



E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2015; 3(3): 321-323
© 2015 JEZS
Received: 02-04-2015
Accepted: 05-05-2015

Bismillah Shah
Department of Entomology,
The University of Agriculture,
Peshawar-Pakistan.

Imtiaz Ali Khan
Department of Entomology,
The University of Agriculture,
Peshawar-Pakistan.

Nazeer Ahmed
State Key Laboratory of Crop
Stress Biology for Arid Areas,
Northwest A&F University,
Yangling, china.

Study on the biology of blowfly and the food consumption of blowfly maggots

Bismillah Shah, Imtiaz Ali Khan, Nazeer Ahmed

Abstract

To study the biology of blowfly and the food consumption of blowfly maggots, the present research work was carried out at Entomology research laboratory, The University of Agriculture, Peshawar during 2013. The blowfly (green bottles, blue bottles or carrion flies), is a well known scavenger insects and primary insects commonly utilized to indicate a post-mortem interval. Due to its importance as a death indicator in forensic entomology, a considerable amount of data on its growth and development has been generated. This experiment was conducted in two steps. In step 1, fresh meat was exposed to collect the eggs which were reared and used to study the biology of blowfly. Calculating the age of different life stages of blowfly, hourly developmental data is presented i-e eggs hatched in 16 hours while all the three instars of larvae took 92 hours followed by the pupal stage which was 336 hours. Adult's life was recorded 192 hours. In this way the total duration was recorded 636 hours. In step 2, to study the food consumption of blowfly maggots, three plastic jars provided each with known amount of meat and 10 active feeding 1st instar larvae were placed in an incubator at a constant temperature and relative humidity. The average meat consumed by 10 larvae was 19.3 gm and the average meat consumed per larvae was recorded 1.93 gm. This report recommends the study of biology of blowflies on different feeding sources plus growth rates and food consumption rate of blowfly maggots on different body tissues or food sources.

Keywords: Blowfly, Green bottles, Blue bottles, Carrion flies, Scavengers, Maggots, Instar, Forensic entomology.

1. Introduction

The blowflies (green bottles, blue bottles or carrion flies), is well known scavenger insects and belongs to family Calliphoridae and order Diptera. The name blowfly comes from an older English term for meat that had eggs laid on it, which was said to be fly blown. Blowflies are recognized as being among the first wave of the faunal succession on human cadavers [1, 2]. The adults are commonly 7 to 16 mm in length. Calliphorides are shiny with metallic coloring, often with blue, green or black thoraces and abdomens. Antennae are three-segmented and aristate. The characteristics and arrangement of hair like bristles are used to tell the difference between members of this family. All blow flies have bristles located on the meron. The postscutellum is absent or weakly developed. The costa is unbroken and the subcosta is apparent on the insect [3]. About 1,100 species of blow flies are known, with 228 species in the Neotropics, and a large number of species in Africa and Southern Europe. The most common areas to find Calliphoridae species are in India, Japan, China, Central America, and the Southern United States. The typical habitats for blow flies are temperate to tropical areas that provide a layer of loose, damp soil and litter where larvae may thrive and pupate. Adult blow flies are attracted to nectar, carrion, garbage, and other refuse and soggy, bloody or soiled hair, fur, or wool. Adult blow flies are occasional pollinators, being attracted to flowers with strong odors resembling rotting meat, such as the American pawpaw or dead horse arum. Most blow fly larvae feed in carrion or other decaying organic matter. They often infest wounds of sheep, goats, cattle, and other animals. The current theory is that females visit carrion both for protein and egg laying. Blowfly eggs, usually yellowish or white in color, are about 1.5 mm x 0.4 mm and when laid, look like rice balls. While the female blowfly typically lays 150–200 eggs per batch, she usually lays around 2,000 eggs during the course of her life. Blow flies have caught the interest of researchers in a variety of fields, although the large body of literature on calliphorids has been concentrated on solving the problem of myiasis in livestock. Maggot debridement therapy (MDT) is the medical use of selected, tested and disinfected fly larvae, including blowfly maggots, for cleaning non-healing wounds.

Correspondence:
Bismillah Shah
Department of Entomology,
The University of Agriculture,
Peshawar-Pakistan.

Lucilia sericata (*Phaenicia sericata*), or the common green bottle fly, is the preferred species used in maggot therapy [4]. Salmonellosis has also been proven to be transmitted by the blowfly through saliva, feces and direct contact by the flies' tarsi. Adult blowflies may be able to spread pathogens via their sponging mouthparts, vomit, intestinal tract, sticky pads of their feet, or even their body or leg hairs [5]. Blowflies are usually the first insects to come in contact with carrion because they have the ability to smell dead animal matter from up to 1 mile (1.6 km) away [6]. *Calliphora vicina* and *Cynomya mortuorum* are important flies of forensic entomology. Other forensically important Calliphoridae are *Phormia regina*, *Calliphora vomitoria*, *Calliphora livida*, *Lucilia cuprina*, *Lucilia sericata*, *Lucilia illustris*, *Chrysomya rufifacies*, *Chrysomya megacephala*, *Cochliomyia macellaria*, and *Protophormia terraenovae*. One myth states that species from the genus *Lucilia* can sense death and show up right before it even occurs [7]. This experiment was conducted to study the biology of blowfly and to report the food consumption of blowfly maggots.

2. Materials and Methods

The present research work was carried out at the Entomology research laboratory, The University of Agriculture, Peshawar to study the biology of blowfly and the food consumption of blowfly maggots during 2013. The experiment was conducted in two steps.

2.1 Collection and rearing of blowflies

Laboratory specimens of blowflies used in this study were originated from eggs collected from exposed sliced meat placed in a plastic dish near the buffalo intestine at village Manki, District Swabi, KPK, Pakistan. The blowflies laid eggs on the sliced meat which was later on reared. 5 cm deep layer of soil was taken in the shoes box, which was made suitable for rearing with the help of scissor. The meat was then placed in the box which was covered by a fine mesh to prevent the entry of parasitoids. Observations were taken on hourly basis. The maggots were observed, collected with the help of forcep/needle and preserved in the small bottles throughout their developmental stages at different time-intervals. As the 3rd instar larvae finished feeding and reached the wandering phase, they left the food and migrated to the soil present in the box for pupation. Few pupae were collected by using forcep and preserved in 70% alcohol. Once all larvae pupated, any remaining food was removed from the box. The box containing pupae was then brought to the Entomology laboratory, The University of Agriculture, Peshawar and placed in the incubator to keep the temperature and relative humidity constant. Adults emerged after a few days. The total time taken by each stage of the blowfly lifecycle was recorded.

2.2 Studying the food consumption of blowfly larvae

The emerged adults are then transferred to the rearing cage for further experiment. Sugar solution was provided in petridishes in the rearing cage. Five days after the emergence, a dish containing sliced meat was placed in the rearing cage having adult blowflies. Then the mated blowfly females started laying eggs on the sliced meat. To study the food consumption of all the three instars of blowfly larvae, three plastic jars were taken and provided with 5 cm deep layer of soil. Approximately 40 grams of fresh sliced meat was placed on a smooth platform and kept in each jar. 10 active feeding first instar larvae were selected and placed over the meat in each of the three jars. All the three jars were covered with a fine muslin cloth with the help of elastic rubber bands. These experimental jars were then

placed in incubator to maintain the constant temperature of 25 ± 2 °C and relative humidity $65 \pm 10\%$. When the third instar larvae finished feeding and reached the wandering phase, they left the food and migrated out of the platform to the soil present in each jar for pupation. When all larvae pupariated, the remaining food/meat was then removed from each jar. The weight of the remaining meat of each jar was taken separately. Hence calculated the average amount of meat consumed by the blowfly maggots during their whole larval stage.

3. Results and Discussion

The present research work was carried out at the Entomology research laboratory, The University of Agriculture, Peshawar to study the biology of blowfly and the food consumption of blowfly maggots. The results are described and discussed below:

Table 1 showed the biology of blowfly. Results revealed that the egg stage of blowfly persisted for 16 hrs. There are three larval instars. The duration of first instar larvae was 24 hrs. The second instar larvae took 20 hours to reach the third instar while the time taken by the third instar larvae to the pupal stage was 48 hours. Pupal stage was recorded 336 hours means 14 days and the adult life was noticed 192 hours i-e 8 days. The total duration of the whole life cycle of blowfly was calculated 636 hours which was almost 27 days. The egg hatch time reported by Kamal [8] at a temperature of 26.7°C had a range of 10-22 hours and is essentially the same range reported in this study. Additionally, the peak emergence reported in this study occurred in 16 hours which coincides with 16 hours in Kamal's study and 15.5 hours in Allen's study. The result of this study was in agreement with the report of Firoozfar [9], who concluded that larvae complete their development in 4-13 days. In our study, the duration of adult stage and mating was found to be 08 days whereas it was reported two weeks in studies of Spiller [10].

Table 1: Biology of blowfly

| Life Stages | | Duration |
|----------------|------------------------|-------------------|
| Egg | | 16 hrs. |
| Larva | 1 st instar | 24 hrs. |
| | 2 nd instar | 20 hrs. |
| | 3 rd instar | 48 hrs. |
| Pupa | | 336 hrs.(14 days) |
| Adult | | 192 hrs.(8 days) |
| Total duration | | 636 hrs. |

Table 2 showed the food consumption of blowfly larvae. Results revealed that 57.9 gm of meat was consumed by 30 larvae in their whole larval duration. The average meat consumed by 10 larvae was 19.3 gm and the average meat consumed per larva was recorded 1.93 gm. The result of the present study supports the conclusion of Kaneshrajah and Turner [11], suggesting that for blowflies, growth rates also vary considerably on different tissues and that growth is poorest on liver as compared to other organs. Clark *et al.* [12] carried out similar study looking at the food sources structure that had no significant effect on time to wandering and so the data from liquidized and chunked replicates were pooled for subsequent analysis of the larval feeding period. Although there was a large and significant difference in the time taken to reach the wandering stage for larvae reared of different tissues, with larvae fed on lung and heart.

Table 2: Food Consumption of blowfly maggots.

| Replications | Total no. of larvae | Initial weight | Final weight | Consumed weight | Consumed food/larvae |
|--------------|---------------------|----------------|--------------|-----------------|----------------------|
| R1 | 10 | 40 gm | 21.6 gm | 18.4 gm | 1.84 gm |
| R2 | 10 | 40 gm | 20.1 gm | 19.9 gm | 1.99 gm |
| R3 | 10 | 40 gm | 20.4 gm | 19.6 gm | 1.96 gm |
| Total | 30 | 120 gm | 62.1 gm | 57.9 gm | 5.79 gm |
| Mean | 10 | 40 gm | 20.7 gm | 19.3 gm | 1.93 gm |

4. Conclusion and Recommendations

From the present research work reported here, it is concluded that the total life cycle of blowfly (egg - adult) recorded in this study is approximately 27 days, which may vary with the variation in temperatures at different life stages and the availability of different food sources. This study recommends the study of biology of blowfly on different feeding sources. The possibility of the night oviposition by blowflies should always be taken into consideration. The analysis of the blowfly insect colonizers of corpse can be a valuable forensic tool in the determination of post-mortem interval (PMI). Evidently, the position at which larvae feed on a body will be a crucial observation at a crime scene when investigating PMI. Clearly the tissues of which blowfly larvae feed does have an important effect on growth rates and this needs to be taken into account more explicitly in the calibration of growth models for estimation of post-mortem interval.

5. References

- Nuorteva P. Sarcosaprophagous insects as forensic indicator. In: Tedeschi, C.G., W.G. Eckert and L.G. Tedeschi (Eds.), Forensic Medicine. A study in Trauma and Environmental Hazards, Saunders, Philadelphia 1997; 2:1072-1095.
- Smith KGV. A manual of Forensic Entomology. British Museum (Natural History), London, and Cornell University Press, Ithaca, New York, 1986.
- Anne Hastings, David Yeates, Joanna Hamilton (2004). "Anatomical Atlas of Flies". CSIRO. Retrieved 13 January, 2012.
- Monaghan, Peter (1 June). "Rx: Maggots, Notes from Academe". The Chronicle of Higher Education 2007; 53(39):A48.
- Olsen, Alan R. "Regulatory Action Criteria for Filth and Other Extraneous Materials*1 III. Review of Flies and Food borne Enteric Disease". Regulatory Toxicology and Pharmacology 1998; 28 (3):199-211. doi:10.1006/rtph.1998.1271.
- Joel Greenberg. Many more than we know: insects. A Natural History of the Chicago Region. University of Chicago Press. ISBN 978-0-226-30649-0, 2004, 291-316.
- Brundage, Adrienne. "Calliphoridae". Texas A&M University, College Station, 2008.
- Kamal AS. Comparative study of thirteen species of sarcosaprophagous Calliphoridae and Sarcophagidae (Diptera) I. Bionomics. Annals of the Entomological Society of America 1958; 51:261-270.
- Firoozfar F, Kazemi M, Baniardalani M, Abolhassani M, Khoobdel M, Rafinejd J. Mass rearing of *Lucilia sericata* Meigen (Diptera: Calliphoridae). Asian Pacific J. Tropical Biomedicine, 2011, 54-56.
- Spiller D. House Flies. In: Insect Colonization and Mass Production, Smith, C.N. (Ed.). Chapter 14, Academic Press, New York, USA, ISBN-13: 978-0123956019, 1966, 203-225.
- Kaneshrajah G, Turner B. *Calliphora vicina* larvae grow at different rates on different body tissues. Int. J. Legal Med 2004; 118:242-244. doi:10.1007/s00414-004-0444-5.
- Clark K, Evans L, Wall R. Growth rates of the blowfly, *Lucilia sericata*, on different body tissues. Forensic Sci. Int 2006; 156(2-3):145-9.