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A POTENCY OF CHOSEN BOTANICALS ON OVIPOSITION DETERRENCE AND ADULT EMERGENCE OF THE RED FLOUR BEETLE, *TRIBOLIUM CASTANEUM*

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ABSTRACT

Experiments were conducted to study the bioefficacies of different leaf powders of Withania somnifera, Pongamia pinnata, Calotropis gigantea, and Phyllanthus amarus, against the red flour beetle, Tribolium castaneum (Herbst) that infests stored green gram seeds. Dried leaf powders of Withania Somnifera and Pongamia Pinnata (5mg/seed) were found to be simpler, inflicting 100 percent mortality, than leaf powders of Calotropis gigantea and Phyllanthus amarus (20mg/g seed), revealed 73.1% and 69.2%mortality severally. However, all plant leaf powders showed 100percent ovicidal activity.NoF1 adult emerged at 20mg/g seed treated with all plant powders. It absolutely was terminated that leaf powders of W. somnifera and Pongamia pinnata showed vital mortality, oviposition deterrence, and F1 adult deterrence of T.castaneum at very low concentrations. Hence, these ethnobotanicals powders could also be prompt as admixtures within the integrated management of beetle infestation of Green gram seeds throughout storage.

KEYWORDS: ***Tribolium castaneum,Oviposition,mortality,Ethnobotanicals***

INTRODUCTION

Pest insects affect food output directly by reducing the standard and amount of the crop produced, or indirectly by serving as vectors of plant diseases. The red flour beetle, *Tribolium castaneum* may be a serious pest of stored grains and products (Zettler, 1991). The red flour beetle, *Tribolium castaneum* Herbst (Coleoptera: Tenebrionidae), is one among the Foremost widespread and harmful stored-product pests throughout the planet. Beetles and larvae feed on a very wide range of dry vegetable substances, such as milled cereal products (Rees 2004). Common remedial measures include the utilization of synthetic compounds/agents to repel or kill pests. These chemical compounds have their own damaging effects on the crops, stored grains products. Though effective, such synthetic pesticides cause consequently residual pollution of the environment and toxicity to consumers. Their perennial use for many years has disrupted biological management by natural enemies and has led to the revitalization of stored product insect pests. Several of those stored product insects have developed resistance to the commonly used chemicals (Subramanian and Hag strum, 1995; Srivastava and Singh, 2002). These issues have highlighted the necessity to develop insect management alternative methods. Biological management strategies have their own edges like lesser losses, minimum unhealthy effects on stored products, and few toxic to health [3, 4]. Likewise, several medicative plants and spices are used as pest management agents (Lale, 1992; Isman, 1995; Yankanchi and Gonugade, 2009). Farmers and researchers usually claim the victorious use of plant materials in insect pest management, together with ash (Ofuya, 1986; Ajayi et al., 1987), vegetable oils (Schoovoven, 1978; Kazi et al., 1999), plant extracts (Chiasson et al., 2004; Devanand and Usha Rani, 2008; Yankanchi, 2009), and biological science powders (Abdullahi and Muhammad, 2004; Patil et al., 2006; Shukla et al., 2007; Gupta and Srivastav, 2008). It's been reported that some plant preparations and ancient strategies area unit a lot of safer than chemical pesticides (Verma and Dubey, 1999; Weaver and Subramanian, 2000; Yankanchi and Patil, 2009).

Therefore, plant materials ought to be explored to protect stored products against pest infestation. This study aimed to protect stored green gram seeds from T.castaneum infestation under laboratory conditions using leaf powders of *W. somnifera, P. pinnata, Calotropis gigantea,* and *Phyllanthus amarus* likewise as their impact on oviposition and F1 adult deterrence of pulse beetle. And to identify the foremost potent botanical which will be terribly effective.

MATERIALS AND METHODS

Collection of plant materials

The different plant powders used in this investigation was taken from the leaves of *Withania somnifera (L), Pongamia pinnata (L), Phyllanthus amarus (L)* and, *C. gigantea (L)*.The leaves of different plants were washed with distilled water to remove dust particles and shade dried. The leaves were then pulverized with the help of an electric grinder to obtain fine powder

Insect culture

The red flour beetle, *Tribolium castaneum* (Herbst) adults were obtained from naturally infested green gram seeds from the grocery shop and brought to the laboratory. The beetles were reared on the clean and un-infested green gram (*Vigna radiata*). A hundred adult insects were released in a plastic container capped with a muslin cloth to provide ventilation, containing 500 g green gram seeds. The plastic container was kept under controlled temperature (28 ± 2°c) and, relative humidity (70 ± 5%). After 48 h, the adults were removed and the container was left for 25 days to obtain adult beetles for the experiment.

Effect of powder on mortality, oviposition and F1 emergence

In various clear plastic containers, fine leaf powders were tested at doses of 0 (control), 5, 10, and 20 mg/g green gram seeds (0-2 percent w/w) (200 ml).The required amount of powder was mixed thoroughly with 20 g green gram seeds. Ten pairs of 0-48 hold adults were released into each container and the containers were capped. The number of dead beetles was recorded after 48 h of treatment. When the beetle didn't respond to mild pressure with a fingertip, mortality was considered. To avoid the possibility of death mimicry, the beetles were watched for 30 min and again subjected to gentle pressure. Percentage insect mortality was calculated using the corrected formula of Abbott (1925). The total number of eggs are laid on the seed surface was recorded after 4 days of treatment. Percent deterrence of oviposition was calculated following Elhag (2000). To determine the F1 progeny detergence efficacy of plant powders, 20 g green gram seeds (each seed with two eggs) were placed in a separate plastic container (200 ml) and treated with the above doses of leaf powders. The number of emerged F1 adults was counted after 25 days, and the percentage deterrent was determined using Aldryhim (1995) formula (number of progeny in care – number of progeny in recovery/number of progeny in control X 100). Both tests have been conducted three times and d ata is the mean ± SD. Data were subjected to one-way ANOVA. Means were separated by Duncan's multiple range test (DMRT) when ANOVA was significant ($p < 0.05$) (SPSS 10, version).

RESULTS

The results presented in Table-1 indicate that leaf powders of *Withania somnifera, Pongamia pinnata, Phyllanthus amarus* and, *Calotropis gigantea* were significantly effective for mortality, reduction in oviposition, and F1 progeny production of *Tribolium castaneum.* Leaf powders of *W. somnifera* and *P.pinnata* were found to be more effective than leaf powder of P. amarus and C.gigantea because 20 mg/g dose caused 100% mortality of the beetles. A significantly higher number of eggs are laid on untreated control seeds than on powder treated seed ($p<0.05$). Oviposition deterrence was recorded as 96.8% and 92.6% in seed treated with 20 mg/g *W. somnifera* and *P.Pinnata* powder respectively. The

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Ovicidal activity was recorded as 100% at 5 mg/g *W. somnifera and P. pinnata, 20mg/g P.amarus* and *C.gigantea* leaf powder, which caused none of the F1 adults to emerge.

Table: 1. Effect of different plant powders on mortality of *Tribolium castaneum*

Plant powders	Treatment (mg/g)	% Mortality
Withania somnifera	5 mg/g	67.8 ± 2.4b
	10 mg/g	78.4 ± 2.7b
	20 mg/g	100 ± 0.0a
Pongamia pinnata	5 mg/g	73.1 ± 3.1b
	10 mg/g	87.5 ± 2.8a
	20 mg/g	100 ± 0.0a
Calotropis gigantea	5 mg/g	24.9 ± 2.3c
	10 mg/g	42.2 ± 2.7c
	20 mg/g	73.1 ± 3.9b
Phyllanthus amarus	5 mg/g	28.8 ± 1.6c
	10 mg/g	32.7 ± 2.1c
	20 mg/g	69.2 ± 3.6b
Control(0)	02.6 ± 0.3d	

Table: 2. Effect of different plant powders on oviposition of *Tribolium castaneum*

Plant powders	Treatment (mg/g)	% Oviposition
Withania somnifera	5 mg/g	55.1 ± 2.8c
	10 mg/g	81.2 ± 4.2a
	20 mg/g	92.6 ± 4.8a
Pongamia pinnata	5 mg/g	73.3 ± 3.7b
	10 mg/g	86.4 ± 4.2a
	20 mg/g	96.8 ± 4.1a
Calotropis gigantea	5 mg/g	44.1 ± 2.7c
	10 mg/g	57.3 ± 3.6c
	20 mg/g	68.0 ± 3.8b
Phyllanthus amarus	5 mg/g	23.0 ± 2.6d
	10 mg/g	36. 3 ± 2.9d
	20 mg/g	67.8 ± 3.7b
Control(0)	8.6 ± 2.6d	

Table: 3.Effect of different plant powders on F1 adult deterrence of *Tribolium castaneum*

Plant powders	Treatment (mg/g)	% F1 adult deterrence
Withania somnifera	5 mg/g	100 ± 0.0a
	10 mg/g	100 ± 0.0a
	20 mg/g	100 ± 0.0a
Pongamia pinnata	5 mg/g	100 ± 0.0a
	10 mg/g	100 ± 0.0a
	20 mg/g	100 ± 0.0a
	5 mg/g	48.7 ± 2.1c

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Calotropis gigantea	10 mg/g	74.7 ± 4.2b
	20 mg/g	100 ± 0.0a
Phyllanthus amarus	5 mg/g	56.7 ± 3.4c
	10 mg/g	68.0 ± 3.9b
	20 mg/g	100 ± 0.0a
Control(0)	02.6 ± 0.3d	

Values are mean ± standard deviation of three replicates. Means followed by same letters within each column do not differ significantly by DMRT test ($p < 0.05$)

DISCUSSION

The findings clearly show the effectiveness, by decreasing lifespan and deterring oviposition of *Tribolium castaneum,* of the *W. somnifera, P. pinnata, Calotropis gigantea* and *Phyllanthus amarus* leaves. Plant powder ovicidal behavior was found to reduce T.castaneum progeny generation in stored green gram seeds. In *W. somnifera* and *Pongamia pinnata* powder, a dosage of 20 mg/g (2 percent w/w) was determined to be lethal that caused 100 percent mortality and inhibition of F1 by ovicidal action. Essential oils derived from *L. sempervirens and D. winteri's* leaves and bark have shown to have interaction and toxicity to T.castaneum as well as repellent action. A large number of plant products have been tested for their repellents against stored grain pests, such as essential oils (RegnaultRoger, 1997; Cosimi et al., 2009; Nerio et al., 2009). Another study has shown that the essential oils from Evodia rutaecarpa Hook F and Thomas (Liu and Ho, 1999), *Ocimum gratissimum L.* (Ogendo et al., 2008), and *Artemisia vulgaris L* can also be repelled from *T. castaneum* (Wang et al., 2006).

At 4% (Koona and Koona, 2006), Tithonia divers folia leaf powder was less than 4% in powdered materials (Adedire and Akinneye, 2004), and clove, red, and black pepper powders, with 2.5% w/w were comparatively less in bruising compared to Erigeron floribundus powdered materials(Aslam et al, 2002). The aromatic quality of the leaf powders shows that they contain highly effective volatile constituents against insects. *Somnifera and Pongamia pinnata* insecticide activity is well known to various insect pests (Kazi et al., 1999; Kim et al., 2003; Shaktivadivel and Daniel, 2008; Gupta and Srivastava, 2009). But previous researchers have focused solely on plant extracts and essential oils, and there is a shortage of documents on the use of *W.somnifera, P. pinnata, Calotropis gigantea,* and *Phyllanthus amarus* leaf powders. Primary oils cannot be used in the management of food commodity infestations processed in jute bags due to increment volatility loss (Risha et al., 1999). The present research suggests the use of *Pongamia pinnata* and *W. somnifera* as more feasible.

The results of this study based on laboratory testings, therefore, suggest the possible use by small-scale farmers who store small quantities of pulsing pulses for consumption and planting, *P.Pinnata* and *W. Somnifera*, as an admixture in pest control strategies. Both *P.Pinnata* and *Withania somnifera* plants can scrutinize further to establish the precise mode of action and effect of the active ingredients on non-target species.

CONCLUSION

It was observed and concluded that all of these plants have strong repellent activities against red flour beetle which is an important pest of stored products. *P.Pinnata* and *W. Somnifera* had shown powerful repellent activity among all four extracts while *Phyllanthus amarus* proved to be the least effective. Overall, these plant extracts show majestic repellent activity and, these are a potential source of safe biological insect repellents in the future. Because Plant extracts are an alternative tool for controlling pesticides to minimize the adverse impacts on the atmosphere of certain pesticides. In the quest for newer, more selective, and biodegradable insecticidal compounds, these findings may be helpful.

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