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**Effect of The Sweet Orange Peel Extracts (*Citrus Sinensis* L.) On The
 Mortality Rate of Cowpea Weevils (*Callosobruchus Maculatus*. J.)**

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ABSTRACT

The Insecticidal property of *Citrus sinensis* peel extracts was evaluated to determine their efficacy and optimize their use in reducing cowpea losses due to attack by *Callosobruchus maculatus*. Varying concentrations of acetone, ethanol and methanol were obtained and evaluated at 6.25%, 12.5%, 25%, 50% and 100%. The mortality was monitored at 3 days interval. The toxicity of the treatment was dependent on concentration and period of exposure. Acetonic extract of *Citrus sinensis* was the most effective of all extracts. It caused 100% *Callosobruchus maculatus* mortality at 100% concentration within 3 days of exposure. All rates of plant extracts caused mortality of bruchid and were significantly different compared with the control ($P < 0.05$). There is a need to adapt the use of plant extracts in preventing damages against store pests. It is less toxic, environmental friendly, renewable, cheap and degradable. Protecting stored cowpea using *Citrus sinensis* peel at small-holder level is a viable storing method.

Keywords: *Citrus sinensis*, Extract, *Callosobruchus maculatus*, Mortality.

1.0 INTRODUCTION

Provision of adequate food has always been a challenge facing mankind. This is particularly true in the tropics and sub-tropics where the climate provides a favourable environment for a wide range of insects and massive efforts are required to suppress the damages caused by this pest in order to achieve an adequate food supply. In developing countries, the problem is compounded by the rapid increase in human population (Mvumi and Stathers, 2003). The loss due to pests and diseases is about 35% on the field and 14% in storage, giving about a total loss of about 50% of agricultural crops annually. Thus elimination of these insects and pests or mitigation of their activities will go a long way in reducing world food crisis as well as improve human and animal health (Ngamo *et al.*, 2001).

Cowpea *Vigna unguiculata* (L.) is an important grain legume in marginal areas in Africa. It is rich in protein that provides food to human being and feed to livestock as an early maturing

crop which is drought tolerant and fixes nitrogen (Sariah, 2010). The protein found in cowpea is

similar to most cultivated legumes, rich in the essential amino acids, lysine and tryptophan. Despite its potential benefits, small holder farmers in Africa have serious problems in protecting their harvested cowpea from insect pest infestation during storage (Timko and Singh, 2008).

Efficient methods for managing cowpea weevils have been developed but they are not feasible for the poor resource farmer. Moreover, the use of insecticides has been linked to environmental hazards, development of insect resistance, deleterious effects on non-target organisms and chemical residues on stored grain (Cherry *et al.*, 2005; Epidiet *et al.*, 2008).

Plant extracts insecticidal properties could be considered as an alternative insecticide (Dal Bellow *et al.*, 2001). Peasant farmers and researchers often claim successful use of plant materials in insect pest control including

powder, plant extract, ash, vegetable oil and spice (Ajayiet *al.*, 1998).

2.0 MATERIALS AND METHODS

2.1 Study area

The experiment was conducted in the zoological laboratory of the department of Biological sciences and Chemistry Laboratory, Kaduna State University with the following coordinate points: latitude 10^o.31' North and longitude 7^o.36' East and 6.14 meters above sea level.

2.2 Source of plant material

The peel of *Citrus sinensis* was obtained from fresh ripe orange fruits (*Citrus sinensis*) purchased from fruits dealers within Kaduna metropolis. It was peeled, washed with clean water and air dried for 10 days at room temperature (28°C) under the shade. It was then grinded into fine powder using blender and stored in airtight container until it was used.

2.3 Infecting the Cowpea Seeds

Adults of *Callosobruchus maculatus* were obtained from naturally infested cowpea from Kawo market, Kaduna, Nigeria. The weevils were reared in 200g of clean uninfected variety of cowpea seeds inside a plastic container which was capped with muslin cloth (allows ventilation and avoid entry of other insect) and kept at room temperature of (28°C) and relative humidity (75%). The culture was maintained by continually replacing devoured and infested seeds with fresh uninfected cowpea in accordance with Onu and Sulyman (1997).

2.4 Preparation of Plant Extract

The grinded *Citrus sinensis* peels were divided into three equal parts 50 grams each and soaked in methanol, ethanol and acetone respectively for 72 hrs. The mixture was filtered and the filtrate was subjected to rotary evaporator to separate the solvent from the extract. Each extract was poured into a beaker and covered with muslin cloth to allow total traces of solvent by evaporation using Soxhlet extraction method (Anon, 1984). The extract was scrapped into amber bottle, wrapped with foil and stored inside freezer until required for analysis.

2.5 Toxicity Test

20g of uninfected cowpea was put in plastic containers. Each of the six concentrations of extracts (6.25%, 12.5%, 25%, 50%, 100%) wastested for all the parameters with 0% serving as the control. The mixture of the seeds and peel extract was shaken thoroughly for two minutes with 1ml of each concentration to ensure uniform coating of the extract over the grain surface and left for 30 mins for complete evaporation before introducing the adult *Callosobruchus maculatus*. All treatments were replicated three times and placed on the laboratory bench in a completely randomized design (CRD) at room temperature (26-30°C) and the mortality count was carried out in a clean glass petri dish after 24, 48 and 72 hours and the number of dead *C. maculatus* were counted and recorded according to the methods of Ekehet *al* 2013.

2.6 Data analysis

Data generated from the study was analysed using Analysis of Variance (ANOVA) at 0.05% and Duncans multiple Range test to determine whether there were significant differences between treated and untreated means.

3.0 RESULTS

3.1 Effect of *Citrus sinensis* extracts on mortality of *C. maculatus*.

The effects of the different extracts of orange peel on mortality of *C. maculatus* are shown in table 1. All treatments recorded higher mortality than untreated control. There is significant difference between them, with Acetonic peel extract the most effective as it has the highest overall mortality rate (M=2.06 +_1.739 SD) as compared to the other two extract after 72 hours. The control recorded least mortality. The methanolic and ethanolic extracts recorded significantly higher mortality than the control (p<0.05).

3.2 Toxicity effects of different extracts of *Citrus sinensis* on *C. maculatus*.

Table 2 summarizes the toxicity effects of different concentration of orange peel on *C. maculatus* after 72 hours of treatments. Cumulatively, Acetonic extract recorded the highest mortality effect at the highest

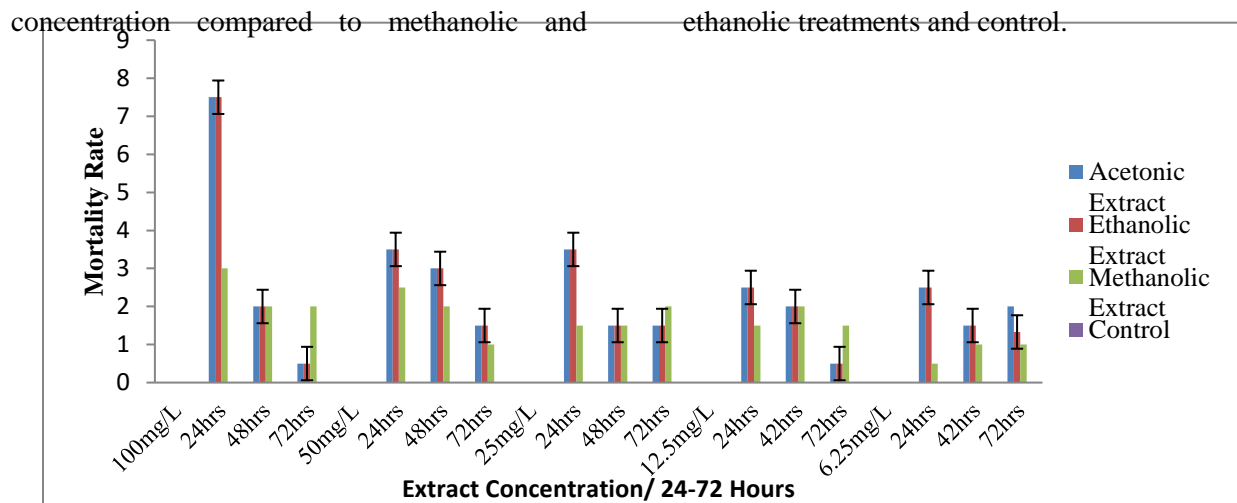


Fig.1.Effects of *Citrus sinensis* extract on mortality of *C. maculatus*

4.0 DISCUSSION

The effects of different extracts of *Citrus sinensis* on *Callosobruchus maculatus* were found to increase with increase in concentration levels, although in certain case the mortality with 25mg/l of ethanolic extract was a bit up than 50mg/l of same extract. This trend of result was reported by Gupta and Srivastava(2008) with use of *Withaniasomnifera* applied at 5% and 10% against *callosobruchuschinensis*L. infesting green gram (*Vignaradiata*).

The results indicated that Acetonic extract of *Citrus sinensis*(orange peel) recorded significantly ($p < 0.05$) higher mortality and lower adult emergence of *C. maculatus* at higher concentration of 100mg/l than other treatments and the control. This is consistent with Maheshwari and Dwivedi(1997) stated that Acetone extract of *Cassia occidentalis* and *Croton bonplandianus* were effective in deterring oviposition in *Callosobruchuschinensis*. Current experiment indicated that the orange peel extract gave different rates of mortality which differs according to the concentrations used on adult *Callosobruchus maculatus*. It is clear that the percentage of mortality of adult weevils positively correlated with the concentration of the extract in both periods and in all treatment. Significant differences between mortality rates of weevils from different extracts of orange peel shows that the active compounds responsible for

the mortality of the insect depend on the type of solvent used in their extraction from the Orange peels this is consistent with the observation of Asawalamet *al.*,(2007). The extract at 100mg/l applied to 50g of seeds recorded high mortality of *C. maculatus* and therefore afforded protection to stored cowpea against the weevils infestation..this is In agreement with Zewar(1987), that exposure of *Callosobruchus maculatus* to a higher concentration of *Citrus sinensis* peel extract of 12ml/kg seeds will cause 100% death of the weevils after two days of exposure due to its strong repellent properties. *Citrus sinensis* peel extract have the advantage of being easy to extract from the peel, cost effective than insecticidal effect on pest of stored product and is not toxic to mammals.

5.0 CONCLUSION

All extracts are effective against *C. maculatus*, but Acetonic extract is recommended for use in preservation of cowpea seeds in storage being the most effective extract tested in this study. It

is also recommended that, farmers should make use of Orange peels as a potential, cheap and environmental friendly as alternative to chemical preservatives used in cowpea storage.

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