Comparative efficacy of the bark and root powders of *Acacia nilotica* against maize weevil *Sitophilus zeamais* (Motschulsky)(Coleoptera:Curculionidae) in Kano State of Nigeria

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**Sitophilus zeamais** is one of the most important pests of maize in storage causing severe economic damage to the grain. Comparative assessment of the efficacy of *Acacia nilotica* bark and root powder on the mortality of *S. zeamais* was conducted at Bayero University, Kano. *A. nilotica* bark and root was obtained from *A. nilotica* plant collected from Tofa L.G.A in Kano State and these were shade dried and grounded using pestle and mortar and later sieved using fine mesh to obtained fine particles. Maize grain was collected from Dawanau market. The test insect was obtained from infested maize and was identified morphologically. Twenty gram of disinfested maize were separately introduced into separate Petri dishes and three different amounts of *A. nilotica* bark and root powder (0.5, 1.0 and 1.5 g) were separately inoculated into these Petri dishes. Control treatment was then set along. All the Petri dishes were vigorously shaken. Ten adult *S. zeamais* was inoculated into each Petri dish and these were covered with muslin cloth. Each treatment was replicated three times. Mortality of the insect was assessed on daily basis. Highest mortality of the weevil (100%) was observed after 144 h of treating maize grain with the highest treatment level (1.5 g) of both bark and root powders when compared with other treatment levels (0.5 and 1.0 g) which recorded 100% of the weevil only after 168 h of treatment and this result was found to be better than untreated maize grain which does show any sign of insect mortality after 168 h of treatment.

**Key words**: Maize, *Sitophilus zeamais*, *Acacia nilotica*, bark, root, powder.

**INTRODUCTION**

Maize is a staple food in many countries throughout Africa, Latin Africa and Asia. It serves as an important source of dietary carbohydrate for human consumption. Nearly one thousand species of insect have been found associated with stored product in various part of the world (GC, 2006). According to Ngugi et al. (1985) insect is the major pest in all the major maize producing areas in Tanzania and *Sitophilus zeamais* is the major pest of the maize which cause damage to stored maize grain by boring the grain and eating the inner part which reduces maize weight and quality in terms of consumption and germination (FAO, 1985). Prempeh (1971) estimated that out of the total annual harvest of 250-300,000 tones of maize in Ghana about 2% was loss to *S. zeamais*.
Currently control of the insect largely depends on the use of synthetic insecticide. However, the use of synthetic insecticide to protect maize grain against attack of grain weevil in storage may cause serious health hazard (Talukder and Howse, 1994). Problems of pest resistance and resurgence and is quite expensive to small holders farmers (Illoba and Ekrakene, 2006). The search for alternative control measures is therefore of paramount importance. Several locally available plant materials have been reported to possess the ability of protecting maize grain in storage against infestation by insect (Ajayi and Adedire, 2003; Akinkurolere et al., 2006). Hall (1980) observed that crushed Eucalyptus leaves can be effective in the control of maize weevil S. zeamaise. The use of local plants products and other available materials to protect stored grains have been reported by Golob et al. (1982) and Hall (1980). Powders of Chenopodium ambrosioides and in combination with wood ash have been reported to be effective against S. zeamaise (Ntonifer et al., 2011). According to the authors 2 g of the powder treated with the grain caused 100% mortality within 3 days and the combination with wood ash 50:50 killed S. zeamaise at a faster rate than powder singly. The present study was conducted using bark and root powder from Acacia nilotica collected from Tofa local government of Kano State in order to assess the efficacy of these products on the mortality of the maize weevil S. zeamaise which has been a serious pest of stored maize in this region.

MATERIALS AND METHODS

Study area

The study was conducted at Bayero University Kano under ambient condition of temperature and relative humidity27±2 °C and relative humidity of 75±5 % (Fig. 1).

Collection and identification of plant materials

Bark and root of A. nilotica used in his study were collected from Tofa local government area Secretariat Farm land, Kano State and the plant parts was identified at the Department of Biological Science Bayero University, Kano.

Preparation of powders

The plant materials collected were thoroughly washed with distilled water to remove soil, and debris and later shade dried at room temperature (Mulongu et al., 2007) after drying they were then separately pounded into powder using a pestle and mortar and sieved to obtain the fine powder particles (Mukhtar and Tukur, 2000). Each powder was stored in Polythene bags until required.

Collection and disinfestation of maize grain

The maize grains used for the study were purchased from Dawanau Market, Kano State in Nigeria. Prior to the experiment the grains were disinfected in the oven at 40°C for four hours to eliminate any form of insects infestation and allow to cool at room temperature before use (Bakele et al., 1996).

Collection and identification of insects

The insect were obtained from naturally infested stored maize grains brought from Dawanau Market in Kano State. The insect was identified based on their morphological features (Halstead, 1963).

Culture of the insect

Unsexed adult of S. zeamaise were reared in jar containing disinfested whole maize grain as described by Haine (1991). The top of each jar was covered with muslin cloth fastened tightly with rubber band in order to permit aeration.

Bioassay

Bioassay was conducted based on the procedure described by Ntonifer et al. (2011) with slight modification. 20 g of disinfested maize grain were weighed into separate Petri dishes, and three different concentrations of bark and root powders from the A. nilotica plant (0.5, 1.0 and 1.5 g) was separately inoculated into separately Petri dish, containing 20 g of disinfested maize, which correspond to 2.5, 5.0 and 7.5% w/w respectively. All the Petri dish was vigorously shaken to ensure proper mixing of maize grains with plant powder. Control treatment was set along with no plant material powder. Ten adults of the insects were inoculated into each Petri dish (Mulongu et al., 2007). All the Petri dish was labeled according to the concentration used and covered with muslin cloth to permit aeration (Akinwumi et al., 2007). Each treatment was replicated three times. The experiment was arranged in completely randomized design. Mortality count of the S. zeamaise was carried out on daily basis of post treatment.

DISCUSSION

The effectiveness of A. nilotica bark and root powders against stored maize weevil S. zeamaise was assessed in this study. The result of the study indicated that all the powders used at varying level of application were better than untreated control in protecting maize against S. zeamaise infestation. The mortality of the weevil was found to increase with the treatment level and the duration of application. Highest mortality of the weevil (100%) was observed after 144 h of treating maize grain with the highest treatment level (1.5 g) of both bark and root powders when compared with other treatment levels (0.5 and 1.0 g) which recorded 100% of the weevil only after 168 h of treatment (Table 1) and this result was found to be better than untreated maize grain which does show any sign of insect mortality after 168 h of treatment. The exact mechanism of action of these powders is not clear, but physical abrasion of the insect cuticle with subsequent loss of body fluid or blockage of the spiracle (Ogunwol et al., 1998) might be implicated. The weevil might also picks up lethal doses of the treatment and this can result in stomach poisoning and consequently
Figure 1. Study area.
leading to insect mortality. The potential pesticidal activities of several plant product against insect in storage including neem, Pyrethrum and tephrosia have been reported (Akhtar and Isman, 2004; Mbaiguinam et al., 2006; Greenberg et al., 2006). The finding from this study was also in agreement with that of Tapondjou et al. (2002) that reported the effectiveness of Chenopodia ambrosioides leaves as post harvest grain protectant against six stored product beetle including S. zeamaise. Mulungu et al. (2007) have also recorded significant reduction of the number of live maize weevil when treated with leaf powder of Eucalyptus E. macrorhyncha F. Muell, pawpaw Carica papaya L. neem Azadirachta indica A.Juss and Lantana camara L. and this was similar to the finding in this study.

Conclusions

The result of this study indicated that A. nilotica bark and root powders at varying level of application were effective against stored maize weevil S. zeamaise when compared with untreated control in protecting maize against S. zeamaise infestation. These powders can therefore be use to protect stored maize against S. zeamaise infestation.

RECOMMENDATIONS

Based on the finding from this study bark and root powders from A. nilotica should be further screen in order to isolate the active compound that may be useful in developing commercially and economical available pesticide from A. nilotica plant.

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### Table 1. Mortality of S. zeamaise (in hours) treated with varying amount of A. nilotica bark and root powders.

| A. nilotica and root powder | Amount applied/20 g (Conc. in %) | No. of insects used | Mortality after infestation (in hours) |
|---------------------------|----------------------------------|---------------------|--------------------------------------|
|                           | 0.5(2.5)                         | 10                  | 24 48 72 96 120 168 192 216          |
| Bark                      | 1.0(5.0)                         | 10                  | 10.5 38.0 51.1 64 87 100            |
|                           | 1.5(7.5)                         | 10                  | 20.0 50.8 72.3 87 94.1 100          |
| Root                      | 0.5(2.5)                         | 10                  | 9 33.3 45.1 59 79.3 100            |
|                           | 1.0(5.0)                         | 10                  | 17.6 47.1 67.8 74 86 100          |
| Control (untreated)       | 1.5(7.5)                         | 10                  | 38.0 67.3 77 80.4 100            |

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