

Taxonomic studies on flesh fly species (Diptera: Sarcophagidae) *Parasarcophaga dux* and *Parasarcophaga sarupi* of Indian origin

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Abstract

The male genitalia of two species belonging to the genus *Parasarcophaga* Johnston and Tieg, i.e., *dux* (Thomson), and *sarupi* Nandi have been studied in detail. The present work includes the descriptions and detailed illustrations of external male genitalic structures which have not been published so far these two species. A key to the studied species is also given.

Keywords: Diptera, flesh fly, key, *Parasarcophaga*, Sarcophagidae

Introduction

Taxonomic studies on sarcophagid flies remained poorly undertaken in India and adjacent countries till 1920s. Senior-White (1924) [16] revised these flies from the Oriental region and described several new species. Extensive faunistic exploration was done in India and 163 species of Sarcophagidae have been recorded from different states and union territories of the country by Nandi (2002) [7,8]. Now, the Indian flesh flies are represented under 3 subfamilies: - Miltogrammatinae, Paramacronychiinae and Sarcophaginae containing between them 50 genera. The Miltogrammatinae are represented by 22 genera in the tribes Amobiini, Miltogrammatinae, Phyllotelini and Metopiini. The poorly known Paramacronychiinae are represented by one genus in the tribe Paramacronychiinae and the well-known subfamily Sarcophaginae is represented by 27 genera in the tribes Raviniinae, Protodexiini and Sarcophaginae.

In India, Sarcophagidae family consists of 126 species, out of which 89 species are from the genus *Sarcophaga* which amounts for 70% of the Indian Sarcophagidae family. The genus *Blaesoxipha* consist of 9 species which amounts for 7% of the Indian Sarcophagidae family (Chakraborty *et al*, 2017) [1].

The members of the family Sarcophagidae are commonly known as 'flesh flies'. Adult flies measure in length from 4 mm to 18 mm. Body grayish to black with three black stripes on the thorax. The abdomen has a light and dark gray checkerboard pattern and is often red at the tip. Although the name would seem to indicate a habit of breeding in vertebrate carcasses, this is by no means typical for the family, which includes specialists ranging from inhabitants of pitcher plants to bat coprophages, crab saprophages, wasp nest inquilines, and insect parasitoids. With some 2600 described species worldwide (Pape *et al.*, 2009) [10], Indian representatives belong to 117 species under 38 genera of three subfamilies (Nandi, 2002; Sinha & Nandi, 2002a & b) [7, 8, 18, 19].

Materials and Methods

Collections and Preservation

Adult flies were collected from localities falling in the states comprising the North Indian states i.e., Punjab, Jammu & Kashmir, Himachal Pradesh, Uttarakhand and Rajasthan. Extensive and intensive survey work was planned keeping in view different seasons of the year. Varied habitats like forests, bushes, flowers, heaps of garbage, rotting fruits and vegetables, decaying animal remains, excreta of animals etc. were visited to collect the flesh flies. The collected specimens were killed by putting them in a killing jar charged with ethyl acetate. The dead specimens were pinned using standard entomological pins piercing the right side of the mesothorax.

In order to examine the male genitalia, the abdomen was softly detached with the help of fine forceps. The same was put in 10% KOH overnight to soften the chitin and dissolve away muscles and other unwanted parts. The genitalia was dissected from the abdomen and put in ascending grades of alcohol. After dehydration, all the structures were preserved in the clove oil for clearance purposes until used for identification and photography. Identification of all the specimens was done using the keys given by Senior-White *et al.* (1940) [17] and Nandi (2002) [7,8]. The arrangement of various bristles present on the thorax is important taxonomically. So these were carefully studied on both the sides of the insect. Terminology used by Senior-White *et al.* (1940) [17] has been followed while describing the chaetotaxy. The adult specimens were photographed with the help of an Image Processing Unit installed in the DRS laboratory of Department of Zoology and Environmental Sciences, Punjabi University, Patiala. Photography of each specimen as well as of the male genitalia from different angles has been done and all the photographs have been arranged in the form of plates and presented in the present study.

Key to studied species

1. Ventralia strongly curved; lateral plate of paraphallus wide and blunt at end.....*sarupi* Nandi
2. Ventralia almost straight; lateral plate of paraphallus narrow and pointed at end.....*dux* (Thomson)

***Parasarcophaga (Liosarcophaga) sarupi* Nandi**

Parasarcophaga sarupi Nandi



Fig. 1 Adult Male (D.V.)



Fig. 2 Adult Male (L.V.)



Fig. 3 Male Genitalia (L.V.)

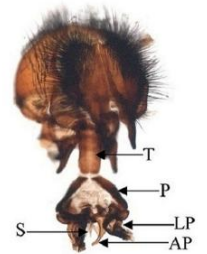


Fig. 4 Male Genitalia (V.V.)



Fig. 5 Forceps (V.V.)

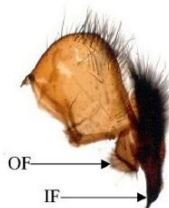


Fig. 6 Forceps (L.V.)

Parasarcophaga (Liosarcophaga) sarupi Nandi, 1979, *Orient. Inst.* 13 (1-2) 191; Nandi, 1992, *J. Beng. nat. Hist. Soc.*, 11(2): 37.

Male: Body length 12mm.

Head: Width of frons about two-fifths that of one eye; frontal vitta black, its width at narrowest point of frons about twice that of each parafrontal; parafrontal and parafacial black with brown pollen; antennae black and reaching up to about 0.8x distance to vibrissae; facial ridge brownish with silvery pollen; vibrissae long; frontal bristles 13, posterior 2 reclinate, anterior 5 below base of antennae, rest cruciate and directed forwards; gena black, silvery pollen and with short hair; post gena black with black and white hair; palpi slender and black; proboscis black.

Thorax: Black with yellowish pollen and with three black longitudinal stripes; *ac* 0+5; *dc* 5+5; *ia* 1+3; *ps* 1; *h* 3; *ph* 2; *np* 4; *pa* 2; *sa* 4; *st* 1+1+1; *mpl* 7; *hpl* 7-9; prostigmatic and propleural bristles well developed and accompanied with short hair; pro- and mesothoracic spiracles brown; apicoscutellar and

discoscutellar bristles 1 pair each; lateroscutellar bristles 2 pairs.

Wings: Hyaline with brown veins; R1 bare; R4+5 with row of about 9-10 short setae located dorsally and extending up to more than half from basal node to r-m; costal spines short; epaulet black; basicostal scale yellowish; squama white; halter brown.

Legs: Black; fore femur with two rows of long bristles along posterodorsal surface; fore tibia with row of 3 bristles along basal one-third of anterodorsal surface; mid femur with row of 5 bristles along middle portion of anterolateral surface; mid tibia with 1 bristles each on anteroventral and anterolateral surface; hind femur with pair of rows of bristles along anterodorsal surface; hind tibia with row of bristles along anterodorsal surface.

Abdomen : Black with silvery checkered pattern; median marginal bristles on second and third abdominal tergites absent but each with 3 lateral marginal bristles, fourth with 2 median and 3 lateral marginal bristles, fifth with row of 14 marginal bristles; sternite first to fourth with short hair; fifth sternite Y-shaped with tuft of short spines laterally on arms.

Genitalia: First genital segment brown but without marginal bristles, second black with long hair; inner forceps gradually tapering, bearing notch on distal end and with hair almost three-fourths of its basal end; outer forceps almost oval with long hair; anterior paramere almost straight, slender and slightly pointed at end; posterior paramere curved at end and pointed apically; theca shorter than paraphallus, both sclerotised; apical plate of paraphallus sclerotised, long pointed at end and with long lateral processes, end of processes are bifurcated and one branch longer than other; lateral plate of paraphallus wide, blunt at end and almost membranous; styli of glans long and pointed; ventralia membranous, strongly curved anteriorly and pointed terminally.

Material examined: HIMACHAL PRADESH: An dhre ta, 12. vii. 2010 - 2♂♂.

Distribution: India: Himachal Pradesh, Meghalaya, Mizoram and Uttar Pradesh.

Remarks: This species is similar to *Parasarcophaga (Liosarcophaga) jaipurensis* but differs from it by the structure of ventralia and apical and lateral plate of paraphallus. It has been recorded from Himachal Pradesh for the first time.

***Parasarcophaga (Liosarcophaga) dux* (Thomson)**

Parasarcophaga dux (Thomson)



Fig. 7 Adult Male (D.V.)



Fig. 8 Adult Male (L.V.)

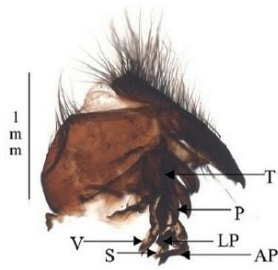


Fig. 9 Male Genitalia (L.V.)

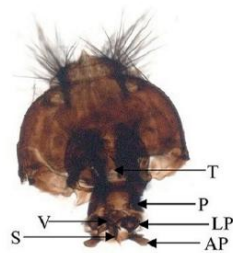


Fig. 10 Male Genitalia (V.V.)

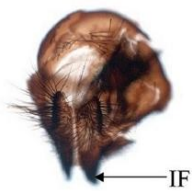


Fig. 11 Forceps (V.V.)

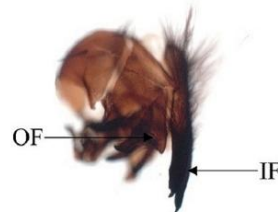


Fig. 12 Forceps (L.V.)

Sarcophaga dux Thomson, 1869, K. *svenska Vetensk Acad. fregatten Eugenie resa omkring jorden*, 2(1): 534; Kano and Shinonaga, 1994, *Jap. J. sanit. Zool.*, 45: 259.

Sarcophaga exuberans Pandelle, 1896, *Revta Ent.*, 15: 186.

Sarcophaga subtuberosa Parker, 1917, *Proc. U. S. natn. Mus.*, 54: 89.

Sarcophaga dux luzonensis Parker, 1919, *Bull. Brooklyn ent. Soc.*, 14: 43.

Sarcophaga ceylonensis Parker, 1923, *Ann. Mag. nat. Hist.*, (9)11: 125; Provolny, 1987, *Acta ent. Mus. Natn. Prague*, 42: 159.

Sarcophaga craggy Parker, 1923, *Ann. Mag. nat. Hist.*, (9)11: 126.

Parasarcophaga (Liosarcophaga) misera: Rohdendorf, 1937, *Fauna USSR, Dipt.*, 19(1): 223 (misidentification, not walker, 1849).

Sarcophaga exuberansoides Zumpt, 1964, *Verh. Naturf. Ges. Basel.*, 75: 70.

Parasarcophaga (Liosarcophaga) dux: Nandi, 1977, *Rec. zool. Surv. India.*, 73: 214; Nandi, 1992, *J. Beng. nat. Hist. Soc.*, 11(2): 37.

Male: Body length 10-14mm.

Head: Width of frons about three-fourths that of one eye; frontal vitta black, its width at narrowest point of frons about more than twice that of each parafrontal; parafrontal and parafacial black with silvery to golden pollen; antennae brownish, with silvery pollen and reaching up to about 0.8x distance to vibrissae; facial ridge light brown with silvery pollen; vibrissae long; frontal bristles 9-10, posterior 2 reclinate, anterior 3 below base of antennae, rest cruciate and directed forwards; gena black with black hair; post gena black with silvery hair.

Thorax: Blackish with three black longitudinal stripes; *ac* 0+1; *dc* 5+5 (posterior 2 *dc* stout); *ia* 1+3; *ps* 1; *h* 3; *ph* 2; *np* 4; *pa* 2; *sa* 4; *st* 1+1+1; *mpl* 6; *hpl* 9; upper part of propleura bear with silvery pollen; prostigmatic and propleural bristles well developed and accompanied with short hair; pro- and mesothoracic spiracle brown; apicoscutellar and discoscutellar bristles 1 pair each; lateroscutellar bristles 2 pairs.

Wings: Hyaline with brown veins; R1 bare; R4+5 with a row of about 9-10 short setae located dorsally and extending up to about two-thirds from basal node to r-m; costal spines stout; epaulet black with short black spines; basicostal scale yellowish; squama white; halter brown.

Legs: Black; fore femur with two rows of long bristles along posterodorsal surface; fore tibia with a row of 3 bristles along basal one-third of anterodorsal surface; mid femur with a row of 4-5 short bristles along middle portion of anterodorsal surface; mid tibia with a row of 2-3 bristles along middle portion of anterodorsal surface; hind femur with a pair of rows of bristles along anterodorsal surface; hind tibia with 2 long and row of short bristles along anterodorsal surface.

Abdomen: Black with silvery checked pattern; median marginal bristles on second and third abdominal tergites absent but each with 2 pairs of lateral marginal bristles, fourth with a pair of median and 3 lateral marginal bristles, fifth with a row of about 16 marginal bristles; sternite first and second with long hair but third and fourth with short hair; fifth sternite V-shaped.

Genitalia: Inner forceps almost straight, pointed and slightly curved at end; outer forceps nearly oval with hair on distal end; anterior paramere uniform, straight and pointed at end; posterior paramere curved, widened medially and with 2-3 hair; theca shorter than paraphallus, both are sclerotised; apical plate of paraphallus with straight lateral process and its end unequal; lateral plate of paraphallus wide and abruptly pointed apically; styli of glans short and comb like anteriorly; ventralia wide, well developed and plate-like.

Material examined: PUNJAB: Patiala, 5. vii. 2012 - 1♂.

Distribution: India; Assam, Andhra Pradesh, Arunachal Pradesh, Bihar, Goa, Gujarat, Jammu & Kashmir, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Madhya Pradesh, Mizoram, Nagaland, Odisha, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal and Union territories of Andaman Nicobar; Bangladesh; Bhutan; Nepal; Pakistan; Myanmar; Sri Lanka; Albania; Australia; Austria; Azerbaijan; Azores; Bismarck Archipelago; Bonin Islands; Borneo; Bulgaria; Cape Verde Islands; Caroline Islands; China; Christmas Island; Cyprus; Croatia; Czech Republic; Denmark; Egypt; Fiji; Finland; France; Germany; Great Britain; Greece; Gruzia; Guam; Hianan Island; Hawaiian Island; Hungary; Indonesia; Israel; Italy; Japan; Kazakhstan; Kiribati; Madagascar; Malta; Mariana Islands; Marshall Islands; Micronesia; Mongolia; New Guinea; Niue; Palau; Philippines; Poland; Pitcairn Islands; Romania; Russia; Serbia; Singapore; Slovakia; South Korea; Spain; Sweden; Switzerland; Tajikistan; Taiwan; Thailand; Turkmenistan; Ukraine; Uzbekistan; Wake Islands and Western Samoa.

Remarks

This species is similar to *P. (Liosarcophaga.) harpax* but differ from it by the structure of ventralia and lateral of paraphallus. Moreover, the styli of glans are thicker and shorter here.

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