

LABORATORY ASSESEMENT OF THE EFFICACY OF NEEM (AZADIRACHTA INDICA A. JUSS) EXTRACTS IN THE CONTROL OF BEAN WEEVIL (*CALLOSOBRUCHUS MACULATUS* (F) BRUCHIDAE) ON STORED COWPEA

S. U. Yahaya and Y. Abdulsalam

Department of Crop Science, Kano University of Science and Technology
P.M.B. 3244, Wudil, Kano State
suyahya2007@yahoo.com

ABSTRACT

*Laboratory experiment was conducted at the Crop Science Department, Kano University of Science and Technology, Wudil to assess the efficacy of various neem extracts in the control of bean weevil (*Callosobruchus maculatus*) on stored cowpea. The research was aimed at establishing the best rate of neem extract that will control cowpea bean weevil in storage. Results of the study showed that 5.0 g of neem seed and neem leave powders recorded the highest effect in terms of the highest mortality rate at the first and second week after inoculation, while the neem bark powder recorded the least mortality rate. This shows that, the use of neem extracts will serve as a substitute to the synthetic pesticides which poses threats to human lives and thus economically viable.*

KEYWORDS: *Callosobruchus maculatus* (F) Bruchidae (Bean weevil), Cowpea, Neem

INTRODUCTION

Cowpea (*Vigna unguiculata* (L) Walp) is an important food legume and is a versatile crop cultivated between 35°N to 30°S of the equator, covering Asia, Middle East, Southern Europe as well as Central and Southern America and Africa (Singh *et al*, 1997). Substantial part of cowpea production comes from the drier regions of Nigeria which accounts for about 4 million hectares with 1.7 million metric tonnes. Cowpea is one of the most difficult grains to be preserved after harvest by resource poor farmers. Three agents of cowpea deterioration after harvest are the insects, moulds and rodents with insects being the most difficult to control. Taylor (1994) reported bean weevil (*Callosobruchus maculatus*) as the most damaging storage pest of cowpea. In low resource farms, *C. maculatus* infestation starts in the field and continues in storage.

Neem (*Azadirachta indica* A. Juss) is a fast growing tree native to the Indian sub continent where its medicinal and insecticidal properties are well known (SAPP, 2008). Pest control using neem extracts from the neem tree is currently practiced in more than 55 countries throughout the world, and neem products have been in use in parts of Asia such as Burma and India for over 2500 years. Research has shown that neem extracts can be used as biopesticide against nearly 200 species of insects. This at different level may serve as insecticidal, repellent, antifeedant, acaricidal, growth inhibiting, nematocidal, fungicidal, antiviral and oviposition deterrent among others (SAPP, 2008., Neemuses.com, 2010).

Plant parts with insect controlling properties include the seeds, leaves with compounds that acts mainly as a stomach poison

and with a systemic effect on insects (SAPP, 2008). The target organism for neem extracts were reported to be coleopterans, lepidopterans, orthopterans, and to large extent stored insects such as *C. Maculatus*. Modern scientists have now identified azadirachtin as the key ingredient mainly responsible for pesticidal, larvicidal and antifeedant action on various insects and pests.

De silva *et al* (2007) reported that hydroalcoholic extract obtained from neem leaves displayed a significant antifeedant activity when it was added to the insect diet via *Phaseolus vulgaris* seeds. *A. Indica* seeds were introduced in Brazil in the 70's where it has been used as a phytochemical biopesticide (Martinez, 2002). Neem extracts and their biologically active ingredients have been extensively studied because of their efficacy against a broad spectrum of pests, minimal toxicity and rapid disappearance from the environment (Isman, 2000).

The indiscriminate use of synthetic pesticides for controlling *C. maculatus* of cowpea in store has eventually led to an increase in the level of toxic residues in food stuffs, as well as considerable environmental contamination. This study is an attempt to exploit the potentials as well as the efficacy of the various rates of neem extracts with a view to find out the best rate of a particular neem extract for the control of Bean weevil (*C. maculatus*) in stored cowpea.

MATERIALS AND METHODS

Test Materials

Cowpea grains (c.v. Dan'ila) were obtained from the market and fumigated using phostoxin. They were sieved to remove the debris of the dead insects and also sorted.

Two hundred and fifty grammes (250 g) of the cowpea grains were put in 30 laboratory jars (with punched lids to allow air circulation). These were labelled and arranged on a laboratory bench.

Neem Preparations

Fresh neem leaves, seeds and bark were collected from the surroundings. These were air dried for about 4 - 5 days. The various sources were grinded and sieved to a fine powder.

Treatments and Experimental design

The experiment was conducted at the Crop Science laboratory of Kano University of Science and Technology, Wudil in 2009/2010 season. The treatments consisted of 2.5 , 5.0 and 7.5 g each of neem leave, neem seed and neem bark powders and a control. These were applied in an appropriately labelled jars each, containing 250 g of cowpea grain. The cowpea grain - neem extracts were shaken to ensure uniformity. The experiment was a completely randomized design and was repeated three times. The jars were placed randomly at a distance from each others.. At this stage, twenty adults of *C. maculatus* were obtained and inoculated in each jar.

Data Collection and Analysis

Data on percent mortality as affected by the various treatments were recorded at weekly intervals for three weeks. The percent mortality at each sampling were deduced as:-

$$\% \text{ Mortality} = \frac{\text{Number of dead insects}}{\text{Total number of insects inoculated}} \times 100$$

The data was subjected to analysis of variance using 'F' - test as described by Snedecor and Cochran (1967). Where significant difference exists, the means were ranked using Duncan Multiple Range Test as described by Duncan (1955).

RESULTS AND DISCUSSION

Results of the percent mortality of *C. maculatus* as affected by various neem extracts across first to third week after inoculation are presented in Table 1. This showed that 5.0 g neem seed powder has the highest mortality rate (68.30%) as at the first week after inoculation. The percent mortality rate was followed by 2.5 g neem seed treatment (65.00%). The result also indicated that 7.5 g neem seed and 2.5 g neem bark treatment (Figure 1) had recorded 46.70% and 55% mortality rates all of which recorded statistically the same effect at this sampling. This is an indication of the toxicity of the neem seed due to its systemic properties as reported by SAPP (2008). Similarly, the effect exhibited by the 7.5 g neem seed and 2.5 g neem bark treatments at this sampling might be due to the broad spectrum activity of the neem acting in various capacities as insect repellent, antifeedant growth inhibitor and oviposition deterrent as reported by SAPP (2008)., and Neemuses.com (2010). Lale (2002) also made a similar observation.

Table 1: Percent Mortality of *Callosobruchus maculatus* (F) Bruchidae as affected by various neem extracts across 1 - 3 weeks after inoculation.

Treatment	Weeks After Inoculation		
	1	2	3
2.5 g Neem Seed Powder	65.00ab	13.30c	21.70
5.0 g Neem Seed Powder	68.30a	25.00bc	11.70
7.5 g Neem Seed Powder	46.70abc	35.00abc	20.00
2.5 g Neem Leave Powder	26.70cd	50.00ab	38.30
5.0 g Neem Leave Powder	25.00cd	56.70a	26.70
7.5 g Neem Leave Powder	15.00d	51.70ab	38.30
2.5 g Neem Bark Powder	55.00abc	30.00abc	25.00
5.0 g Neem Bark Powder	41.70abc	40.00abc	40.00
7.5 g Neem Bark Powder	36.70cd	25.00bc	53.30
Control	25.00cd	25.00	43.30
SE ±	9.16	8.80	9.89

Means followed by the same letter(s) within columns are not significantly different using DMRT.

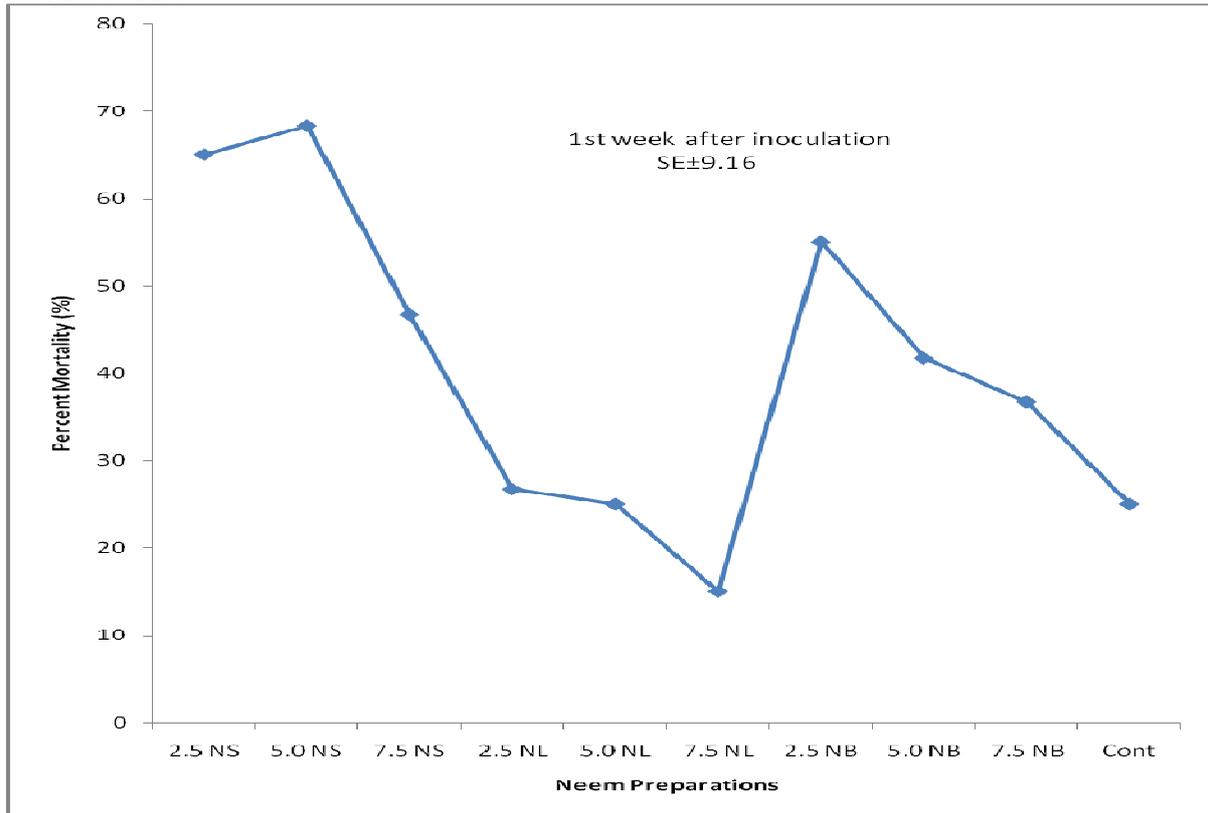


Figure 1: Percent mortality of *Callosobruchus maculatus* (F) Bruchidae as affected by various neem extracts at the 1st week after inoculation.

NS = Neem Seed powder, NL = Neem Leave powder, NB = Neem Bark powder, Cont = Control

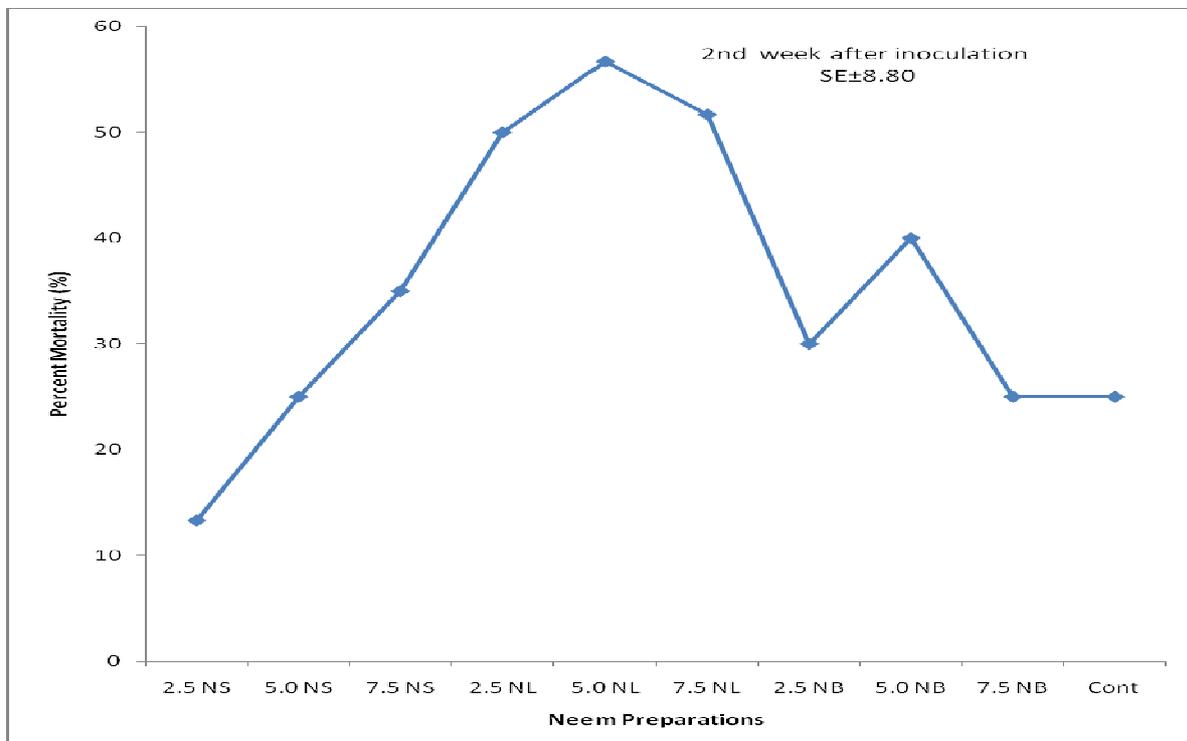


Figure 2: Percent mortality of *Callosobruchus maculatus* (F) Bruchidae as affected by various neem extracts at the second week after inoculation.

NS = Neem Seed powder, NL = Neem Leave powder, NB = Neem Bark powder, Cont = Control

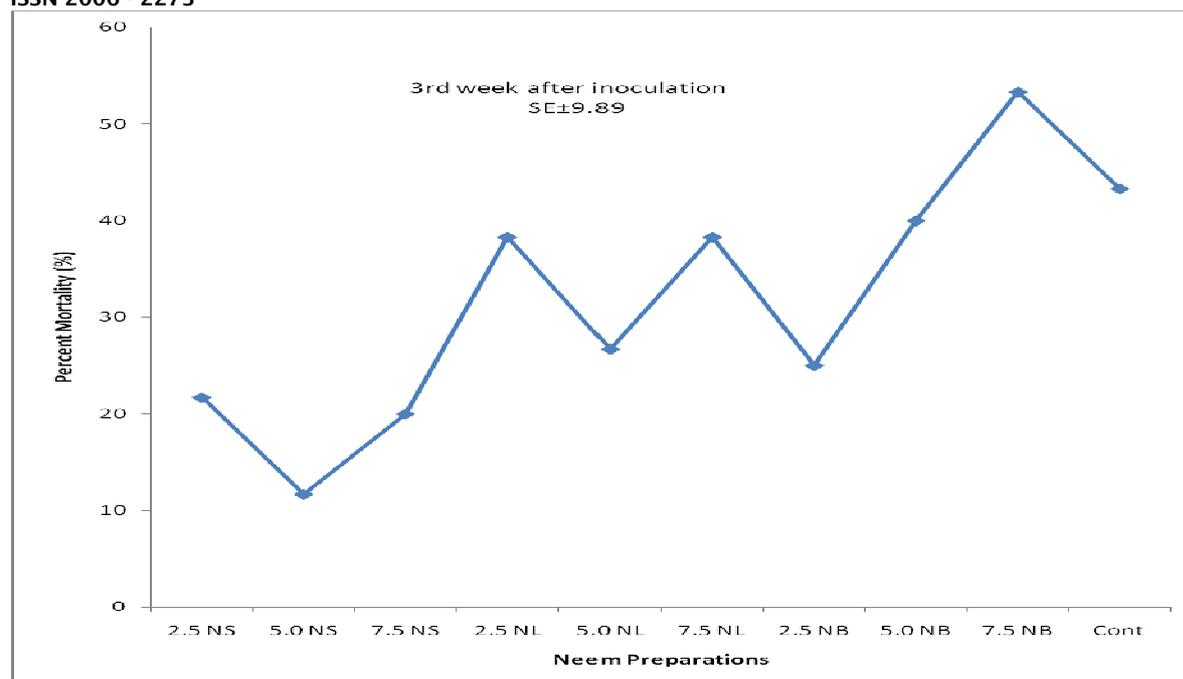


Figure 3: Percent mortality of *Callosobruchus maculatus* (F) Bruchidae as affected by various neem extracts at the 3rd week after inoculation.

NS = Neem Seed powder, NL = Neem Leave powder, NB = Neem Bark powder, Cont = Control

As at the second week of sampling (Figure 2) cowpea treated with 5.0 g neem leave recorded the highest mortality (56.70%). This was followed by 2.5 g and 7.5 g neem leave treatments all of which produced statistically the same effect. This indicated the efficacy of the neem leave as most effective at this time. In the same vein the neem extracts were reported to have minimal residual toxicity coupled with their rapid disappearance from the environment as reported by Isman (2000). The ability of the neem leave to have recorded highest mortality at this sample might be attributed to fading of the neem seed extract as well as the activity of the neem leave in displaying a significant antifeedant effect due to hydroalcoholic extracts in the neem leaves at this time of sampling. This confirms the report of De Silva *et al* (2007). The sampling in the third week after inoculation (Figure

3) however, did not record any significant effect of all the extracts as they produced statistically the same effect. This is due to the rapid disappearance of the neem extracts as reported by Isman (2000).

CONCLUSION

A significant effect of the neem seed and neem leave powders at 5.0 g per 250 g of cowpea grain were observed as having the highest mortality rate on bean weevil (*C. maculatus*) for cowpea in store during this study.

This reveals the potentials of these extracts in combating bean weevil for cowpea in store and also may be a substitute to the conventional chemical control. If fully exploited, this may be cost effective as well as combat the threats posed to human lives by the use of synthetic insecticides.

REFERENCES

- Duncan, D.B (1955). Multiple Range and Multiple F-test. *Biometrice* 11: 1 - 42
- Jose de Paula de Silva., Antonio, E.M.C., and Wilson, R.C (2007). Antifeedant and allelopathic activities of the hydroalcoholic extract obtained from neem (*Azadirachta indica*) leaves. *Revista Brasileira de Farmacognosia* 17(4): 1 - 6. Jao Pessoa. Brazil.
- Isman, M.B (2000). Biopesticides based on phytochemical. In: Okoil, G.S., Dhaliwal, K., Koul (eds). *Phytochemical biopesticides*. Overseas publishers association. Amsterdam.
- Lale, N.E.S. (2002). Stored Product Entomology and Acarology in Tropical Africa. Neem as an ideal source of Biopesticides. Pp 152 - 153.
- Martinez, S.S (2002). *Onim (Azadirachta indica): Natureza Usos Multiplos Producao*. IAPAR Londrina.
- Neemuses.com.mht (2010). RYM exports. The Indian Neem Tree Company. Pp1-5.
- SAPP (2008). The SAPP project data base. Southern African Pesticidal Plants. The natural Resource Institute. University of Green Witch. Pp1-8.
- Singh, B.B., Dashiell, K.E., and Jackai, L.E.N. (1997). *Advances in Cowpea Research. Post Harvest Insect Pests*. Pp295.
- Snedecor, G.W., and Cochran, W.G. (1967). *Statistical Methods*. 6th edition. IOWA State University Press U.S.A.
- Taylor (1994). Methyl Bromide. Is there any future for this note worthy fumigant? *Journal of Stored Products Research* 30: 253 - 260.