

Original Research Article

ASSESSMENT OF POST-HARVEST INSECT AND MOULD INFESTATION OF *VIGNA SUBTERRANEA*

ABSTRACT

The degree of resistance to post-harvest damage done by infestation of insect and mould on four varieties of *Vigna subterranea* was determined. The speckled flecked spotted variety (SFSV), Brown variety(BV), Cream black eye variety(CBEV) and Cream no eye variety CNEV) were randomly sampled from some major markets in South Eastern Nigeria. Samples were exposed to pest and mould attack at room temperature in the laboratory for five months. Samples were inoculated into Sabourand Dextrose Agar (SDA) supplemented with amoxicillin and incubated at room temperature for five to seven days to determine fungal growth. Cream black eye variety showed no resistance, while the Brown variety showed low resistance, speckled flecked spotted variety had a high resistance and Cream black eye variety had very high resistance to pest and mould attack. The total colony forming units (cfu) obtained, reduced as resistivity increased across the four varieties. *Callosobruchus maculatus* was identified as the insect that carried out the damage in some of the varieties of *Vigna subterranea*. Poor hygiene and management of warehouses contributed to the level of insect infestation amongst susceptible varieties.

Key words: *Vigna subterranean*, post-harvest, insect, mould.

INTRODUCTION

Insect and mould infestations on food products are great threat to food security in Nigeria and beyond. Food products especially nuts and grains are damaged both qualitatively and quantitatively. Post-harvest mal-practices are the major reasons for insect and mould infestation of our stored food product. Farmers, traders and consumers store food products in conditions that support the growth of microorganisms and conducive for insects and rodents to feed and carry out their activities (Nwankwo *et al.*, 2015).

Loss of nutritional value of our food is an alarming effect of food contamination all over the globe. This low nutritional value of food results to malnutrition which is the greatest threat to the public health. Many developing countries where their climatic condition favors the proliferation of these moulds tend to suffer more of these dieting problems (Kouadio *et al.*, 2013).

The tones of food lost all over the world due to contamination of food stuffs is unbearable. About one billion metric tons of food stuff was estimated lost by the United Nations (UN) and Food and Agricultural Organization (FAO) per year. FAO has disclosed that 25% of the world's grains are contaminated with mycotoxins (Kouadio *et al.*, 2013).

Toxigenic moulds are one of the greatest threats associated with the contamination of food stuff by microorganisms. They produce secondary metabolites known as mycotoxins, which may be carcinogenic, tetarogenic, genotoxic and hepatotoxic (Mohamed, 2011).

Besides mycotoxin production, the ubiquity of toxigenic moulds is a challenge to control. They thrive in humid, warm and even damp environment. According to Anyanwu. (2007) over one thousand varieties of these moulds exist. Common occurring species of toxigenic moulds are those of *Aspergillus*, *Penicillium* and *Fusarium*. They contaminate food substrate of varying nutritional constituents; ranging from major food nutrients to minor ones. Foods rich in carbohydrates (e.g maize, rice, cassava by products and millet), Proteins (e.g Beans, wheat, fishes, etc) and other nutrients are not exceptional (Saravanakumar *et al.*, 2007).

In line with the world's population demand for nutrient rich food stuff, *V. subterranea* is nutritionally endowed to cob malnutrition since it has been proven to contain a reasonable amount of some major food classes such as protein, carbohydrate, and lipids. About 63% carbohydrate, 6.5% oil and 19% protein is present in *V. subterranea* seed. No harm is associated with consumption of nut at different stages of maturity (so far it's well processed) (Okonkwo *et al.*, 2010; Hillocks *et al.*, 2012; Aviara *et al.*, 2013).

Vigna subterranea has an appealing flavor which has highly influenced it's demand from the local markets where producers sell them. It shares high nutritive value like other popularly consumed African legumes. *V. subterranea* is capable of growing in arid land where Ground nut (*Arachis hypogea*), maize (*Zea mays* L.) and sorghum (*Sorghum bicolor*) have failed (Hillocks *et al.*, 2012).

According to Aviara *et al.* (2013), Nigerians are the highest producers of *V. subterranea* in Africa. History has it that the crop originated from the north eastern states of Nigeria to the rest parts of the country, excluding the riverine and swampy zones of the country.

The crop *V. subterranea* is a crop with many hidden potentials. Studies have shown that the crop has the capacity of contributing to food security in the world. The crop can be cultivated in regions of the world where rain is low. Besides, high disease resistance capacity has been found as one of the inherent potentials of the crop. Infact it's been noted as the most resistant pulse crop with high yield in regions with low rainfall (Akpalu *et al.*, 2013).

However, the good qualities of this nut, does not actually mean total absence of infestation by pest, as various extreme conditions may over power the resistance of this crop. Researchers in some publications have disclosed that pest and disease are major problems affecting the high yield of *V. subterranea* in Africa (Aviara *et al.*, 2013; Akpalu *et al.*, 2013; Hillocks *et al.*, 2012). Poor processing and storage system are practices that contribute to post-harvest contamination and commercialization problems of bambara nut (Hillocks *et al.*, 2012).

Callosobruchus maculatus (cowpea weevil) has been identified as the major insect that attacks *V. subterranea* during post-harvest storage (Magagula and Maina, 2012).

The fact that very little research effort has been directed towards the improvement of this crop is also a limiting factor (Aviara *et al.*, 2013).

MATERIALS AND METHODS

Sample collection was done according to the method stated by Nwankwo *et al.* (2015) and Abriba *et al.* (2013) with some little modifications. Samples were exposed to pest and mould attack at room temperature with no form of preservative or pesticides added for four months.

Sabouraud Dextrose Agar (SDA) supplemented with amoxicillin was used to grow the moulds. Each of the cereal grains will be placed at the centre of the Petridishes containing SDA supplemented with amoxicillin and incubated at room temperature (30-32°C) for 5-7 days (Nwankwo *et al.*, 2015). Blocks of Pure cultures obtained with the aid of a cork borer from the plates were stained with lactophenol cotton blue solution and examined under the microscope using ×40 objective lens. Standard mycological atlas was used to identify the moulds. The resulting spore heads and mycelia were compared with existing pictures in the atlas.

RESULTS

The four varieties of *Vigna subterranean* assessed for post-harvest insect and mould infestation were Cream black eye variety (CBEV), Cream no eye variety (CNEV), Speckled flecked spotted variety (SFSV) and Brown variety (BV).

These four varieties had different levels of susceptibility and measurable resistance to post-harvest insect and mould infestation as shown in figure 1. *Callosobruchus maculatus* (cowpea weevil) was identified as the major insect that carried out the damage across the four varieties of *Vigna subterranea*. Within the space of four months, *Callosobruchus maculatus* successfully attacked three varieties (CBEV, SFSV and BV) out of the four varieties. However, mould infestation was associated with all the varieties.

Aspergillus niger, *Penicillium species*, *Mucor species*, *Trichophyton species* and *Rhizopus species* were identified after mycological analysis of the samples. The total colony forming units (cfu) obtained from the readings per plate, indicated an increase in viable mould contamination as insect infestation increased.

The method of storage, poor hygiene and management of warehouses contributed to the level of insect infestation amongst susceptible varieties. *Vigna subterranea* in sack bags and kept in ware houses were the most prevalent method of grain storage among traders in South Eastern Nigeria as shown in plate 1. However, grains from local farmers were stored in plastic gallons to prevent insect attack as shown in Plates 2.



Plate 2: *Vigna subterranea* store in plastic gallons by local farmers of Mbu-Akpoti, Enugu State, to prevent insect mould attack.



Plate 2: Bambara nut stored in sack bags in New Enugu market ware house Enugu, Enugu state.

The dirtiness of the environment, grains of *V.subterranea* and other food grains on the floor, could attract rodents, insects and fungal spores contamination.

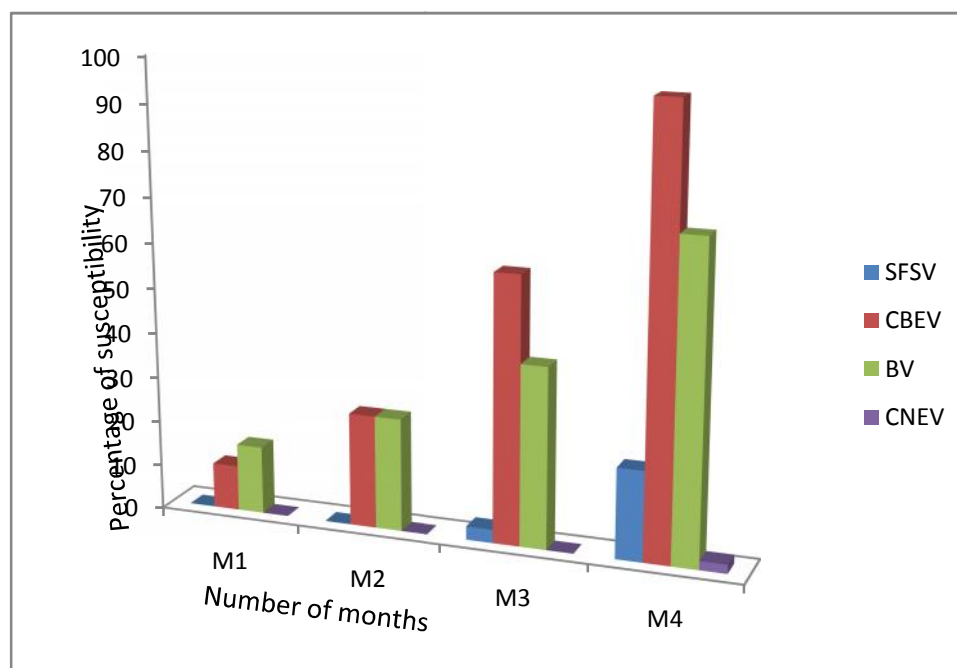


FIG. 1: Rate of insect infestation in four varieties of *Vigna subterranea* within the space of four months.

KEY:

M1-First month

M2- Second month

M3-Third month

M4- fourth month

The highest damage occurred in CBEV (Cream black eyed variety), followed by BV (Brown variety), thirdly by SFSV (speckled flecked spotted variety) and CNEV (Cream no eye variety) had no attack.

CONCLUSION AND RECOMENDATION

The war against insect and mould infestation is not a one man's battle. The Government and individuals should contribute meaningfully to see that this battle is won. The benefits of awareness amongst rural farmers who are the major producers of *V. subterranean* can never be over emphasized. Farmers and traders of this food produce should be enlightened on the importance of good warehouse management and hygiene practice. Bambara nut should be harvested at the prime of maturity as early or late harvest may enhance postharvest losses. More so, there is need for frequent monitoring of stored bambara nut for adequate remedial measures to be taken before the losses appreciates.

The mechanism by which the resistant variety is enabled is not yet researched. Therefore, Researcher in this line may chose to find out the mechanism and effort should be geared towards incorporating those properties into other varieties.

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