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Fauna and relative frequency of synanthropic flies in the biggest Persian Gulf Island, Qeshm, Iran

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ABSTRACT

Objective: To identify the diversity and relative abundance of medically important species of synanthropic flies and their seasonal activity on Qeshm Island in Persian Gulf, Iran.
Methods: Flies collection was performed during March 2011 to February 2012 in all different areas of the island by using the common fly trap and plastic water bottle fly trap, reverse-cone model, containing tainted lamb or beef meat as bait. The captured flies were identified by using valid flies systematic keys, checklists and species description. The relative abundances and seasonal activity of flies were estimated by means of flies captured per trap in every month.
Results: In this study a total number of 11 species of medically important flies in three families including Calliphoridae, Sarcophagidae and Muscidae, were collected. The relative mean abundance of flies was estimated to be 6.3 ± 1.1 per trap. The most abundance was seen in rural areas in the south of Qeshm Island with 10.1 ± 1.5 per trap. In this island, medically impotent flies had two peaks of activity in early spring and early autumn, during April and October. Flies activity decreased in July and August due to the high increase of temperature and humidity of the weather. In February, the relative decrease in air temperature reduced the activity of the flies.
Conclusions: Diversity and abundance of flies in spring and early autumn were higher than other seasons, especially in rural areas of Southern Qeshm Island. Insect control measures should be conducted during the peak of flies activity.

1. Introduction

Flies are insects of the Diptera order and Cyclorrhapha suborder, with a great biodiversity and about 150 000 described species in 158 families[1]. Some of the flies which are adapted to live and feed in human habitat are called synanthropic flies with over 50 reported species[2,3]. Of these, 21 species have been listed by regulatory agencies, which is more important in transmission of human enteric protozoan parasites[4]. The synanthropic flies including several species of Muscidae (house flies and relatives), Calliphoridae (blow flies and bottle flies) and Sarcophagidae (flesh flies) families, not only are a nuisance but they can be also as a vector of pathogens[1,2]. These flies live in unsanitary conditions and feed on contaminate habitats such as filthy garbage, animal and human excrement and other decaying materials and then also readily and rapidly move to food and human environments and transmit human pathogens through this close relationship[2,3].

Filth flies are capable to mechanically or biologically transmit various pathogens including viruses, bacteria, protozoa, nematodes, cestode eggs and other pathogens on its hairs, mouthparts, vomitus and feces[2,5]. Furthermore, the larvae of these flies with contamination of tissues and organs can also cause myiasis disease in human and livestock[6].

Some of the adult flies including stable flies (*Stomoxys*), tsetse flies and Hippoboscidae can transfer some pathogens via biting and blood feeding to humans and animals[6,7]. The studies in developing countries have shown that the control of flies have had meaningful relation to reduction of diarrheal diseases and some eye infections such as trachoma[2,8,9]. In addition, it has been proved that the incidence of diarrheal and gastroenteritis diseases are very closely related to population abundance of flies that had the most prevalence in summer[10,11].

Faunistic studies of Calliphoridae, Sarcophagidae, Muscidae and Fannidae in some areas of Iran have been undertaken[12-16]. In previous studies that have been conducted in three islands in Persian Gulf, including Greater Tunb, Lesser Tunb and Abu-Muosa, several species of medically important flies have been reported[17].

Qeshm is the biggest island in the Persian Gulf and is important due to tourism, economic and commercial opportunities. This island, with hot and humid weather is suitable for propagation and spread of flies.

The identification of medically important flies in this island is necessary in order to program planning control. The main aim of the present study was to identify different species of the medically important flies in the island.

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2. Materials and methods

2.1. Study area

This study was carried out during March 2011 to February 2012 in Qeshm Island with 26°32'–27°6' N, 55°15'–56°30' E, and an area of 1491 km^2 in Persian Gulf, Iran. This island is long and rectangular in shape looking like a fish, with a length of about 125 km and an average width of 11–12 km (Figure 1).

2.2. Flies collection methods

In order to collect flies, some common fly traps and hand made bottle fly trap (reverse-cone model), containing tainted lamb or beef meat as bait, were placed on waste sites and around human habitations. The location of trap was 1.5–2.0 m in height from ground level and was suspended during the day. To prevent the escape of trapped flies, bottle mouth was narrowed with plastic or mesh fabric. For trapping flies, some appropriate area was determined in different geographical directions of the island. For this purpose, Qeshm City, Tula and Dargahan in the east and north east areas of Island, in the center, Ramkan, in Southern Souza, Shib Deraz and Masen, in North Tomban and Laft port were chosen for fly trapping. Most villages were located in the southern area of the Qeshm Island, therefore more trapping locations were chosen from this area (Figure 1). In the west of Island, Basaeedo areas, due to low human habitat, poor and unsuitable road, capturing was not done permanently. Monthly trappings during March 2011 to February 2012, and in favor of sunny days (without wind and rain) were done in the middle of each month. Four traps were installed in spring in Basaeedo area. The trappings which were placed properly after sunrise twice daily in the afternoons and evenings were also monitored. Captured flies were counted after collection. Average monthly temperature and relative humidity during the day were recorded (Table 1).

The flies were identified by using valid flies systematic keys, checklists and species description and illustrations[1,18-25].

Table 1
The climatic condition of Qeshm Island during March 2011 to February 2012.

Climatic condition	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (°C)	20	25	27	32	34	35	35	36	30	26	20	18
Relative humidity (%)	77	71	62	61	66	70	68	72	70	50	38	66

2.3. Data analysis

Abundances and relative abundances of flies were measured in percentages and mean ± SE. To compare the relative abundance of flies captured in traps, mean abundances per trap in different months were expressed by using Two-way ANOVA and Tukey tests. The Kolmogorov-Smirnov test and Levene's test were used to assess normality of data and equality of variance, respectively. To compare means (per trap) in different months, Duncan's test was used. All tests were performed by using SPSS version 17. Excel software was used to draw the diagram.

3. Results

In this study, a total of 112 fly traps were placed in different parts of the island. Eight (7%) of the traps had been destroyed by animals, wind or other environmental factors.

In total, 810 insects were caught in the traps. About 156 (19.3%) of the collected insects were bees and other insects including non medical importance flies. A total number of 654 (80.7%) of medically important flies from Muscidae, Calliphoridae and Sarcophagidae families were collected in different parts of the Qeshm Island.

The Sarcophagidae species with relative abundance of 43.9% (n = 287, male 26, female 261), were more frequent trapped flies, which was followed by Calliphoridae species with relative abundance of 36.4% (n = 238, male 40, female 198). The Muscidae was less frequent with 19.7% (n = 129, male 32, female 97). In total, 85.1% (n = 556) of the all captured flies were females.

A total of 11 species of medically important flies were trapped on the island. Of these, four species were from Calliphoridae, four and three species were from Sarcophagidae and Muscidae, respectively.

In the family of Calliphoridae, four species including *Lucilia sericata*, *Chrysomya megacephala* (*C. megacephala*), *Chrysomya albiceps* (*C. albiceps*) and *Calliphora vicina* were identified. Also the species of *Passeromyia heterochaeta* (*P. heterochaeta*), *Muscina stabulans* and *Musca domestica* (*M. domestica*) belonging to family of Muscidae were collected from all parts of the island (Table 2).

Among the Sarcophagidae species, *Sarcophaga aegyptica* and *Sarcophaga africa* were collected in south of the island, but *Wohlfahrthia magnifica* was distributed in all regions of the island. Also one specimen of *Sarcophaga* was collected from Shibderaz village in south of Qeshm Island. In this species, the shape of male genitalia and its aedeagus had not any resemblance to other known species in checklists (Figure 3). This species is under study, and for species identification, it is necessary a greater number of this fly to be collected.

The mean abundances of captured flies regardless of their monthly activity and species were 6.3 ± 1.1 per trap. There was significant

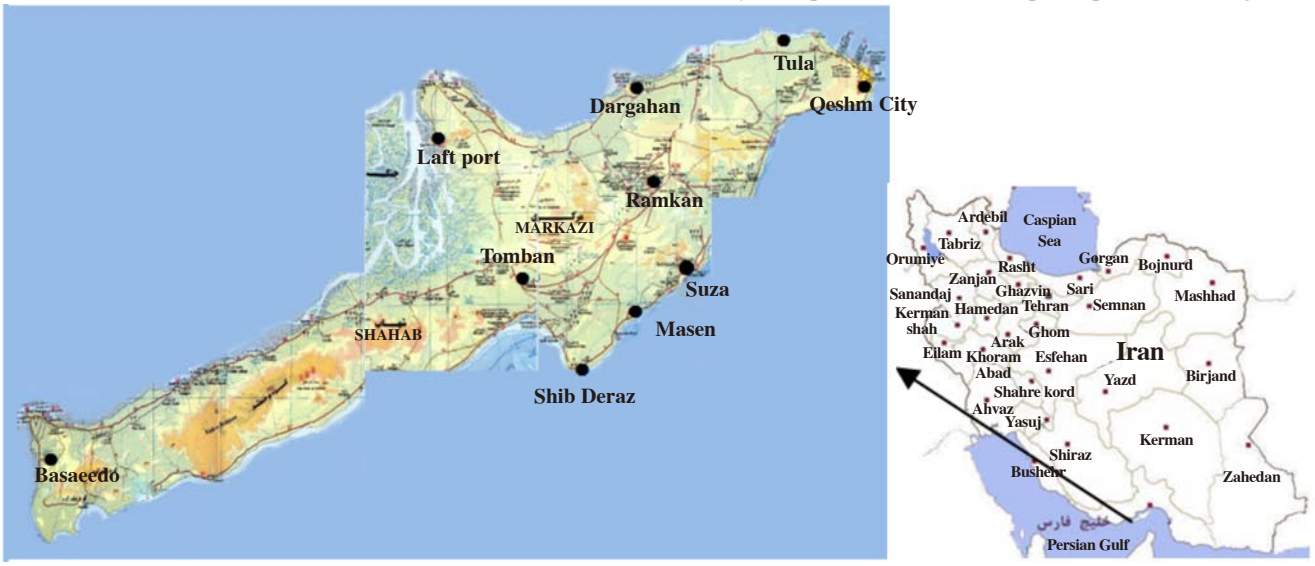

Figure 1. Geographic areas studied in Qeshm Island in the Persian Gulf, Iran.

differences in mean frequency of flies between some traps in all parts of the island ($P < 0.05$) (Table 3). The mean abundance index in south of the island (Masen, Souza, Shib Dreaz and Tomban) was 10.1 ± 1.5 per trap. The index for Qeshm City was 5.5 ± 0.1. The flies were less frequent in northern and central regions of the island with 3.8 ± 0.8 per trap.

Table 2

The relative frequency and sex ratio of synanthropic collected flies in Qeshm Island during March 2011 to February 2012.

Species	Number (male, female)	Relative frequency (%)
M. domestica	73 (19, 54)	18.6
Muscina stabulans	48 (11, 37)	12.2
P. heterochaeta	8 (2, 6)	3.0
Lucillia sericata	8 (1, 7)	2.0
Calliphora vicina	51 (11, 40)	13.0
C. albiceps	91 (10, 81)	23.2
C. megacephala	88 (18, 70)	22.4
Sarcophaga aegyptica	2 (2, 0)	0.5
Sarcophaga africa	2 (2, 0)	0.5
Sarcophaga sp.	1 (1, 0)	0.2
Wohlfahrtia magnifica	21 (21, 0)	5.3
Total	393 (98, 295)	100.0

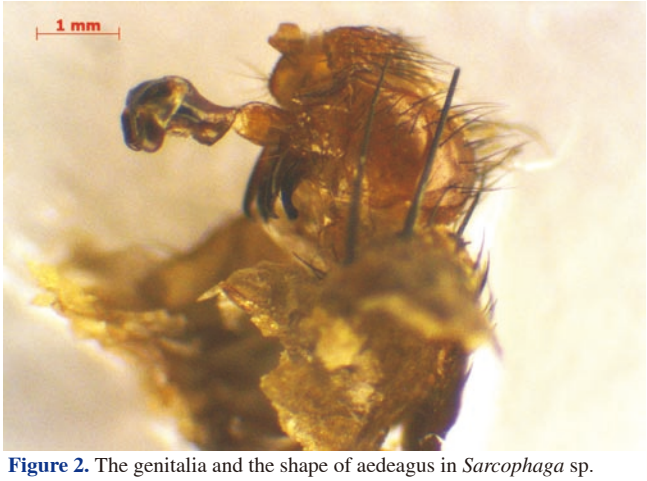

Figure 2. The genitalia and the shape of aedeagus in *Sarcophaga* sp.

Table 3

The abundance of medically important flies in trapped flies in different areas of Qeshm Island during March 2011 to February 2012.

Study areas in Qeshm Island	Number of trap	Number of collected flies	Frequency per trap (mean ± SE)
East (Qeshm City)	11	61	5.5 ± 0.1
North east (Dargahan, Tula)	22	84	3.8 ± 0.8
Center (Ramkan)	12	45	3.8 ± 0.9
North (Laft port)	10	0	0
West (Basaeedo)	3	0	0
South (Ship Draz, Souza, Mosen, Tomban)	46	464	10.1 ± 1.5*
Total	104	654	6.3 ± 1.1

*: Significant diffidence with other area ($P < 0.05$).

No collection was made in Laft port and Basaeedo harbor, in the north and west of Island, respectively (Table 3 and Figure 1). The number of flies caught in traps during the season and different months had significant differences ($P < 0.05$). Flies in the islands, based on an appropriate temperature, had two peaks of activity in early spring and early fall. Abundance of flies in traps during April and May were significantly higher than other months ($P < 0.05$) (Figure 3). The abundance of flies in October was lower than that in April and May, respectively, but significantly higher than those in other months ($P < 0.05$). In the months of July, August and February the lowest frequency of flies were seen in Figure 3. The maximum numbers of captured flies were seen in spring (56%, $n = 366$) and autumn (26.6%, $n = 174$), the lowest were seen in summer (6.1%, $n = 40$) and winter (11.3%, $n = 74$), respectively.

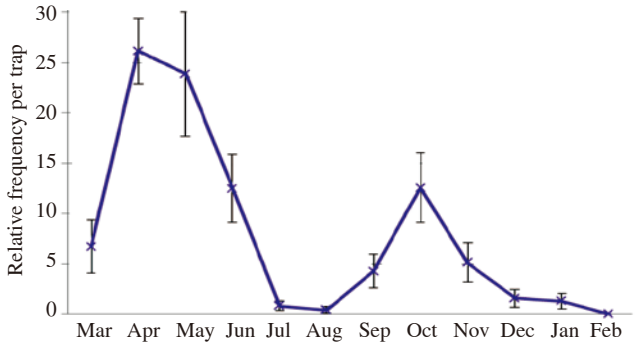

Figure 3. The monthly relative abundances of flies in Qeshm Island during March 2011 to Feb 2012.
Values are expressed as mean ± SE.

4. Discussion

In this study, 11 species of medically important flies were trapped and reported from Qeshm Island which represented a relatively high diversity of the flies in this island.

These species have medical and forensic importance to humans. In addition, the larvae of these can also cause myiasis in human and livestock[2,6,26].

In an earlier study that has been carried out in Greater Tunb, Lesser Tunb and Abu Musa islands, 10 species of medically important flies were reported. Species diversity of flies in Qeshm Island is very similar to the three islands, Greater Tunb, Lesser Tunb and Abu-Muosa in Persian Gulf[17]. It is probably due to the relatively close distances and similar climatic conditions of these islands.

The *P. heterochaeta* (Villeneuve) which was captured in this survey was rare in Persian Gulf region and was recently recorded as a Palaearctic bird parasite in Persian Gulf islands[27].

In this study, the Calliphorid, *C. albiceps* (hairy blowfly) and *C. megacephala* (the oriental latrine fly) and the house fly, *M. domestica* were the most common species in traps, respectively. This is probably because of different attractions for flies to fly traps. The survey in the Northeast Thailand showed that *C. megacephala* and *M. domestica* are synanthropic flies which are adapted to live in close association with human habitations and likely mechanical vectors of several pathogens to humans[28].

It seems that Muscidae flies had the fewer tendencies to fly traps. In the study that was conducted on three islands, similar results were observed and fewer Muscidae flies were captured in traps[17]. Fly traps have the same limitation in comparison to other methods such as nets sweeping technique. Most of the female flies were attracted to these traps[16]. In this study more than 85% of the captured flies were female. In fact, female flies, in order to find a suitable environment for feeding and ovipositing or larviposition were attracted to meat and other baits in the trap[16,17,29]. This produces a problem in identification of Sarcophagidae flies. The identification of adult Sarcophagidae is done mainly through the male genitalia and with the current keys, the females cannot be identified to species level[19,20]. In this study, about 91% of the collected Sarcophagidae flies in traps were female, therefore only 9% ($n = 26$) of them can be identified. As most of the Sarcophagidae flies entered the traps for larviposition, it is possible to breed the larvae for male adult identification. However, in this study due to lack of insectarium or appropriate laboratory in island, breeding of Sarcophagidae larvaes was not possible. This is a weak point of our study.

The mean abundances of flies were 6.3 ± 1.1 per trap but flies density in different seasons and months were different. Seasonal activities of flies depend on climatic conditions such as humidity and temperature[1,2,5].

In this Island, medically important flies had two peaks of activity in early spring and early autumn, during April and October. Flies activity decreased in July and August due to the high increase of temperature and humidity of the air and in February, due to the relative decrease in air temperature.

The best overall methods of nonbiting synanthropic flies control are environmental sanitation and reduction of feeding and breeding resources[29]. To make the flies away from the human environment has long been practiced to keep flies from entering homes and other human habitats. Using of physical barriers and pyrethroid impregnated nets and curtains at the entrance and also the personal protection techniques including topical application of effective repellents[17,29,30], are the practical flies control methods in this island.

The tourist Qeshm Island has high diversity and abundance of medically important flies. As flies were active during the year in the island, it showed suitable climatic conditions for fly breeding and development. Fly diversity and abundance especially in spring and early autumn were higher in rural areas of southern Qeshm Island. Insect control measures and sanitation management plans should be conducted during the peak of fly activity. Further microbiological studies of these synanthropic flies are recommended in Persian Gulf Island.

Conflict of interest statement

We declare that we have no conflict of interest.

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