Repellent Effect of Some Indigenous Plant Extracts on *Tribolium Castaneum, (*Red Flour Beetle) Infesting Wheat Products

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Abstract— **Ethanolic plant extracts of *Citrullus colocynthis* (Tumba), *Tephrosia purpurea* (Sarpfonk) and *Balanites aegypticaa* (Hingotaa) were tested for their repellent effect against stored grain pest *Triboilum castaneum (red flour beetle)* under the laboratory conditions. Area preference method (Obeng-Ofori et al., 1998) was adopted to test the efficacy of plant extracts. The results revealed that all the tested plant materials had repellent effects at different concentrations against the test insect. Ethanolic extract of *Citrullus* showed maximum repellency (0) @ 5% concentration for 90 minutes followed by *Citrullus+Balanites* (0.06), *Tephrosia* (0.12), *Tephrosia+Balanites* (0.32), *Balanites* (0.46) and *Tephrosia+ Citrullus* (0.46).**

Key words: ethanolic, repellency, area preference method, maximum and minimum.

I. INTRODUCTION

Tribolium castaneum is one of the major destructive pests of wheat and wheat products (Weston and Rattlingourd 2000; Mishra *et al* 2012a, 2012b). Both larvae and adult are causing damage. These beetles are mainly found on broken or damaged grains and thus are considered to be the secondary pest of all wheat and wheat products. In case of heavy infestations the flour becomes mouldy and loses its dough quality. The flour turns yellowish and produces a pungent smell. Entomologists worldwide are effortlessly aiming at an efficient control of stored grain insect pests. Over decades, the stored grain pests have been controlled using synthetic chemical pesticides. This led to rise of severe problems such as environmental pollution, health hazards and development of pesticide resistance (Mohan *et al.*2010). To overcome these problems, there is an urgent need to devise safe and effective methods with non-toxic effects on non-targeted organisms (Tomlin, 2003). Botanical insecticides used in the control of stored grain insect pests proved to be very useful by controlling the environmental conditions inside the stores unit thereby maximizing its insecticidal effect. Here, the natural products such as powders, extracts and oils can be used.

II. MATERIALS AND METHODS

The studies were conducted under the controlled conditions in the Research Cell of Department of Zoology, J.N.V.University, Jodhpur in the year 2013-2015.

A. Collection of Insects

Heterogenous samples of *Tribolium castaneum* were collected from various flour mills of Jodhpur region.

B. *Rearing of Insects*

The homogenous population of *Tribolium castaneum* in wheat flour was maintained at 30±2°C and 70±5% R.H. under the laboratory conditions. The rearing jars were covered with muslin cloth and fastened with rubber bands to prevent their escape. The insects were left undisturbed for 7 days in the jars for mating and oviposition and then the adults were removed from the jars. Then the jars were placed in an incubator maintained at 30°C and 70%R.H. for completing the life cycle of insects after emergence from the eggs in the food. The population received from the jars after a month was considered of uniform age and were thus used for the experimentation.

C. *Preparation of Plant Extracts*

Fresh leaves of *Citrullus colocynthis (Tumba), Tephrosia purpurea (Sarpfonk), Balanites aegypticaa (Hingotaa),* were collected from the campus of J.N.V.U and CAZRI, Jodhpur. Plant materials were air dried under shade and then milled into fine powders using electric grinder.

The ethanolic extract for each plant was obtained by mixing 50gm of plant fine powder in 100ml of ethanol in a flask. The flask mouth was plugged with cotton, covered with aluminium foil. Then these flasks were placed in a rotary shaker at 120rpm for 24 hours. After that the extract was filtered out using a filter paper. Ethanol from the filtered material was allowed to evaporate using rotary evaporator. The remaining extract was considered as stock solution and different concentrations was prepared for laboratory testing.

D. *Repellency Test*

Area Preference method:-Take 10cm Whatmann filter paper and cut it into half. 1ml of each extract solution was applied to half filter paper disc as uniformly as possible with a pipette. Extract treated and control half disc were air dried to evaporate the solvent completely. Full discs were then re-made by attaching treated halves to untreated halves of same dimensions with a cello tape. Each filter paper was placed in a petridish and 10 adult test insects (Tribolium castaneum) were released at the centre of each filter paper disc and then covered. Each treatment was replicated 3 times and the % of insects present on treated (G) and control (P) areas were recorded after 30 minutes, 60 minutes and 90 minutes.

$$\boldsymbol{IR} = \frac{\boldsymbol{2G}}{\boldsymbol{G+P}}$$ (*Mazzenetto, 2002)*

Where, IR= Index of Repellency
If IR > 1, then the extract is Attractant.
If IR = 1, then the extract is Neutral.
If IR < 1, then the extract is Repellent.

TABLE 1

REPELLENCY EFFECT OF ETHANOLIC PLANT EXTRACTS ON *Tribolium castaneum*

Plant Name	**Doses %**	**INDEX OF REPELLENCY (IR)**		
		30 min.	**60 min.**	**90 min.**
Citrullus colocynthis (Tumba)	1%	0.87	0.73	0.6
	2.50%	0.52	0.53	0.32
	5%	0.2	0.13	0
Tephrosia purpurea (Sarpfonk)	1%	0.93	0.92	0.66
	2.50%	0.6	0.6	0.26
	5%	0.4	0.32	0.12
Balanites aegyptiaca (Hingotaa)	1%	1.06	0.8	0.52
	2.50%	0.86	1	0.72
	5%	0.92	0.86	0.46
Citrullus+ Tephrosia	1%	1.32	1.12	1
	2.50%	1.12	0.92	0.72
	5%	0.86	0.72	0.46
Tephrosia + Balanites	1%	1.06	0.66	0.6
	2.50%	0.86	0.46	0.26
	5%	0.66	0.12	0.06
Citrullus+ Balanites	1%	1.32	0.86	0.52
	2.50%	1.12	0.86	0.6
	5%	0.86	0.52	0.32

RESULTS AND DISCUSSIONS

The results regarding the evaluation of repellent potential of different extracts revealed that repellency increases with increase in concentration of plant extracts and also when applied for longer duration all the extracts showed significant results as compared to control condition. In case of extract treatment @ 5% concentration for the duration of 90minutes, *Citrullus* showed highest index of repellency (0) followed by *Citrullus+Balanites* (0.06), *Tephrosia* (0.12), *Tephrosia+Balanites* (0.32), *Balanites* (0.46) and *Tephrosia+ Citrullus* (0.46).
Ray D.P. *et al* (200) studied the composition and repellent activity of the essential oils of Marigold flower. Al Jabr (2006) repoted that essential oils of *M. chamomilla* showed strong repellency against *Oryzaephilus surinamensis* and *Tribolium castaneum*. Mkolo (2011) studied the repellency effects of *Mentha piperita* leaves against adults *Amblyomma hebraeum.* Auamcharoen *et al* (2012) studied the toxic and repellent effect of methanol extract against *Tribolium castaneum* and other insect pests. Many plants commonly regarded as safe contain toxic compounds, which may prove unsafe for both humans and animals to consume .Suthisut *et al.*(2011). Wekesa *et al*. (2011) studied the repellent action of *Hyptis spicigera* extracts on *Sitophilus zeamais*. Zia *et al.* (2011) demonstrated the highly lethal/ repellent effect of some plant extracts against stored-product beetles.

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