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SHORT COMMUNICATION

Diversity and distribution of dipterous flies of medical and veterinary importance in Tayma, Saudi Arabia

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ABSTRACT

The present study aims to investigate the distribution and diversity of dipterous flies in Tayma (Saudi Arabia) during the spring of 2018. A total of 12 dipterous species were collected from three different sites located in Tayma (Tabuk, Saudi Arabia) located in the Northern part of Saudi Arabia. The taxa of flies were dominated by *Musca domestica* and *Musca sorbens*. No significant difference was observed between the total number of flies collected using different traps (t-test, P>0.05) and among the studied sites (ANOVA, P>0.05). The highest number of flies was recorded from Site 3 (a cattle farm). However, lower number of flies was reported from the dates palm farms. In conclusion, the species *Musca domestica* was found to be the most abundant species in all locations with remarkable high abundance in animal facilities (slaughterhouse and animal farm).

Keywords: *Musca domestica*; dipterous flies; traps; Tayma; Saudi Arabia.

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's 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). However, studies concerning biological and ecological aspects of dipterous flies in Saudi Arabia are scarce. Few studies were conducted in Saudi Arabia such as the study carried out in Jazan region by Hilali *et al.* (2003) and Dawah and Abdullah (2006). Another study conducted by El-Badry *et al.* (2009) focused on sandfly prevalence in Al-Madinah Al-Munwarah. Aziz *et al.* (2016)

surveyed the distribution and diversity of the dipterous flies in five locations (animal market, slaughterhouse, vegetable market, vegetable farm and residential area) all located in the Northern part of Saudi Arabia (Tabuk). Another study by Alahmed *et al.* (2006) concentrated on the seasonal activity of flies causing myiasis to the livestock animals in the Central part of Saudi Arabia (Riyadh). Hanan (2010) investigated the distribution of flies in selected cattle farms and slaughterhouses located in the Southern part of Saudi Arabia (Jazan). 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).

There are few studies surveying the distribution and prevalence of the dipterous flies in Saudi Arabia. The present study aimed to investigate the distribution and diversity of the flies (Diptera) of medical and veterinary importance in three selected sites of Tayma (Tabuk, Saudi Arabia). Two different types of flies' traps were used in this study. Therefore, the efficacy of the flies' traps was also investigated.

MATERIALS AND METHODS

Study sites

The present study was carried out in three selected sampling sites located in Tayma (Tabuk, Saudi Arabia). Tayma belongs to Tabuk Governorate which is located in the North-western part of Arabian Peninsula. This area is considered as an arid region with low annual precipitation (less than 100mm/year). The temperature varies during different seasons. During the winter, the temperature can be dropped to below zero. However, the temperature during summer can be as high as 50º C. The three selected sites located at coordinates of 22.6412º (longitude) and 38.3849 (latitude). The three sampling sites were about 15 km from Tayma city. The nature of the study sites is that the Site 1 and Site 2 date palm orchards and the Site 3 is a cattle siege.

Sampling of dipterous flies

The sampling of medical and veterinary importance flies was carried out at fortnightly every two weeks for three consecutive sampling occasions between February and March 2018. Two different types of traps were used in collecting the flies; Sticky Traps and Yellow Sticky Traps (Figure 1). The Sticky Traps are spiral traps (Flies Catchers, manufactured by Aeroxon, Czech). However, the Yellow Sticky Traps are Aphid glue trap (25x10 cm). At each sampling site, three replicates of each trap type were deployed. The traps were left for 48 hours before collecting back the traps. Thereafter, the traps were retrieved and transferred to the laboratory. In the laboratory, the flies were counted and identified using several taxonomical keys (McAlpine 1981-1989; Shaumar *et al.*, 1989; Borkent and Wirth, 1997; Kurahashi *et al.*, 1997; Greenberg and Kunich; 2002; Carvalho and Mello-Patiu, 2008; Couri, 2010).

Statistical analysis

The data were analyzed statistically using SPSS (version 20). The student t-test was used to determine the difference in the means of flies collected using two different traps. However, the one-way ANOVA (at $P<0.05$) was employed to compare the means of flies abundance among the three studied sites.

Figure 1. The traps used in the present study to sample the dipterous flies, (a) The Yellow Sticky Traps and (b) The Sticky Traps.

RESULTS

A total of 12 dipterous species of medical and veterinary importance were collected from three sites using two different types of traps. The abundance of the total number of collected flies was not significantly different according to the type of trap used (t=-0.035, P= 0.973). Furthermore, the abundance of flies collected did not vary among the study sites (ANOVA, $F_{2,15}$= 0.706, P=0.509). The housefly (*Musca domestica*) was the most abundant species followed by *Musca sorbens* (Table 1). The total number of flies collected from each site and the number of the most abundance flies; *Musca domestica* and *Musca sorbens* collected by two different types of traps are illustrated in Figure 2 and Figure 3.

Table 1. Abundance (mean±SD) of dipterous flies collected from three selected sites using two different types of traps in Tayma, Saudi Arabia.

	Sticky Trap			**Yellow Sticky Trap**		
Species	**Site 1**	**Site 2**	**Site 3**	**Site 1**	**Site 2**	**Site 3**
Musca domestica	13.67±12.58	15.000±7.55	8.00±5.00	17.33±22.37	13.33±10.07	14.00±14.73
Musca sorbens	2.33±3.22	0.667±1.16	1.33±0.58	2.33±2.52	1.33±1.53	0.33±0.58
Syrphidae species	0.00±0.00	0.000±0.00	4.67±3.06	0.00±0.00	0.33±0.58	5.00±3.46
Calliphora sp. 1	0.00±0.00	0.333±0.58	5.00±6.25	3.67±4.73	0.00±0.00	0.67±0.58
Calliphora sp. 2	1.00±1.00	0.000±0.00	1.00±1.73	0.00±0.00	0.67±0.58	0.33±0.58
Calliphora sp. 3	0.33±0.58	0.333±0.58	1.67±1.53	0.00±0.00	0.00±0.00	0.00±0.00
Chrysomya sp.	0.00±0.00	0.000±0.00	0.33±0.58	0.00±0.00	1.00±1.00	0.00±0.00
Wohlfahrtia sp.	0.00±0.00	0.000±0.00	0.67±0.58	0.00±0.00	0.00±0.00	0.00±0.00
Lucilia sp.	0.33±0.58	1.333±1.53	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
Tabanus sp.1	0.00±0.00	0.000±0.00	3.00±1.73	0.33±0.58	0.33±0.58	2.67±3.77
Tabanus sp. 2	0.67±0.58	0.000±0.00	2.33±1.16	0.00±0.00	0.33±0.58	1.67±0.58
Culex sp.	0.33±0.58	0.000±0.00	1.00±1.73	0.00±0.00	0.33±0.58	0.00±0.00
Total number	**18.68±9.50**	**17.667±6.66**	**29.00±7.81**	**23.67±20.55**	**17.67±13.87**	**24.67±22.81**

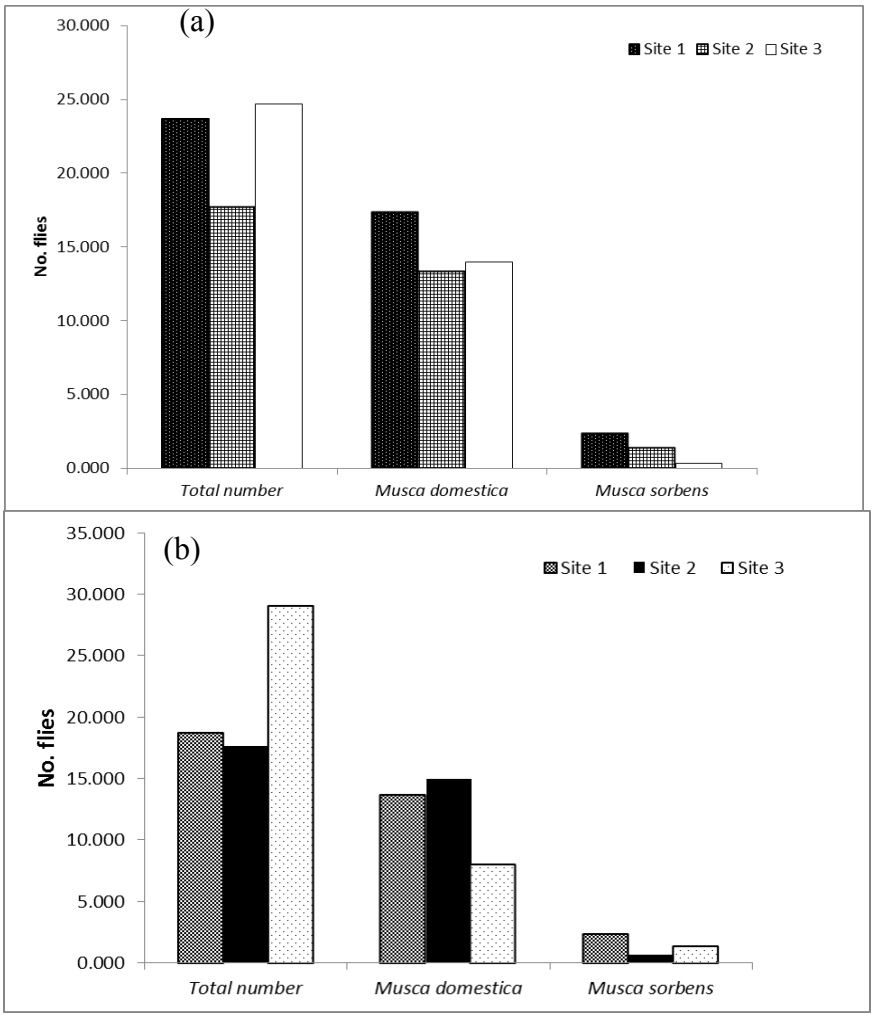

Figure 2. (a)The abundance of the total number of flies, *Musca domestica* and *Musca sorbens* in the three sampling sites in Tayma (Tabuk, Saudi Arabia) collected using The Sticky Traps. (b) The abundance of the total number of flies, *Musca domestica* and *Musca sorbens* in the three sampling sites in Tayma (Tabuk, Saudi Arabia) collected using The Yellow Sticky Traps.

DISCUSSION

In the present study, 12 dipterous species were collected from three different sampling sites located in Tayma (Saudi Arabia). The number of recorded species found in this study is comparable with other studies (e.g. see Hanan, 2010). For example, 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 *Musca sorbens*. The abundance of these two flies 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 Tabuk (Saudi Arabia), Aziz *et al.* (2016) 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 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 394 individuals of flies belonging to 12 taxa were reported in less than two months for three 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.

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 as a slightly higher compared to relevant studies from other parts of Saudi Arabia. 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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