Seasonal Abundance and Distribution of Two Forensically Important Blowflies from Genus *Chrysomya* in Jeddah, Saudi Arabia

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ABSTRACT

The seasonal activity and abundance of two blowflies species of forensic entomology were investigated by using baited traps in four slaughterhouses at four different locations in Jeddah City, Saudi Arabia. This study were carried out from 19 February,2013 to 21 January ,2014. Three traps were fitted in each slaughterhouse. Two blowflies were attracte, *Chrysomya megacephala* and *Crysomya marginalis*. The results showed that the most abundant in all the sites was the *C. megacephala* (significant difference) than the second type of blowflies *C. marginalis*, which has been caught in small quantities in four seasons. The study showed that the peak seasonal activity of the fly C. *megacephala* was in the winter season with significant differences from the other seasons in the Jeddah area, where the average temperature in this season is the maximum 30.8 and minimum is 20.9 It is suitable for the spread of this kind of flies as well as C. marginalis. It found that less season activity of these insects was the summer, where the average temperature in Jeddah was 37.2 degrees in maximum and it was minimum 28.4 ° C and thus the climatic conditions, food and the presence of host may affect the distribution and activity of blue flies in the Jeddah area.I t was found from the study that female attracted traps food baits traps more than males with significant differences, where the average was in females 91.71 and 2.49 and males 36.33 and 0.38 in the winter season, the highest rate of attraction for these insects in different seasons for each of the *C. megacephala* and *C. marginalis*, respectively. Compared with other seasons, it has also attracted the male less than females in bait traps . This is an important study to identify the activity of certain types of blue flies, which are considered of great importance in forensic medicine.

Keywords: Forensic Entomology, Seasonal abundance, blowflies

INTRODUCTION

A range of insects present on a corpse can be used as evidence in forensic investigations to estimate the post-mortem interval (PMI). Commonly, estimation of PMI using insect evidence requires accurate species identification, with subsequent examination of thermobiological profiles to determine age (Amendt *et al.,* 2004; Catts, 1992; Catts and Goff, 1992). Amendt *et al.* (2004) stated that, forensic entomologists preferentially use evidence from initial corpse colonisers, such as flesh flies (Diptera: Sarcophagidae) and blow flies (Diptera: Calliphoridae). The kind of death affects decomposition, because it determines how fast a corpse can reach putrefaction (Anderson 1995). Season has important impact on the weather and the flora and fauna of a region which influence significantly the faunal colonisation of a body. Many fly spices vary in abundance depend upon season (Serbino and Godoy 2007). The larval morphology and developmental rate of *Chrysomya megacephala* (F.) and *Chrysomya rufifacies* (Macquart), the two most forensically important blowfly species in Thailand, are studied. The results indicated that larvae of *C. megacephala* developed more rapidly in April, pupariation initiated at 84 h at temperatures averaging 31.4°C, and the larvae grew slower in the rainy season and winter. Similarly, rapid development of *C. rufifacies* larvae appeared in the summer (Sukontason *et al*., 2008). Population abundance in necrophagous flies has usually been estimated from periodic census by using baited traps (Martinez-Sanchez *et al*., 2000). The relative abundance of certain insects and the potentially differing time of colonization of the remains in different seasons are essential factors to understand the succession process in carcasses(Smith, 1986). Studies of this nature should be performed throughout the year, in order to develop a valid database for specific areas (Serbino, 2007). Al-Shareef and Al-Qurashi (2016) studied some biological aspects of the blowfly *Chrysomya albiceps* (Wiedemann 1819) and found that Total heat requirements for *C. albiceps* to develop from the first larval instar to adult eclosion were the lowest at 20 °C (89.46 DD) and the highest at 30 °C (129.138 DD). Almesbah,(2010) found that the family of blue flies (Calliphoridae) was the most common types of flies on the presence of bodies and had two more abundantly present, *Chrysoma albiceps and P. ruficornis*. In Saudi Arabia, Abuzeid (2014), studied the the climatic conditions and feeding activity on flesh and blue fly. He found that the most prevalent type is *Calliphora vicina* in spring and noted that it attracted to the liver meat than beef and fish meat.

The aim of this study were to investigate the diversity and population dynamics of the blowfly *Chrysomya megacephala* and *Chrysomya marginalis* (Diptera) in Jeddah City, Saudi Arabia. We believe that the information of this study can significantly increase the knowledge of the blowfly associated the with

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carcasses and provides information on blue files as forensic indicators.

MATERIALS AND METHODS

Collection of adult blue flies were made every two weeks during the course of one year, February 2013 through January 2014, and included the four seasons (winter - spring - summer - autumn). Each season is about three months in order to evaluate the current distribution of blue fly in Jeddah city, Saudi Arabia. Four Slaughterhouses were chosen in four different areas, north, eastern, south and western of Jeddah City, Saud Arabia (Fig. 1).

Baited traps were used to collect adult stages of blue fillies and it is a biological trap, save for the environment. It was made from plastic materials, 23 Cm diameter X 26 Cm length (Fig. 2). Sheep liver obtained from sheep house animals were placed in each trap as bait with small amount of water to keep smell on analysis of sheep liver for long time. Three pitfall traps were placed inside each slaughterhouse (near each of entrance, garbage and sheep yard).

Adult fly collection was performed every 2 weeks / season using Baited traps. Flies were collected and preserved in 70% ethanol in vials labelled with the date, time of collection, area of infestation and the flies were identified to species to record the current states of blue files in terms of abundance and distribution in Jeddah City.

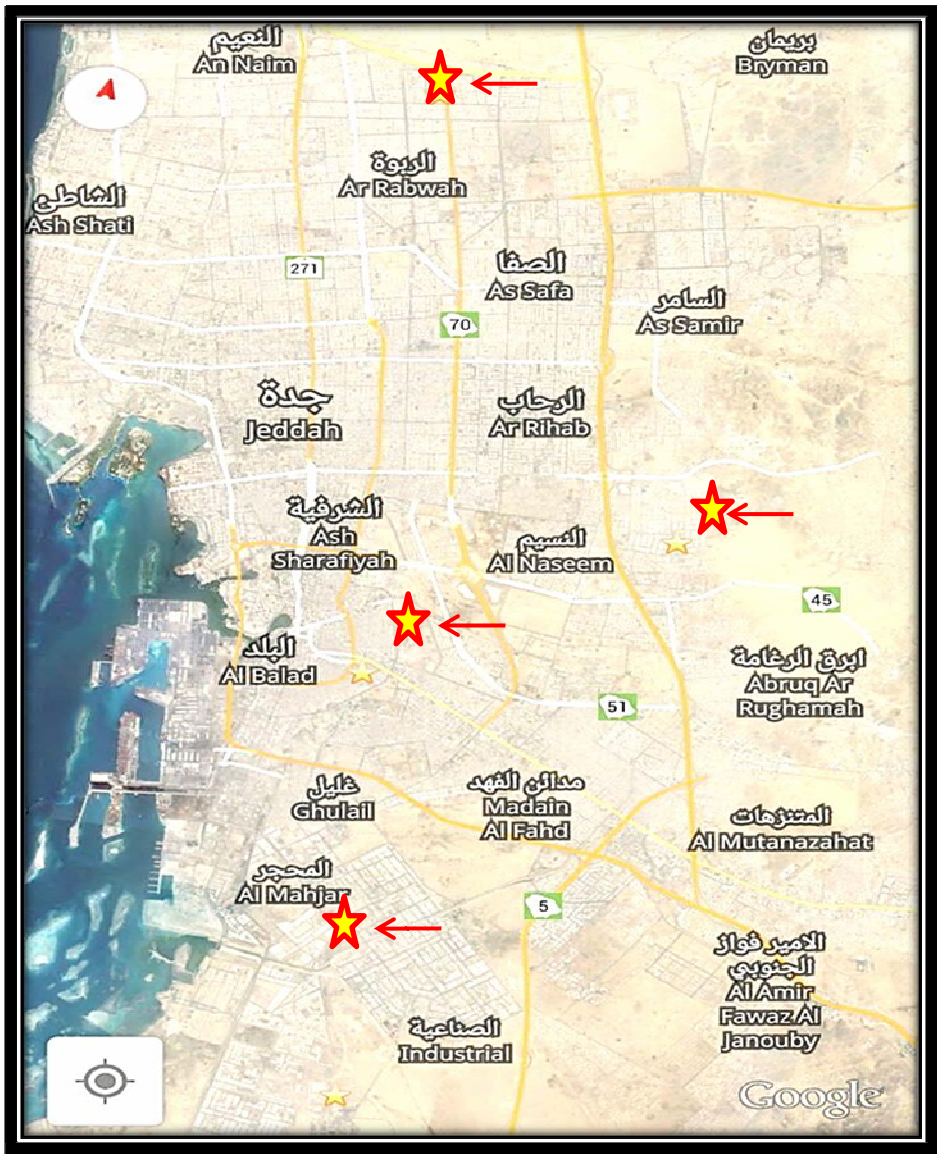

Fig.1 Map of Jeddah City showing the locations of blowfly trap sites

Fig.2. Baited of adult blowflies trap

Daily minimum and maximum temperatures and RH were recorded in Jeddah city through the Faculty of Meteorology, Environment and Arid Land agriculture, King Abdulaziz University, Jeddah, Saudi Arabia.The flies were identified by British Museum, London.

Factorial experiments was employed to compare the difference in terms of abundance among areas, seasons and species and carried out in the form of Randomized complete block design.

RESULTS AND DISCUSSIONS

This study was the first 1-year-round for predicting the population density of two blowflies, *Chrysomya megacephala* and *Chrysomya marginalis* in Jeddah City , Saudi Arabia.

During this survey two adult flies which use in forensic medicine were caught by traps fitted for collection of adult *Chrysomya albiceps*. These were *Chrysomya megacephala and Chrysomya. marginalis* , Diptera: Calliphoridae (Fig. 3). From the total number of flies collected, *C. megacephala* was revealed as the dominant species when compared with *C. marginalis*. *C. megacephala* was significantly higher than *C. marginalis* ($P<0.05$). *C. megacephala* was most abundant with averge mean of 30.09. *Chrysomya megacephala* has a wide geographical distribution. *C. megacephala* is most common in the oriental region and Australia (Richard, and Shearer, 1997). Also, *C. megacephala* prefer warm climates, and display a correlation between warmer temperatures and higher fecundity (Tomberlin *et al*., 2001). Shiun-Feng and Yeh (2008) demonstrated that *C. megacephala* is considered important to forensic science because it is one of the first flies to show up on a corpse, and so the time of death can easily be determined when *Chrysomya megacephala* larvae are found on a body**.**

The results of (Fig. 4) showed the general pattern of *C. megacephala* and *C. marginalis* population size are rising to a peak in winter followed by small beak in spring and decline in summer. Then start to increase again in Autumn. The distributions of two blue flies species caught in traps are shown in Table 1. From low number in summer, the population increased in Autumn reaching a major peak in winter then decreased in spring.

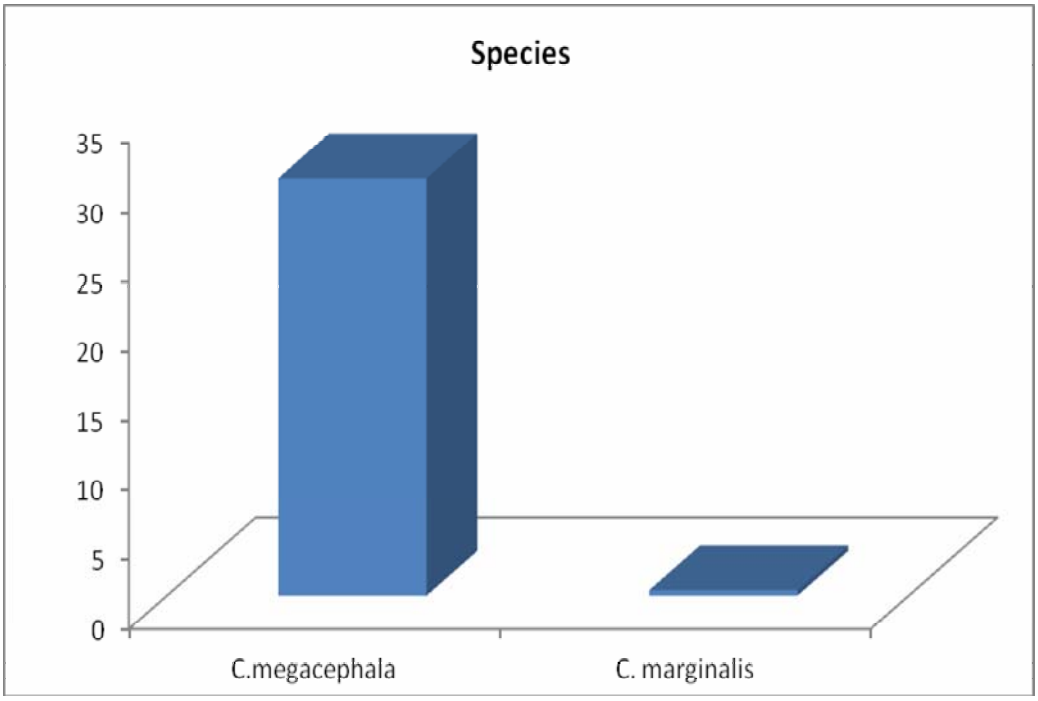

Fig.3. The presence of *C. megacephala* and *C. marginalis* during one year study in Jeddah, Saudi Arabia

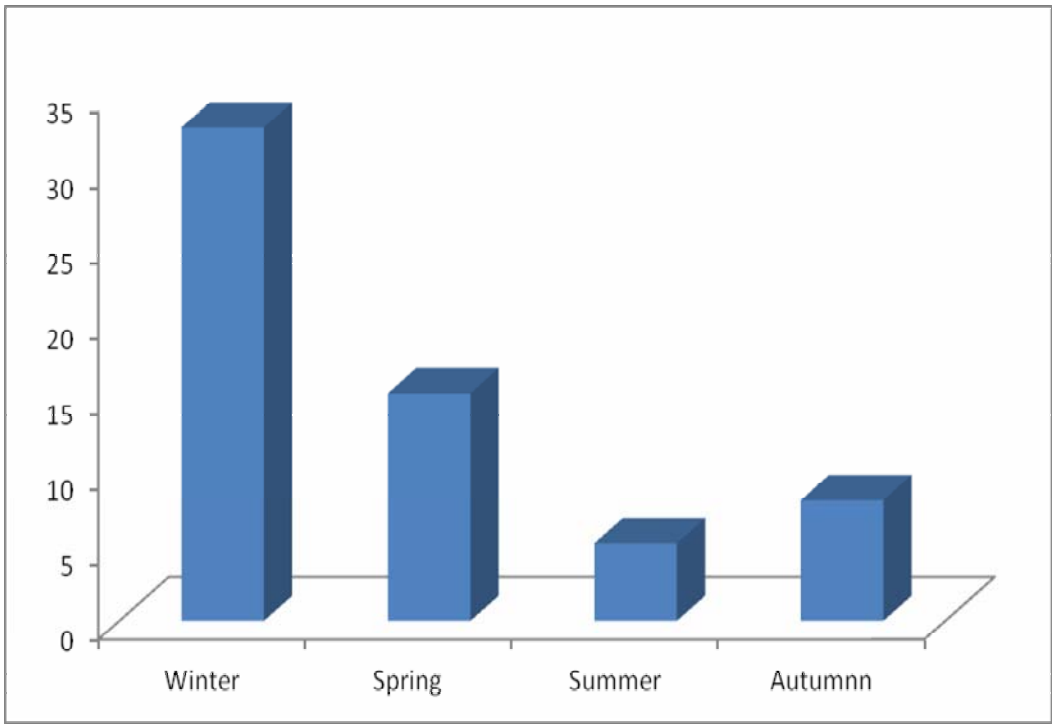

Fig. 4. Seasonal abundance in population density of *C. megacephala* and *C. marginalis* during one year of study

Table 1. Distribution of adult blowflies collected from traps during four seasons

Season	Means
Winter	32.73a
Spring	15.09b
Summer	5.13b
Autumn	8.00b

Different letter shown as a significant difference within groups when P <0.05

There were a significant different between the number caught in Winter and other seasons, but ther were no significant different among other seasons (Table 1). The results of Anderson , 1984 showed that the mild conditions allowed blue fillies to breed in carcasses throughout the winter when there are sufficient adults to allow breeding and the mild temperature in winter season in Jeddah city fit for successful larval development. The results of (Alahmed et al., 2006) showed that the distribution of *C. albiceps* and *W. nuba* flies may beinfluenced by the prevailing climatic conditions, such as temperature and humidity and probably the availability of hosts. Also statistical analysis of fly density with temperature revealed that *C. megacephala* exhibited the potentiality for adaptation to widely different temperatures, ranging from 15°C to 40°C (Ngoen-klan et al., 2011). During all seasons the *C. megacephala* was the most dominant with the peak during winter season in Jeddah city (Fig.5) . *C. marginalis* obtained maximum numbers in winterand very low in other seasons. There was a significant difference between presence of *C. megacephala* in winter and other seasons, but no significant difference was found among the numbers caught in all seasons for *C. marginalis*. (Table 2). Statistical analysis of fly density with temperature revealed that *C. megacephala* exhibited the potentiality for adaptation to widely different temperatures, ranging from 30.8 °C to 37.2°C in Jeddah city, Saudi Arabia. The average temperature and relative humidity of all study sites were ranged from 30..8°C to 37.2 and 70.9%, to78.1 %, respectively (Table 3). Sukontason *et al*. (2008) revealed that the developmental rate of *C. megacephala* larvae rapidly appeared in April at an average temperature of 31.4°C. Moreover, Reigada and Godoy (2005) suggested that adults of this species cannot overwinter because low temperatures restrict their growth.

Table 2. Population dynamics of *C. megacephala* and *C. marginals* in four seasons

Species	*C. megacephala*	*C. marginals*
Season		
Winter	64.02a	1.431c
Spring	30.17b	0.007c
Summer	10.27c	0.000c
Autumn	15.89bc	0.104c

Different letter shown as a significant difference within groups when P <0.05

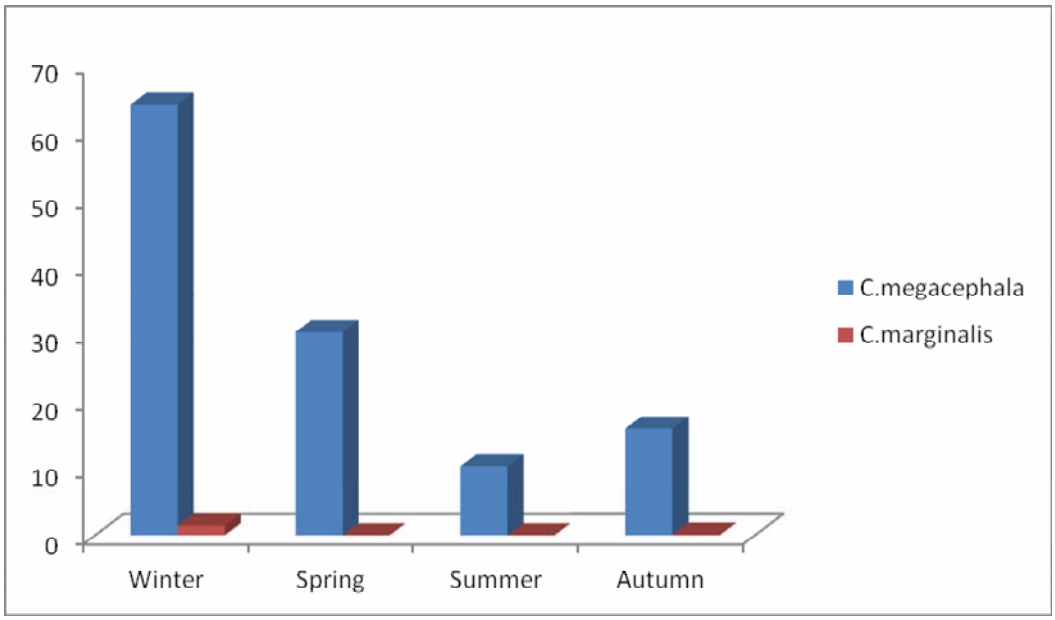

Fig.5. The difference in population dynamics of *C. megacephala* and *C. marginals*

Higher numbers of females than males were found in both *C. megacephala* and *C. marginalis* (Fig. 6). For *C. megacephala*, the year-round occurrence without any peak of density corresponded with other reports. Lertthamnongtham *et al*., (2003) proposed that predominate females were at 1.5:1 to 30:1 female/male ratios. This study was in agreement with the study of Avancini and Silveira (2000) which revealed that the female to male ratio for M. domestica showed a strong prevalence of females at ratios from 1.5:1 (in the morning) to 26.8:1 (at noon). Also, Ngoen-klan *et al*., 2011 found that the total number of specimens collected from 18 sites, showing significantly higher numbers of females than males. More females than males being collected from the field survey suggested that the potential for finding protein was from natural sources used for oviposition, food source, and/or breeding places (Spradbery 1979).

This information is potentially useful for estimating the postmortem interval of a corpse in forensic investigations, where the corpse becomes infesting with these fly species.

We believe that this information can significantly increase the level of knowledge of fly diversity associated with carcasses and consequently provide information on flies as forensic indicator.

Table 3. Mean temperature and relative humidity during different seasons in Jeddah region , Saudi Arabia

Season	Mean temperature(C)		RH%
	Maximum	Minimum	
Winter	30.8± 2.9	20.9 ± 2.3	70.9 ± 9.60
Spring	35.8 ± 4.0	24.6 ± 2.7	72.34 ± 10.6
Summer	37.2± 1.7	28.4 ± 1.9	73.8 ± 10.2
Autumn	34.9± 1.9	25.7 ± 2.32	78.1 ± 9.7

Table 4. The seasonal trend of sex ratio (male/female) of *Chrysomya megacephala* and *C. marginalis* collected from February 2013 to January 2014

Season	*C. megacephala*		*C. marginalis*	
	Male	Female	Male	Male
Winnter	36.33a	91.71a	0.38	2.49
Spring	23.53b	36.82b	0.00	0.01
Summer	10.50c	10.04c	0.00	0.00
Autumn	10.47c	21.31c	0.03	0.18

Different letter shown as a significant difference within groups when P <0.05

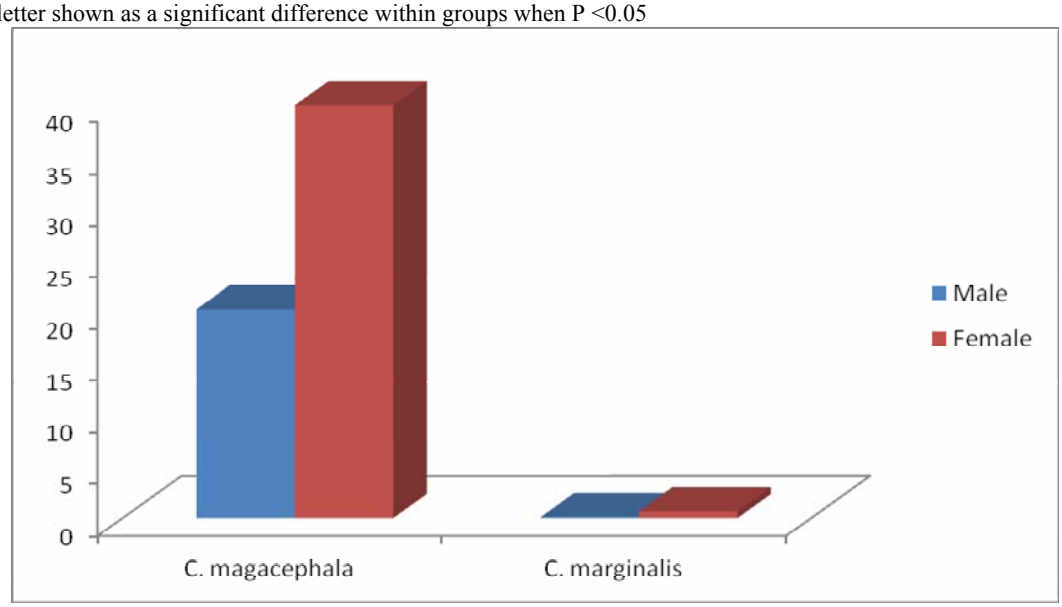

Fig. 6. Abundance of male and fameless from two blowflies during one year of study

REFERENCES

Abouzied, E. M. 2014. Insect colonization and succession on rabbit carcasses in southwestern mountains of the Kingdom of Saudi Arabia. J. Med. Entomol. 56:1168–1174

Alahmed, A. M., A. S. Al Dawood, and S.M. Kheir. 2006. Seasonal activity of flies causing myiasis in livestock animals using sticky traps baited with swormlure-4 in Riyadh region, Saudi Arabia. Basic and Appl. Sci., 7(1) : 109-119.

Al-Mesbah H.A. 2010. A study of forensically important necrophagous Diptera in Kuwait University of Central Lancashire, Faculty of Science, Forensic and Investigation Department , M Sc Thesis.

Al-Shareef, L.A.H. and S.I.D. Al-Qurashi. 2016. Study of some biological aspects of the blowfly *Chrysomya albiceps* (Wiedemann 1819)(Diptera:Calliphoridae) in Jeddah, Saudi Arabia. Egyptian J. Forensic Sci. 6(1): 11-16.

Amendt,J.,R. Krettek, and R. Zehner. 2004. Forensic entomolog *Naturwissenschaften* 91: 51-65.

Anderson, J.M. E., E. Shipp, and P.J. Anderson. 1984. Distribution of Calliphoridae in arid zone habitat using baited sticky traps. Gen. Appl. Ent., 16:3-8.

Anderson, G. S. 1995. The use of insects in death investigations: an analysis of forensic entomology cases in British Columbia over the five years period. Canadian Soc. Forensic Sci. J. 28:277-292.

Avancini R.M., G.A.Silveira. 2000. Age structure and abundance in populations of muscoid flies from a poultry facility in Southeast Brazil. Mem. Inst. Oswaldo Cruz. 95:259–264.

Catts, E. P. 1992. Problems in estimating the postmortem interval in death investigations. J. Agric. Entomol., 9 (4): 245-255.

Catts, E. P., and M.L. Goff. 1992. Forensic entomology in criminal investigations. Ann. Rev. Entomol. 37: 253-272.

Lertthamnongtham, S., K.L. Sukontason, K. Sukontason, S. Piangjai, W. Choochote, R.C.Vogtsberger, and J. K.Olson. 2003. Seasonal fluctuations in populations of the two most forensically important fly species in northern Thailand. Ann. Trop. Med. Parasitol., 97:87– 91.

Martinez-Sanchez, A., S. Rojo, and M. A. Marcos-Garica. 2000. Annual and spatial activity of dung flies carrion in a Mediterranean holm-oak pasture ecosystem. Med. Vet. Entomol., 14: 56-63.

Ngoen-klan, R., K. Moophayak, T. Klong-klaew, K.N. Irvine, K.L. Sukontason, C. Prangkio, P. Somboon, and K. Sukontason. 2011 Do climatic and physical factors affect populations of the blow fly Chrysomya megacephala and house fly *Musca domestica*?., Parasitol. Res., 109:1279–1292.

Reigada, C., and W.A.C. Godoy. 2005. Seasonal fecundity and body size in *Chrysomya megacephala* (Fabricius) (Diptera: Calliphoridae). Neotrop. Entomol. 34:163–168.

Richard, W. and D. Shearer. 1997. Veterinary Ectoparasites: biology, pathology and control. Blackwell Science Ltd. pp 253.

Serbino, M.B.S. and W. A. C.Godoy. 2007. Seasonal abundance and distribution of necrophagous Diptera in Western Sao Paulo State, Brazil. Functional Ecosys. Commun. 1(2): 145- 147.

Shiuh-Feng, S. and T. Yeh. 2008. "Larval competition of *Chrysomya megacephala* and *Chrysomya rufifacies*: behavior and ecological studies of two blow fly species of forensic significance". *J. Med. Entomol.* 45 (4): 785–799.

Smith, K. G. V. 1986. A manual of forensic entomology. Trustees of the British Museum(Natural history), London

Spradbery, J.P. 1979. The reproductive status of *Chrysomya* species (Diptera: Calliphoridae) attracted to liver-baited blow fly traps in Papua New Guinea. J Aust. Entomol. Soc., 18:57–61.

Sukontason, K., S. Piangjai, S. Siriwattanarungsee, and K.L. Sukontason. 2008. Morphology and developmental rate of blowflies *Chrysomya megacephala* and *Chrysomya rufifacies* in Thailand: application in forensic entomology. Parasit. Res.,102(6): 1207-1216.

Tomberlin, J.K, W. K. Reeves, and D.C.Sheppard. 2001. "First record of *Chrysomya megacephala* (Calliphoridae: Diptera) in Georgia, USA". Florida Entomol. 84(2): 300–3005.

الملخص العربي

النشاط الموسمى لنوعين من الذباب الأزرق المستخدم فى الطب الشرعى فى منطقة جدة بالمملكة العربية السعودية

شذى أبراهيم ضيف الله القرشى

تمت دراسة النشاط الموسمى لنوعين من الذباب الأزرق والذى له أهمية كبيرة فى الطب الشرعى باستخدام مصائد الطعوم الجاذبة البيلوجية فى أربع مسالخ فى مناطق مختلفة من مدينة جدة. وقد وضع فى كل مسلخ ٣ مصائد. والنوعين التى تم جمعها من المصائد هى الذباب الأزرق *Chrysomya megacephala* والنوع الآخر من الذباب الأزرق هو *Chrysomya marginalis*. أوضحت النتائج ان النوع الأكثر عددا فى كل المواقع هو *C. megacephala* (الفرق معنوى) عن النوع الثانى من الذباب الأزرق *C.marginalis* والتى تم أصطيادها بكميات قليلة جدا. واوضحت الدراسة ان ذروة النشاط الموسمى لذبابة C. megacephala كانت فى موسم الشتاء وبفروق معنوية عن المواسم الأخرى فى منطقة جدة حيث كان متوسط درجة الحرارة فى هذا الموسم هو القصوى ٣٠,٨ والصغرى هى ٢٠,٩ وهى مناسبة لتكاثر هذا النوع من الذباب وكذلك الحال بالنسبه للذباب الأزرق من النوع *C.marginalis*. ووجد أن أقل موسم نشاط لهذه الحشرات هو فصل الصيف حيث كان متوسط درجة الحراة فى جدة هو ٣٧,٢ درجة مئوية القصوى والصغرى ٢٨,٤ درجة مئوية وبالتالى الظروف المناخية والغذاء ووجود العائل قد يؤثران على توزيع ونشاط الذباب الأزرق فى منطقة جدة.

وجد من الدراسة أن الأناث المنجذبة لمصائد الطعوم الغذائية أكثر من الذكور وبفروق معنوية حيث كان المتوسط فى الأناث ٩١,٧١ و ٢,٤٩ والذكور ٣٦,٣٣ و ٠,٣٨ فى موسم الشتاء وهو أعلى معدل جذب لهذه الحشرات فى المواسم المختلفة لكل من *C. megacephala* و*C. marginalis* على التوالى. ومقارنة مع المواسم الأخرى وجد أيضا أن معدل جذب الذكور اقل من الأناث فى مصائد الطعوم الجاذبة.

تعتبر هذه الدراسة مهمة للتعرف على نشاط بعض أنواع الذباب الأزرق والذى له أهمية كبيرة فى الطب الشرعى.