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Bioassay of *Mundulea sericea* Ethanol Leaf Extract and Leaf Powder against *Callosobruchus maculatus* (F.) on Stored Cowpea

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Strictly as per the compliance and regulations of :

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I. Introduction

The toxicity of most tropical flora as biopesticides against a number of field and stored-product insect pests have been evaluated (Arnason, 1989) however, scanty information is available for some important medicinal plants like *Mundulea sericea*(Wild) A. Chev. (syn.*M.suberosa* Benth), a leguminous shrub belonging to the family fabaceae. It is widely distributed in some parts of tropical Africa and India: The bark, leaves, seeds and roots of this plant have been found to be good fish poison, insecticide and as an aphrodisiac (Luyengi, 1994). Furthermore, Phytochemicals like rotenoids,flavones,chalcones and imidazole derivatives have been extractected from the plant some of which have antifungal effect (Eksteen, *et al.,* 2001).

C. maculatus is a field-to-store beetles seriously pestivorous on stored cowpea and other legumes at the larval stage especially at optimum conditions of 30-35 ^{O}C and70% and above relative humidity, creating many adult emergence holes, subsequently reducing stored grains to powder form loaded with frass, unpleasant odour and culminating to loss of weight and seed viability as well as and marketability. Singh *et al.,* (1978) reported 100% cowpea seed infestation by *C. maculatus* within 3-5 months of storage period. Similarly, Tanzubil, (1991) showed 100% seed damage causing 60% weight loss within 6 months storage period. Loss of cowpea grains to the pest in Nigeria has been estimated to be about 29000 tonnes (dry weight only) (Caswell, 1973). Fumigants like aluminium phosphide (Phostoxin) tablet and pirimiphos- methyl (Actellic 25EC and 2% dust) are the current pesticides used to manage this pest on stored cowpea and other legumes which are associated with the problems of insect resistance and resurgence, ecological pollution, side effects on non-target organisms, pesticide misuse by illiterate farmers as well as cost of the chemicals has made a global search into novel botanicals and other chemical-free storage strategies inevitable. It is against this background that the bioassay of *Mundulea seracea* ethanolic crude extract and leaf powder were evaluated.

II. Material and Methods

Adult *C. maculatus and* cowpea (SAMPEA-7) used for this research were both obtained from Crop Protection Department, Institute for Agricultural Research, Ahmadu Bello University Zaria. Two trials were carried out from April –August 2009 and October, 2009-February 2010 under 27± 3^{o}C and 70-80% relative humidity.

Culture of *C. maculatus*: Adult *C. maculatus* from naturally infested cowpea were identified, sexed and thirty (30) pairs introduced into 500 g uninfested cowpea in two insect-proof Kilner jars and kept under laboratory conditions. After about thirty-five (35) days, newly emerged F_1 adults were collected and used to

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infest the cowpea samples tested during the investigation.

Plant materials:

a. Mundulea leaf ethanolic extract; About 1 kg of shade- dried *mundulea sericea* leaves collected from the surroundings of IAR was powdered using a Retsch SM2000 cutting mill and soaked in 100% methanol for a night. The suspension was filtered twice, first under vacuum through a double layer Whatman filter paper and then by gravity through a single sheet of Whatman number one(No.1) filter paper.The methanol was recovered through vacuum distillation at 30-35^{O}c using a rotary evaporator. The process was repeated three times and subsequently concentrated to dryness and the resultant product diluted with distilled water for use in the experiment.
b. Leaf powder; About 1 kg of fresh *mundulea sericea* leaves was pounded using local wooden pestle and mortar. The product obtained was shade-dried for three days and pounded, sieved and the resultant powder used for the experiment.

Standard checks: Actellic (25EC) and actellic dust used as standard checks for the ethanolic extract and leaf powder respectively were bought from an agro-allied shop in Samaru market, Zaria, Kaduna State Nigeria.

Application rates: All treatments except the untreated control were applied at three concentrations of 1, 2 and 3 ml/100g and g/100g of cowpea seeds for crude extract and leaf powder respectively. Each was replicated three times and all the jars thoroughly shaken to ensure adequate mixing and coating of seeds by the treatments before infestating all jars with five pairs of newly emerged *C. maculatus*. The set up was left on laboratory benches in a completely randomized design layout (CRD).

The parameters evaluated include mortality, oviposition, progeny emergence, seed damage and viability. Insect mortality counts was conducted at 24, 48 and 72 hours post-treatment and two weeks later, all introduced insects were sieved out and oviposition assessed by randomly picking 20 seeds from each jar and the number of eggs laid on each counted and recorded. F_1, F_2 and F_3 progeny emergence was carried out at 4, 8 and 12 weeks post-treatment while damage and seed viability tests were conducted at the end of the three months storage period.

III. Results

Treatments result on insect mortality as shown in figure 1 revealed that all treatments significantly ($p<0.05$) caused higher mortality of adult *C. maculatus* compared to the untreated control. Most insects died within 24 h post-treatment with 100% mortality records at all levels in actellic (25EC) as well as in 2 and 3 g/100g cowpea seeds of actellic dust. This was closely followed by ethanolic extract of *Mundulea sericea* leaf with 90% mortality at 3ml/100g cowpea seeds and 80% at 1 and 2ml as well as at 3g/100 of cowpea seeds of *Mundulea sericea* leaf powder. The untreated control had the least mortality count of about 40%. At 48 hours post-treatment, 30% mortality count was further recorded at the untreated control, 20% each of 1ml level of the crude extract and at all levels of *mundulea sericea* leaf powder with no mortality count at the standard checks. Mortality of about 25%, 23% and 10% were recorded in the untreated control, 1g/100g cowpea seeds of Mundulea leaf powder and at 3ml/100g cowpea seeds of crude extract respectively on the third day (i.e. 72 hours post-treatment).

Results on oviposition in figure 2, showed that all treatments at all levels applied, significantly ($p<0.05$) reduced oviposition by adult *C. maculatus* when compared with the untreated control. There was a significant difference in oviposition between the plant materials and the synthetic pesticides used in which actellic (25EC) had the least (1.2) number of eggs laid followed by actellic dust at 2 and3g/100g cowpea seeds with 12.2 number of eggs each. *Mundulea seracea* ethanolic extract suppressed oviposition more than the powder however, not in quite a significant manner and both were better than the untreated control with the highest oviposition record (219.9). Oviposition was generally observed to decrease with increased levels of all the treatments applied. Reduction in oviposition has inhibited progeny emergence especially the F_3 generation where emergence was only recorded in the untreated control (1025). Few F1 and F_2 insects were recorded particularly at levels 1 and 2/ 100g cowpea seeds of *Mundulea sericea* ethanolic extract and leaf powder.

In terms of damage, all treatments significantly $P<0.05$) protected cowpea grains against damage by *C. maculatus.* The highest seed damage was recorded in the untreated control (217) followed by *Mundulea sericea* ethanolic extract at 1ml/100g cowpea seeds (24) and at 1 and 2g/100g cowpea seeds with10 and 4 respectively.Seed viability was also not affected by the treatments especially at the lowest concentration. Hihgest percentage viability was recorded at 1ml/100g cowpea seeds of actellic (25EC) with 97%, followed by *Mundulea sericea* powder at the same concentration with 93.1% while the untreated control had the least percentage viability (22.4%).

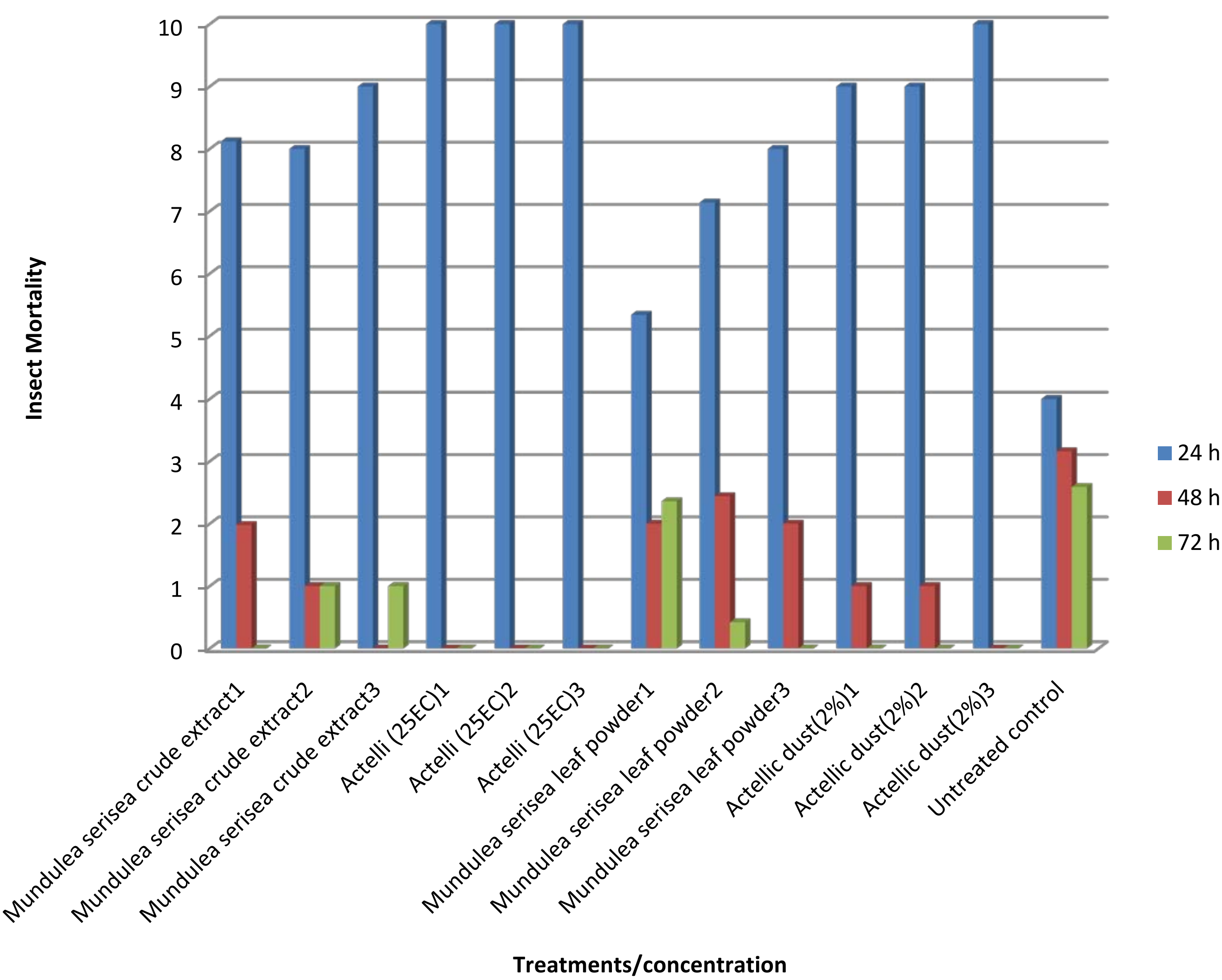


Figure1:Effects of *Mundulea* ethanolic Extract and Leaf Powder on *C. maculatus* Mortality

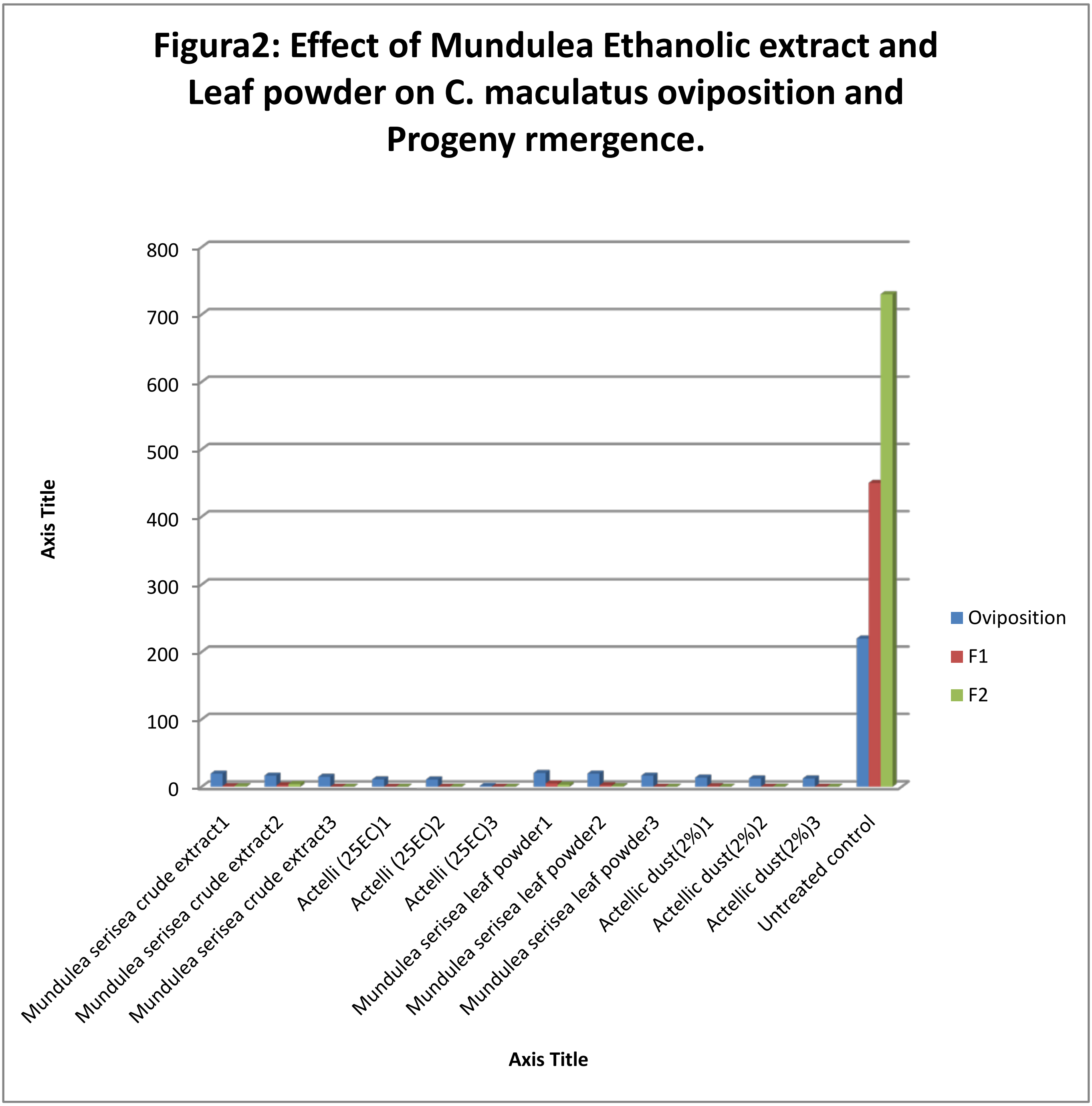
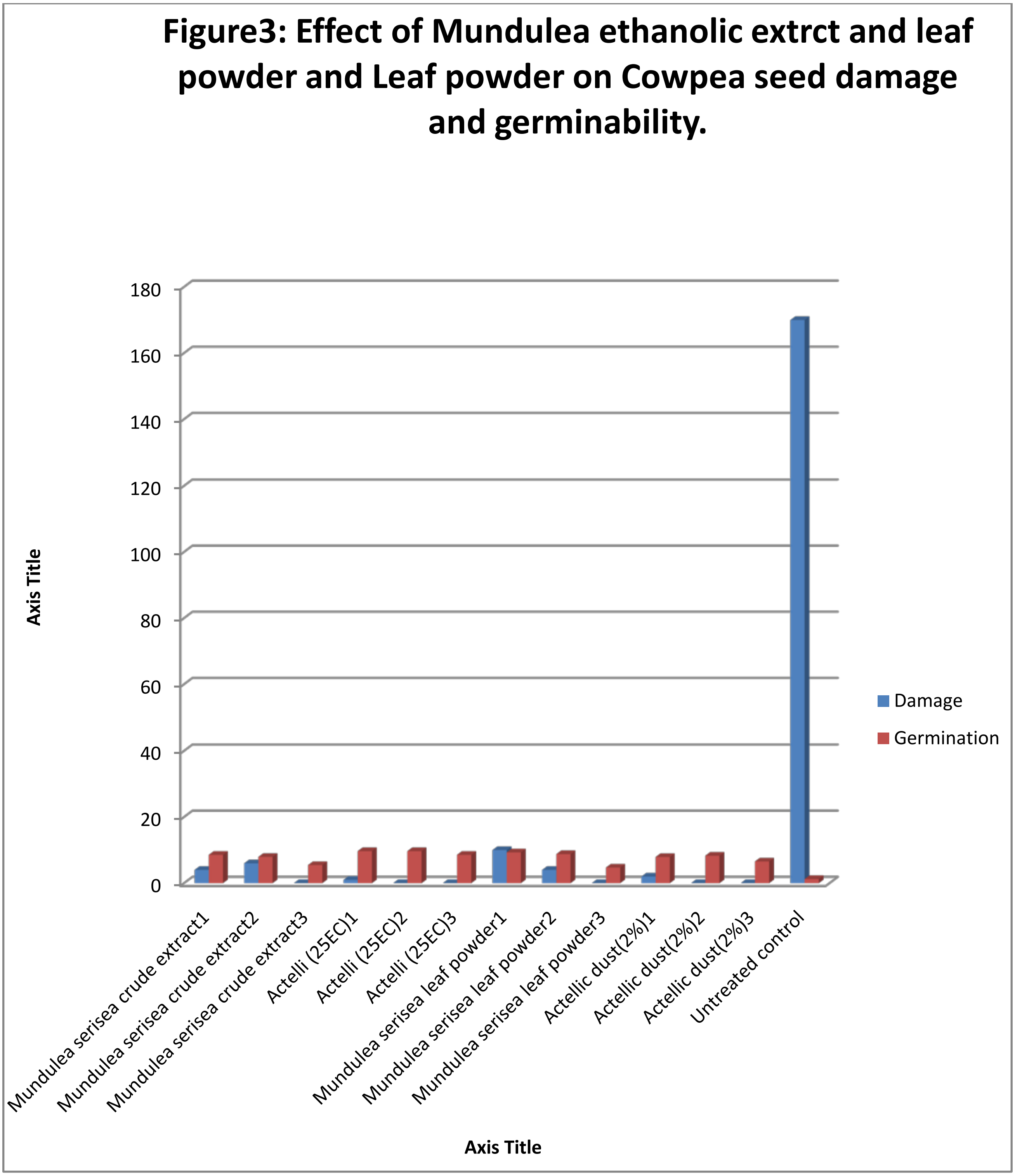


Figura2: Effect of Mundulea Ethanolic extract and Leaf powder on C. maculatus oviposition and Progeny rmergence.
Axis Title
800
700
600
500
400
300
200
100
0
Oviposition
F1
F2
Mundulea serisea crude extract1
Mundulea serisea crude extract2
Mundulea serisea crude extract3
Actelli (25EC)1
Actelli (25EC)2
Actelli (25EC)3
Mundulea serisea leaf powder1
Mundulea serisea leaf powder2
Mundulea serisea leaf powder3
Actellic dust(2%)1
Actellic dust(2%)2
Actellic dust(2%)3
Untreated control
Axis Title



IV. Discussion

Potency investigation of *Mundulea sericea* ethanolic extract and leaf powders against *C. maculatus* attack on stored cowpea revealed that, the botanicals like their synthetic counterparts significantly ($P<0.05$) caused higher insect mortality, reduced oviposition and inhibited progeny emergence without interfering with seed integrity in terms of seed damage and germinability, However, the synthetics were more effective in all the parameters evaluated as complete 100% mortality was achieved in their treated jars within 24 hours post-treatment. *Mundulea sericea* crude extract was also found to be more effective than the

Global Journal of Science Frontier Research (D) Volume XII Issue IX Version I Year 2012

powder which was in turn better than the untreated control.

The knock –down effect exhibited by the plant materials could be attributed to some active compounds contained (rotenoids, flavones, isoflavones, chalcones and some imidazole derivatives) in the plant materials and exposed to action through methanolic extraction and pulveristion of the leaf powders. These compounds have been found to exhibit potent inhibitory activity against phorbol ester-induced ornithine decarboxylase in mouse epidermal cells (Luyengi, 1994). Several authors Like Okonkwo and Ewete (1998) acheived 100% protection of cowpea grains against *C. maculatus* attack by admixing 3g/25g cowpea seeds of *Dennatia tripetala* (pepper*)* fruit powder. Oparaeke and Dike (1996) used botanical extracts and powders of garlic and lemon grass to protect cowpea against *C. maculatus* and *C. chinensis.* Oviposition and progeny emergence were also found to be significantly ($P<0.05$) reduced by all treatments compared to the untreated control however, actellic (25EC) was outstanding in performance followed by the dust and then *Mundulea sericea* ethanolic extract and leaf powder.

Complete inhibition of progeny emergence was observed in all actellic treated seeds while few F_1, F_2 and F_3 were seen particularly at the lower levels of the botanicals. This outcome suggests that oviposition and progeny emergence was dose dependant since both were observed to decrease as the levels were increased. Shortened adult life-span by treatments must have been responsible for reduced oviposition and progeny emergence which is in agreement with the findings of [Sowumi and Akinusi 1983; Bhaduri *et al.,*1985; Ali, *et al.,* 1981] who used neem kernel,tridax procumbense and custard apple seed powders against *C. chinensis* and *C. maculatus* on stored cowpea without harm to seeds in terms of damage and viability.

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