferae	Taramira	"	26.75
8.	*Hibiscus esculentus* (L.)	Malvaceae	Bhindi	"	16.00
9.	*Linum usitatissimum* (L.)	Linaceae	Alsi	"	26.20
10.	*Luffa acutangula* (L.)	Cucurbitaceae	Tori	"	14.00
11.	*Lycopersicon esculentum* (Miller)	Solanaceae	Tomato	"	14.48
12	*Mangifera indica* (L.)	Anacardiaceae	Mango	"	67.89
13.	*Ocimum sanctum* (L.)	Labiatae	Tulsi	"	12.44
14.	*Pithecellobium dulce* (Bth)	Mimosoideae	Jangal jalebi	"	12.04
15.	*Piper cubeba* (Linn.f.)	Piperaceae	Kabab-chini	"	15.31
16.	*Cinnamomum zeylanicum* (Blume)	Lauraceae	Darchini	Bark	4.610
17.	*Coriandrum sativum* (L.)	Umbelliferae	Dhanya	Shoots	9.82 (Sticky substance)
18.	*Rosa damascena* (Miller.)	Rosaceae	Rose	Flowers	0.02 (essential oil)

TABLE 2. AVERAGE % REPELLENCY OF SIX PLANT OILS AGAINST *TRIBOLIUM CASTANEUM*.

S. No.	Scientific names of plant	% Mean* repellency after					
		1 week	2 weeks	1 month	2 months	4 months	Repellency class
1.	*Luffa acutangula*	80.25± 3.73	86.43± 3.36	57.85±16.43	51.43±14.01	60.00±1.34	IV
2.	*Eruca sativa*	36.16±11.92	62.50±13.99	73.93±16.73	88.16± 2.07	59.06±1.89	IV
3.	*Lycopersicon esculantum*	73.21± 2.16	61.00± 3.76	58.50± 8.01	29.64±24.05	58.44±1.83	III
4.	*Ocimum sanctum*	66.52 ± 6.08	90.06± 3.33	72.50± 3.60	12.19± 6.89	11.66±4.58	III
5.	*Linum usitatissimum*	59.86± 6.15	85.08± 2.34	65.63± 5.74	11.25± 6.30	7.81 ±6.96	III
6.	*Mangifera indica*	63.50± 8.63	86.07± 2.72	35.71±22.02	1.43 ± 8.11	22.19±5.97	III
7.	Control	6.47 ± 9.76	- 6.42± 8.52	17.10±10.46	- 3.14± 6.92	8.44 ±1.76	I

* Mean of 8 replicates, ± Standard error of the mean.

repellency method followed is that of Laudani *et al.* [13] and McDonald *et al* . [14] with certain modifications. Filter paper strips, Whatman No.1 (8x8 Cm) were treated with 1 ml of 1% oil in acetone. The total active material on the treated surface came to 156.25 µg/ cm.^{2} After evaporation of acetone, the treated paper strips were joined lengthwise edge-to-edge with untreated paper strips (8x4 Cm) with celotape on the underside of the strips. Two glass rings (4.5cm in height and 7 cm in diameter) were placed over two matched strips in such a way that the joined edges bisected the ring providing equal areas of the treated and untreated papers. Ten insects were released in each test area and number of insects on treated and untreated halves was recorded twice daily (9 a.m and 3 p.m) for 5 days. There were eight replicates for each treatment and tests were made after 1,2,4 and 8 weeks.

The mean percent repellency was assigned a class by using the following scale[15].

Class I, 0.1 to 20%; Class II, 20.1 to 40%; Class III, 40.1 to 60%; Class IV, 60.1 to 80% Class V, 80.1 to 100%.

Results and Discussion

Eighteen plant oils were screened for their repellent activity over a period of two months.Out of these plants, `*Luffa acutangula,Eruca sativa* and *Ocimum sanctum* showed maximum repellent activity (Class IV), while *Lycopersicon esculantum, Linum usitatissimum* and *Mangifera indica* showed moderate repellent activity (Class III). These six plants were screened further for two months. *Luffa acutangula* and *Eruca sativa* were found to maintain their repellency during this time while *Ocimum sanctum* oil lost some activity (Table 2).

The oils from *Luffa acutangula* and *Eruca sativa* showed appreciable activity (Class IV) for four months. Repellents with this level of activity and persistence are generally considered to have potential for controlling storage pests. Besides repellency; these two plants are known to have toxic properties to various animals [16,17]. Jabbar *et al.* [18] studied the toxic potential of *Eruca sativa* and *Artemisia kurramensis* in laboratory against rice pests and reported their insecticidal effects slightly weaker than DDT and lindane. They also tried the mixture of these vegetable oils with chlorinated pesticides to enhance the toxicity of the vegetable oils.

The present studies have confirmed that taramira *(Eruca sativa)* oil is not only toxic but a good repellent to the test insect as well. Oils of *Eruca sativa* and *Luffa acutangula* need further study to find out their antifeedant and toxic values in combination with modern pesticides so as to find a way of their possible practical use.

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