IJBPAS, October, 2018, 7(10): 1874-1882

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

CLIMATIC FACTORS AND THE SEASONAL ABUNDANCE OF *SARCOPHAGA DUX* (DIPTERA: SARCOPHAGIDAE) IN JEDDAH, SAUDI ARABIA

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Received 28th May 2018; Revised 13th June 2018; Accepted 18th July 2018; Available online 1st Oct. 2018

https://doi.org/10.31032/IJBPAS/2018/7.10.4559

ABSTRACT

The Final Flight trap was used to survey and identify flesh flies (Diptera: Sarcophagidae). This study was performed within one year, from March 2017 to February 2018 in Jeddah Governorate. Two species were identified; *Wohlfahritia nuba* and *Sarcophaga dux*. The populations of *W. nuba* was recorded in little numbers during irregular periods while the *S. dux* was the dominant specie and available over the year. In addition, both of seasonal activity and the impact of climatic factors on flies abundance were investigated. The results illustrated a significant difference in terms of population density of *S. dux* within the year. Two highest peaks of *S. dux* density and activity were observed in March and September respectively during 2017 and another lowest peak occurred in February 2018. The results also showed that the correlation between population density of *S. dux* and both temperature and humidity were positively significant. Furthermore, the traps that were placed in the southern slaughterhouse differ significantly from other locations, whereas the location of vegetables market traps recorded the lowest numbers of flies. This study suggests that the variation of population density of *S. dux* flies in all locations due to the time of collection, temperature, humidity as well as people habits in which meat consumption

increases especially in holidays and religious occasions causing more animal wastes which creates an appropriate breeding sites for flies. Thus, the current observations revealed a prominent of fly's activity during December which corresponds with Eid al-Adha holiday.

Keywords: *Sarcophaga dux*.; Seasonal abundance; Final Flight trap; Jeddah, KSA

INTRODUCTION

Sarcophagus flies commonly known as flesh flies because these flies depend on live or dead tissues (Watson & Dallwit, 2003). These flies are of medical & veterinary importance and prevailing in many parts of the world including Saudi Arabia. Some of the species of family Sarcophagidae are myiasis producing as well as forensically important as they are known to colonize human and animal carcass (Alikhan et al 2016; Nishida 1984). Most of the species are scavengers of small carrion such as dead small vertebrates and primarily feed on human and animal waste (Madubunyi 1986). Some species of Flesh flies are mechanical vectors of pathogens, can carry leprosy bacilli (Sreevtsa et al 1990) may also cause myiasis in vertebrates (Zumpt 1965). *Sarcophaga dux* is forensically important fly as it may invade the corps with in short time.

This fly is also connected with the transmission of disease causing organisms such as *Escherichia coli*; *Shigella dysenteriae*; *Streptococcus* spp., *Salmo nella* spp., tapeworms, and even the polio virus (Smith and Whitman 1992). *Wohlfahratia* species can cause myiasis by laying larvae on the skin of healthy mammals including human infants (Brauer, & Bergenstamm, 1889, Hall et al 1995) Sarcophagid larvae feed on decomposing organic matter, carcasses and corpses and excrements (Byrd & Castner, 2001).

The objective of this work is to study the role of climatic factors on the population density of the *Sarcophaga dux*, the dominant species in Jeddah Governorate.

MATERIAL AND METHODS

The collection of *Sarcophaga dux* was made from March 2017 to February 2018.Flies were collected from 4 different vulnerable points of Jeddah, Fish market, Camel market, Vegetable market and Northern slaughter (Fig.1).The collection was done by using Final Flight trap with some modification. The collected specimens were brought to the laboratory and were

transferred to the freezer to immobilize the flies. The adult flies were morphologically identified with authentic available identification keys (Borror, *et al*., 1981).The Meteorological data on various parameters was collected from the records of National Meteorology and Environment centre, Jeddah. Data was analyzed on monthly basis. Climate variables considered for study were temperature and relative humidity. The collected data were statistically analyzed using analysis of variance (ANOVA) and LSD compared means at $P \leq 0.05$ by using SAS software program, SAS (2006). Correlation Coefficient was used to determine the relationship between climatic conditions (temperature, relative humidity) and the density dominant species.

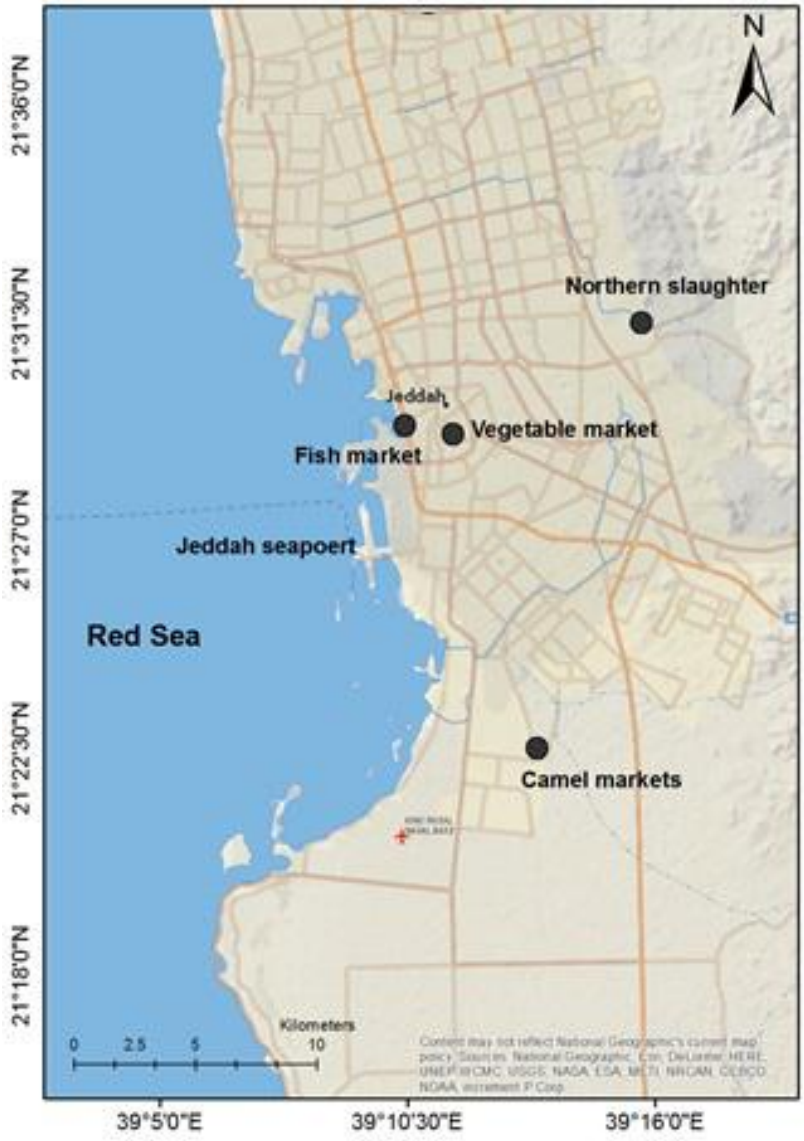

Figure 1: Collection sites of *Sarcophaga dux*in Jeddah

RESULTS AND DISCUSSION

The present study was planned to survey of dominant flesh flies species and its seasonal activity in Jeddah governorate. The work was carried out form March 2017 up to Feb. 2018. During the survey, 4774 adult flesh flies were collected represent 2 different species were belonged to the genera of *Sarcophaga* and *Wohlfahritia*.

The results showed that *S. dux* were the most widespread species and represent 98.6% from all collected flesh flies whereas the adult of *W.nuba* were the least 1.4%. Adults of the Sarcophagid flies can be identified with 3 black and grey longitudinal stripes on the dorsal surface of the thorax, 3-4 anterior and posterior dorso-central bristles, red eyes which are smooth and rarely hairy. Arista plumose on its basal half, vein M1+2 and anterior transverse vein is always present, Cu is acute (Fig2).

Abdomen with grey/black checker board giving it the shape of the chessboard. Sixth tergite of the female red in color, separated dorsally with row of strong bristles at the edge. Wing with the sharp angled 4th vein. Orange brown epandrium, long bristles on hind margins of protandrial segment. Aristae with long hair *S. dux (Fig 3 a)*.Whereas abdomen *W.nub is* also grey with 3 black round spots at the end of each segment.-Head with bare aristae or with very short hairs. Less hair on the head than other Sarcophagids. Calypter present. Wing venation showing 4th vein sharply angled *(Fig 3 b)*.

The seasonal activity of *S.dux*, the dominant species in Jeddah Governorate, with reference to temperature and humidity was also recorded.

The results showed that flesh flies activities had continue during one year of survey. The records indicated that the effect of temperature and humidity is one of the most important factors determining the density of flesh flies population and its activities.

The results of the recovered data showed the continuous prevalence of the *S.dux* species that belong to the dipterous family (*Sarophagidae*: *Diptera*) within the Jeddah city throughout the year from March2017 to February 2018 with significant variations in the population density based on the time during data collection (Table 1).

The study of the prominent peaks during the variable climatic conditions determine the maximum abundance of *S. dux* for implementing the control methods effectively. The

population of the fly starts increasing during the start of February and reaches to the peak in March after it starts declining may be due to local climatic factors.

The statistical analysis showed high significant variations in the population density during March and September, three prominent peaks were recorded where the first and second peak occurred during March and September during the year 2017 whereas the third peak occurred during February 2018 (Fig. 4).

Table (2) shows the relation with temperature humidity and flesh fly population (March2017 – Feb.2018). Our results showed that a positive non-significant association (correlation) between the average population density for the flesh fly and the average temperature with the peak correlation r = +0.295, p = 0.044 and positive non-significant association (correlation) between the average population density of the flesh flies and the percentage humidity that reached the peak correlation r= + 0.312, p=0.032).

Figure 2: Dorsal view of the three thoracic stripes on *S. dux* and *W.nuba*

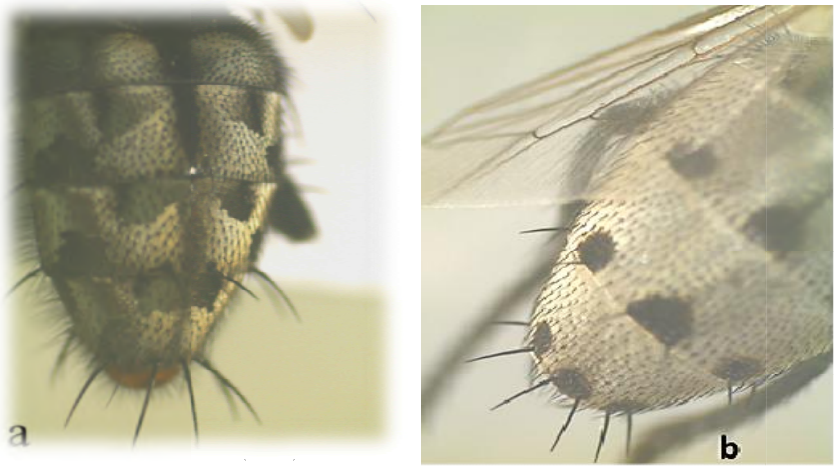

Figure 3: Dorsal view of the abdomen on*S.dux* (a) and *W. nuba* (b).

Table (1): Statistic a analysis of the population density of *Sarcophaga dux*

MONTHS	MEAN* ± S.E	Temperature(C°) (Avg)	Relative Humidity (%) (Avg)
March, 2017	160.25^{a}± 0.6	23.5	64.25
April	62.75^{cd}± 0.6	29.72	59%
May	84.50^{c}± 0.5	29.2	56.5
June	86.25^{c}± 0.9	32.2	54.25
July	64.00^{cd} ± 0.5	32.47	54.25
August	56.50^{d}± 0.6	34.87	48.5
Sept.	171.00^{a}± 0.8	32.5	63.25
Oct.	117.75^{b}± 1.2	31.37	65.5
Nov.	79.00^{cd}± 1.3	29.27	64.75
Dec.	76.00^{cd}± 0.9	26.45	39
Jan. 2018	89.50^{c}± 1.4	25.2	53.25
Feb.	120.25^{b}± 1.2	25.1	68

***Means followed by the same letter are not significantly different according to LSD at (0.05).**

Table (2): Simple correlation and regression values between the weather factors and weekly mean of *S. dux*

Variable	Simple correlation "r"	Probability "P"
Temperature	0.295	0.044
R.H. %	0.312	0.032

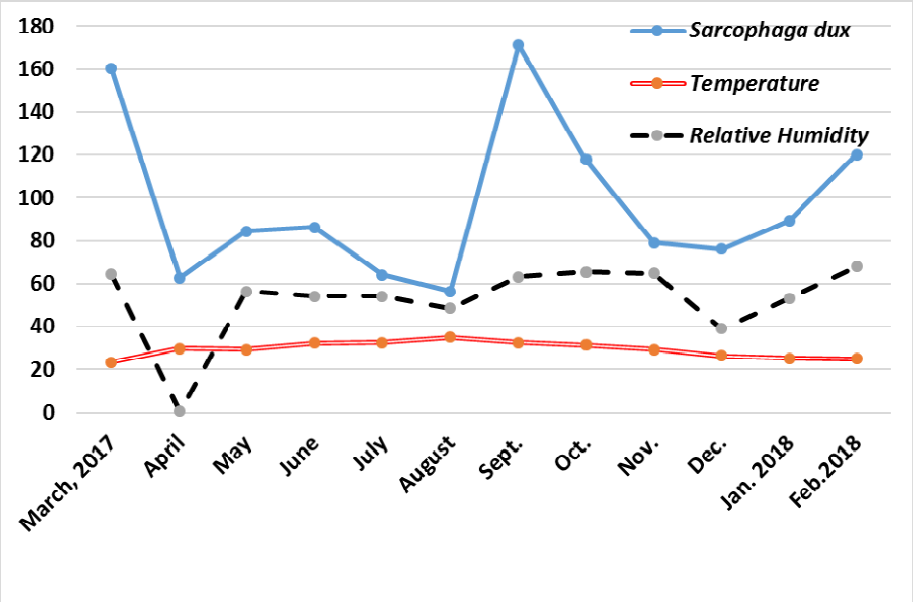

Figure 4: The Seasonal abundance of *S. dux* Jeddah Governorate March2017- Feb.2018

Furthermore, the results showed that the number of the collected flies from the southern Slaughterhouse (camels market) was significantly higher than other locations over the year with percentage of 45%, followed by the northern Slaughterhouse (25%), then Fish market (21%), whereas the vegetables market recorded the lowest population of flies with percentage of 9% only. This could be explained as these kinds of flies are ovoviviparous and often depositing their larvae into decayed animal tissues, therefore vegetables market materials might not be environmentally convenient for breeding of flesh flies offspring compared to the other locations (Table 3 & Fig 5).

Climate is the key factor in the abundance of flies. A positive relationship was recorded between the abundance of the fly and temperature. Mullieri et al (2008) also describe the similar results with a high peak in February and September. Our results also exhibit the same pattern. No seasonal variation in Sarcophaga was observed by (Ferreira 1979) in Brazil. (Taleb et al 2016) opine that the high temperatures enhance the population abundance of Sarcophaga species. (Bansode et al 2016) studied the effect of temperature on the development of *Parasarcophaga ruficarnis* and concluded that the high temperature decreases the time to complete the life cycle resulting the more adult flies.

CONCLUSION

Our study reveals that the *Sarcophaga dux* respond positively to a warming climate and decline with the lower temperatures.

ACKNOWLEDGEMENT

The authors would like to thank Professor Masroor Alikhan, Public Health Pest laboratory, Al Amana, Bariman, Jeddah, Saudi Arabia & all our colleagues and friends for their kind help during this study.

Table (3): The annual total population fluctuation of the S. dux between selected locations by Final Flight trap March 2017- Feb.2018

LOCATIONS	MEAN* ± S.E
Camel market	700^{a}± 0.54
Northern slaughter	389^{b}± 0.28
Fish market	329^{c}± 0.15
Vegetable market	138^{d}± 0.29

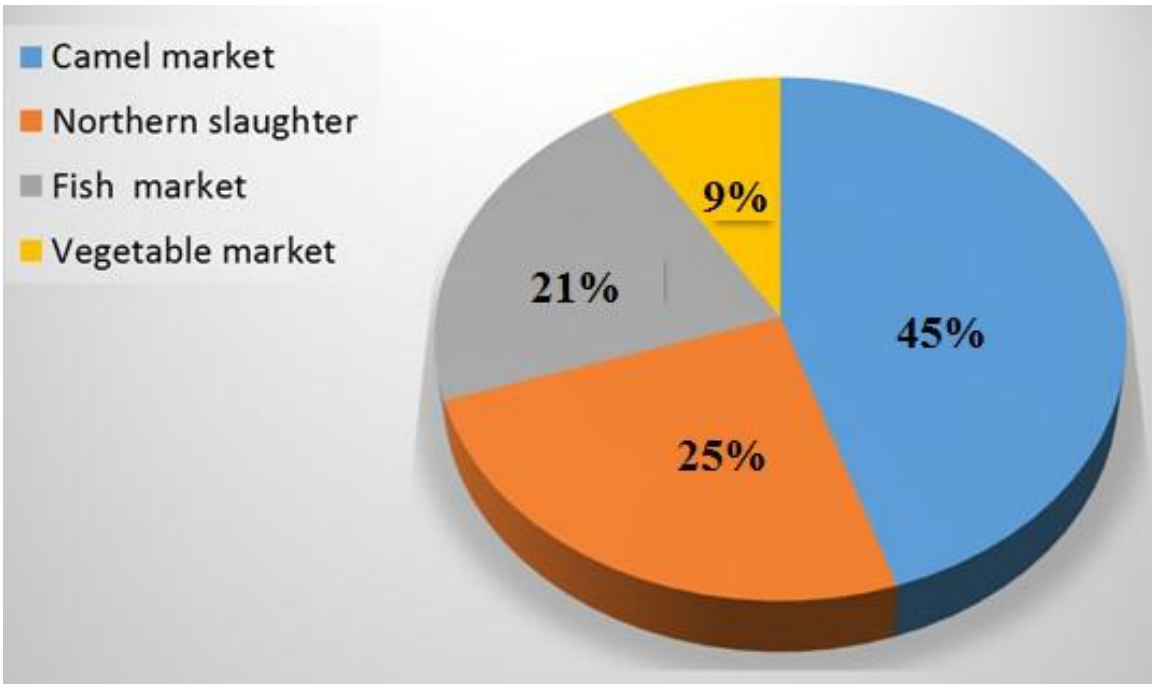

Figure 5: The percentage prevalence of *S.dux* recovered from selected locations by Final Flight traps in Jeddah Governorate

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