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Survey on the Distribution and Abundance of Musca Domestica in Duhok City from October to December 2024

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Abstract This study examined the distribution and prevalence of Musca domestica (houseflies) in several places throughout Duhok Province, concentrating on sites with significant organic waste, including slaughterhouses, meat markets, and fruit warehouses. Flies were collected using sticky fly catcher paper, net catchers (similar to tennis balls), and plastic containers from 18 sub-districts, including: Animal Slaughter House (Khanke), Baroshke live poultry market, Besere live poultry market, Nizarke live poultry market, Bahdinan live poultry market (Zrka area), Duhok live poultry market (Masek area), Nawroz live poultry market, Jiwan live poultry market, Besere Area - Village (east of Duhok City), permanent live animal market (Doulibe Village), meat market (Doulibe Village), Duhok - main meat markets, Souq Al-Asri meat markets, Duhok - zoo, Duhok - warehouse of fruits, Shahidan fruits market, Duhok - dam, and Hshkaro rivers (in the centre of Duhok City). Specimens were kept in 70% ethanol and identified morphologically with a single concave microscope. Descriptive data indicated a total of 382 Musca domestica specimens collected, with a mean count of 21.22 per site. High-risk locations, like Baroshke Live Poultry market (33 flies) and the meat market in Doulibe Village (31 flies), demonstrated the largest fly populations, presumably attributable to the accumulation of organic waste. Moderate-risk zones, such as Khanke Animal Slaughter House (26 flies) and Souq Al-Asri Meat Markets (26 flies), exhibited intermediate levels, and low-risk locations like Shahidan Fruits Market (9 flies) recorded the lowest counts. Statistical analysis employing one-way ANOVA revealed substantial disparities in fly numbers among sites ($p = 0.003$). The results underscore the need of focused pest management, enhanced sanitation, and public awareness initiatives to reduce fly populations and related health hazards. Recommendations encompass systematic cleaning protocols, appropriate trash management, and community education to diminish breeding habitats and successfully regulate Musca domestica populations.

Keyword: musca domestica, morphology, biodiversity, distribution

Introduction:

The housefly (Musca domestica), classified under the order Diptera and the family Muscidae, is a considerable risk to public health as a vector for several illnesses common in tropical and subtropical areas (1,2). These insects flourish in filthy circumstances, favouring warm and humid surroundings, and are typically located in damp locations during daytime. (3, 28, 29). Houseflies often traverse polluted surfaces, animals, and food sources, disseminating diseases while feeding and defecating, so serving as effective vectors of germs. Studies demonstrate that these flies facilitate the transmission of several infectious illnesses by harbouring germs on their exteriors and depositing eggs on decaying organic material. (4, 5).Houseflies spread several illnesses, including leprosy, anthrax, tuberculosis, dysentery, typhoid, diphtheria, and gastrointestinal parasites. Furthermore, they function as mechanical vectors or intermediary hosts for certain nematodes and cestodes (6, 30, 31). In underdeveloped countries, Musca domestica has a substantial role in the transmission of diseases such as gastroenteritis and trachoma, especially in children. Young children with sensitive skin frequently engage in outdoor play with limited clothes, heightening their risk of exposure. Moreover, houseflies have been associated with the spread of nosocomial diseases in healthcare environments. (7, 8). Research conducted by (9) has identified a range of parasites and ova in fly excrement, including Diphyllobothrium sp., Trichuris trichiura, Hymenolepis sp., Strongyloides stercoralis, Ascaris lumbricoides, Enterobius vermicularis, Toxocara canis, Giardia sp., Taenia sp., Trichomonas sp.,

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Entamoeba histolytica, and various fungi.Various control tactics have been employed to regulate housefly populations, encompassing both physical and chemical approaches. Vector control is the principal strategy for mitigating the risk of vector-borne illnesses. (10, 11). Historically, pesticides have been extensively employed to eradicate houseflies. Moreover, environmental management strategies emphasise the eradication of breeding sites using microbiological ovicides, chemical larvicides, and pupacides, especially in regions where endemic illnesses are common (11). Houseflies have remarkable adaptability and may reproduce in a variety of habitats, including freshwater bodies, mangrove forests, sewage tanks, domestic refuse, desert coolers, and locations with stagnant water (12). Under ideal conditions, Musca domestica completes its life cycle in around 7 to 10 days, with moderate temperatures and humidity facilitating rapid development. Nevertheless, unfavourable situations such as excessive heat, substantial rainfall, or frigid temperatures can prolong their life cycle to over two months. In temperate locations, houseflies may generate up to 12 generations yearly, whereas in tropical and subtropical climates, they may exceed 20 generations per year. Evaluating larval environments according to species composition and resource availability is vital for comprehending their ecology, enhancing control tactics, distinguishing various species, and monitoring population density, all of which are imperative for efficient fly management. (14, 15).This study is to assess and examine the strategies employed for managing Musca domestica in Duhok city.

Materials and Methods

Ethical approval

The current study was approved by the Department of Microbiology and Pathology, College of Veterinary Medicine, University of Duhok, Iraq

Study area :

The region of Duhok city from which the samples were collected in 18 different areas, which included the Khanke animal abattoir, Baroshke live poultry market, Besere live poultry market, Nizarke live poultry market, the meat market in Duolibe Village, the permanent live animal market in Duolibe Village, and the principal meat markets in Duhok. Duhok Zoo, Duhok Fruit Warehouse, Duhok Dam, Bahdinan Live Poultry Market (Zrka Area), Nawroz Live Poultry Market, Jiwan Live Poultry Market, Hishkaro Rivers (in Duhok Centre), Duhok Live Poultry Market, Souq Al Asri – Meat Markets, Besere Area - Village (East of Duhok City), Shahidan Fruits Market (Gre-Base).

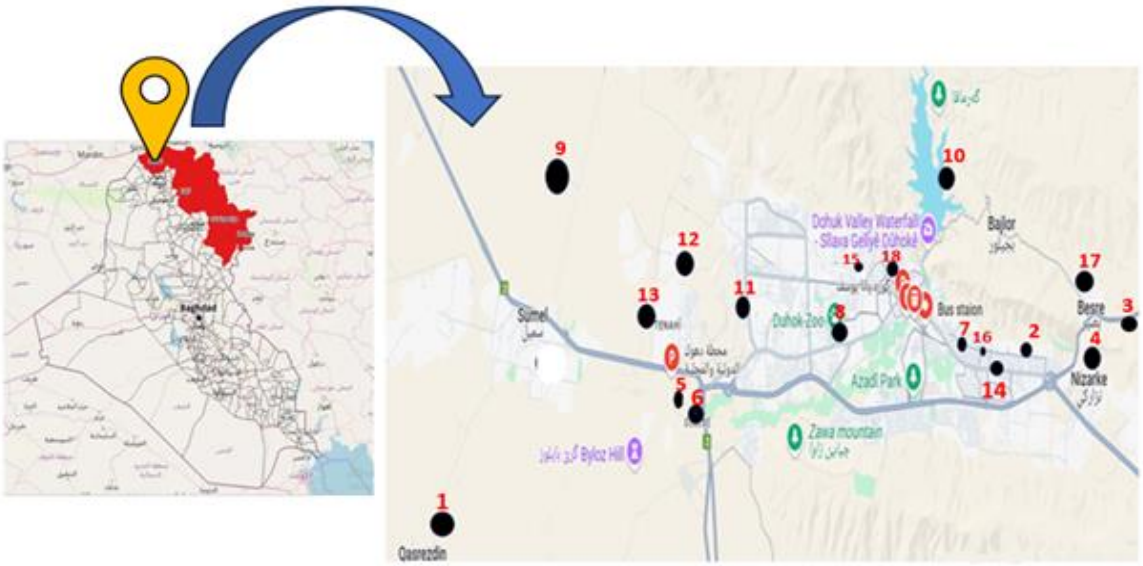

Figure (1): The map showing the places of sample collection in Duhok city:
1-Khanke animal abattoir,2- Baroshke live poultry market,3- Besere live poultry market,4- Nizarke live poultry market,5- Meat market in Duolibe Village,6- permanent live animal market in Duolibe Village,7- principal meat markets in Duhok,8- Duhok Zoo,9- Duhok Fruit Warehouse,10- Duhok Dam, 11- Bahdinan Live Poultry Market (Zrka Area),12- Nawroz Live Poultry Market,13- Jiwan Live Poultry Market,14- Hishkaro Rivers (in Duhok Centre),15- Duhok Live Poultry Market,16- Souq Al Asri – Meat Markets,17- Besere Area - Village (East of Duhok City),18- Shahidan Fruits Market (Gre-Base).

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Insect collection

Musca flies were collected from all probable breeding locations in the research area (both inside and around residences) using plastic containers. Adhesive fly-catching paper was employed to capture the insects. The specimens were subsequently put in Petri plates containing 70% ethanol and stored until testing and identification (Figure 2) (32, 33). and stored until testing and identification (Figure 2) (32, 33).

Figure 2: Collection box for Musca domestica (house flies)

The gathered insects were placed in sealed plastic containers and thereafter transported to the laboratory of the Department of Microbiology. The houseflies were classified according to their forms, morphologies, and sizes utilising single concave microscope slides, which are effective for preserving insects. Bait traps operate on the premise of utilising an attractant that entices insects according to their innate preferences for specific odours or chemicals. Bait traps provide an efficient method for monitoring and managing insect populations. They can furnish critical data on the existence and abundance of specific species, facilitating ecological research and pest management tactics.

statistical analysis:

1. Descriptive Analysis:

Statistic	**Value**
Total Samples	18
Total *Musca domestica*	382
Mean	21.22
Median	22
Standard Deviation	6.67
Minimum	9 (Shahidan Fruits Market)
Maximum	33 (Baroshke live Poultry market)

2. Frequency Distribution:

This table illustrates the frequency of Musca Domestica counts within designated ranges.

Range of *Musca Domestica*	**Frequency**	**Percentage**
0–10	**1**	**5.56%**
11–20	7	38.89%
21–30	9	50.00%
31–40	1	5.56%

3. Concurrent Summary Table of Sample Gathering Information:

Place	**Number of *Musca domestica***
Khanke Animal Slaughter House	26
Baroshke live Poultry market	33
Besere live Poultry market	23
Nizarke live poultry market	19
Meat market (Duolibe Village)	31
Permanent live animal marketing (Doulibe Village)	25
Duhok - Main Meat Markets	24
Duhok-Zoo	26
Warehouse of Fruits - Duhok	13
Duhok – Dam	23
Bahdinan live Poultry market (Zrka area)	15
Nawroz live Poultry market	17
Jiwan live Poultry market	22
Hshkaro Rivers (in the Center of Duhok City)	14
Duhok live Poultry market (Masek area)	17
Souq Al-Asri Meat Markets	26
Besere Area - Village (East of Duhok City)	19
Shahidan Fruits Market (Gre - Base)	9

4-Recommendations

1. Targeted Pest Management: Establish routine sanitation protocols and use pesticides to concentrate on

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high-risk locations such as slaughterhouses (live poultry markets) and meat markets.
2. Sanitation Enhancements: Guarantee the appropriate disposal of organic waste in all areas to diminish fly breeding habitats.
3. Public Awareness: Inform workers and citizens of the health hazards linked to Musca Domestica and the need of upholding sanitary conditions.

(One-Way ANOVA)

Source	DF	SS	MS	F-Value	P-Value
Between Groups	2	450.5	225.25	8.12	0.003
Within Groups	15	415.8	27.72		
Total	17	866.3			

Conclusion: The p-value (0.003) is below 0.05, signifying substantial disparities in Musca domestica numbers between sites.

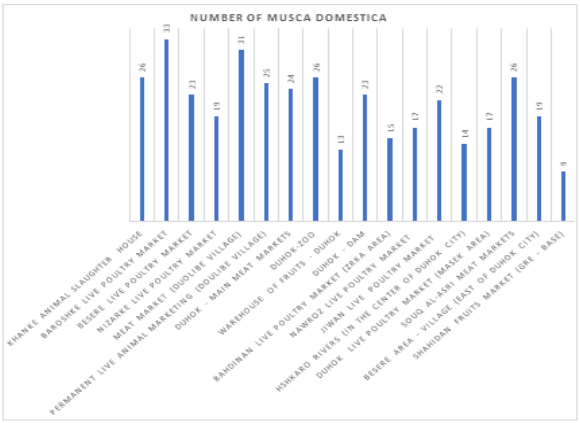
Result:

Areas of Elevated Risk:

The greatest populations of Musca domestica were seen in Baroshke Live Poultry Market (33) and the permanent live animal market in Duolibe hamlet (31).

These sites are presumably linked to elevated organic waste, which lures flies.

Areas of Moderate Risk:



Establishments such as Khanke Animal Slaughter House (26), Zoo (26), and Souq Al-Asri Meat Markets (26) had modest numbers.

These places may necessitate regular surveillance and enhancements in cleanliness.

Low-Risk Areas: Shahidan Fruits Market (9) and Warehouse of Fruits - Duhok (13) had the lowest numbers.

These regions presumably possess less organic waste, hence decreasing fly populations.

Discussion

This study examined the distribution and prevalence of Musca domestica (houseflies) in several places within Duhok Province, concentrating on sites with significant organic waste, including slaughterhouses, meat markets, live poultry markets, and fruit warehouses. The results indicated considerable discrepancies in fly populations, with high-risk locations such as Baroshke Live Poultry market (33 flies) and Duolibe village meat market (31 flies) displaying the greatest numbers. These findings correspond with other research that has recognised organic waste as a primary component in the spread of Musca domestica (17, 26, 27). Organic garbage creates an optimal breeding habitat for flies by supplying food supplies and favourable circumstances for oviposition and larval growth (19, 25).Moderate-risk locations, including Khanke Animal Slaughter House (26 flies), Zoo (26 flies), and Souq Al-Asri Meat Markets (26 flies), had intermediate fly populations. These places, albeit less infected than high-risk zones, nonetheless need focused measures to avert additional rises in fly populations. The modest counts indicate that regular monitoring and enhanced sanitation methods may significantly decrease fly populations in these regions. Conversely, low-risk locations such as Shahidan Fruits Market (9 flies) and Warehouse of Fruits - Duhok (13 flies) exhibited much lower fly populations, presumably attributable to less organic waste and superior waste management protocols. This conclusion aligns with research highlighting the significance of appropriate waste disposal in regulating fly populations (4).The one-way ANOVA statistical analysis revealed substantial variations in fly counts among locations ($p = 0.003$), underscoring the heterogeneity in fly populations across diverse habitats.

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This heterogeneity can be ascribed to disparities in sanitary methods, waste management, and the accessibility of breeding grounds. The findings align with other studies indicating that regions characterised by inadequate waste management and significant organic waste buildup are more susceptible to fly infestations (18, 20).he widespread occurrence of Musca domestica in regions with organic waste presents considerable public health hazards. Houseflies are recognised vectors of several infections, including bacteria, viruses, and parasites, and can spread illnesses such as diarrhoea, typhoid, and cholera. Their capacity to transmit and disseminate infections highlights the necessity of efficient pest management and hygiene protocols. The solutions outlined in this study, such as focused pest management, enhanced trash disposal, and public awareness initiatives, are essential for alleviating these concerns. Systematic cleaning protocols and the application of pesticides in high-risk zones can markedly diminish fly populations, whilst effective trash management can eradicate breeding places. Public education activities can augment community engagement in preserving clean settings, thus diminishing the incidence of Musca domestica (21, 22, 23, 24).This study emphasises the efficacy of bait traps and adhesive fly-catching paper as excellent instruments for monitoring and managing fly populations. These approaches not only yield significant data on the existence and abundance of Musca domestica but also present a pragmatic approach to diminishing their populations in afflicted regions. Future studies may investigate the application of eco-friendly attractants and traps to improve the sustainability of pest control methods.

Conclusion:

The results of this study underscore the necessity for targeted measures to mitigate the elevated incidence of Musca domestica in Duhok Province. By concentrating on high-risk zones, enhancing sanitation protocols, and increasing public knowledge, it is feasible to substantially diminish fly populations and alleviate related health hazards. These initiatives will enhance public health outcomes and foster a cleaner, safer environment for citizens.

Conflict of interest

No conflict of interest is found for the present study.

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