NIGER AGRIC. J. 35 (2004) 103 111

RELATIVE ABUNDANCE OF *COSMOPOLITES SORDIDUS* GERMAR IN A PLANTAIN CROPPING SYSTEM IN SOUTHEASTERN NIGERIA

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ABSTRACT
A sequential sampling for the adult banana weevil, *Cosmopolites sordidus* Germar, (Coleoptera : Curculionidae) in a plantain cropping system was done in a humid forest agro-ecology of Uyo, southeastern Nigeria for twelve months to determine the relative abundance of the insect. The results obtained from two locations in the area showed a common trend with the abundance of the weevil being climatic dependent. Correlation analysis revealed that the number of the weevil was positively correlated with rainfall, relative humidity and temperature. However, it was only with rainfall that the relationship was significant ($P < 0.05$). The number of the weevil was at peak in May/June and September/October, the months rainfall was the highest. The low number of the insect encountered from December through March was attributable to the dry weather that caused soil desiccation and possible mortalities or aestivation of the insect.
Key Words: *Cosmopolites sordidus*, plantain, temperature, rainfall, relative humidity.

INTRODUCTION

Plantain (*Musa* AAB group) provides more than a quarter of the food energy requirement of estimated 70 million people in West and Central Africa (Swennen, 1990). As a food commodity, it is very rich in carbohydrates, minerals and vitamins, and is utilized in many food forms for adults, infants and invalids. Nigeria is the largest producer of plantain in the world (Swennen, 1990; Ogazi, 1996). Its prominence as a paramount food is noticed by its presence in the backyard of every rural dweller in the southern part of the country, where the climate favours its cultivation.

However, the actual yield of plantain in Nigeria is as low as 15 t ha^{-1}. This is far below its potential yield of 50 t ha^{-1} (Tezenas du Montcel, 1987). A major constraint in the cultivation of plantain is the damage caused by the banana weevil, *C. sordidus*. This insect is of global importance in the cultivation of crops in the Musaceae family. Ortiz *et al.*, (1995) reported that of all the cultivated bananas, plantain is the most susceptible to *C. sordidus*. Hills (1983) had asserted that this insect was found wherever plantain was grown in Nigeria, particularly in southeastern Nigeria.

The female insect is known to lay its eggs singly on the corm of plantain slightly above or below soil level (Frison, *et al.*, 1999). The eggs hatch into larvae, the only damaging stage of the insect. These bore into the corm where they feed and grow until they metamorphose into the pupae. The feeding by larvae significantly disrupts absorption and translocation of plant nutrients. Feeding marks by larvae are seen as galleries on the periphery and cross-section of the corm. Plantain so infested looks weak and stunted and are prone to snapping, toppling and poorly filled fruits. Damage is often exacerbated by secondary pathogens such as nematodes and fungi (Vuylsteke, *et al.*, 1993; Gold *et al.*, 1998). Rukazambuga (1996) reported that in East Africa, yield losses attributable to the weevil was over 52% in the third ratoon crop.

Studies on the banana weevil are sparse in Nigeria. A recent survey of pests of plantain in the study area, Akwa Ibom State, southeastern Nigeria (Inyang, 2004), highlights the prominence of this insect as all plantain plots surveyed were infested.

Knowledge of the population fluctuation of insect pests is a necessary tool in effective management decision (Kumar, 1984; Dent, 1991). Shillingford (1988) stated that environmental factors influence the population levels of the banana weevil and this may determine extent of damage. It is therefore necessary that the relative abundance of the insect be established in local agro-ecosystems. From studies carried out elsewhere, a certain degree of controversy exists over the relative abundance of the insect. Uzakah (1995) cited workers in different agro-ecologies with reports of marked variations in the insect abundance within the year. Some of them reported that the adult population of the insect were subject only to short term fluctuations, being relatively constant throughout the year, and were little influenced by climatic factors. Others found peak populations during the dry season. Pavis and Lemaire (1996) similarly reported on contrasting results by workers.

This study was conducted to determine the population trend of the adult banana weevil and how this was related with climatic factors in the plantain cropping system of Akwa Ibom State, representing the humid rainforest of southeastern Nigeria.

MATERIALS AND METHODS

The study was carried out between May 2001 and April 2002 in Uyo, Akwa Ibom State, one of the major plantain producing areas of Nigeria (Ogazi, 1996). Uyo is situated on latitude 4°3' and 5°3'N; longitude 07°05' and 8°20'E with an altitude of 100m above sea level (Peters *et al.*, 1989).

Sampling/trapping of adult banana weevil

Adult banana weevils are free-living but have been found to be attracted to the corm or pseudo-stem of plantain. Thus, traps from these materials are used to attract the beetles for the purpose of monitoring their population in an area (Swennen, 1990; Ogenga-Latigo and Bakyalire, 1993; Gold *et al.*, 1994). In this study sequential sampling of adult banana weevils was done in two selected backyard plantain plots of over eight years old in Uyo, Akwa Ibom State, Nigeria.

Preparation and placement of traps

Gold and Bagabe (1997) reported that in a study of traps used for banana weevils, they found the greatest catch is made by traps placed at the base of the banana mats. Consequently, in this study traps were prepared from pseudo-stem of plantain freshly cut as described by Swennen (1990). The pseudo-stems were cut diagonally into 15-18 cm lengths and each was split into two equal halves. Then split surfaces were placed at the base of selected plantain mats, two per mat at 180° apart as shown in Plate 1.From each location, sampling/trapping of adult weevils was done from ten randomly selected plantain stools. Traps were set up and weevil population counted three days after setting up the traps (Plate 2). Pseudo-stem traps were replaced with fresh traps after counting of weevil. During each counting day, the traps were carefully overturned and trapped adult weevils were counted. The spots the traps were placed were also carefully examined for any weevil left on the soil surface. The number of weevils was recorded. The counting of weevils was done six times per month.

Computation of weevil population

The population of weevils per month, plantain stool, per trap and sampling day was computed following the methods of Sharma and Lopez (1990) and Baker and Addison (1992). The monthly population was the cumulative total trapped for the month. A total of ten stools were sampled per location and since each stool had two pseudo-stem traps, there were a total of 20 traps per each location and adult weevils were counted six times per month. Therefore the monthly weevil population was divided by 10, 20 and 6 to give the weevil population per stool, trap and sampling day respectively.

The total number of weevils trapped was classified per stool, per trap and per sampling day for the two locations. The yearly average was computed from the monthly weevil population.

Paired t-test (Wahua, 1999) was used to determine any significant difference between the two locations sampled. The population trend of the adult weevil was depicted graphically by curve obtained by plotting the weevil numbers trapped against months of sampling. The weather parameters namely temperature, rainfall and relative humidity during the period of sampling, were monitored from the Meteorological Unit of the University of Uyo. A correlation analysis was done to determine any relationship between the weevil numbers and the weather parameters.

RESULTS AND DISCUSSION

The number of banana weevils trapped during the twelve months sampling are presented in Table 1 and the weather parameters during the same period are presented in Table 2 while the curves obtained when weevil numbers, rainfall, relative humidity and temperature where plotted against the months of the year is presented in Figure 1.

Table 1 indicated total weevil number, monthly total trapped, number per stool, number per trap and number per day. T-test analysis indicated that there was no significant difference ($P > 0.05$) between weevil numbers trapped from plantain in the two locations sampled (calculated $t = -0.28$ and tabulated t ($t_{0.05}$) = 2.074). The weevil numbers showed a bimodal peaks within a year. The first and higher peak occurred between April and June and the second and lower peak between September and October. Low numbers occurred between December and February and also between July and August (Fig. 1). A simple linear correlation analysis showed that the correlation coefficient between weevil numbers and rainfall was positive ($r = 0.82$) and significant at 5% probability level. The relationship between the weevil numbers and relative humidity and temperature were also positive but not significant: $r = 0.30$ and $r = 0.02$ respectively.

The results obtained in this study have shown that the population of *C. sordidus* was weather dependent. Rainfall was not only positively correlated with the weevil numbers, but significantly ($P < 0.05$) too. Usually, soil moisture level and relative humidity have direct correlation with rainfall (Frison *et al.*, 1999). Banana weevils have been reported to respond positively to moisture regime (Frison *et al.*,1999), highly susceptible to desiccation and prefer moist environments (Roth and Willis, 1963). Factors influencing soil moisture may therefore encourage moisture may therefore encourage banana weevil (Ittyeipe, 1986; Jones, 1986). A rainfall regime range of 0.00 (January) 503.2 (June) obtained during the period of study was wide enough to affect the population dynamics of the weevil.

Plate 1: Trapping technique for adult banana weevil using split pseudo-stem (arrowed)

Plate 2: Trapped weevils (arrowed) are seen on the split pseudo-stem surface when upturned during counting day.

Table 1: Mean numbers of banana weevils trapped from two plantain plots (Location 1 and location 2) in Uyo, Akwa Ibom State, southeastern Nigeria for twelve months of trapping.

Month	Total monthly weevil trapped Location one	Total Monthly Weevil Trapped Location two	No. Of Weevil Per stool Location one	No. Of Weevil per stool Location two	No. Of Weevil Per trap Location one	No. of weevil per trap Location two	No. Of Weevil Per sampling day Location one	No. Of weevil per sampling day Location Two
January	2	7	0.2	0.7	0.1	0.4	0.3	1.2
February	7	12	0.7	1.2	0.4	0.6	1.2	2.0
March	10	13	1.0	1.3	0.5	0.7	1.6	2.1
April	13	15	1.3	1.5	0.7	0.8	2.1	2.5
May	47	32	4.7	3.2	2.3	1.6	7.8	5.3
June	48	47	4.8	4.7	2.4	2.4	8.0	7.8
July	7	15	0.7	1.5	0.4	0.8	1.1	2.5
August	7	12	0.7	1.2	0.4	0.6	3.0	2.0
Sept.	18	18	1.8	1.8	0.9	0.9	3.0	3.0
October	23	18	2.3	1.8	1.2	0.9	3.8	3.0
Nov.	15	22	1.5	2.2	0.8	1.1	2.5	3.6
Dec.	10	15	1.0	1.5	0.5	0.8	1.6	2.5
Σ	207	226	20.7	22.6	10.4	11.3	34.5	37.7
Mean	17.3	18.8	1.7	1.9	0.9	0.9	3.1	3.1
Calculated T ($t_{0.05}$)		0.28						

Tabulated $t_{0.05}$=2.074

Table 2: Average rainfall, relative humidity and temperature during the period of sampling for the banana weevil, *Cosmopolites sordidus* in the study area

Period of sampling (months)	Rainfall (mm)	Relative humidity (%)	Temperature (°C)
January	0.0	58	26.9
February	10.8	68	28.1
March	135.1	78	27.9
April	261.4	82	27.6
May	339.7	81	27.1
June	503.2	80	26.5
July	219.0	85	25.7
August	182.6	87	25.3
September	270.6	86	25.5
October	225.6	84	26.0
November	117.3	82	26.6
December	0.4	78	26.5

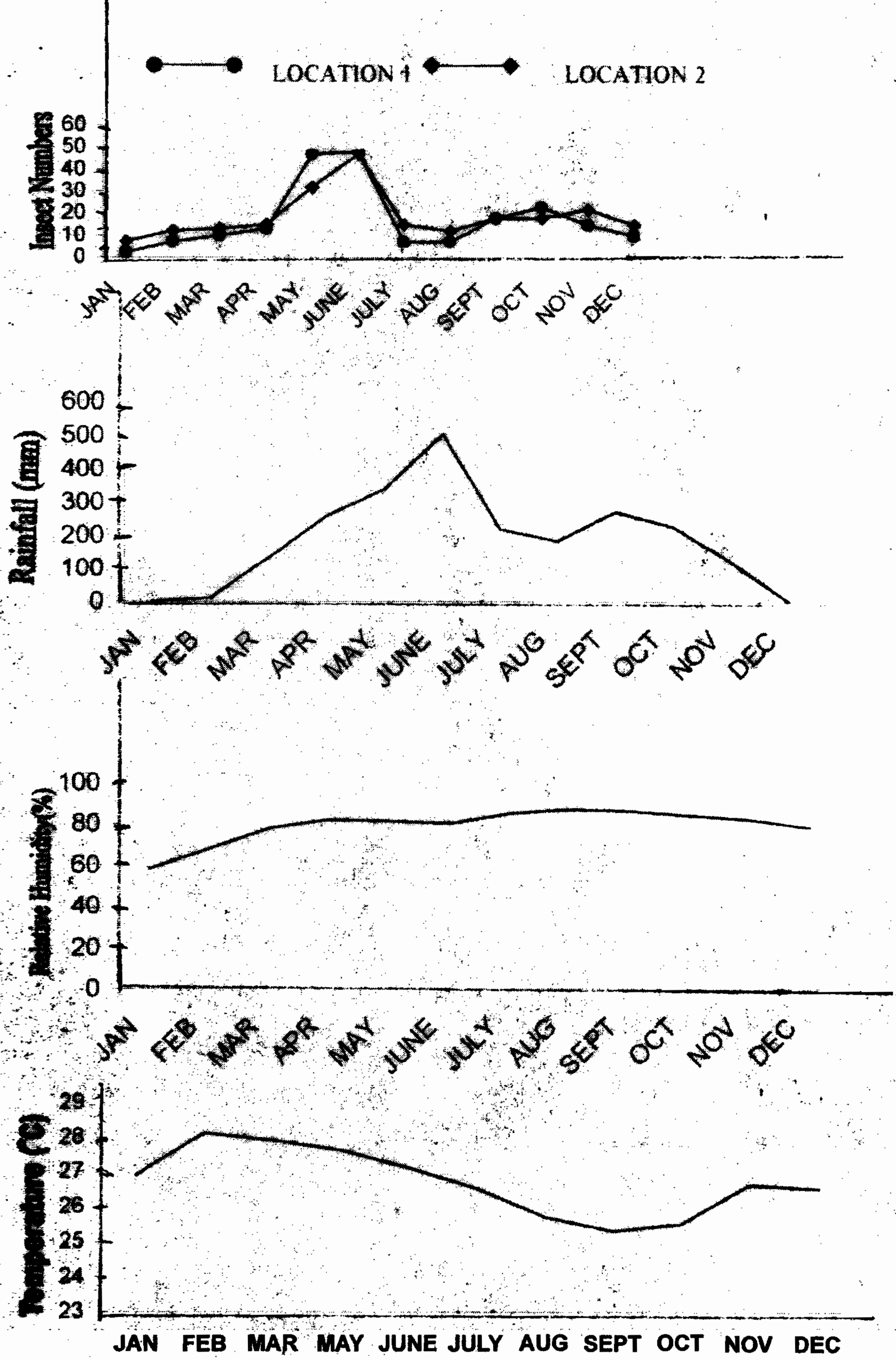

Fig. 1: Curve patterns for banana weevil numbers, rainfall, relative humidity and temperature during sampling period

The correlation between the weevil number (population) and the relative humidity and the temperature, though positive, was not significant.

Cuille (1950) had attributed variation in the population dynamics of the curculionid weevil in French West Indies among other factors to variation in temperature and humidity. Shillingford (1988) had also alluded to this. However, Arleu *et al.* (1984) reported that the adult insect population was not so much influenced by climatic factors. Uzakah (1995) cited Cardenas and Arango (1986) as reporting that t no relationship existed between *C. sordidus* population and rainfall but higher humidity increased trap catches.

The main population peaks found in this study were in May/June and September/October coinciding with highest rainfall months of the period of study. Arleu *et al.*, (1984) observed main population peaks of the weevil at the start of rainy season with smaller peaks coinciding with lowest rainfall levels. A depression in the weevil population curve in July and August might be due to high moisture level accumulated from the heavier downpour of May/June. Frison *et al.*, (1999) had observed that high soil moisture level encourages banana weevil movement while Inyang and Ansa (2002) had observed that high moisture levels leads to high mortalities of terrestrial arthropods. The observation by Arleu *et al.*, (1984) indirectly support the idea that weevil population can be hampered by excessive rainfall. The low numbers of the weevil obtained in this study from November through March is attributable to dry weather. However, Pinheiro *et al.*, (1985) cited by Uzakah (1995) in their work in old established plantations in Brazil observed peak population of the weevil in dry season.

CONCLUSION

The study has revealed the occurrence of *C. sordidus* in the plantain cropping system of Akwa Ibom State of Nigeria. The high population of *C. sordidus observed* in the area is a warning sign that control must be incorporated into plantain farming for optimum performance and yield of the crop.

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