Entomology and Applied Science Letters
Volume 10, Issue 4, Page No: 56-61

Available Online at: **www.easletters.com**

ISSN No: 2349-2864

Study of Bacterial Contamination of House Flies in Different Environments

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ABSTRACT

Musca domestica is one of the most important agents in the transmission of pathogenic organisms from contaminated materials to the human body. In various studies, the role of flies in the transmission of many diseases has been well-proven. The purpose of this study was to investigate the bacterial contamination of *Musca domestica* in different sources. In this study, samples were collected from slaughterhouses, coastal areas, hospital grounds, and urban and rural waste. After collection, the samples were transferred into sterile glass containers and then the isolation and identification of bacterial species was done in the laboratory. Based on the obtained results, *Escherichia coli* was the dominant species in this study. From all the examined samples, most of the contaminations were related to *E. coli*, *Staphylococcus aureus*, *Enterobacter aerogenes*, and *Staphylococcus epidermidis*, respectively. Based on the results of this study, it can be said that the presence of these insects in public centers can be carriers of pathogenic agents. Considering the necessity of preventing the spread of infection and pollution in public places and different parts of the environment, it seems necessary to improve and carry out sanitary engineering measures to control these insects.

Keywords: *Musca domestica,* Pathogenic organisms, Diseases, Transmission.

HOW TO CITE THIS ARTICLE: Gioia G, Freeman J, Sipka A, Santisteban C, Wieland M, Alanis Gallardo V, et al. Study of Bacterial Contamination of House Flies in Different Environments. Entomol Appl Sci Lett. 2023;10(4):56-61. https://doi.org/10.51847/Rb6CEz672N

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Received: 14/09/2023
Accepted: 11/12/2023

INTRODUCTION

The housefly is constantly next to humans and in contact with food and human waste [1-3]. In this way, houseflies in different environments can transmit pathogenic organisms from contaminated materials to humans. The role of flies in the transmission of diseases, especially intestinal diseases related to gram-negative organisms such as salmonellosis, shigellosis, campylobacter, etc., has been proven [4-9]. They also cause the transmission of gram-positive bacteria such as streptococci and staphylococci [10, 11] the fly is well adapted to pick up pathogens from different environments and sources. A fly's proboscis is easily contaminated with a wide variety of fine hairs. In addition, each of the fly's hairy legs secretes a sticky substance that increases the potential for pathogen transmission. Therefore, it is not surprising that more than 100 species of pathogenic organisms were isolated from Max's digestive tract [12, 13]. Pathogenic bacteria on the surface of the body

and digestive system of houseflies remain for a long time. The fly can swallow liquid food and usually regurgitates the food that has entered the stomach to dilute the solids to facilitate digestion. In addition, fecal drops may be deposited during the feeding process. Wolff's study showed that there is a correlation between houseflies and enteric fever, and flies carry *Salmonella typhi* and *Salmonella paratyphi* type A, and these microorganisms survive in the flies' bodies for a long time [14].

Researchers stated that houseflies could act as carriers of H. pylori if they carry the bacteria in food contaminated with humans. *Helicobacter pylori* infection is one of the most common chronic human bacterial infections and affects the largest population in the world [15, 16]. The study of Esrey *et al*. and Cohen *et al*. showed that there is a significant relationship between the fly population and diarrhea and the prevalence of shigellosis [17-19]. Emerson *et al.* also showed that fly control can reduce trachoma and diarrhea among children in the Gambia [20, 21]. Prüss and Mariotti also stated that trachoma is through person-to-person contact and that flies appear to be the main routes of transmission [22].

Today, to control flies, various methods are used, such as improving the environment (including installing nets on doors and windows, collecting and sanitary disposal of garbage, using tapes impregnated with poison, spatial spraying, etc.), which is the best method. Collection and sanitary disposal of waste [23]. Considering the importance of the housefly as a mechanical vector in the spread of diseases, the present study was conducted to determine the bacterial contamination of *M. domestica* in different environments.

MATERIALS AND METHODS

This descriptive study was conducted to determine the contamination of houseflies in different seasons. 10 stations were selected from 5 sources including urban and rural waste, hospital grounds, coastal areas, and slaughterhouses. In collecting flies, only adults were caught and an entomological net was used for catching. Sampling was done twice a month and once in each studied area. According to the schedule of the Gantt table, continuous sampling was done for at least one year. A total of 384 houseflies were collected for microbial examination and transferred to the laboratory in sterile glass containers.

At first, the flies were identified using a stereomicroscope and according to their morphological characteristics, including antenna, wing, forehead furrow, and body surface hair. Then the external surface of their body was washed with sterile physiological serum and then they were dissected with an entomological needle and their digestive system was transferred into the physiological serum. Before separating the intestines, each of the flies was washed in a sterile hygiene solution and in sterile serum to prevent the mixing of internal and external bacteria. Then, their intestines were separated from the mouth to the anus, after washing and crushing the intestines, both the solution obtained from washing the external surface and the physiological serum containing the digestive system of insects were centrifuged for 5 minutes at 2000 rpm and the resulting sediment was analyzed. For bacterial studies, Blood Agar, EMB Agar, Nutrient Agar, Nutrient Broth, and Mannitol Salt Agar were prepared from Merck Germany.

The culture mediums were made according to the instructions written on them and with the standard method and kept in the refrigerator. After culture, the samples were placed in an incubator at 37°C for 24 hours. After staining and microscopic examination, standard diagnostic tests such as mannitol, Simon Citrate, lysine, urea (OF), Methyl Red (MR test), Vegs Cotter (VP test), Triple Sugar Iron Agar (TSI), DNase, etc. were performed on the colonies [24].

RESULTS AND DISCUSSION

Based on the obtained results, *Escherichia coli* was the dominant species in this study. From all the examined samples, most of the contaminations were related to *E. coli*, *Staphylococcus aureus*, *Enterobacter aerogenes*, and *Staphylococcus epidermidis*, respectively.

The highest percentage of samples contaminated with *E. coli* were related to hospital premises and the lowest percentage were related to urban waste. At the same time, the highest percentage of samples infected with *Staphylococcus aureus* was related to urban waste, and the lowest was related to coastal areas. In this study, the

percentage of sample contamination with *Enterobacter aerogenes* and *Staphylococcus epidermidis* was higher in urban and rural waste. Based on the results of the present study, the percentage of *Staphylococcus aureus* isolated from the digestive tract of flies (10%) was higher than *Staphylococcus aureus* isolated from the body surface of flies (8%). The highest rate of infection with *Staphylococcus aureus* isolated from the digestive tract of flies was related to hospitals and the highest rate of infection with *Staphylococcus aureus* isolated from the body surface of flies was related to slaughterhouses. *E. coli* isolated from the digestive tract of flies (24%) was more than *E. coli* isolated from the body surface of flies (22%). The highest level of contamination in the digestive tract of flies (6%) and the highest level of contamination from the surface of the fly's body (6%) with *E. coli* were related to hospitals.

The maximum amount of contamination with *Staphylococcus epidermidis* isolated from the digestive system of flies was related to urban waste and the highest amount of contamination with *Staphylococcus epidermidis* isolated from the body surface of flies was related to rural waste. The percentage of *Staphylococcus epidermidis* isolated from the body surface of flies (6%) was higher than *Staphylococcus epidermidis* isolated from the digestive system of flies (3%). The highest level of infection with *Enterobacter aerogenes* isolated from the digestive system of flies was related to urban waste and the highest level of infection with *Enterobacter aerogenes* isolated from the body surface of flies was related to urban and rural waste. Based on the results, the percentage of *Enterobacter aerogenes* isolated from the digestive tract of flies (9%) was higher than that of *Enterobacter aerogenes* isolated from the body surface of flies (5%).

Table 1. Microbial contamination of flies caught from different regions.

Microorganism isolation zone	Source of microorganism isolation	Total number of samples	The percentage of contamination with *E. coli* (%)	The percentage of contamination with *Staphylococcus aureus* (%)	The percentage of contamination with *Staphylococcus epidermidis* (%)	The percentage of contamination with *Enterobacter aerogenes* (%)
Urban	Northern urban waste	48	5.2	2.60	2.08	2.34
	Southern urban waste	48	5.7	3.13	2.60	2.86
	Eastern hospital campus	48	6.25	2.08	0	1.56
	Western hospital campus	48	6.25	1.82	0.2	1.56
Rural	Rural waste	48	5.7	2.60	2.08	2.60
	North coastal areas	48	5.46	2.08	1.56	1.82
	Southern coastal areas	48	5.7	1.82	1.04	1.82
	Slaughterhouse	48	5.7	2.34	0.2	2.08
Total	All regions	384	46	19.01	9.89	16.66

The samples collected from urban and rural waste were more contaminated with *E. coli* and less contaminated with *Staphylococcus epidermidis*. The samples collected from the hospitals were mostly infected with *E. coli* and less infected with *Staphylococcus epidermidis*. The samples collected from coastal areas were more infected with *E. coli* and less infected with *Staphylococcus epidermidis* and *Enterobacter aerogenes*. The samples collected from the slaughterhouse were mostly infected with *E. coli* and less infected with *Staphylococcus epidermidis*. The samples collected from urban waste were mostly infected with *E. coli* and less infected with *Staphylococcus epidermidis* **(Table 1)**.

What is certain is that high contamination of flies with pathogens can cause bacterial diseases in communities. Therefore, the presence and abundance of infected flies in public environments, including urban and rural wastes, is very dangerous and threatens the health of society. The contact of houseflies with different sources, including garbage that contains various pathogenic microorganisms, and the transmission of pathogenic agents by them has been confirmed in different studies [3, 25, 26]. Due to the specific behavior of these organisms, the presence of flies as one of the most important mechanical carriers has been observed in

different types of places where the isolation of disease pathogens has been studied.

Slaughterhouses, urban and rural waste, and hospital waste are among the environments where flies are present. In the present study, *Enterobacter aerogenes*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, and *E. coli* species were isolated from flies. The findings of this study were consistent with the results obtained in studies conducted in other parts of the world, including in the case of *Staphylococcus*, *Streptococcus*, and *Escherichia coli* bacteria [10, 27].

All kinds of bacterial diseases are transmitted by houseflies, the most dangerous of which include dengue fever, cholera, and poisoning caused by Staphylococcus aureus [28]. Their nutritional characteristics and the habits of carriers cause the transmission of intestinal pathogens to humans. Flies as reservoirs of various intestinal pathogens play a role in digestive diseases such as diarrhea, colitis, and gastroenteritis [28].

In the present study, the most isolated bacterial species was Escherichia coli in the digestive tract of the fly. Escherichia coli is a gram-negative bacterium that lives in the digestive tract and warm blood, and it seems that for this reason, the percentage of infection in the digestive tract of the fly with this bacterium was higher than its body surface. Escherichia coli is a common microorganism in feces that has been isolated from flies of the Musidae and Caliphoridae families in many studies [29, 30].

In the present study, the highest percentage of body surface contamination was related to *Staphylococcus epidermidis* bacteria. The results showed that the percentage of bacteria isolated from the intestines is more than the surface of the fly's body, and these findings were in line with the results of other studies [30], which of course can be attributed to various factors such as the type of microorganism, its binding rate. It depends on the body surface of the fly, as well as the intensity of the pollution of the tank.

The existence of these insects in public centers and different environments is considered a disturbing factor and carrier of pathogenic agents and is of interest to health engineers. Hospital waste, urban and rural waste, and landfills are the main sources of infection and are suitable places for insects to mechanically transmit infectious agents and cause summer diarrhea epidemics, etc. Therefore, public places should not be a place for the creation and spread of infection and pollution and endanger the health of the environment people, and society, therefore improving the environment and carrying out environmental health engineering measures as well as fighting and controlling these insects to provide the basic goals of health and creating A healthy and safe environment is essential. In the field of fighting flies, many methods must be done with full care and by qualified people to avoid environmental pollution. In general, it can be said that the presence of flies indicates a lack of hygiene and unsanitary conditions. Fly control is still an important public health measure that helps eradicate this transmission of diseases, especially in developing countries.

CONCLUSION

Flies are effective in the occurrence of diseases and transmission of bacterial agents in logic. The presence of flies is a sign of a lack of hygiene and lack of proper health control and supervision in the environment. Accordingly, to prevent infection, all fly breeding sites should be destroyed and the access of these insects to garbage and food remains should be limited as much as possible. In addition, good hygiene practices such as covering food, heating leftover food before consumption, and thoroughly washing containers, as well as the use of insecticides, will be effective in reducing contact with environmental vectors.

ACKNOWLEDGMENTS: None

CONFLICT OF INTEREST: None

FINANCIAL SUPPORT: None

ETHICS STATEMENT: None

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