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Age structure and diurnal activity of *Musca domestica* L. (Diptera: Muscidae)

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ABSTRACT: Distribution, sex ratio, abundance of various ovarian stages of development insemination rate, age composition and diurnal activity were studied in sweepnet catches of *Musca domestica* L. Collections were made from different location: house, refuse dump, market, cafeteria and poultry between 07.00h and 14.00h from October to December, 2003. Diurnal activity was also investigated by making sweeps at 07.00h, 12.00h and 17.00h from cafeteria. Market and cafeteria harboured the bulk of the population of *M. domestica*. The sex ratio of males to females was 1:2 except in poultry with a ratio of 1:1. Only house exhibited variation in the proportion in ovarian stages of development, the non-gravid, ¼ gravid and ½ gravid being most abundant and gravid the least. Insemination rate was 64.8% with a ratio of inseminated to uninsemination of 2.1 from site to site except poultry with a ratio of 3:1. *M. domestica* approximately 6/18 days and 6/14/18 days were more abundant in house and poultry respectively. Their diurnal numbers increased from 07.00h, females being commonly two times males.

Key words: Age structure, Diurnal activity, *Musca domestica* L.

Introduction

Housefly, *Musca domestica*, is one of the most widespread fly species in the world. They have adapted their life style to the human life style by using waste products of human communities to live on and breed in. They can breed in animal faeces, garbage, rotting fruits and vegetables and in other decomposing organic materials. Houseflies are a nuisance in human and livestock habitation (West, 1951; Miller *et al*., 1993).

Organic waste materials and relatively high temperatures at livestock farms promote rapid development and the continuous presence of flies (Howard and Wall, 1996). Houseflies may be responsible for the transmission of over 100 different pathogens (Prospischil, 1994). They may transmit intestinal worms, or their eggs, and are potential vectors of pathogens of dysentery, gastroenteritis, typhoid, cholera, foot and mouth disease and tuberculosis. They may also disperse ectoparasites (Aigbodion *et al*., 1999). Studies on the age structure and population dynamic of houseflies suggest that both vary continuously over time (Krafsur *et al*., 1985). It is important to constantly appraise the status of housefly in the human and livestock environment. The objective therefore of this present work is to assess the sex ratio of *Musca*

domestica in Benin City, the abundance of various ovarian stages of development, the insemination rate, the age composition and their diurnal activity.

Materials and Methods

Study area

This study was carried out in Benin City, the capital of Edo State, Nigeria. This is a highly populated urban area located between Latitude 5°35' and 5°14', with an approximate land area of 112km^2. Rainfall is high, 1850-2445mm, throughout the year. Temperature is also high, about 30-36°C.

In the peak of rainfall, relative humidity is maximum (about 75%) but drops to about 45-50% during the dry months (November-March). The city is about 78m sea level and is located within the moist rainfall zone of Nigeria. The climate is tropical.

Collection procedure

Houseflies were collected from five locations within Benin City. These sampling location include (1) a residential house at Osasogie in Ugbowo where there is abundance of food resources; (2) refuse dump with abundance of domestic garbage located in an isolated area in Ugbowo away from residential quarters; (3) the popular Uselu market with abundance of food stuff on display; (4) a poultry farm at Isiohor in Benin; (5) a cafeteria within the University of Benin.

Samples were collected between the months of October and December 2003, using a sweep net; sweeps were made between 07.00h and 14.00h with 20mins being used for each collection.

To investigate the diurnal component of abundance and sex ratio, samples were collected weekly from the Cafeteria within the University of Benin at 07.00h, 12.00h and 17.00h for 30mins each.

Houseflies collected were killed with ethyl acetate vapour and the females were stored in labelled specimen bottles, refrigerated 1 to 24hrs capture until dissection. Dissections were made under a light microscope in saline solution. Reproductive tract were withdrawn and the ovaries were examined for the degree of ovarian development (Tyndale-Biscoe and Hughes, 1969) and the follicular relics were examined for the number of oviposition (Detinova, 1962). Also, the spermathecae were examined for sperm to ascertain the state of insemination (Corbet and Smith, 1974).

Data analysis

Data were presented in frequency of occurrence, transformed to percentages and analysed by Kolmogorov – Smirnov one sample test for each sampling location and between each sampling location (Siegel 1956; Campbell, 1989). Ratio for deviation from 1:1 (Lewis and taylor, 1976) was also applied.

Results

Sex ratio

The sex ratio of *Musca domestica* collected from the five different locations in Benin City is shown in Table 1. Males were less than females in a ratio 1:2 except for the samples from poultry with a ratio of 1:1. There was no significant difference ($P>0.05$) in the proportions of males and females from the five locations (Table 1).

Ovarian stages of development

The proportions of females in each state of ovarian development are listed in Table 2 according to the various site of collection. Non-gravid, ¼ gravid and ½ gravid females were more abundant in the house, with gravid being the least. There was no significant different (P>0.05) in the proportions in other sites as well as overall data.

A comparison of the proportion from site to site of ¼ gravid females showed house as having the bulk of the population, market and cafeteria being the least. Other ovarian stages were evenly distributed from site to site.

Insemination rate

The insemination rate from the dissected samples was 64.8%. The ratio of inseminated to uninseminated was 2:1 in each sampling locations except in poultry which showed a ratio of 3:1. There was no significant variation (P>0.05) in the proportion of inseminated and uninseminated from site to site (Table 3).

Age composition

Age composition oof *M. domestica* in benin City is shown in Table 4. The proportion in various age groups in house and poultry varied significantly (P<0.05), the 6 days and 18 days old having the bulk of the population in the former site and 65, 14 and 18 days old more in the lattersite. The 26 days old and 10/26 days old were the least respectively. The pooled data followed the same pattern. The proportions in age groups in other sites were constantly distributed. There was no significant variation (P>0.05) in the proportion in each age group from site to site.

Diurnal abundance

The diurnal component of sex ratio is shown in Table 5. The males and females were in ratio 1:2 except for 07.00h with a ratio of 1:1. The pooled data showed that females were commonly two times males. The abundance of flies caught increased from 07.00h to 17.00h (Table 5).

Table 1: Sex ratio of *Musca domestica* in Benin City, Oct.-Dec., 2003.

Site of Collection	**No. caught**	**% (No.)**		
		Male	**Female**	**Ratio, M:F**
House	922	39.9 (368)	60.1 (554)	1:2
Refuse dump	1215	37.9 (461)	62.1 (754)	1:2
Market	2171	33.1 (718)	66.9 (1453)	1:2
Poultry	470	48.9 (230)	51.1 (240)	1:1
Cafeteria	2463	38.1 (938)	61.9 (1525)	1:2
Total	**7241**	**37.5 (2715)**	**62.5 (4526)**	**1:2**

Table 2: Abundance of *Musca domestica* in various ovarian stages of development in Benin City, October – December, 2003.

Site of Collection	No. caught	% (No) Dissected	% No. ovarian stage of development				
			Non gravid	¼ Gravid	½ Gravid	¾ Gravid	Gravid
House	442	87.8(388)	25.1(111)	24.0(100)	17.4(77)	12.7(56)	8.6(38)
Refuse dump	623	61.0(380)	16.2(101)	10.3(64)	15.3(95)	12.0(75)	7.2(45)
Market	1096	55.7(610)	9.2(101)	7.8(86)	17.3(190)	12.0(132)	9.2(101)
Cafeteria	1277	55.3(706)	8.9(114)	5.8(74)	14.1(180)	18.5(236)	8.0(102)
Poultry	185	89.2(165)	22.2(410)	13.0(24)	27.0(50)	17.8(33)	9.2(17)
Total	**3623**	**62.1(2249)**	**12.9(468)**	**9.8(354)**	**16.3(592)**	**14.7(532)**	**8.4(303)**

Table 3: Insemination rate of *Musca domestica* in Benin City, Oct. – Dec., 2003.

Locality	No. collected	% No. Dissected	% (No.)		Insemination Ratio
			Inseminated	Uninseminated	2:1
House	442	87.8(388)	60.9(269)	26.9(119)	2:1
Refuse dump	623	61.0(380)	37.7(235)	23.3(145)	2:1
Market	1096	55.7(610)	34.7(380)	21.0(230)	2:1
Poultry	185	89.2(165)	66.0(122)	23.2(43)	2:1
Cafeteria	1277	55.3(706)	35.3(451)	20.0(255)	3:1
Total	**3623**	**62.1(2249)**	**40.2(1457)**	**21.9(1792)**	**2:1**

Table 4: Age composition of *Musca domestica* in Benin City, October-December, 2003.

Site of Collection	No. caught	% No. Dissected	% (No) Ovarian Stage of Development					
			0(6)*	1(10)	2(14)	3(18)	4(22)	5(26)
House	442	87.8(388)	29.0(128)	4.1(18)	19.9(88)	22.2(98)	10.4(46)	2.3(10)
Refuse dump	623	61.0(380)	19.6(122)	1.0(6)	14.9(93)	13.0(81)	10.0(62)	2.6(16)
Market	1096	55.7(610)	11.0(120)	2.3(25)	9.6(105)	20(224)	9.2(101)	3.2(25)
Cafeteria	1277	55.3(706)	8.2(105)	1.6(20)	9.7(124)	21.1(270)	12.5(159)	2.2(28)
Poultry	185	89.2(165)	27.0(50)	2.2(4)	20.0(37)	28.1(52)	8.7(16)	3.2(6)
Total	**3623**	**62.1(2249)**	**14.5(525)**	**2.0(73)**	**12.3(447)**	**20.0(52)**	**10.6(384)**	**2.6(95)**

Table 5: Diurnal abundance of *Musca domestica* in cafeteria in Benin City, October – December, 2003.

Time of collection	**%(No) caught**	**% (No)**		
		Male	**Female**	**Ratio, M:F**
07.00h – 07.30h	11.0(1446)	41.0(183)	59.0(26.3)	1:1
12.00h – 12.30h	34.7(1407)	38.0(535)	62.0(872)	1:2
17.00h – 17.30h	54.3(2197)	35.8(787)	64.2(1410)	1:2
Total	**4050**	**37.2(1505)**	**62.8(2545)**	**1:2**

Discussion

The sex ratio of house flies in the present study indicates that females were twice males except in the poultry where they are equal. This could be attributed to *M. domestica* males having a shorter life span (Rockstein and Liebermann, 1958) than females. Also, female preference for nourishment and oviposition site would make them readily available during collection. Sacca and Benetti (1960) and Goodman *et al*., (1968) stated that houseflies require exogenous protein and carbohydrates before yolk deposition may occur.

Krafsur *et al*., (1985) attributed the abundance of virgin flies in certain locations to the presence of more abundant males. Thus, the abundance of non-gravid females in samples from house can be related to this. Also the presence of more ¼ gravid females in the house samples in respect to other sampling location could be related to the abundance of more non-gravid females since 69 hours is required from eclosion at 27°C for mature eggs to develop (Adams, 1974). However, the low abundance of gravid females in the house sample is believed to be consistent with the idea that houseflies oviposit within the day they become gravid (Krafsur *et al*., 1985).

The insemination rate of housefly collected from house, market, refuse dump, cafeteria and poultry is 64.8% and the ratio of inseminated is 2:1 and 3:1 for poultry. The reason for such is that most flies according to Krafsur *et al*., (1985) becomes inseminated within a day of becoming receptive and this correlates to the onset of vitallogenesis. Also Smith (1956) found that normally inseminated females rarely remated, even after their supply of sperm has been depleted by continued oviposition. Insemination in this study was not recorded according to the degree of insemination. Thus, as long as houseflies have become inseminated, presence of sperm in the spermathecae indicated insemination.

The abundance of 6 days old females in house samples could be attributed to the abundance of non-gravid females, which have not oviposited. Abundance of 6, 14 and 18 day old female in poultry samples could be attributed to rapid development of eggs from eclosion to maturation (Adam, 1974). The low abundance of houseflies with age of approximately 26 days could be, according to Arroyo-Sanchez (1998), that housefly usually live 15 to 28 days and are unable to realize their potential reproductive capacity.

A diurnal component of sex ratio suggests that relative proportion of males and females in catches increases from 07.00 to 17.00 hour. The abundance of flies at 17.00 hour in the cafeteria could be as a result of flies inactivity at night, with ceilings, beams and overhead wires within building, trees and shrubs, various kind of outdoor wires and grasses reported as overnight resting sites (Arroyo-Sanchez, 1998). The abundance of female to male at 12.00 hour and 17.00 hour can also be related to ready availability of protein and other nourishment from food leftovers of animal and vegetable origin (D'Almeida, 1989; Oliveira *et al*., 1999) and the report that parous flies seek protein at midday (Krafsur *et al*., 1985). The aspect of the bionomics of housefly reporter in this work could be useful during control programme.

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