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## PRELIMINARY CHECKLIST OF FLIES ASSOCIATED WITH PIG CARRIONS DECOMPOSITION IN OKIJA, ANAMBRA STATE, NIGERIA

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### ABSTRACT

*The decomposition process of pig carrions was carried out in Okija, Anambra State, Nigeria. The study area was located on 05°53.240N and 006°48.50E within the ambient temperature and relative humidity of 30.2 ± 0.28 °C and 68.5 ± 1.34%, respectively. Flies found on the carrions were collected, preserved in 70% ethanol and identified. The flies encountered belong to six families (Calliphoridae, Sarcophagidae, Ulidiidae, Tephritidae, Stratiomyidae and Muscidae) and ten species (Chrysomya abiceps, Chrysomya regalis, Chrysomya chloropyga, Isomyia dubiosa, Isomyia sp., Sarcophaga inzi, Chrysomya africana, Trirhithum sp., Hermetia illucens and Musca domestica). The successional pattern of the flies was predictable. Their activities on the carrions include consumption of the carrion tissues and using same to propagate their progeny. All the flies except the Trirhithum sp. played defined roles on the carrions and were established as flies of forensic importance, while the Trirhithum sp. was referred to as opportunistic fly of the carrion resource.*

**Keywords:** Flies, Pig carrions, Decomposition, Forensic insects, Okija

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### INTRODUCTION

Man has continued to encounter insects in his daily living. They are found in almost every habitat. One of such habitats that provide excellent food and breeding resources is a vertebrate corpse. About 400 insect species have been found on a pig cadaver during its various stages of decay (Payne, 1965). In addition to their ecological importance in decomposition, such insects present important tools for crime investigations (Erzinchioglu, 1983; Catts and Goff, 1992), allowing the time at which a dead body was colonised to be estimated (Greenberg, 1991). In particular, flies of different species especially the flesh fly and the blow fly are among the first colonisers of corpse or carrion and may serve as a biological clock in measuring the time of death up to two or more weeks.

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Such an entomologically based estimate may be far more precise than the medical examiners, which is limited to about a day or two postmortem (Greenberg and Kunich, 2002).

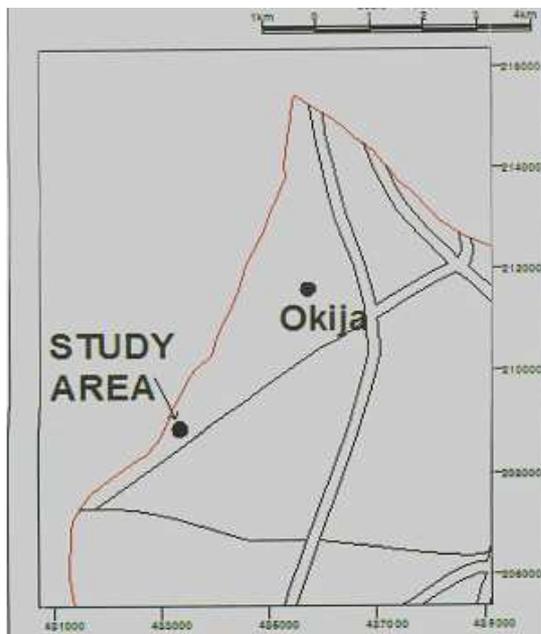
Carrion feeders are usually dipterous flies. Adult blow and flesh flies have finely tuned sense of smell and are attracted in large numbers by the odours of decay, often within a few hours of death. They sometimes swarm to wounds or open sores and ulcers on living vertebrates especially man causing a disease condition known as myiasis. Fly larvae feed and break open the carcass and expose it to other insects and arthropods which either come to feed and breed on the carcass or prey on other participant of the food resource. This important ecological role leading to the total decomposition of the carcass is also of importance to the forensic entomologist as a

means of calculating the postmortem interval in homicide cases (Ekanem, 2008).

The aspect of insect study on decomposing carrions, using pig cadaver as a model to human corpse in the developed countries has gained acceptance in their law courts, contrary to the developing countries, such as Nigeria. Hence, the present study critically observed complete decomposition of pig carrions and their associated flies in Okija, Anambra State, Nigeria. The study observed different stages of the carrions decomposition, collected flies that were attracted to the carrions at the different stages of decomposition and cultured their immature stages to adult stages for the purpose of identification. The emergence of flies is used to estimate the postmortem interval (PMI) of corpse, thus may be a needful forensic entomology tool for investigation of homicide cases in Anambra State, Nigeria.

## MATERIALS AND METHODS

**Study Site:** The study was carried out between January and May, 2012 in an open fallow plot; 05°53.240N and 006°48.510E, in Ubahueze-Ihite, Okija (Figure 1).



**Figure 1: Map showing Ubahueze-Ihite Okija in Ihiala Local Government Area, Anambra State, Nigeria (Okija-in-Home, 2010)**

Okija is a town in Ihiala Local Government Area of Anambra State, Nigeria. The vegetation in Okija is derived tropical savanna with patches of forest and palm trees. The topography is a combination of high and lowlands with Umuhu and Ihite villages constituting the lowlands. The temperature in Okija ranges from 26 °C to 30 °C with wet and dry seasons in a yearly cycle (Okija-in-Home, 2010).

**Experimental Animal:** Six healthy white pigs (*Sus scrofa* Linn.) with mean weight of 24.80 ± 0.90kg were used as recommended by Catts and Goff (1992), as a suitable model for human corpse decomposition. The pigs were purchased from a piggery in Umuogu, Okija. The pigs were killed at 06 hours 30 minutes, washed with clean water, placed in a polyester sack and transported without delay to the fallow plot. The six pigs were grouped into two. Pigs in each group of three pigs were deposited three meters apart and five meters apart between groups. The pig carrions were guarded against vertebrate scavengers with wire gauze that permits entrance of insects and other arthropods. The wire gauze was used to form cylindrical cages (height 83 cm and diameter 80 cm) supported with cement blocks.

**Insect Collection:** Before daily collection, the decomposition state of the carrions was noted. The cages and the cement blocks were set aside so that the flies on the carrions could easily be collected with a pair of blunt forceps for immature stages, sweep net for the adults and preserved in 70% ethanol. They were later sorted into their taxonomic group in the Zoology Laboratory, Nnamdi Azikiwe University, Awka and sent to Insect Museum, Institute of Agricultural Research, Ahmadu Bello University, Zaria for the identification of the species. The temperature and relative humidity of the study site was obtained with a portable thermo-hygrometer, under a shade.

## RESULTS

During the study, flies collected from the decomposing pig carrions were categorised into six families (Calliphoridae, Sarcophagidae,

**Table 1: Checklist of flies associated with pig carrions decomposition in Okija, Anambra State, Nigeria**

Family	Species
<b>*Calliphoridae</b>	<i>Chrysomya albiceps</i> (Wied) <i>Chrysomya regalis</i> (Rob-Desv) <i>Chrysomya chloropyga</i> (Wied) <i>Isomyia dubiosa</i> (Villen) <i>Isomyia</i> sp.
<b>*Sarcophagidae</b>	<i>Sarcophaga inzi</i> (Curran)
<b>Ulidiidae</b>	<i>Chrysomyza africana</i> (Hendel)
<b>Tephritidae</b>	<i>Trirhithum</i> sp.
<b>*Stratiomyiidae</b>	<i>Hermetia illucens</i> (Linn.)
<b>*Muscidae</b>	<i>Musca domestica</i> (Linn.)

\* Fly families often referred to as insects of forensic importance

**Table 2: Fly succession on decomposing pig carrions in Okija, Anambra State, Nigeria**

Condition of the body	Insect taxa
<b>Fresh</b>	<i>Sarcophaga inzi</i> , <i>Chrysomya abiceps</i> , <i>Chrysomya regalis</i> , <i>Chrysomya chloropyga</i> , <i>Isomyia dubiosa</i> and <i>Isomyia</i> sp.
<b>Bloated</b>	<i>Sarcophaga inzi</i> , <i>Chrysomya abiceps</i> , <i>Chrysomya regalis</i> , <i>Chrysomya chloropyga</i> , <i>Isomyia dubiosa</i> and <i>Isomyia</i> sp., <i>Musca domestica</i> and <i>Trirhithum</i> sp.
<b>Active decay</b>	<i>Sarcophaga inzi</i> , <i>Chrysomya abiceps</i> , <i>Chrysomya regalis</i> , <i>Chrysomya chloropyga</i> , <i>Isomyia dubiosa</i> and <i>Isomyia</i> sp., <i>Musca domestica</i> , <i>Trirhithum</i> sp. and <i>Chrysomyza africana</i>
<b>Dry decay</b>	<i>Sarcophaga inzi</i> , <i>Chrysomya abiceps</i> , <i>Chrysomya regalis</i> , <i>Chrysomya chloropyga</i> , <i>Isomyia dubiosa</i> and <i>Isomyia</i> sp., <i>Musca domestica</i> , <i>Trirhithum</i> sp., <i>Chrysomyza africana</i> and <i>Hermetia illucens</i> .

Ulidiidae, Tephritidae, Stratiomyiidae, Muscidae), ten species: *Chrysomya abiceps*, *Chrysomya regalis*, *Chrysomya chloropyga*, *Isomyia dubiosa*, *Isomyia* sp., *Sarcophaga inzi*, *Chrysomyza africana*, *Trirhithum* sp., *Hermetia illucens* and *Musca domestica* (Table 1).

The flies were attracted to the carrions according to the decomposition stages of the pig carrions were: *Sarcophaga inzi* was the first fly attracted to the carrions, followed by clusters of *Chrysomya* and *Isomyia* species i.e. *Chrysomya abiceps*, *Chrysomya regalis*, *Chrysomya chloropyga*, *Isomyia dubiosa* and *Isomyia* sp., during the fresh stage. They were also observed during the bloating, active and

dry decay stages. *Musca domestica* and *Trirhithum* sp. were observed during the bloating stage in addition to the previous collection. *Sarcophaga inzi*, *Chrysomya abiceps*, *Chrysomya regalis*, *Chrysomya chloropyga*, *Isomyia dubiosa*, *Isomyia* sp., *Musca domestica* and *Trirhithum* sp., were repeatedly collected during the active decay stage in addition to a new species, *Chrysomyza africana*. During the dry decay stage, collections of *Sarcophaga inzi*, *Chrysomya abiceps*, *Chrysomya regalis*, *Chrysomya chloropyga*, *Isomyia dubiosa*, *Isomyia* sp. and *Musca domestica*, were also made with the exception of *Trirhithum* sp. Another new insect species collected during the

dry decay stage was *Hermetia illucens* (Table 2).

The mean daily ambient temperature and relative humidity of the study site throughout the study period recorded were  $30.20 \pm 0.28^\circ\text{C}$  and  $68.50 \pm 1.34\%$ , respectively.

## DISCUSSION

The fly families Calliphoridae, Sarcophagidae, Muscidae, Tephritidae, Stratiomyiidae and Ulidiidae were seen to be consistent on the carrions and show regular sequence of occurrence. With exception of Ulidiidae and Tephritidae all other families have been reported (Ekanem and Usua, 2000; Ekanem and Dike, 2010; Ekrakene and Iloba, 2011) to be associated with decomposing pig carrions.

The calliphorid species collected from this study were sporadic and preponderance on the carrions for few days. Their larvae were found to form in masses at the orifices of the pig carrions within the first two days and later began to spread all over the carrion's body which resulted in the fast degradation of the carrions. Greenberg and Povolny (1971) and Ekrakene and Iloba (2011) also reported that *Chrysomya rufifacies* is more adapted to tropical conditions and is found all year round. In this study, *C. rufifacies* was not observed; *Chrysomya* species observed were *C. albiceps*, *C. chloropyga* and *C. regalis*. *Chrysomya* species have been used as important forensic insects (Goff *et al.*, 1986; Goff and Odum, 1987; Singh and Bharti, 2006).

The sarcophagid species, *Sarcophaga inzi* was the first fly that visited the pig carrions. Although the adults were continuously collected throughout the study period, the larvae mass was not observed. Similar observations have been reported in rabbit carrion in Alexandria, Egypt (Tantawi *et al.*, 1996), in decaying rabbit carcasses in Punjab (Bharti and Singh, 2003), and in pig carcasses in southeastern Nigeria (Ekanem and Dike, 2010). The sarcophagid flies observed in this study deposited their first instar larvae singly and they prefer feeding from the inner tissues of the carrion. This may be a reason why their larvae mass was not observed on the carrions.

The muscids are cosmopolitan but species occurrence varies from region to region. In this study, *Musca domestica* was the only muscid species that was collected. Negligible number was seen at the onset of the bloating decay stage but later became conspicuous at the peak of the bloating stage of the carrions. Ekanem and Dike (2010) reported same arrival time and stated that muscids arrive at carcasses during the bloated stage when the odour of decomposition had become noticeable. Their arrival at this stage agreed that they prefer animal tissues at advanced stage of decomposition.

Tephritids are one of the flies that are referred to as fruit flies. As the name suggests, they are mainly associated with fruits and plant origin. In this study, *Trirhithum* sp. was collected during the peak of bloating stage and active decomposition stages. Its economic importance on agriculture has been discussed on relevant literatures. Hence its roles on decomposing carrions are scanty. In this study tephritids collected were very few and its larvae were not collected among the larvae collected and reared. This suggested that they are opportunistic flies which took the advantage of the carrions in the study site.

The family of Ulidiidae was represented by *Chrysomya africana*. In this study, its larvae were first collected during the dry decay stage. However, few adults were collected during the active decay stage. The presence of the larvae at this decomposition stage is vital as they can assist forensic investigators estimate the PMI of badly decomposed carrion. They may still provide basis for toxicological assessment of the carrion as alternative to blood, urine or soft tissues which had dried out.

Stratiomyiidae family was represented by *Hermetia illucens*. Only the larvae and not the adults were collected during the dry decay stage and were present till skeletonization of the carrions. *Hermetia illucens* has been implicated as a forensic insect by few researchers. Lord *et al.* (1993) had reported that it initiates oviposition 20 to 30 days after death and its life cycle would require at least 55 days depending on temperature for completions. They also concluded that *Hermetia illucens* could provide

valuable parameters to forensic investigators for estimating the PMI of badly decomposed remains. Also the information provided by the development time of *Hermetia illucens* in combination with the time required by the ant *Anoplolepis longipes* to establish a colony was used by Goff and Win (1997), to solve a case in which human remains was found inside a metal tool box. The collection of *Hermetia illucens* larvae during the dry decay stage when the carrions had badly decomposed agreed with the report of Lord *et al.* (1993).

**Conclusion:** It is implicit from this study, that flies are important group of insects in the decomposition of carrions. The identified species of flies, except the tephritids and the ulidiids, have been earlier reported as insects of forensic importance which can offer forensic investigators on homicides, the estimated time that has elapsed prior to the discovery of the corpse, if the natural decomposition was not altered. The collection of *Chrysomya africana* larvae during active and dry decay stages alongside *Hermetia illucens* larvae can provide information to forensic investigators of this region an estimation of the time since death of badly decomposed corpse. The fly species collected except the tephritids may represent important tools in crime scene investigations, and can enhance the estimation of time at which a dead body was colonized.

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