

# Spatial distribution of Sarcophagidae (Insecta, Diptera) in Fars province, Iran

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**ABSTRACT:** Spatial distribution of flesh flies (Diptera: Sarcophagidae) are important for predicting the prevalence of some disease which they are involved in them. There aren't studies on ecology and biology of members Sarcophagidae family in Iran. The aim of this study was to find spatial distribution of these flies in Fars province of Iran during 2011 – 2012. The sampling procedure has been done in 71 sampling sites in 27 villages of nine counties of Fars province. Collecting of adult flies was done by means of bottle traps. A total of 1518 samples from 13 species of Sarcophagidae collected. Statistical analysis showed significant differences among sampled species based on their relative abundances ( $P$  value < 0.05). Four species, *S. aegyptica*, *S. argyrostoma*, *W. nuba*, and *S. africa* were found in almost all parts of the province. Most of the collected species, nine of thirteen species, were found in southern part which shows the relative relation of Sarcophagid flies to temperate areas in lower altitudes. Results of this study revealed that *S. variegata* can be mentioned as representative of northern parts. Presence of nine other species, *S. crassipalpis*, *S. flagellifera*, *S. dux*, *S. hirtipes*, *Sarcophila meridionalis*, *Ravinia pernix*, *W. magnifica* and *W. villeneuvi* on any corps can refer its origin to south of the province.

**Key Words:** Fars province, Iran, Medical Entomology, Myiasis, Sarcophagidae

## INTRODUCTION

The flesh flies (Diptera: Sarcophagidae) has more than 2600 identified species (Pape et al., 2009) in over 100 genera around the world (Fan & Pape, 1996). Their name would seem to indicate a habit of breeding in vertebrate carcasses (Pape et al., 2009) as initial corpse colonizers (Fan & Pape, 1996). From the sanitary viewpoint, flesh flies are of relevant importance (Zumpt, 1965). They are also specialists ranging from inhabitants of pitcher plants to bat coprophages, crab saprophages, wasp nest inquilines, and insect parasitoids (Pape et al., 2009). Many sarcophagid species have the potential to be used to estimate the PMI (Post Mortem Interval) or place of death (Carvalho & Linhares 2001; Guo et al., 2010). Their impact on human and animal health is well known for their potential ability as myiasis producers (Zumpt, 1965).

Sanitary impact of flies has been done only on house fly, *Musca domestica* (Diptera: Muscidae) (Kassiri et al., 2012) in Iran. Few species of Sarcophagidae has mentioned as responsible for some myiasis cases in the country (Maleki et al., 2013) but their importance on forensic science remained obscure due to lake of study on the species fauna and diversity in Iran. Following some initial works on constructing new traps (Akbarzadeh<sub>a</sub> et al., 2012) study the species diversity of medically and forensically important flies has been done in Fars province of Iran (Akbarzadeh<sub>b</sub>, 2012). During this study various species of Sarcophagidae have been identified. The aim of this study was to find spatial distribution of these flies in Fars province of Iran during 2011 – 2012.

## MATERIALS AND METHODS

### Study area

Fars is one of the 31 provinces of Iran, located in the southern part of the country. The province with 122608 km<sup>2</sup> has 23 counties and its center is Shiraz. Due to topographic characters there are three distinct climatic regions in the province (table 1).

### Sampling procedure

The sampling procedure has been done in 72 sites of nine counties of the Fars province including Abadeh, Sepidan, Arsanjan, Shiraz, Kazerun, Neyriz, Darab, Jahrum and Lar (fig 1). Three villages in each county and three cattle keeping houses in each village have been selected randomly for hanging up the traps.

A kind of adult fly trap, bottle trap, was used for sampling of adult and larvae (fig2). The traps were equipped with fresh cow meat and were sampled in monthly intervals.

The statistical analysis has been done using non-parametric method, The Kruskal-Wallis one way ANOVA.

## RESULTS

A total of 1518 samples from 13 species of Sarcophagidae collected from various study sites in different parts of Fars province. *Sarcophaga argyrostoma* with 842 individual (55.5%) was the most prevalent species and *Ravinia pernix* with only one sample was the rarest species in all collected samples. Most of the samples, 856 (56.4%), were from central part of the province (Table 2).

Relative abundances of sampled species have been calculated with dividing the number of collected individual to all individuals. *Ravinia pernix*, *S. dux*, *S. hirtipes*, *Sarcophila meridionalis* and *W. magnifica* has been excluded from statistical analysis because of their low number. Statistical analysis showed significant differences among sampled counties based on relative abundances of other remained species, *S. aegyptica*, *S. africa*, *S. argyrostoma*, *S. crassipalpis*, *S. flagellifera*, *S. variegata*, *W. nuba*, *W. villeneuvi*. (P value<0.05).

Only one sample of *Ravinia pernix* has been collected in traps of southern part of Fars province. Spatial distributions of other collected species in Fars province have shown in fig 3. Three species, *S. aegyptica*, *S. argyrostoma* and *W. nuba*, were found in almost all sampling sites. With lower abundances, *S. africa* also were found in various parts of the province. *S. variegata* were found in northern and central parts of the province but the remained species *S. crassipalpis*, *S. flagellifera*, *S. dux*, *S. hirtipes*, *Sarcophila meridionalis*, *Ravinia pernix*, *W. magnifica* and *W. villeneuvi* were found in southern part of the province.

## DISCUSSIONS

Almost all of studies on Sarcophagidae of Iran return back to few decades ago when most of their species have reported for Iranian fauna. In recent years investigations on biology and ecology of medically important flies starts with some basic studies (Akbarzadeh<sub>a</sub> et al., 2012). There is only one research in literature which shows the results of a study on fly fauna in Tehran city, capital of Iran, with about 1200 m elevation from sea level (Khoobdel et al., 2008). Two species, *S. crassipalpis* and *W. magnifica* of six reported species of Sarcophagidae family from Tehran were similar to Sarcophagidae species of Fars province. In other parts of the country all reported species were in relation with one kind of myiasis disease. There aren't studies on ecology and biology of members of this family in Iran. Results of this study can show spatial distribution of Sarcophagidae species in Fars province of Iran.

Due to its being a culturophile and a synanthrope, *S. argyrostoma* occurs in all the zoogeographical regions except Australia and New Zealand (Povolný & Verves, 1997). It seems that it is more prevalent in some countries and responsible for myiasis cases around the world (Grassberger & Reiter, 2002). Results of this study showed that this species is more common among members of Sarcophagidae family in Fars province of Iran.

Species using resources that occur in discrete patches typically show much spatial variation in density from patch to patch (Hanski, 1987). Most of the collected species, nine of thirteen species, were found in southern part. The southern part was lower in altitude range (730 – 1196m) and higher in mean temperature ( $22.6 \pm 1.5^{\circ}\text{C}$ ) comparing with other two regions, central and northern. These results can show the relative relation of Sarcophagid flies to temperate areas in lower altitudes.

The species that has been found only in northern part of the province was *S. variegata*. Northern part of Fars province is in higher altitude from sea level (1579 – 2320) and lower the mean temperature in 2011 ( $16.1 \pm$

2.2) in comparisons with other parts of the province. It cleared that has been adapted to lower temperature at higher altitudes from sea level.

Most of Sarcophagidae species are potentially myiasis agents and domestic animal such as sheep and goats are their preferred hosts (Akbarzadeh<sub>6</sub> et al., 2012). Majority of Sarcophagidae flies in Fars province have been found in southern part of the province where is very hot and very humid in summer. Nomadic behaviour, movement of sheep and goat from hot to moderate area, is usual to escape from the hard condition of summer and finding suitable grazing area in north. This condition increases the risk of human myiasis due to lake of their main hosts, sheep and goats.

Information about spatial distribution of flies is also useful for forensic investigations as indicative of movement of the corpse (Catts, 1992). Results of this study revealed that *S. variegata* can be mentioned as representative of northern parts. Presence of nine other species, *S. crassipalpis*, *S. flagellifera*, *S. dux*, *S. hirtipes*, *Sarcophila meridionalis*, *Ravinia pernix*, *W. magnifica* and *W. villeneuvi* on any corps can refer its origin to south of the province.

The influence of climatic and geographical conditions such as temperature, relative humidity and altitude of their habitat patches on distribution of Sarcophagidae flies aren't more considered in literature. For completing the knowledge about spatial distribution of Sarcophagidae and their relation to temperature and humidity this study has to continue in other climatic and geographical conditions of Iran.

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Table 1. Climatic data of various geographical regions of Fars province.  
Zumpt F. 1965. Myiasis in Man and Animals in the Old World. London, Butterworths, London, England.

Part of the province	Altitude ranges of sampling sites	Temperature in 2011(°C)	Background precipitation (mm)	Precipitation in 2011 (°C)
North	1579 - 2320	16.1 ± 2.2	400 - 600	320.1 ± 289.2
Center	839 - 2024	20.4 ± 2.6	200 - 400	248.3 ± 75.2
South	730 - 1196	22.6 ± 1.5	>200	252.3 ± 72.8

Table 2. Number of collected flies of Sarcophagidae family, Fars province, Iran, 2011 – 2012.

Species	Part of Fars Province									Total
	Northern counties			Central counties			Southern counties			
	Abadeh	Sepidan	Arsanjan	Shiraz	Neyriz	Kazerun	Darab	Jahrum	Lar	
1 <i>Ravinia pernix</i> Harris, 1780	0	0	0	0	0	0	0	0	1	1
2 <i>S. aegyptica</i> Salem, 1935	9	6	43	8	48	65	22	46	43	290
3 <i>S. africa</i> Wiedemann, 1824	19	0	0	13	1	42	1	4	17	97
4 <i>S. argyrostoma</i> Robineau-Desvoidy, 1830	37	51	51	143	223	157	36	113	31	842
5 <i>S. crassipalpis</i> Macquart, 1839	0	0	0	0	21	0	0	2	0	23
6 <i>S. dux</i> Thoms	0	0	0	0	0	1	0	0	6	7
7 <i>S. flagellifera</i> Grunin, 1964	0	0	0	0	45	9	0	7	0	61
8 <i>S. hirtipes</i> Wiedemann, 1830	0	0	0	0	0	3	0	2	4	9
9 <i>S. variegata</i> Scopoli, 1763	9	0	0	3	0	0	0	0	0	12
10 <i>Sarcophila meridionalis</i> Rohdendorf & Verves, 1985	0	0	0	0	2	3	0	0	0	5
11 <i>W. magnifica</i> Schiner, 1862	0	0	0	0	0	1	0	1	4	6
12 <i>W. nuba</i> Wiedemann, 1830	0	0	3	4	51	10	17	54	7	146
13 <i>W. villeneuvi</i> Salem, 1938	0	0	0	0	0	3	7	9	0	19
Total	74	57	97	171	391	294	83	238	113	1518
Total of region	228			856			434			1518



Figure1. Map of Fars province, south of Iran.



Figure2. A bottle trap hanged in Karmostaj village, Lar county, Fars province.

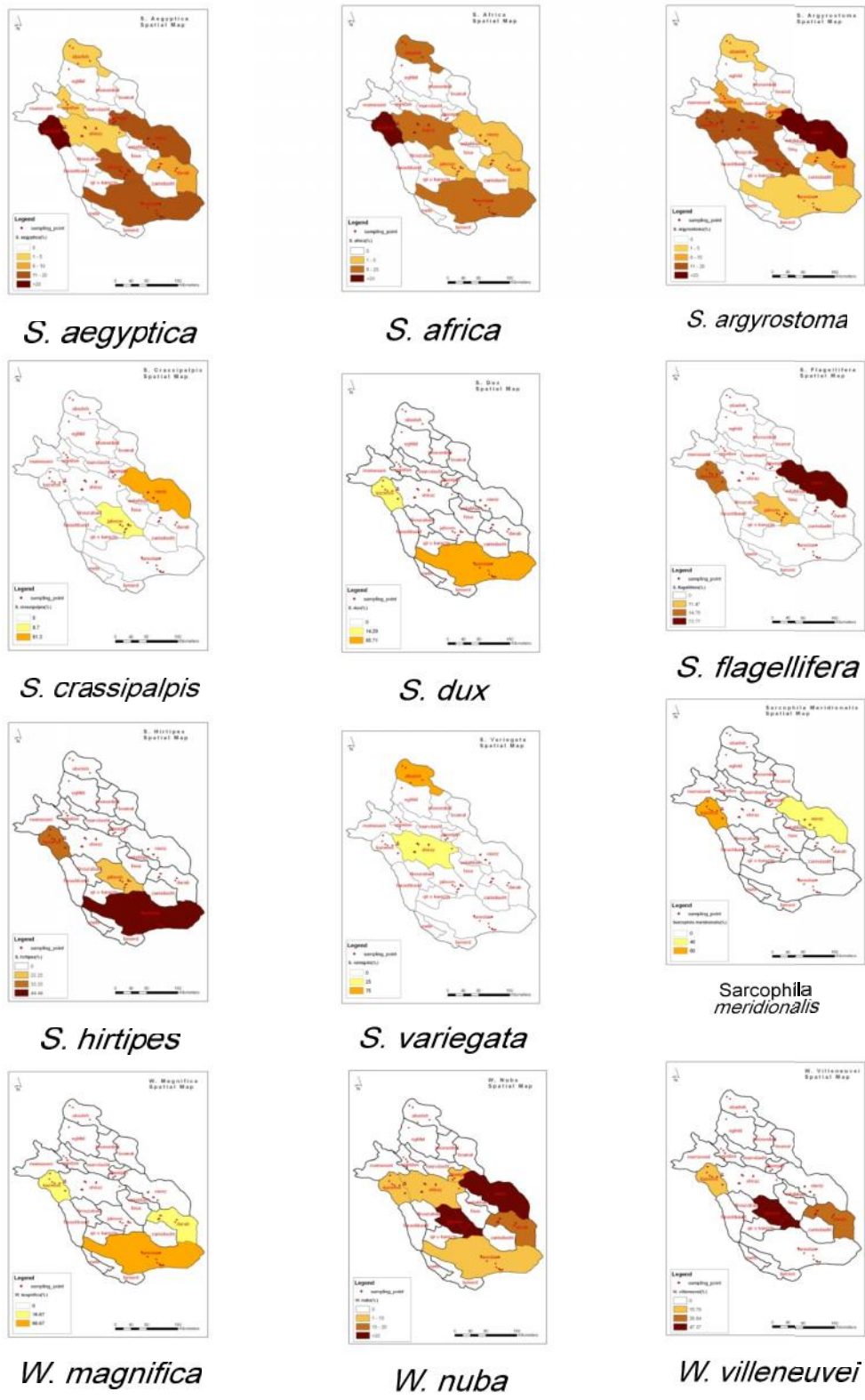


Figure3. Showing the spatial distribution of various species of Saercofagidae in Fars province using ArcGIS9®.