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BIO-DIVERSITY OF MAIZE STEM BORERS IN KWARA STATE, NIGERIA

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ABSTRACT

A survey of maize stem borers was conducted in selected Local Government Areas (LGAs) of Kwara State (Oyun, Irepodun, Ilorin East and Edu) from June to August, 2019. Five farms were surveyed in the LGAs for stem borer larvae, the larvae obtained were caged differently based on LGAs and reared to adult, then taken to Insect Museum at Department of Crop protection, Ahmadu Bello University, Zaria, Kaduna State for identification. The results showed that species of *Sesamia calamistis* were found to be prevalent. Also results revealed that Ilorin East Local Government Area had the highest incidence (26.4 %) and severity (49.0 %) of maize borer infestation. The result of this study has shown that all the four LGAs surveyed for maize stem borers were positive but varied in terms of incidence and severity from one LGA to the other during the 2018 cropping season. Conventional identification carried out in the insect museum showed that *S. calamistis* was the most predominant stem/stalk borer species.

Key words: Survey, stem borers, larvae, species, maize

INTRODUCTION

Maize is one of the major cereal crops and ranks third in production worldwide following wheat and rice (Romney *et al.*, 2003). In more than 20 developing countries in the world, maize is the single largest source of calories and protein for the poor and is a primary weaning food for babies. In sub-Saharan Africa, maize is one of the most important staple foods, providing food and income to over 300 million resource-poor smallholders (Olaniyan, 2015). Over 650 million people consume an average of 43 kg of maize per year which is 35 % increase since 1960, reaching 85–140 kg in Kenya, Lesotho, Malawi, South Africa, Zambia and Zimbabwe. Its cultivation spans the entire continent and is the dominant cereal food crop in many countries, accounting for 56 % of total harvested area of annual food crops and 30-70 % of total caloric consumption. Maize is a monoecious plant grown from latitude 58º N to 40º S and is adaptable to a wide range of agro-ecological zones in Africa. Over 100 million people in Africa utilize maize as a staple food crop (FAO, 2015), and as a constituent of livestock feed. Biotic factors that reduce maize yields in Africa are stem borers, the parasitic weed *Striga*and *Maize streak virus* (MSV). For instance, Alegbejo *et al.* (2002) reported that *Maize streak virus* (MSV) alone caused yield losses that range from a trace to almost 100 %. The other diseases that affect maize include leaf blight, rusts, stalk and ear rots, and systemic foliar diseases (Alegbejo *et al.*, 2002).

The yield potential for sub-Saharan Africa is 5 tonnes/ha in tropical highlands, 7.0 in subtropical and mid-altitude zones and 4.5 in tropical lowland, compared to the current yields of 0.6, 2.5 and 0.7 tonnes/ha respectively (Ukeh *et al.*, 2010). This large yield gap is attributable to both abiotic and biotic constraints.

Stem borers have been the most damaging group of insect pests in maize cultivation worldwide. Feeding by borer larvae on maize plants usually results in crop losses as a consequence of death of the growing point (dead heart), early leaf senescence, reduced translocation, lodging and direct damage to the ears. Yield losses due to stem borers in Africa vary from 0 - 100 % among ecological zones, regions and seasons. In sub Saharan Africa, particularly Nigeria, they can cause 20 - 40 % losses during cultivation and 30 – 90 % losses in postharvest and during storage. The major species of stem borers associated with maize in Nigeria are the maize stalk borer, *Busseola fusca* Fuller (Noctuidae), the pink stalk borer, *Sesamia calamistis* Hampson (Noctuidae), the millet stem borer, *Acigona ignefusalis* Hampson (Pyralidae) and the Africa sugarcane borer, *Eldana saccharina* Walker (Pyralidae) (Balogun and Tanimola, 2001). Others of less importance are the spotted stalk borer (*Chilo partellus* Swinehoe. Pyralidae), *C. orichalcociliella*, *C. suppressalis*, and the ear borer (*Mussidia nigrivenella* Pyralidae) (Khan, *et al*. 2001). *Busseola fusca* larvae feed on the aboveground parts of the grass hosts, causing economically important yield losses to crops such as maize. Feeding and tunneling by *B. fusca* larvae can result in the destruction of the growing point (resulting in "dead hearts"), early leaf senescence, interference with nutrient and metabolite translocation resulting in malformation of the grain, stem breakage, plant stunting, and direct damage to ears (Kfir *et al.*, 2002).

The severity and nature of stem borer damage depends upon the borer species, the number of larvae feeding on the plants and the plant reaction to the borer feeding. The occurrence of maize stem borers affects the crop throughout the growth stages from seedling to maturity. The objectives of this research work were to determine the occurrence and distribution of stem borers in the surveyed fields. The information thereby obtained would be useful as basis for developing resistant maize varieties.

MATERIALS AND METHODS

Study Sites and Sampling Technique

Four local government areas were selected for the study in Kwara State, namely; Oyun, Irepodun, Ilorin East and Edu. Kwara State is in the Southern Guinea Savanna of Nigeria, with Geographical Positioning System (GPS) co-ordinates of (Lat. 9.52335N, and Longitude. In each Local Government, 5 farm sites were surveyed in 2018 cropping season. The passport data of each site was captured using structured questionnaire (Plate 1). Information on the longitude, latitude and elevation of each farm was obtained using Geographical Positioning System (GPS) equipment. Details is as shown in Table 1. Maize stem borer severity was determined by visual observation of holes on the maize plants, based on 9- point rating scale (Table 2). The infested plants were selected randomly and the lepidopteron in their larval stage (stem borers) inside the infested plants were collected.

Table 1: Local Government Areas and locations where farms were surveyed

Local govt. area	Location	Long. (^{0}E)	Lat. (^{0}N)	Altitude (masl)
Oyun	Odo ata	8.113	4.721	236
"	Ago eleko	8.106	4.651	241
'	Oke ibe	8.127	4.70	239
"	Ilemonai	8.125	4.71	301
"	Oke yidi	8.082	4.682	332
Irepodun	Oro	8.235	4.51	295
"	Oke ola	8.230	4.883	302
"	Araromi ipo	8.324	4.943	227
"	Ogudu	8.260	4.803	315
"	Oke maria	8.251	4.808	321
Ilorin East	Oke oyi	8.611	4.721	298
"	Share	8.623	4.767	310
"	Babanloma	8.621	4.650	301
"	Osin gada	8.616	4.764	273
"	Osin	8.616	4.766	214
Edu	Shonga	9.004	5.148	197
"	Chigangiworo	9.004	5.142	201
"	Basin area	9.007	5.140	234
"	Maiyaki shonga	9.008	5.141	243
"	Ferry port	9.007	5.141	274

(masl= metres above sea level)

Table 2: Visual scoring scale used for assessing stem borer damage on maize plants

Visual rating of plant damage	Numerical score	Resistance reaction
Damage	0	Likely escape
Few pin holes	1	Highly resistant
Few short holes on few leaves	2	Resistant
Several short holes (<50%)	3	Resistant
Several leaves with short holes (>50%)	4	Moderately resistant
Elongated lesion on a few leaves	5	Moderately resistant
Elongated lesions on several leaves	6	Susceptible
Several leaves with long lesions or tattering	7	Susceptible
Severe tattering	8	Highly susceptible
Plant dying as a result of foliar damage	9	Extremely sensitive to damage

Source: CIMMYT,2011

Rearing of Larvae

Wooden insect cages measuring 25 by 50 cm in diameter and 50cm of height were used. The cages were cleaned thoroughly and small quantity of moist top soil was evenly distributed in the cages, before the insect larvae were introduced into the cages. The collected insects from surveyed farm sites were placed inside their designated cages for each LGA. Fresh maize leaves were continuously supplied into the cages for larval feeding.

Identification and Classification Techniques

The insects at their adult stage were taken out of their respective cages and kept in different transparent plastic containers and labeled (for the different farms at which they were collected). The samples were taken to the insect laboratory (Insect Museum) of the Department of Crop Protection, Faculty of Agriculture Ahmadu Bello University (ABU), Zaria, Kaduna State for identification and classification by comparing with various existing species in the Insect Museum.

Data Analysis

The average infested plants, in each farm from various LGAs were converted into percent infestation. The data were subjected to Analysis of Variance (ANOVA) using Minitab package version 19.2.0. Significant levels of the ANOVA were tested at 5 % probability level and means were separated using least significant difference (LSD). Borer incidence was recorded by counting the healthy and infested plants in each farm to calculate the percentage infestation of the pest as described by Liaqat *et al.* (2002) which is given as follows:

$$\text{Percentage of stem borer infestation} = \frac{\textit{Number of infested plant}}{\textit{Total number of plants}} \times 100$$

RESULTS

Incidence of stem borer infestation in selected Local Government Area of Kwara State

The results indicated that there were significant ($p \leq 0.05$) differences among the four local government areas surveyed in terms of incidence of stem borers infestation (Figure 1), Ilorin east LGA had the highest incidence (58.33%) of stem borers which was significant different from Edu (12.00%), and Oyun (13.33%), while Irepodun had the least incidence of stem borers (Table 3).

Plate 1: Picture of stem borers collected from surveyed farms in LGA's of Kwara State

Table 3: Infestation of maize plant by stem borers

Local Govt Area	Location	Hectares(m²)	Incidence(%)	Severity(%)
Oyun	Odo ata	3	7	3
"	Ago eleko	5	35	20
'	Oke ibe	10	50	20
"	Oke ita	4	20	30
"	Oke yidi	2	20	20
Irepodun	Oro	2	20	20
"	Oke ola	2	20	10
"	Araromi ipo	3	15	10
"	Ogudu	3.5	15	10
"	Oke maria	1.5	20	10
Ilorin East	Oke oyi	4	30	70
"	Share	3	4	55
"	Babanloma	2	30	50
"	Osin gada	4	30	20
"	Osin	2	35	50
Edu	Shonga	3.5	30	20
"	Chigangi woro	4	35	50
"	Basin area	3	15	10
"	Maiyaki shonga	4	25	20
"	Ferry port	4	10	12

Severity of stem borer infestation in selected Local Government Areas of Kwara State

The difference in severity of maize stem borers were significant (Figure 2). Ilorin east LGA had the highest severity (33.33 %) which was significantly different from that observed in Irepodun LGA which had the lowest severity (7.00 %). The differences in stem borer severity among other LGAs were not significantly different.

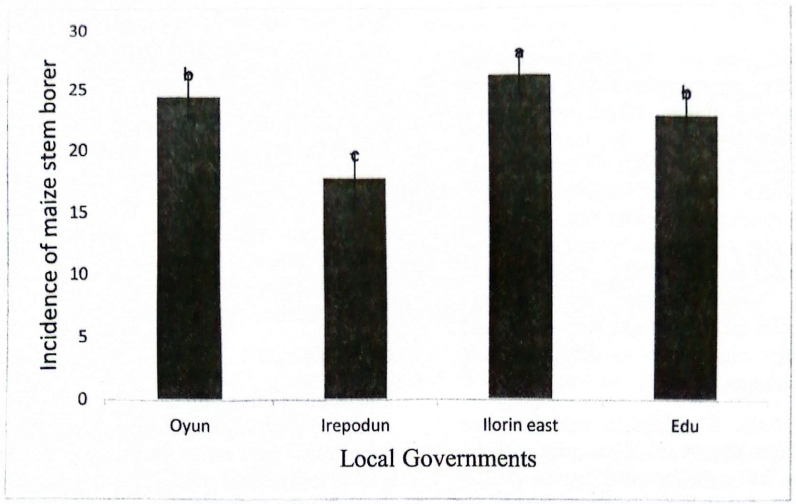

Figure 1: Incidence of maize stem borer in selected local government of Kwara State

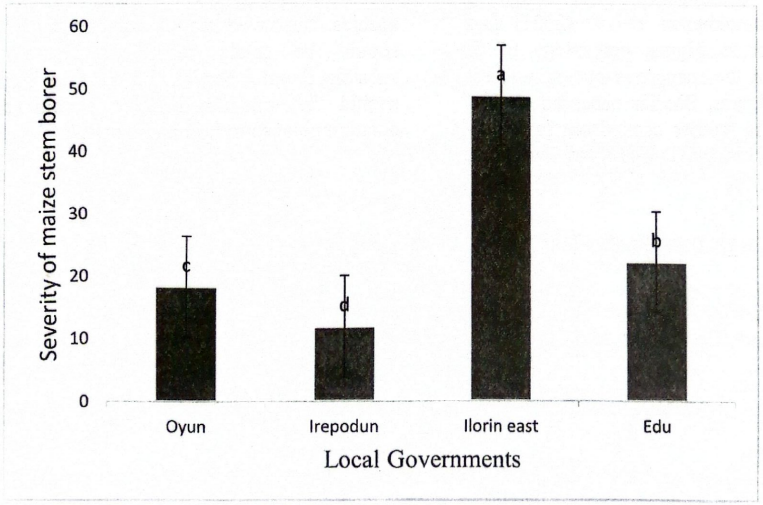

Figure 2: Severity of maize stem borer in selected local government of Kwara State

DISCUSSION

information from various farmers met on the farms during survey about the knowledge of the occurrence of stem borers was positive. They were aware of the presence and infestation of the pest, but no management strategy was attempted against it. The cropping system practiced by most farmers in the areas also encourages favourite breeding environment for the survival and infestation of stem borers because most farmers intercropped maize with sorghum, millet and pearl millet which serve as alternative host for stem borer species.

In this study, *S. calamistis* was the most predominant stem/stalk borer species. This agreed with the finding of Okweche (2010) who reported that *B. fusca*, *S. calamistis*, *C. partellus*, *E. saccharina* and *C. ignefusalis* were the most important and widely distributed lepidopterous stem borers in Nigeria. Obhiokhenan *et al.* (2001) had earlier reported higher percentage of *S. calamistis* in the mangrove and rain forest zones of Nigeria. Similar observations had been made in studies carried out in South-western Nigeria by Balogun and Tanimola, 2001 who reported that the major spec... stem borers associated with maize in Nig... are the maize stalk borer, *Busseola fu...* Fuller (Noctuidae), the pink stalk bo... *Sesamia calamistis* Hampson (Noctuid... the millet stem borer, *Acigona ignefusa...* Hampson (Pyralidae) and the Afr... sugarcane borer, *Eldana saccharina* Wa... (Pyralidae). Idoko *et al.* (2012) fou... reported that the difference in popula... between the two borer species was due to ... feeding habit of the borers.

CONCLUSION

The result of this study has shown that all ... four LGAs surveyed for maize stem bor... were positive but varied in terms of incide... and severity from one LGA to the oth... during the 2018 cropping seaso... Conventional identification carried out in t... insect museum showed that *S. calamistis* w... the most predominant stem/stalk bor... species. Improved resistant maize cultiva... should be made readily available ... subsidized rate for them. Further stud... should be conducted to ascertain th... occurrence of stem borers annually

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