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Original Article

Ecological Survey of Medically Important Flies in Andimeshk County, Southwest Iran: Species Composition, Diversity and Synanthropy

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Abstract

Background: Flies play a significant role in public health because of their potential to transmit human pathogens and cause myiasis. This study aimed to investigate the species composition, abundance, biodiversity, and synanthropy of medically important flies in southwest Iran .

Methods: Flies were collected from urban, semi-urban and non-residential ecosystems of Andimeshk county, southwest Iran, from 2020 to 2021 using a bottle trap and sweep net. All collected specimens were identified using taxonomic keys. Biodiversity and synanthropic indices were calculated.

Results: A total of 15644 flies belonging to three families of Sarcophagidae, Calliphoridae and Muscidae were collected, comprising 11 genus and 18 species of *Sarcophaga ruficornis* (0.5%), *S. aegyptica* (0.9%), *S. melanura* (0.6%), *S. africa* (0.6%), *Sarcophaga* sp. (2.6%), *Ravinia pernix* (0.4%), *Sarcophila* sp. (0.3%), *Wohlfahrtia* sp. (0.6%), *Chrysomya albiceps* (9%), *Chrysomya megacephala* (36.3%), *Lucilia sericata* (2.5%), *Calliphora vicina* (0.3%), *Polenia* sp. (0.5%), *Musca domestica* (30.8%), *Musca automnalis* (0.6%), *Muscina stabulans* (2.4%), *Muscina prolapse* (0.4%), *Atherigona* sp. (0.6%) were trapped. The synanthropic index (SI) was +52.25, +46.2, +35.1, +35.95, and +21.45 for the myiasis-causing species, including *C. vicina*, *S. africa*, *C. albispes*, *C. megalocephala* and *S. aegyptica*, respectively. The biodiversity and evenness indices were 1.82±0.026 and 0.6306±0.0009, indicating a relatively high diversity and moderate/high evenness of flies in the study area.

Conclusion: Given synanthropic behavior and widespread presence of *C. megacephala*, this species should be prioritized in future surveillance and control programs to reduce public health risks.

Keywords: Myiasis; Diptera; Biodiversity; Sarchophagidae; Calliphoridae

Introduction

Flies, representing a diverse assemblage within the order of Diptera, hold significant importance in medical entomology, impacting public health through disease transmission, myiasis induction, and their critical role in forensic investigations (1). In the context of human and veterinary health, flies serve as mechanical and biological vectors of numerous pathogens, contributing to the spread of bacterial, viral, protozoan, and helminthic diseases (2). Furthermore, myiasis, the infestation of living vertebrate tissues by fly larvae, presents a substantial medical and veterinary burden globally. Myiasis-causing flies span multiple families, notably Oestridae, Calliphoridae and Sarcophagidae, each exhibiting distinct biological and ecological characteristics that influence their pathogenicity (3). The species composition of

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myiasis-inducing flies is highly geographically variable, reflecting regional climatic conditions, environmental factors and host availability. For instance, *Chrysomya bezziana*, the Old World screwworm, is a dominant myiasis agent in tropical and subtropical regions, causing obligate myiasis in humans and animals (4). In contrast, *Cochliomyia hominivorax*, the New World screwworm, has historically posed a significant threat in the Americas, particularly in Brazil, before its eradication in many areas (5). *Lucilia sericata*, known for its facultative myiasis and therapeutic applications in maggot debridement therapy, is widely distributed and contributes to wound myiasis globally (6). Species within the genus *Sarcophaga* also play a role in facultative myiasis, demonstrating adaptability to diverse ecological niches (7). In Malaysia, *Chrysomya megacephala* has been identified as a prevalent agent of human and animal myiasis, highlighting the regional variations in dominant myiasis-causing species (8).

In addition, flies belonging to the families Muscidae and Fanniidae are recognized as significant mechanical vectors, capable of transmitting a wide array of human pathogens, including viruses, bacteria, fungi and protozoa (9). Their role in disease transmission is primarily attributed to their unselective feeding habits and frequent interactions with diverse environments where pathogens thrive (10). Specifically, *Musca domestica* (the housefly) is a well-documented vector, implicated in the transmission of enteric pathogens such as *Salmonella* spp., *Escherichia coli* and *Shigella* spp., which are responsible for diarrheal diseases (11). Furthermore, *M. domestica* has been associated with the spread of parasitic protozoa, including *Entamoeba histolytica* and *Giardia lamblia*, contributing to gastrointestinal infections (12). This species is also reported as a rare cause of intestinal myiasis in humans (13). Flies in the genus *Muscina*, such as *Muscina stabulans* (the false stable fly), also play a role in mechanical transmission, particularly of bacterial pathogens (14). Additionally, *Fannia canicularis* (the lesser house fly) has been implicated in the transmission of various pathogens, although its role is generally considered secondary to *M. domestica* (9, 15). The frequent contact of these flies with fecal matter, decaying organic matter, and human food sources further amplifies their potential to acquire and disseminate pathogens, posing a substantial public health risk (9).

Given the importance of the aforementioned issues, it is of particular importance to understand the ecological parameters of medically important flies, including abundance, biodiversity and the synanthropic index. The synanthropic index is crucial for assessing the potential of flies to act as vectors of human pathogens, as species exhibiting high synanthropy tend to have increased contact with human populations and their domestic environments. Flies that thrive in proximity to human settlements capitalize on readily available resources, including food waste, animal excrement and suitable breeding sites, thereby enhancing their reproductive success and population densities. Consequently, species with elevated synanthropic indices pose a heightened risk of disease transmission due to their frequent interactions with human food and living spaces. For instance, *Calliphora vicina* (the blue bottle fly) and *L. sericata* (the green bottle fly) are consistently identified as highly synanthropic species across various regions, demonstrating a strong affinity for human habitation. Studies conducted in Egypt and other locales have documented the significant synanthropy of these species, highlighting their role as potential vectors of enteric pathogens and other disease agents (16, 17). Furthermore, the synanthropic behavior of these flies is influenced by factors such as urbanization, sanitation practices and availability of suitable breeding substrates, underscoring the importance of environmental management in mitigating their public health impact (16). Understanding the biodiversity of medically important flies illuminates the complex interactions between these insects and human health, highlighting their critical roles in disease transmission, forensic investigations, and ecological systems. So, the biodiversity of flies not only highlights their role in disease transmission but also underscores their broader ecological and medical importance. As such, continued research into fly biodiversity is essential for managing public health risks and appreciating their contributions to ecological systems (18, 19). Many studies in Iran have demonstrated the medical importance of flies. Sanei-Dehkordi (2020) documented the species composition and diversity of Calyptratae flies in hospital environments along the northern Persian Gulf coast, which is geographically close to Khuzestan Province. The study emphasizes the synanthropic behavior of these flies and their potential role in disease transmission and hospital sanitation challenges (19). Jafari et al. (2019) identified the flesh fly species (family Sarcophagidae) in Iran using mitochondrial gene markers. Accurate species identification is crucial for forensic entomology and medical entomology, as different species vary in their ecological roles and medical importance. The study included species found in various Iranian provinces, contributing to the knowledge of fly biodiversity and aiding in the correct identification of species in forensic and medical contexts (20). Talebzadeh (2020) has used molecular techniques to identify six key flesh fly species of forensic and medical importance in Iran. It highlighted the diversity of flesh flies in the country and provides a molecular framework for species differentiation, which is essential for studies on fly ecology, behavior, and their role in disease transmission (21). Khosravi et al. (2024) investigated the prevalence of *Wolbachia*-a widespread bacterial endosymbiont known to influence insect reproduction-in brachyceran flies collected across various regions of Iran. The research highlights the diversity of fly species infected by *Wolbachia*, which has implications for understanding fly population dynamics and potential vector control strategies. This work provided important insights into the microbial ecology of medically important flies in Iran, which may influence their biology and vector competence (22).

Andimeshk County, in southwestern Iran's Khuzestan Province, has a unique ecological and geographical setting that is particularly suitable for studying medically significant flies. The region's warm climate, diverse habitats-including riverine systems, agricultural areas, and urban settlements-and its position as a transitional zone between arid and semi-arid climates create favorable conditions for the proliferation of fly species such as Calliphoridae, Sarcophagidae and Muscidae. These flies often thrive in environments with abundant organic waste and livestock farming, both common in Andimeshk, contributing to complex fly population dynamics and synanthropic behavior. From a public health perspective, Khuzestan Province faces ongoing challenges related to sanitation and vector-borne diseases. The combination of inadequate waste management, livestock farming, and high population density in Andimeshk heightens the risk of disease transmission mediated by flies. However, despite these risks, there is a notable lack of localized data on the species composition and ecology of medically important flies in this area. Therefore, the purpose of this study was to determine species composition, abundance, biodiversity, and synanthropy of medically important flies in Andimeshk County in southwest Iran during 2020–2021. Conducting this study in Andimeshk County is essential to fill this knowledge gap and to support for developing targeted public health and vector control strategies adapted to the region.

Materials and Methods

Sampling Area

The descriptive–analytic study was conducted in Andimeshk County, north of Khuzestan Province, southwest Iran, and has a landmass of

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approximately 53,120 km^2 (9.4% of Khuzestan Province) with hot regions that are suitable for arthropod growth and reproduction. Its population is 167,126. This area includes hilly areas, plains, and foothills in rural and urban areas. The area has a temperate climate and relatively warm, humid summer, and is located between 32°27′ N latitude and 48°21′ E longitude. The elevation of the study area ranges from 176 meters above sea level. The mean annual temperature in the area is between 12 °C and 42 °C, and the mean precipitation is 402.5 mm annually. Its strategic location, fertile agricultural lands, and the presence of the national railway line connecting it to Tehran city and other regions of Iran contribute to its significance (Fig. 1).

Sampling Methodology

Sampling was conducted in Andimeshk County, north of Khuzestan Province, southwest Iran, from 2020 to 2021, covering a period of 12 months. The study included monthly sampling across three distinct habitat types: urban areas (Andimeshk, Husseiniyeh and Azadi cities), semi-urban areas (three villages) and non-residential areas located at least 5 km^2 away from human settlements. Bottle traps were utilized as the sampling tool due to their proven effectiveness in capturing flies across diverse habitats. These traps were constructed using 1.5-liter mineral water bottles to withstand environmental conditions and baited with calf liver, beef or fish, ensuring consistent fly attraction. Traps were installed at a standardized height of approximately 1.5 meters above ground level, optimizing capture rates by targeting the typical flight height of flies. Sampling sites within each habitat type were selected using a stratified random sampling approach to reduce spatial biases and ensure representative coverage of urban, semi-urban and non-residential areas. Traps were deployed for one week each month to account for seasonal variations in fly populations and ensure comprehensive data collection over the study period. After one week of exposure, traps were collected and securely transported to the Medical Entomology Laboratory at Ahvaz Jundishapur University of Medical Sciences. Captured flies were identified using reliable taxonomic keys (23–25). This ensured accurate species-level identification critical for biodiversity and synanthropy assessments.

Data Analysis

The abundance of captured fly species was determined and graphed using the SPSS version 21 software. The calculation of biodiversity and species evenness of flies in the mentioned area was performed using the Species Diversity Richness (SDR) software.

The Shannon-Wiener Index is a commonly used measure of biodiversity within a community. Both species richness (the number of different species) and species evenness (the relative abundance of each species) are taken into account.

The formula for calculating the Shannon-Wiener Index is as follows (19):

$$H = -\sum_{i=1}^{s} Pi \ln Pi$$

Where: pi represents the proportion or relative abundance of each species within the community (n_i/N), ln(pi) represents the natural logarithm of pi, and Σ represents the sum of the calculations for each species. The Shannon-Wiener Index (H') value varies between 1 and 4.5. A higher value indicates greater diversity.

The evenness index is a measure of the equitability of species distribution within a community. It is derived from the Shannon-Wiener index and is calculated using the following formula:

Evenness Index= H'/ ln(S)

Where: H' represents the Shannon-Wiener Index and ln(S) represents the natural logarithm of the total number of species (S) present in the community. A value of 1 indicates perfect evenness, where all species have equal abundance, while a value closer to 0 indicates uneven distribution, with some species dominating over others.

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The synanthropic Index was calculated using the following formula (26):
Synanthropic Index (SI)= (2a+b- 2c)/ 2

a: the percentage of fly species captured in urban areas; b: the percentage of fly species captured in semi-urban (rural) areas and c: the percentage of fly species captured in non-residential areas. The resulting synanthropic index (SI) will fall within the range of -100 to +100. Higher positive values indicate a greater level of interaction between flies and human-inhabited areas, while lower negative values indicate less contact between flies and residential regions.

Results

Species Composition and Abundance

In this study, a total of 15644 adult flies belonging to three families of Calliphoridae, Sarcophagidae and Muscidae were collected and identified. Among the 11 identified genera, four, four and three genera belonged to the families Sarcophagidae, Calliphoridae and Muscidae, respectively. *Sarcophaga ruficornis* (0.5 %), *S. aegyptica* (0.9%), *S. melanura* (0.6%), *S. africa* (0.6%), *Sarcophaga sp*. (2.6%), *Ravinia pernix* (0.4%), *Sarcophila* sp. (0.3%)., *Wohlfahrtia* sp. (0.6%) from Sarchophagidae, *Chrysomya albiceps* (9%), *C. megacephala* (36.3%), *Lucilia sericata* (2.5%), *Calliphora vicina* (0.3%), *Polenia* sp.(0.5%) from Calliphoriade and *Musca domestica* (30.8%), *Musca automnalis* (0.6%), *Muscina stabulans* (2.4 %), *Muscina prolapse* (0.4%), *Atherigona* sp. (0.6%) from Muscidae were identified.

Of the total identified specimens, 50.8% were species known to be associated with human or animal myiasis, including *S. ruficornis*, *S. aegyptica*, *S. melanura*, *S. africa*, *C. albiceps*, *C. megacephala*, *L. sericata*, *C. vicina* and 30.8% belonged to *M. domestica* as species causing accidental myiasis (Table 1). The abundance of medically important flies in Andimeshk, Husseiniyeh and Azadi Cities was 38.7%, 35.1% and 26.2%, respectively (Table 1). *Chrysomya megacephala* was found to be the most prevalent species, accounting for 41.1%, 34.5% and 31.7% of the total fly population in Andimeshk, Hosseinieh and Azadi, respectively (Table 1). In Azadi City, 31% of the collected flies belonged to this species, while the highest abundance was attributed to *M. domestica*, accounting for 36.8% of the fly population.

The highest frequency of flies was observed in the urban areas, accounting for 43.6% of the total fly population, while the lowest frequency was recorded in the non-residential area, with a frequency of 27.5% (Table 1). Analysis of the urban area revealed that *M. domestica* was the dominant species, comprising 43.7% of the total fly population. *Chrysomya megacephala* was the second most prevalent species, accounting for 36.3%. *Chrysomya megacephala* is a well-documented cause of myiasis and thus a public health concern. Conversely, in rural areas, *C. megacephala* was the most frequent species, comprising 39.1% of the fly population, followed by *M. domestica*, which accounted for 33.9%. These findings showed that the prevalence and composition of medically important flies differ between urban and rural areas in Andimeshk County.

Seasonal Abundance

The seasonal abundance of medically important flies in Andimeshk County during 2020–2021 is summarized in Table 2. A total of 15,644 flies were collected across four seasons, with the highest number recorded in spring (30.35%) and winter (27.5%), followed by autumn (22.46%) and summer (19.68%). Among the identified species, *C. megacephala* was the most prevalent, accounting for 36.3% of the total flies collected throughout the year, with peak abundance observed in spring (43.1%) and winter (38.9%). *Musca domestica* was the second most abundant species, representing 30.8% of the total, with its highest occurrence in summer (49.0%). Other notable species included *Atriguna* spp. (10.6%) and *C. albiceps* (9.0%), which showed significant seasonal variation, par-

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ticularly in autumn and winter. Less abundant species such as *Sarchophaga* sp., *Wohlfahrtia* spp. and *L. serricata* were consistently present across all seasons but in lower proportions. These findings highlight the seasonal dynamics and species composition of medically important flies in the region, which is critical for understanding their potential role in disease transmission and for developing targeted control strategies.

Synanthropic Index

Synanthropic indices of medically important flies in Andimeshk County revealed a clear distinction in human association. Five myiasis-causing species, including *C. vicina*, *S. africa*, *C. albiceps*, *C. megacephala* and *S. aegyptiaca*, exhibited high synanthropy indices of +52.25, +46.2, +35.1, +35.95, and +21.45, respectively, indicating a strong preference for areas with high human population density. Notably, *C. vicina* and *S. africa* displayed the highest levels of synanthropy. Conversely, *M. autumnalis* presented a negative synanthropic index (-25.45), signifying a low degree of human association and minimal inclination towards densely populated areas (Table 2). These findings demonstrate that in Andimeshk County, myiasis-causing species with high synanthropic indices are predominantly distributed in proximity to human populations.

Biodiversity Indices

The Shannon-Wiener biodiversity index of medically important flies in Andimeshk County was 1.82±0.026, indicating a relatively high level of fly diversity in that area. Additionally, the evenness index was accounted for 0.6306± 0.0009, suggesting that the species exhibits a relatively desirable level of population evenness. The closer this index is to 1, the more favorable the population evenness of the species in the region is considered. Biodiversity indices, based on population density, revealed the highest diversity (H'= 1.89) and evenness (E= 0.654) in non-residential areas. While no significant differences were found between urban and semi-urban areas ($P= 0.471$), both showed significantly lower diversity and evenness compared to non-residential areas ($P= 0.0035$). Seasonally, winter exhibited the highest diversity (H'= 1.78) and evenness (E= 0.618). Although spring and winter did not differ significantly ($P= 0.283$), significant differences were observed between winter and autumn ($P= 0.0018$) and winter and summer ($P= 0.0084$). Among the three cities in Andimeshk County, Andimeshk City displayed the highest diversity (H'= 1.83) and evenness (E= 0.639), with significant differences compared to Hosseinieh and Azadi ($P< 0.0001$ and $P< 0.0004$ for diversity, and $P< 0.0001$ and $P< 0.0005$ for evenness, respectively) (Table 4).

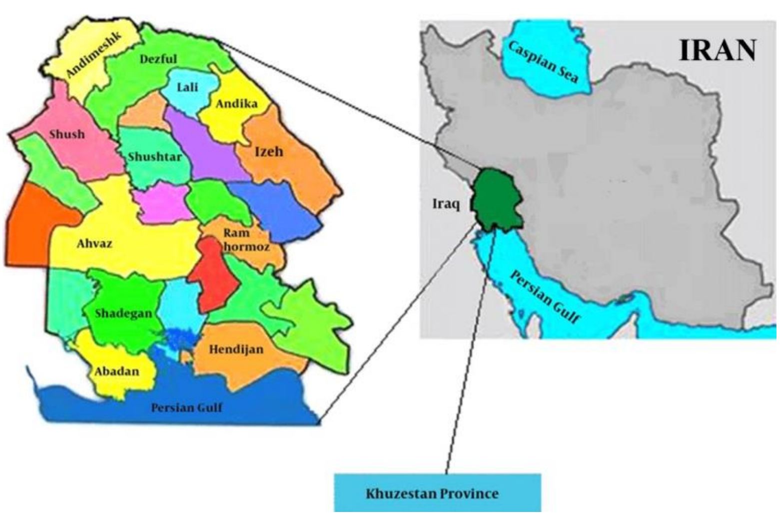

Fig. 1. Geographic location of Andimeshk County, Khuzestan Province, southwest Iran

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Table 1. Spatial abundance of medically important flies in the cities of Andimeshk County in 2020‒2021

Species	Andimeshk	Hosseinieh	Azadi	Total (County)
	No (%)	No (%)	No (%)	No (%)
***Sarcophaga* sp.**	91 (1.5)	120 (2.2)	101(2.5)	412(2.6)
***Wohlfahrtia* sp**	58 (0.9)	27 (0.5)	13(0.3)	98(0.6)
Musca prolups	16(0.3)	6 (0.1)	42(1.0)	64(0.4)
Chrysomyia albiceps	620 (10.1)	495 (9.0)	298 (7.4)	1413(9.0)
Muscina stabulans	159 (2.6)	118 (2.2)	103(2.5)	380(2.4)
***Atriguna* sp.**	638 (10.4)	541(9.9)	481(11.9)	1660(10.6)
C. megacephala	2519 (41.1)	1887(34.5)	1279(31.7)	5685(36.3)
Lucillia serricata	185 (3.0)	112(2.0)	88(2.2)	385(2.5)
Musca domestica	1468 (24.0)	1860(34.0)	1486(36.8)	4814(30.8)
Calliphora vicina	25 (0.4)	15(0.3)	6(0.1)	46(0.3)
M. autumnalis	33 (0.5)	35(0.6)	28(0.7)	96(0.6)
***Polenia* sp.**	14 (0.2)	38(0.7)	26(0.6)	78(0.5)
S. ruficornis	31(0.5)	29(0.5)	22(0.5)	82(0.5)
S. aegyptica	61(1.0)	59(1.1)	20(0.5)	140(0.9)
Ravinia pernix	24(0.4)	28(0.5)	8(0.2)	60(0.4)
S. melanura	39(0.6)	43(0.8)	9(0.2)	91(0.6)
***Sarcophila* sp.**	18(0.3)	17(0.3)	11(0.3)	46(0.3)
S. africa	30(0.5)	44(0.8)	20(0.5)	94(0.6)
Total	**6049(38.7)**	**5495(35.1)**	**4011(26.2)**	**15644(100)**

Table 2. Seasonal abundance of medically important flies in Andimeshk County, southwest Iran in 2020‒2021

Season	Spring	Summer	Autumn	Winter	Year
Species	**No. (%)**	**No. (%)**	**No. (%)**	**No. (%)**	**No. (%)**
Sarcophaga sp.	114(2.4)	42(1.04)	109(3.1)	147(3.4)	412(2.6)
Wohlfahrtia spp.	29(0.6)	18(0.6)	18(0.5)	33(0.8)	98(0.6)
Musca prolapsa	28(0.6)	9(0.3)	8(0.2)	19(0.4)	64(0.4)
Chrysomya albiceps	479(10.1)	157(5.1)	289(8.2)	488(11.3)	1413(0.9)
Muscina stabulans	92(1.9)	93(0.3)	115(3.3)	80(1.9)	380(2.4)
Atriguna spp.	457(9.6)	327(6.1)	416(11.8)	460(10.7)	1660(10.6)
C. megacephala	2045(43.1)	722(23.4)	1244(35.4)	1674(38.9)	5685(36.3)
Lucilia serricata	126(2.7)	51(1.7)	100(2.8)	108(2.5)	385(2.5)
M. domestica	1159(24.4)	1508(0.49)	1044(29.7)	1103(25.6)	4814(30.8)
Calliphora vicina	22(0.5)	7(0.2)	8(0.2)	9(0.2)	46(0.3)
M. autumnalis	20(0.4)	25(0.8)	21(0.6)	30(0.7)	96(0.6)
Polenia sp.	21(0.4)	21(0.7)	21(0.6)	15(0.3)	78(0.5)
S. ruficornis	29(0.6)	12(0.4)	12(0.3)	29(0.7)	82(0.5)
S. aegyptica	48(0.1)	23(0.7)	32(0.9)	37(0.9)	140(0.9)
R. pernix	15(0.3)	14(0.5)	17(0.5)	14(0.3)	60(0.4)
S. melanura	21(0.4)	21(0.7)	25(0.7)	24(0.6)	91(0.6)
Sarcophila sp.	13(0.3)	9(0.3)	13(0.4)	11(0.3)	46(0.3)
S. africa	31(0.7)	20(0.6)	22(0.6)	21(0.5)	94(0.6)
Total	**4749(30.36)**	**3079(19.68)**	**3514(22.46)**	**4302(27.5)**	**15644(100)**

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Table 3. Synanthropy of medically important flies in Andimeshk County based on the sampling area in 2020–2021

Species	Urban	Semi-urban (Rural)	Non-residential	Synanthropic Index
	No (%)	No (%)	No (%)	
***Sarcophaga* sp.**	160 (2.35)	126(2.79)	126(2.9)	23.85
***Wohlfahrtia* sp.**	52 (0.76)	32(0.71)	14(0.32)	14.6
Musca prolups	18 (0.26)	17(0.38)	29(0.67)	-3.6
Chrysomyia albiceps	665 (9.75)	393(8.7)	365(8.47)	35.1
Muscina stabulans	64 (0.94)	127(2.8)	189(4.39)	-16.2
***Atriguna* sp.**	758 (11.3)	568(12.58)	324(7.5)	43.9
C. megacephala	2503 (37.2)	1758(39.1)	1369(32)	35.95
Lucillia serricata	134 (1.96)	124(2.75)	127(2.9)	17.9
Musca domestica	2106 (43.7)	1511(33.9)	1177(27.5)	33.15
Calliphora vicina	26 (0.38)	12(0.26)	8(0.18)	52.25
M. autumnalis	23 (0.34)	17(0.38)	56(1.3)	-25.45
***Polenia* sp.**	36 (0.53)	14(0.31)	28(0.65)	19.3
S. ruficornis	37 (0.54)	19(0.4)	26(0.6)	25
S. aegyptica	70 (1.03)	20(0.4)	50(1.2)	21.45
Ravinia pernix	22 (0.32)	16(0.35)	22(0.51)	13.3
S. melanura	30 (0.44)	29(0.64)	32(0.74)	13.75
***Sarcophila* sp.**	14 (0.2)	16(0.35)	16(0.37)	13
S. africa	57(0.83)	31(0.69)	29(0.66)	46.2
Total	**6797 (43.6)**	**4496(28.9)**	**4288(27.5)**	

Table 4. Biodiversity indices of medically important flies in Andimeshk County (2020–2021)

Biodiversity		Shannon-Wiener	Species Evenness
Season	Spring	1.76	0.607
	Summer	1.73	0.599
	Autumn	1.69	0.587
	Winter	1.78	0.618
Population density	Urban	1.707	0.059
	Semi urban	1.722	0.596
	Non-residential	1.89	0.654
City	Andimeshk	1.83	0.639
	Azadi	1.73	0.6
	Hosseinieh	1.82	0.633

Discussion

The results of the study provided valuable insights into the abundance, distribution, synanthropy and biodiversity of medically important flies, particularly myiasis-causing species in Andimeshk County. A total of 15581 adult flies were collected and identified, representing three families of Sarchophagidae, Calliphoridae and Muscidae, 11 genera and 18 species. These three families are reported as the most prevalent medically important flies from different provinces of Iran (27). Several species that are known to be associated with human and animal myiasis, highlighting the potential health risks posed by these flies, including *C. megacephala*, *C. albiceps*, *L. sericata*, *C. vicina*, *S. africa*, *S. melanura*, *S. aegyptica*, *S. ruficornis* and *Chrysomya megacephala*, were the most prevalent in Andimeshk county, accounting for 36.3% followed by *M. domestic* (30.8%) of captured flies. This species is known to cause myiasis, a parasitic infestation that can affect human and animal tissues. The findings are consistent with a study conducted in Abadan, southwest Iran, where *C. megacephala*, *C. bezziana* and *C. albiceps* were identified and *C. megacephala* was reported as the dominant species (28). While *C. bezziana* has been reported in Abadan, there is no evidence of its presence in Andimeshk County. Nevertheless, the absence of this species in the current study does not definitively indicate its absence in Andimeshk County. The lack of this species may be attributed to the sampling technique employed, as the traps used utilized meat bait that does not attract *C. bezziana* effectively. This species causes obligate myiasis and inflicts damage on or invades the host's living tissues, so it necessitates a different type of bait to be successfully captured. Further investigations are required for a conclusive determination. Similarly, in Hormozgan Province, southern Iran, a study identified and introduced 10 fly species, with *C. megacephala* reported as the predominant species with 37.3% frequency (19). Also, in Sistan and Baluchestan Province, southeast Iran, *C. vicina* was identified and reported as the dominant species among 28 medically important flies, but *C. megacephala* and *C. albiceps* were also collected and reported (29). Five forensically important species, including *C. vicina*, *L. sericata*, *M. domestica*, *W. nuba* and *C. albiceps*, were reported from central Iran with the potential to cause human and animal myiasis (30). The distribution of *C. megacephala* in Iran shows a predominantly southern presence, particularly in regions like Abadan County in Khuzestan Province in the southwest, Bandar Abbas County and Triple Iranian Islands in Hormozgan Province, and Khash and Iranshahr in Sistan and Baluchistan Province in the southeast (30, 31-32). *Chrysomya megacephala* is commonly found in urban, semi-urban, and rural areas, with its activity peaking in autumn (32). *Chrysomya albiceps* has been reported from Sistan and Baluchestan, West Azarbaijan, Tehran, Khorasan Razavi, Fars, Gilan and Mazandaran provinces of Iran (30). It should be noted that *C. albiceps*, which shares a similar morphology with *C. megacephala*, is a medically important fly species from a biological perspective and can serve as a facultative agent of myiasis. However, its significance in disease transmission is not as significant as *C. megacephala*, which is an invasive species and an obligatory agent of myiasis (33).

In urban areas of Andimeshk County, the frequency of flies was higher compared to rural and non-residential areas. This suggests that flies are more commonly found in areas with higher human population density. The most prevalent species in urban areas was *M. domestica*, commonly known as the housefly. This species is distributed in all parts of Iran and was reported as a dominant species from Fuladshahr in Isfahan Province, Juybar and Sari in the North of Iran, and from Tehran Province (34-35). *Musca domestica* is associated with human environments and unsanitary conditions and has the potential to transmit diseases and cause myiasis in humans (13, 27). *Chrysomya megacephala* was the second prevalent species in urban areas, further highlighting its importance as a medically significant fly. In rural areas, *C. megacephala* was the most frequent species, followed by *M. domestica*. The higher abundance of *C. megacephala* in rural compared to urban areas is likely due to a combination of ecological and anthropogenic factors. Specifically, rural areas often exhibit a greater prevalence of animal populations, providing ample resources for larval development. Furthermore, breeding sites such as open latrines and accumulated animal manure, which are more common in rural landscapes, offer optimal conditions for oviposition and larval survival. Conversely, the comparatively lower application of insecticides and other pest management strategies in rural areas may contribute to reducing fly mortality, facilitating population expansion. Given that *C. megacephala* is a synanthropic species and a mechanical vector for pathogenic bacteria, the observed distributional pattern has implications for public health, particularly in rural communities where transmission risks may be elevated due to increased fly densities and potential infestation via body parts (36).

Lucilia serricata and *C. vicina* in urban areas and *C. albiceps* in rural areas the most prevalent species in southern Italy, demonstrating a higher abundance of fly population in those areas (37). These findings suggest that the prevalence and composition of myiasis flies may differ between urban and rural areas. In urban areas, the presence of flies is often associated with unsanitary conditions, inadequate waste management, and the proximity of human settlements to garbage dumps. These factors create favorable breeding sites for flies, leading to increased populations. For example, certain species of flies, such as the housefly, *M. domestica* and blow flies (Calliphoridae), are commonly found in urban environments where organic waste and decaying matter are abundant (38). In rural areas, the abundance of myiasis flies can be influenced by factors such as livestock farming practices, agricultural activities and the presence of open animal wounds. Flies, particularly those belonging to the family Calliphoridae, are attracted to open wounds and animal feces, which provide suitable conditions for egg laying and larval development. Additionally, agricultural practices such as the use of manure or the presence of livestock can contribute to an increased fly population in rural areas (39).

The synanthropic index calculated in the study provides additional insights into the preference of medically important flies for areas with high human population density. This index was +52.25, +46.2, +35.1 and 35.95 and +21.45 for the five myiasis-causing species, including *C. vicina*, *S. africa*, *C. albiceps*, *C. megacephala* and *S. aegyptica*, respectively. Species such as *C. vicina* and *S. africa* exhibited high synanthropic indices, indicating a strong affinity for human-inhabited areas. These species are likely to be commonly found in households and areas with high human activity. On the other hand, *M. autumnalis* had a significantly lower synanthropic index, suggesting a lower affinity for areas with high human population density. According to the SI results, *C. vicina* is the most synanthropic species in Andimeshk County, with a value of +55.25. In Colombia, in the family Calliphoridae, the most abundant species were *C. vicina* with a synanthropic index (SI) of +83.1, followed by *L. sericata* (SI= +92.2) (40). This eusynanthropic species is strongly related to the human environment. The SI values of this species have been reported as +38.85, +49.45, +55.2, +72 and +77.12 in other studies around the world. Additionally, *L. sericata*, *C. albiceps* with SI of +66.33, +51.94 have been reported as myiasis-causing agents from southern Italy (37). Synanthropic flies identified from settlements include *M. domestica*, *C. megacephala* and *Calliphora* and pathogenic bacteria identified from synanthropic flies in settlements include *Salmonella typhi*, *Shigella*, *Escherichia coli*, *Campylobacter*, *Bacillus*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* (36).

The Shannon-Wiener biodiversity index was estimated as 1.82±0.026, indicating a relatively high biodiversity of flies in Andimeshk County. Additionally, Pielou's evenness index was calculated as 0.6306±0.0009, suggesting a relatively desirable level of population evenness among the species. Concerning the biodiversity of the Calliphoridae flies in Abadan County, southwest Iran, the diversity indices were calculated as species evenness = 0.49 and H'= 0.67 (28). Species diversity of medically important necrophagous flies in Ilam Province, southwest Iran, showed different values based on temperature fluctuations. The biodiversity index was 2.39, 2.31 and 2.24, and the species evenness index was 0.46, 0.42 and 0.39 in cold, temperate, and warm climates, respectively (41). This study confirms our findings regarding the higher biodiversity and species evenness during the cold season, as our research demonstrated that these two indices were higher in winter compared to other seasons. For central Iran, the biodiversity parameters were reported as a Shannon-Wiener index of 1.87, species richness of 13, and evenness of 0.720 (30). The maximum diversity in Jouybar County, northern Iran, comprised a species richness of seven, an evenness of 0.540 and a Shannon-Weiner index of 1.005 (35). The discrepancies in the calculated index values can be attributed to various factors. For instance, the sampling area, climatic conditions and topographic conditions can significantly impact the results. The observed higher Shannon diversity index (H′= 1.89) and evenness (E= 0.654) in non-residential areas compared to urban and semi-urban zones align with broader ecological patterns of biodiversity responses to urbanization. These results suggest that reduced human disturbance and greater habitat heterogeneity in non-residential areas support more balanced fly communities, while urbanized environments impose selective pressures that favor a subset of species adapted to anthropogenic conditions. Non-residential areas likely provide diverse microhabitats and resources, for example, decaying organic matter, varied vegetation, that sustain a wider range of fly species (42-44). Biodiversity, including species richness and evenness, exhibits high and satisfactory values in regions with extensive plant coverage, as diverse plant communities provide essential habitats and resources that support a greater variety of insect species and individuals, thereby enhancing overall ecosystem functionality (42). Also observed positive correlations between fly frequency and temperature suggest that shifts in climatic conditions may significantly alter fly biodiversity, potentially impacting ecological processes and public health (39). A larger sampling area that encompasses favorable climatic and topographic conditions facilitates the establishment of diverse fly species, thereby resulting in increased sample collection and consequently higher species richness and diversity (42). Andimeshk County benefits from relatively extensive vegetation cover, largely attributed to the agricultural activities of its residents. This rich plant coverage serves as a vital resource for herbivorous insects by providing abundant food supplies and creating suitable habitats for shelter. Consequently, this favorable environment supports higher insect biodiversity, including a diverse range of fly species. The interplay between agricultural practices and natural vegetation in the region highlights the critical role of plant cover in sustaining and enhancing local insect populations.

Conclusion

The prevalence of medically important flies, particularly those associated with myiasis, in southwest Iran emphasizes the need for targeted interventions to reduce the health risks posed by these species. The results of this study provide valuable baseline data for further research and public health interventions in Andimeshk County. Continued surveillance and monitoring of fly populations, along with proper waste management practices and hygiene measures, are essential for preventing fly-borne diseases and protecting public health in the region.

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Ethical consideration

The study was approved by the Ethics Committee of Ahvaz Jundishapour University of Medical Sciences with ethics code IR. AJUMS.REC.1398.603.

Conflict of interest statement

The authors declare there is no conflict of interest**.**

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