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BIO-INSECTICIDAL ACTIVITY OF CORIANDER (*CORIANDRUM SATIVUM*) LEAVES POWDER AGAINST COWPEA BRUCHID (*CALLOSOBRUCHUS MACULATUS* (FABRICUS) COLEOPTERA: CHRYSOMELIDAE) ON STORED CHICKPEA (*CICER ARIETINUM* (L.) (WALPER)

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ABSTRACT

Laboratory experiment was carried out to assess the insecticidal activity of coriander leaves powder against *Callosobruchus maculatus* (F.). The leaves powder were applied at 1.0, 1.5, 2.0, 2.5 and 3.0 g/kg of chickpea and the 0.0g/kg untreated seeds served as control. The experiment was laid out in a Complete Randomized Design with six treatments replicated three times. Data collected were adult mortality, oviposition rate, F_1 progeny emergence, seeds damage, weight loss, weevil perforated index and seeds germination were carried out. Significant difference ($P<0.05$), were recorded between the chickpea, dose and exposure period after treatment. The results obtained showed that the plant powder was very effective in protecting stored chickpea against *C. maculatus* at the highest dosage (3.0 g/kg) 120 hrs after treatment where complete 100% adult mortality were observed. There was no F_1 progeny emergence of *C. maculatus* in chickpea treated at the dosage of 3.0 g/kg, while, at the same dosage, almost completely inhibited the F_1 progeny emergence. Also, the different dosage levels significantly protected the seeds against seed damage and weight loss caused by *C. maculatus* compared with the untreated control after 60 days of storage. The viability of seeds was not affected by the leaves powder. Therefore, the leaves powder could be a good candidate in insect pest management, especially against *C. maculatus* in stored chickpea seeds.

Keywords: Chickpea, Coriander, *Callosobruchus Maculatus*, Mortality, Oviposition

INTRODUCTION

Stored product pests are a great challenge in our economy because they infest, infect and contaminate stored agricultural products and animal feed. Stored products are frequently damaged by insect pests and this may account to 20-30% in the tropics (Sathish, 2020). Chickpea is an important legume crop all over the world because it contains a high content of easily digestible protein, iron and folate (Chichaybelu, 2021). It is an important source of vitamins and minerals (Cassell and Caddick, 2010).

Chickpea is a vital crop, providing income and nutrition for smallholder farmers and is also a major export commodity. However, storage pests are causing substantial damage and losses, negatively affecting farmers' livelihoods and food security. Farmers traditionally store their chickpea grain in storage facilities that are prone to quality and quantity losses (Dante and Dawud, 2003).

Chickpea is seriously infested by pulse beetles *Callosobruchus maculatus* (F.) (Coleoptera: Chrysomelidae: Bruchinae) all over the world (Armstrong, 2017). *C. maculatus* is one of the most serious pests brought into storage containers with harvested chickpea in the field that can cause total loss of the stored crop in a few months. *C. maculatus* L. attacked chickpea are significantly affected not only in terms of quantitative and qualitative, but also these grains lose their germinating capacity completely as well (Aidooid, 2019). The estimated post-harvest losses caused by bruchids may range from 30-40% within 6 months and when left unattended losses could be up to 100%. The presence of *C. maculatus* in chickpea crops was resulted in significant losses up to 50% (Sharma, 2013). When bruchids damage chickpea grains, they become unsuitable for planting due to poor germination and for consumption as food or feed due to spoilage, bad odor, and toxin production, they accumulate frass, exuviae, webbing, and insect cadavers which may result in grain that is unfit for human consumption and/or induced changes in the storage environment warm, moist 'hot-spots' that are suitable for the development of storage fungi that resulting in additional losses (Musa and Adebayo, 2017). Reduction of insect damage in stored grains is mainly a serious problem in developing countries of the tropics due to favorable climatic conditions and poor storage structures. A warm and humid climate of the region is most conducive for losses of stored chickpeas by insects and storage moulds and the insect damage intensifies mould development (Alemayehu, 2015).

Management of insect pests in many storage systems relies primarily on applying synthetic insecticides. Use of synthetic insecticides is currently the most effective way to prevent the infestation of stored product pests. However, continuous and heavy use of these chemicals has caused adverse effects on non-target organisms, and the development of pesticide resistance in some stored product pests. To solve this problem, many researchers have discovered alternative pest management products derived from plants (Adedire *et al*., 2011).

Currently, many farmers in Africa and Asia are using botanicals to protect their legumes from attack by insects, with varying success degrees, due to the type of formulations and the commodities used among others. Plant products are cheap and are easily accessed by farmers and small-scale industries in the form of crude or partially purified extracts. It was indicated that mixing storage pulses and plant products such as leaf, bark, powder or extracted oils reduced the oviposition rate, inhibited the adult emergence of bruchids, and decreased the seed damage rate (Dhivya *et al.,* 2019).

Plant based insecticides (PBI) have been used for many centuries (Meena *et al.*, 2005) among limited resource farmers in developing countries used to control insect pests of both field crops and stored produce but their potentials was initially limited and ignored. Some of these plant species possess one or more useful properties such as repellency, anti-feedant, fast knock down, flushing action, biodegradability, broad-spectrum of activity and ability to reduce insect resistance. However, most of them are either weak insecticidally or may require other plant species with different mode of action (depending on the rate of application) to increase their potency (Musa and Uddin, 2016).

Coriander (*Coriandrum sativum*) Coriander powder were recorded as the strongest repellent and had the most toxic effects on *C. maculatus* and significantly reduced the oviposition rate and adult emergence after infestation on chickpea seeds (Cassell and Caddick, 2010). This study was aimed at assessing the efficacy of coriander plant powder on the management of *C. maculatus* on stored chickpea.

MATERIALS AND METHODS

Experimental site

The study was carried out in the Entomology laboratory of the Department of Agricultural Technology, Mohamet Lawan College of Agriculture, Maiduguri. The experiment was carried out under ambient conditions of temperature 27-32 ^{O}C, a relative humidity of 65-75%, and a photoperiod of 12-hour light: 12-hour darkness. The study was carried out over a three month period (10th September to 9th November 2024), which lies between latitude 11^{0}50´ and 12^{0} 05´North and longitude 13^{0} 09´ and 12^{0} 20´ East in the North eastern agro-ecological zone of Nigeria.

Source of Experimental Materials

The chickpea seeds were obtained at seeds bank of Mohamet Lawan College of Agriculture, ensuring that the seeds are free from any insecticide residues. To eradicate any potential insect eggs and larvae, the seeds were handpicked to remove damaged ones and contaminants, the clean grains were put in a polyethylene bag, firmly tied with a rubber band and inserted into a transparent airtight plastic bucket, and underwent a 72-hour sterilization process at -5°C in a deep freezer, exploiting the susceptibility of all insect life stages to low temperatures (Sinclair *et al*., 2003). Following de-infestation, the chickpea seeds were left to air dry naturally for 72 hours in the laboratory, a precautionary measure to prevent mould growth on the grains before use for the experiment (Adedire *et al*., 2011).

Insect Culturing Procedure

The stocks of adult *C. maculatus* was obtained from the Entomology laboratory of Mohamet Lawan College of Agriculture, Maiduguri and were used in raising new progenies of the same cohort. Adult unsexed *C. maculatus* were introduced on 500 g of sterilised untreated chickpea seeds, and are placed on plastic bucket and covered with a muslin cloth and held tight with a rubber band to prevent adult weevils from escaping. The culture was left to stand on the laboratory shelf for 10 days. The aim was to produce a steady and sufficient supply of weevils of known age for experimental purposes.

The bucket was shaken every day to improve aeration and to prevent attack by unwanted microorganisms. The adult weevils were sieved out at 10 days after their introduction to the chickpea seeds in the bucket. The time frame of 10 days was given to allow the adult weevils to lay enough eggs. The culture was then kept back on the shelf in the laboratory for F_1 emergence. After 21 days, newly emerged F_1 weevils were used to set up the main experiments.

Collection and Preparation of Coriander Leaves

The coriander leaves were collected at the Mohamet Lawan college of Agriculture horticultural garden and then taking to Entomological laboratory; the leaves were cut and thoroughly cleaned with distilled water to remove any unwanted debris. The washed leaves then left to shade dry at room temperature. After about 15 days, the leaves were completely dried, and placed in an electric grinder (Philips HL7756/00 Mixer Grinder, Eindhoven, Netherlands) to ground into a fine powder. The powder was sieved through a 60µm mesh size (60 Mesh Sieve, Pak lab, Karachi, Pakistan), and stored at room temperature in air-tight jars to preserve the quality.

Identification and Sexing of Adult of *C. Maculatus*

The identification and sexing of *C. maculatus* were carried out in the Entomology laboratory, Department of Agricultural Technology, Mohamet Lawan college of Agriculture, Maiduguri. Male bruchid weevils have a relatively shorter abdomen, and the dorsal side of the terminal segment has a pronounced inward and downward curve. On the other hand, the dorsal side of the terminal segment is only slightly deflexed downward in females, and their abdomens are comparably longer. While the markings or the visible dark spots in the males are less distinct, the females also have two noticeable black spots on their elytra and males are smaller than females (Odeyemi and Daramola 2000).

Effect of Coriander Leaves Powder on Adult Mortality and Adult Emergence of *C. Maculatus*

Fifty (50g) of chickpea seeds were admixed with the following concentrations of leaves powders: 1.0, 1.5, 2.0, 2.5, and 3.0g. The mixture was placed in 250ml capacity bottle; twenty pairs of adult *C. maculatus* were introduced separately with different level of plant powder concentration. In addition, untreated samples were infested with adult *C. maculatus* to act as a control. Each treatment was repeated three times. The number and documentation of adult mortality was assessed after 24, 48, 72, 96 and 120 hours after treatment concentration were recorded.

Data Collection

The data were collected on adult mortality, oviposition of adults, adult emergence and grain damage, weight loss and weevils perforation. Adult mortality was assessed every 24 hours after setting up the experiment, for (120 hours) 5 days, by sieving out the adult weevils and counting dead ones among the 20 unsexed adults initially introduced. The dead insects were identified when they did not respond to probing by a camel hairbrush, on their abdomen (Gariba *et al*., 2021). Surviving adults were reintroduced into their respective experimental units. Adult mortality was monitored and assessed till the treated chickpea seeds induced mortality on the introduced adult weevils.

Percentage mortality was corrected using Abbott's formula (Abbott, 1925) when control mortality was greater than 5% and less than 20%. Percentage mortality was calculated using the formula adopted by Gever and Echezona (2023):

$$Mortality\ (\%) = \frac{\text{Number of dead adults}}{\text{Total number of adults}} \times 100 \qquad (1)$$

Oviposition was assessed by determining the number of seeds with eggs laid on them by *C. maculatus* adult females. This was done after assessing adult mortality, because it is reported that adult females begin to lay eggs from 2 days up to 7 days after their introduction to stored grains (Deshwal *et al*., 2020). This time frame was to allow the adult weevils to lay enough eggs. The number of grains with eggs was assessed by randomly selecting 20 grains and counting the grains with eggs, with the aid of a hand lens. The grains were kept back in their respective experimental units on the shelf in the laboratory, for F_1 adult emergence.

After 23 days, the F_1 progeny began emerging and newly emerged adult weevils were sieved out and counted every 24 hours, until there was no further emergence. The newly emerged adults were removed from the experimental units to prevent double counting.

Damage to the chickpea grains was estimated using the exit holes produced by the newly emerged adult beetles (F_1 progeny), as an indicator of damage (Oluwafemi, 2012). Damage of the grains was estimated using the method adopted by Gever and Echezona (2023). Chickpea seeds (20) were selected at random, and seeds with exit holes were sorted and counted. Percentage seed damage was obtained by adopting the formula used by Kemabonta *et al*. (2010):

$$Damage\ (\%) = \frac{\text{Number of grains with exit holes}}{\text{Number of grains sampled}} \times 100 \quad (2)$$

While percentage Seed weight loss was determined using the count and weight method of Gwinner *et al*. (1996) thus:

$$Weight\ loss(\%) = (Wu \times Nd) - \frac{(Wd \times Nu)}{Wu \times (Nd + Nu)} \times 100 \quad (3)$$

Where,
Wu = Weight of undamaged seed,
Nu = Number of undamaged seed,
Wd = Weight of damaged seed, and
Nd = Number of damaged seed.

Statistical Analysis

Data were subjected to analysis of variance (ANOVA) and treatment means were separated using Tukey's Kramer's Honestly Test (HSD) at 5% level of probability. The ANOVA was performed with Statistix 9.0 software.

RESULTS AND DISCUSSION

Effect of Coriander Leave Powder on the Mortality of *C. Maculatus* on Treated Chickpea Seed

The results of experiments conducted to study the effect of coriander leave powder against *C. maculatus* was presented in Table 1. The results obtained showed that coriander leaf powder significantly (p < 0.05) reduced adult weevils compare to untreated chickpeas. The results clearly indicated that all the treatments revealed a wide variation in mortality compared to untreated control. Data on mortality of *C. maculatus* after 24, 48, 72, 96, and 120 hrs after treatment were recorded in (Table 1). Among the treatments tested for pulse beetle, 3.0 g/kg gave 80.7 mortalities after 24hr while in untreated control very few mortality of 0.6 per cent was observed. The weevil mortality ranges from 32.3% to 100%. Coriander leaf powder was potent which caused 80% mortality of adult *C. maculatus* after 24 hr of treatment. Similar trend of results were also recorded after 48, 72, 96 and 120 hrs of treatment. At 48hrs after treatment at the highest concentration rate of 3.0g/kg 86.3% was recorded. Furthermore, after 72hrs treatment 93.3% mortality was observed when compared with untreated control of only 2.0% was recorded. Moreover, at 96hrs of exposure at the least application rate 65.0% was observed, while at the highest concentration rate 98.0% mortality was recorded when compared with untreated with only 2.7%. At 120hrs of exposure at the least application rate 76.3% mortality was reported and at the highest application rate of 3.0 g/kg 100% mortality was observed. The results showed that adult weevil mortality increased with an increase in exposure period and concentration dependent. (Table 1).

Table 1: Effect of Coriander Leave Powder on the Mortality of *C. Maculatus* on Treated Chickpea Seed

Conc. rate (g/Kg)	Mortality (%)				
	24hrs	48hrs	72hrs	96hrs	120hrs
0.0	0.6±0.3^{e}	1.7±0.3^{d}	2.0±0.6^{d}	2.7±0.3^{e}	3.0±0.6^{d}
1.0	32.3±2.7^{d}	49.3±3.4^{c}	55.7±2.9^{c}	65.0±1.2^{d}	76.3±2.0^{c}
1.5	49.3±3.4^{c}	65.7±2.9^{b}	68.7±2.9^{b}	72.7±1.5^{c}	86.3±2.0^{b}
2.0	65.7±2.9^{b}	76.7±2.4^{ab}	79.7±2.0^{ab}	82.7±2.0^{b}	96.7±2.1^{a}
2.5	76.5±2.8^{ab}	83.6±2.7^{a}	86.3±3.7^{a}	96.3±2.2a	99.8±2.4^{a}
3.0	80.7±1.2^{a}	86.3±2.0^{a}	93.3±3.7^{a}	98.0±0.6^{a}	100.0±0.0^{a}
F	164	184	157	835	629
P	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Means in the same column followed by same letter(s) are not significantly different from each other at 5% level of probability according to Tukey Kramer's HSD Test

The effect of coriander leaves powder on progeny emergence of *C. maculatus* is presented in Table 2. The number of emerged *C. maculatus* decreased with an increase in the number of hours after treatment. The number of emerged progeny in the control (20.0%) was significantly higher (P < 0.05) than other treatment at 5% probability level indicating that the coriander leaves powder was successfully inhibited oviposition potential of *C. maculatus* and very effective at reducing progeny emergence. At 120 hrs after infestation, the highest percentage adult emergence was obtained from the control compared to the treatments. The number of eggs laid by *C. maculatus* on treated chickpea seed was significantly lower (p < 0.05) than untreated seeds. There was significant difference (p > 0.05) in the mean number of eggs laid on the treated seeds. The numbers of egg laid were 11.7, 8.0, 2.7, 0.3 respectively against 1.0, 1.5, 2.0 and 2.5 concentration rate respectively and complete inhibition of egg laid at the highest concentration of 3.0 g/kg when compared to untreated control that recorded 89.6.6 eggs. The percentage adult emergence in the untreated cowpea seeds was significantly different (p < 0.05) from oviposition and emergence in the treated chickpea seeds. There was no sign of progeny development in chickpea seeds treated at concentration rate of 2.0 g/kg and above. It was only concentration rate of 1.0 and 1.5 that had 6.0 and 2.0% adult emergence which significantly different from untreated that had 48% adult emergence.

Table 2: Effect of Coriander Leave Powder on Oviposition and Adult Emergence of *C. Maculatus* on Treated Chickpea

Conc. rate (g/Kg)	Oviposition rate (%)	Adult Emergence
0.0	89.3±6.6^{a}	48.3±9.9^{a}
1.0	11.7±0.9^{b}	6.0±0.6^{b}
1.5	8.0±0.6^{c}	2.0±0.5^{c}
2.0	2.7±0.9^{d}	0.0±0.0^{d}
2.5	0.3±0.3^{e}	0.0±0.0^{d}
3.0	0.0±0.0^{e}	0.0±0.0^{d}
F	154	21.8
P	<0.0001	<0.0001

Means in the same column followed by same letter(s) are not significantly different from each other at 5% level of probability according to Tukey Kramer's HSD Test

Percentage Seed Damage, Weight Loss and Weevil Perforation Index Caused by *C. Maculatus* in Chickpea Treated with Coriander

Table 3 shows mean percentage damage, weight loss and perforation index of chickpea seeds caused by *C. maculatus*. The result revealed that the coriander leaves powder was very effective at controlling damage, weight loss and perforation index in chickpea. There was neither seed damage nor weight loss recorded in the treated chickpea seeds and Weevil Perforation Index was zero for the concentration tested except in the treated seeds with 1.0 and 1.5 g after 60 days of storage. Mean numbers of damage seed, percent damage, weight loss and perforated seeds in the various treatments was significantly different from the untreated seeds which recorded 33.3%, 89.0%, 3.0 and 92.0%, respectively of number of seed damage, percent seed damage, weight loss and perforated seeds. However, the WPI of 5.3 obtained for 1.0 g/kg, was significantly different from WPI of the untreated control. The efficacy of this powder may be attributed to their active components responsible for their insecticidal properties.

Table 3: Percentage Seed Damage, Weight Loss and Weevil Perforation Index Caused by *C. Maculatus* in Chickpea Treated with Coriander

Conc. rate (g/Kg)	No. of seed damage (%)	Seed damage (%)	Weight loss (%)	WPI
0.0	33.3±2.4^{a}	89.0±0.6^{a}	3.0±0.6^{a}	92.0±4.0^{a}
1.0	3.0±1.5^{b}	1.7±0.3^{b}	2.0±0.5^{ab}	5.3±1.9^{b}
1.5	1.3±0.5^{bc}	1.0±0.0^{bc}	1.6±0.3^{abc}	1.0± 0.6^{b}
2.0	0.0±0.0^{c}	0.0±0.0^{c}	0.3±0.3^{bc}	0.0±0.0^{b}
2.5	0.0± 0.0^{c}	0.0±0.0^{c}	0.0±0.0^{c}	0.0±0.0^{b}
3.0	0.0±0.0^{c}	0.0±0.0^{c}	0.0±0.0^{c}	0.0±0.0^{b}
F	36.4	95.9	8.56	411
P	<0.0001	<0.0001	0.0029	<0.0001

Means in the same column followed by same letter(s) are not significantly different from each other at 5% level of probability according to Tukey Kramer's HSD Test

Discussion

The present study demonstrated the insecticidal potential of using coriander leaves powder to control *C. maculatus* in stored chickpea, based on results showed that coriander powder had caused 100 percent mortality within 120 hrs (5 days). This study showed that coriander leaves powder also has significant insecticidal effects against *C. maculatus* which vary with the dose rate and exposure periods. The effectiveness of this plant powder indicates a possible contact action of the active constituents against the test insect. The results of this study are in conformity to some degree with the report of some workers, like Shukula *et al.* (2009), Adedire *et al*. (2011), Sanon *et al*. (2018), Chichaybelu (2021), who observed that certain botanicals are effectively toxic against storage insect pests including *C. maculatus*. The resultant mortality rates of *C. maculatus* in this investigation could be attributed to the toxic effects of the chemicals in the tested plant powder. The findings obtained in the current study are in agreement with Govindan and Nelson (2007) who reported that the different effects of the same tested toxicant at the different times may be due to the amount of toxicant which introduced to the site of action. These findings are consistent with results of this study where coriander powder reduced significantly the number of bruchids and consequently the number of damaged seeds. The coriander leaves powder also reduced significantly the production and inhibited F_1 progeny emergence of *C. maculatus*. In the current study the tested materials, plant powders (coriander), negatively affected on the all tested parameter (% mortality, % hatchability, % emerged adults and % reduction). According to Islam *et al.* (2013), effective control of protectants is attributed to the mortality of adult and/or immature stages, confirmed by lack of progeny generation. Also this result is in agreement with the findings of Kaur *et al.* (2019) who stated that sweet flag, *Acorus calamus* rhizome powder (5 g/100 g pea seeds) resulted in 98.89 per cent mortality of the pulse beetle, *C. chinensis* at two days after treatments. Similar results were documented and concluded by Shukula *et al*. (2009) who observed that *Ocimum canum* leaf powder at 5 percent treated green seeds and caused 68.70 percent mortality to *C. maculatus*. This findings are in line with Kaur *et al.* (2019) who found that *A. calamus* at 1g / 100 g of treated pea, no seeds damage was observed. Also Rathod *et al.* (2019) who reported that *A. calamus* at 3g / kg of green gram seeds showed no eggs were laid. This finding is in conformity with Fotso *et al*. (2018) who mentioned that plant powders were used against *C. maculatus* and *T. granarium* on cowpea seeds and wheat grains, increased adult mortality and reduced progeny and the loss percentage of seeds weight was lesser compared to control. Avadhani *et al*. (2013) reported that the effect of root, bark and leaf of *Pracaena arborea* against *S. zeamais* and *C. maculatus* increased adult mortality, reduced progeny and loss of grain weight was lesser compared to control. Armstrong (2017) reported that plant powders (mustard, turmeric, anise and black pepper) used against *S. oryzae, R. dominica* and *T. castaneum* increased adult mortality and reduced progeny. Armstrong (2017) also found that the loss of grains weight was lower than that of untreated control. Manju *et al.* (2019) who found that (red pepper-fennel, cumin and garlic) powders had complete protective for cowpea seeds against *C. maculatus* for up to 90 days. Moreover, Haile (2006) found that plant powders (red pepper, fennel, cumin and garlic) against *S. oryzae* and *C. maculatus* increased adult mortality, reduced progeny and the loss grain weight was lesser compared to untreated control. The efficacy of these plants powder could be attributed to the presence of phytochemical metabolites present in it. Chougouron *et al*. (2015) reported that, the plant secondary metabolites are responsible for diverse activities including their insecticidal properties. This shows that coriander leaves powder are highly effective in controlling bruchids infestations, which could be due to the presence of some bioactive compounds. The same tendencies were recorded by other authors. Mahama *et al*. (2018) reported similar result with a significant reduction in the progeny F_1 production of *C. maculatus* on seeds treated with *Eucalyptus camaldulensis* leaf extracts on Bambara groundnut grains. Reduction in the F_1 progeny emergence of *C. maculatus* in the Bambara groundnut treated with *Ocimum canum* Sims leaf extract fractions was also obtained by Kosini and Nukenine (2017). Chandel *et al*. (2018) stated that the reduction in adult emergence could either be due to egg mortality, larval mortality, or even reduction in hatching of the eggs. This shows that coriander leaves powder probably have oviposition deterrent, ovicidal, and lavicidal properties. The highest percentage of inhibition of *C. maculatus* F_1 progeny could be attributed to the highest mortality of the adult *C. maculatus* in the mortality test observed at the last day of exposure at these dose rates. Present findings line with finding of Rathod *et al.* (2019) who found that *O. canum* leaf powder at 3g/kg of green gram treated seeds results showed less numbers of eggs were laid. Regarding the hatchability, insecticidal plant powder reduced the egg hatching significantly. This studies agreement with findings of Kaur *et al.* (2019) stated that No seed damage and weight loss was recorded in pea seeds treated with sweet flag powder at 3g/100g and 5g/100g. Grain damage indicated the quantitative loss in stored grains due to insect feeding showing a direct relationship between insect population and grains damage. In our findings, the powder provides a significant reduction in seed damage activity compared with the untreated seeds. These effects resulted in reduced weight; especially, protection by the farmers who store cowpea for consumption, planting and industrial level. This finding is disagreed with the findings of Adedire *et al.* (2011) his work stating that plant extracts may affect the taste of the seeds in storage making it not accepted in the market.

CONCLUSION

Study the effect of coriander as insecticidal plant powders against *C. macultus* infesting the stored chickpea, the results revealed that the efficacy of the powder caused 100.00 percent mortality to the weevil five days (120hours) after treatments. It caused complete inhibited egg laying and progeny development and also no weight losses recorded up to 60 days after treatment. It is concluded that all the five dose of coriander leaves powder (1.0, 1.5, 2.0, 2.5 and 3.00 %) are highly effective against *C. macultus* viz., mortality, oviposition adult emergence, seed damage, seed weight loss and seed perforation. Therefore, the resource poor farmers can use botanical powder (Coriander) in controlling weevils in stored chickpea as they may not afford to buy insecticides due to high cost. Furthermore, the use of botanical pesticides to control weevil is an appropriate strategy to avoid environmental pollution and other hazards, since the insecticides are used by farmers and in agro industries currently affect the environment.

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