



Monitoring Diptera species of medical and veterinary importance in Saudi Arabia: Comparative efficacy of lure-baited and chromotropic traps

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Abstract

A number of Diptera species have medical and veterinary importance as they cause myiasis and act as vectors for protozoans, helminth eggs, as well as bacterial pathogens. In this research here, eleven Diptera species were monitored in five locations in Northwestern part of Saudi Arabia, using three types of traps (lure-baited traps, window fly trap and yellow sticky traps). As a general trend, the dominant flies were *Musca domestica*, *Musca sorbens*, *Calliphora* sp., blowfly *Chrysomya* sp. and *Sarcophaga haemorrhoidalis*. No significant differences were observed among the total number of flies collected indoor and outdoor at each site using different traps. In the slaughter house, the three types of traps showed significant differences in the mean of collected flies ($F = 4.135$). Lure-baited traps showed significant differences in the abundance of the flies collected over the other two traps. In vegetable markets, fly abundance varied significantly among the three types of traps ($F = 13.934$). In the animal market, the mean number of flies collected varied significantly among the three types of traps ($F = 4.792$). Similar patterns of variation in the number of flies collected by different traps were shown in farms ($F = 4.747$). However, in the residential area, no significant difference was detected in the mean number of flies collected by three traps ($F = 2.620$). *M. domestica* was found to be the most abundant species in all locations with a remarkable high abundance in animal facilities, and the lure-baited traps were found to be the most effective

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for monitoring fly abundance. Overall, our research adds basic knowledge for future control programs against flies of medical and veterinary importance in Saudi Arabia.

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1. Introduction

Diptera plays a key role in nutrient cycling in terrestrial ecosystems as they accelerate the breakdown of animal tissues, which facilitates the action of decomposing microorganisms [1]. It is well known that several dipteran species have medical and veterinary importance as they cause myiasis [2,3] and are considered mechanical and biological vectors for protozoan cysts, helminth eggs, bacterial and viral pathogens [4]. Flies are synanthropic as they have a close association with human environments. Generally, flies feed on human foodstuffs and wastes where they can pick up and transport various disease agents. For example, the housefly *Musca domestica* L. (Diptera: Muscidae), has been reported as a mechanical vector for more than 65 human and animal gastro-intestinal diseases and caused by protozoan (amoebic dysentery), bacterial (shigellosis, salmonellosis and cholera) and helminths (round worms, hookworms, pinworms and tapeworms) infections as well as viral and rickettsial infections [4]. Moreover, flies are reported to have economic importance. For example, Miller et al. [5] reported that the high population density of the housefly in poultry farms causes annoyance to workers, in addition to their indirect effect causing reduction in the egg production of hens. The expenditure on controlling the dipterous flies can be remarkably high. For instance, the US spend more than 1.6 million US dollars to control housefly populations in poultry farms [6]. According to the recent report of Zakai [7], 19,302 cases of cutaneous leishmaniasis were reported in Saudi Arabia during the period of 6 years (2006–2012).

The occurrence, distribution and prevalence of these dipterous in metropolitan areas are factors of public health relevance. In rural areas, these insects can cause decreased livestock production spreading important animal diseases [8]. During the last two decades, there is a growing interest among medical entomologists to study the biology and ecology of flies in poultry farms, slaughter houses, cattle farms, food courts, factories, landfill and waste management plants in relation to environmental and climatic variables [9]. This is initial yet essential step to improve the future control and

management programs. Indeed, dipterous flies are of medical and economic importance and can be associated with epidemic outbreaks of diseases or causing economic losses [10–12].

Despite this, there are few studies concerning biological and ecological aspects of dipterous flies in Saudi Arabia. For example, interesting studies were conducted in Jazan region by Hilali et al. [13]. However, Alahmed et al. [14] studied the seasonal activity of flies causing myiasis in livestock animals in Riyadh region. Hanan [15] focused on the prevalence of dipterous flies of veterinary importance in selected sheep farms and slaughter houses in Jazan, Saudi Arabia. She surveyed Dipterous flies in three private sheep farms and three governmental slaughter houses in Jazan and reported 5312 individuals belonging to 12 species, 8 genera, 7 families: Calliphoridae, Sarcophagidae, Muscidae, Ceratopogonidae, Uti-lidae, Sphaeroceridae, and Chloropidae.

To our knowledge, there is no information available about the abundance of flies of medical and veterinary importance in the Northern region of Saudi Arabia, and scarce knowledge is available about the effectiveness of different traps for monitoring of dipterous flies in arid regions. Therefore, this research firstly investigated the abundance and distribution of flies in Tabuk with emphasis on the effectiveness of using different traps.

2. Materials and methods

2.1. Study sites

Tabuk is the capital city of the Tabuk Region in north-western Saudi Arabia. Temperatures in the summer ranged from 26 to 46 °C, while in winter they are between –4 and 18 °C, with wide spread frosts. Rainfalls in Tabuk Area occurred in the winter months from November to March, and precipitation ranged between 50 and 150 mm. The present study was conducted in five out-door and in-door places of slaughter house (28.384786 N, 36.534745E), vegetable market (28.428301 N, 36.616465 E), animal market (28.439784N, 36.460424 E), farm (28.403872 N, 36.540155 E) and residential (28.379869 N,

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