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DAMAGE ASSESSMENT oF INFESTATION BY COWPEA WEEVILS (CALLOSBRUCHUS MACULATUS) ON COWPEA (VIGNA UNGUICULATA) AND (VIGNA SUBTERRANEAN)

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Abstract

Bambara nut (Vigna subterranean] and Beans (Vigna unguiculata) are indigenous Nigerian crops that are grown across the country and by extension cultivated by subsistence farmers throughout sub-Saharan Africa. Research findings indicate that these crops have nutritional and agronomic potential, but it remains scientifically neglected. The aim of this work is to determine the most susceptible cowpea type (Vigna unguiculata and Vigna subterranean) to infestation by cowpea weevils (Callosbruchus maculatus). Weight loss determination technique was used to obtain the most infested cowpea during the three weeks of pest exposure. plate 1 had weight loss of 0.1g for white bean seeds and 0.3g for white Bambara nut. Plate 2 had weight loss of 0.1g for bean seeds and 0.2g for Bambara nut. Plate 3 had 0.2g for bean seeds and 0.4g for Bambara nut respectively. However, the control had 0g weight loss. Similarly, for brown cowpea, Plate 1 had weight loss of 0.1g for bean seeds and 0.5g for Bambara nut. Plate 2 had weight loss of 0.1g for bean seeds and 0.6g for Bambara nut. Plate 3 had 0.2g for bean seeds and 0.4g for Bambara nut. However, the control experiment had 0g weight loss for both seed types. The results shows that Vigna subterranea seeds are

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more susceptible to cawpea weevils as the weight loss was more than that of Vigna unguiculata seeds after infestation. Recommendation on the provision of good storage facility to serve as a barrier for infestation by Cowpea weevil is essential in food security.

INTRODUCTION

Cowpeas are leguminous seeds that are widely produced in Africa under marginal production systems. Cowpeas perform well even when produced in marginal soils due to their ability to fix substantial nitrogen in the soil. (Hallen et al, 2003)

In Nigeria cowpeas are produced country wide as an intercrop, particularly in warm areas with low rainfall such as Yobe, Borno, Adamawa and Gombe state, as well as dry plateau areas. Cowpea contains essential vitamins and minerals, as are good source of potassium, copper, phosphorus, manganese and magnesium. Dry cowpeas are an excellent source of the water- soluble vitamins, thiamin and folic acid and also a good source of riboflavin and vitamin B6 (Adebowale et al., 2013).

BAMBARA NUT (Vigna subterranean)

Cowpea (Vigna subterranean) is an indigenous Nigerian crop that is grown across the country, though Bambara nut (Vigna subterranean) is grown extensively in Nigeria (Adebowale and Lawan, 2013) it is one of the underutilized legumes in the country. Nigeria produced over 100,000 metric tons yearly, (Asiedu, 2013). In North Eastern Nigeria, Bambara nut is the third most important legumes after peanut and cowpea (Adebowale et al., 2013). The cultivars had distinct color (Vigna subterranean) seeds coat thickness. Bambara nut seeds makes balanced food as it contains sufficient quantities of carbohydrate, protein and fats with relatively high proportion of lysine and methionine as percentage of the protein, despite it nutrient composition, it is nutritional superior to many legumes and is the preferred crop for many local people (Brought and. Azam-Ali,2011).

Bambara nut (Vigna subterranean) is a rich source of protein (20-25%) and its seeds are valued for their nutritional and economic importance, it contains about 60% carbohydrate. Its protein is reported to be higher in the

essential amino acids methionine than other grain legumes and contains 6-12% oil when is half of peanuts. The gross energy value of Bambara nut is greater than that of other common pulses such as cowpea and pigeon pea (FAO, 2012). Legumes are nutritious foods and substitute for animal protein arises from the knowledge of the functional properties of the seed flour and other products. In Africa, mal nutrition is prevalent due to lack of sufficient animal protein, hence the search for alternative sources of protein from lesser-known legumes in lieu of expensive and scarce animal protein (Adebowale and Lawal, 2013).

Madamba (2012) reported good indications of the possible use of food of plant origin to overcome the problem of shortage of foods of animal origin. Therefore, the use of legume seeds may be the beginning of a series of formulations which lead to a substantial drop in dependency of animal sources for nutritious foods. Unfortunately, legume seeds contained anti nutritional factors like enzyme inhibitors, phytates, oxalates, saponins and polyphenolic compounds, all of which limit their utilization (Liener, 2011). Although, remarkable improvement in the nutritive value and quality of legume seeds have been achieved through dehulling, heat treatment, germination, fermentation, soaking and partial hydrolysis of proteolytic enzyme (Basu et al., 2012). As part of the efforts made to solve the problem of low protein intake in Nigeria, nutritionists have advocated increase consumption of food legumes, such as Vigna unguiculata and Glycine max in campaign.

In North Eastern of Nigeria freshly harvested pods or seeds are cooked shelled and eaten as snacks (Ijarotimi and Esho, 2014) or milled into nutritious flour used for preparation of acceptable shelf stable food products such as extruded "moin moin "analogue, called "Okpo" which is very popular among the Igbo tribe of the Eastern Nigeria (Ijarotimi, 2014), but cannot be keep for more than 12hours. Since Bambara nut (Vigna subterranean) is very nutritious and of economic importance, it could be utilized in the development of more acceptable shelf stable food products such as extruded snacks. Presently, the common consumed traditional snacks are produced by germination, frying, roasting, boiling, baking,

drying-These include snacks such as akara, okpa, dodo, dodo-ikire, moinmoin, cassava chips, tapioca, Massa, melon cake, etc. (Liener, 2011).
Some of the traditional snacks are unhygienically produced and package and not shelf stable, keeping only for few hours or days at ambient temperature. So, Bambara nut could be utilized in the production of more shelf stable, hygienically processed, well packaged and acceptable product such as extruded snacks. Formulation and development of nutrient weaning food from local readily available raw material have received a lot of attention in many developing countries (FAO. 2012).

BEANS (Vigna unguiculate)

Beans (Vigna unguiculate) are red kidney simply delicious, naturally nutritious food, all types of beans - including black, cranberry, great northern, dark red kidney, light red kidney, white kidney and small red, are good source of protein, excellent source of fiber and naturally fat free, sodium free and cholesterol free.(Tosh and Yada, 2010) Cowpeas contains some complex sugar called Oligosaccharide, which are non-digestible, fermented fibers. They are broken down by beneficial bacterial in the colon, which may result in gas production and flatulence. Cowpeas contain between 21 to 25% protein, which is much higher than other source of vegetable. Regular intake of dry Beans (Vigna unguiculate) is extremely important worldwide as they provide a good source of protein at a low cost compare to animal protein source, like beef, pork and chicken (USDA. a routine Database).

Beans (Vigna unguiculate) is a leguminous crop widely grown as an intercrop with cereals in the marginal lands of sub-sahara Africa, through improved breeding lines and agronomic practice. There is potential for increased production of beans (Vigna unguiculate) despite the prevailing production challenges of declining soil fertility, unreliable rainfall, pests and diseases (Singh et al, 2005).

COWPEA WEEVILS

Callosbruchus maculatus is the most important insect pest which attack cowpeas in the field and during the storage. Despite its importance in

tropical regions, cowpea yield potential and seed quality is often reduced by insect pest damage. One of the major destructive post-harvest of cowpea worldwide is the cowpea weevil (Callosbruchus maculatus). Cowpea weevil causes irreparable damage to the tissue, which reduce the nutritive value and quality of the seeds for planting. The damage is caused by larvae feeding and development inside the seeds and when adults emerge they leave circular exist holes. The damage reduces weight and may render the seeds to be unfit for human consumption, due to the fungal growth associated with increased temperature in the storage (Obopile, 2006).
The aim of this work is to determine the damage caused to two different types of cowpeas; Bambara nut (Vigna subterranean) and Beans seeds (Vigna unguiculate) by cowpea weevils (Callosbruchus maculatus) in a laboratory condition.

MATERIALS AND METHODS

The materials used in this research include weighing balance, culture vials, white plastic containers, Petri dish, white cloth, cowpea seeds (white and brown bean seeds, and white and brown Bambara nuts) and cowpea weevils (Callosobruchus maculatus).

SAMPLE COLLECTION

White and brown varieties of Vigna unguiculata and white and brown varieties of Vigna subterranean were obtained from the market, making sure that no insecticides were applied on them. Damage and immature seeds were also removed.

METHODS

Callosobruchus maculatus were obtained from infested seeds that were bought from the market in Damaturu. The weevils were cultured at ambient Laboratory temperature of 22- 29°C in a white plastic storage container with naked transparent tightly fitted lids in which the upper part of the lid was open to replace with white cloths to ensure ventilation as well as prevent

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the escape of the insects. The culture were kept until the old insects dies out and new ones started imaging (Salihu 2012).

IDENTIFICATION OF MALE AND FEMALE INSECTS

The female insects were identified by their distinct black spot on both sides of the elytra where the adult males have brown elytra without black spots.

EXPERIMENTAL SETUP

Equal weight of Cowpea seeds were weighed into the culture vials which were appropriately labelled in three replicates and a control. The setups were arranged on the Laboratory table undisturbed.

INOCULATION

Three grams (3g) of cowpea seeds were place into petri dish followed by two male three female. Three set of this preparation were setup to obtained plate 1, plate 2, plate 3 and a control which has just 3g of cowpea seeds without weevil added. White and brown bean seeds and white and brown Bambara nut seeds were exposed for three weeks and their weight loss were determined in each plate corresponding to the damage done by the cowpea weevils (Salihu 2012). Weight loss was determined by calculating the difference in weight of the cowpea before and after exposure to the weevils.

RESULTS

Table 1, shows infested seeds weight loss for white cowpea bean seeds (Vigna unguiculata) and white Bambara nut (Vigna subterranea).

	PLATE 1		PLATE 2		PLATE 3		PLATE 4	
	VU	VS	VU	VS	VU	VS	VU	VS
Initial weight (g)	3	3	3	3	3	3	3	3
Final weight(g)	2.9	2.7	2.9	2.8	2.8	2.6	3	3

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Weight loss (g)								
	0.1	0.3	0.1	0.2	0.2	0.4	0.0	0.0

Key: VU = Vigna unguiculata (bean seeds), VS = Vigna subterranean (Bambara nut)

Table 2, shows infested seeds weight loss for brown cowpea bean seeds (Vigna unguiculata) and brown Bambara nut (Vigna subterranea).

	PLATE 1		PLATE 2		PLATE 3		PLATE 4	
	VU	VS	VU	VS	VU	VS	VU	VS
Initial weight (g)	3	3	3	3	3	3	3	3
Final weight(g)	2.9	2.5	2.9	2.4	2.8	2.6	3	3
Weight loss (g)	0.1	0.5	0.1	0.6	0.2	0.4	0.0	0.0

Key: VU = Vigna unguiculata (bean seeds), VS = Vigna subterranean (Bambara nut)

DISCUSSION

The comparative study of damage assessment of white and brown varieties of both Vigna unguiculata (bean seeds) and Vigna subterranean (Bambara nut) by cawpea weevils (Callosobruchus maculatus) was carried out to determine the most vulnerable for infestation.

Table 1, shows levels of seeds infestation by weight loss for white varieties of cowpea bean seeds (Vigna unguiculata) and white Bambara nut (Vigna subterranea). Initial weight of bean seeds and Bambara nut in all plates were 3g, after three weeks of culture with cowpea weevils, plate 1 had weight loss of 0.1g for bean seeds and 0.3g for Bambara nut. Plate 2 had weight loss of 0.1g for bean seeds and 0.2g for Bambara nut. Plate 3 had 0.2g for bean seeds and 0.4g for Bambara nut respectively. However, the

control had 0g weight loss. The above results shows that Vigna subterranea seeds are more susceptible to cawpea weevils as the weight loss was more than that of Vigna unguiculata seeds, probably due to its relatively high nutritional value (Singh and Pandey, 2001) compare to other types of cowpea.

Similarly, table 2 shows levels of seeds infestation by weight loss for brown varieties of cowpea bean seeds (Vigna unguiculata) and brown Bambara nut (Vigna subterrnea). Plate 1 had weight loss of 0.1g for bean seeds and 0.5g for Bambara nut. Plate 2 had weight loss of 0.1g for bean seeds and 0.6g for Bambara nut. Plate 3 had 0.2g for bean seeds and 0.4g for Bambara nut. However, the control experiment had 0g weight loss for both seed types. This results also revealed that Vigna subterranea seeds are more prompt to attack by cawpea weevils as the weight loss was more than that of Vigna unguiculata seeds. This is becouse the gross energy value of Bambara nut is greater than that of other common pulses such as cowpea and pigeon pea (FAO, 2010). These make it palatable and attractive to weevils.

CONCLUSION

Infestation study by cowpea weevils have shown that Bambara nut (Vigna subterranean) has more resistance than bean seeds (Vigna unguiculata)

RECOMMENDATION

Provision of good storage facility to serve as a barrier for infestation by Cowpea weevil which could cause irreparable damage to the tissue, reducing the nutritive value and quality of the seeds for planting. The damage reduces weight and may render the seeds to be unfit for human consumption, due to the fungal growth associated with increased temperature in the store.

Further study should be carried out to findings way of minimizing infestation against cowpea weevils.

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