

# The Effect of Flesh Age, Trap Colour, Decomposition Stage, Temperature and Relative Humidity on the Visitation Pattern of Blow and Flesh Flies

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## ABSTRACT

The present study was conducted to know the effect of flesh age, trap colours, decomposition stage, temperature and relative humidity on the visitation pattern of the flies of the families Calliphoridae and Sarcophagidae in the study area during Fall Season, 2003. Five traps of different colours were used to collect the flies using rabbit flesh as bait. Blow fly data were mostly concentrated on central three days of data collection. *L. ampullacea*, *L. sinensis*, *L. illustris* and *L. indica* proved to be very important species numerically in comparison to the rest of the species. Some species like *L. ampullacea* were the regular visitors. Flesh flies proved to be the early visitors. The population of most of the calliphorid flies had their population peaks during the 2<sup>nd</sup> day of data collection while that of flesh flies was observed on the 1<sup>st</sup> day of data collection. Some fly species were occasional visitors of the traps. Green colour was successful in attracting more number of flies compared to the rest of the colours. Fresh stage of flesh decomposition was preferred by the flies in comparison to bloated stage in terms of number as well as variety. A decrease of a few degrees in the environmental temperature resulted in the reduction of a large number of visiting flies. The visitation pattern of flies did not follow a specific trend with respect to changes in the percent mean relative humidity.

**Key Words:** Blue bottle; Green bottle; Flesh fly; Forensic entomology; Calliphoridae; Sarcophagidae

## INTRODUCTION

Blow flies (Diptera: Calliphoridae) include green bottles, blue bottles, brown bottles and black bottles whereas flesh flies (Diptera: Sarcophagidae) comprise sarcophagus flies. Both families are collectively represented by nearly 1000 described species from all geographical regions (Senior-White *et al.*, 1940; Zumpt, 1965; Tenquist & Wright, 1976; Spradbery, 1991). Blow flies cause myiasis in human (James, 1947; Hall & Wall, 1994; Luisto & Nuorteva, 1947; Laitinen *et al.*, 1970) and in animals (Botzler & Hurley, 1979; Zumpt, 1965; Liebisch *et al.* 1983; Hall & Wall, 1994; Mashkei, 1990; Wetzal & Fischer, 1971; Brinkman, 1976; Watts, *et al.*, 1976; Owens & Titchener, 1997; Farkas, 1997), act as vectors of bacterial, viral and rickettsial pathogens (Lindsay & Scudder, 1956). Flesh flies act as predators (Schwendinger & Pape, 2000; Pape & Arribas, 1999; Pape *et al.*, 2000) and parasitoids (Allen & Pape, 1996; Mckillup *et al.*, 2000). Blow flies and flesh flies are used to estimate the length of post-mortem interval and provide evidence in criminal investigations (Joyce, 1984; Greenberg, 1985; Chao, 1973; Erzincinoglu, 1983; Smith, 1986; Anderson 1997; Amendt *et al.*, 2000; Catts & Haskell, 1990). These flies also act as hosts for different parasitoids (Holdaway & Evans, 1930; Roberts, 1933, 1935; Ulyett, 1943; Altson, 1920; Lindquist, 1932, 1940; Ulyett & Devries, 1941). Their use in maggots

therapy is of great importance too (Baer, 1931; Hewitt, 1932; Sherman *et al.*, 1996; Sherman, 1997, 2000, 2001, 2002, 2003; Stoddard & Sherman, 1995).

Thus enormous importance of these flies inspired the author to carry out some ecological studies. The main objective of this endeavour was to determine the effect of flesh age, stage of decomposition, trap colour, temperature and percent relative humidity on the visitation pattern of blow flies and flesh flies in the study area during the study period.

## MATERIALS AND METHODS

The present study aimed at knowing the effect of flesh age, decomposition stage, trap colour, temperature and relative humidity on visitation pattern of the green bottles, blue bottles and flesh flies of Faisalabad District during Fall Season, 2003. Five Blow fly-traps were set 11 feet high on the roof of the building of the Post Graduate Department of Zoology, GC University, Faisalabad. Inter trap distance was 2.52m. Grey, green, red, yellow and black coloured traps were used for this research project. Five rabbits were killed simultaneously with chloroform and used as baits. The trapped flies were collected daily until the flies cease to visit the traps. The collected flies were preserved in 75% alcohol. Properly labeled vials were stored in the laboratory for species analysis. The experiment was repeated during each

month of the fall season. The collected flies were identified to species level using keys provided by Smith (1986) and Senior-White *et al.* (1940). Environmental data were collected from nearby observatory.

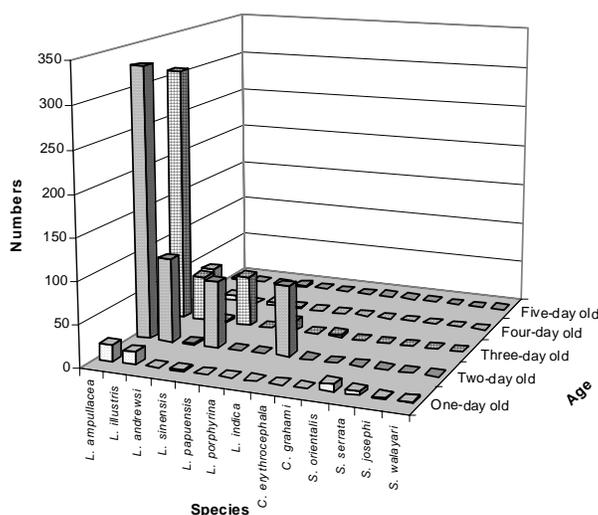
**RESULTS**

Fig. 1 depicts that the data of Calliphorid flies were mostly concentrated on central three days of data collection. *Lucilia ampullacea* was represented by huge numbers during the trap data collection period. *L. ampullacea*, *L. sinensis*, *L. illustris* and *L. indica* proved to be very important species numerically in comparison to the rest of the species. *L. ampullacea*, *L. sinensis* and *L. illustris* were the regular visitors of the rabbit flesh while *L. indica*

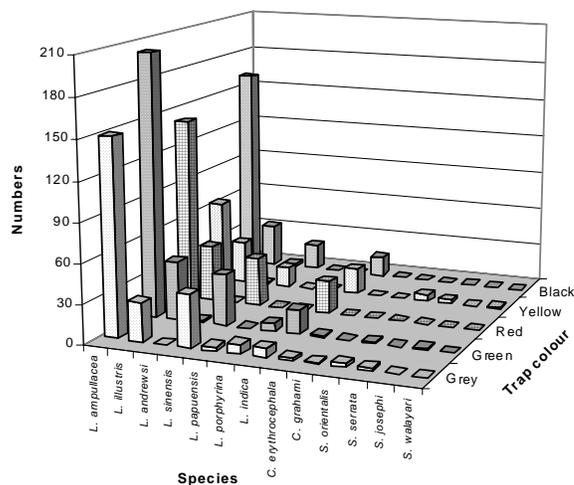
preferred 2<sup>nd</sup> day of data collection. *L. papuensis*, *L. porphyrina* and *Calliphora erythrocephala* chooses the third day of data collection for trap visits. *L. andrewsi* preferred the second and third day of data collection *Sarcophaga orientalis*, *S. serrata*, *S. josephi* and *S. walayari* preferred the first day of data collection for trap visits. The population of most of the calliphorid flies had their population peaks during the second day of data collection while that of sarcophagous flies was observed on the 1<sup>st</sup> day of data collection. *L. papuensis*, *C. erythrocephala* *C. grahami*, *S. josephi* and *S. walayari* proved to be occasional visitors of the traps.

Fig. 2 shows the cumulative visitation pattern of various species of blow and flesh flies during Fall Season, 2003. *L. ampullacea*, *L. illustris*, *L. sinensis*, *L. indica*,

**Fig. 1. The effect of flesh age on the visitation pattern of blow flies and flesh flies during Fall Season, 2003**



**Fig. 2. The effect of trap colour on the visitation pattern of blow flies and flesh flies during Fall Season, 2003**



*Lucilia* spp. and *Sarcophaga* spp. were present in all the traps of different colours baited with rabbit flesh of different ages during the study period. Green trap proved to be favourite trap for *L. ampullacea* and *L. illustris*. While grey, green and red traps were favourite of *L. sinensis*. *L. indica* was noticed in great numbers in red trap. *C. grahmi* only appeared in grey trap in case of family Calliphoridae while in case of family Sarcophagidae *S. orientalis* appeared in great number in yellow trap only. *S. josephi* was represented by single specimen in green trap.

Two stages of rabbit flesh decomposition were recognized during the present study. These were fresh stage and bloated stage. It appeared from Table I that flies of the families Calliphoridae and Sarcophagidae mostly preferred fresh stage of flesh decomposition. *Lucilia andrewsi* did not seem to have any preference for either of the stages. Manifold numerical supremacy was demonstrated by *L. ampullacea*, *L. illustris*, *L. sinensis* and *L. indica* during the present study in fresh stage compared to bloated stage. *L. papuensis*, *L. porphyrina*, *C. erythrocephala*, *C. grahmi*, *S. orientalis*, *S. serrata*, *S. josephi* and *S. walayari* did not visited the bloated stage of rabbit flesh at all.

Table II shows the effect of mean temperature and mean percent relative humidity on the visitation pattern of blow flies and flesh flies. A decrease of a few degrees in the environmental temperature resulted in the reduction of a large number of visiting flies. The number of blow flies and flesh flies visiting the rabbit flesh did not follow a specific pattern with respect to changes in the percent mean relative humidity.

## DISCUSSION

The data of Calliphorid flies were mostly concentrated on the central three days of data collection. The reason behind this seems to be that the kairomones emitted by rabbit flesh spread slowly and with the passage of time more and more flies visit the traps which correspond to the increase of kairomone concentration. The kairomone concentration also increases due to the activity of the larvae of the blow flies and flesh flies as it is known that the activity of the insects on their food greatly increases the emission of Kairomones (Mattiacci *et al.*, 1994; Du *et al.*, 1996; Soussi *et al.*, 1998). Four species of the family Sarcophagidae *i.e.* *S. orientalis*, *S. serrata*, *S. josephi* and *S. walayari* visited the traps only on the 1<sup>st</sup> day of data collection. It shows that these species are early visitor of the decaying flesh. *L. ampullacea*, *L. sinensis* and *L. illustris* were present in all the fly trapping data samples indicating that these species are among the regular visitors of the decaying rabbit flesh. This means that these species do not respond to the qualitative change that might be occurring in the emission of kairomones. When effect of flesh age was observed on the basis of population of visiting flies. It was found that *L. ampullacea* was very important species numerically during the trap data collection period. This may

**Table I. The effect of different decomposition stages of rabbit flesh on the Visitation Pattern of blow flies and flesh flies during Fall Season, 2003**

Species	Fresh Stage	Bloated Stage	Total
<i>Lucilia ampullacea</i>	582	139	721
<i>Lucilia illustris</i>	154	28	182
<i>Lucilia andrewsi</i>	2	3	5
<i>Lucilia sinensis</i>	124	27	151
<i>Lucilia papuensis</i>	3	0	3
<i>Lucilia porphyrina</i>	17	0	17
<i>Lucilia indica</i>	84	1	85
<i>Lucilia spp.</i>	53	17	70
<i>Calliphora erythrocephala</i>	3	0	3
<i>Calliphora grahmi</i>	1	0	1
<i>Calliphora spp.</i>	1	0	1
<i>Sarcophaga orientalis</i>	9	0	9
<i>Sarcophaga serrata</i>	5	0	5
<i>Sarcophaga Josephi</i>	1	0	1
<i>Sarcophaga walayari</i>	1	0	1
<i>Sarcophaga spp.</i>	52	4	56

**Table II. The effect of temperature and relative humidity on the Visitation Pattern of blow flies and flesh flies during Fall Season, 2003**

Months	Mean Temperature	Mean Relative Humidity	Blow Flies	Flesh Flies
September	30.27 °C	68.70 %	1043	16
October	25.68 °C	52.60 %	183	0
November	14.67 °C	67.90 %	69	0

be due to two reasons i) the population of *L. ampullacea* in the study area may be very great or ii) *L. ampullacea* perhaps very much like the decaying flesh. *L. ampullacea*, *L. sinensis* and *L. illustris* were the most important species numerically in comparison to the rest of species trapped. It may be due to the abundance of these species in the study area or their likeness for the decaying flesh. *C. grahmi* was captured on the 5<sup>th</sup> day of data collection in November indicating that this species of the Calliphoridae family was not prefer kairomones emitted at a latter stage of decomposition of the rabbit flesh but these also love to visit the traps in the cold climate. *L. indica* preferred the second day of data collection. *L. papuensis*, *L. porphyrina* and *C. erythrocephala* chooses the third day of collection. This indicates the preference of these flies for different types of kairomones emitted at different ages of the decaying rabbit flesh. The population of the collected flies had their peaks during second day of data collection. This indicates that the number of visiting flies varies with the amount and composition of the Kairomones emitted by rabbit flesh. It also shows the highest response qualitatively and quantitatively on the 2<sup>nd</sup> compared to the rest of the days of data collection. It was observed during the present study that flies of the families Calliphoridae and Sarcophagidae showed a visitation pattern with very low population size during November, 2003. It may be due to the reduced

activities of the flies in response to low temperature prevailing in the environment where the traps were set.

During the present study five trap colours namely grey, green, red, yellow and black were used to trap the blow flies and flesh flies. The results of present investigation indicate that the colour of the traps did not elicit a profound effect on the visitation pattern of the flies of the family Calliphoridae and Sarcophagidae. However, green trap attracted more flies than any other coloured trap followed by black, grey, red and yellow.

Fresh and bloated stages of the rabbit flesh with reference to visitation pattern of the flies of the families Calliphoridae and Sarcophagidae were also studied during the present research project. These results showed that *L. papuensis*, *L. porphyrina*, *C. erythrocephala*, *C. grahmi*, *S. orientalis*, *S. serrata*, *S. josephi* and *S. walayari* were exclusive to the fresh stage of decomposition of rabbit flesh with reference to visitation of these flies. The rest of the flies namely *L. ampullacea*, *L. illustris*, *L. andrewi*, *L. sinensis* and *L. indica* did not show any discrimination between the two stages of decay with reference to visitation pattern of the blow flies and flesh flies. It was also observed during the present study that the fresh stage proved to be more important than the bloated stage in terms of the size of the populations of flies of families Calliphoridae and Sarcophagidae. It was also noticed that the fresh stage of decay of rabbit flesh was also important in terms of variety (species) of flies. This means that the kairomones emitted during the fresh stage of decay of rabbit flesh are more important in attracting a large number of flies belonging to different species. When the flesh enter the blotted stage, the flies perhaps do not like the kairomones emitted at this stage as feeding and oviposition deterring kairomones are also known (Anderson *et al.*, 1995).

It was observed during present investigation that with the decrease in the mean temperature a few degree, the number of visiting flies of the families Calliphoridae and Sarcophagidae also decreased sharply. The huge numbers of blow flies and flesh flies were observed during September, 2003. During October, 2003 moderate number of visiting flies was observed. The data of the blow flies and flesh flies collected during November, 2003 portrayed a very low number of visiting flies of the families Calliphoridae and Sarcophagidae. It proves that the number of flies visiting the traps decreases with the decrease in the mean temperature. It was also observed during the present study period that the mean percent relative humidity does not show a definite pattern, therefore, it was assumed that mean percent relative humidity did not have any appreciable effect on the number of species or number of flies.

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(Received 13 January 2004; Accepted 26 February 2004)