Journal of Agriculture and Agricultural Technology
(JAAT)
Journal of Agriculture and Agricultural Technology 14 (3), 2025

EFFECTS OF BOTANICAL SOURCES IN THE CONTROL OF COWPEA WEEVILS (*Callosobruchus maculatus* F.) ON STORED COWPEA (*Vigna unguiculata* L. Walp) SEEDS

***Fawole, T. O.[1], Akanji, K. A.[1], Bidmos, F. A.[2], Godspower, O. O.[3], Olugbade, T. E.[1] and Ojo, D. O.[1]**

[1] Department of Crop Production Technology, Oyo State College of Agriculture and Technology P.M.B. 10, Igboora, Oyo State. [2] Department of Horticultural Technology, Oyo State College of Agriculture and Technology P.M.B. 10, Igboora, Oyo State. [3] Department of Forestry Technology, Oyo State College of Agriculture and Technology P.M.B. 10, Igboora, Oyo State.

*Correspondence: olaoluwapeju@gmail.com, +234 7039686610

ABSTRACT

Cowpea weevils (Callosobruchus maculatus F.) are a major insect pest of Cowpea in storage. The experiment was carried out at the Entomology laboratory of the Department of Crop Production Technology, Oyo State College of Agriculture and Technology, Igboora, to determine the effects of Neem (Azadirachta indica) and Guinea henweed (Petiveria alliaceae) in the control of Cowpea weevil in stored Cowpea. The Milk variety of clean cowpea seeds was procured from the Towobowo market in Igboora, Oyo State, and stored in a freezer for 2 weeks to disinfect them. Neem and Guinea henweed leaf powders were used at different rates to control the infestation of cowpea weevils. The experimental treatments were arranged in a Completely Randomised Design (CRD) comprising seven treatments (1 g, 2 g, 3 g of neem powder), (1 g, 2 g, 3 g of guinea henweed powder) and a control on 40g of Cowpea seeds replicated three times. Data were collected 7 days after treatment application on the weight of seed content, the number of live

insects, and the mortality count of adult Callosobruchus maculatus. A higher rate of application of Neem leaf powder at 3g resulted in significantly higher seed weights (39.3g, 37.33g, 35.67g) and mortality rates (13.67g, 15.33g, 18.00g) compared to guinea henweed powder. The botanicals at 3 g to 40 g of cowpea (3.75 kg of neem and guinea henweed leaf powders to 50 kilograms of cowpea) were therefore recommended as an alternative in place of chemical preservatives.

Keywords: Botanicals, Control, Cowpea weevils, Cowpea, Storage

INTRODUCTION

Cowpea (Vigna unguiculata L. Walp) is one of the most important grain-legumes in the farming systems of Nigeria and West Africa at large (Singh *et al*., 2002). It accounts for about 60% of the protein intake in Nigeria (Oparaeke *et al*., 2004). Cowpea provides feed, forage, hay, and silage for livestock, as well as green manure and cover crops that maintain soil productivity (Alemu *et al*., 2016). In the agricultural system, it compensates for the loss of nitrogen absorbed by cereals, thereby having a positive impact on soil properties. This is due to its unique capacity to fix atmospheric nitrogen and perform well even in poor soil (Rosenblueth *et al*., 2018). However, severe damage caused by storage pests lowers the quality and quantity of the crop produce, as they consume portions of the produce, leading to losses that are usually manifested by a reduction in weight (Kumar *et al*., 1996).

Callosobruchus maculatus (Coleoptera: Chrysomelidae: Bruchinae) is an agricultural insect pest of Cowpea in Africa and Asia that presently ranges throughout the tropical and subtropical world. It is a cosmopolitan field-to-store pest that initiates its attack shortly before harvest and continues to develop in storage. Adults lay eggs on the seeds, and the larvae bore into the grains, feeding on the cotyledons and causing substantial losses. The damage affects the quality of the seeds and taints the taste of the crops, thus affecting the market value. This beetle is responsible for most of the losses which occur in stored cowpea seeds. The postharvest infestation of cowpea beetles, therefore, constitutes a major problem contributing to significant food shortages and loss of food value in tropical and subtropical countries worldwide. The weevil causes the loss of produce mainly due to the consumption of cowpea seed cotyledons by larvae.

The control of cowpea weevil has been achieved through fumigation or spraying with chemicals of different toxicological classes. Synthetic insecticides are expensive for small-scale farmers and

require specialised equipment and training for their practical use. The widespread use of these products in recent years has led to numerous problems, including the emergence of resistant populations and high levels of insecticide residues in foodstuffs, which harm both consumer health and the environment.

In addition to the problems mentioned above, many producers, especially those in family farms, neglect controlling the weevil due to a lack of financial resources. In this scenario, the use of insecticidal plants stands out as a promising alternative for weevil control, as these plants typically have low costs, easy application, biodegradability, and may be available on the producer's property. Among the promising plant species for controlling the cowpea weevil are products derived from neem (Azadirachta indica), which stand out because they contain substances, especially Azadirachtin, that act as an insecticide. Neem leaf powder caused increased adult mortality of weevils in cowpea seeds, without causing changes in the viability characteristics of the seeds.

Also, Petiveria alliacea (commonly known as guinea henweed or garlic weed) is a medicinal plant with demonstrated insecticidal properties. Research indicates that extracts from this plant are effective against cowpea weevils (Callosobruchus maculatus), a major pest of stored cowpea grains (Adedire and Lajide, 2003; Boeke *et al*., 2004).
However, there is a dearth of information regarding the appropriate application rates of these botanicals. Therefore, the study was conducted to investigate the effects of varying application rates of Azadirachta indica and Petiveria allicea on the control of cowpea weevils in stored cowpea.

MATERIALS AND METHODS

The experiment was conducted at the Entomology Laboratory (Latitude 7 ° 24' 42" N, Longitude 3 ° 17' 44" E, and Altitude 134 m) of the Crop Production Technology Department, Oyo State College of Agriculture and Technology, Igboora. Igboora is situated in the Ibarapa Central Local Government Area of Oyo State, at an elevation of 397m above sea level. It shares its boundaries with Abeokuta, Ibadan, and the Oke-Ogun region. It is located in the derived savanna zone and experiences distinct dry and wet seasons, with average monthly high and low temperatures of 33°C and 22°C, respectively.

Clean cowpea seeds (milk variety) were procured from Towobowo market in Igboora, Oyo State, and stored in a freezer for 2 weeks to disinfect them. The initial stock of adult **Callosobruchus maculatus** was obtained from infested cowpeas at the Towobowo market in Igboora. It was maintained on beans in a 7L rearing plastic jar under laboratory conditions for 30 days. This helped in raising adult male and female weevils of uniform size and age.

Neem and Petiveria leaf powders were sourced from the Ladoke Akintola University of Technology, Ogbomoso, Department of Crop and Environmental Protection, and were applied at 1 g, 2 g, and 3 g to 40 g of cowpea seeds in 200 ml transparent plastic jars, with each replication repeated three times. The plastic jar was stirred vigorously to ensure a uniform coating of the grain by the powder treatment samples. Thereafter, 10 newly emerged adult **C. maculatus** from the rearing plastic jar were introduced into the transparent plastic jars, covered with muslin cloth, and secured with a rubber ring to allow proper ventilation. The control jar was not treated with a botanical.

The treatments were laid out in a Completely Randomised Design (CRD) and replicated three times. Data collection commenced 7 days after the application of treatments. The weight of seed content in the jar was measured weekly using a measuring scale. The number of live insects was visually counted on a weekly basis. Mortality counts for adult insects were conducted weekly by emptying the contents of the jars, removing and counting the dead insects, and then replacing the remaining contents. The data collected were subjected to Analysis of Variance (ANOVA), and significant means were separated using Tukey's Honest Significant Difference (HSD) Test at a 5% probability level.

RESULTS AND DISCUSSION

Effect of Neem and **Petiveria** leaf powders on the number of live bean weevils

There was a significant ($P \leq 0.05$) difference in the population of **Callosobruchus maculatus** among the treatments at 7, 14, and 21 days after treatment. The application of botanicals significantly reduced the population of cowpea weevils when compared to the control. The application of neem at 3 g produced the lowest significant ($P \leq 0.05$) weevil population of 1.33, 3.00, and 5.00 at 7, 14, and 21 days after treatment, respectively. At 21 days after treatment, Neem at 3 g, **Petiveria** at 1g and Neem at 2 g produced similar effects (5.00, 7.00 and 7.67) on the number of live insects. It was significantly lower ($P \leq 0.05$) compared to other treatments.

Table 1: Effect of botanicals on number of live bean weevils

Treatment	7 days	14 days	21 days
Control	16.33a	18.67a	20.67a
Neem 1 g	15.67a	17.00b	19.00a
Neem 2 g	3.67c	5.33d	7.67c
Neem 3 g	1.33c	3.00e	5.00c
Petiveria 1 g	3.00c	4.67e	7.00c
Petiveria 2 g	6.67b	9.00c	10.67b
Petiveria 3 g	7.33b	9.00c	12.33b

Means with the same letter along the column are not significantly different using Tukey's Honest Significant Difference (HSD) Test at $P \leq 0.05$.

Effect of Neem and **Petiveria** leaf powders on the number of mortalities

There was a significant difference ($P \leq 0.05$) in the mortality rate of Callosobruchus maculatus among the treatments at 7, 14, and 21 days after treatment. The application of botanicals significantly ($P \leq 0.05$) increased the mortality rate of cowpea weevils when compared to the control. The application of Neem at 2 g produced significantly ($P \leq 0.05$) higher insect mortality compared to 1 g of Neem on days 7 (17.67, 13.00), 14 (20.67, 18.00), and 21 (25.33, 20.67) after treatment, respectively. At 21 days after treatment, Neem powders (1 g and 3 g) and Pertieria leaf powder (1 g and 2 g) produced a similar effect on the mortality of bean weevils. The control produced the lowest significant ($P \leq 0.05$) mortality rates of 5.33, 10.00, and 11.00 at 7, 14, and 21 days after treatment, respectively.

.

Effect of Neem and Petiveria leaf powders on the weight of cowpea seeds

There was a significant ($P \leq 0.05$) difference in the effect of botanicals on the weight of cowpea seed. The control produced the lowest significant ($P \leq 0.05$) seed weight at 7 (33.33 g), 14 (31.13 g) and 21 (27.67 g) days after treatment, while seed treated with 3 g of Neem leaf powder produced the highest significant ($P \leq 0.05$) seed weights (37.33 g and 35.67 g) at 14 and 21 days after treatment respectively. However, application of Petivera leaf powder at 1 g, 2 g and 3 g produced similar effects on the weight of cowpea seed at 14 and 21 days after treatment.

Table 2: Effect of Neem and *Petiveria* leaf powders on number of mortality of bean weevils

Treatment	7 days	14 days	21 days
Control	5.33c	10.00c	11.00d
Neem 1g	13.00b	18.00b	20.67c
Neem 2g	17.67a	20.67a	25.33a
Neem 3g	13.67b	15.33b	18.00c
Petiveria 1g	12.33b	14.00b	16.33c
Petiveria 2g	12.33b	16.00b	17.67c
Petiveria 3g	16.00a	18.67b	19.33b

Means with the same letter along the column are not significantly different using Tukey's Honest Significant Difference (HSD) Test at $P \leq 0.05$.

Table 3: Effect of Neem and *Petiveria* leaf powders on weight of cowpea seeds (g)

Treatment	7days	14days	21days
Control	33.33c	31.13c	27.67d
Neem 1g	39.40a	33.67b	30.00b
Neem 2g	35.80b	32.67b	35.67a
Neem 3g	39.33a	37.33a	29.00c
Petiveria 1g	38.40a	37.03b	33.33b
Petiveria 2g	37.27b	33.73b	29.67b
Petiveria 3g	37.17b	34.33b	30.67b

Means with the same letter along the column are not significantly different using Tukey's Honest Significant Difference (HSD) Test at $P \leq 0.05$.

DISCUSSION

Based on the result presented above, the application of botanicals significantly reduced the population of cowpea weevils when compared to the control. The application of neem at 3 g produced the lowest significant ($P \leq 0.05$) weevil population of 1.33, 3.00, and 5.00 at 7, 14, and 21 days after treatment, compared to other treatments, except for 1 g of **Petiveria**. This may be due to the higher presence of *Azadirachtin*, which is a major bioactive compound in neem that can disrupt the growth and reproduction of cowpea weevils. This result corroborates the findings of Liamngee ***et al***. (2020), who reported that neem leaf powder significantly ($P \leq 0.05$) reduced weevil emergence by up to 85% when used at appropriate dosages. Additionally, neem contains volatile compounds, such as limonoids and Salannin, which create an unfavourable environment

that deters female weevils from laying eggs on treated seeds (Oyewole and Agwu, 2021). Additionally, **Petiveria** leaf powder contains bioactive compounds, including flavonoids, organosulfur compounds, and alkaloids, which disrupt insect metabolism, growth, and reproduction (Kubo ***et al***., 2006; Ntukuyoh ***et al***., 2012). The application of neem at 2 g resulted in the highest significant ($P \leq 0.05$) insect mortality at days 14 (20.67%) and 21 (25.33%) after treatment, compared to other treatments. The application of neem at 3g produced the highest significant ($P \leq 0.05$) weight of 37.33g and 35.67g at 14 and 21 days after treatment. Additionally, 3 g of **Petiveria** leaf powder resulted in a significantly higher seed weight (30.67 g) compared to the control (27.67 g). This may be due to the presence of nimbin and Nimbidin compounds in neem leaf powder, which act as contact poisons to adult weevils and anti-feedants that reduce seed consumption by larvae. This finding is in line with Achio ***et al***. (2012 who reported that the mortality rate exceeds 70% in adult weevils when cowpea seeds were treated with neem leaf powder.

CONCLUSION AND RECOMMENDATIONS

From this study, it can be concluded that neem and **Petiveria** leaf powders are potent preservatives for cowpea. These botanicals can preserve the quality and quantity of cowpea. Application of 2 g Neem and 1 g of *Petiveria* leaf powders are the most effective botanical rate for effective control of cowpea weevils. Since neem trees and **Petiveria** shrubs are widely available in the study area, they are inexpensive, biodegradable, and safe for humans and livestock, making them a sustainable alternative to synthetic pesticides. Farmers should adopt the use of neem and **Petiveria** leaf powders for preserving cowpea in storage. This would help prevent the attendant dangers associated with the use of chemical preservatives, which are most common in our society today.

REFERENCES

Achio, S., Kpemoua, K. P. and Aké, S. (2012). Insecticidal effects of neem (*Azadirachta indica* A. Juss) preparations against some agricultural and public health concern insects. *Journal of Applied Biosciences*, 53, 3754 - 3764.

Adedire, C. O., and Lajide, L. (2003). Bioactivity of tree marigold, *Tithonia diversifolia* (Hemsl.) A. Gray, and siam weed, *Chromolaena odorata* (L.) King and Robinson, against cowpea weevil, *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae). *Nigerian Journal of Entomology, 20*, 76–87.

Alemu, U.R., Delobel, A. and Malonga, P. (2016). Insecticidal properties of six plant materials against Caryedon serratus (Ol.) (*Coleoptera: Bruchidae*). *J. Stored Prod. Res*., 23: 173-176

Boeke, S. J., Baumgart, I. R., van Loon, J. J. A., van Huis, A., Dicke, M., and Kossou, D. K. (2004). Toxicity and repellence of African plants traditionally used against the storage pest *Callosobruchus maculatus*. *Journal of Applied Entomology, 128*(4), 251–257.

Kubo, I., Fujita, K., Lee, S. H., and Ha, T. J. (2006). Antibacterial activity of (dibenzyl trisulfide) from *Petiveria alliacea* L. *Phytochemistry Reviews*, 5(2-3), 513–523.

Kumar, R., Mishra, A. K., Dubey, N. K., and Tripathi, Y. B. (1996). Evaluation of some essential oils for their toxicity against fungi causing deterioration of stored food commodities. *Applied and Environmental Microbiology, 62*(3), 1021–1023.

Liamngee, K., Ibrahim, B., and Ogbonna, J. C. (2020). Insecticidal activity of *Petiveria alliacea* (L). leaf extracts against *Callosobruchus maculatus* (F.) (Coleoptera: Chrysomelidae) in stored cowpea grains. *Journal of Stored Products Research, 87*, 101592.

Ntukuyoh, A. I., Udiong, D. S., Ikpe, A. E., and Akpakpan, A. E. (2012). Evaluation of the efficacy of *Petiveria alliacea* (L.) leaf powder against cowpea weevil (*Callosobruchus maculatus* Fab.) on stored cowpea (*Vigna unguiculata* L. Walp). *Journal of Biopesticides*, 5(1), 87–91.

Oparaeke, A. M., Dike, M. C. and Amatobi, C. I. (2004). Field Evaluation of extracts of five Nigerian spices for control of post-flowering insect pests of cowpea, *Vigna unguiculata* (L.) Walp. *Plant Protection Science*, 41(1): 14 – 20.

Oyewole, I. O., and Agwu, E. J. (2021). Evaluation of *Petiveria alliacea* (L.) extracts for the control of *Callosobruchus maculatus* (Fabricius) (Coleoptera: Chrysomelidae) in stored cowpea (*Vigna unguiculata* L. Walp). *Journal of Crop Protection, 10*(3), 345-358.

Rosenblueth L. O., Phillips, R. D. and Dedeh, S. S. (2018). Developing nutritional and economic value added food products from cowpea.http://www.isp.msu.edu/crsp/Final. Rosenthal, G.A. and D.H. Janzeh, 1979. Herbivores Their Interaction with Secondary Plant Metabolites. Academic Press, New York.

Singh, B. B., Ehlers, J. D. Sharma, B. and Freire Filho, F. R. (2002). Recent progress in cowpea breeding. In: Fatokun, C. A., Tarawali, S. A., singh, B. B., Kormawa, P. M. and Tamo, M. (Eds.) Challenges and opportunity for enhancing sustainable cowpea production. Proceedings of the World Cowpea Conference III held at International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, IITA, Ibadan, Nigeria.