Direct Research Journal of Agriculture and Food Science
Vol. 9, Pp. 198-203, 2021
ISSN 2354-4147
DOI: https://doi.org/10.26765/DRJAFS890123756
Article Number: DRJAFS890123756

https://directresearchpublisher.org/drjafs/

Full-Length Research Paper

Ethanolic extract of catwort (*Nepeta cateria* L.) in the management of beans weevil (*Callosobruchus maculatus*) *Fab.* (Coleoptera: Bruchidae)

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Received 16 April 2021; Accepted 6 May 2021 Published 2 July 2021

ABSTRACT: Ethanolic extracts of Catwort (*Nepeta cateria* L.) leaves were screened for secondary metabolite constituents to test and investigate their insecticidal activity against cowpea weevil (*Callosobruchus maculatus* L.): (Fab) (Coleoptera: Bruchidea). Phytochemical analysis of the extracts revealed the presence of alkaloid, saponins, flavonoids, tannins, carbohydrates, Phlobo-tannins acids, steride, glycoside, and anthraquinone. The Ethanolic leaves extract of Nepeta *cateria* L. was found to cause significant mortality on the target insect at different concentrations. The study found that the effect of the extracts was proportional to the treatment concentration, with higher concentrations having a stronger effect on insect activity. At different hours after treatment, the observed overall mean mortality increased with increasing time intervals after treatment with the bio-based plant mean extract mortality. The results showed that 2.5g of Ethanolic leaf extracts of *Nepeta cateria* L. showed the highest mortality against ovicidal and insecticidal control of C. *maculatus* at 1.0g, 1.5g, 2.0g, and 2.5g, respectively after treatment.

Keywords: Ethanolic, catwort, phytochemical, mortality, Bruchidea

INTRODUCTION

Vigna unguiculata L. Walp is a popular food crop in tropical areas, particularly in West Africa, where it provides a low-cost source of protein (Ajayi and Adedire, 2003; Adedire et al., 2011). Cowpea seed contains about 25% protein and 67 percent carbohydrates when dry. It's also high in calcium, iron, vitamins, and beta-carotene (Adedire et al., 2011). Cowpea is the most widely grown legume in Sub-Saharan Africa, where it is essential to community diets (Ndiaye, 2007). The seeds and leaves are high in protein (24-33%) and are used to make a variety of dishes for food and feed (Bressuni, 1985). Cowpea can fill dietary protein gaps in developing countries, which account for three-quarters of the world's population, which is why it is known as "meat of the poor" (Delobel and Tran, 1993). Despite its nutritional and economic importance, cowpea falls short of meeting populations' quantitative and qualitative needs. Reduced yield due to a variety of factors, including V. *unguiculata's* susceptibility to diseases and pests (Parh, 1999; Ngakou et al., 2008). The main storage insect pest of cowpea

seeds is *Callosobrochus maculatus Fab.* (Coleoptera: Bruchidae). Infestation begins in the field and spreads to the storage systems. If no or little action is taken, this causes a drop in production or total post-harvest loss of the crop stock (Ngamo and Hance, 2007). According to Labeyrio (1992), the severity of post-harvest losses due to insect-led infestation in Africa causes peasants to work for insects rather than for economic gain. According to Adedire and Akinneye (2004), Callosobruchus maculatus Fab: (Coleoptera: Bruchidae) caused massive weight loss, decreased viability, and decreased commercial value of cowpea seeds. Because synthetic chemicals are toxic to man and his domestic animals, there is a growing concern about using them to control these insects' pests; therefore, plant-based products can be a safe, affordable, and accessible alternative to synthetic crop protection products. *Nepeta cateria L.* can be used by rural farmers to control insect pest infestations during storage. The goal of this study is to look into the anti-feedant and anti-oviposition responses of Ethanolic extract of Catswort *(Nepeta cateria L.)* in the management of C. maculatus (Coleoptera: Bruchidae) in Nigeria's Sudan savannah Ecological Zone.

MATERIALS AND METHODS

The study was carried out at the Federal College of Agricultural Produce Technology's Entomology Laboratory in Kano. Bunkure L.G.A Kano State was the site of the ethnobotanical survey. Because of their high production of cereals and legumes, the site was presented and considered.

Collection and processing of cowpea seeds

Cowpea seeds for this study were obtained from the International Institute of Tropical Agriculture (IITA Kano substation). Before the trail, the seeds were frozen at -5 degrees Celsius for 7 days to kill pathogens or their eggs. Fresh leaves of natural indigenous plants Nepeta cataria L. were collected in fresh form, free of insecticide, from Barkum village Bunkure Local Government Area, Kano State Nigeria, and authenticated and identified at the Plant Science Department, taxonomy section Bayero University Kano, Nigeria. After rinsing the plant materials in clean water to remove sand and other impurities, the plants were cut into smaller pieces and air-dried in a well-ventilated laboratory.

Using a pestle and motor, the dry leaves were ground into a fine powder. The powders were sieved to pass through perforations of $1mm^2$. Before extraction, the powders were packed in plastic containers with tight lids and kept in a refrigerator at 4ºC.

Extraction technique

The Soxhlet extractor is used in the extraction of natural product solid-liquid from natural resources. A solvent is selected that selectively dissolves the desired compound while leaving the undesired insoluble solid behind. *Callosobrochus maculatus* were reared at the Pest Management Technology Department. Ten (5) pairs of sexed *C. Maculatus* according to the report of (*Hallstead, 1963*) were introduced into Kilner jar container containing 300g of *Vigna unguculata* L. Wasp and covered with Muslin cloth to provide ventilation and prevent the escape of beetle. The trails were kept in the laboratory at an ambient temperature of 28 ± 2^{o}c and 75±5% relative humidity, to allow for mating and oviposition.

Phytochemical screening

Tannins

In a test tube, 2-drops of $FeCl_3$ (5%w/v) solution were added to the extract and shake. A dirty green or dark blue-black coloration if observed gave a positive result or confirmed the presence of tannins (Evans and Trease, 1999; Cannel, 2000).

Flavonoids

The extract ($2cm^3$) was put into a test tube into which magnesium chips and few drops of hydrochloric acid (HCl) were added. A cloudy colouration with a production of fumes was taken as preliminary evidence for the presence of Flavonoids (Evans and Trease, 1999; Cannel, 2000).

Alkaloids

A quantity ($5cm^3$) of 1% of hydrochloric acid was added to $2cm^3$ of the extract in a test tube and was then left overnight and later divided into two parts. In a test tube and was then left overnight and later divided into two parts. In the first test tubes 2-drops of dragon of reagent were added and in the other test tube same quantity of Meyer's reagent were added. In both cases, the formation of precipitator indicated the presence of alkaloids (Evans and Trease, 1999; Cannel, 2000).

Saponins

Distilled water ($5cm^3$) was added to $2cm^3$ of the extract and shaken vigorously. The formation of foam following

the shaking indicated the presence of saponins (Evans Trease, 1999; Cannel, 2000).

Glycosides

The extract (1cm^3) was dissolved in 2cm^3 of chloroform and 2-drops of concentrated sulphuric acid (H_2SO_4) were added. A reddish-brown colour at the interface indicated the presence of cardiac glycoside (Evans and Trease, 1999; Cannel, 2000).

Anthraquinone

In a test tube, 2cm^3 of 10% of hydrochloric acid was added to 2cm^3 of extract and filtered. Either layer was pipetted out or an equal volume of 10% ammonia was added to the solution. A pink colour was observed which donates the presence of anthraquinone (Evans and Trease, 1999; Cannel, 2000).

Carbohydrate

In test tube, 5cm^3 of a mixture of equal volumes of Fehling's A and B was added to the extract. The resultant mixture was boiled for 2mins. a brick red precipitation indicated the presence of carbohydrates (Evans and Trease, Cannel, 2000).

Acids

The extract (3cm^3) was diluted with 2cm^3 of distilled water. The solution was made alkaline by the addition of 2-drops of ammonia with 2cm^3 of concentrated Hydrochloric acid. The formation of bubbles indicated the presence of acids (Evans and Trease, 1999, Cannel, 2000).

Phlobotannins

In a test tube, 5cm^3 of distilled water was added to the extract and boiled with 1% HCl for 2min. no visible reaction was obtained. This indicated the absence of phlobotannins (Evans and Trease, 1999; Cannel, 2000).

Steroids

In a test tube, 1cm^3 of concentrated H_2SO_4 was added to the extract. The solution was mixed with 2cm^3 of water. A red colour was observed indicating the presence of sterols (Evans and Trease, 1999; Cannel, 2000).

Determination of the effects of ethanolic plants leaves extract on adult mortality of *Callosobruchus maculatus* on cowpea seed

The experiments were carried out at the pest management technology entomology laboratory at the Federal College of Agricultural Produce Technology, Hotoro Kano, and were replicated three times in a Completely Randomized Design using 1g, 1.5g, 2.0g, and 2.5g of plant extracts Nepeta cataria admixture with a 20g of cowpea seeds in a kilner jar. Ten (10) pairs of 1-2 day old adults of C. maculatus were introduced and covered in each of the three (3) replicates. Adult mortality was assessed every 24 hours with a sharp object; adults were detected and considered dead when they were touched or probed with the object and there was no response from C. *maculatus*. At the end of the mortality test, all insects' dead were removed from the kilner jar. Percentage adult mortality was corrected using (Odeyemi and Daramola, 2000) formula in Abbott (1998).

RESULTS AND DISCUSSION

The results of phytochemical screening (Table 1) show that Alkaloid, Saponins, Flavonoids, Tannins, Carbohydrate, Phlobo-tannins, and Acids were positive in the extracts, whereas steroids and Glycosine were negative. The outcome of mortality with Nepeta cataria L. plant leaf extracts. At various concentrations are depicted in (Table 2). The results showed that mean mortality was found at 1.5g and 2.0g concentrations after 48 hours of treatment admixture. However, at 72 hours, the application of 2.5g of Nepeta cateria was found to have a higher mean mortality rate than all other treatments. At 96 hours, the application of 2.5g of Nepeta cateria showed the highest mortality rate compared to all other treatments. At 120 hours, mean mortality was found to be significantly higher with the application of 2.0g of the treatment than with all other treatments, despite the fact that 1.5g and 2.0g were statistically equivalent. At 144 hours, the application of 2.5g of Nepeta cateria was found to have a significantly higher mean mortality rate than all other treatments. At 168 hours, the mean mortality rate was found to be significantly higher when compared to all other treatments using 2.0g and 2.5g. This finding was also reported by Ojo and Ogunyele (2013), who found that treating insects with some plant extract powders resulted in adult insect mortality, causing a mating imbalance and sexual communication as well as discouraging females from laying eggs. C. *maculatus* oviposition was found to decrease with increasing concentrations of Nepeta cateria at different hourly intervals, as shown in (Figure 1). According to the figure above, the highest oviposition was found to be significant

Table 1: Phytochemical identification and composition of ethanolic leaf extracts of *Nepeta cataria.*

Alkaloid	+
Flavonoids	+
Tannin	+
Steroids	–
Anthraquinone	+
Carbohydrate	+
Glycoside	–
Phlobo-tannin	+
Acid	+

Table 2: Ethanolic effect of Nepata cateria L. concentration on bean weevil insect

TREATMENT (DOSE/20G)	24HRS	48HRS	72HR	96HR	120HRS	144HRS	168HRS
1.0gmean± SD	0.00±0.00	0.33+0.58	1.33±1.16	2.33±2.31	2.33±0.58	2.33± 1.56	0.67±0.58
1.5g mean±SD	0.00±0.00	0.67±1.16	1.67±1.53	3.33±1.53	2.33±1.53	1.67±2.09	0.33±0.58
2.0g mean±SD	0.00±0.00	1.33±1.16	1.33±1.53	3.67±0.58	3.00±1.73	0.67±1.16	0.00±0.00
2.5gmean±SD	0.00±0.00	1.67±0.58	2.00±2. 00	4.00±0.00	2.33±1.53	0.00±0.00	0.00±0.00

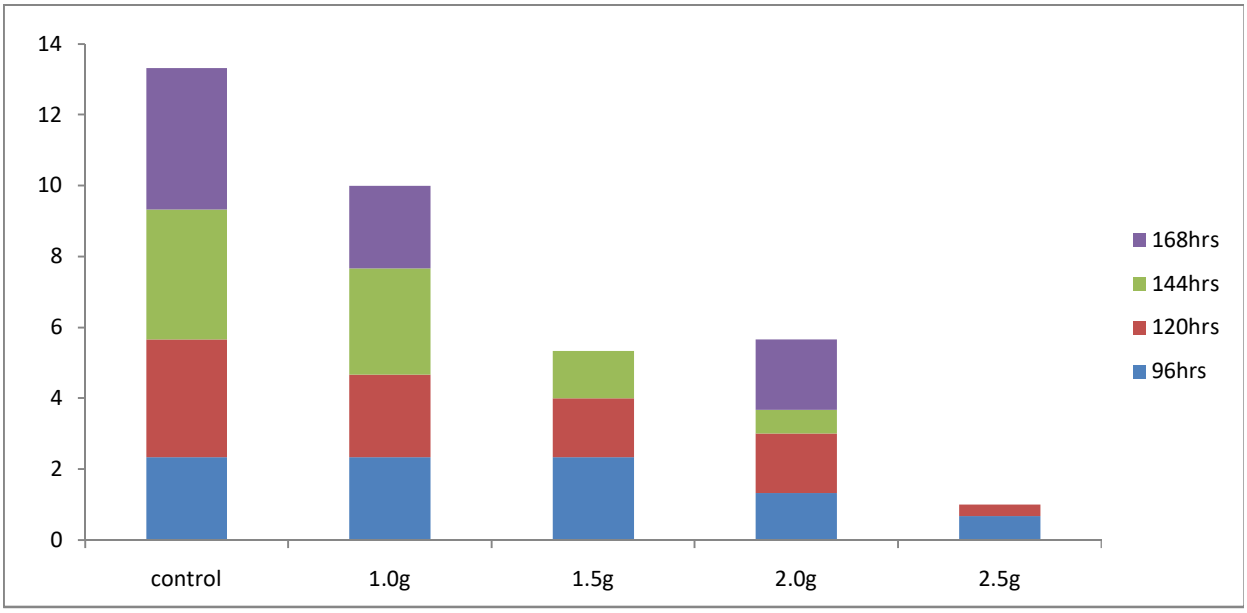

Figure 1: Mean ethanolic leaf extract of *Nepata cateria* on oviposition deposition.

with the application of 1.0g of the treatments at 96hrs and the least anti-oviposition was found at 2.5g at 168hrs when compared to all other treatments. This is consistent with the findings of Adesina and Ofuya (2015) discovered that powders of A. chordifolia leaf extract may reduce egg oviposition in C. maculatus. The figure in (Table 2) depicts the mean germination rate of treated cowpea seed planted in petri dish within 24 hours to 168 hours. When all other treatments were compared, the control had the lowest germination rate, as shown in the figure. This could be due to holes made on the cowpea, which may have affected the germination rate. However, according to the graph, the metabolites in the leaf extract have no negative effects that could slow seed germination. This supports the findings of Barau et al. (2020), who found that maize seeds treated with Senna

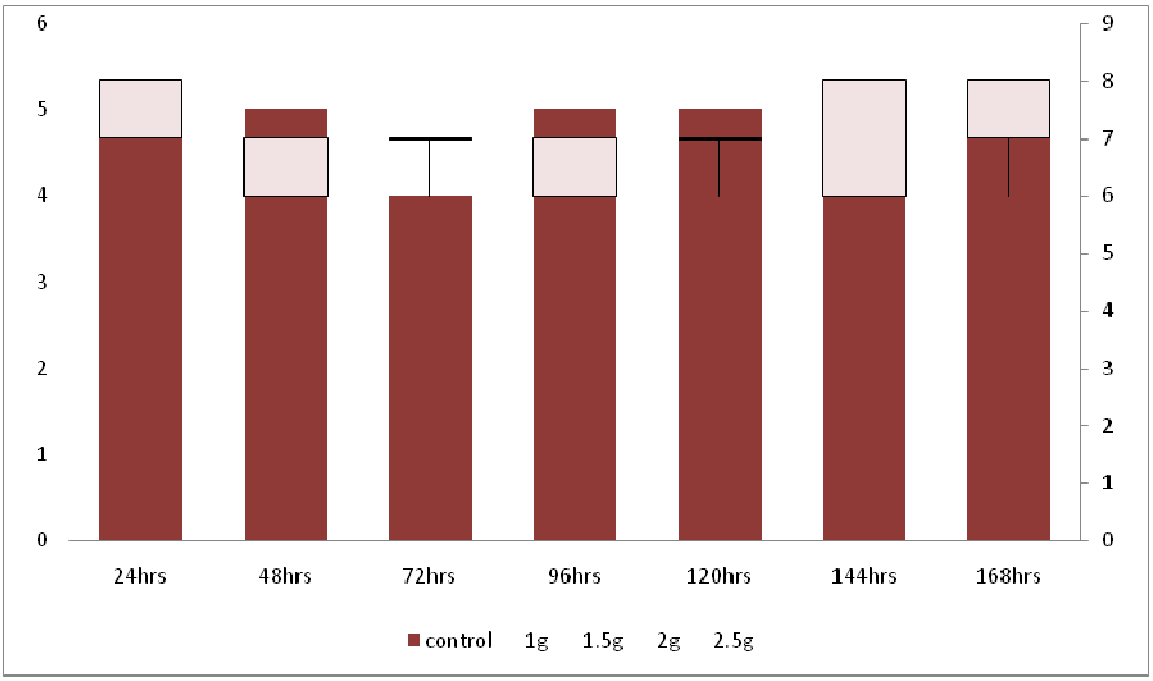

Figure 2: Mean ethanolic leaf extract of *Nepeta cateria* on germination rate.

occidentalis had higher germination than other treatments.

Conclusion

Nepeta cataria L. was found to have a significant effect on insect mortality and anti-oviposition, but there were no significant effects on cowpea seed germination rate during the study period. *C. maculatus (Fab.) (Coleoptera: Bruchidea) activities were retrogressive when leaf extracts at 2.0g and 2.5g concentrations were used, with higher insecticidal efficacy on C. Maculatus.* According to the study, there was no evidence of oviposition deposition during the experiment, which could be attributed to the action of cartwort. The current study demonstrates that an ethanolic leaf extract of N. Cateria have insect repellent and anti-oviposition properties that can be used in the management of C. Cowpea maculatus infestation More research is needed to determine the metabolic potential of the leaf, stem, roots, or entire plants.

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