

Insects of Saudi Arabia

Diptera: Synanthropic Flies

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SUMMARY

The entomological investigations carried out during the Public Hygiene Project of CIBA-GEIGY Limited with the Ministry of Municipal & Rural Affairs in Saudi Arabia from 1975 to 1978 offered an opportunity to collect flies from numerous habitats in various regions of the country. Most of these records are new for Saudi Arabia. Special emphasis was laid on comparing sampling with reference to the species' synanthropic behaviour under urban and rural conditions. In addition, a fairly large number of flies was collected in different desert habitats. A checklist of the species is given and biological aspects are discussed. Reference is also made to the geographic distribution and the synanthropic significance of each species.

I. INTRODUCTION

The importance of synanthropic Diptera in the mechanical transmission of human disease and zoonoses has been shown by several authors (WARD et al. 1945; POVOLNÝ and PRIVORA, 1961; OJALA and NUORTEVA 1963, 1966; MIHÁLYI, 1967a, GREENBERG 1973). Although no detailed studies on this subject are currently available from Saudi Arabia it may be assumed that similar conditions occur within this geographical area. On the basis of research work carried out in different parts of the world it has been proved that houseflies and other synanthropic flies are carriers of organisms causing gastro-enteric diseases including cholera, and also poliomyelitis, trachoma, helminthic infections etc. (ZUMPT and PATTERSON 1952; TESCHNER 1959; NUORTEVA 1963; GREENBERG 1973).

Little is known about the insects of medical importance of Saudi Arabia. A few papers have been published recently: on mosquitoes (MATTINGLY and KNIGHT, 1956); on fly control (PEFFLY, 1961); on fleas (LEWIS, 1964); on miscellaneous vectors of human diseases (SEBAI et al., 1974) and on sand flies (LEWIS and BÜTTIKER, 1979). In a synoptic list of the insects collected in Saudi Arabia BECCARI (1971) has mentioned the Diptera recorded by a number of earlier authors, in particular Dr. H. MARTIN, FAO, and F. SHALABY (1961; 1962).

One of the most remarkable effects of the rapid economic development of Saudi Arabia during the last decade has been the expansion of urban communities in several parts of the Kingdom. The hectic growth of the main towns in all regions of the country has produced numerous biotopes suitable for the development of synanthropic flies.

Investigation of the behaviour, diurnal activity, abiotic and biotic factors influencing the phenology etc. have a direct bearing on fly control operations. These subjects will be covered in a separate paper (BÜTTIKER and ATTIAH, in prep.).

Other dipterous families such as the Bombyliidae, Trypetidae, Tachinidae, Lauxaniidae, Oestridae and Hippoboscidae were recorded from Saudi Arabia by SHALABY (1961, 1962) and BECCARI (1961).

There are quite a number of papers dealing with the entomofauna of neighbouring countries of the Middle East. With regard to Diptera, mention should be made of EMDEN (1948) on the Muscids of Yemen, and the list of Egyptian Diptera by STEYSKAL and SAAD EL-BIALY (1967).

Studies on the dipterous fauna of different biotopes ranging from various human habitations and dwellings, as well as garbage dumps, factories, stables, slaughterhouses, markets, hospitals etc. have been carried out on several occasions in different countries (e.g. STEYSKAL 1957; KIRCHBERG 1958; TESCHNER 1961; MIHÁLYI 1965, 1966; KÜHLHORN 1973).

Many investigations on the composition of the dipterous fauna of the urban biotopes have been published, particularly on the large cities of Europe (WEIDNER 1952; TESCHNER 1961; SCHUMANN 1963; PETERS 1959).

Special studies on the flies frequenting human faeces have been made on several occasions (KIRCHBERG 1951; ZUMPT and PATTERSON 1952; STEYSKAL 1957; TESCHNER 1959; MIHÁLYI 1965).

Because of the variety of biotopes present in areas inhabited by man, it has been shown that the composition of the dipterous fauna is quite different from that in inhabited biotopes (e.g. MIHÁLYI 1967b).

Investigations with the species of Diptera occurring in areas of human habitation are important for assessing which flies may be involved in the possible transmission of diseases, in causing nuisance, and in reducing the production of meat and milk in livestock.

The results obtained by various authors in Europe and America have made it clear that a large number of fly species may occur in these man-made environments. It is of interest to note that in some European studies (*) a considerable number of dipterous families has been found; amazingly larger for the authors of the individual investigations, see KÜHLHORN (1973).

numbers of species have been obtained under rural conditions, e.g. 457 species in farms, 428 in cow stables etc., in village houses 108, on dung heaps 178. In the urban environment figures show a similar situation: 209 species "in town", in a flat 181, in a zoological garden 231 etc.

The present paper gives a preliminary account of the synanthropic and hemisynanthropic flies of Saudi Arabia, collected within the framework of the CIBA-GEIGY Public Hygiene Project for the Ministry of Municipal & Rural Affairs, Government of the Kingdom of Saudi Arabia, during the period of March 1975 to December 1977, covering the following towns:

Jeddah	Dammam	Riyadh
Mecca	Al Khobar	
Medina	Qatif	
Taif	Hofuf/Mubarratz	

The study was confined to the families Muscidae, Calliphoridae, Sarcophagidae, Anthomyiidae, Piophilidae and Milichiidae. Groups of smaller Diptera, such as Psychodidae, Drosophilidae, Cecidomyiidae etc. were excluded for various reasons. It should be remembered that the insect control operation and the Public Hygiene Project was mainly directed against houseflies and other synanthropic Brachycera, mosquitoes and sand flies (LEWIS and BÜTTIKER, 1979).

Special attention was paid to the synanthropic flies in fruit and vegetable markets, in slaughter houses, in fish markets, on garbage heaps in the cities, and on the main garbage dumps out of town. A comparison has been made between these habitats and the conditions inside villas, in ornamental gardens, in some farmhouses situated in desert and in the desert proper. In addition various Diptera have been included in the list from a number of habitats in semi-arid areas and from an expedition to the Asir Province (BÜTTIKER and WITTMER 1979). Further information about collecting in Saudi Arabia is available in BÜTTIKER (1979).

2. METHODS AND IDENTIFICATION

It was intended to carry out fly sampling at monthly intervals in various biotopes of one town in the Western (Jeddah), Central (Riyadh) and Eastern (Dammam) Regions. However, due to pressure of work and other investigations, it was not always possible to adhere strictly to this plan. Irregular sampling was carried out in a number of other towns, and whenever possible specimens were collected from rural and desert biotopes.

In most cases a Japanese-type nylon net was used for collecting, particularly on garbage dumps, vegetable and fish markets, in gardens and in the desert. Single fly catches by means of vials or small jars were carried out within the towns. Some samples were made with a Malaise-trap during the entomological expedition of Büttiker and Wittmer to the Asir Province (April 1976), and in Riyadh and its surroundings.

A fairly large number of flies was obtained during nocturnal excursions at more or less regular intervals to the desert near Jeddah, Riyadh and Dammam. On these occasions a pressurised propane gas lamp was used or the head-lamps of a motor car.

The collecting of flies for the present survey was carried out independently of the regular fly population density monitoring programme of the Project because the assessment of the fly population involved the use of the sticky fly papers which made it impossible to identify the trapped flies specifically.

After capture, the flies were immediately placed in methylated spirit (70%) for preservation. Identification of a reference collection was first arranged by one of the authors (A.C.P.) and this was used for further identifications of the more common species. All doubtful and newly-collected species from natural habitats were sent to the British Museum (Nat. Hist.) London for identification.

The approach described by GREGOR & POVOLNÝ (1958) and POVOLNÝ (in GREENBERG, 1971) has been used in assessing the synanthropic significance of each species, and these have been placed in two groups, eusynanthropic and hemisynanthropic species. According to GREGOR & POVOLNÝ (1958) and MIHÁLYI (1967a), synanthropy in itself cannot show the degree of importance of each species from the public health point of view.

In the context of public health, the most dangerous species are those where the adults feed first on faeces or carrion and then visit meat or fish for oviposition. Most species of Calliphoridae and Sarcophagidae fall into this category. *Musca domestica* is also a very important synanthropic species and is of considerable importance regarding the mechanical transmission of diseases. It has become particularly important in Saudi Arabia because it sometimes occurs in enormous numbers, especially around rapidly developing or expanding urban communities. In most European countries, hygienic disposal of faecal wastes has almost reduced *Musca domestica* in urban areas, and the main dangers to hygiene now come from Calliphoridae and Sarcophagidae.

PIOPHILIDAE

Piophilidae (L.)

Biology

The highest densities are attained in offal and heaps of bones in slaughter-houses, fish and food processing plants, kitchens, carrion pits etc. Larvae mainly in cheese, meat and other protein food. Records from faeces and carrion may be based on confusion with other species. Adults usually endophilic.

Distribution

Cosmopolitan. Originally a Palaearctic species and has spread all over the world through anthropobiocoenosis. In Saudi Arabia has been sampled in the Eastern region from Qatif fish market on 28.IV.1975.

Synanthropic significance

Seemingly slight, but little known of its hygienic importance.

MILICHIIDAE

Desmometopa m-nigrum (Zett.)

Biology

Saprophagous. Outside Saudi Arabia it has been reared from rotten cow-pea seed, and from other rotting vegetable materials. The adults are often the prey of larger predators (HENNING 1956). Larvae unknown.

Distribution

Epicentre in Mediterranean subregion; cosmopolitan. Favours arid habitats, sand dunes etc. In Saudi Arabia, from the Eastern Region (Dammam slaughter-house, 28.IV.1975). Other milichiid species were collected from Qatif fish market on 28.IV.1975 and from Riyadh (indoors) on 5.VII.1975.

Synanthropic significance

Slight. Most Milichiidae seem to be saprophagous but several genera have acquired specialized habits which have no relation with man; some genera found in birds nests (*Meoneura*, *Carnus*). Mostly of no known medical importance.

According to POVOLNÝ (in GREENBERG 1971) populations of *M. domestica* s. lat. are not confined to human habitations in the tropics and sub-tropics of the Old World, and even the synanthropic population may be exophilous, especially during hot summers. In Saudi Arabia the situation is somewhat more complicated and reference is made to the description published elsewhere (BÜTTIKER and ATTIAH, in prep.). There are three subspecies with considerable differences in their biology and behaviour (HULLEY, 1975).

Distribution

Cosmopolitan. *M.d. calleva* and *M.d. curviforceps* are more or less restricted to the Afrotropical region, whereas *M.d. domestica* occurs throughout the rest of the world and only sporadically infringes upon the Afrotropical region, through introductions via shipping. In Africa, *calleva* (exophilous) and *curviforceps* (endophilous) overlap geographically and occasionally ecologically, in which case some hybridisation occurs. In Saudi Arabia only *domestica* and *calleva* have been found so far. In most samples, April 1975 to December 1977, *M. domestica* was the most common species and it formed 80%–100% of all samples in all regions. In the desert samples *M. sorbens* was very much more common than *M. domestica*.

Table 3
Eastern Region
Distribution of Synanthropic Flies in Different Biotopes

Species	Bioto pes					
	Indoors	Gardens	Garbage	Markets	Slaughter houses	Deserts
<i>Musca domestica</i>	+++	+++	+++	+++	+++	
<i>M. domestica domestica</i>				+++	+++	
<i>M. domestica calleva</i>						
<i>M. lucidula</i>						
<i>M. albina</i>						
<i>M. sorbens</i>				++		+++
<i>Muscina stabulans</i>						
<i>Fannia canicularis</i>						
<i>Stomoxys calcitrans</i>			+			
<i>Anthomyia tempestatum</i>						
<i>Delia platura</i>						
<i>Chrysomya albiceps</i>		+	++	+++	+++	
<i>C. chloropyga f. putoria</i>						
<i>C. marginalis</i>				++		
<i>Lucilia sericata</i>				+	++	
<i>L. cuprina</i>					++	
<i>Calliphora vicina</i>			+			
<i>Sarcophaga haemorrhoidalis</i>						
<i>S. hirtipes</i>						
<i>S. ruficornis</i>				+		
<i>Wohlfahrtia nuba</i>						
<i>W. indigena</i>						
<i>Desmometopa m. nigrum</i>					++	
<i>Piophilidae casei</i>				++		

+ = rare
++ = fairly common
+++ = very abundant