Faculty of Agriculture & Veterinary Medicine, Thamar University

Yemeni Journal of Agriculture & Veterinary Sciences

Available online at; WWW.YJAVS.COM

**DOI:** xxxx.xxxx

# Seasonal abundance of flies (Diptera) in animal farms in some areas of Dhamar governorate, Yemen

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**Article history:**

**Received**

8 May 2014

**Accepted**

25May 2014

## ABSTRACT

An entomological study was conducted from June 2011 to May 2012, with main objective to identify, determine the relative abundance and seasonal distribution of biting and nuisance flies parasitizing animals in some areas of Dhamar. A total of 1243 flies were collected from four areas of Dhamar, namely, Rosaba dairy farms, Souk Al-Rabo`a, Agriculture & Veterinary Medicine Faculty campus and slaughterhouses. All flies were collected and examined according to standard parasitological techniques. Nine genera of biting and nuisance flies were identified. The genera were *Musca*, *Stomoxys*, *Luicila*, *Sarcophaga*, *Calliphora*, *Chrysomya*, *Fannia*, *Tabanus* and *Hippobosc*a and their relative abundance were 51.8 %, 14.8%, 12.6%, 11.3%, 7.4 %, 0.8 %, 0.6%, 0.6% and 0.1% respectively. Significant differences ($P<0.05$) in the relative abundance of the flies among different genera were observed. The flies population was increased significantly ($P< 0.05$) with the beginning of the rainy season and reached the peak in April (15.9 %); whereas, declined to its lower level in October (2.5%). The results of this study could be useful for designing control program for controlling biting and nuisance flies in Dhamar Governorate to avoid their impact on animals and their productivity.

**Keywords**: Seasonal abundance, animals, flies, Yemen

## INTRODUCTION

The livestock play an important role in the global economy, particularly in developing countries. It provide a flow of essential food products throughout the year, sustain the employment and income of millions of people in rural areas, contribute draught energy and manure for crop production (Jahan and Rahman, 2003; Forster *et al*., 2009; Swanepoel *et al*., 2010; Changbunjong *et al*., 2013). In Yemen, the current population of livestock is estimated as 20.9 million and is predicted to increase 3.2 % per year to reach 30 million by 2025 (Mark and Grange, 2008; WFP, 2013). The livestock sector contributes about 16% of the total National Gross Domesticated Product (GDP) and over 23.3% of the Agricultural GDP (Al-Mamari, 2008).

The Diptera, the true flies, is one of the largest orders in the class insecta with over 120,000 described species. All these species have a complex life-cycle with complete metamorphosis. Hence, the larvae are completely different in structure and behavior to the adults. As a result, dipterous flies can be ectoparasites as larvae or adults, but they are rarely parasites in both lifecycle stages (Urquhart *et al*., 1996; Wall and Shearer, 2001).

Adult flies may feed on blood, sweat, skin secretions, tears, saliva, urine or faeces of the domestic animals and human to which they are attracted. They may do this either by puncturing the skin directly, in which case they are known as biting flies, or by scavenging at the surface of the skin, wounds or body orifices, in which case they may be classified as non-biting or nuisance flies (Wall and Shearer, 2001; Holdsworth *et al*., 2006).

Flies may cause a severe problem to animals. Their bites are painful constituting a nuisance to animals, blood loss, allergic reactions such as skin rashes, itching, and body swelling, a loss of milk production in dairy animals, interference with normal grazing habits and increased energy utilization by the animal in its effort to remove flies (Vitela *et al*., 2007; Karshima *et al*., 2011). In addition, biting and nuisance flies may act as mechanical and biological vectors for a range of pathogenic diseases and cause myiasis in human and animal (Scala *et al*, 2001; Otranto *et al*., 2005; Sinshaw *et al*., 2006; Logan and Birkett, 2007; Sukontason, *et al*., 2008; Schnur *et al*., 2009; Andrade *et al*., 2010; Bosly, 2010; Sinha, 2012).

A successful control program includes: weekly removal of bedding, proper choice of bedding material, use of less-toxic insecticides, release of biological control agents and use of physical controls, such as traps. The incorporation of these methods is required to manage flies across animal farms or areas (Kaufman *et al*., 2005).

Information on current status of biting and nuisance flies in Dhamar is scanty and sufficient data in a compiled form is not available. Therefore, the purpose of this study was to identify, determine the relative abundance and seasonal distribution of biting and nuisance flies parasitizing animals in some areas of Dhamar governorate, Yemen.

## MATERIALS & METHODS

### *1. Study area*

Dhamar is located approximately 100 km south to Sana`a, the capital of Yemen. It is situated at 14.58′N latitude, 44 43′E longitude and at an altitude of 2425 meter above sea level (Figure 1). The mean of temperature, relative humidity and rainfall recorded from June 2011 to May 2012 are 24.3 °C, 59.7 % and 64.2 mm respectively. It`s irrigated by underground water. It is a semi-cultivated area with many animal farms containing cattle, sheep, goats, horses and poultry. Cattle, small ruminants and equidae were used as study animals. An entomologic study was carried out from June 2011 to May 2012 in some areas of Dhamar, namely, Rosaba dairy farms, Souk Al-Rabo`a, Agriculture & Veterinary Medicine Faculty campus and slaughterhouses/ abattoirs.

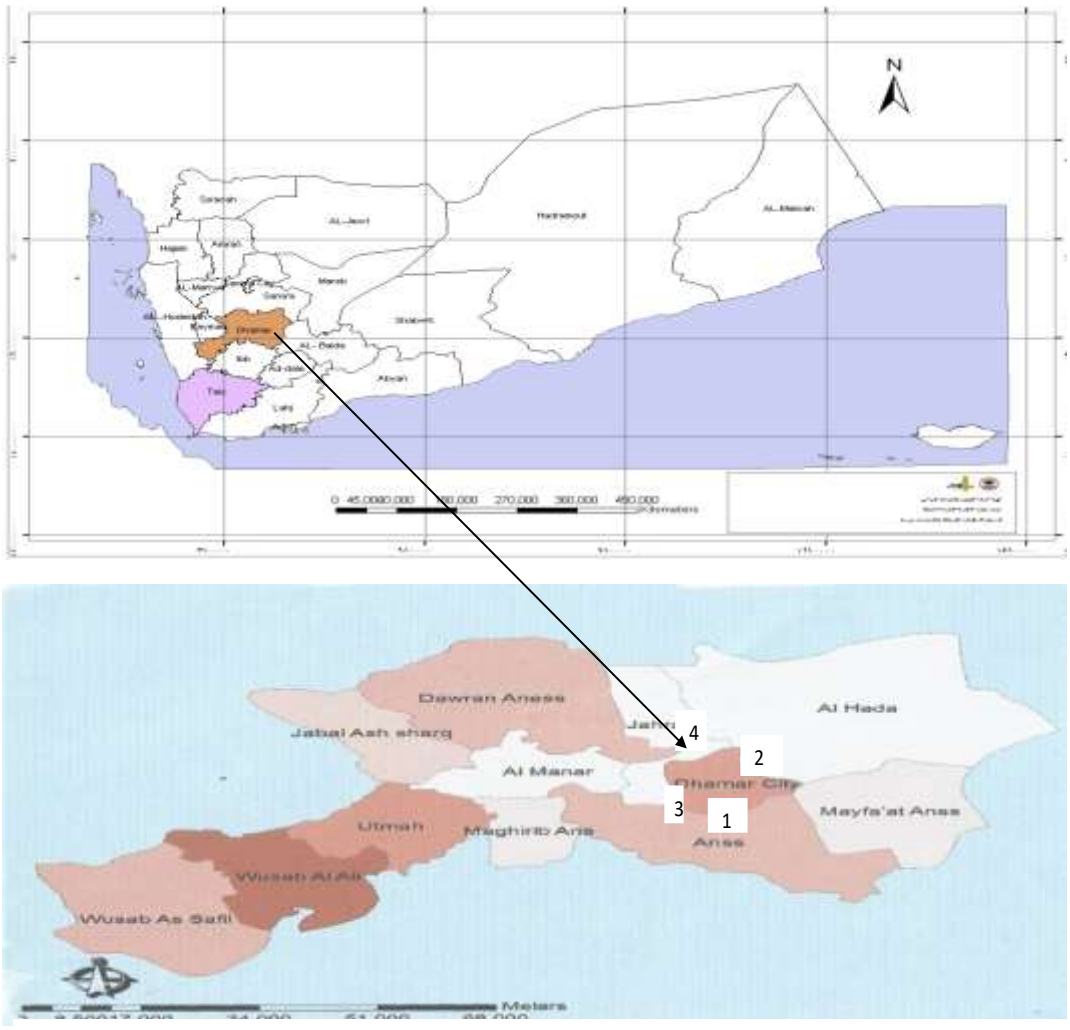


**Figure 1:** Geographical location of the Four studied areas of Dhamar Governorate:(1) Souk AlRabo`a, (2) Slaughterhouses, (3) Faculty of Agri. &Vet. Campus (4) Rosaba dairy farms.
Sources: Agricultural and Researches and Extension Authority, Dhamar & National Information Centre, Sana`a, Yemen

### *2. Study design and collection of samples*

Flies were collected at two-week interval from June, 2011 to May, 2012 by sticky traps, aerial sweeping and hand nets. Sticky traps deployment sites were selected to represent all habitats that could be related to fly multiplication, behavior, feeding, and other related aspects. Sticky ribbon type traps were fixed at a height of 1 meter above ground level. The traps were set before/ at sunrise and collected next day morning. In each catchment, sticky trap was kept in a bag, labeled by date, area and other information that may be relevant from the aspect of data analysis was included and brought to laboratory. Similarly, collection of flies by aerial sweeping nets was carried out according to Thadeu and Barros (2001). In brief, one observer with aid hand net (22 cm diameter and 40 cm deep, 75 cm handle length) remained near the animals at different intervals of times and captured flies hovering around the animals. At the end of each catchment, flies were brought to the

laboratory in special container. Flies were killed and preserved in a 70% ethyl alcohol. All samples were brought to Department of Veterinary Parasitology, Faculty of Agriculture and Veterinary Medicine, Thamar University, Dhamar, for processing, counting and identification.

*3. Processing and identification of flies*

In laboratory, Flies collected by sticky traps, aerial sweeping and hand nets were sorted, counted and then mounted on a stereomicroscope for identification. Identification was made with several taxonomic keys of Urquhart *et al.* (1996), Wall and Shearer (2001), Mullen and Durden (2002). Flies were identified to genus level.

Meteorological data, namely, temperature, relative humidity and rainfall were obtained from agricultural and extension Authority station, Dhamar.

*4. Data analysis*

The data obtained from this study were uploaded into Microsoft Excel spreadsheet and summarized by using tables. Statistical analyses were performed by using SPSS 17.1 for Windows. *P* value less than 0.05 was considered significant.

## RESULTS

### *1. Genera diversity and relative abundance of the flies*

A total of 1243 flies were collected and examined from different areas of Dhamar. The flies identified were belonging to 9 genera. The genera were *Musca* ( Linnaeus), *Stomoxys* (Geoffroy), *Luicila* ( Robineau-Dsvoiyd), *Sarcophaga* (Meigen), *Calliphora* (Robineau-Dsvoiyd), *Chrysomya* (Macqurt), *Fannia* (Robineau-Dsvoiyd), *Tabanus*( Leach) and *Hippobosca* (Linnaeus) and their relative abundance were 51.8 %, 14.8%, 12.6%, 11.3%, 7.4 %, 0.8 %, 0.6%, 0.6% and 0.1% respectively as presented in Table 1. There were significant differences ($P<0.05$) in the relative abundance of the flies among different genera identified. Among the total flies collected, *Musca Spp.* were the most prevalent abundant flies and they were represented 51.8 percent of total samples examined and identified. While *Hippobosca Spp*. was found in very low number 0.1 percent. Other species were presence in varying percentages.

**Table 1.** Genera diversity and relative abundance of flies in animal farms in Dhamar, governorate from June 2011 to May 2012

| Genus | No. of flies collected | Relative abundance (%) | *P* value |
|---|---|---|---|
| ***Calliphora*** | 92 | 7.4 | 0.000 |
| ***Chysomya*** | 10 | 0.8 | |
| ***Fannia*** | 8 | 0.6 | |
| ***Hippobosca*** | 1 | 0.1 | |
| ***Lucilia*** | 156 | 12.6 | |
| ***Musca*** | 644 | 51.8 | |
| ***Sarcophaga*** | 140 | 11.3 | |
| ***Stomoxys*** | 184 | 14.8 | |
| ***Tabanus*** | 8 | 0.6 | |
| **Total** | 1243 | 100.0 | |

The results of flies' density distribution in different areas of Dhamar are presented in Table 2. The higher number of flies was recorded in Rosaba area (40.31%); whereas the lower number was recorded in Souk Al-Rabo`a (13.92%). Significant differences (P<0.05) were observed between the numbers/density of flies and study area (locality).

**Table 2**. Distribution of flies in animal farms in study areas of Dhamar governorate form June 2011 to May 2012

| Area | Call | Chry | Fan | Hip | Lu | Mu | Sar | St | Ta | Total | Abundance % | *P* value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Rosaba area** | 20 | 0 | 0 | 0 | 48 | 277 | 56 | 95 | 5 | 501 | 40.31 | 0.000 |
| **Slaughterhouses** | 32 | 2 | 0 | 0 | 54 | 141 | 62 | 17 | 0 | 308 | 24.78 | |
| **Sough Al-Raboa** | 22 | 4 | 3 | 0 | 20 | 100 | 10 | 12 | 2 | 173 | 13.92 | |
| **Agri. &Vet. Faculty campus** | 18 | 4 | 5 | 1 | 34 | 126 | 12 | 60 | 1 | 261 | 21.00 | |
| Total | 92 | 10 | 8 | 1 | 156 | 644 | 140 | 184 | 8 | 1243 | 100.00 | |

Call= *Calliphora,* Chry= *Chysomya,* Fan= *Fannia,* Hip= *Hippobosca,* Lu= *Lucilia,* Mu= *Musca,* Sar= *Sarcophaga,* St= *Stomoxys,* Ta= *Tabanus.*

**2. *The effect of season and meteorological parameter on flies density at the study areas***

The results of seasonal abundance of flies, meteorological parameters and relationship between the abundance of flies and meteorological parameters in study areas of Dhamar are presented in Tables 3 & 4 and Figure 2. In general, the flies' population increased from March and reached the peak in April (15.9 %); whereas, gradually declined to reaching its lowest levels in October (2.5%). Statistically, There were significant differences (P< 0.05) in relative abundance of flies and month variation (seasons). The mean of temperature, relative humidity and rainfall recorded in April were 22.4 °C, 77 % and 97.6 mm respectively; whereas in October were 22.9 °C, 47.0 % and 0.00 respectively.

**Table 3**. Seasonal abundance (Monthly) of flies in animal farms in Dhamar governorate from June 2011 to May 2012

| Month | Call | Chry | Fan | Hip | Lu | Mu | Sar | St | Ta | Total | Abundance % | *P* value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Jun** | 7 | 2 | 0 | 0 | 13 | 75 | 20 | 18 | 0 | 134 | 10.8 | 0.000 |
| **Jul** | 7 | 0 | 0 | 0 | 10 | 53 | 15 | 19 | 0 | 104 | 8.4 | |
| **Aug** | 6 | 0 | 0 | 0 | 13 | 73 | 23 | 16 | 0 | 131 | 10.5 | |
| **Seb** | 3 | 0 | 0 | 0 | 8 | 34 | 14 | 7 | 0 | 66 | 5.3 | |
| **Oct** | 1 | 0 | 3 | 1 | 7 | 8 | 4 | 8 | 0 | 32 | 2.6 | |
| **Nov** | 1 | 0 | 0 | 0 | 4 | 21 | 6 | 6 | 0 | 38 | 3.1 | |
| **Dec** | 3 | 0 | 5 | 0 | 3 | 24 | 6 | 5 | 0 | 47 | 3.6 | |
| **Jan** | 7 | 0 | 0 | 0 | 14 | 31 | 11 | 9 | 5 | 97 | 6.2 | |
| **Feb** | 7 | 0 | 0 | 0 | 21 | 44 | 13 | 17 | 0 | 102 | 8.2 | |
| **Mar** | 21 | 0 | 0 | 0 | 24 | 64 | 5 | 18 | 0 | 132 | 10.6 | |
| **Apr** | 13 | 5 | 0 | 0 | 15 | 126 | 12 | 23 | 3 | 198 | 15.9 | |
| **May** | 16 | 3 | 0 | 0 | 24 | 91 | 11 | 38 | 0 | 183 | 14.7 | |
| **Total** | 92 | 10 | 8 | 1 | 156 | 644 | 140 | 184 | 8 | 1243 | 100.0 | |

Call= *Calliphora,* Chry= *Chysomya,* Fan= *Fannia,* Hip= *Hippobosca,* Lu= *Lucilia,* Mu= *Musca,* Sar= *Sarcophaga,* St= *Stomoxys,* Ta= *Tabanus.*

**Table 4.** Monthly mean of temperature, relative humidity and rainfall at the study areas and abundance of flies from June 2011 to May 2012

| Month | Temperature (°C) | Relative humidity (%) | Rainfall (mm) | No. of the flies | Abundance % |
|---|---|---|---|---|---|
| **Jun** | 27.0 | 58 | 41.3 | 134 | 10.8 |
| **Jul** | 26.8 | 63 | 87.7 | 104 | 8.4 |
| **Aug** | 24.1 | 69 | 106 | 131 | 10.5 |
| **Seb** | 24.0 | 60 | 18.5 | 66 | 5.3 |
| **Oct** | 22.9 | 47 | 0 | 32 | 2.6 |
| **Nov** | 22.0 | 63 | 3 | 38 | 3.1 |
| **Dec** | 21.6 | 47 | 0 | 47 | 3.8 |
| **Jan** | 22.3 | 57 | 0 | 97 | 6.2 |
| **Feb** | 23.7 | 51 | 0 | 102 | 8.2 |
| **Mar** | 24.5 | 51 | 21 | 132 | 10.6 |
| **Apr** | 22.4 | 77 | 97.6 | 198 | 15.9 |
| **May** | 26.1 | 51 | 159.5 | 183 | 14.7 |

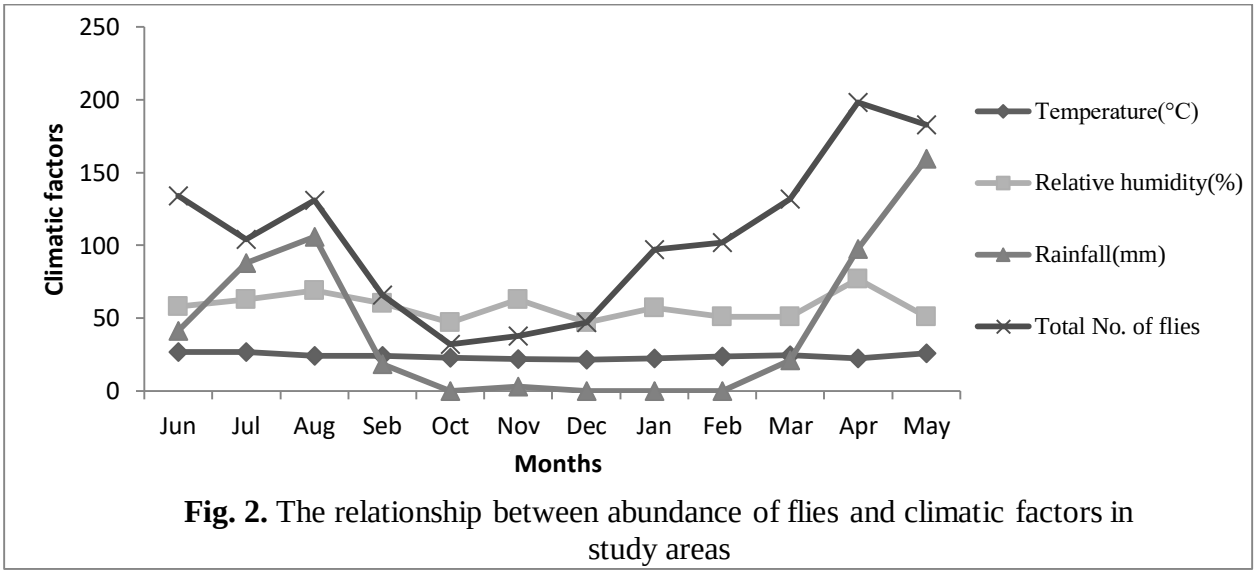


**Fig. 2.** The relationship between abundance of flies and climatic factors in study areas

## DISCUSSION

**1.** *Genera diversity and relative abundance of the flies*

A total of 1243 flies were collected from June 2011 to May 2012. Biting and nuisance flies belonging to 9 genera were identified: *Musca, Stomoxys, Lucilia, Sarcophaga, Calliphora, chrysomya, Tabanus, Fannia and Hippobosca.* In Dhamar as well as Yemen, though there is no specific study was carried out on biting and nuisance flies attaching animals. Thus, the findings of this study may be considered as first work in compiled form. However, many workers in different geographical regions of the world carried out many studies on biting and non-biting flies and identified same genera/species or more than these genera recorded in current study (Ahmed *et al.*, 2005; Sinshaw *et al.*, 2006; Abdul_Rassoul *et al.*, 2009; Fetene and Worku, 2009; Bosly, 2010; Muenworn *et al.*,

2010; Karshima *et al*., 2011; Oku *et al*., 2011).

Flies belong to *Musca* genus were found to be the most abundant, occurring throughout the study. The results of this study are in agreement with findings of other workers (Srinivasan *et al*., 2009; Abdul_Rassoul *et al*., 2009), who carried out studies on the *Musca spp*. The predominant abundance of *Musca spp*. compared to other genera in the current study could be attributed to the *Musca* species are a worldwide distributed pest organism on animal farms, home and everywhere. Moreover, may be the macro and micro-environmental conditions are conducive for flies to breed and the larvae to complete their life cycle.

*Hippobosca spp* was recorded in low number. This species were collected from experimental station farm in Agriculture & Veterinary Medicine Faculty campus, Thamar University. The results of this study are in agreement with findings of Sinshaw *et al*. (2006) who recorded this parasite species in low number in his study at Ethiopia. The low number of *Hippobosca spp.* recorded in this study could be attributed to host specifity and inefficiency technique used during the collection of specimen.

In this study flies belong *Fannia*, *Stomoxy*, *Luicila*, *Sarcophaga*, *Calliphora*, *Chysomya* and *Tabanus* genera were also caught and recorded with varying percentages. These results are partially in agreement with findings of Ahmed *et al*. (2005) in Nigeria; Sinshow *et al*. (2006) in Ethiopia; Abdul_ Rasssoul *et al*. (2009) in Iraq; Bosly (2010) in S. Arabia; Oku *et al*. (2011) in Nigeria; Karshima *et al*. (2011) in Nigeria and Changbunjong *et al*. (2013) in Thailand, who studied the biting and nuisance flies attacking livestock and public health. The differences between the results of this study and findings of above workers may be to feeding habit of flies, vegetation of study area, existing of animal host, and weather condition factors.

All areas investigated in this study shared similar topographical feature, however, the relative abundance flies were varied among them. The higher population density of the flies was recorded in Rosaba area; whereas the lower in Souk Al-Raboa area. These differences in abundance/ density of flies might be due to the integrated effect of more than one factor such as animal number, animals' management practice, micro environmental conditions and presence of natural enemies in the surveyed areas.

*2. The effect of season and meteorological parameters on flies density at the study areas*

Knowing the month variation (season) impact on relative abundance and activity of the flies is important in determining the period of maximum risk of flies for the successful implementation of control program (El_Badry *et al*., 2008). The results of this study revealed that there is seasonal variation on the abundance of the flies. Generally, the population increased at the beginning of the rainy season (March) and reached the peak in the April and May; whereas, declined to lower level in late wet season (October) as depicted in Tables 3 & 4 and Figure 2. The general increase in relative abundance of flies in the rainy season and a decline in the dry season is in consonance with the observations of workers in different ecological regions of the world ( Thadeu and Barros, 2001; Otranto

*et al*., 2005; Ahmed *et al*., 2005; Sinshaw *et al*., 2006; Srinivasan *et al*., 2009; Muenworn *et al*., 2010; Karshima *et al*., 2011; Oku *et al*., 2011). The higher population of flies recorded in this study during the rainy season may be attributed to that flies require a wet habitat for multiplication and larval growth is also dependent up on wet soil/mud. Ahmed *et al*. (2005) suggested that optimum temperatures that stimulate rapid reproduction appear to fall between mean temperatures of 24.1 °C-28.6 °C. it`s therefore, appeared that flies density is significantly influenced by the meteorological parameters in study areas.

## CONCLUSION

In general, this study demonstrated that there are several genera of biting and nuisance flies inhabited the different areas of Dhamar, which are representing a silent danger to livestock industry. The population density/ number of flies correlated with climatic factors and the relative abundance of flies researched the peak during rainy season. It is suggested that, particular attention should be paid to toward controlling the biting and nuisance flies in study areas to prevent impact of these flies on livestock industry. Since the findings of this study are preliminary, further entomological studies are needed to be conducted in different seasons, agro-ecological zones of country and with more sophisticated techniques to generate a complete data set on fauna species of flies in Yemen.

## ACKNOWLEDGMENTS

The Authors thankful to staff workers at Rosaba dairy farm, Central slaughterhouses/abattoirs, small farmers at Souk Al_Raboa for their help and hospitalities extended during the collection of samples. Thanks also extend to Agricultural and Researches and Extension Authority for providing the meteorological data.

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# الوفرة الموسمية للذباب المتطفل على الحيوانات المزرعية في بعض مناطق محافظة ذمار ، اليمن

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الملخص

أجريت هذه الدراسة في محافظة ذمار في الفترة من يونيو ٢٠١١ إلى مايو ٢٠١٢ ، بغرض التعرف على أجناس الذباب الثاقب واللاعق التي تتطفل على الحيوانات ونسبة وفرتها و تواجدها الموسمي. تم جمع ١٢٤٣عينة من الذباب من حظائر الحيوانات من أربع مناطق مختلفة من المحافظة وهي مزرعة رصابة، سوق الربوع، كلية الزراعة والطب البيطري والمسالخ ذمار باستخدام مصائد لاصقة وشبكات اليد. تم فحص و عد عينات الذباب عيانيا ومختبريا وفقا للطرق المعملية. تم التعرف على ٩ جنس من أجناس الذباب الثاقب واللاعق، وهي: الذباب المنزلي (٥١,٨%)، ذباب الإسطبل (١٤,٨ %) والذباب الأخضر (١٢,٦ %)، ذباب اللحم (١١,٣%)، الذباب الأزرق ( ٧,٤%)، ذباب الدودة الحلزونية (٠,٨%)، ذباب المرحاض (٠,٦%)، ذباب الخيل (٠,٦%) وذباب الشعران (٠,١%)على التوالي. أوضحت الدراسة أن هناك فروق معنوية (P<٠,٠٥ ) بين الوفرة العددية لأجناس الذباب التي تم التعرف عليها. تباينت نسب الوفرة العددية للذباب وفقا لأشهر السنة، فقد سجلت اعلي نسبة في شهر ابريل ( ١٥,٩ %) وادني نسبة في شهر أكتوبر (٢,٥ %). كما اظهر التحليل الإحصائي للنتائج أن هناك فروق معنوية (P<٠,٠٥) بين الوفرة العددية للذباب وأشهر السنة (الموسم). يمكن الاستفادة من نتائج هذه الدراسة في تصميم برنامج لمكافحة الذباب وللحد من انتشارها وتأثيرها على الحيوانات و إنتاجها في منطقة ذمار، اليمن.

كلمات مفتاحيه: الوفرة العددية، الذباب، الحيوانات المز رعية، ذمار، اليمن.

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