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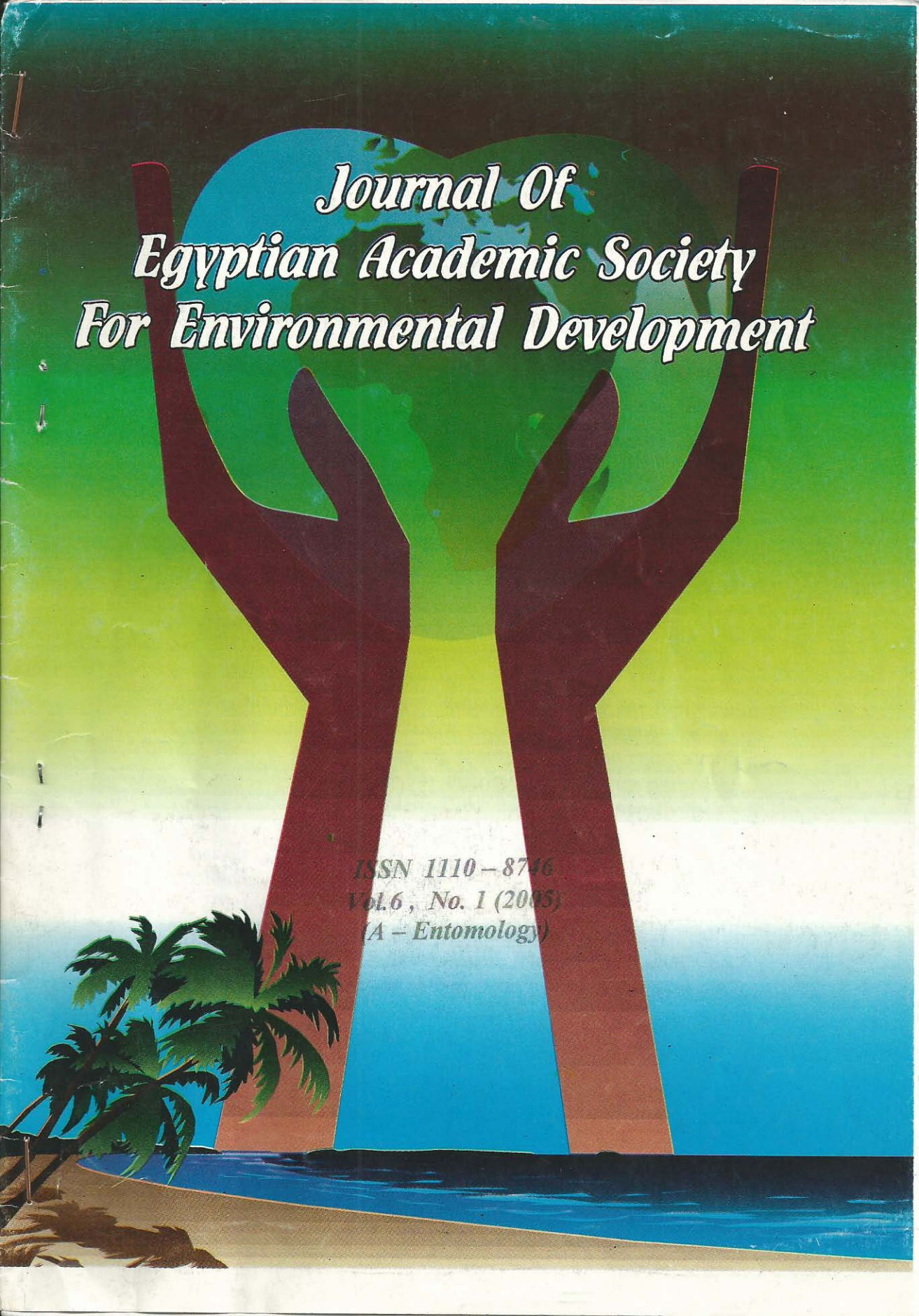

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SURVEY AND ECOLOGY OF *SERGENTOMYIA* SANDFLIES (DIPTERA: PSYCHODIDAE) IN ASIR REGION, SOUTHWESTERN SAUDI ARABIA

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ABSTRACT

Sergentomyia sandflies (Diptera: Psychodidae) were surveyed, for two successive years (May, 2000 to May, 2002) in 4 areas lying within 3 topographically different zones of Asir region, southwestern Saudi Arabia. 3273 flies (1787 males and 1486 females) belonging to fifteen *Sergentomyia* species were collected using sticky paper traps. Five of these namely *S. sonyae*, *S. palestinensis*, *S. schwetzi*, *S. dreyfussi*, and *S. squamipleuris* were recorded for the first time in Asir region. *Sergentomyia tiberiadis* (Adler, Theodor & Lourie), *S. fallax*, (Parrot), and *S. calcarata* (Parrot), were the most abundant species regarding density and/or distribution, they represented 26.5, 24.7 and 20% of the total flies collected, respectively. *S. christophersi* (Sinton), *S. africana* (Theodor), S. *dreyfussi* (Parrot), were less abundant species representing 9.7, 6.4 and 5.4% of the total flies collected, respectively. Meanwhile, *S. antennata* (Newstead), *S. clydei* (Sinton), *S. magna* (Sinton), *S. taizi* (Lewis), *S. sonyae* (Lewis), *S. palestinensis* (Adler, Theodor), *S. schwetzi* (Adler, Theodor & Parrot), *S. squamipleuris* (Newstead) and *S. adleri* (Theodor) were found in much lower abundance ranging between 0.1 to 1.9% of the total flies collected. The highest abundance of flies were recorded in Al-Magarda area (29.67 flies / visit) followed by Mohayel area, Abha sector and Rijal Alma'a area (15.36, 12.42 and 8.33 flies / visit, respectively). A high significant difference ($P > 0.001$) was found between the abundance of *Sergentomyia* sandflies

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at low and high altitudes. The highest fly abundance was found in the low land of Tihama. In most cases the density of flies collected indoors was significantly greater than the density of flies collected outdoors ($P < 0.001$). The monthly abundance of the three dominant species in the region (*S. tiberiadis, S. fallax, S. calcarata*) were recorded.

INTRODUCTION

In Addition to leishmaniasis which is endemic in Asir region (al-Zahrani *et al.*, 1989), an outbreak of RVF was reported in September, 2000 causing many causalities among humans and associated livestock along the southwestern border of Saudi Arabia ((Jup *et al.* 2002 and Miller *et al.* 2002). Disease transmission is influenced by little-known geographical and climatic factors that determine the distribution of different vectors, causative agents, and reservoirs. Most studies on sandflies in Saudi Arabia and other parts of the world focus on genus *Phlebotomus* because many species of this genus were proved as vectors of leishmaniasis. Recently some researcher are interested in the role which may be played by the genus *Sergentomyia* in the transmission of certain diseases as leishmaniasis and Rift valley fever (RVF). Lawyer *et al.* (1990), found that Leishmania amastigotes transformed to procylic promastigotes in *S. schwetzi*, but the parasites multiplied slowly and did not develop beyond procylic promasigotes. Yaghoobi *et al.* (2004) found natural leptomonad infection in *S. sintoni* collected from gerbil and Jird burrows. On the other hand Turell and Perkins (1990) concluded that sand flies could serve as vectors of RVF virus, whereas Dohm *et al.* (2000) experimentally infected *S. schwetzi* with RVF virus and found that 41% of the inoculated flies became infected and developed disseminated infections but non of the flies transmitted the virus. The last authors concluded that additional studies are needed to determine the role of *Sergentomyia* sand flies as vectors of leishmaniasis and RVF virus. The sandfly fauna of southwest Saudi Arabia has been poorly studied in comparison with other areas of the Kingdom. Only three studies were directed to the fauna and taxonomy of sandflies in this region. A survey of *Phlebotominae* sandfly of Saudi Arabia including Asir region was carried out between 1975 and 1978 by Lewis and Büttiker 1980. This was followed up by the work of Lewis & Büttiker, 1982 and Büttiker & Lewis 1983 on sandfly ecology and taxonomy of Saudi Arabia including Asir region. The most recent study on the distribution and ecology of the genus *Phlebotomus* in

Asir region by Ibrahim and Abdoon is now under publication. Therefore, the aim of this study, besides updating knowledge of prevalent local *Sergentomyia* species, was to analyze aspects related to the distribution and abundance of this dominant sandfly genus in Asir region.

MATERIALS AND METHODS

The study area:

Asir region lies in the southwestern part of the Kingdom of Saudi Arabia between latitude 17:27 - 21:00 and longitude 41:23 - 44:33. Its population exceeds one and a half million (2004 Census), representing 10 % of the kingdom population and occupies one quarter of the Kingdom's total area (fig.1). The region is mountainous and can be divided into 3 distinct topographical zones. The characteristic features of the study area are summarized in table (1). Sand flies were collected from four selected areas (Al-Magarda, Mohayel, Rijal Alma'a and Abha sector) representing different topographic, altitudinal, vegetation and climatic conditions.

Methodology:

Sandflies were collected by using sticky traps. White printing papers (21x29.7 cm) painted with castor oil were pasted to thin wooden rectangular frame with handle. At each collection site, thirty sticky traps were, set randomly in intra-domiciliary and, extra-domiciliary settings close to wall cracks and crevices in front of rodents' burrows, as well as animal housings. Traps were placed at the site of collection, before sunset (18:00 h) and collected the following morning before sunrise (06:00 h). Flies were removed from the sticky papers and placed in 70% ethanol and then transferred to the laboratory for further processing. Preserved sandflies were, examined and samples belonging to the genus *Sergentomyia* were separated, cleared in chloral hydrate and mounted in Puri's medium for identification. Sandflies were identified in the research and training center on vectors of diseases, Faculty of Science, Ain Shams University, Egypt according to the key of Lewis and Büttiker (1982). Data were statistically analyzed by using the SPSS computer program V. 10.0 (SPSS Inc., Chicago, USA).

RESULTS AND DISCUSSION

The species composition, relative abundance, sex ratio of various species of *Sergentomyia* sandflies in 4 selected areas of Asir region, throughout the period from May, 2000 to May, 2002, are presented in table (2) Fifteen *Sergentomyia* species were identified throughout the study period, namely: *S. tiberiadis* (Adler, Theodor & Lourie), *S. fallax* (Parrot), *S. calcarata* (Parrot), *S. christophersi* (Sinton), *S. africana* (Theodor), *S. dreyfussi* (Parrot), *S. antennata* (Newstead), *S. clydei* (Sinton), *S. magna* (Sinton), *S. taizi* (Lewis), *S. sonyae* (Lewis), *S. palestinensis* (Adler, Theodor), *S. schwetzi* (Adler, Theodor & Parrot), *S. squamipleuris* (Newstead) and *S. adleri* (Theodor). Five out of the fifteen species of *Sergentomyia* identified during the present investigation were not recorded before in Asir region. These species are *S. sonyae*, *S. palestinensis, S. schwetzi, S. dreyfussi,* and *S. squamipleuris.* It seems that the species composition and the prevalence of certain species of *Sergentomyia* sandflies in Asir area is quite different from other parts of Saudi Arabia. This is clear from our study and the study of Lewis and Büttiker (1982). This difference may be attributed to the soil ecology, altitude , climate , vegetation, the presence of many caves which may act as suitable breeding habitats for the flies and/or other factors. In our investigation *S. tiberiadis, S. fallax,* and *S. calcarata* were the most abundant species. They represented 26.5, 24.7 and 20% of the total flies collected, respectively. Bakr (1995) found that *S. clydei, S. antennata* and *S. christophersi* were the most common *Sergentomyia* species in Hail area, Saudi Arabia. Lewis and Büttiker (1982) found that the predominant species of *Sergentomyia* in Asir region were S. *taizi* , *S. fallax*, and *S. africana.* They represented 33.8, 16.8 and *13.9%* of the total *Sergentomyia* flies collected respectively. In the same study *S. fallax, S. antennata* and *S. christophersi* were the highly abundant species of *Sergentomyia* in other parts of the kingdom, representing 19.5, 12.4 and 12.3% of *Sergentomyia* flies collected, respectively. Dominance of *S. fallax and S. tiberiadis* in Asir region also confirms the marked affinity with the fauna of southern Sinai where both species were found as the most dominant *Sergentomyia* species (El Sawaf *et al.* 1987 and Kamal, 2004).

Our results (table, 2) show that 1787 males and 1486 females were collected throughout the study period. The higher proportion of males in the capture may be due to an effect of larval environment, larval competition (Hard *et al.*, 1989) and/or the method of collection.

The male biased sex ratio was also observed by Lewis & Büttiker (1980), Büttiker *et al.*, (1982) and Ibrahim and Abdoon (2005) in Asir; Yuval, (1991) in Jordan valley; Hassan *et al.* (1999) and Kamal (2004) in Sinai, Egypt.

The spatial distributions of the Sergentomyia sandflies are shown in table (3). The species composition was most diverse in Al-Magarda (13 species) followed by Rijal Alma'a (12 species), Mohayel (11 species), and Abha sector (10 species). Ten species were collected from all localities (*S. tiberiadis, S. fallax,, S. calcarata, S. christophersi*, S. *africana*, S. *dreyfussi*, *S. antennata*, *S. clydei*, *S. magna S. taizi*), two species *(S. sonyae* and *S. schwetzi)* were collected from two localities, and three species (*S. palestinensis, S. squamipleuris* and *S. adleri*) were collected from only one locality. The highest abundance of flies was recorded in Al-Magarda areas (29.67 flies / visit) followed by Mohayel area, Abha sector and Rijal Alma'a area (15.36, 12.42 and 8.33 flies / visit, respectively). The high abundance of sandflies in Al-Magarda area is mostly associated with a high minimum temperatures (20 °C) and low relative humidity (35- 55% R.H.) throughout most of the year. A significant positive correlation was found between the distribution and abundance of the collected species ($r = 0.713$ and $P \leq 0.05$).

Asir region was divided into three altitudinal levels that ranged from 0-800 m a.s.l. (above sea level) in Tihama, 1220-1750 m a.s.l. in Asir plateau and 1600-3100 m a.s.l. in Sarawat mountains. The altitudinal distributions of the Sergentomyia species are shown in fig. (2). A high significant difference ($P \leq 0.001$) was found between the abundance of *Sergentomyia* sandflies at low and high altitudes. The highest abundance was found in the low land of Tihama (31.84 flies / visit), whereas very low fly density was observed at higher altitudes of Sarawat Mountains and Asir plateau (1.39% and 0.43 flies / visit, respectively). This may indicate that Tihama lowland is the most favorable site for the breeding and activity of *Sergentomyia* sandflies. The high abundance of sandflies in Tihama lowland (costal plains and foothills) may be due to suitable breeding places, climate, vegetation, available hosts (rodents), altitude and/or other factors. The higher abundance of sandflies at lower altitudes were also reported in Asir region by Lewis & Büttiker, (1980), Büttiker *et al.* (1982), and in Sinai, Egypt, Kamal (2004). The last author stated that *Sergentomyia* species occurred mostly at altitudes ranging from 0-500 m. Low fly abundance at higher altitudes, may be due to unfavorable

climatic conditions of low temperature, fog and strong winds. Our results declared that more species of *Sergentomyia* were collected at lower altitudes. These results contradict what have been found by Büttiker *et al.*, (1982). The authors stated that the species spectrum shows a tendency for more species to occur at higher altitudes than in the Tihama districts. All species were collected from the lowland (costal plains and foothills) but at different densities. Six species: *S. tiberiadis S. fallax, S. christophersi., S. clydei., S. dreyfussi, and S. africana* , were recovered at all altitudinal levels. Seven and eight species were collected from the plateau (1220-1750 m. a.s.l.) and Sarawat Mountains (1600-3100 m. a.s.l.), respectively. On the other hand *S. calcarata, S. magna, S. palestinensis., S. schwetzi* and *S. sonyae*, S. *squamipleuris* disappeared in the plateau and Sarawat mountains. *S. africana, S. dreyfussi, S. taizi, S. antennata, christophersi., S. clydei., S. fallax* were the highly abundant species in Sarawat mountains representing 21.5, 17.72, 16.46, 13.92, 12.66, 10.13 and 6.33% of the total flies collected, respectively. Whereas *S. fallax, and S. tiberiadis* and *S. christophersi* were the highly abundant species in the plateau representing 16.58, 12.56 and 11% of of the total flies collected, respectively. In the lowland *S. tiberiadis* , *S. fallax* , *S. calcarata* were the highly abundant species representing 22.5, 20.6 and 16% of the total flies collected, respectively. Although all species were collected from the lowlands, the relative abundance of each species and its density in different altitudes indicate that *S. africana, S. dreyfussi, S. taizi, S. antennata,* favored high altitudes, whereas *S. tiberiadis* , *S. fallax* , *S. calcarata* favored low altitudes ($P \leq 0.05$). These results are mostly in agreement with what have been found by Lewis and Büttiker (1982) in Saudi Arabia.

The monthly abundance of the three dominant species (*S. tiberiadis, S. fallax, S. calcarata*) as well as the total population of *Sergentomyia* sandflies throughout the period from May 2000 to May 2002 are illustrated in fig (3). Other species were not separately illustrated because the number of specimens collected was very low to draw a conclusion. *S. tiberiadis* and *S. fallax* were collected in different densities throughout all months of the year, whereas *S. calcarata* completely disappeared during January & July 2001 and in February 2002. The prevalence *S. tiberiadis* and *S. fallax* throughout the year may be due to their ability in tolerating a wide range of conditions. The monthly distribution of the three species mostly followed a similar trend especially in the second year of investigation, where alternating increases and decreases in the density of flies were

recorded in subsequent months. The reason for the alternation in fly density is unknown. Peaks in fly abundance were recorded in June, October, December and February of the first year and in September, October, December and March of the second year of study. Peaks of fly abundance were alternating with depressions in May, August, January and March of the first year of study and in June, November, February and May of the second year. High peaks of sandfly abundance were also recorded in Sinai, Egypt during June and October (Kamal, 2004), whereas in Turkey, Toprak and Ozer (2005) found that peaks of sandfly abundance occurred between May and October. Inspite of the complete disappearance of *S. calcarata* during January & July 2001 and in February 2002, the other two species were abundant all the year round, especially in the low lands and foothills of Tihama. Flies abundance all the year round may be due to favorable atmospheric and breeding conditions in this area. The statistical analysis of data showed a non-significantly positive correlation ($P \leq 0.05$) between fly density and temperature at the foothills, where the maximum number of flies was recorded ($r = 0.204$ & 0.153), during the 1st and 2nd years of study, respectively. Whereas, a significant ($P \leq 0.05$) negative correlation was found between the density of flies and relative humidity ($r = -0.640$) during the 1st year of study, whereas this correlation was insignificant during the2nd year of study. Similar correlations were found between the abundance of *Phlebotomus* sandflies and temperature & relative humidity in Asir region (Ibrahim and Abdoon 2005). Results of the present work also agree with the finding of Rebelo *et al.* (2001) who stated that, the simple correlation coefficient showed a decreased association between the monthly variation of the sandflies and the temperature and relative moisture changes. Meanwhile our results partially contradicts the findings of Kamal (2004) who stated that, the simple correlation coefficient showed an increased association between the monthly variation of sandflies with the temperature and relative humidity.

Sergentomyia, represents an important group of sandflies in southwest region of Saudi Arabia. It is of interest to note that almost all species of *Sergentomyia* were collected inside houses and in most cases the density of flies collected indoors was significantly greater than the density of flies collected outdoors ($P \leq 0.001$). This may indicate an affinity for feeding on human and/or animals kept inside houses. This assumption mostly disagree with what have been

reported by many researchers that most of *Sergentomyia* species had affinity to cold blooded animals and wild habitats or had similar affinity to both habitats; (Quate (1964) in Sudan, Abonnenc (1972) in Ethiopia , Lewis and Büttiker (1982) in Saudi Arabia Jacobson *et al.* (2003) in occupied Palestine, Yaghoobi-Ershadi *et al.* (2003) in Iran and Kamal, (2004) in Sinai, Egypt). However some researchers as Minter (1964) reported that some species of *Sergentomyia* feed on mammals, including humans. Namita *et al.* (1991) in India, stated that four of five *Sergentomyia babu* were positive for human blood and the remaining one for bovine) and Yaghoobi-Ershadi *et al.* (2001) collected *S. palestinensis* from bedrooms.

It is largely believed that most *Sergentomyia* sandflies have no role in *Leishmania* transmission (Lewis and Dyce, 1998). None of the authors proved that *Sergentomyia* sand flies are active vectors of leishmaniasis (Lewis,1974; Garnham, 1971; Lawyer *et al.* 1990 and Yaghoobi *et al.* 2004) or Rift valley fever (Turell and Perkins 1990 & Dohm *et al.* 2000) Dominance of this genus in the area and the presence of a large number of species (15 species) as compared to the prevalent *Phlebotomus* species (Ibrahim and Abdoon, in press), may highlight its role as a probable vector of diseases in this area. So, intensive research programs are still needed to clarify the possible role of the highly abundant species of *Sergentomyia* in viral diseases transmission in southwestern provinces of Saudi Arabia.

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Table (1): Ecologic characteristics of three topographic zones of Asir region, southwestern Saudi Arabia.

Zone	Altitude (Meter)	General Climate	Temperature °C		R. H. %		Av. Rain Fall (mm)	Months of Max. Rain	Vegetation
			Min	Max	Min	Max			
Sarawat Asir	1600 - 3100	Moderately warm, semi-humid, mountainous climate	8	24	45	70	342	March	Dense growth of *Juniperus* trees, mixed with *Acacia sp.*, stony surface, with caves and isolated rocks
Asir plateau	1220 - 1750	Semi-arid, cool highland climate	10	26	35	65	250	April & October	The vegetation cover and grass in the plateau is rather poor but they become fairly dense at the edge of the mountains. The main types of plant include Achillea *sp.*, and *Anthemis tigrensis*
Tihama Lowland	0 – 800	Semi-arid, semi-humid Mountainous climate at foothills Humid, hot costal desert at costal plain	20	39.4	35	90	98	November & January	A Fairly lush growth of *Acacia* spp. in the plains and on the bottom of hill sides is seen. In wadis, vegetation is dense consisting of *Acacia* trees, *Ziziphus spina-christe* and Dom trees

Table (2): Species composition, relative abundance and sex ratio of *Sergentomyia* sandflies collected from different areas of Asir, Saudi Arabia, throughout the period from May 2000 to May 2002.

Species	Total No collected	%	No. ♂♂	No ♀	Sex ratio ♂:♀
S. tiberiadis	867	26.5	488	379	1:0.78
S. fallax	807	24.7	428	379	1:0.89
S. calcarata	660	20	342	318	1:0.93
S. christophersi	317	9.7	179	138	1:0.77
S. africana	210	6.4	109	101	1:0.93
S. deryfussi	177	5.4	97	80	1:0.82
S. antennata	62	1.9	36	26	1:0.72
S. clydei	47	1.4	24	23	1:0.96
S. magna	45	1.4	29	16	1:0.52
S. taizi	25	0.7	18	7	1:0.39
S. sonyae	22	0.7	15	7	1:0.47
S. palestinensis	12	0.4	10	2	1:0.20
S. schwetzi	11	0.3	9	2	1:0.22
S. squamipleuris	7	0.2	1	6	1:6.00
S. adleri	4	0.1	2	2	1:1.00
Total	3273	100	1787	1486	1:0.83

Table (3): Spatial distribution of *Sergentomyia* sandflies in Asir region, Saudi Arabia throughout the period from May 2000 to May 2002.

Species	Sector			
	Rijal Alma'a	Abha Sector	Mohayel	Al-Magarda
	No of flies / Visit			
S. tiberiadis	2.58	2.67	3.84	7.6
S. calcarata	1.5	0.97	3.72	6.44
S. fallax	2.92	2.67	4.96	6.45
S. antennata	0.42	0.42	0.56	0.42
S. taizi	0	0.06	0.16	0.26
S. africana	0.42	0.55	0.12	2.17
S. dreyfussi	0.08	0.12	0.44	2.19
S. christophersi	2.58	0.64	0.08	2.76
S. clydei	0.67	0.15	0.16	0.43
S. magna	0.17	0.09	0.08	0.49
S. sonyae	0.08	0	0	0.28
S. adleri	0	0	0	0.03
S. palestinensis	0	0	0	0.14
S. squamipleuris	0.58	0	0	0
S. schwetzi	0.42	0	0.24	0
Total	12.42	8.33	15.36	29.67

Table (2): Species composition, relative abundance and sex ratio of *Sergentomyia* sandflies collected from different areas of Asir, Saudi Arabia, throughout the period from May 2000 to May 2002.

Species	Total No collected	%	No. ♂♂	No ♀	Sex ratio ♂:♀
S. tiberiadis	867	26.5	488	379	1:0.78
S. fallax	807	24.7	428	379	1:0.89
S. calcarata	660	20	342	318	1:0.93
S. christophersi	317	9.7	179	138	1:0.77
S. africana	210	6.4	109	101	1:0.93
S. deryfussi	177	5.4	97	80	1:0.82
S. antennata	62	1.9	36	26	1:0.72
S. clydei	47	1.4	24	23	1:0.96
S. magna	45	1.4	29	16	1:0.52
S. taizi	25	0.7	18	7	1:0.39
S. sonyae	22	0.7	15	7	1:0.47
S. palestinensis	12	0.4	10	2	1:0.20
S. schwetzi	11	0.3	9	2	1:0.22
S. squamipleuris	7	0.2	1	6	1:6.00
S. adleri	4	0.1	2	2	1:1.00
Total	3273	100	1787	1486	1:0.83

fig. (2): Average number of *Sergentomyia* sandflies collected / visit from different altitudes of Asir region, Kingdom of Saudi Arabia (May, 2000 to May 2002).

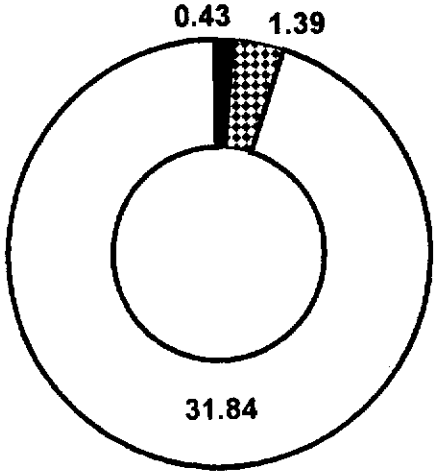
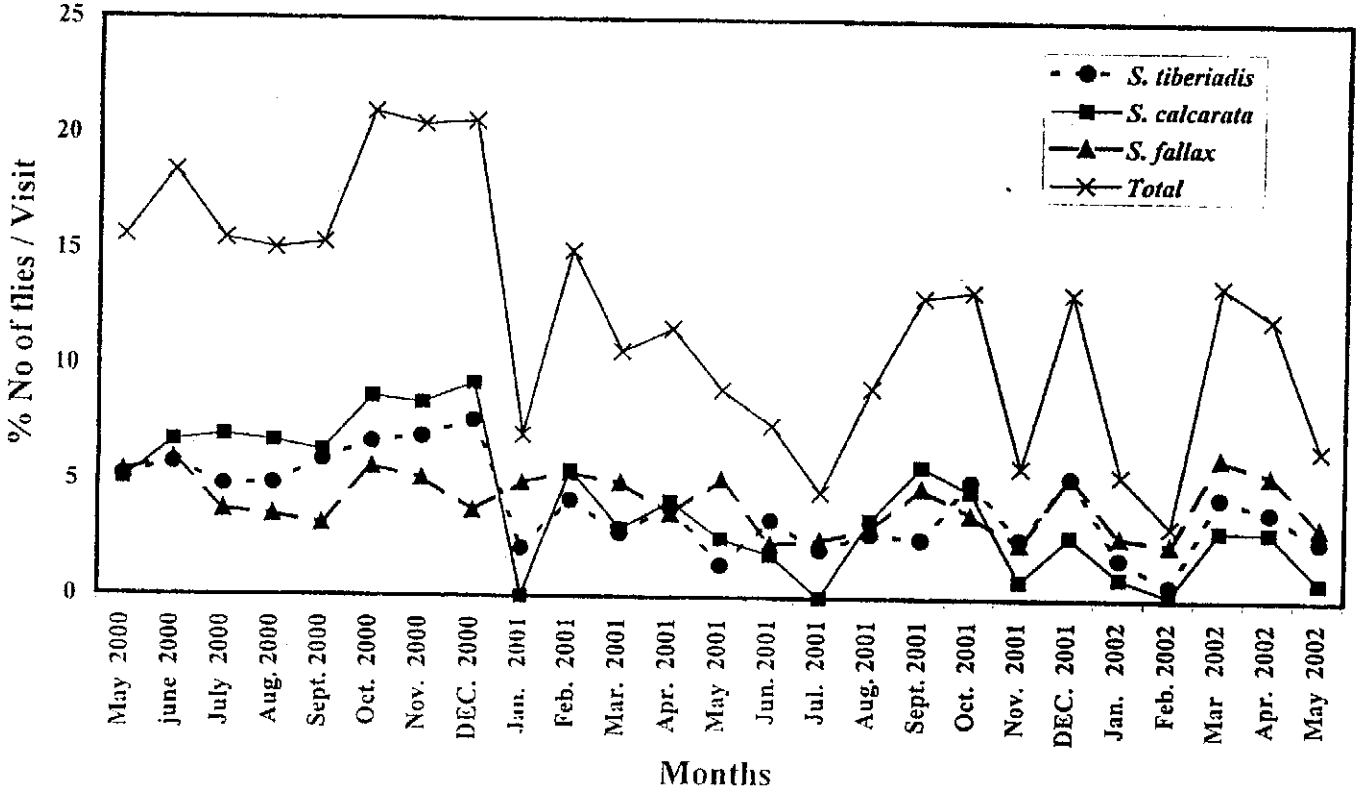


Fig. (3): Monthly abundance of the prevalent species of *Sergentomyia* sandflies in Asir region, Saudi Arabia throughout the period from May 2000 to May 2002.



حصر و بيئة ذباب الرمل من جنس *سرجنتومايا* (ذوات الجناحين – سايكوديدي) في منطقة عسير، جنوب غرب المملكة العربية السعودية.

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تم إجراء حصر لذباب الرمل من جنس *سرجنتومايا* (ذوات الجناحين – سايكوديدي) لمدة عامين متتاليين (مايو ٢٠٠٠ حتى مايو ٢٠٠٢) في أربع مناطق تقع ضمن ثلاث نطاقات طبوغرافية مختلفة في منطقة عسير بجنوب غرب المملكة العربية السعودية وذلك باستخدام المصايد الورقية اللاصقة. وقد تم جمع ٣٢٧٠٣ ذبابة منها ١٧٨٧ ذكر و ١٤٨٦ أنثى ، تنتمي لخمسة عشر نوعا من جنس *سرجنتومايا*، منها خمس أنواع لم تسجل من قبل من منطقة عسير وهي أنواع *سونيا* ، *بالستينسيس* ، *كوتزاي* ، *دريفوساي* ، *سكواميلورس* . وتبين أن الأنواع *تبريادس* ، *فالاكس* ، *وكالكاراتا* هي أكثر الأنواع انتشارا و كثافة في منطقة الدراسة حيث مثلت ٢٦,٥ ، ٢٤,٧ و ٢٠ % من ذباب *سرجنتومايا* الذي تم جمعه، على التوالي. وتلتها أنواع أقل انتشارا هي *كرستوفرساي* ، *افريكانا* ، *دريفوساي* حيث مثلت ٩,٧ ، ٦,٤ ، ٥,٤ % من مجموع الذباب الذي تم جمعه، على التوالي . أما الأنواع الأخرى وهي *انتاتا* ، *كلايبياي* ، *ماجنا* ، *تعزى* ، *سونيا* ، *بلاستيبنسيس* ، *كوتزاي* ، *سكواميلورس* ، *ادلري* فقد وجدت بكثافة ضئيلة جداً تراوحت بين ٠,١ % ، ١,٩ % من مجموع الذباب الذي تم جمعه . وقد سجلت أعلى كثافة للذباب في منطقة المجاردة ٢٩,٦٧ ذبابة / زيارة تلتها منطقة محايل ثم قطاع أبها ومنطقة رجال ألمع (١٥,٣٦ ، ١٢,٤٢ ، ٨,٣٣ ذبابة / زيارة، على التوالي). وتبين أن كثافة الذباب في تهامة المنخفضة أعلى بكثير من كثافته في المناطق المرتفعة. وكانت كثافة ذباب *سرجنتومايا* داخل المنازل أكبر منها خارج المنازل . وتناولت الدراسة أيضا تحديدا للتوزيع الشهري لعشيرة السرجنتومايا وللأنواع الأكثر انتشارا في المنطقة وهي *تبريادس* ، *فالكس* و*كالكاراتا*.