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Distribution of Medical Flies along Wadi El-Rayan Protected Area

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ABSTRACT

To shed some light on distribution, abundance and diversity of flies' species in Wadi El-Rayan Protected Area, several field trips for one year from winter 2017 to autumn 2018 were carried out. In the present result, the flies in Wadi El-Rayan Protected Area were comprised 5families include, Calliphoridae, Muscidae, Sarcophagidae, Piophilidae and Phoridae. Calliphoridae was the most abundant and diversify family during the study period, it represented (52.48% of the total flies count) and comprised 5 species (41.67% of the total recorded species), followed by Muscidae (41 Trap/day, 42.88% and 3 species, 25%), Sarcophagidae (2.6 Trap/day, 2.68% and 2 species, 16.67%), Phoridae (1 Trap/day, 1.046% and only species, 8.33%) and Piophilidae with an annual average of (0.88 Trap/day, 0.92% and only one species, 8.33%).But the most dominant flies species were *Musca domestica* and *Chrysomya megacephala*. Seasonally, flies were flourished in summer, while winter is the lowest abundant season. Spatially, they regularly distributed among study sites. The previous findings were confirmed by that the flies were semi-stable in their temporal distribution and there is fairness in their spatial distribution. The diversity indices indicate that poor in richness of flies diversity in the investigated area.

INTRODUCTION

Diptera is an important insects order as several species from this order is known for the medical, agricultural and veterinary importance. Among the dipterous species, flies are the most ubiquitous insects as they closely live to human settlements and cause severe problems including nuisance and transmit diseases to human beings (Chow, 1940; Greenberg, 1971; Marchiori, 2014; Zakai, 2014, Aziz *et al*., 2016). Furthermore, some flies species are of veterinary importance as they cause myiasis (Nurita *et al*., 2008). Flies are distributed globally and can be found in all habitats with no exceptions and feed in liquid and semi-liquid organic materials and food. They are incriminated for various diseases. For example, *Musca domestica* L. (Diptera: Muscidae) is considered as a mechanical vector for 65 human diseases such as Amebiasis and Giardiasis (Marchiori, 2014; Aziz *et al*., 2016). In addition, some dipterous taxa are known for their economic importance as their high density is associated with the economic loss in poultry and egg production farms as they disturb the workers and decrease the final products quality (Miller *et al*., 1993). Control efforts of flies in poultry production farms are known for the high cost. For example, the USA spends almost 2 million US dollars annually to control the flies population in human residential areas and poultry farms (Crespo *et al*., 1998).

One of the most important health issues is studying the occurrence, distribution, and diversity of dipterous flies in the urban and rural areas (Couri and Barros, 2010, Zakai, 2014, Aziz *et al*., 2016). One of the key factors for successful management program is surveying the distribution, prevalence, and diversity of the flies. This biological information will help to improve the efficacy of current management techniques (Nurita and Abu Hassan, 2013, Aziz *et al*., 2016). Undoubtedly, dipterous flies are of medical and veterinary importance can be associated with an epidemic outbreak of diseases or causing economic significant losses (Mellor *et al*., 2000; Heath 2002; Williams, 2009; Barin *et al*., 2010). Most of the related studies found the prevalence of certain families of flies such as Calliphoridae, Sarcophagidae, Muscidae, Tanabidae, Ceratopogonidae, Utilidae, Sphaeroceridae, and Chloropidae (e.g. Hilali *et al*., 2003, Hanan, 2010, Aziz *et al*., 2016).

Wadi El-Rayan has a special historical significance as a major crossroad that was used for many centuries by travelers between the Nile Valley and the oases of the Western Desert. Remains of human settlements from Egyptian and Roman-Greek eras are found in the area (Fakhry, 1957). In the seventies, two lakes were created in the lower portion of Wadi El Rayan sub-depression to channel out excess agricultural drainage water in order to slow down the increase of the water table in the Fayoum main depression and in the Qaroun Lake. The creation of a large body of water in this hyper-arid area had a striking ecological impact: new species of plants, mammals, birds and invertebrates moved to Wadi El Rayan area. The Wadi El Rayan depression is an important site for the deposition of Eolian sand in the Western Desert. Extensive dune fields run the length of WRPA oriented NNW to SSE and, probably, they are formed within the Holocene period as a result of disintegration and transportation of friable stones. The dunes vary in length from a few hundred meters to thirty km and may reach height of 30 m (IUCN, 2000a). The climate Wadi El-Rayan is typically Saharan, hot and dry with scanty winter rain and bright sunshine throughout the year. According to the bio-climatic provinces of Egypt defined by, the area is hyper-arid with mild winters and hot summers. The vegetation is confined to inter-dune areas around springs and at the base of large dunes. The vegetation cover is made of perennial plants and a few individuals of *Calligonum comosum* and *Zygophyllum album* Ayyad and Ghabbour (1986).

Insects biodiversity and activity is very much affected by the environmental factors in which they live (Gullan & Cranston, 2000). It is believed that diversity evolves through niche specialization and resource partitioning. Flies can be found almost anywhere in the world. Many flies, however, play very useful roles in plant pollination, scavenging, and controlling various insect pests (by either direct feeding or parasitism) (Rosmoser & Stoffolano, 1998). There are few studies surveying the distribution and prevalence of the dipterous flies in Egypt. Therefore, the present study aimed to investigate the distribution and diversity of the flies (Diptera) of medical importance in four selected sites of Wadi El-Rayan Protected Area.

MATERIALS AND METHODS

The Study Area:

Wadi El-Rayan Protected Area (WRPA) is one of Egypt's 27 protected areas. Natural features and landscapes, biodiversity and the World Heritage site in Wadi El-Hitan have drawn national and international attention to its value. It is located in the Fayoum Governorate on the Western Desert of Egypt about 120 Km from Cairo. The WRPA is a popular recreation area due to its close proximity to Cairo. Over 150,000 visitors per year visit it. Wadi El-Rayan Protected Area (WRPA) is a large natural area of desert, lakes and oasis located in the Western Desert of Egypt in the Fayoum Governorate.

Today, the protected area is 1,759 km2 in size. WRPA's natural landscapes are a popular attraction for national and

international visitors. A growing number of people are attracted to the only waterfalls in Egypt, sand beaches, natural beauty, camping, bird watching, and the internationally important World Heritage Site. The protected area also hosts a variety of economic activities that support local communities, such as fish farming, traditional fishing in the Rayan lakes, agriculture at the land reclamation area, oil extraction, and cafeterias that serve tourists. The variety of resources and services in the protected area require sustainable sources of funding accompanied by wise and effective management. With these ingredients, WRPA staff can protect the natural values, thereby ensuring the provision of sustained benefits to local communities.

Four stations were chosen and covering a limit of 2 Km within the protected area. The name of stations is depending on the local native inhabitant inside the protected area. Accurate reading of the exact position of each sampling station is taken by the GPS (Satellite-based Global positioning system) set (Fig.1).

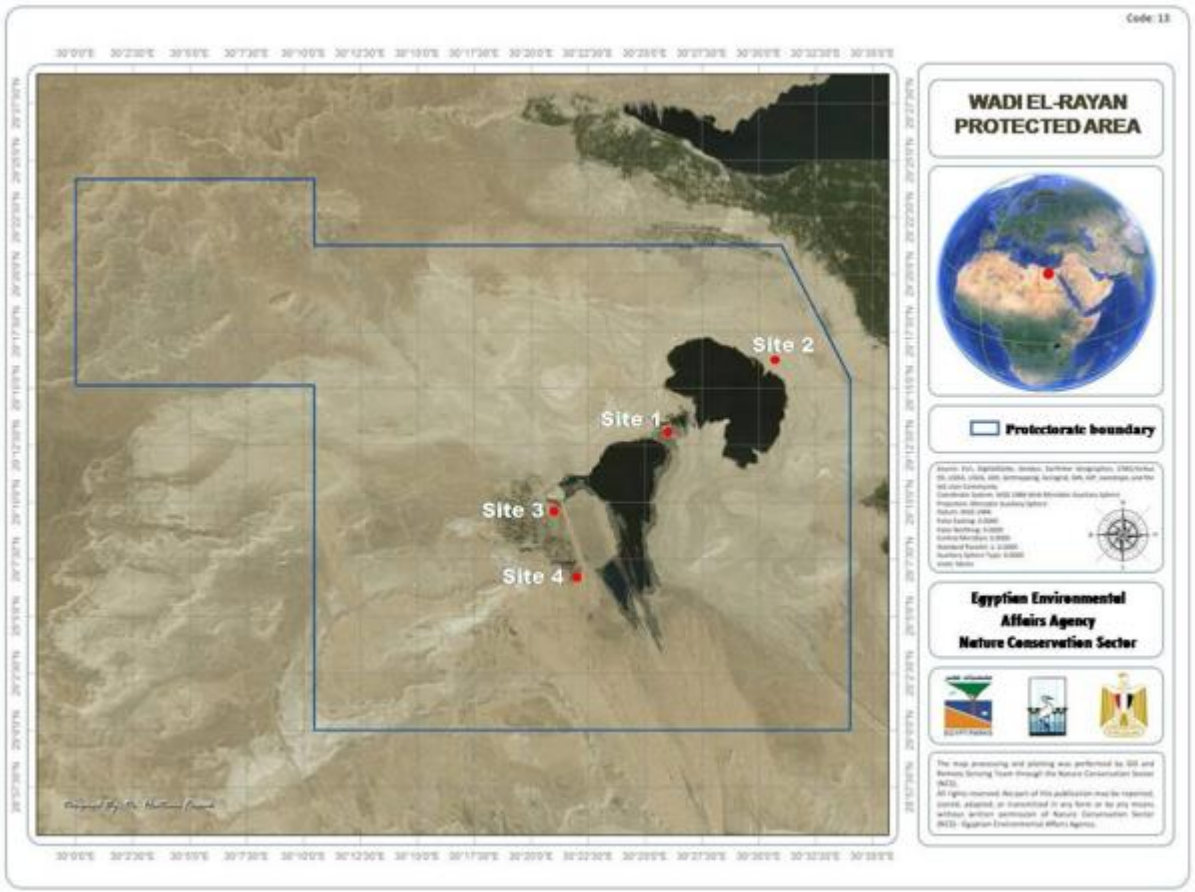

Fig.1: Landsat image showing the study area and the investigated sectors and sites at (WRPA).

Field Trips and Sample Collection:

The flies were surveyed in several field trips for one year from winter 2017 to autumn 2018 in the different selected sites along (WAPRA). The study site consists of four different ecological habitats in site1 (Waterfalls and cafeterias area), site2 (the village of Moses), site3 (the village of al-Khidr) and site4 (Vanguard village areas). Two types of traps were used: a cylinder-shape cone trap having a diameter of 10 inches and height of 12 inches (WHO, 1991) and a rectangular-shape cone trap having a length of 10 inches breadth of 10 inches and height of 12 inches. Baits used in these traps were yeast, sugar, salted fish, shrimp paste and fresh liver. The baits weighed 25 gram each. The baits were placed in separate

containers and then placed in a bigger container prior to introduction into traps. Three pairs of traps were placed at each study site for diurnal and nocturnal collection of flies. Each pair consisted of cylindrical and rectangular traps. For the diurnal collection traps were set around 7.05 am – 7.06 am and collected before 7.23 pm7.24pm, while for the nocturnal collection–traps were set around 7.23 pm – 7.24 pm and collected before 7.05 am – 7.06 am. Four replicates were conducted at each study site.

Identification of Species:

Traps collected were then sealed into a plastic bag and flies caught were killed using chloroform. Flies were brought back to the laboratory and identified based mainly on keys by Inder *et al.* (1979) and Kurahashi *et al.* (1997). A statistical analysis using non-parametric Mann-Whitney test was used to determine the effectiveness of the 2 types of trap. Meteorological data of the study site were obtained from the Meteorological Service.

Data Analysis:

Four diversity indices were calculated to estimate the stability of groups structuralize, species richness (Margalef, 1968), Shannon–Wiener diversity index (Shannon and Wiener, 1963), Evenness or equitability (Pielou, 1975), and Simpson index (Simpson, 1949)

RESULTS

Medical Flies Composition:

The survey about flies inhabiting Wadi Al-Rian Protected Area revealed that there are 12 flies species recorded an annual average abundance of 233.25 Trap/day. The identified flies species were belonging to five families namely; Calliphoridae, Muscidae, Sarcophagidae, Piophilidae and Phoridae. Calliphoridae was the most abundant and diversify family during the study period, it recorded an annual average of 50.2 Trap/day (52.48% of the total flies count) and represented by 5species comprised 41.67% of the total recorded species. Muscidae was the second abundant (41 Trap/day, 42.88% of the total flies count) and also the second diversify family (3 species, 25%), followed by Sarcophagidae with an annual average of (2.6 Trap/day, 2.68%) and diversity of (2 species, 16.67%), Phoridae with an annual average of (1 Trap/day, 1.046%) and diversity of (one species, 8.33%) and Piophilidae with an annual average of (0.88 Trap/day, 0.92%) and diversity of (one species, 8.33%) (Table.1).

Table 1: Abundance, relative abundance and number of species for each family of flies recorded in Wadi Al-Rayan Protected Area.

Dipterafamiles	Annual average abundance ind./m^3	Relative Abundance %	No. of species	Species number %
Calliphoridae	50.2	52.48	5	41.67
Muscidae	41	42.88	3	25
Sarcophagidae	2.6	2.68	2	16.67
Piophilidae	0.875	0.92	1	8.33
Phoridae	1	1.05	1	8.33
Total	233.25	100	22	100

Temporal Distributions Of The Medical Insect Recorded In Wadi Al-Rayan Protectorate:

a.Abundance:

As shown in figure (2), the abundance of medical flies varies greatly from season to another. They were flourished in summer with an average of 196.25 Trap/day (51.31% of the total recorded flies count), followed by spring (88 Trap/day, 23.01%), autumn (77.5 Trap/day, 20.26%) and winter cam at the last (20.75 Trap/day, 5.42% of the total recorded counts).

In this context, the variations in abundance of recorded families during investigated seasons were showed that the Calliphoridae in summer was the highest abundant family with an abundance of 103 Trap/day, followed by Muscidea with an abundance of 81.75 Trap/day and Sarcophagidae (6.25 Trap/day). During spring, Muscidae was the highest abundant family (46 Trap/day), followed by Calliphoridae (38.25 Trap/day) and Sarcophagidae (2.25 Trap/day). During autumn, Calliphoridae (45.5 Trap/day) was the highest abundant family, followed by Muscidae (30.25 Trap/day) and Sarcophagidae (1 Trap/day). In winter, the highest group was Calliphoridae (14 Trap/day), followed by and Muscidae (6 Trap/day), Sarcophagidae (0.75 Trap/day) and groups were rare and recorded little abundance (Fig.3).

b.Number of Species:

Figure (4) showed that the number of recorded flies species was varied seasonally within a narrow range. From this result, the highest species number (12 species) was recorded in each of summer and spring, followed by autumn (11 species), and the lowest species number (7 species) was recorded in winter.

In this context, the seasonal variations of species numbers of each family were explained that summer listed 5 Calliphoridae species, 3 Muscidae species, 2 Sarcophagidae species and one species for each of Piophilidae and Phoridae. On the other hand, spring listed the same as in summer. While, autumn noted 5 Calliphoridae species, 3 Muscidae species, 2 Sarcophagidae species and one species of Phoridae. Finally, winter flies were comprised 3 Calliphoridae species, 3 Muscidae species and only one species of Sarcophagidae (Fig. 4).

Spatial Distribution of the Zooplankton Groups:

a.Abundance:

The spatial distribution of recorded insect families at study area showed that the insect abundance was high at site 1 with an annual average of 272 Trap/day which represented about (29.15 % of the total abundance), followed by site 2 (239 Trap/day, 25.62%), and site 3 (225.75 Trap/day, 24.2%). While site 4 had the lowest abundance beings 196.25 Trap/day (21 % of the total abundance).

With regards of the spatial variations of abundance of recorded families, Calliphoridae recorded its highest annual average abundance at site 1 being 75.75 Trap/day, followed by site 3 (46.25 Trap/day), and site 2 (40. 5 Trap/day), while it was low at site 4 being 38.25 Trap/day. On the other hand, the highest annual average of Muscidae abundance occurred at site 2 being (45.5 Trap/day), followed by site 1(44.5 Trap/day), and site 3 (39.5 Trap/day), while its lowest one appeared at site 4 (34.5 Trap/day). Concerning the annual average of Sarcophagidae abundance, it was recorded its highest value (5.5 Trap/day) at site 1, followed by (2.5 Trap/day) at site 2, and (1.75 Trap/day) at site 3, while the lowest value (0.5 Trap/day) was recorded at site 4.Phoridaewas the fourth abundant group, they recorded their highest annual average of abundance at each of site2 and site 4 being (1.25 Trap/day), followed by site 1 (1 Trap/day), while the lowest annual average was recorded at site 3 being (0.5 Trap/day). Successively, the highest annual average of Piophilidae abundance was recorded at site 1 being (1.75 Trap/day), followed by site 4 (1 Trap/day), and site 3 (0.5 Trap/day), while its lowest one occurred at site 2 (0.25 Trap/day) (Fig. 5).

b- Number of Species:

The spatial distribution of number of insect species was represented in figure (6). As a result of the figure, the recorded species were equally distributed among investigated sites. Each of site 1, site 2 and site 4 has the same and highest diversity (12 species) (5Calliphoridae species, 3 Muscidae, 2Sarcophagidaenand only one species for each of Piophilidae and Phoridae). On the other hand, site 3 has diversity of 11 species (5 Calliphoridae species, 2 Muscidae, 2 Sarcophagidae and only one species for each of Piophilidae and Phoridae).

Spatiotemporal Distribution of Zooplankton:

a- Abundance:

At all sampling sites during all surveyed seasons, flies abundance show high three peaks (Fig.7). The first peak occurred in Site 1 during summer with an abundance of 249 Trap/day, the second peak was recorded in site 2 during summer with an abundance of 185 Trap/day and the third one was recorded in site 3 during summer with an abundance of 185 Trap/day. On the other hand, the smallest values of abundance occurred in site 3 during winter (15 Trap/day), site 4 during winter (18 Trap/day) and site 2 during winter with an abundance of 20 Trap/day.

According to the present data, Calliphoridae abundance was fluctuated between the high value (130 Trap/day) at site 1 during summer and low value (9 Trap/day) at site 3 during winter. On the other side, the high value of Muscidae abundance (97 Trap/day) was recorded in each of site 1 and site 2 during summer, while the low value (4 Trap/day) were recorded in site 4 during winter. Sarcophagidae abundance was ranged between highest abundance (14 Trap/day) at site 1 during summer, and lowest abundance (2 Trap/day) at many sites. Piophilidae recorded its highest abundance (5 Trap/day) at site 1 during summer, while its lowest one (1 Trap/day) happened at each of site 4 during spring and site 2 during summer. Successfully, Phoridae had high abundance (4 Trap/day) at site 4 during summer, but the low value (1 Trap/day) was noticed at each of site 4 during spring, site 2 during summer and site 1 during autumn.

b- Number of Species:

The number of flies' species recorded its highest value (12 species) at each of site1 and site 2 during summer, followed by 10 species at each of site 1during spring and site 3 during summer and 9 species at site 4 during spring. On the other side, the lowest number of species (2 species) was recorded in site 2 during winter and 4 species at site 3 during winter (Fig. 8).

Regarding flies families, the highest number of Calliphoridae species (5 species) was recorded at each of site 1 during spring, and site 1, site 2 and site 4 during summer, followed by 4 species at each of site 3 during spring and summer and site 4 during autumn, while the lowest one (one species) was recorded at site 2 during winter. In this context, the number of Muscidae species was high (3 species) at site 1 during spring and site 1 and site 2 during summer, while the lowest one (one species) has occurred at many sites. On the other hand, the number of Sarcophagidae species was high (2 species) at all sites during summer, while its lowest value (one species) was recorded at many sites during different seasons. The only recorded Piophilidae species was recorded at all sites during spring and summer. On the other hand, the only recorded Phoridae species was recorded at all sites during summer and autumn (Fig.8).

Stability of Flies Distribution In Wadi Al-Rian Protected Area:

a.Temporal Stability:

The present data showed that flies species were semi-stable in their temporal distribution, where 50% of flies species were recorded in four investigated season, 41.67% found in three seasons, 8.33% collected in two seasons and there is no any species recorded in only one season (Fig. 9).

b- Spatial Stability:

It is clear from figure (10), the flies species were ideal distributed between investigated sites, where 91.67% of the total flies species were recorded in four sites, while 8.33% were collected from three sites. In this context, there is no species were recorded in two or one sites only.

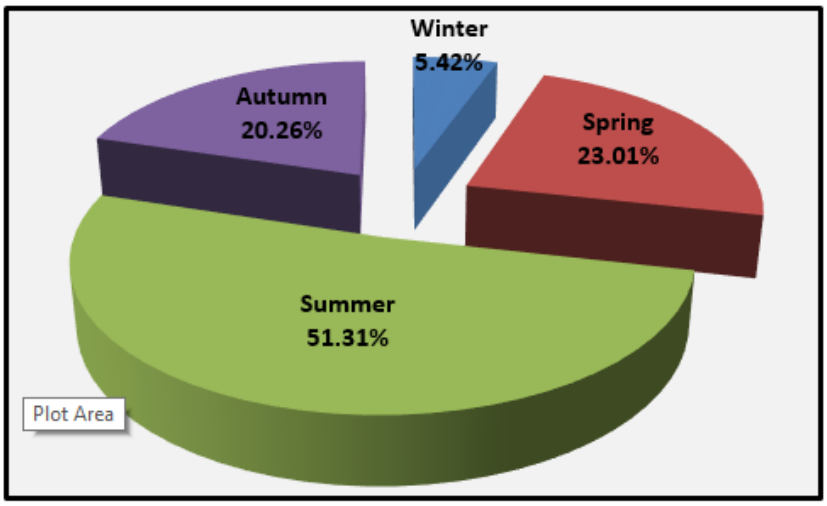

Fig.2: The percentage of average abundance (Trap/day) of the total recorded flies in Wadi Al-Rian Protectorate during the survey seasons.

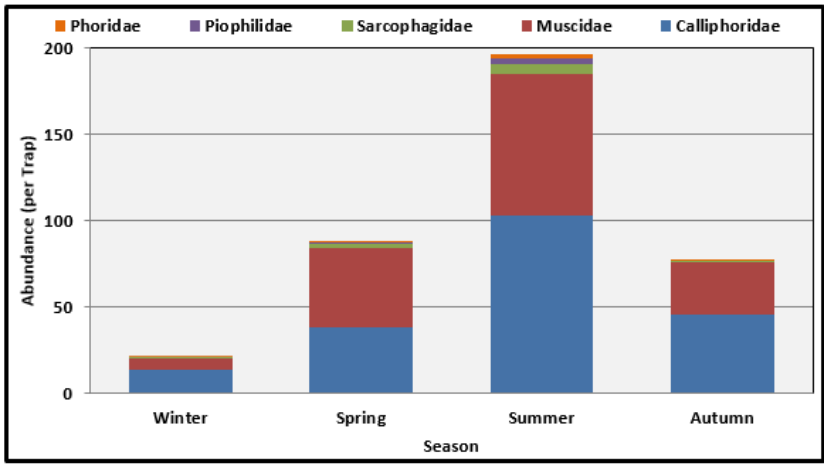

Fig.3: The average abundance of the total flies recorded in Wadi Al-Rian Protected Area during different seasons.

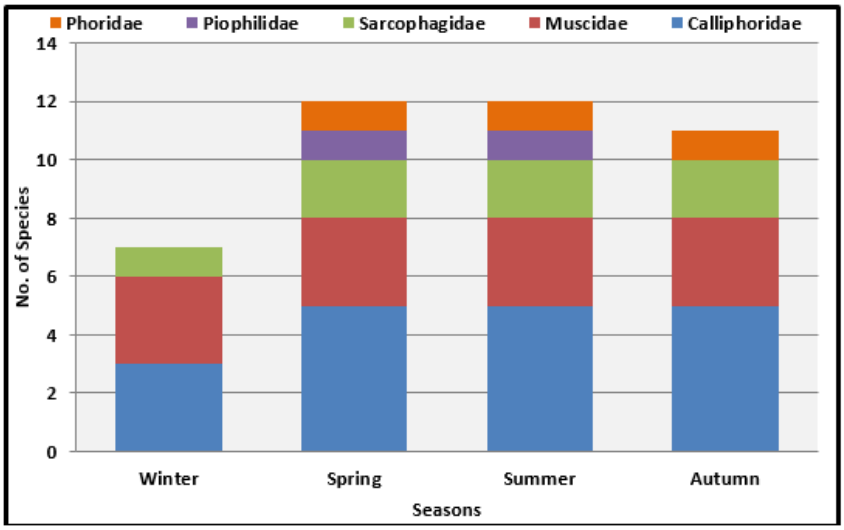

Fig.4: Seasonal variations of the number of insect species recorded in Wadi Al-Rayan Protected Area during different seasons.

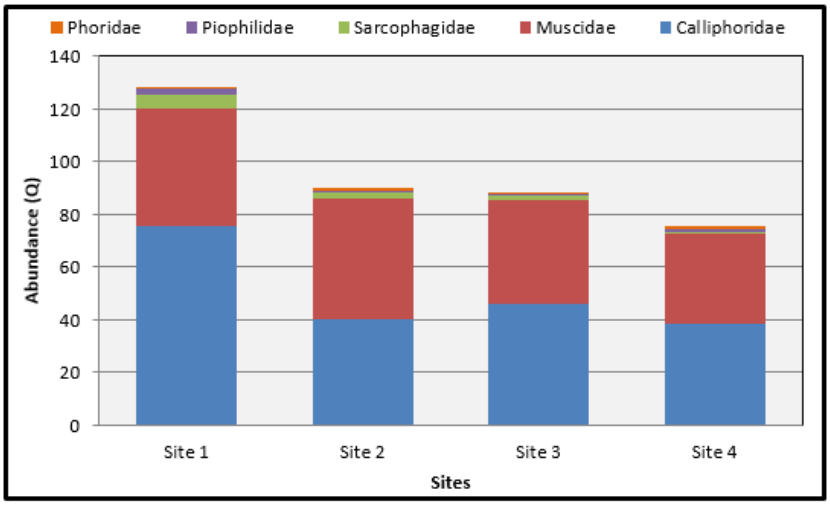

Fig.5: The spatial abundance of the flies groups at Wadi Al-Rayan Protected Area.

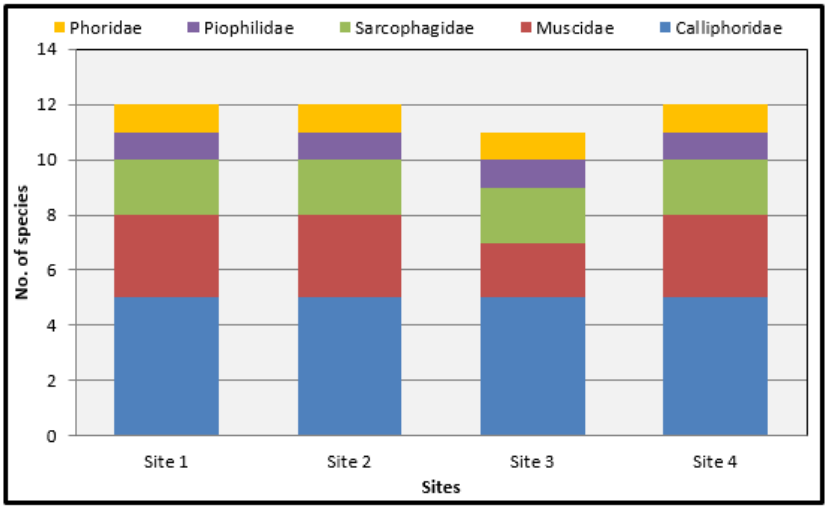

Fig.6: The spatial distribution of flies diversity at Wadi Al-Rayan Protected Area.

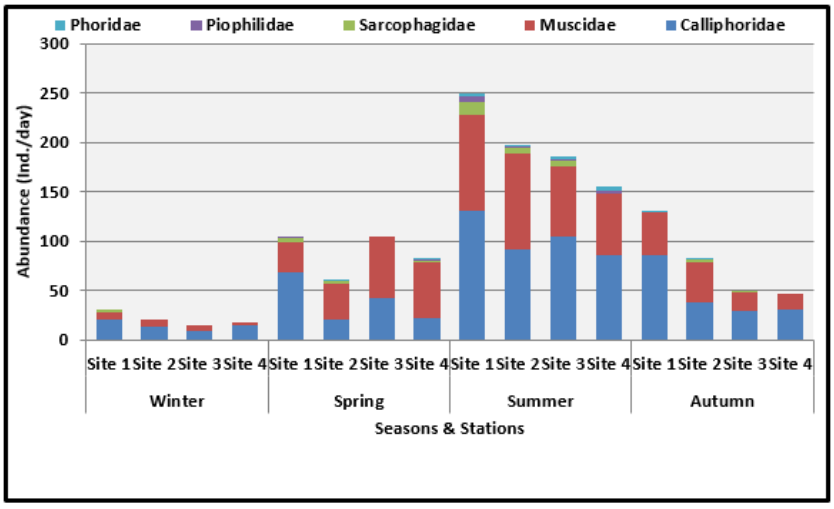

Fig.7: The Abundance (Trap/day) of the flies groups recorded at different sites of Wadi Al-Rayan Protected Area during the study period.

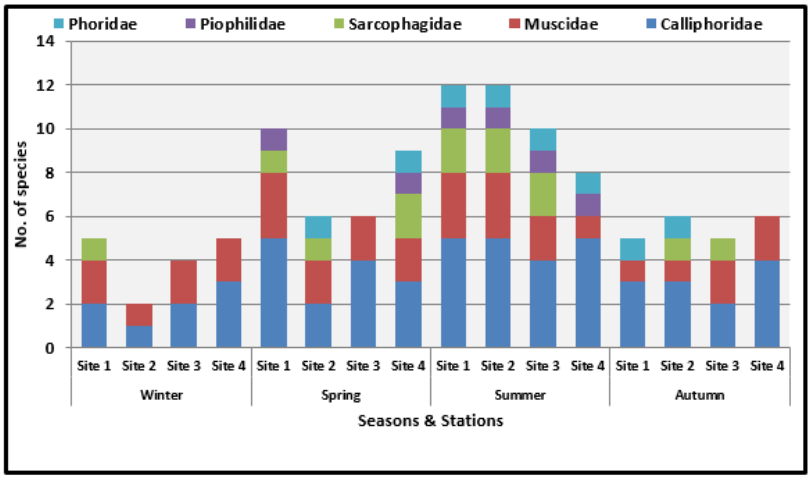

Fig.8: diversity of flies groups recorded at different sites of Wadi Al-Rayan Protected Area during study period.

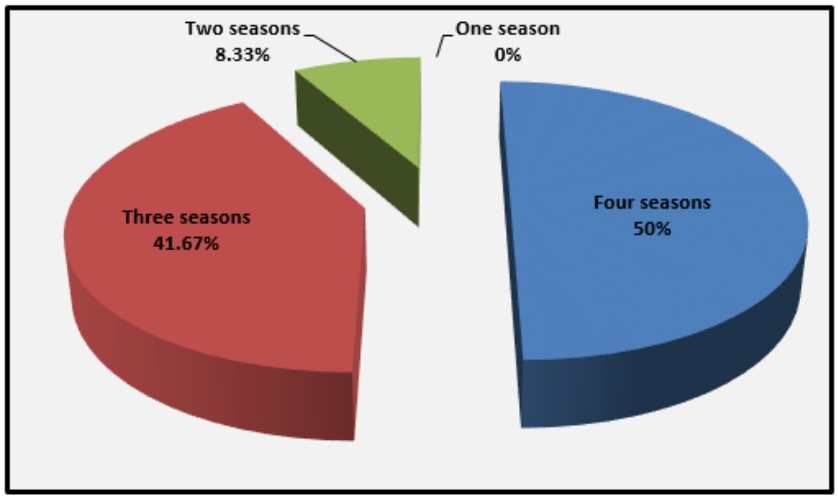

Fig.9: The stability of flies distribution in Wadi Al-Rayan Protected Area on temporal scale.

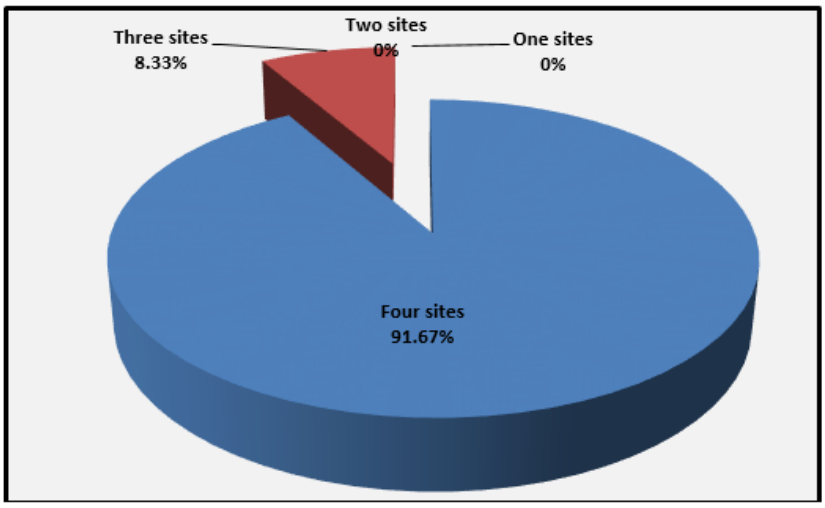

Fig.10: The stability of flies distribution in Wadi Al-Rayan Protected Area on a spatial scale.

Diversity Indices of Zooplankton Distribution in Wadi Al-Rayan:

As a result of the table (2), the ecological diversity indices has fluctuated within a wide range between stations during four seasons. Where, the highest value of species richness (2.149) was recorded in site during spring, followed by2.084 in site during summer, while the lowest value (0.3338) occurred in site 2 during winter, followed by 0.8218 in site 1 during autumn. Also, the highest value of Shannon index (0.9341) was recorded in site during winter, followed by 0.8447 in site 3 during winter, but the lowest value (0.4641) was recorded in site 4 during spring, followed by 0.5546 in site 3 during summer. In this context, the highest Evenness values were 1.715 and 1.523during summer in site 1 and site 4, respectively. But, the lowest Evenness values were 0.6474 at site 2 during winter and 1.02at site 4 during spring. Concerning the Simpson index, its highest value was 0.7498 and 0.7288during summer at site 1 and site 4, respectively. While, the lowest value of Simpson index was 0.4789 at site 2 during winter, followed by 0.5011 at site 4 during spring.

Table (2): The Diversity indices for flies species inhabiting Wadi Al-Rian Protected Area

Seasons	Sites	Species richness	Eveness index	Shannon index	Simpson index
Winter	site 1	1.176	0.7838	1.262	0.6483
	site 2	0.3338	0.9341	0.6474	0.4789
	site 3	1.108	0.8447	1.171	0.6952
	site 4	1.384	0.8379	1.349	0.719
Spring	site 1	2.149	0.6291	1.509	0.6667
	site 2	1.216	0.6917	1.239	0.6311
	site 3	1.077	0.5941	1.064	0.5691
	site 4	1.815	0.4641	1.02	0.5011
Summer	site 1	1.994	0.69	1.715	0.7498
	site 2	2.084	0.6115	1.519	0.6941
	site 3	1.724	0.5549	1.278	0.6302
	site 4	1.388	0.7323	1.523	0.7288
Autumn	site 1	0.8218	0.6701	1.079	0.615
	site 2	1.132	0.7089	1.27	0.6612
	site 3	1.022	0.6383	1.027	0.5788
	site 4	1.299	0.7375	1.321	0.6799

DISCUSSION

Insects are powerful and rapid adaptive organisms with high fecundity rates and short life cycles. Due to human interruption in agro-ecosystem and global climatic variations are disturbing the insect ecosystem. According to the present study, 12 flies species belonging to five families namely; Calliphoridae, Muscidae, Sarcophagidae, Piophilidae and Phoridae were inhabiting Wadi Al-Ryan Protected Area. Abd El-Halim *et al*., (2009) trapped 33 flies species from Matruh Governorate. Also, Al-Enazi *et al* (2018) collected 12 dipterous species from three different sampling sites located in Tayma (Saudi Arabia). Aziz *et al*. (2016) reported 11 dipterous species from Tabuk region collected from 5 locations. The present study revealed that the dominant flies species were *Musca domestica* and *Chrysomya megacephala*. The abundance of *Musca domestica* species was reported in several studies (Meyer and Petersen 1983; Miller *et al*. 1993; Cook *et al*. 1999; Marchiori *et al*. 2000; Kaufman *et al*. 2005, Srinivasan *et al*., 2009; Abdul_Rassoul *et al*., 2009, Urech *et al*., 2012, Al-Shaibani and Al-Mahedi 2014; Aziz *et al*. 2016).

In a study investigating the dipterous species in different locations of Wadi Al-

Rian Protected Area agreement with Aziz *et al*. (2016) which reported that genus *Musca* was the most dominant genus in animal facilities (slaughterhouse and cattle market). Similarly, Al-Shaibani and Al-Mahedi (2014) reported the same findings from Yemen (Southern part of The Arabian Peninsula). This is acceptable fact as the genus *Musca* is known for its global distribution with strong adaptability and acclimation to various environmental conditions. Despite that, some studies from Saudi Arabia, other flies taxa were reported to be more dominant such as *Chrysomya albiceps, Wohlfahrtia nuba* and *Chrysomya bezziana* (Alahmed *et al*., 2006). Hanan (2010) reported that the dominant flies were *Coproica vegans* and *Anatricus erianceus* collected from animal facilities located in the South of Saudi Arabia.

In the present study, a total number of 1530 individuals of flies belonging to 12 taxa were reported in one year for four sampling occasions. In slaughterhouse and sheep farms located in the Southern part of Saudi Arabia, 5312 individuals belonging to 12 taxa were reported by Hanan (2010), different Findings were reported as a total 5312 individuals of 12 species were collected. This discrepancy in the findings in different literature is probably due to remarkable variation in the geographical, physical and chemical variables which may show significant variation among different parts of Saudi Arabia. It is widely known that the temperature is the key factor controlling abundance and diversity of dipterous flies in addition to humidity and precipitation (Levine and Levine 1991, Oshaghi *et al*. 2009, Shiravi *et al*. 2011) humidity and rainfall. The species indices values resulting from the present data confirmed and indicated that the species disturbance between sites during study period. The diversity indices values indicate the pouring in richness of flies diversity in the investigated area. (Bojanic *et al.,* 2012) found that the species richness (S) was positively related to overall abundance on a temporal scale, but the strength of that relationship was negatively related to increased trophic state. Insect abundance and species dominance increased proportionally with increased trophic state. The present results concluded that species richness was positively related to overall abundance and was also affected by environmental status of the area. Diversity indices give better information about the environmental conditions under which the organisms live than consideration of individual taxa alone (Teles 1994). Biological indicators were used by many environmental agencies throughout the world to monitor the status and trends of aquatic ecosystems (Hughes and Noss, 1992 and Weigel, 2003). Flies species richness in investigated area is a key measure not only for biological status but also for ecosystem stability (Ciss et al., 2013). Patra *et al.* (2011) showed that the species richness ranges between 1 and 5 shows moderate pollution, where larger index indicates more healthy water body but when it tends towards 1 means increase pollution and damage should be suspected.

The present study appeared that the species richness index ranged from 0.3338 to 2.149 moreover, Shannon index ranged from 0.4641 to 0.9341, this means that the area is polluted at moderate side. The results of evenness index showed that human activities affect the equitability of the flies distribution within the study area, this is in congruence with that reported by Holland *et al*. (2014). Choosing the most effective traps in collecting dipterous flies is crucial for the comprehensive survey of adult flies (Harvey *et al*., 2010; Akberzadeh *et al*. 2012).

In the present study, two types of traps were used; Sticky Trap and Yellow Sticky Traps. These two types of traps have been previously reported to be effective traps catching different flies species (Suenaga and Kurahashi 1994, Hall 1995, Baz *et al*. 2007, Gerry *et al*. 2007; Akberzadeh *et al*., 2012, Aziz *et al*., 2016). These two types are known to be totally safe for the human being and the ambient environment as they contain no harmful chemicals. There are several considerations should be taken into account

when selecting the flies trap. Harvey *et al*. (2010) suggested that the effective trap should be economically affordable with high efficacy to attract high number (abundance) and species (diversity) of flies.

Conclusions

The number of collected flies species is considered not higher compared to relevant studies. Both two types of sticky traps showed to be suitable traps in collecting dipterous flies. Furthermore, they show to have no negative effects on the environment and/or human being. This study provides the necessary information required for future management and control programs of flies in the region.

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