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Study on the insecticidal efficacy of some plants extract on maize and beans weevils in Gashua, Yobe state, northeast, Nigeria

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Abstract
This study was carried out in Gashua metropolis, Bade Local Government Area of Yobe State, Northeastern, Nigeria between January to May, 2022. The aim of this study is to compare the insecticidal efficacy of some plants extract on Beans and Maize weevils. The impact of maize and bean weevil on the food security possess a serious challenge to humans. There is an increased pressure to replace the synthetic chemical pesticides gradually with bio-pesticides which are safe to human and nontarget organism. Bio- pesticides are type of pesticide derived from natural material such as animal, plant and bacteria. The test insects were randomly collected from different grain stores situated within Gashua Central Market in Yobe State, Nigeria, using a clean three glass jars with capacity of 3kg and conveyed to the Parasitology/Entomology Research Laboratory in the Department of Biological Sciences, Federal University Gashua for further examination. The current study has shown that *Moringa* leave had the highest efficacy followed by neem and garlic with the least efficacy. The extract was more effective to the maize weevils than the bean weevils. It is necessary to maintain good sanitary measures to reduce weevil infestation in storage.

Keywords: Insecticidal, plant extract, weevils, Gashua, Yobe, Nigeria

Introduction
Pest control in Africa is mostly depended upon the use of synthetic chemical pesticide.). Pesticides are substance or mixture of substance used to prevent, destroy, repel, attack, sterilize or mitigate pest. The use of these chemical has already caused great damage to health, ecosystem, soil, ground water. There is also increased pest resistance and the negative environmental impact of these chemical have led to the development of safer, more environmentally acceptable and cost-effective control alternative, especially the use of plant products (Grzywacz and Leavett, 2012) [31]. It is increasingly urgent that bio-pesticide which is environment friendly method of improving pest and disease control are used (Aktar, 2009; Alam, 2000) [8, 10].

Bio- pesticides are type of pesticide derived from natural material as animal, plant, bacteria, (Alam, 2000) [10]. Bio pesticides or biological pesticides based on pathogenic microorganism are specific to a target pest. (Gupta and Dikshit, 2010) [32]. There is an increased pressure to replace them gradually with bio-pesticides which are safe to human and non-Target organism (USEPA, 2017) [71]. The uninterrupted and indiscriminate uses of synthetic chemical has not only led to the resistance development. The accumulation of toxic residues on food grain has resulted into health hazard in human has reported a widespread resistance development to almost all group of pesticide for protection of stored grain. The insecticidal resistance is one of the emerging problem in stored grain protection. The poor storage facilities at traditional level in the developing nation were considered unsuitable for effective conventional chemical control as most the storage types were open to re-infestation by insect pest (Khattak *et al.*, 2000) [42]. Stored grain resistance in relation to population build up various insect pest relied upon factors such as moisture content, hardness of grain (Khattak, *et al;* 2000) [42].

Several plant products has been used to produce bio-pesticides, *viz*: Neem (*Azadirachta indica*) extract **i**s a broad spectrum botanical pesticide commonly used for store grain protection worldwide (Medeiios *et al.*, 2007; Costa *et al.*, 2014; Choupanian *et al.*, 2017) [48, 74, 75]. Garlic *(Allium sativum)* was indigenous to Europe and western Asia (Christopher, 1998) [20]. It has the ability or potential to effectively preserve and protect food substance against deterioration occasioned by pest or insect attack (Borroffice, 2002).

The chemical extracted from this plant is a repellent and also good in killing insect (Alfred., 1972) [76]. (Karunamoorthi and Hailu, 2014) [77].

Moringa (*Moringa oleifera*) is a plant of family *Moringa oleifera*, various part of the plant are used as nutritious food commodity in many countries, that is Pakistan, Indian, Philippines, and part of Africa (Anwar *et al*., 2005) [26]. The plant has gained widespread popularity due to potent antibacterial, antifungal, antioxidant (Mayo *et al.*, 2012) [78].

Insect pest cause heavy food grain losses in storage particularly at the farm level in Nigeria (Lai, 1988) [79]. In sub-Saharan Africa grain losses generally result from in adequate post-harvest management practices and poorly designed storage structure. In a survey conducted in the Nyanza district in kenya, it was found that 20% of corn crops were already infected with weevills at the time of harvest (Nyambo. 1993) [80] in Togo corn cobs stored in granaries in storage particularly at the farm level in tropical countries. Insect pest cause heavy food grain losses in storage, particularly at the farm level (Lai, 1988) [79].

Babarinde *et al*., (2008) [81] had reported the menace of insect pest infestation on harvested crop produce or processed products such as biscuits and snacks. Voracious feeding on whole grain by this insect causes product weight lost, fungal growth quality lost through an increase in free fatty acid and it can even completely destroy stored grain in all types of storage system.

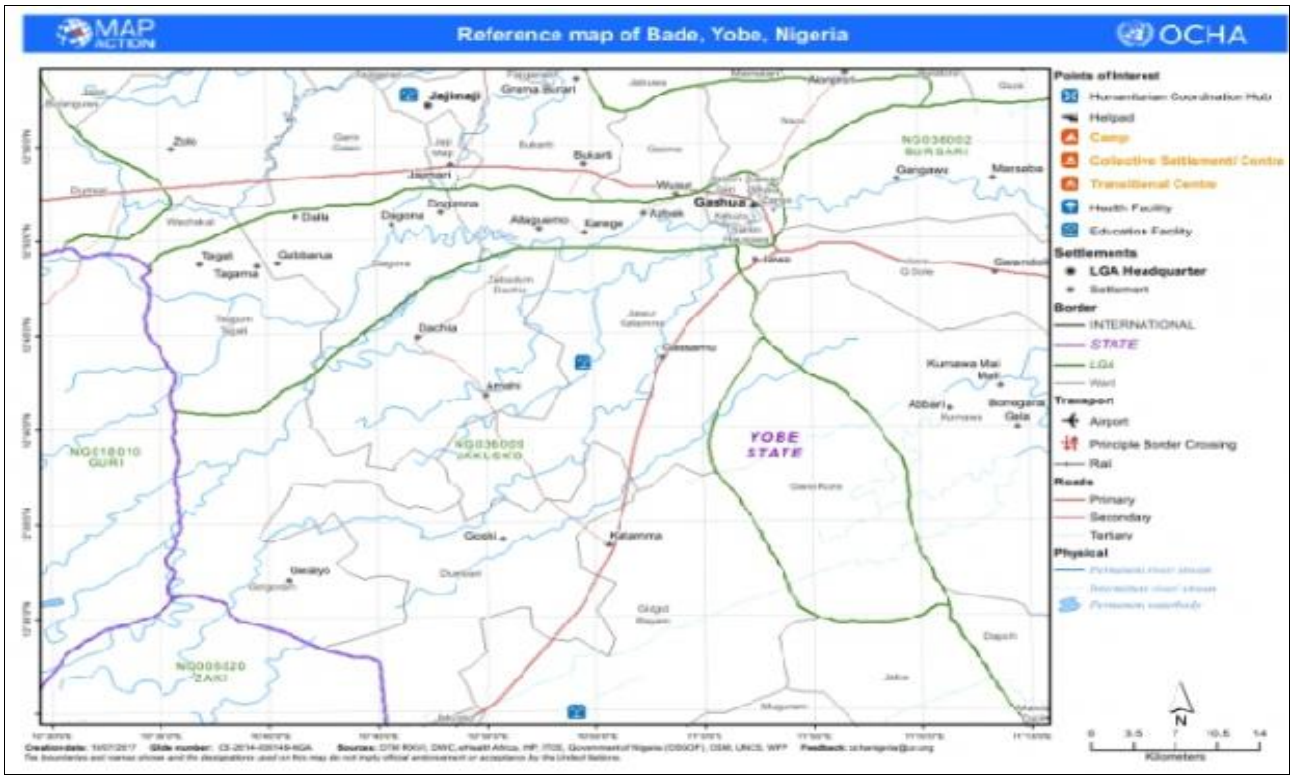
It has been established by several researchers that the maize weevil cause severe quantitative and qualitative losses in stored maize grain (Adedire, 2001: FAO, 2002) [5, 27] one pair of weevil can reproduce about one million of it's species within a period of three months under favorable condition. (Thomas *et al*., 2002) [82]. The aim of this study is to compare the insecticidal efficacy of some plant extract on Beans and Maize weevils at store in Gashua, Yobe State, Nigeria.

Materials and Methods

Study Area

The study was carried out in Gashua metropolis, the administrative headquarters of Bade Local Government Area of Yobe State, Northeastern, Nigeria. Its geographical coordinate are Latitude 12. 160° N and Longitute 1104° E with altitude of 299 m. According to 2006 census Gashua has a population of about 122,000. Gashua is mostly dominated by some ethnic group such as Bade, Hausa, Kanuri and Fulani. It has the potentiality for both rainfall and irrigation farming. The hottest month are March, April, and May with temperature ranges from 38-46 °C, in rainy season June to September temperature range fall from 23-28 °C, with rainfall of 500-1000 mm.

The people in Gashua engaged in animal rearing, farming, fishing and trading. The citizen of Gashua metropolis are mainly educated where by majority of the people living within Gashua are not educated. The different kinds of crop cultivated in Gashua are Rice, Bean, Millet etc. the species of tree found in Gashua include neem tree, moringa, mango, guava tree etc.



Map 1: Map of Gashua, Yobe State, Northeast, Nigeria

Collection of samples

The test insect were collected from the Gashua Central Market Bade Local Government Area of Yobe State, Northeastern, Nigeria, using a clean three glass jars with capacity of 3kg. The test insect was immediately taking to the laboratory of the department of Biological science Federal University Gashua. For immediate analysis within 45 minutes the insect was transferred into slightly pierced clean and unused transparent container the insect was distributed into three different transparent containers in respect to the plant extract dosage which also contain bean and maize seed. (Rup, and Chopra 1984) [83].

Preparation of plants extract

Preparation o*f A. sativum*

Garlic (*Allium sativum*) was peeled and sliced into small pieces to increase the surface area for drying. Placed spread under shade In dark room for 21 days in the laboratory. The dried sliced garlic was milled manually using a pestle and mortar. The obtained powder was sieved through 25 mesh screen, stored in tightly close jar wrapped with Aluminum foil and kept in the laboratory at room temperature.

Preparation of *M. oleifera*

Moringa leave was purchased from Gashua Central Market, it was air dried and was pounded using mortar and pestle to powder foam, the *moringa* leave was then sieved through 25mm mesh screen and then store in tightly close jar wrapped with Aluminum foil to prevent from losing it efficacy (Abdullahi and Muhammad, 2004) [84].

Preparation of *Azadirachta indica*

Fresh neem leaves were collected from the school premises Federal University Gashua. The collected neem leaves were dried and crushed using a pistle and mortar into fine particle, and was sealed in an air tight container to prevent it from losing it choky smell. (Rajasheka and shivanandappa, 2012) [12]. The sample where air dried for two weeks and pound using a pestle and mortar and was sieved through 25mm mesh screen and stored in an air tight container wrapped with aluminum foil to prevent it from losing its efficacy. Ethanol was used as solvent of extraction and bioactivity test of the mortality count was recorded.

Extraction of the Plant Extract

About 30g of neem, moringa and garlic was put Into 250ml beaker, separately and 200ml of ethanol was added, agitated for proper mixing and it was allowed to settle. After 1 day concentrate was separated from the chaff using a muslin cloth. The filtrate was poured into beaker and was allowed for 2 days for the ethanol to evaporate. (Asemave and Anure, 2019) [85].

Bioactivity test of the mortality count

About 0.1g, 0.5g, and 1g each of neem, garlic and moringa sample were weighed and added to a 10g of undamaged and uninfected bean and maize seed in a plastic transparent container. The containers with the content. were gently shaken to ensure thorough mixing of the maize and bean seed with plant extract. Ten (10) pairs of *(C. bruchinae*) and (S. *zeamais*) adult were then introduced into the plastic container. The plastic rubber we're well covered with the container covers. Untreated bean and maize seed with 10 maize and bean weevil was use as control. The mortality count was assessed after 24hr, 48hr, and 72hrs for 3 days. On day 3 all insect both dead and alive were removed from each container.

Statistical analysis

The data obtained were analyzed using mean ±standard deviation. Sample where analyse in triplet. Software used was ANOVA software, One way ANOVA.

Plate 1: Preparation of plants extract

Plate 2: Extraction of the Plant Extract

Plate 3: Storage of the extract in air tight container

Plate 4: Bioactivity test of extract on weevils

Results

Table 1: Preparation of plants extract

Extract	Colour	Texture	Mass of sample	Mass of extract	% of extract	% of marc
Garlic	Cream / dirty white	Oily	30 g	3.2	10.66	65.20
Moringa	Drak Green	Powder	30 g	4.1	13.67	60.10
Neem	Green	Powder	30 g	3.04	10.13	70.50

% of extract =
% of marc =

Table 2: Mortality counts of *C. bruchinae* at 24 hrs

Plant extract	0.1 g	0.5 g	1 g	PV
Neam	2±0.2000	4±0.1000	6±0.1000	< 0.0001
Garlic	1±0.1000	1±0.1000	2±0.1528	< 0.0001
Moringa	2±0.1000	4±0.1528	6±0.2000	< 0.0001

Table 3: Mortality counts of *S. zeamais* at 24hrs

Plant extract	0.1 g	0.5 g	1 g	PV
Neam	1±0.1000	3±0.1520	5±0.3000	< 0.0001
Garlic	2±0.0577	2±0.0577	3±0.1000	< 0.0001
Moringa	3±0.1528	5±0.1000	8±0.200	0.0004

Table 4: Mortality counts of *C. bruchinae* at 48hrs

Plant extract	0.1 g	0.5 g	1 g	PV
Neam	3±0.0577	5±0.0577	7.3±0.5774	0.0001
Garlic	2±0.1000	3±0.1000	3.3±0.5774	0.0001
Moringa	4±0.2082	6±0.1528	7.4±0.5508	0.0001

Table 5: Mortality counts of *S. zeamais* at 48 hrs

Plant extract	0.1g	0.5g	1g	PV
Neam	2.4±0.5880	5±0.000	6±0.0116	0.0001
Garlic	2.3±0.5774	2.3±0.5774	3±0.1155	0.0001
Moringa	3.7±0.5774	7±0.000	8.7±0.5774	0.0001

Table 6: Mortality counts of *C. bruchinae* at 72 hrs

Plant extract	0.1 g	0.5 g	1 g	PV
Neam	4±0.000	6.3±0.1333	7±0.000	0.0001
Garlic	2±0.000	3.3±0.333	4.3±0.333	0.0001
Moringa	3±0.000	7.3±0.333	8.3±0.333	0.0001

Table 7: Mortality counts of *S. zeamais* at 72 hrs

Plant extract	0.1 g	0.5 g	1 g	PV
Neam	4.3±0.333	7±0.000	8.7±0.5774	0.0001
Garlic	3±0.000	2±0.000	4.4±0.0000	0.0001
Moringa	6.3±0.333	7.2±0.4691	10.3±0.5774	0.0001

Discussions

The current study has shown that *Moringa* leave had the highest efficacy followed by neem and garlic with the less efficacy. The extract was more effective to the maize weevil than the bean weevil. Plastic container which contain maize weevil has the highest mortality rate. Alfred., (1972) [76] opined that the garlic extract was more effective at higher concentration. The chemical extracted from this plant is a repellent and also good in killing insect. (Karunamoorthi and Hailu, 2014) [77]. Moringa extract was effective even at low concentration, and so as the neem extract. The mortality count of neem, moringa and garlic extract against the weevil increased with time (24 h, 48 h, 72 h). Respectively. All of the plant extract is more effective at higher concentration. The higher mortality of weevils observed corroborate with the report, that Been leaves (*Azadirachta indica*) extract **i**s a broad-spectrum botanical pesticide commonly used for store grain protection worldwide (Medeiios *et al.,* 2007; Costa *et al.,* 2014; Choupanian *et al.,* 2017) [48, 74, 75].

Conclusion

The research has derived neem, moringa, and garlic-based pesticides against *S. zeamais* and *C. bruchinae* on stored maize and bean seed. It was found that neem, moringa and garlic gave comparable mortality count against the maize and bean weevil. The mortality count of the plant extract was also comparable. Garlic which was less effective against the weevil as comparable to the beer and moringa extract. All the plant extract use in this research work were quite effective as pesticides against *S. zeamais* and *C. bruchinae* at dose of 0.1 g/10 g at the end of 24 hrs it was also confirmed that the prolong exposure of the insect pest to the extract increase efficiency in the control of the pest. Therefore, these plants mentioned above could be used as pesticides at the dose of 0.1 g/10 g of bean a d maize seed to prevent *S. zeamais* and *C. bruchinae* during storage. This will reduce synthetic pesticides usage, remove the risk of toxic residues in food and ensure the continued availability of insect free bean and maix seed for food, planting and trading.

Recommendations

More research should be done on toxicity of the prolong use of the organic insecticide on human. Both the government and private sector should invest more on the manufacturing, packaging and mass distribution of storage pest repellent and control of natural origin should be encouraged to reduce the production and use of synthetic chemical which has resulted to high ecological damage and has raised human and environmental health concern over time.

It is necessary to maintain good sanitary measures to reduce weevil infestation in storage. Cleaning of ware house and containers thoroughly before storage of new product (Lale, 2001) [5]. The concept of sun drying is a promising strategy and has potential role in disinfestation.

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