

# Contribution to the knowledge of flesh flies (Diptera: Sarcophagidae: Sarcophaginae) attracted to carcasses in Piura, Peru

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**Abstract.** Despite being the most diverse family of flies found in carcasses and corps in the Neotropical Region, Sarcophagidae is still underestimated in Peru. This research was developed in the Department of Piura, Northern Peru and we identify the flesh flies captured on two kinds of animal carcasses: dog and guinea pigs. As a result, a new record was documented for Peru: *Blaesoxipha (Gigantotheca) plinthopyga* (Wiedemann, 1830) and eight new records for the Department of Piura.

**Keywords.** Forensic entomology; Diptera; Flesh flies; New records; Northern Peru.

## INTRODUCTION

Sarcophagidae is a family of flies, commonly called “flesh flies”, that are distributed globally, comprising 173 genera and more than 3,000 species (Pape *et al.*, 2011). The females are ovoviviparous multilarviparous, that is, they deposit many first instar larvae directly on the substrate (Meier *et al.*, 1999). This habit of larviposition constitutes an adaptive advantage against other early colonizers flies as Calliphoridae or Muscidae (Barros *et al.*, 2008). Adults are 5 to 20 mm long, dull gray in color with three longitudinal black stripes on mesonotum, a row of meral setae, and subscutellum undeveloped (Carvalho & Mello-Patiu, 2008).

Sarcophagidae has great forensic importance because they are pioneering flies in colonizing human and animal carcasses, along with Calliphoridae and Muscidae (Oliveira-Costa & Mello-Patiu, 2004; Santos, 2018). Although sarcophagids are the most diverse flies found in carcasses and corpses in the Neotropical region (Alves *et al.*, 2014), studies on association of flesh flies and carcass decomposition are still rare. One of the limiting factors is the taxonomic difficulty presented by the group, whose specific identification is mainly based on features of the male terminalia complex (Santos, 2018). Even so, the few records of Sarcophagidae associated with animal carcasses have been made mainly on pigs carcasses, as it is the most internationally accepted biomodel (Jagmahender & Sharma, 2008), since it

allows extrapolating information to cases of human corpses, because of their similarity with the cadaveric decomposition (Tomberlin *et al.*, 2011; Schoenly *et al.*, 2006), with the association of arthropods and their succession along the decomposition process (Matuszewski *et al.*, 2019).

In Peru, there are one study of Sarcophagidae fauna of Flores & Dale (1995), but without a forensic focus. Also, “The World Catalog of Sarcophagidae” by Pape (1996) compiles data from the literature and summarizes the record of 109 species from Peru. However, catalog information does not allow identifying which species are attracted by carcasses and which have possible forensic importance for the region. Both Lopes (1969) and Pape (1996) catalogs recorded only five species from Piura, as their type-localities, and no other record has been documented for this region over the past 50 years. For this reason, this work is important for the update of the records of the Sarcophagidae fauna attracted to carcasses in Department of Piura, Northern Peru.

## MATERIAL AND METHODS

Adult Sarcophaginae were collected, between years 2017-2019, on mammal carcasses: guinea pig and dog. Specimens were preserved in 70% ethanol and species identification was carried out in the Laboratory of Neotropical Diptera of the Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil (MNRJ), based

on taxonomic keys and comparison with specialized literature (Carvalho & Mello-Patiu, 2008; Buenaventura *et al.*, 2009; Vairo *et al.*, 2011; Buenaventura & Pape, 2013; Camargo *et al.*, 2018). Due to the taxonomic difficulty for identifying females of this group, only males were identified. The classification followed that proposed by Pape (1996) and the voucher specimens were deposited in the Entomological Collection of MNRJ.

The collected species are presented as a listing, furnishing the worldwide and the Peruvian distribution, bibliographic references, as well as comments on previous records in animal carcasses. The examined material was registered in the following order: DEPARTMENT – Province, District, Town, altitude in meters (geographic coordinates), collection date, type of carcass, number of ♂, Collector. The new records from Piura Department are indicated with an asterisk (\*), while the new records from Peru are indicated with a cross (†).

## RESULTS

A total of 18 male specimens were obtained and five genera and nine species were identified, all belonging to the subfamily Sarcophaginae (Diptera: Sarcophagidae). Eight species are new records for Piura, and *Blaesoxipha (Gigantotheca) plinthopyga* is also a new record for Peru.

### Subfamily Sarcophaginae

#### *Argoravinia rufiventris* (Walker, 1849)

**Material examined:** PIURA – Piura, Castilla, Caserío Miraflores, 32 m (05°10'00.51"S, 80°36'51.27"W), 20.vi.2017, guinea pig carcass, 3 ♂, K. Andrade leg.

**World distribution:** Argentina, Bolivia, Brazil, Costa Rica, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Marshall Islands, Mexico, Panama, Peru, Puerto Rico, Trinidad & Tobago, USA (Pape, 1996).

**Distribution in Peru:** Piura (Townsend, 1912 as *Sarcophaga argentea*).

**Remarks:** Registered in pig carcasses (Watson & Carlton, 2003; Barros *et al.*, 2008; Rosa *et al.*, 2011; Alves *et al.*, 2014), bear and deer (Watson & Carlton, 2003), and rat (Beuter *et al.*, 2012).

#### *Blaesoxipha (Gigantotheca) plinthopyga* (Wiedemann, 1830) \*†

**Material examined:** PIURA – Piura, Castilla, Caserío Miraflores, 32 m (05°10'00.51"S, 80°36'51.27"W), 20.vi.2017, guinea pig carcass, 2 ♂ K. Andrade leg.; PIURA – Huancabamba, Quispampa bajo, 2,088 m (05°15'15.5"S, 79°27'02.6"W), 27.vii.2019, dog carcass, 1 ♂, K. Andrade & R. García leg.

**World distribution:** American Virgin Islands, Bahamas, Brazil, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Galápagos Islands, Great Antilles, Guatemala, Guyana, Hawaiian Island, Jamaica, Lesser Antilles, Mexico, Nicaragua, Panama, Puerto Rico, USA, Venezuela (Pape, 1996; Pape *et al.*, 2004; Salazar-Ortega *et al.*, 2012; Mello-Patiu, 2016).

**Distribution in Peru:** This is new record for Piura and Peru.

**Remarks:** Registered in pig carcasses (Mello-Patiu *et al.*, 2014a), rat (Beuter *et al.*, 2012), snake (Andrade-Herrera *et al.*, 2020) and human corpse (Wells & Smith, 2013).

#### *Microcerella matucanensis* (Lopes, 1974) \*

**Material examined:** PIURA – Huancabamba, Huancabamba, Quispampa bajo, 2,088 m (05°15'15.5"S, 79°27'02.6"W), 27.vii.2019, dog carcass, 2 ♂, K. Andrade & R. García leg.

**World distribution:** Chile and Peru (Lopes, 1974; Lopes & Tibana, 1982).

**Distribution in Peru:** Lima (Matucana y Chacacayo), Tacna (cam. Pachia) (Lopes, 1974 as *Townsendisca matucanensis*; Lopes & Tibana, 1982 as *Townsendisca matucanensis*). This is new record for Piura.

**Remarks:** Not previously registered in mammal carcass.

#### *Oxysarcodexia amorosa* (Schiner, 1868) \*

**Material examined:** PIURA – Huancabamba, Huancabamba, Quispampa bajo, 2,088 m (05°15'15.5"S, 79°27'02.6"W), 27.vii.2019, dog carcass, 2 ♂, K. Andrade & R. García leg.

**World distribution:** Brazil, Colombia, Costa Rica, Ecuador, Guyana, Mexico, Panama, Peru (Lopes & Tibana, 1987; Pape, 1996; Pape *et al.*, 2004).

**Distribution in Peru:** Junin, Huanuco (Tingo Maria) (Lopes & Tibana, 1987). This is a new record for Piura.

**Remarks:** Registered in pig carcasses (Barbosa *et al.*, 2009; Bitar *et al.*, 2013; Lopes *et al.*, 2018), dog (Toma *et al.*, 2020), and snake (Andrade-Herrera *et al.*, 2020).

#### *Oxysarcodexia bakeri* (Aldrich, 1916) \*

**Material examined:** PIURA – Piura, Castilla, Caserío Miraflores, 32 m (05°10'00.51"S, 80°36'51.27"W), 20.vi.2017, guinea pig carcass, 3 ♂, K. Andrade leg.

**World distribution:** Bahamas, Brazil, Chile, Colombia, Cuba, Dominica, Ecuador, El Salvador, Guadalupe, Haiti,

Honduras, Jamaica, Mexico, Peru, Puerto Rico, Turks & Caicos Islands, USA (Lopes & Tibana, 1987; Flores & Dale, 1995; Pape, 1996; Salazar-Ortega *et al.*, 2012; Mello-Patiu, 2016).

**Distribution in Peru:** Lima (Flores & Dale, 1995). This is a new record for Piura.

**Remarks:** Not registered previously in mammal carcasses, but on fish and liver baits (Flores & Dale, 1995), chicken viscera and fish (Yepes-Gaurisas *et al.*, 2013) and decomposing fish (Valverde-Castro *et al.*, 2017).

#### ***Oxysarcodexia conclausa* (Walker, 1861) \***

**Material examined:** PIURA – Huancabamba, Huancabamba, Quispampa bajo, 2,088 m (05°15'15.5"S, 79°27'02.6"W), 27.vii.2019, dog carcass, 2 ♂, K. Andrade & R. García leg.

**World distribution:** Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Panama, Peru, Trinidad & Tobago, USA (Pape, 1996).

**Distribution in Peru:** Tacna (cam. Pachia) (Lopes & Tibana, 1982). This is a new record for Piura.

**Remarks:** Registered in snake carcass (Andrade-Herrera *et al.*, 2020), and decomposing fish (Valverde-Castro *et al.*, 2017).

#### ***Oxysarcodexia grandis* (Lopes, 1946) \***

**Material examined:** PIURA – Huancabamba, Huancabamba, Quispampa bajo, 2,088 m (05°15'15.5"S, 79°27'02.6"W), 27.vii.2019, dog carcass, 1 ♂, K. Andrade & R. García leg.

**World distribution:** Brazil, Colombia, Ecuador and Peru (Pape, 1996).

**Distribution in Peru:** Cajamarca (San Miguel), Junin (Lopes, 1975; Lopes & Tibana, 1987). This is a new record for Piura.

**Remarks:** Not registered previously in mammal carcasses, but on chicken viscera (Yepes-Gaurisas *et al.*, 2013).

#### ***Peckia (Euboettcheria) abrupta* (Lopes, 1954) \***

**Material examined:** PIURA – Huancabamba, Huancabamba, Quispampa bajo, 2,088 m (05°15'15.5"S, 79°27'02.6"W), 27.vii.2019, dog carcass, 1 ♂, K. Andrade & R. García leg.

**World distribution:** Brazil, Ecuador and Peru (Lopes, 1954; Pape, 1996; Buenaventura & Pape, 2013).

**Distribution in Peru:** Lima (Callao) (Lopes, 1954 as *Paraphrissopoda (Euboettcheria) abrupta*). This is a new record for Piura.

**Remarks:** Not registered previously in mammal carcasses.

#### ***Peckia (Euboettcheria) australis* (Townsend, 1927) \***

**Material examined:** PIURA – Piura, Castilla, Caserío Miraflores, 32 m (05°10'00.51"S, 80°36'51.27"W), 20.vi.2017, guinea pig carcass, 1 ♂, K. Andrade leg.

**World distribution:** Argentina, Brazil, Paraguay and Peru (Pape, 1996; Buenaventura & Pape, 2013).

**Distribution in Peru:** Junin (Chanchamayo) (Buenaventura & Pape, 2013). This is a new record for Piura.

**Remarks:** Registered in human corpse (Gaedke & Mougá, 2017).

## DISCUSSION

In this study, we found nine species were attracted by two kinds of mammal carcasses in the region of Piura, Peru. Lopes (1969) and Pape (1996) catalogued five species for Piura: *Argoravinia aurea* (Townsend), *Argoravinia rufiventris* (Wiedemann), *Peckia (Peckia) auribarbata* (Townsend), *Ravinia aurigena* (Townsend), and *Tricharaea (Sarcophagula) peruana* (Townsend). Of these previously reported species, only one is recorded in the present study: *Argoravinia rufiventris*, with the remaining eight species representing the first records for this region and one of them the first record for Peru.

Very few surveys on Sarcophagidae had been carried out in Peru, one of them was that of Flores & Dale (1995), who revealed species collected in an ecological study using traps baited with meat, excrement and fruit. Lopes (1975, 1992) studied interesting material from Peru collected by Dr. C. Korytkowski and described three new genera and six new species. Lopes (1969) catalogued 35 Sarcophaginae species from Peru and later Pape (1996) compiled 109 species of this subfamily recorded from this country, mainly based on taxonomic studies. Few recent studies in Peru on insects attracted or associated with animal carcasses have mentioned the family Sarcophagidae (Huchet & Greenberg, 2010; Gines *et al.*, 2015; Medina-Achín *et al.*, 2018; Andrade-Herrera *et al.*, 2018; Andrade-Herrera & Marchiori, 2019), but they were unable to determine the species due to the taxonomic difficulty of this group. However, it is necessary to increase the studies on this family of dipterans, as they present a great diversity of life habits and great species richness in South America (Pape, 1996), especially in Peru where their knowledge is underestimated.

The subfamily Sarcophaginae includes mostly sarcosaprophagous species, *i.e.*, those which the larvae feed on or breed in decomposing organic matter (Mello-Patiu *et al.*, 2014b). Some species explore small invertebrate carcasses, other species explore vertebrate feces, some others can be found in vertebrate carcasses (Barros *et al.*, 2008; Ledo *et al.*, 2012; Mello-Patiu *et al.*, 2014a; Farrell *et al.*, 2015; Lopes *et al.*, 2018; Andrade-Herrera *et al.*, 2020) and others may even act as myiasis-causing flies in man and others animals (Calderón-Arguedas *et al.*, 2004; Hagman *et al.*, 2005; Medina *et al.*, 2009; Mello-Patiu & Luna-Dias, 2010). On the other hand, the larviposition habit of these species constitutes an adaptive advantage related to the faster colonization of carcasses than the oviparous species belonging to Calliphoridae (Barros *et al.*, 2008). All of these characteristics give them medical and forensic importance and allow them to be used as tools for determining the post-mortem interval (IPM) (Sharma *et al.*, 2015).

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