# OLFACTORY RESPONSE OF THE BLOWFLY, *CHRYSOMYA CHLOROPYGA* (WIED.) (DIPTERA: CALLIPHORIDAE) TO ODOUR SOURCES

**Muse W. A.* and Obembe M. T.**
Department of Zoology, Obafemi Awolowo University, Ile-Ife, Nigeria
*Corresponding e-mail: wmuse2002@yahoo.co.uk
(Received: September, 2013; Accepted: November, 2013)

## ABSTRACT

Attractants to the blowfly, *Chrysomya chloropyga,* in the enviroment were used to studybait preference of the fly in the laboratory. The attractants included sheep dung, decayed liver, poultry dung, fresh liver and mixture of ground rice and fish paste. *C. chloropyga* were reared on a mixture of ground rice and fish, and sugar in the laboratory. The flies were separated into sexes at emergence. The male and female flies were divided into batches each. A batch of male flies and a batch of female flies were separately maintained on liver and sugar while another batch of male flies and a batch of female flies were also maintained on sugar only. Olfactory response to the various attractants was thereafter determined using eight-day old flies. Female maintained on only sugar and those maintained on sugar and liver responded faster to fresh and decayed liver and poultry dung than males similarly maintained. Females on sugar only responded faster to fresh and decayed liver and poultry dung than females maintained on sugar and liver. There was no significant difference in the males similarly maintained, to fresh and decayed liver and poultry dung. Previous exposure to either sugar only or to liver and sugar influenced the response of the females to the odour sources.

**Keywords:** *Chyrsomya*, Olfactory Response, Liver, Dung, Mixture of Rice and Fish.

## INTRODUCTION

Olfaction in insects can be defined as chemo-stimulation by odours, in a very low concentration (Gillott, 1991). Olfaction is a very important phenomenon in insects which helps them in locating their food and hosts. Studies of olfactory response of *Glossina fuscipes fuscipes* confirmed that host selection behaviour involve an olfactory signal from the odour source (Gouteux *et al*., 1995). Studies of blowfly, *Lucilia sericata*, indicated that the strength of response to visual cue is weak in relation to smell (Wall and Smith, 1996), which is attained by the antennal receptors (DeVaney *et al.* 1870). Archer and Elgar (2003) reported that more flies attended carcassed early than late in decay, particularly the gravid females but Gill-King (1997) expained that flies are attracted to carrion because certain compounds are released with the breakdown of protein. Spivak *et al.* (1990) observed that flies will approach a drop of rotten squid up wind, then land close to the source, before making the final journey on foot. Hall (1995) observed that odour location is very precise in blowflies enabling them to locate bodies through air vents in the walls of buildings. Odours from decomposing cadaver in a shallow burial sites was easily detected by the blowflies and Kondriguez and Bass (1985) concluded that odour was more important than visual cues in attracting flies. Schoonhoven (1968) reported that olfaction more commonly function over short distance in host selection and odour from bacterial decomposition are effective in inducing probing and orientation behaviour at short distances ( Morris *et al.,*1997)

Blowflies detect carcasses primarily by odour, but the attractiveness varies with the degree of decomposition of the carcasses (Nuorteva, 1977). Dead animal tissues are attractive to a number of insects and other vertebrates (Smith, 1986).It has been reported that blowflies are the first to colonize corpses and can be attracted over great distances (Macleod and Donelly, 1963). Some species of flies, such as *L. illustris*, prefer fresh pig carrion while *Calliphora vicinia* prefer decomposed remains to fresh (Erzinçliouğlu, 1996). *Chrysomya putoria*, a closely related species of *C. chloropyga*, is attracted in large numbers to raw meat and fish (Lindsay*et al*., 2012). Strangways-Dixon (1960) reported that the female blowfly, *Calliphora erythrocaphala*, selected protein in quantities which varied with different phases of reproductive cycle. The objective of this investigation was to determine response by *C. chloropyga,* a blowfly ubiquitous in Nigeria, to various diets,thereby ascertaining the most prefered diet for its development and control.

## MATERIALS AND METHODS

### Collection and Rearing of Insect

Adult male and female blowfly *Chrysomya chloropyga* were collected from the refuse dumpin Obafemi Awolowo University, Ile-Ife, Nigeria (7°28'N, 4°34'E). The flies were reared in cages (40x40x40cm) using a mixture of ground rice and fish paste and sugar (Anantiko *et al*., 1982). Newly emerged adult flies were separated into males and females. Males and females were further divided into two batches each. A batch of male and a batch of female were separately maintained on liver and sugar. The other batches of males and females were separately maintained on sugar only. The batches of males and females from the two feeding regimes, at eight days of age, were then separately used for the experiments to determine their response to sheep dung, decayed liver, fresh liver, poultry dung and mixture ground rice and fish paste.

### Determination of Response Time

Fig. 1 shows the set up of the apparatus which was used for the study of response of the flies to the odour sources. The apparatus, which was designed in the laboratory, consists of two plastic cylindrical cages A and B (4cm high and 7cm diameter) sealed at both ends. Cage A was covered with cloth net while cage B were sealed with transparent cellophane materials ensuring an air-tight condition. The two cages were connected by a transparent glass tube (30cm long, 3cm diameter). In the experiment, a male or female fly was put A while bait was put in cage B. An air-tight condition was ensured so that the odour from the attractant was directed from cage B through the transparent glass tube to the fly in cage A. A stop clock was immediately started. The time (in seconds)taken for the fly to reach the other cage containing an attractant was recorded. All experiments were carried out in triplicates.

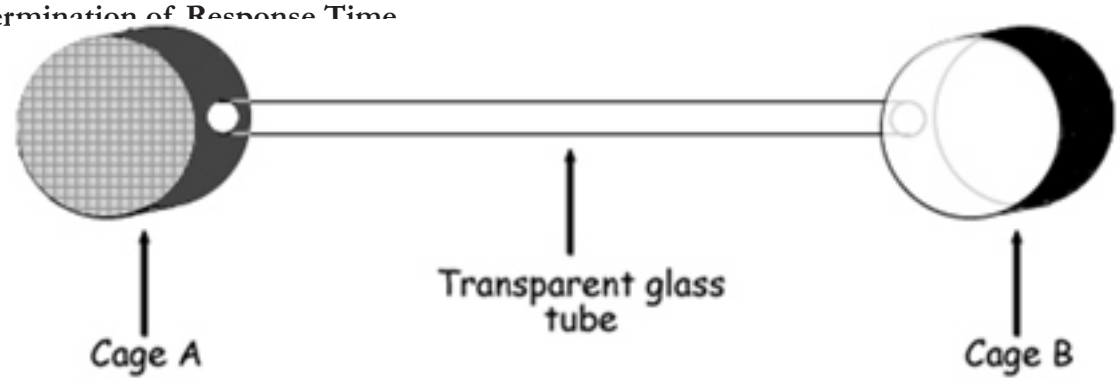


**Fig.1.** Apparatus for Olfactory Response

### Statistical Methods

The data collected were subjected to statistical analyses using SPSS Version 16.0. Mean response time was calculated for each fly in triplicate. The means of the response times of the flies to the attractants were compared using graphical analyses, and the differences between the response times were determined by Analysis of Variance(ANOVA) test.

## RESULTS

### Experiment 1. Response of Male and Female Flies Maintained on Sugar Only

Fig. 2 shows the response time of males and females maintained on sugar only. There was significant difference in the responses to all the attractants in the males and females maintained on sugar only ($F = 1.727$, $df = 117$, $p < 0.05$). Females responded significantly faster than males to decayed liver and poultry waste but no significant difference in the response time in males and females to sheep dung, fresh liver and mixture of rice and fish. There was significant difference in the response time to decayed liver and poultry dung in male and female flies maintained on sugar only. Female flies maintained on sugar only responded faster to decayed liver, poultry dung and fresh liver than the male flies maintained on sugar only (Fig. 2).

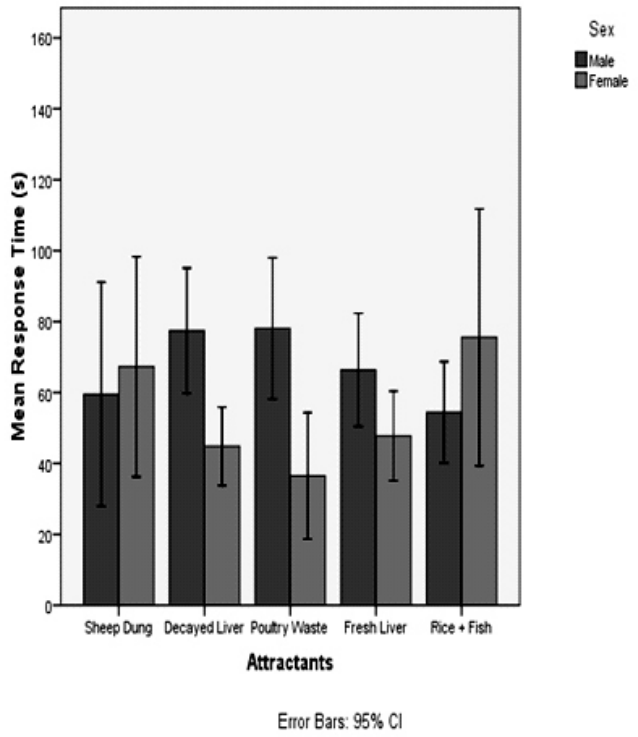


**Fig. 2.** Response Time of Males and Females Maintained on Sugar Only

**Experiment 2. Response of Males and Females Maintained on Sugar and Liver.**
There was no significant difference in the responses to all the attractants in males and females maintained on sugar and liver ($F = 1.328$, $df = 119$, $p = 0.05$). However, females responded faster than males to all attractants except in sheep dung (Fig. 3).

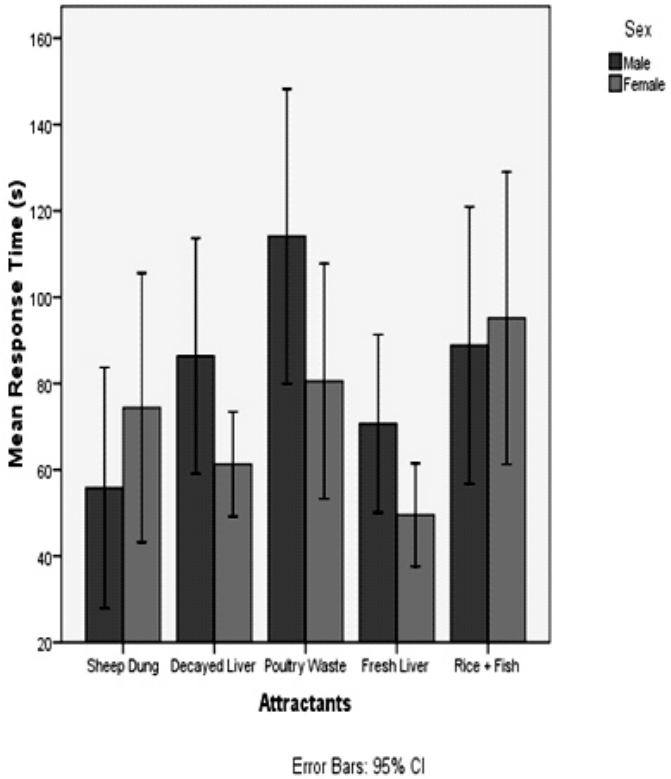


**Fig. 3**. Response Time of Males and Females Maintained on Sugar and Liver

**Experiment 3. Comparison of Responses between Females Maintained on Sugar Only and Females Maintained on Sugar and Liver.** There was significant difference in the responses of the females maintained on sugar only and females maintained on sugar and liver ($F = 1.366$, $df = 104$, $p < 0.05$). Females maintained on sugar only responded significantly faster to decayed liver, poultry dung and fresh liver than females maintained on sugar and liver(Fig.4).

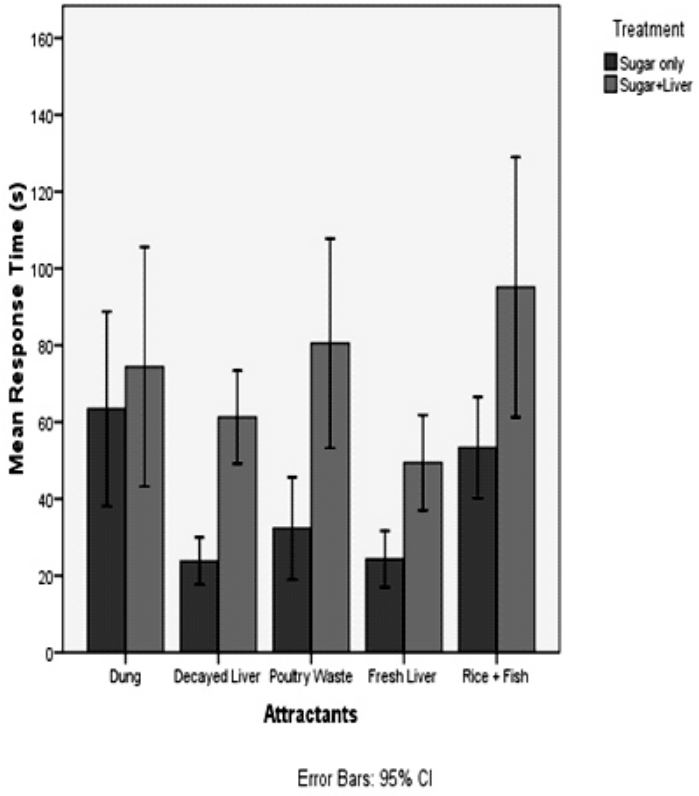


**Fig. 4.** Response Time of Females Maintained on Sugar and Females Maintained on Sugar and Liver

**Experiment 4. Comparison of Responses between Males Maintained on Sugar Only and Males Maintained on Sugar and Liver.** Comparison of responses between males maintained on sugar only and males maintained on sugar and liver (Fig. 5) shows the absence of significant difference in their responses ($F = 1.299$, $df = 121$, $p > 0.05$).

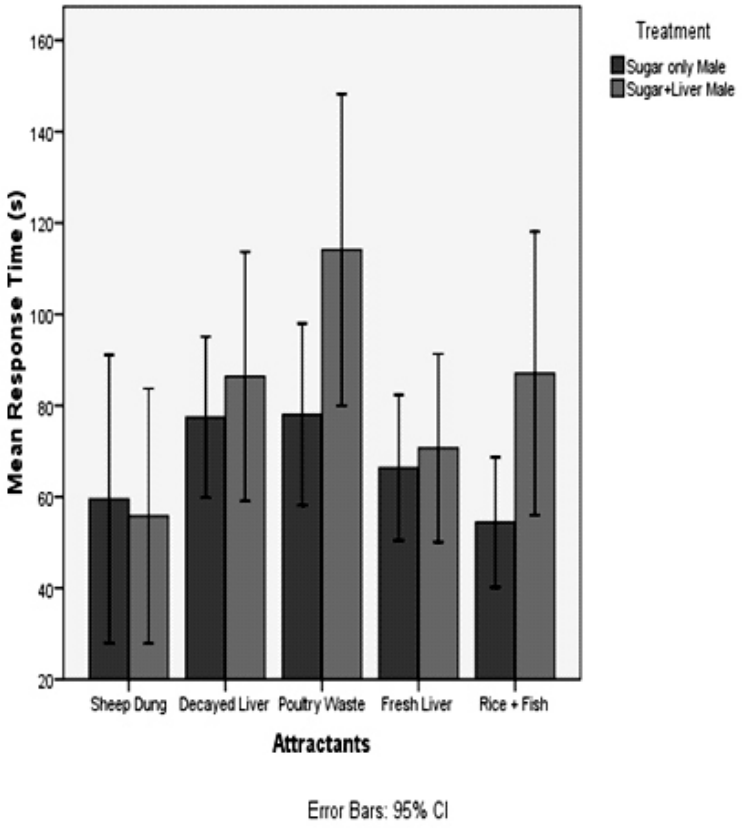


**Fig. 5** Response Time of Males Maintained on Sugar and Males Maintained on Sugar and Liver

## DISCUSSION

Odours emanating from fresh liver, decayed liver and mixture of rice and fish, sheep dung and poultry dung influence the response of the flies. Female flies maintained on sugar only showed preference for fresh and decayed liver and poultry dung mainly because of the absence of previous exposure of the females to proteinous diet. Males have preference for sugar, hence, their weak responses to sudden exposure to the different types of odours used as attractants. Leila *et al.* (2003) has reported that females are more attracted and numerous on carrion and in traps than males as earlier demonstrated by Macleod and Dnnelly. (1957) and Nuorteva (1959a and b). Unlike the male's weak response to the attractants because of previous exposure to sugar, the previous exposure of females to liver did not deter them from responding to the attractants faster than males.

Female seem to constantly reach out for oviposition sites (Smith, 1986) and protein source for ovarian development (Timothy *et al.*, 2010) sice thte process of yolk accumulation in insect oocytes requires nutritional protein intake in many insect groups, including blowflies such as *Lucilia seracata* (Rasso *et al.*, 1954., Stoffolano, 1974). The response time of male maintained on sugar only to sheep dung, decayed liver, poultry dung, fresh liver and mixture of ground rice and fish was higher than the response time of females to decayed and fresh liver and poultry dung. This demonstrated the importance of proteinous attractants to the females. Fresh and decomposed liver have been found to be suitable sources of vitellogenic protein for ovarian development in a related species, *Licilia sericata* (Timothy *et al.*, 2010. The response of male maintained on sugar only was not significantly different from the response of males maintained on sugar and liver, indicating that the highly proteinous attractants is not a priority for males since males even responded weakly to decayed liver, mixture of ground rice paste and poultry waste necessary for ovarian development in females. Previous exposure to protein diet greatly influence the behavior of flies to odours as demonstrated by the significant difference in the response of females maintained on sugar and liver. Ashworth and Wall (1995)

reported that previous exposure of *Lucilia seracata* to protein affects its activities and locomotor responses to liver odour because protein fed females exhibited lower lever of spontaneous activity than protein deprived individuals. Among the five odour sources used, it is shown that females responded significantly to fresh liver, decayed liver and poultry wastes than sheep dung and mixtures of ground rice and fish. Females prefer liver as diet to a mixture of ground rice and fish and also prefer poultry wastes to sheep dung. Female *C. chloropyga* responded faster to protein sources than the males. Therefore, response to odour sources is dependent on sex and exposure to previous diet. The strong preference for fresh and decayed liver indicates their importance for feeding, ovarian development and oviposition by the blowfly and this is consistent with Huntington and Higley (2010) who reported that fresh and decomposed flesh remain a suitable protein source for carrion-feeding blowflies. Fresh and decomposed liver are therefore good candidates for the mass trapping of the *C. chloropyga* which can progressively reduce the blowfly population in a Field-designed experiment as reported for *Chrysomya* species (Spradberry, 1979) and *Lucilia sericata* Hayes *et al.* (1999). The use of baits is a possible technique for controlling myiasis flies because it can disrupt orientation and therefore cause the flies to miss the oviposition sites (Anon, 1997). In conclusion, fresh and decomposed liver can be used to distrupt the short distance orientation response of the blowfly *Chrysomya chloropyga*.

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