# DIPTERAN FAUNA OF AN ABATTOIR AND ITS CONTIGUOUS FALLOW PLOT IN A GUINEA SAVANNA ECOSYSTEM

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**ABSTRACT**

***The pitfall trap was used in the study of the dipteran populations of an abattoir and a contiguous fallow plot, in relation to their relative abundance and distribution. A total number of 140 adult species of Synydas and Stomorhina cribrata, and 400 dipteran larvae were captured at the abattoir using pitfall techniques, with correspondingly fewer species of similar dipterans trapped at the contiguous fallow plot. Significant difference existed in the trapping of the Diptera larvae with more trapped at the abattoir than the fallow plot using Student t-test. There was also a preponderance of calliphorid species at the abattoir when the sweep net was used, with these species implicated as being potential pests of medical and forensic importance. The presence of Sarcophaga sp. and Fannia canicularis in the sweep net collection at the abattoir was also traced to the presence of decaying fall-offs from carcass. Other possible implications of the collected dipteran species at the abattoir and its vicinity were also discussed.***

**Keywords:** Dipteran fauna, Abattoir, Contiguous fallow plots, Guinea savanna

## INTRODUCTION

Animals serve as essential sources of protein. This has led to the establishment of animal forms and ranges for mass production of animal protein. The slaughter of animals for human consumption leads to the production of a large quantity of abattoir waste, with many slaughtering being carried out on rural slaughter slabs and at unauthorized places. In Nigeria there are only a few standard abattoirs (Abubakar, 1998). Environmentally, the establishment of these abattoirs has led to the development of peculiar insect population in response to such human activities. The importance of the insect fauna and the ever-increasing need to have in-depth knowledge of them have given rise to the evolution of sampling methods and even the modification of the existing ones in order to study them in their natural and artificial habitats.

The pitfall trap and the sweep net are devices for studying insect population. Both devices are capable of providing impressive collections of data from situations where few animals will be recorded by absolute estimated (Ewuim and Nwoye, 2002). The pitfall trap has been found useful as collecting devices for studying daily rhythms of activity, seasonal incidence and the dispersion of single species in one type of vegetable. In general, pitfall traps are useful in studying spatial distribution of population and the seasonal occurrence of species (Sing and Lal, 1988).

The sweep net is perhaps the most widely used device for sampling insects from vegetation; simple and capable of collecting sparsely dispersed species (Southwood, 1978). It is however important to define a standard sweeping before commencing a sampling programme because the method and pattern of sweeping can affect capture rates (Kogan and Pitre, 1980; Gauld and Bolton, 1988).

Some instances on the use of pitfall techniques in Nigeria in studying epigaeic fauna include those of Badejo and Lasebikan (1996) on the effect of habitat disturbance on collembolan fauna; Ewuim (1996; 1997), Ewuim and Ezenwugo (1997), Ewuim *et al*. (1997) on ant fauna in some Nigeria ecosystem. Ewuim (2002, 2004) dwelt on the efficacy of killing-preserving agent in pitfall traps. Ewuim *et al*. (2004) also compared the epigaeic insect populations of a forest and a fallow farmland in the same locality in Nigeria. Instances in the use of sweep nets by Nigerian workers have been reported (Ewuim and Nwoye, (2002).

This paper focuses on the use of two devices, the pitfall trap and the sweep net, in sampling the dipterans populations of an abattoir and its contiguous plot. Data obtained were compared using student's t-test to ascertain whether significant differences occurred in the pitfall and sweep net catches of the dipterans from both habitats.

## MATERIALS AND METHODS

**Study Area:** The study site was the Awka abattoir. Awka is located latitude $5^0$ and $6^0$ 25′N and longitude $7^0$E and $8^0$ E. The town stretches for 8 km in an East-West direction along the Enugu-Onitsha Expressway and about 5 km in a North-South orientation. The dimension of Awka is 1,207,800$m^2$ or 12,007 hectares.

Ecologically, Awka lies in the Guinea Savanna experiencing between 1,000 mm and 1,500 mm of rain annually (Iloeje, 1981). It also experiences two seasons – the dry and the wet season with a bout of harmattan from December to January. A North-South and East-West escarpment gives Awka its topographic character. From this escarpment, flood surges down towards Amikwo in which the abattoir is located.

Groundwater saturation here leads to the formation of intermittent streams / ponds used in meat slaughtering processes (Muoghalu and Omocho, 1997).

The abattoir is located between Amikwo and Obunagu villages. The present location resulted from its relocation from Ekenwida along the Old Enugu-Onitsha Road to Eke-Awka and finally to its present location in 1980. It lies in a low stretching across the present Enugu-Onitsha Expressway into Okpuno. Some of the inherent environment problems relate to these location attributes. The dominant species of plants found at the abattoir and its adjoining habitat were *Amaranthus* sp., *Eleusine* sp. *Indica* (L.) Gaertn, *Sida acuta,* Burm f. *Solanium,* sp., *Cyperus sp., Esculentus* L*, and Amaranthus Hybridus* L*.*

**Sampling Methods:** The sampling instruments used were pitfall traps and the sweep nets. The pitfall traps consisted of circular plastic dishes, 9 cm in height with mouth diameter of 8.4 cm. The preservative used was 5 % formalin, poured at least two-thirds filled of each container. 5 % formalin was effective in trapping, killing and preservation of insects. Six traps were set at random at the sites on each sampling day. Each trap was buried in the soil so that the rim flushes with ground level. The traps were collected after 24 hours of sampling. Recovered traps were closed and taken to the laboratory. Dissecting microscope was used to sort out the animals into various taxonomic groups after emptying the contents of each trap into a girded Petri dish.

The sweep net used was made of thick white cotton mesh with a round mouth measuring 92 cm in perimeter. Aerial insects were collected by twenty-five random strokes. Sampling was done for one hour between 10.00 and 11.00 a.m. Sampling for ground and airborne insects were done during the months of April – July 2005 and August to October 2004.

The collected insects were placed in a jar containing cotton wool soaked in chloroform. The dipterans and their larvae were identified using "Insect of Nigeria – Check list and Bibliography" by Medler (1980). The identification of the specimens was verified in the Department of Crop Protection, Institute of Agricultural Research, Ahmadu Bello University, Zaria, Nigeria. The voucher specimens were also kept as reference point for further studies.

## RESULTS

Table 1 shows the bi-monthly pitfall catches of dipterans from both the abattoir and the contiguous plots. A total number of 607 dipterans including larvae were collected from both sites. The pitfall catches were made up of 140 adults species of *Synydas* sp. and *Stomorhina cribata,* and 400 diptera larvae. For the contiguous fallow plot, 57 adults of similar species were trapped with 10 Diptera larvae. There were no significant differences in the trapping of the dipterans except for their larvae, with more trapped from the abattoir than from the fallow plot.

The various types of flies obtained using the sweep net are also shown on Table 2. Majority of the flies collected were the calliphorids with four species viz. *Chrysomia putoria, C. albiceps, Rhinia apicalis* and *Stomorhina cribrata.* The highest collection of Diptera (28.33 %) was made for *Syndas* sp. (Empididae), followed by *Atherigona* (Muscidae) (24.70%). A genus of Diopsidae family (*Diasemopsis* sp.) recorded 7.99 % of the total collection while the least collection of 6.05 % was recorded for *Hermetia illucens* (Stratromyiidae).

There was also no statistical differences in the Student t-test carried out to determine whether significant differences exist in the fly populations obtained at both the abattoir and the contiguous plots (Table 2), since the tabulated t-value (2.365) was less than the calculated value (0.1654). From the bi-monthly sweep net catches of Diptera made between August and October, 2004, *Chryosomia* was the most abundant (with a percentage relative abundance of 52.90%), followed by *Sarcophaga* sp.

**Table 1: Bi-monthly dipteral populations sampled using pitfall technique**

| Dipterans | April 1 | May 11 | May 111 | June 1V | June V | July V1 | Total catches | Calculated t value+ |
|---|---|---|---|---|---|---|---|---|
| ***Synydas* sp** | 4 | 10 | 13 | 19 | 13 | 15 | 74 | 1.242 |
| | 3 | 8 | 10 | 8 | 4 | 10 | 43 | |
| ***Stomorhina cribrata*** | 12 | 10 | 10 | 9 | 13 | 12 | 66 | 0.498 |
| | 4 | 5 | 4 | 5 | 2 | 4 | 24 | |
| **Dipteran** | 7 | 250 | 78 | 18 | 18 | 34 | 400 | 7.105+ |
| **larvae** | - | - | - | - | - | - | 0 | |
| **Total** | **23** | **270** | **101** | **46** | **44** | **61** | **540** | **1.578** |

**Dipteran groups for abattoir occupy the first row while those for contiguous plot occupy the second row. +Significant at 5% probability level: $t_{0.05}$ =2.228*

**Table 2: Types of flies at the Awka abattoir sampled using both the pitfall trap and the sweep net**

| Family | Species | No of Flies Collected | % of Flies Collected |
|---|---|---|---|
| **Calliphoridae** | *Chrysomia putoria* | 21 | 5.07% |
| | *Chrysoma albiceps* | 17 | 4.11% |
| | *Rhinia apicalis* | 9 | 2.17% |
| | *Synydas* sp. | 90 | 21.7% |
| **Muscidae** | *Atherigona* sp. | 102 | 24.6% |
| **Empididae** | *Stomorhina cribrata* | 117 | 28.3% |
| **Diopsidae** | *Diasemopsis* sp | 33 | 7.97% |
| **Stratromyiidae** | *Hermetia illucens* | 25 | 6.04% |
| **Total** | | **414** | **100** |

(Sarcophagidae), which had a percentage relative abundance of 21.02 %. *Fannia canicularis* (Muscidae sp.) has a percentage relative abundance of 18.84 %, with Culicidae family recording 7.24 % relative abundance.

**Table 3: Total catches of insect groups obtained at the Awka abattoir in 2004 using sweep net technique**

| Dipterans | Bi-Monthly Sweep Net Catches [2004] | | | | | | Total | Relative Abundance |
|---|---|---|---|---|---|---|---|---|
| | Aug | | Sept | | Oct | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | | |
| **Culicidae** | | | | | | | | |
| **Caliphoridae** | 0 | 3 | 1 | 0 | 2 | 4 | 10 | 7.24 |
| ***Chysomya* sp** | 18 | 8 | 9 | 13 | 19 | 6 | 73 | 52.90 |
| **Muscidae** | | | | | | | | |
| ***Fannia canicularis*** | 6 | 2 | 7 | 3 | 5 | 3 | 26 | 18.84 |
| **Sarcohagidae** | | | | | | | | |
| ***Sarcophaga* sp.** | 3 | 6 | 5 | 8 | 4 | 3 | 29 | 21.02 |
| **Total** | **27** | **19** | **22** | **24** | **30** | **19** | **138** | **100** |

## DISCUSSION

The various flies obtained from the investigation belong to five families Calliphoridae Muscidae Empididae, Diopsidae and Stratromyiidae. The increased incidence in the captures of Diptera larvae in the installed pitfall traps especially at the abattoir is not only as a result of the crawling and wandering activities of the dipteran forms but also as a result of their feeding activity on patches of rumen of slaughtered animals and other slaughter house by-products. The slaughterhouse by-products, whose availability is assured by regular slaughtering of animals (Abubakar, 1988) at the abattoir are often not properly disposed and are usually at various stages of decay at the sites. The significant difference existing in the trapping of the Diptera larvae, with majority of the larvae trapped from the abattoir is no doubt not only related to their increased relative abundance at the abattoir, but also to their locomotory activity (Table 1). This observation is in line with Chapman (2000) who noted that the relative low speed of locomotion is associated with crawling movement in Diptera larvae, which is often effected by changes in body shape rather than legs. This therefore decreased their chances of availability in the contiguous fallow plot likely to favour only population. The presence of *Synidas* sp. and *Stomorhina cribrata* in the pitfall traps are likely related to the properties of the killing – preserving agent which are known to be attractive (Luft 1968; Skuhravy, 1970; Ewuim, 2002).

The significant difference, which however did not exist when the dipteran populations of the abattoir was compared with the contiguous plot (Table 2) no doubt is indicative of the nearness of the two habitats allowing them to support similar dipteran fauna, though in variable numbers.

In addition, the existences of intermittent streams near the abattoir, and the constant availability of decaying fall-offs from carcass at the abattoir may have respectively favoured the existence of *Synidas* sp. (empedids) and *Stomorrihina cribrata* (callophorids) at the abattoir. The preponderance of calliphorid species at the abattoir when the sweep net was used may not be unrelated to the fact that at most times their species are garbage and carcass feeders, making them potential pests of medical and forensic importance (Ekanem and Usua, 2000). Boorman, (1981) also noted that despite the unpleasant habits of the calliphorids, they perform a very valuable service since their maggot dispose off the corpses of animals. There is no doubt therefore that the ever-present fall-offs from the carcass at the abattoir markedly contributed to the presence and preponderance of the calliphorids. The presence of the sarcophagid (*Sarcophaga* sp.) and the muscid. (*Fannia canicularis)* is also attributed to the presence of these decaying fall-offs from these carcass including decaying spilled blood.

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