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## INFESTATION AND ABUNDANCE OF FRUIT FLIES OF MANGO AND ORANGE FROM SELECTED MARKETS IN AKWA IBOM STATE, NIGERIA

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### ABSTRACT

Mangoes and orange fruits need important consideration if fruit production is to be successful and sustainable. Insect pests and diseases threaten the profitability of mango and orange farming. In particular, fruit flies have become an increasingly prevalent insect in Nigeria, owing to the damage incidence and economic losses, especially to the mango and orange value chains. This study was conducted to determine the species composition, abundance and prevalence of fruit flies on mango and orange fruits from Akwa Ibom State. Two (2) varieties of mango fruits comprising German and cherries types were gotten from 2 markets (Etinan urban and Itam markets) while oranges were obtained from 3 markets (Akpan Andem, Itam and Mbiopkoro markets). Fruits were kept in the laboratory in cups and covered in such a way as to keep them away from any other pests and prevent emerging fruit flies from escaping. The samples were studied at ambient conditions and were incubated for up to 4 weeks until all the fruit flies emerged as adults. Three species of fruit fly were identified from the different types of mango namely: *Drosophila melanogaster*, *Bactrocera dorsalis* and *Bactrocera papayae*. Mango fruits from Etinan urban had the highest abundance of fruit flies infestation than those from Itam market (81.7% and 18.3%) respectively. Among the fruit flies encountered during the study, *Drosophila melanogaster* had the highest prevalence (95.4%) and the least was *Bactrocera papayae* (1.42%). Two species of fruit flies (*Drosophila melanogaster* and *Bactrocera dorsalis*) were identified on oranges. *Drosophila melanogaster* was higher in abundance (79.38%) than *Bactrocera dorsalis* (20.62%). Oranges from Mbiopkoro were the most affected. Species diversity and evenness were slightly different amongst the 3 markets. The current study has shown Mango and orange fruit flies infestation to be a serious threat to fruit production in Akwa Ibom State. Since the population of these pests are detrimental to the economic values of mango and orange fruits, control measures should be put in place.

**KEYWORDS:** *fruit flies, infestation, mango, orange, fruits*

### INTRODUCTION

Fruit and vegetable production is one of the fastest growing sectors of the horticulture industry in Africa (Weinberger and Lumpkin, 2007). They hold a key position in agricultural production in Africa due to the number of farmers involved and the income generated by this industry. The subsector contributes to poverty alleviation by promoting food security while helping to increase total export earnings. It has been an integral part of the economic growth and development of Africa and can have a positive impact on the achievement of the Sustainable Development Goals (SDGs) in sub-Saharan Africa (World Bank, 2008). Throughout Africa, several fruit and vegetable crops are grown for both domestic and export markets. The major ones include mango and citrus (Gafoor et al., 2010). Many pests and diseases threaten the profitability of the agricultural fruit crop subsector, particularly, the fruit flies (Ryckewaert, 2003), forcing farmers to resort to synthetic pesticides with all the risks that this entails for human health, other non-targets and the environment. Pests and diseases, insufficient investments, inadequate basic and applied research, porous quarantine borders and economic treaties, limited knowledge of the incidence and management of key pests and diseases (Norman, 2003), hinder the subsector from realizing its full potentials. Currently, the key insect pest constraint for the increased and sustainable production of fruit and vegetable crops in Africa is infestation by fruit flies (Jaeger, 2008).

Tephritid fruit flies have been recognized as one of the most economically important group of insects which pose serious threat to the fruit and vegetable industry in Sub-Saharan Africa (SSA) (White and Elson-Harris, 1992; Ekesi and Billah, 2006; De Meyer et al., 2010). The oriental fruit fly, *Bactrocera dorsalis* mostly prefer mango and citrus fruits as host (Jayanthi and Varghese, 2002). In Nigeria, citrus is the most widely grown fruit crop (Umeh et al. 1998; Ibeawuchi et al. 2015). Geographic distribution of global citrus production on the average from 2009 to 2010 showed that Nigeria is the world's seventh largest producer of citrus (UNCTAD, 2013). However, Tephritid fruit fly attacks on citrus cause economic yield losses and have been identified as the major constraint to citrus production in Nigeria (Umeh et al. 1998; Umeh and Onukwu, 2011). The same can be said about the effect of fruit flies on mango production in Nigeria. This has drastically affected the quality of fruits and foreign exchange earnings from mango and citrus production for Nigeria (Umeh et al., 1998; Agus et al., 2022).

Fruit fly infestation has led to heavy losses in yield and quality of fresh fruits. Fruit fly research and management is yet to be fully optimized in most parts of Africa including Nigeria. There is limited knowledge and awareness among stakeholders along the fruit and vegetable value chain in Akwa Ibom State and Nigeria at large in terms of the species concerned, their economic impact and management strategies (STDF, 2009), and hence, this study.

**Materials and method**

**The Study Area**

This study was conducted in the laboratory of the Department of Animal and Environmental Biology, Faculty of Science, University of Uyo, Nigeria. Uyo is the capital city of Akwa Ibom State, Nigeria. It lies in the coastal zone of the tropical rainforest of Nigeria, within latitude 4°32' N and 5°33' N and longitude 7°25' E and 8°25' E. The study was carried out between May and July 2018 and between August and September, 2023. Fruits bought for the study were randomly selected from Akpan Andem, Itam and Mbiokoro markets in Uyo metropolis and Etinan urban markets in Etinan LGA of Akwa Ibom State, Nigeria. The study areas are characterized by both rainy and dry season, with rainy and dry seasons lasting from April to October and from November to March respectively.

**Fruit handling methods and rearing of fruit flies**

Fruits were placed on plastic containers, containing 1.5cm layer of sterile saw dust. One sample each was placed in one container. The covers of the container were perforated, and a little hole was made on each container. The holes were capped with cotton wool to maintain a well aerated room under ambient conditions. The samples were incubated for up to 4 weeks until all the fruit flies emerged as adults. Adult flies were then extracted by using aspirator, transferred into a holding tube before identification. Sample size of orange (*Citrus sinensis*) and two mango types [*Mangifera indica* (German Type; Long) and *Mangifera indica* (Cherrie Type; Short)] were primarily determined by the availability of fruits. Fruits were identified at the Department of Botany and Ecological Studies, University of Uyo.

**Identification of fruit flies**

Fruit flies extracted from the fruits were identified using morphological features such as size, colour of the entire body as well as of the eyes. Other features include patterns

on both thorax and abdomen. *Drosophila melanogaster* is usually red-eyed, tan or pale yellow in color, with size of about 1/3 of a housefly. The *Bactrocera* species are specifically identified by the various thoracic and abdominal patterns. These morphological identifications were done in line with the published keys of Billa et al. (2009) and Miller et al. (2017).

**RESULTS**

The result of infestation and abundance of fruit flies of orange and mango indicated the presence of only two (2) fruit fly species, *Bactrocera dorsalis* and *Drosophila melanogaster* on orange and three (3) species on mango fruits, *Bactrocera dorsalis*, *Bactrocera papayae* and *Drosophila melanogaster*. Fruit fly data for mangoes from Etinan urban and Itam markets is presented in table 1. There was a significant difference in the abundance of fruit flies on mango fruits from the study areas as well as among different fruit fly species. The fruit flies data for oranges from Akpan Andem, Itam and Mbiokoro markets is presented in Table 2. There was a significant difference in the abundance of different fruit flies on orange fruits from the study areas but not among the different markets sampled.

Table 3 shows that during the study, *Drosophila melanogaster* was observed to have the highest prevalence in all the markets sampled, followed by *Bactrocera dorsalis*. The least was *Bactrocera papaya*, for mangoes. On oranges, *D. melanogaster* also had the highest prevalence than *B. dorsalis*. Mango fruits from the Etinan urban market were found to be infested by three species of fruit flies whereas only one (1) species of fruit fly (*D. melanogaster*) was present in samples collected from Itam market. On oranges, fruits from all the markets sampled had both *D. melanogaster* and *B. dorsalis* infestations only.

Table 1: Fruit fly abundance of mangoes from Etinan Urban and Itam markets.

Fruit source	Fruitfly Species			Total
	<i>Drosophila melanogaster</i>	<i>Bactrocera dorsalis</i>	<i>Bactrocera papayae</i>	
Etinan Urban	10,845	450	200	11,495
Itam	2570	-	-	2570
Total	13,415	450	200	14,065

X<sup>2</sup> calc= 152.23, X<sup>2</sup> tab= 5.991, df= 2, p< 0.05

Table 2: Fruit fly abundance of oranges from Akpan Andem, Itam and Mbiokoro markets in Uyo metropolis

Fruit source	Fruit fly species		Total number of fruit flies
	<i>Drosophila melanogaster</i>	<i>Bactrocera dorsalis</i>	
Akpan Andem	139	34	173
Itam	140	38	178
Mbiokoro	103	42	145

X<sup>2</sup> calc= 72.34, X<sup>2</sup> tab= 3.973, df= 1, p< 0.05

Table 3: Prevalence of different fruit fly species infestation on mango and orange fruits in the study areas.

Study Area	Fruit Fly Species of mango			Total
	<i>Drosophila melanogaster</i> prevalence (%)	<i>Bactrocera dorsalis</i> prevalence (%)	<i>Bactrocera papayae</i> prevalence (%)	
Etinan Urban	10,845(94.4)	450 (3.9)	200 (1.7)	11,495 (100)
Itam	2570(100)	0 (0)	0 (0)	2570 (100)
Study Area	Fruit Fly Species of oranges			Total
Akpan Andem	139 (80.3)	34 (19.7)	0 (0)	173 (100)
Itam	140 (78.6)	38 (21.4)	0 (0)	178 (100)
Mbiokporo	103 (71.0)	42 (29.0)	0 (0)	145 (100)

## DISCUSSION

Among the two (2) mango varieties studied, *Drosophilla melanogaster* attacked the german type more than the cherries type. This finding is in agreement with that of Vergas *et al.* (1990), and Agus *et al.* (2022). This finding could as well be attributable to the conditions at the Etinan urban markets, especially storage and preservation methods. Fruits obtained from the Itam market; a more urban market had lower fruit fly infestation. Trader around Uyo metropolis most times buy fruits while still on the trees. It is possible the traders harvested these fruits before they were fully ripped to prevent pest infestation and wastages and thus inhibited the abundance of fruit fly infestation. It is also possible that this urban market may have better sanitary procedures and practices that minimize reservoir spoil fruits from where adult fruit flies may emerge and infest fresh mangoes. *Bactrocera dorsalis* in was only found in the Etinan urban market but absent in fruits bought from Itam market. The abundance of *Bactrocera dorsalis* in German and Cherries type from Etinan urban market could be due to cultivation of other crops that also serve as food and habitat for this fruit fly species. The work of Qureshi *et al.* (2000), who reported that local varieties did not show any satisfactory resistance against fruit flies on Mango agrees with this observation. The absence of *Bactrocera dorsalis* in German and cherries type from the Itam study site may be due to the use of pesticides on vegetables and fruits being sold at the markets resulting in the reduction of fruit fly numbers. *Bactrocera papayae* recorded 119 and 81 in German and Cherries types respectively from Etinan Urban whereas more was recorded in both mango varieties from the Itam market.

Naturally ripped fruits were found more in Etinan urban market and could be why more fruit flies were present, as infestation increases with ripening. These results are similar to that of (Liu and Yeh, 1982; Tariq *et al.*, 2002; Umeh *et al.*, 2009), who related the abundance of fruit flies with the ripening of crops. Temperature and other abiotic factors had a non-significant effect on the abundance of fruit flies. This also agrees with the results of Raghuvanshi *et al.* (2012). On oranges, the present study revealed that *Drosophila* species is the dominant fruit fly over *Bactrocera* species infesting oranges and mango fruits sold in all the markets under this study. Though, no record has been documented on the fruit fly species composition of orange and mangoes in Akwa

Ibom State, some researches have been carried out in the South South region of Nigeria. Umeh *et al.* (2008) reported the presence of *Bactrocera* species in Delta, Edo, Ogun, Anambra and Benue which are among the major orange producing states in Nigeria. *Bactrocera* fruit flies were identified in two separate surveys conducted in 2003 and 2006 (Umeh *et al.*,2008). The present study is also in agreement with those of Umeh and Onukwu. (2011) who reported that *Bactrocera* species were the abundant fruit fly species in 2014, 2015 and 2020 respectively in Benue State, Nigeria. This present study presents the first record of fruitfly infestation in the studied fruits in Akwa Ibom State, Nigeria. The abundance and species diversity of orange fruit flies in Uyo metropolis were higher in Itam, followed by Mbiokporo and lower in Akpan Andem. All the locations recorded equilibrium for evenness with just two species identified.

## Conclusion

This study examined the infestation and abundance of fruit flies in mango fruits from Etinan Urban market and Itam markets as well as on orange fruits from Akpan Andem, Itam and Mbiokporo markets in Akwa Ibom State. It was found that all the mango and orange fruits sampled were infested by fruit flies which quickened the rate of decay of mango fruits. Fruit flies are major pests devastating the fruit and crop industry in Akwa Ibom and Nigeria. They are a significant constraint to the fruit and vegetable subsector. These findings are necessary inputs in decision on National Planning and Agricultural Development. It highlights the need for improved study and management of pests of fruits in Akwa Ibom State and Nigeria.

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