

Effect of *Ocimum basilicum* L. and *Eucalyptus camaledulensis* Dehn. powders on Cowpea weevil (*Callosobruchus maculatus* F.) in stored cowpea

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Abstract: A laboratory experiment was carried out during the period June – September 2011 at Abu Naama Faculty of Agriculture - University of Sinnar, Sudan, to study the effect of different powdered preparations of leaves and flowers of Rehan and leaves of Cafure on cowpea weevil (*Callosobruchus maculatus* Fabric.). The experiment was laid out as a complete randomized design (CRD) with four replicates. Different concentrations of the two tested plants were formulated by weight from 2 kg of cowpea seeds to give the following treatments: Rehan leaves powder 5% and 10%, Rehan flowers powder 5% and 10%, Cafure leaves powder 5%, and 10%, and untreated control. The treatments were added to clean cowpea seeds. Number of eggs, number of adults, and 100 seed weight were recorded every two weeks up to the end of the experiment. Results indicated that Rehan and Cafure powders of the two concentrations 5%, 10% significantly reduced the number of eggs and adults of cowpea weevil *Callosobruchus maculatus* up to 12 weeks compared to the untreated control. Results also indicated that starting from the 4th week up until the 10th week; all treatments of 10% concentration were significantly different from the untreated control in term of 100 seed weight. Results concluded that the performance of the tested preparations will still encourage the inclusion of these products in IPM programs with other natural and biological measures.

Key words: *Ocimum basilicum*, *Eucalyptus camaledulensis*, *Callosobruchus maculatus*.

INTRODUCTION

Cowpea (*Vigna unguiculata* L) is a very important and cheap source of dietary protein for many countries in the tropics. It is an important leguminous crop providing plant protein for human and animals (Okosun and Adedire 2010). It also serves as a basic raw material for the production of cookies, bread, ground beef patties and many other delicacies (Singh, 2001) However, Cowpea seeds used to make flour, sprouts and weaning food for young children, thus reducing stunted growth (Ntonifor *et al.*, 2006). The main pests of this crop during the growing season are the aphids *Aphis cracivora*, Pod borer (*Maruca vitrata*) and (*Heliotis spp.*) caterpillars that feed on tender foliage and young pods. In

storage, cowpea grains suffer great qualitative and quantitative losses caused by various insect pest species, especially cowpea weevil (*Callosobruchus maculatus*) which make the grains virtually unfit for consumption (Abdullahi and Muhammad 2004). The fact that cowpea grains are used as human food and feed for livestock renders the use of toxic synthetic insecticides unacceptable since this may lead to great hazards to health and environment (Aslam *et al.*, 2002). Chemical control using fumigants and synthetic insecticides has dominated control strategy against insect pests. The synthetic insecticides are also associated with various ecological problems such as environmental hazards, lethal effect on non target organisms, pest resurgence, pest resistance and mammalian toxicity due to residue

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persistence (Lajide *et al.*, 2003; Asawalam and Adesiyan 2001, Epiidi *et al.*, 2008). Furthermore, the current renewed interests in reducing environmental contamination necessitate the use of effective alternative pest management technologies such as traditional botanical agents. (Kéita *et al.*, 2001) found that Leaf, bark, seed powder and oil extracts of *Ocimum basilicum* reduce oviposition rate and suppress adult emergence of bruchids and also reduced seed damage rate when mixed with stored grains. However, (Asawalam and Adesiyan 2001) reported the insecticidal potentials of *Ocimum basilicum* against the maize weevil. Their study revealed that this powder has bioactive components which protected the grain against maize weevil infestation. *C. longa* and *D. tripetala*, and were safe for humans and cheaper than synthetic insecticides.(Tunc *et al.*, 2000) tested *Eucalyptus camaldulenses* against eggs of two stored pest product insects, the confused *Tribolium confusum*, and Mediterranean flour moth *Ephestia kuehniella*. The exposure from eucalyptus caused 45% and 65% mortalities. Therefore the objectives of this study were to evaluate powders derived from Rehan (*Ocimum basilicum* L.), and Cafure (*Eucalyptus camaldulensis* Dehn) against activities of cowpea weevil (*Callosobruchus maculatus* Fabric.) on stored cowpea as well as testing the persistence of this various preparations.

MATERIALS AND METHODS

Experimental site

A laboratory experiment was carried out during the period June – September 2011, to study the effect and persistence of two concentrations of leaves and seeds of Rehan and two concentrations of leaves of Cafure on cowpea weevil (*Callosobruchus maculatus*).

Preparation of materials:-

Seeds of cowpea

The seeds of Cowpea were obtained from Abu Naama local market. The damaged seeds were isolated from the undamaged seeds; the safe seeds were sterilized in an incubator for 10 minutes

under 50°C. After 24 hours the sterilized seeds were packed in Kenaf bags 2kg/bag (35x50 cm).

Rehan and Cafure leaves Powder

The fresh leaves of the two mentioned plants were collected and separated on Kenaf sacks and dried under shade for 15 days. The dried leaves were blended using an electric blender for each plant separately. The fine powder was kept in paper bags.

Rehan flowers powder

The ripe flowers of Rehan were collected from the neighboring fields and separated on Kenaf sacks. The clean seeds were left to dry for 15 days under shade. The well - dried Rehan seeds were powdered to a uniform mesh and the obtained powder was kept in paper bags.

Layout and treatments

The experiment was laid out as a complete randomized design (CRD) with four replicates. Two concentrations (5%, 10%) of Rehan leaves, flowers powder, and Cafure leaves powder were used against cowpea weevil. The percentage was taken from the weight of the cowpea lot (2 kg).

The powders were formulated to give the following seven treatments.

Rehan leaves powder (RL 5%), Rehan leaves powder (RL 10%), Rehan flower powders (RF 5%), Rehan flowers powder (RF 10%), Cafure leaves powder (CL 5%), Cafure leaves powder (CL 10%), and untreated control. The treatments were added to the clean seeds of cowpea randomly and then stored in the store.

Data collected

Data on the number of eggs/seed, number of adults, and 100 seed weight were recorded. The readings were taken every two weeks up to the end of the experiment.

Statistical analysis

The obtained data were subjected to statistical analysis using Statistical Analysis System (SAS) program. Analysis of variance was performed using (ANOVA), and the mean separation was done using Duncan multiple range test (DMRT).

Results of the analysis of variance were presented as means.

ABBREVIATIONS: RL= Rehan leaves, RF= Rehan Flowers, CL= Cafure Leaves CRD= Complete Randomized Design, SAS= Statistical Analysis System. (ANOVA)= Analysis of variance, DMRT= Duncan multiple Range Test.

RESULTS AND DISCUSSION

Number of eggs

Results in Table (1) showed that all treatments used from Rehan and Cafure significantly reduced the number of *C. maculatus* eggs as compared with the untreated control ($p \leq 0.05$). Their effect started from the 2nd week and continued up to the 12th week. However, the highest concentrations exhibited better performance. The same result was also obtained by (Srivastava *et al.*, 1988) who concluded that *Eucalyptus camaldulensis* powder could be used for the control of *Callosobruchus*

chieinsis on the seeds of red grain *Cajanus cajana* at a concentration of 0.1%. However, the *Eucalyptus* leaf powder at 10-20g per 100g seed was effective in the control of *C. maculatus* on stored cowpea (Lajide *et al.*, 2003). This finding is in line with that of (Pathak and Krishna 1986), they mentioned that the odor of *Eucalyptus camadulensis*, *E. rostrate*, *Azadirachta indica* and *Ocimum basilicum* in the laboratory resulted in the decline of egg hatching in *Earias vittella* F. The previous result is also in agreement with that reported by (Shukla *et al.*, 2007), who stated that *O. basilicum* leaves powder is effective against *C. maculatus*. They also mentioned that other workers have previously reported that powders of *Ocimum spp.* reduce lifespan and oviposition of bruchids. However, *C. maculatus* was used by most of these workers in their experiments (Table 1).

Table(1). Effect of Rehan and Cafure powdered treatments on average number of *Callosobruchus maculatus* eggs on cowpea seeds.

Treatments	Duration in weeks						
	2	4	6	8	10	12	14
Control	239.75 ^a	481.00 ^a	624.75 ^a	482.75 ^a	687.25 ^a	527.25 ^a	519.25 ^a
RL5%	119.75 ^b	271.25 ^b	309.25 ^c	369.50 ^b	377.25 ^b	415.75 ^b	404.75 ^b
RL10%	11.50 ^d	103.00 ^c	251.25 ^d	253.75 ^d	258.00 ^d	267.90 ^c	314.00 ^{cd}
RF5%	76.75 ^{bc}	221.75 ^{bc}	333.50 ^c	373.25 ^b	482.75 ^b	397.00 ^b	357.25 ^{cd}
RF10%	32.25 ^c	117.00 ^c	371.50 ^c	268.50 ^{cd}	281.00 ^d	283.00 ^c	322.50 ^{cd}
CL5%	146.50 ^b	265.25 ^b	498.75 ^b	315.50 ^{bc}	410.25 ^b	449.75 ^b	504.25 ^a
CL10%	85.00 ^{bc}	187.25 ^{bc}	297.50 ^d	293.50 ^{cd}	290.50 ^d	301.00 ^c	342.25 ^{cd}

Means followed by the same letter(s) in a column are not significantly different according to DMRT.

Number of adults

Results in Table (2) showed that all Rehan and Cafure treatments in the 1st 2weeks had no significant difference on the number of *C. maculatus* adults compared to the untreated control ($p \leq 0.05$). However, in the 4th week, all treatments significantly reduced the number of insect adults. On the other hand, the results showed that all the higher concentrations of Rehan and Cafure treatments depicted lower adults' number, which continued up to the last two weeks with no significant differences between them. This result agreed with the

previous result of eggs number, and with that founded by (Shaaya *et al.*, 1991) who mentioned that using *Ocimum basilicum* essential oil in a fumigation chamber caused 100% mortality in adults of *Oryzaephilus surinamensis*, 80% mortality in *Rhyssopertha domiica*, and 45% mortality in *Sitophilus oryzae*. Moreover (Oparaeke *et al.* 2002) reported that *Ocimum gratissimum* L. at 2.5g, 5.0g and 10.0g/100g affected cowpea grains with 46.7%, 46.7% and 65.0% adult bruchid mortality respectively within 24 hours. This result is also consistent with that of (Adlan, 2002) who mentioned that *E.*

camaldulensis leaves, flowers, seeds, stems and barks (powder, water and organic extract) at concentrations of 2.5, 5 and 10% have shown promising repelling activities against the faba bean beetle *Bruchidius incarnates*, the red flour beetle *Tribolium castaneum*, and the khabra beetle *Trogoderma granarium*. (Echezona 2006) reported that the proportional combination of

50:50% (1:1g) of *P. guineense* and *C. aequalis* or *E. camaldulensis* were also very effective in causing unusually high adult weevil mortality. This is the first of such combination “therapy” for storage protection with plant-derived powders. This result may have been due to additive and/or synergistic toxicity on the bruchids

Table (2). Effect of Rehan and Cafure powdered treatments on average number of *Callosobruchus maculatus* adults on cowpea seeds.

Treatments	Duration in weeks						
	2	4	6	8	10	12	14
Control	2.00 ^a	11.00 ^a	21.25 ^a	22.00 ^a	22.75 ^a	6.25 ^a	5.75 ^a
RL5%	1.50 ^a	2.75 ^{bc}	5.25 ^b	5.75 ^b	6.75 ^b	4.50 ^{bc}	4.75 ^b
RL10%	1.25 ^a	1.75 ^c	4.25 ^b	4.75 ^c	4.25 ^d	3.25 ^d	3.50 ^c
RF5%	1.50 ^a	3.25 ^b	4.75 ^b	5.25 ^b	6.00 ^{bc}	4.75 ^{bc}	5.00 ^b
RF10%	1.50 ^a	2.00 ^c	4.50 ^b	3.50 ^c	5.75 ^{cd}	3.50 ^d	3.25 ^c
CL5%	1.25 ^a	3.75 ^b	5.25 ^b	5.25 ^b	6.50 ^{bc}	5.00 ^{bc}	5.75 ^{ab}
CL10%	1.25 ^a	1.75 ^c	4.25 ^b	3.00 ^c	5.25 ^d	3.50 ^d	3.25 ^c

Means followed by the same letter(s) in a column are not significantly different according to DMRT

100 seed weight

Results in Table (3) showed that all Rehan and Cafure powder treatments in the 1st 2 weeks had significant differences on 100 seed weight in comparison to the untreated control except for CL 5%. However, the untreated control displayed the lowest weight up to the last week (Table 3). The results also showed that from the 4th week up to the 10th week all treatments of 10% concentration were significantly different from untreated control, with no significant differences between them. This result agreed with the results of eggs number and adults' number and with that stated by (Gubara 1983) who concluded that *Occimum basilicum* tested against the khapra beetle *Trogoderma granarium* in the laboratory gave the least damaged sorghum seeds and the damage was 13.7% compared to 87.3% in the control after 6 months of storage. (Parwada et al., 2012) reported that ground plant extracts act by dehydrating and suffocating the stores weevil and also by reducing weevil movements thereby

resulting in reduced grain damage and weight loss. The leaf powders of *Eucalyptus. Tereticornis* *C. papaya* could also have reduced grain weight loss due to the fact that they reduce the relative humidity on the surface of the grain thereby inhibiting egg laying and larval development of the weevils.

A slight reduction in 100 seed weight was observed after 6 weeks and continued up to 14 weeks, this finding could be attributed to the increment in the pest population and the decrease in the seed contents, where the pest completed its life cycle and consumed much of the seed contents (Table 3).

Table (3). Effect of Rehan and Cafure powdered treatments on 100 seed weight (gm.) of cowpea infested by *Callosobruchus maculatus*.

Treatments	Duration in weeks						
	2	4	6	8	10	12	14
Control	24.30 ^d	23.49 ^c	22.11 ^{bc}	19.08 ^d	17.96 ^b	16.91 ^c	16.47 ^d
RL5%	28.47 ^a	26.50 ^{ab}	24.92 ^{ab}	21.65 ^{bcd}	19.35 ^{bc}	18.54 ^b	18.47 ^c
RL10%	29.10 ^a	27.74 ^a	25.56 ^a	24.12 ^a	20.01 ^a	19.71 ^{ab}	19.50 ^b
RF5%	26.78 ^{bc}	25.51 ^{abc}	24.11 ^{abc}	19.87 ^{cd}	19.69 ^{bc}	18.65 ^{cb}	18.30 ^c
RF10%	27.97 ^{abc}	26.79 ^{ab}	25.49 ^a	22.63 ^{ab}	20.75 ^a	19.78 ^{ab}	19.52 ^b
CL5%	26.07 ^{cd}	24.82 ^{bc}	21.58 ^c	20.53 ^{bcd}	19.02 ^{bc}	18.57 ^b	18.35 ^c
CL10%	28.12 ^{ab}	27.49 ^a	25.00 ^a	22.74 ^{ab}	20.91 ^a	19.76 ^{ab}	19.07 ^b

Means followed by the same letter(s) in a column are not significantly different according to DMRT.

CONCLUSION

In conclusion, this study clearly demonstrates the followings:1- It was found that Rehan and Cafure powders of the two concentrations 5%, 10% significantly reduced the number of eggs and number of adults up to 10 weeks. However, the higher concentrations of the tested powders were the only significant from the untreated control regarding 100 seed weight.

2- Tests of the products used will still encourage the inclusion of these products in IPM programs with other natural and biological measures.

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تأثير تجهيزات جافة من *Eucalyptus camaledulensis* و *DehnOcimum basilicum* L. على خنفساء اللوبيا *Callosobrucus maculatus* F في اللوبيا المخزنة

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المستخلص: أجريت تجربة معملية في الفترة من يونيو إلى سبتمبر 2011 بكلية الزراعة (أبونعامه)- جامعة سنار، السودان، لدراسة تأثير تجهيزات من مسحوق أوراق وأزهار نبات الريحان (*Ocimum basilicum* L.) وأوراق نبات الكافور (*Callosobrucus maculatus* F). استخدم التصميم العشوائي الكامل (CRD) المحتوى على 4 مكررات لتنفيذ التجربة، تم تجهيز تركيبات مختلفة من أجزاء النباتات تحت الدراسة اعتماداً على وزن 2كجم من بذور اللوبيا البيضاء لنحصل على التركيزات الآتية: مسحوق أوراق الريحان 5% و10%، مسحوق أزهار الريحان 5% و10%. ومسحوق أوراق الكافور 5% و10%، بالإضافة للشاهد غير المعامل. تم تسجيل أعداد البيض، وأعداد الطور الكامل لخنفساء اللوبيا البيضاء، بالإضافة لوزن المائة حبة من بذور اللوبيا البيضاء وذلك كل أسبوعين حتى نهاية التجربة. دلت النتائج إلى أن التركيزات المستخدمة من أجزاء النباتين (5% و10%) قد أدت إلى خفض أعداد البيض والطور الكامل لخنفساء اللوبيا البيضاء خفصاً معنوياً حتى الأسبوع الثاني عشر بالمقارنة بالشاهد. بينما أوضحت النتائج أنه وبداية الأسبوع الرابع وحتى العاشر من بداية التجربة فإن التركيز 10% من جميع المعاملات أظهر فروقاً معنوية من الشاهد وذلك بحساب وزن المائة حبة من بذور اللوبيا البيضاء. خلصت النتائج إلى أن أداء تجهيزات النباتات تحت الدراسة يشجع استخدامها بتوافق مع الطرق الطبيعية والأحيائية الأخرى المستخدمة في برنامج الإدارة المتكاملة لتلك الآفة.

الكلمات المفتاحية: *Callosobrucus maculatus* ، *Eucalyptus camaledulensis* ، *Ocimum basilicum*