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# Occurrence and Seasonal Variation of *Heteroligus meles* Billb (Coleoptera: Dynastidae) in Upper Niger Delta, Nigeria

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**Abstract:** Studies conducted in 2004/2005 in the rainforest ecological zone of Anwai-Asaba in the Upper Niger delta, Nigeria, examined the occurrence and seasonal variation in the population of yam tuber beetles (*Heteroligus* sp.). The beetle population started building up in May with the peak occurrence as determined by the light traps occurring in July-August. The population trend is climate dependent and the peak was unimodal. Correlation analysis was negative for temperature (b = −0.662) while it was positively correlated with rainfall (b = 0.552) and relative humidity (b = 0.543). Based on the coefficient of determination ($R^2$), beetle occurrence can be predicted on weather elements studied to about 52% for rainfall, 29% relative humidity and 44% for temperature. The best predictive tools for monitoring the commencement of occurrence of the yam beetle are the three major weather parameters, namely temperature, relative humidity and rainfall but the later was more critical according to this study.

**Key words:** Occurrence, yam beetle, population, Niger delta, variation, coefficient

## INTRODUCTION

Yams, *Dioscorea* sp. (Dioscoreae) make important contribution to the agricultural economy of most tropical countries that grow the crop. They are a staple carbohydrate food and income earner through trading in the commodity (IITA, 1998; Nweke *et al*., 1997). Africa produces about 32.9 million metric tones of yam tubers annually (representing about 95% of world's output) and Nigeria alone contributes 28 million metric tones (FAO, 1997; Central Bank of Nigeria, 2005). Recent report indicated Nigeria as the largest producer of yam in the world with annual production of 36.72 million metric tones out of the global total output of 51.49 million metric tones in 2006 (FAO, 2009). Inspite of the important contributions of yam to the socio-economic life of the people, damage caused by yam beetles is a major constraint to higher tuber yield in Nigeria (Taylor, 1964; Tobih and Emosairue, 2006). About four major species of yam beetles have been reported in Nigeria namely, *Heteroligus meles* Billb, *H. appius* Burm., *Prionoryctes rufopiceus*, Arrow and *P. cannaliculus* Arrow (Taylor, 1964). *Heteroligus* sp. are the commonest and most widely distributed. In the old Asaba province of Delta state, Nigeria, yam beetle damage was estimated at 20% (Taylor, 1964). More recent studies by Tobih and Emosairue (2008) and Tobih (2007a, b) showed that yam beetle damage ranged from 31-51% resulting in 23-60% loss in tuber yield. Various type of light traps are used to make phenological observations on insect species. They may be used for general or long-term studies on the diversity of a fauna of a particular group or species (Geir, 1960; Southwood, 1968). This study was undertaken to examine the occurrence and seasonal variation of this important soil insect of yam in Asaba area of upper Niger Delta of Nigeria.

## MATERIALS AND METHODS

**Study area:** A 2 year study (Jan, 2004-Dec 2005) to determine the occurrence and seasonal variation of yam beetle (*Heteroligus* sp.) was carried out in Anwai-Asaba campus of Delta State University. The area is located at (latitude 06°14$^1$ and longitude 06° 49$^1$E) with a hot humid climate, mixed vegetation of forest interspersed with shrubs and grasses. The rainfall pattern is bi-modal with peaks in July and September (1.505 mm), mean temperature of 28±6°C, relative humidity varies from 69-85% while the solar radiation is about 4.8 bars (Nigerian Meteorological Agency, Delta State meteorological Inspectorate, Asaba, (NMA, 2005).

Ten 200 W light traps were placed infront of randomly selected residential houses and classrooms very close to beetle breeding sites. The traps were monitored daily from 1830-1200 h and the beetles attracted were collected daily from the ground or wall of building. Total collections from all traps were summed up monthly. Sample specimens of the adult beetles were sent to the Institute of Insect Museum, Department of Crop Protection, Ahmadu Bello University, Zaria, Nigeria for identification. Correlation analysis was used to determine the relationship between weather variables (temperature, rainfall and relative humidity) and beetle numbers while predictive equations were obtained by regression.

## RESULTS AND DISCUSSION

The adult beetles were identified by comparison with paratypes as *Heteroligus meles*. Occurrence of the beetles commenced in May 2004 when the erstwhile high mean temperatures dropped from approximately 29°C and above to 28°C while the mean relative humidity increased from 79-85% in the same months and year under consideration. Similar upward increases were observed in the rainfall pattern for the same period. The number of adult beetles caught in the month of July and August were 205 and 350 individuals, representing 26 and 44.4% of the total adults caught in the 2004 sampling (Fig. 1).

The beetle peak population coincided with the period when the mean temperature was approximately 27°C, relative humidity 86-88% while rainfall was between 213-273 mm for the same months of July and August, respectively. In 2005 (Fig. 2) the occurrence of the yam beetle commenced in May when the mean temperature dropped from 31°C in April to 29°C while the mean relative humidity increased from 78-82% within the months and year under consideration; rainfall however, increased dramatically from 88 mm in April to 195 mm in May of 2005 sampling.

The number of beetles attracted to light followed the same trend as in 2004 sampling where a total of 182 and trapped. Coincidentally, the mean temperature was 27°C, relative humidity, 86-89% while rainfall ranged from 354-363 mm for the months of July and August in the year under consideration. The 2 year samplings indicated that the occurrence and variation in the population of the yam beetle is weather dependent.

Relative humidity and rainfall were positively correlated with beetle numbers but were not significant ($p \geq 0.05$). However, temperature was negatively correlated with beetle population but was not also significant at 5% probability (Table 1, Fig. 3a-c).

The commencement of the adult beetles is synchronised with the planting season of yam in which temperature is usually low while rainfall and relative humidity are high hence the correlation of these weather elements with beetle occurrence. This was equally reported by Taylor (1964), Onwueme (1978) that yam beetle migrate principally for feeding and breeding purposes. Soil moisture regime and relative humidity was reported by Frison *et al.* (1999) to cause positive response in banana weevils (*Cosmopolites sordidus*) because they are known to be highly vulnerable to desiccation. The observation appear true for yam

Table 1: Pooled correlation coefficient between mean weather, parameter and beetle population for 2004 and 2005

| Weather variables | Mean annual temperature (°C) | Mean relative humidity | Mean annual rainfall (mm) | Mean beetle population |
|---|---|---|---|---|
| Mean annual temperature (°C) | 1.000 | | | |
| Mean % relative humidity | -0.652* | 1.000 | | |
| Mean annual rainfall (mm) | -0.652* | 0.755** | 1.000 | |
| Mean beetle population | -0.662 | 0.543 | 0.552 | 1 |

*Correlation is significant at 5% probability level; **Correlation is significant at 1% probability level

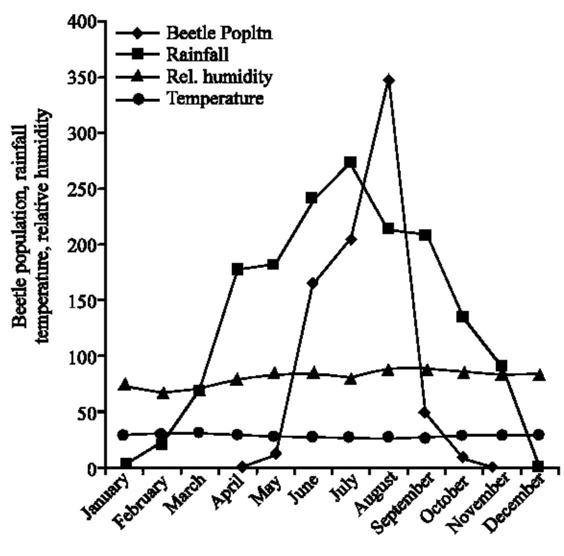


Fig. 1: Distribution of beetle population and major weather parameters, 2004

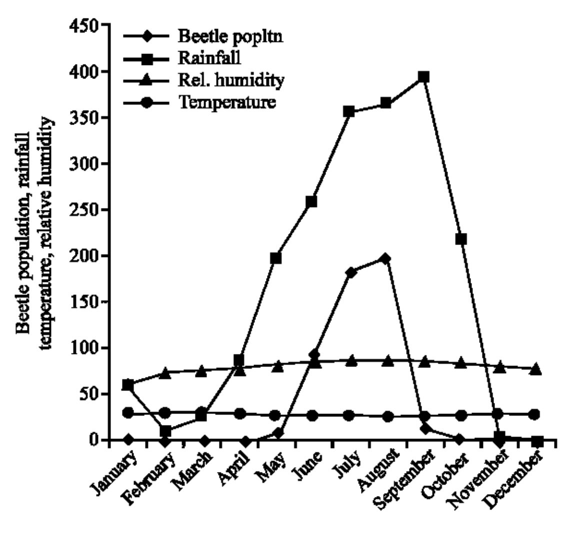


Fig. 2: Distribution of beetle population and major weather parameters, 2005

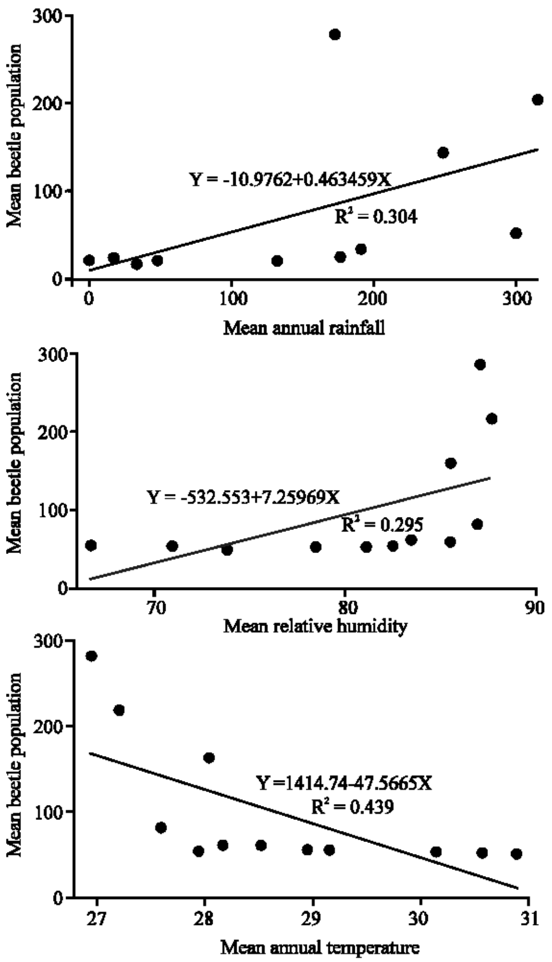


Fig. 3: Relationship between beetle population and mean annual rainfall, relative humidity and temperature

beetles too as it prefers moist environment and good soil moisture with optimum relative humidity and rainfall. This result agreed with the studies of Inyang and Emosairue (2004) on relative abundance of *Cosmopolites sordidus* conducted on plantain cropping system in Southeastern Nigeria. There, it was reported that weevil population is climate dependent with regards to temperature, rainfall and relative humidity.

The peak population of the beetle in July/August for the 2 years studies corroborated earlier report by Tobih *et al.* (2007b) where July/August was reported as the peak period for yam beetle population in Aniocha and Oshimili areas of Delta State, Nigeria. A good knowledge of population fluctuation of any insect pest is a necessary and useful tool in effective management decision according to Kumar (1984). It does appear from this study that the population density and rate of infestation of the beetle vary from year to year and place to place depending on the prevailing biotic and climatic factors (Umeozor, 1998; Taylor, 1964). Yam beetles could only cause damages to yam tubers for a maximum periods of 6-7 months (May-October) according to this investigation whereas other periods they are involve on breeding flight (Nov/Dec) or feeding flight, April/May each year (Taylor, 1964). It was observed that no adult beetle was trapped during breeding periods. This may be due to their migration to the low land areas for hibernation in the case of *H. appius* and breeding purposes for *H. meles* (Taylor, 1964). The pooled regression curves for the weather parameters against beetle population are shown in Fig. 1 while the pooled correlation coefficient between weather and beetle population is shown in Table 1. The correlation analysis indicates an inverse relationship between temperature and beetle population where b = -0.662 (Table 1). Conversely, the same analysis indicated positive relationship for relative humidity (b = 0.543) and rainfall (b = 0.550) although they were not statistically significant ($p \geq 0.05$).

## CONCLUSION

In this study, the regression equation indicated that the weather elements can be used as a monitoring tool for commencement of beetle and their population. For example, about 52% forecast can be made for rainfall, 29% for relative humidity and 44% for temperature. However, it is suggested that the study periods be increased to at least 10 years for more accurate and reliable forecast to be made. Farmers in the study area are advised to plan their yam planting in such a way to avoid the tuberlization period coinciding with the peak population density of the yam beetle in July and August since more attack is likely to occur this period.

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