

## Studies on the Repellent Activities of Four Common Asteraceae in Nigeria against Red Flour Beetle, *Tribolium Castaneum*

Onunkun, O.

Department of Agricultural Science, Adeyemi College of Education, Ondo, Ondo State, Nigeria.

### -----ABSTRACT-----

Laboratory experiment was conducted to evaluate the insecticidal and repellent activities of four species of plants belonging to the family asteraceae that are commonly found in Nigeria against adults of flour beetle *Tribolium castaneum* Herbst (Coleoptera: Tenebrionidae). The treatments were made up of four leaf powders of the plant species, *Chromolaena odorata*, *Ageratum conyzoides*, *Tridax procumbens*, *Vernonia amygdalina*, applied at 0%, 2.5% and 5.0%. Repellency of the treatments was evaluated following the cup bioassay method of Mohan and Fields (2002) with little modifications. It was observed that adult insects exposed to the leaf powders admixed with 100g of wheat grains were most repellent to *Tridax procumbens* and *Vernonia amygdalina* treatments at low concentration (2.5%) of the powders compared to control. Repellency effects of the leaf powders were *Tridax procumbens* > *Vernonia amygdalina* > *Ageratum conyzoides* > *Chromolaena odorata*. The leaf powders of *Tridax procumbens* and *Vernonia amygdalina* have great potential as effective and ecofriendly protectants against the red flour beetle.

**Keywords:** *Tribolium castaneum*, *Chromolaena odorata*, *Ageratum conyzoides*, *Tridax procumbens*, *Vernonia amygdalina*.

Date of Submission: 25 October 2013



Date of Acceptance: 08 January 2014

### I. INTRODUCTION

Wheat is grown on around 10 million ha in Africa, where it is a major staple food crop for several countries. Consumption is twice the production level and the gap is widening because of increased population, change in human diet and food preferences. Observed yields are generally low due to several constraints including drought, insect pests, and diseases (Mahmoud, 2012).

The red flour beetle, *Tribolium castaneum* Herbst (Coleoptera: Tenebrionidae) has been observed as a common pest of stored wheat and other cereals all over the world, since both quality and quantity are seriously damaged by it (Hussain *et al.*, 1996). Insect pest damage to stored grains results in major economic losses in Africa, where subsistence grain production supports the livelihoods of the majority of the population (Udo, 2005). Synthetic pesticides are currently the method of choice to protect stored grain from insect damage. However, their widespread use has led to the development of pest strains resistant to insecticides (Subramanyam and Hagstrum, 1995).

The emergence of biodegradable pesticides as safe option has reduced the problems that result from the use of synthetic insecticides, thus creating a renewed interest in their development and use in integrated pest management of crops. The insecticidal activity of several plants belonging to the Asteraceae family has been described in several studies. Secoy and Smith (1983) reported that pyrethrins, isolated from the dried flowers of *Chrysanthemum cinerariaefolium* Vis. possess insecticidal properties. The present experiment, therefore, aimed to study the repellent effect of the leaf powders of four commonly found asteraceae species in Nigeria: *Chromolaena odorata*, *Ageratum conyzoides*, *Tridax procumbens* and *Vernonia amygdalina* in controlling red flour beetle.

### II. MATERIALS AND METHOD

The adults of red flour beetle, *Tribolium castaneum* were obtained from cultures previously collected for this purpose from infested wheat seeds in Ondo market and maintained at the laboratory of Agricultural Science Department, Adeyemi College of Education, Ondo, Ondo state, Nigeria. The insects were reared on wheat flour plus brewer's yeast (5% by weight) diet at 26- 28°C temperature and 74 – 80% RH.

## 2.1 Selection and collection of plant species

The selection of plants used in the study was based on previously reported insecticidal and repellence properties of the plants against storage insect pests. The plants, with the exception of *Tridax procumbens*, which was collected within Ondo town, were all collected from the main campus, Adeyemi College of Education, Ondo. The leaf part of the plant was plucked by hand and put in a jute bag. The plant materials were subsequently dried under shade for 6 days and pulverized using wooden pestle and mortar. Sieving of the pulverized plant materials was done and 100g of the prepared leaf powder was kept in an air tight container for the purpose of the experiment.

## 2.2 Repellency study

The repellency test adopted the cup bioassay method described by Mohan and Fields (2002) with little modifications. The leaf powders of the four plant species of asteraceae were evaluated for their repellent effect against red flour beetle, *T. castaneum* at the rate of 0%, 2.5% and 5.0%. The experiment was a completely randomized design with five treatments and four replicates. The twenty adult insects that were used in the experiment were sieved out and placed gently in the middle of the perforated plastic container that holds 100g of wheat grains admixed with leaf powder and chemical insecticide treatments. Repellence was determined by the number of insects leaving the treated grain compared to the untreated controls.

## 2.3 Statistical Analysis

A two-way analysis of variance (ANOVA) was performed on data after transformation using square root and arcsine to determine repellent activity of the leaf powders of the four selected asteraceae at different concentrations and duration of exposure. Differences in mean repellency of treatments were compared using Students Newman Keuls(SNK) at  $p < 0.05$ .

## III. RESULTS

The repellence of adult red flour beetle, *Tribolium castaneum* to leaf powders of *Chromolaena odorata*, *Ageratum conyzoides*, *Tridax procumbens* and *Vernonia amygdalina* at different concentrations and period of exposure are depicted in figures 1, 2, 3, 4 and 5 respectively. The results indicate variation in repellence effectiveness of the selected plants. The rate of movement of adult red flour beetle from the perforated cylindrical cup which indicates repellence increased with increase in concentrations of the leaf powders and duration of exposure. The response of adults of *T. castaneum* to treatments of powders of the four asteraceae plant species was fastest for *T. procumbens*. At the highest concentration (5%) and duration of exposure(12 hours) adult red flour beetle elicited 79% repellence. This was closely followed by *V. amygdalina* with 68% repellence. The order of repellency effects of four powdered asteraceae species at the highest dosages and duration of exposure was *Tridax procumbens* > *Vernonia amygdalina* > *Ageratum conyzoides* > *Chromolaena odorata*.

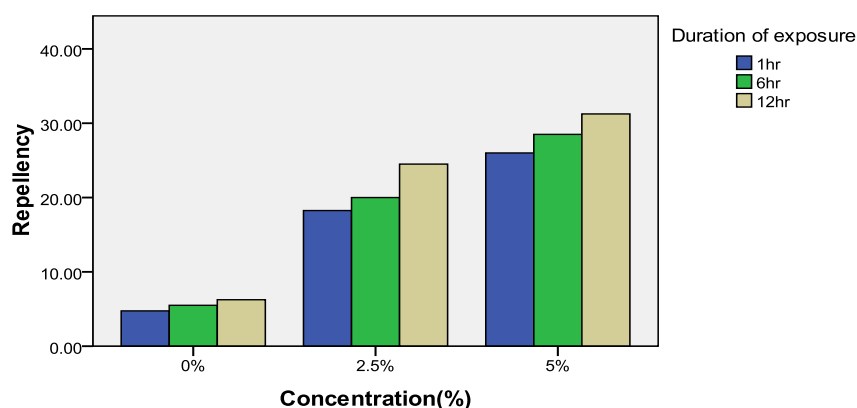


Figure 1. Repellency of *Chromolaena odorata* leaf powder to adult red flour beetle, *Tribolium castaneum*.

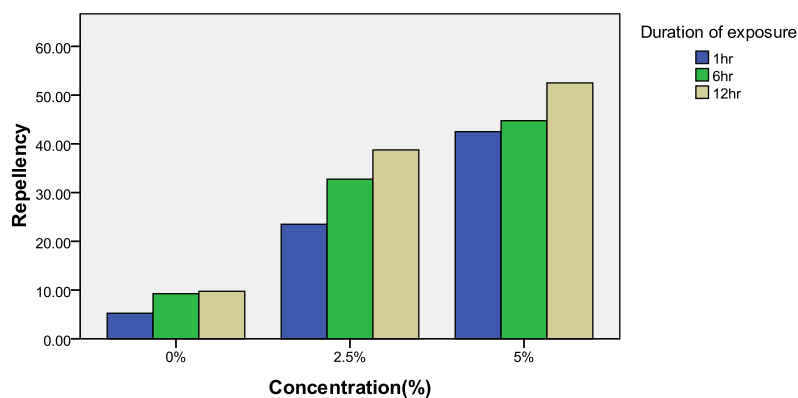


Figure 2. Repellency of *Ageratum conyzoides* leaf powder to adult red flour beetle, *Tribolium castaneum*.

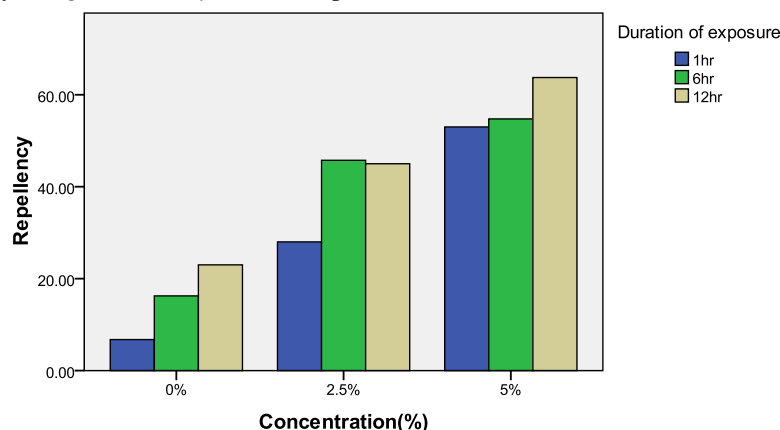


Figure 3. Repellency of *Vernonia amygdalina* leaf powder to adult red flour beetle, *Tribolium castaneum*

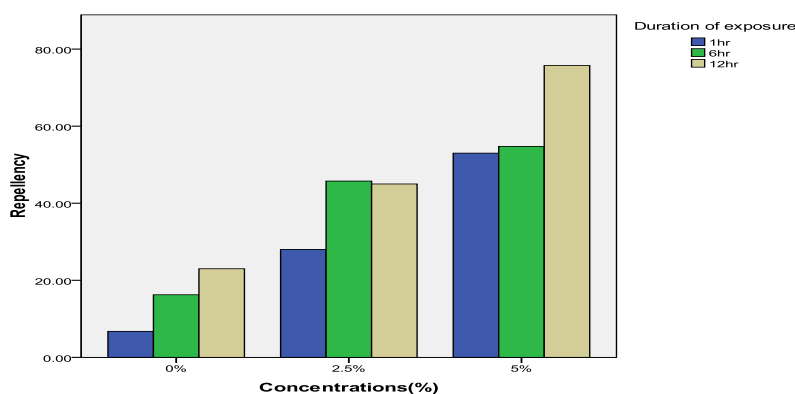


Figure 4. Repellency of *Tridax procumbens* leaf powder to adult red flour beetle, *Tribolium castaneum*

Pascual-Villalobos and Robledo (1998) reported some asteraceae such as *Anacyclus clavatus* Pers., *Asteriscus maritimus* Less., *Artemisia campestris* L., *Atractylis humilis* L., *Centaurea aspera* L., et cetera as effective repellents against adult red flour beetle, *Tribolium castaneum*. Gbolade *et al.*, (1999) evaluated the effects of seed treatment and fumigation of artificially infested cowpea with the volatile oil of air-dried leaves of *Ageratum conyzoides* (Asteraceae) resulted in acute toxicity to adults of the cowpea weevil, *Callosobruchus maculatus* and red flour beetle, *Tribolium castaneum*. Sahayraj and Paulraj (2000) observed that *Spodoptera litura* larva was repelled by groundnut leaves treated with *Tridax procumbens* leaf extract and the repellency increased as the concentration of leaf extract increased.

Based on the present findings, it could be concluded that plant powders of some commonly found asteraceae in Nigeria could be exploited for their repellent properties against red flour beetle infesting wheat. The study has demonstrated that the leaf powders of these plants could serve as a veritable alternative protectants against the storage pest of wheat, red flour beetle, therefore avoiding all the side effects of synthetic pesticides.

#### REFERENCES

- [1.] Gbolade A.A., Onayade O.A and Ayinde B.A(1999). Insecticidal activity of *Ageratum conyzoides* L volatile oil against *Callosobruchus maculatus* F. in seed treatment and fumigation laboratory test. *Insect Sci. Appl.* **19**: 237- 241.
- [2.] Hussain, A., Akram, W. and Khan, F.S., 1996. Determination of insecticide resistance in red flour beetle, *Tribolium castaneum* (Herbst) collected from Rawalpindi. *Pakistan Ent.*, 8: 1-2.
- [3.] Mahmoud E Solh (2012). The importance of wheat for food security in Africa: Challenges and potential. Paper presentation at Wheat for Food Security in Africa conference, Oct 8, 2012, Addis Ababa, Ethiopia.
- [4.] Mohan S and Fields P.G (2002). A simple technique to assess compounds that are repellent or attractive to stored-product insects. *Journal of Stored Products Research* 38 (2002) 23–31
- [5.] Pascual-Villalobos M. J., Robledo A., 1998.- Screening for anti-insect activity in Mediterranean plants.- *Industrial Crops and Products*, 8: 183-194
- [6.] Secoy DM, Smith AE (1983).Use of plants in control of agricultural and domestic pests. *Economic Botany* 37(1): 28-57.
- [7.] Subramanyam, Bh., Hagstrum, D., 1995. Resistance measurement and management. In: Subramanyam, Bh., Hagstrum, D. (Eds.), *Integrated Management of Insects in Stored Products*. Marcel Dekker, Inc., New York, pp. 331–398
- [8.] Udo, I.O., 2005. Evaluation of the potential of some local spices as stored grain protectants against the maize weevil *Sitophilus zeamais* Mots (Coleoptera: Curculionidae). *Journal of Applied Sciences and Environmental Management* 9, 165-168.