

## Efficacy of Neem, Basil and Chilli Powders as Antifeedant in the Red Flour Beetle *Tribolium castaneum* (Herbst) (Coleoptera: Tenebrionidae).

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**Abstract:** *Tribolium castaneum* (Herbst) (Coleoptera: Tenebrionidae), the red flour beetle, is an important pest of stored grains, a serious loss of grain in weight and quality has been reported worldwide. However, the control of the insect by using synthetic chemicals had serious effect to human health and environment. The study was conducted to evaluate the effect of neem leaves, basil leaves and chilli fruits powder as antifeedant and their effect in the number of 3<sup>rd</sup> larval instar which reach adult stage in *T. castaneum* (Herbst). 20grms of clipped local sorghum seeds variety (Fatarita) were treated with the powder of each product separately at two concentrations: 5% and 10% (w/w) and then, the insects were introduced in treated Petridish. The results were checked two weeks after the treatments and the control was untreated. The neem (5% and 10%), chilli (5% and 10%) and basil (10%) were showed antifeedant effect in the 3<sup>rd</sup> larval instar of *T. castaneum*. The Neem5% was showed highest effect as compared to other concentrations. Moreover, all the treatments were reduced the number of larvae which reached the adult stage, and the neem and the chilli concentrations showed higher effects than the basil concentrations.

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### 1. Introduction

Botanical insecticides are considered as alternatives to the synthetic chemicals for being biodegradable, pest specific, non-hazardous to human health and environment and leaving no toxic residue in nature (Periera et al., 1982).

Environmentalists across the world are proclaiming less use of persistent insecticides. The deleterious effect of plant extracts on insects can be manifested in several manners including toxicity, mortality, antifeedant, growth inhibitor, suppression of reproductive behavior and fertility (Kamali. 2009). Scientists in different parts of the world are working for the development and establishment of plant based pesticide, usually called as phytopesticide, botanical pesticide, bio pesticide or natural pesticides (Siddiqui. 2009). There are many plant species which can be used as sources and successful potential insecticidal properties such as *Azadirachta indica* (A. Juss.) (Neem), *Caloptropis procera* (Usher), *Allium sativum* (Garlic) and *Ocimum basilicum* (Rehan).

*Tribolium castaneum* (Herbst) (Coleoptera: Tenebrionidae), commonly known as red flour beetle, is an important cosmopolitan pest of stored grains. Insect caused a serious loss in quantity and quality of stored grain worldwide. For example, *T. castaneum*

infestation in unprotected wheat can damage the grain and its germination completely, physical damage kernels may ranged from 9% to 39% (Karunakaran et al., 2004).

The objectives of the present research work were to evaluate the antifeedant effect of the neem leaves, basil leaves and chilli fruits as powders on the 3<sup>rd</sup> larval instar of the *T. castaneum* fed on sorghum grain. And to investigate the effect of the mentioned plant products on the number of the 3<sup>rd</sup> larval instar of the Red flour beetle *T. castaneum* which reach to adult stage.

### 2. Material and Methods

A laboratory experiment was conducted at Shambat, Department of crop protection, Faculty of Agriculture, University of Khartoum to evaluate the efficacy of three different botanical products, Neem leaves *Azadirachta indica* (Juss.), Basil leaves *Ocimum basilicum* and Chilli fruits *Capsicum furtescens* powder against the *T. castaneum*.

#### 2.1. Insect culture

Adults of *T. castaneum* were obtained from the laboratory culture of the Department of Crop protection, University of Khartoum. The adult insects were reared in plastic bucket (5 kg capacity,

approximate dimensions; top 186mm, bottom 193mm, inner height 188mm) half filled with natural diet, local sorghum variety (Fatarita), and covered with muslin cloth fixed with rubber band and kept in the laboratory at room temperature. Adults of Red flour beetle were allowed to lay their eggs on crushed sorghum brought from local market in Omdurman. Larvae of third instars were collected from the culture for the bioassay.

## 2.2. Preparation of botanical extracts

### 2.2.1. Preparation of Neem and Basil leaves powder

Fresh green leaves of neem and basil were randomly collected from the plants present at the Faculty of Agriculture, University of Khartoum, Shambat. The leaves were washed with water and left under shade to dry for a week. The dry green leaves were then finely powdered by pestle and mortar and kept in glass jar in the laboratory at room temperature (26°C) for further use.

### 2.2.2. Preparation of Chilies Fruits Powder

Fruits of chilli plant were obtained from local market of Khartoum North. The leaves were ground by electric blender; the powder was stored in glass bottle tightly covered, kept in laboratory at room temperature and used for bioassay.

Seeds of local sorghum variety Fatarita purchased from the local market, the seeds were soaked in water for one hour and clipped slightly by nail clipper. Twenty grams of clipped seeds were taken in a Petridish (9cm in diameter). Seeds were then treated by 1g and 2g of Neem, Basil leaves and chilli powders to obtain the concentrations of 5% and 10% (w/w) respectively. The concentrations were calculated as follows; each Petridish contain 20g. So we assume 100% for the final volume 20g; then if we need 5% equal X, by cross multiplication  $X = 1g$  of the corresponding products. Twenty larvae (third instar) were introduced in each Petri-dish. After two weeks; the seeds were weighted and finally the number of emerged adults in each Petri-dish were counted.

The experiment was kept in the laboratory at room temperature. The experiment was arranged in completely randomized design with four replicates. The control was kept untreated.

## 2.3. Statistical analysis

The data were analyzed by using analysis of variance. Means were compared by using the Least Significant Difference (LSD) method. For computation SAS software package (2004) was used.

## 3. Results

### 3.1. The antifeedant effect

Table (1) showed that the neem (5% and 10%), chilli (5% and 10%) and basil (10%) had antifeedant effect to the 3rd larval instar of the *T. castaneum* and the neem 5% derived the best results.

**Table 1. Mean weight loss of sorghum grain caused by *Tribolium castaneum* at 3rd larval instar, after two weeks treatments.**

Treatments	Means loss (gm)
Neem leaf 5%	4.5e
Neem leaf 10%	5.0 cd
Basil leaf 5%	5.38ab
Basil leaf 10%	5.25bc
Chilli fruit 5%	4.88d
Chilli fruit 10%	5.0 cd
Control	5.63a
LSD	0.37
SE+	0.25

The means followed by the same letter (s) are not significantly different at ( $P \leq 0.05$ ) according to LSD.

Results revealed that there were significant differences between neem 5% as compared to neem 10%, chilli 5% and 10% and basil 5% and 10%. There was no significant difference between neem 10% and chilli 5%, but chilli 5% was significantly different compared to basil 5% and 10%. However there was no significant difference between basil 5% and 10%. All treatments indicated significant differences from the control except basil 5%.

**Table 2. Average number of emerged adults of *Tribolium castaneum* after the treatments.**

Treatments	Average No. of emerged adults
Neem leaf 5%	45.0 c
10%Neem leaf	35.0 c
Basil leaf 5%	60.0 b
Basil leaf 10%	56.25b
Chilli fruit 5%	41.25c
Chilli fruit 10%	37.5c
Control	75.0 a
LSD	11.17
SE+	7.6

The means followed by the same letter (s) are not significantly different at ( $P \leq 0.05$ ) according to LSD.

### 3.2. Effect of Neem, Basil and Chilli on the number of larvae developed to adults

Table (2) showed that the application of treatments significantly reduced the number of

emerged adults, and neem 5% and 10%, chilli 5% and 10% were more effective than basil 5% and 10%. Table (2) indicated that there were no significant differences between neem 5% and 10%, chilli 5% and 10%, but were significantly different from basil 5% and 10%. All treatments were significantly different compared to the control.

#### 4. Discussion

Botanical insecticides are considered as alternatives to the synthetic chemicals non-hazardous to human health and environment friendly as they have no toxic residues in nature. Thus, this work was conducted to study the effect of neem, basil leaves and chilli fruits powder as antifeedant and their effect from 3th larval instars to adult stage of *T. castaneum*.

Our results revealed that the neem, basil leaves and chilli fruits powder showed significant characteristics as antifeedant in 3th larval instars of *T. castaneum*. Furthermore the neem leaves were more effective against *T. castaneum* as compared to other treatments. These findings are in agreement with a report which showed that the neem products has antifeedants and repellents actions, which lead to the reduction in food intake and consequently the reduction in body weight of *T. castaneum* (Anonymous, 1992). These findings also support the results of Stoll (2000), who recorded the neem and chilli had antifeedants effect.

The antifeedants effect of neem has been reported in different insects. For example, *Mythimna reparata* (Sharma et al., 1983) and *Zabrotes fasciatus* (Silva et al., 2007). Moreover, Neem leaves, chilli fruits and basil leaves powder caused significant reduction in the number of emerged adults of *T. castaneum*. Neem and chilli were more effective than basil and this might be attributed to their hindrance of growth regulatory mechanism.

#### 5. Conclusion

In conclusion, of neem, basil leaves and chilli fruits have antifeedant effect at the 3th larval instars

of *T. castaneum*. Furthermore, the Neem leaves and Chilli fruits they reduced the number of emerged adults. Whereas, Basil leaves had a little effect.

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#### Competing Interest

None declared.

#### References

- Anonymous. 1992. Neem: A tree for solving global problems. A National Research Council. National Academy Press, Washington, D.C.
- Harma, H., K. Leuschner, A. Sankaram, D. Gunasekhar, M. Marthandamurthi, K. Bhaskaraiah, M. Subrahmanyam and N. Sultana. 1983. Insect antifeedants and growth inhibitors from *Azadirachta indica* and *Plumbago zeylanica*. In: Natural Pesticides from Neem Tree and other Tropical Plants Proceeding of the 2nd International Neem Conference, 1986, GTZ. Eschborn.
- Kamali, H. H. E. L. 2009. Effect of certain medicinal plant extract against stored grain pest *T. Castaneum* Herbst. Am. Eurasian J. Sustain. Agric. 3(2): 139-142.
- Karunakaran C., D. S. Jayas and N. D. G. White. 2004. Identification of wheat kernels damaged by the red flour beetle using x-ray images. Biosyst. Eng. 87(3): 267-274.
- Pierira J. and R. Wohlgenuth. 1982. Neem (*Azadirachta indica* A. Juss.) of West African origin as a protectant of stored maize. Zeitschrift für Angewandte Entomologie. 24(2): 208-214.
- Siddiqui, B. S., S. T. Ali, R. M. Tariq, T. Gulzar, M. Rasheed and R. Mehmood. 2009. GC-based analysis of insecticidal constituents of the flower of *Azadirachta indica* A. Juss. Nat. Product Res. 23(3): 271-283.
- Silva, J. P., A. E. M. Crotti, and W. R. Cunha. 2007. Antifeedant and allelopathic activities of the hydro alcoholic extract obtained from Neem (*Azadirachta indica*) leaves. Revista Brasileira de Farmacognosia 17: 529-532.
- Stoll, G. 2000. Natural Crop Protection in the Tropics, letting information comes to life. Margraf Verlag 2<sup>nd</sup> enlarged and revised edition; 104-243.

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