

# New Record of *Sarcophaga ruficornis*, Fabricius, 1794 (Diptera: Sarcophagidae) from Iran, A Flesh Fly Species of Medical and Forensic Importance



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## Abstract

The study of diptera is necessary in forensic entomology field. This can be important in determining the post-mortem interval (PMI) and also obtain information about the place of death. The aim of this study was to introduce the *Sarcophagaruficornis* on rat carrion as a forensic important species. This study was carried out using a laboratory bred rat (Wistar rats) weighing 352 g as a model for human decomposition. Observations and collections of flies were made daily during May to July 2015. In this study, *S. ruficornis* was seen in the fresh to post decay stages of body decomposition. Highest number of this species caught in the decay stage. The species of fly found in this study could be used in forensic investigations in future.

**Keywords:** Diptera; Forensic Entomology; *S. ruficornis*; Iran

## Introduction

Forensic entomology is the study of cadaveric insect and other arthropods to medico-legal subjects in the judicial system [1]. The study of diptera is imperative in the forensic entomology field. This can be beneficial in determining post-mortem interval (PMI) and also obtain information about the site of death [2]. Insects have a specific pattern to occurrence the bodies, as diptera are mostly found in the early times of body decomposition [3]. Two main groups of insects are mostly attracted to corpse and provide valuable evidence in criminal investigation; the flies and the beetles [1]. The application of the entomological technique to determine the time of death consists of two main measures; the estimate based on the age of the oldest maggots that have developed on the body and estimate based on the development patterns [4].

The order diptera comprises a number of forensically important families, viz. Sarcophagidae, Calliphoridae, Piophilidae, and Fanniidae [5]. Sarcophagidae are a large family

with approximately 2510 identified species. They are frequent in warm climates. Three subfamilies have been identified: Miltogramminae, Sarcophaginae and Paramacronychiinae. Sarcophaginae contains species that are important in medical entomology field [6]. Sarcophaginae larvae feed on excrements and carrions [1]. *Sarcophagaruficornis* of certain interest in many parts of the world, either as a myiasis producing cause or fly seen in a forensic entomology context. Geographically, this species has been recorded in both old and new world [7,8]. But this species has never been reported in Iran so far. *S. ruficornis*, is mainly larviparous (laid 40-80 first instar maggots) and sometimes oviparous. The larva are vermiform and the length of the first, second, third instar and Pupariae 6.8±0.45 mm, 11.8±0.07 mm, 16.9±0.08 mm and 11.7±0.14 mm, respectively [9]. Myiasis caused by *S. ruficornis* reported in some cases [10,11]. Study on the life cycle and seasonal activity of this species can be useful in medico legal investigations in the study area.

Methods

Study site



Figure 1: Map of Khuzestan province, southwest of Iran.

The study was carried out in an outdoor location (N<sup>o</sup>44,82'19"31,E<sup>o</sup>48,45'38"48( in Ahvaz city, Iran. Ahvaz is the capital of Khuzestan Province, located in the southern part of the country and bordering Iraq and the Persian Gulf (Figure 1). The climate of Khuzestan is generally very hot and occasionally humid, particularly in the south, while winters are much more cold and dry. Summertime temperatures routinely exceed 48°C and in the winter can drop below freezing, with occasional snowfall, all the way south to Ahvaz. The averages of temperatures at the time of this study were 37.3°C.

Study animal and insect collection



Figure 2: Wistar rats as a model for human decomposition.



Figure 3: The live larvae were reared on blood agar media.

This study was carried out using a laboratory bred rat (Wistar rats) weighing 352 g as a model for human decomposition (Figure 2). The mice were killed by contusion and placed in an outdoor location. Observations and collections of flies were made daily during June to July 2015. Larvae were collected and divided into two groups; some immature individuals were killed in hot water and stored in 70% alcohol, while others were transferred to the laboratory of entomology for rearing. The live larvae were reared on blood agar media in a thermostatic room (Figure 3).

The adult flies were killed with ethyl acetate and then pinned with entomological pins for identification. Valid taxonomic keys were used for the identification of different species [5,12,13].

Results

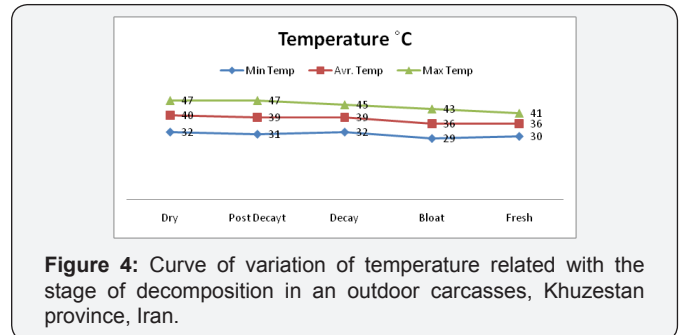


Figure 4: Curve of variation of temperature related with the stage of decomposition in an outdoor carcasses, Khuzestan province, Iran.

In this period of time, fly maggots of the Dipterous family Calliphoridae and Sarcophagidae were collected from the body. *S. ruficornis* was collected during the larval stage. Decomposition time for two rats lasted 39 days, from June 8 to July 17, 2015. *S. ruficornis* was seen in the fresh to mid of post decay stages of body decomposition. Five decaying stages were identified by the morphological changes of the carrions: Fresh, Bloat, Decay, Advanced decay and Remains. Highest number of this species caught in the decay stage. The averages of minimum and maximum temperatures in any stage were shows in (Figure 4).The first maggots were seen in the fresh stage which belonged to Sarcophagidae species. Anterior spiracles of *S. ruficornis* larvae having 11-15 papillae settled in a single row and the posterior spiracle have distinct inner projections between the spiracular slits (Figure 5). In the adult stage, 2nd and 3rd antennomere are at least partly yellow and terminalia is red or orange in ground color.



Figure 5: Posterior spiracle of third instar of *S. ruficornis*.

Discussion

Since insect lives on decomposing body tissues both as a food source and as a natural environments to develop to their next stages, they canskew the validity of the estimated PMI [2]. Forensic entomology is a neglected field among forensic sciences in Iran. This is the first documented report of insect evidence from a model for human decomposition in the city of Ahwaz, south of Iran. Therefore, research in this field is essential and the main aim of this study was to introduce the *S. ruficornis* on rat carrion as a forensic important species in the study area. Studies on insects associated to carrion are well documented

in different regions. Kavitha reported *S. ruficornis* on human cadavers in Malaysia [14]. *S. ruficornis* has been recorded from pig carrions in northern Thailand and southeastern Brazil [15,16]. *S. ruficornis* was reported as the most abundant flesh fly in Kuwait.

In that study, first larvae of *S. ruficornis* were seen after two days and they remained until the last rabbits were collected after 14 days [17]. This report is somewhat similar to the present study. Study on the rates of development of *S. ruficornis* show that the range of optimum temperature for the development of this species is between 20 and 35°C and the longest times of development is in the lowest temperatures [18]. Some species of Sarcophagidae family associated with carcasses were reported from Iran [19,20]. All larval instars of this fly species have been described by scanning electron micrograph (SEM) [7], highlighting the sensory organs (dorsal, terminal and ventral organs) located on the cephalic segment as well as strong, slightly curved mouth hooks. Puparia of *P. ruficornis* were measured as 11.7±0.14 mm in length and a very short pupal respiratory horn was observed dorso laterally in the first abdominal segment [7,9].

The prime characteristics of *P. ruficornis* differ from two other forensically important species; *P. dux* and *P. peregrina*, which have yellowish orange third antenna and palpus [8]. Informative characteristics of male genitalia of this species, particularly the distiphallus, have been displayed using SEM [21]. Investigation on the island of Oahu, Hawaii, USA indicated that this species was an early invader and insect colonizer of the death scene [22]. A document reporting from Kuwait demonstrated the significance of post feeding third instar *P. ruficornis*, which was collected from the blanket which the body remain was wrapped. Based on the age of *P. ruficornis* collected and the location of the body, ~7.5–8.5 days PMI min was estimated [23]. This species can be helpful for the development of forensic entomology in the study area. For estimation of PMI using this insect, it is important to study the rates of development of instars and adult stages. Because insect species are poikilothermic creatures, they usually show different growth patterns depending on the temperature at which they develop.

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### References

- Rivers DB, Dahlem GA (2013) The Science of Forensic Entomology. (Edn 1) John Wiley & Sons, West Sussex, England p. 3-7.
- Matuszewski S, Bajerlein D, Konwerski S, Szpila K (2008) An initial study of insect succession and carrion decomposition in various forest habitats of Central Europe. *Forensic Sci Int* 180 (2): 61- 69.
- Byrd JH, Castner JL (2009) *Forensic Entomology: The Utility of Arthropods in Legal Investigations*. (Edn 1) CRC Press, Boca Raton, USA, pp. 440-442.
- Amendt J, Campobasso CP, Gaudry E, Reiter C, Leblanc HN, et al. (2007) Best practice in forensic entomology, standards and guidelines. *Int J Legal Med* 121 (2): 90-104.
- Carvalho CJ, Mello Patiu CA (2008) Key to the adults of the most common forensic species of Diptera in South America. *Rev Bras de Entomol* 52(3): 390-406.
- Vairo KP, Mello Patiu CA, De Carvalho CJ (2011) Pictorial identification key for species of Sarcophagidae (Diptera) of potential forensic importance in southern Brazil. *Rev Bras de Entomol* 55(3): 333-347.
- Singh D, Garg R, Wadhawan B (2012) Ultramorphological characteristics of immature stages of a forensically important fly *Parasarcophaga ruficornis* (Fabricius) (Diptera: Sarcophagidae). *Parasitol res* 110(2): 821-831.
- Suwannayod S, Sanit S, Sukontason K, Sukontason KL (2013) *Parasarcophaga (Liopygia) ruficornis* (Diptera: Sarcophagidae): A flesh fly species of medical importance. *Trop Biomed* 30(2): 174-180.
- Sukhapanth N, Upatha ES, Ketavan C (1988) Effects of feed and media on egg production, growth and survivorship of flies (Diptera: Calliphoridae, Muscidae and Sarcophagidae). *J Sci Soc Thailand* 14: 41-50.
- Ferraz AC, Proença B, Gadelha BQ, Faria LM, Barbalho MG, et al. (2010) First record of human myiasis caused by association of the species *Chrysomya megacephala* (Diptera: Calliphoridae), *Sarcophaga (Liopygia) ruficornis* (Diptera: Sarcophagidae), and *Muscadomestica* (Diptera: Muscidae). *J Med Entomol* 47(3): 487-490.
- Sukontason KL, Narongchai P, Sripakdee D, Boonchu N, Chaiwong T, et al. (2005) First report of human myiasis caused by *Chrysomya megacephala* and *Chrysomya rufifacies* (Diptera: Calliphoridae) in Thailand, and its implication in forensic entomology. *J Med Entomol* 42(4): 702-704.
- DE Souza Lopes H (1961) Hawaiian Sarcophagidae (Diptera). *Proceedings of the Hawaiian Entomological Society* 17(3): 419-427.
- Meiklejohn KA, Dowton M, Pape T, Wallman JF (2013) A key to the Australian Sarcophagidae (Diptera) with special emphasis on *Sarcophaga (sensulato)*. *Zootaxa* 3680(1): 148-189.
- Kavitha R, Nazni WA, Tan TC, Lee HL, Azirun MS, et al. (2013) Review of forensically important entomological specimens collected from human cadavers in Malaysia (2005–2010). *J Forensic Leg Med* 20(5): 480-482.
- Vitta A, Pumidonming W, Tangchaisuriya U, Poodendean C, Nateeworanart S (2007) A preliminary study on insects associated with pig (*Sus scrofa*) carcasses in Phitsanulok, northern Thailand. *Trop biomed* 24(2): 1-5.
- Gomes L, Gomes G, Desuo IC (2009) A preliminary study of insect fauna on pig carcasses located in sugarcane in winter in southeastern Brazil. *Med and Vet Entomol* 23(2): 155-159.
- Al Mesbah H, Moffatt C, El Azazy OM, Majeed QA (2012) The decomposition of rabbit carcasses and associated necrophagous Diptera in Kuwait. *Forensic sci int* 217(1-3): 27-31.
- Nassu MP, Thyssen PJ, Linhares AX (2014) Developmental rate of immatures of two fly species of forensic importance: *Sarcophaga (Liopygia) ruficornis* and *Microcerrellahalli* (Diptera: Sarcophagidae). *Parasitol research* 113(1): 217-22.
- Keshavarzi D, Fereidooni M, Assareh M, Nasiri Z (2015) A checklist of forensic important flies (Insecta: Diptera) associated with indoor rat carrion in Iran. *J Entomol Zool Stud* 3(3): 140-142.

20. Tuzun A, Dabiri F, Yuksel S (2010) Preliminary study and identification of insects' species of forensic importance in Urmia, Iran. Afr J Biotechnol 9(24): 3649-3658.
21. Giroux M, Pape T, Wheeler TA (2010) Towards a phylogeny of the flesh flies (Diptera: Sarcophagidae): morphology and phylogenetic implications of the acrophallus in the subfamily Sarcophaginae. Zool J Linn Soc 158(4): 740-778.
22. Nolte KB, Pinder RD, Lord WD (1992) Insect larvae used to detect cocaine poisoning in a decomposed body. J Forensic Sci 37(4): 1179-1185.
23. Al Mesbah H, Al Osaimi Z, El Azazy OME (2011) Forensic entomology in Kuwait: The first case report. Forensic Sci Int 206(1-3): e25-e26.



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