Key to adult flesh flies (Diptera: Sarcophagidae) of the British Isles

DANIEL WHITMORE^{1*}, STEEN DUPONT² & STEVEN FALK³

¹ Staatliches Museum für Naturkunde Stuttgart, Rosenstein 1, 70191 Stuttgart, Germany.
<https://orcid.org/0000-0002-6051-5925>

² Natural History Museum, Cromwell Road, London SW7 5BD, United Kingdom.

³ 10 Fishponds Road, Kenilworth CV8 1EX, United Kingdom.

*Corresponding author. E-mail: daniel.whitmore@smns-bw.de

Abstract

We present a key for the identification of males and females of 62 species of flesh flies (Diptera: Sarcophagidae) occurring in the British Isles, following the addition of several species to the British and Irish checklists in the last few years. Footnotes with characters for identification are given for an additional two (2) recently discovered species still awaiting publication, whereas a third species, *Sarcophaga (Liosarcophaga) tibialis* Macquart, 1851, known only from a single record from the 1970s, is not included. The key is based on the study of approximately 10,000 specimens held in the research collections of the Natural History Museum, London and is supplemented by colour photographs of diagnostic characters. The key allows for the identification of all males and 88% of females, the latter without the need for any special preparation or dissection of specimens. Emphasis is placed on characters of the external morphology not requiring a full dissection of the specimens, with the objective of maximising identification accuracy and reaching a wider user base for application in ecological studies, biological recording and forensic investigations.

Key words: biological recording, forensics, identification, Ireland, United Kingdom

Introduction

Flesh flies (Diptera: Sarcophagidae) include approximately 3100 valid species worldwide (Courtney *et al.* 2017). Their larval ecologies are diverse, ranging from necrophagy on large or small carrion to predation, parasitism and kleptoparasitism on invertebrates (Pape 1996). They are important ecosystem service providers as forensic indicators, pollinators (as adults), decomposers (as larvae), and biocontrol agents of agricultural and forest pests. Knowledge of the taxonomy and distribution of the c. 310 species of flesh flies so far known to occur in Europe is relatively good (Pape *et al.* 2015). However, published keys for their morphological identification are outdated or rely primarily on characters of the genitalia requiring a full dissection, making them more difficult to use by non specialists.

A relatively small proportion (c. 20%) of the total European flesh fly fauna occurs in the British Isles, due to the geographic position and geological history of the islands and to the predominantly thermophilous habits of these flies. Knowledge of the British Sarcophagidae was last comprehensively summarised by van Emden (1954) as part of the “Handbooks for the Identification of British Insects” series. His handbook, which treated the families Tachinidae and Calliphoridae (with the present-day Polleniidae, Rhinophoridae and Sarcophagidae as subfamilies), contains keys to 53 sarcophagid species as well as summary information on their distributions and ecologies. Characters and a key for the identification of females of the genus *Sarcophaga* Meigen (*s. l.*) were subsequently published by d’Assis-Fonseca (1953) and Day & d’Assis-Fonseca (1955). Apart from an unpublished draft key by S. Falk and a partial key to the genus *Sarcophaga* by Hackston (2015), no updated keys had been published since van Emden (1954) and Day & d’Assis-Fonseca (1955), and the most comprehensive key allowing to identify most British Sarcophagidae was Pape’s (1987) for Fennoscandia and Denmark. Updates and changes to the British Isles’ Sarcophagidae checklist have been tracked by Chandler (2020a). Following the recent additions of *Macronychia striginervis* (Zetterstedt) and *Metopia tschernovae* Rohdendorf (Whitmore & Perry 2018; Chandler 2020b), the checklist currently includes 62 species, to which three (3) further species will be added in forthcoming papers (Whitmore & Hall, unpublished; Whitmore *et al.*, unpublished) for a provisional total of 65. Of these 65 species, 18 belong to the subfamily Miltogramminae (genera *Amobia*, *Macronychia*, *Metopia*, *Miltogramma*, *Oebalia*, *Pterella*, *Senotainia* and *Taxigramma*), 6 to the subfamily Paramacronychiinae (genera *Agria*, *Angiometopa*, *Brachicoma*, *Nyctia* and *Sarcophila*) and the remaining 41 to the subfamily Sarcophaginae (genera *Blaesoxipha*, *Ravinia* and *Sarcophaga*).

Our knowledge of the distribution ranges of British and Irish Sarcophagidae is still largely incomplete (Falk & Pont 2017; NBN Atlas 2020), making it difficult to assess the conservation status of rarer species as well as potential range changes of all species over time. To address this problem, a recording scheme for UK Sarcophagidae was recently launched as part of the Biological Records Centre’s recording scheme program (Whitmore *et al.* 2020).

The principal aim of this paper is to provide an identification key to adult males and females of all flesh fly species known to be established on the British Isles as at June 2020, thus substantially updating previous published and unpublished resources in terms of species coverage, nomenclature and terminology. The key is designed for both specialist and non-specialist users, from ecologists and biological recorders to forensic scientists. As a tool allowing a more accurate and reliable identification of specimens—of both sexes but particularly females, which have continued to be largely neglected despite the works of d’Assis-Fonseca (1953) and Day & d’Assis-Fonseca (1955)—this key will encourage identifications of these ecologically important flies, thus contributing to an increase in our overall knowledge of their ecology and distribution.

Materials and methods

Characters and character states used to build the key were chosen based on the study of approximately 10,000 specimens housed in the British and Irish Diptera collection of the

Natural History Museum, London (NHMUK), supplemented by additional European specimens from the NMHUK's Main Collection and the collection of the first author (currently SMNS—Staatliches Museum für Naturkunde Stuttgart). Measurements (e.g., of frons to eye width ratio or gena to eye height ratio) were based on a minimum number of 10 males and 10 females where possible, whereas the full pool of specimens was used to check for intraspecific variation in chaetotaxy and colouration. The key couplets relating to species of the genus *Sarcophaga* were based on a matrix of externally visible characters built in Excel, with character states entered separately for males (32 characters) and females (22 characters). Emphasis was placed on externally visible characters in order to supplement the traditional, somewhat excessive reliance on characters of the genitalia for species identification, particularly in the genus *Sarcophaga* (see Discussion).

Specimens were examined using a Zeiss Stemi SV6 stereomicroscope with in-built light source. Digital photographs were taken using a Zeiss Axio Zoom.V16 with AxioCam HRc attached (NHMUK) and stacked in Helicon Focus version 6.3. The figure plates were arranged in Adobe Illustrator CC and edited in Adobe Photoshop CS5.

The nomenclature used for British and Irish Sarcophagidae follows the world catalogue of Pape (1996) and incorporates recent changes by Whitmore *et al.* (2013). The terminology for external morphology mainly follows Cumming & Wood (2017), terminology of the male terminalia follows Whitmore *et al.* (2013) and terminology of the female terminalia and other female-specific structures mostly follows Pape (1987) and Richet *et al.* (2011). Collecting and preparation techniques allowing for an easier identification of specimens were recently provided by Whitmore *et al.* (2020).

Results

Key to Sarcophagidae of the British Isles

[British and Irish Diptera specimens belonging to the family Sarcophagidae can be identified to family level by using the draft key to British families of Ball (2017) or the European family key of Ooesterbroek (2006).]

1. Hind coxa bare on posterior surface (Fig. 1); notopleuron with 2 strong setae and with or without additional setulae **2**
- Hind coxa with fine setulae on posterior surface (Fig. 2); notopleuron with 2 strong, long setae and 2 slightly weaker and shorter setae **subfamily Sarcophaginae 25**
2. Mid tibia with a single, strong anterodorsal seta; if with a few much shorter setae on anterodorsal surface in addition to the strong one, then vibrissa well developed..... **3**

- Mid tibia with 2 strong anterodorsal setae or with a row of anterodorsal setae of irregular length and thickness from which two stronger setae usually stand out; if only one seta stands out from the others in the row, then vibrissa poorly developed, decumbent ... **13**

- 3. Arista with hairs usually distinctly longer than greatest arisal diameter, rarely of about the same length; wing with a long costal spine; wing cell r_{4+5} closed at wing margin or with a short petiole; [in lateral view, frons distinctly protruding compared to vibrissal angle; frontal vitta mostly yellow except at base; pedicel and base of postpedicel yellow; parafacial usually with several unarranged rows of fine setulae along most of its length; tegula yellow]..... ***Taxigramma hilarella* (Zetterstedt, 1844)**
- Arista bare or with very short hairs, distinctly shorter than greatest arisal diameter; wing without, or with a very short, costal spine; wing cell r_{4+5} usually open at wing margin, sometimes closed **4**

- 4. Parafacial with a row of strong, long setae along anterior margin from just above lower eye margin to level of lowermost frontal setae; lunule with a few short, thick setulae [frons distinctly protruding in lateral view compared to vibrissal angle; tegula dark brown/black] **genus *Metopia* Meigen 5**
- Parafacial without strong, long setae along anterior margin; lunule bare..... **9**

- 5. Mid tibia with an anteroventral seta; male: fore tarsus with long hairs on posterior surface of tarsomeres 1–4, the longest up to 4 times as long as width of tarsus (Fig. 3); [frontal vitta dark and broad, over three times as wide as fronto-orbital plate].....
- ***Metopia campestris* (Fallén, 1810)**
- Mid tibia without an anteroventral seta; male fore tarsus at most with slightly elongated, somewhat curled hairs on posterior surface of tarsomeres 1–4 **6**

- 6. Abdominal syntergite 1+2 without median marginal setae; male: fronto-orbital plates normally developed, frontal vitta visible and broad along all of its length; fore tarsomeres 3–4 each with a single short, modified hair on posterior surface; female: frontal vitta wide, about 2/5 to 1/2 width of frons at level of uppermost proclinate orbital seta..... ***Metopia grandii* Venturi, 1953**
- Abdominal syntergite 1+2 usually with a pair of strong median marginal setae, occasionally weak or missing; male: fronto-orbital plates hugely developed anterior to lowermost proclinate orbital seta, covered in shiny silver microtrichosity; fore tarsomeres without, or with a different arrangement, of modified setation; females [indistinguishable at the species level]: frontal vitta narrower, about 1/3 of width of frons measured at level of uppermost proclinate orbital seta..... **7**

- 7. Male fore tarsomeres 2–4 with several short, modified hairs on posterior surface (Fig. 4)

-*Metopia staegerii* Rondani, 1859
- Male fore tarsus without modified setation on posterior surface8
8. Large, shiny fronto-orbital plates usually contiguous, entirely obliterating frontal vitta (rarely slightly separated, showing frontal vitta); row of frontal setae interrupted along silver fronto-orbital plates, usually only a single pair present close to anterior margin; pregonite strongly curved (sickle-shaped), elongate, gradually tapering, with narrow pointed tip*Metopia argyrocephala* (Meigen, 1824)
- Large, shiny fronto-orbital plates separated at middle, showing underlying dark frontal vitta; row of frontal setae uninterrupted along silver fronto-orbital plates; pregonite shorter and stubbier, not strongly curved and with broader tip.....
-*Metopia tschernovae* Rohdendorf, 1955
9. At the same time: tegula, frontal vitta, parafacial, pedicel and postpedicel entirely yellow/dark yellow (at most postpedicel a darker, yellowish-grey colour); mid tibia usually with 2 (one short, one long) anteroventral setae.....
-*Pterella grisea* (Meigen, 1824) (Fig. 8)
- At most part or all of frontal vitta and/or parafacial yellowish-orange; tegula dark brown/black; mid tibia with a single anteroventral seta.....10
10. Arista thickened along distinctly more than half of its length; frons distinctly protruding compared to vibrissal angle (lateral view)**genus *Oebalia* Robineau-Desvoidy 11**
- Arista thickened along distinctly less than half of its length; frons not distinctly protruding compared to vibrissal angle (lateral view)12
11. Facial ridge with thick, short, neatly-spaced decumbent setulae on about 2/3 to 3/4 of distance between vibrissa and antennal insertion; tarsi of all legs light brown; palpi light brown; postpedicel very wide in lateral view, about 4 times as wide as parafacial at its narrowest point; female: abdominal sternite 8 not visible in lateral view
-*Oebalia minuta* (Fallén, 1810)
- Facial ridge with fine, very short, unarranged decumbent setulae on about 1/3 to 2/5 of distance between vibrissa and antennal insertion; tarsi of all legs black; palpi dark brown; postpedicel much narrower in lateral view, about the same width as parafacial at its narrowest point; female: abdominal sternite 8 usually protruding and well visible in lateral view.....*Oebalia cylindrica* (Fallén, 1810) (Fig. 5)
12. Fronto-orbital plate with numerous hair-like proclinate setulae and without strong proclinate setae; in lateral view, antenna inserted approximately at level of middle of

- eye (Fig. 6); a darkish species with grey-silver microtrichosity on thorax and abdomen; abdominal syntergite 1+2 with 2 or more median marginal setae
.....*Amobia signata* (Meigen, 1824)
- Fronto-orbital plate with 2 strong proclinate setae; in lateral view, antenna inserted well above level of middle of eye (Fig. 9); a lighter-coloured species with thick, yellowish-grey microtrichosity on thorax and abdomen; abdominal syntergite 1+2 without median marginal setae.....*Senotainia conica* (Fallén, 1810)
13. Arista bare or with only short pubescence, distinctly shorter than greater arista diameter..... **14**
- Arista plumose, with hairs distinctly longer than greatest arista diameter **21**
14. Vibrissa not differentiated from other, decumbent setae at vibrissal angle; fronto-orbital plate with 3–5 short proclinate setae; frontal vitta dark yellow/orange; parafacial entirely yellow, bare; tegula yellow **genus *Miltogramma* Meigen 15**
- Vibrissa strongly developed, well differentiated from other setae at vibrissal angle; fronto-orbital plate with 2 (rarely 3 or more) long proclinate setae or without proclinate setae; frontal vitta dark brown/black; parafacial at most partly yellow and covered with numerous setulae; tegula dark brown/black **16**
15. Suprasquamal ridge with numerous setulae; pedicel mostly brownish with an orange apex; postpedicel entirely brownish; abdominal tergites 3–4, in posterior view, usually with three fixed dark spots near posterior margin, well visible also on sides of tergites in lateral view; male: fore 4th tarsomere with tufts of long, modified hairs on anterodorsal surface (Fig. 7) ***Miltogramma punctata* Meigen, 1824**
- Suprasquamal ridge bare; pedicel orange-yellow; postpedicel orange-yellow at least at base; abdominal tergites 3–4 with thicker, somewhat more shifting tessellation in posterior view, without distinct dark spots on sides of tergites in lateral view; male without modified setation on fore tarsus ***Miltogramma germari* Meigen, 1824**
16. Vibrissa inserted at level of anterior mouth margin; vibrissal angle well formed and face not strongly retreating in lateral view; area of head below eye with a well-differentiated postgena; arista over 1/2 of length of fore tibia; males without proclinate orbital setae; females: claws short, distinctly shorter than 5th tarsomere
.....***Brachicoma devia* (Fallén, 1820) (Fig. 10)**
- Vibrissa inserted well above anterior mouth margin; vibrissal angle poorly formed so that in lateral view the face is strongly retreating; area of head below eye without a differentiated postgena; arista at most about 1/3 of length of fore tibia; dark markings

- on abdominal tergites never distinctly shifting; males with proclinate orbital setae; females: claws long, about as long as 5th tarsomere
genus *Macronychia* Rondani 17
17. Basicosta yellow; thorax and abdomen with dense, olive-grey microtrichosity and inconspicuous dark markings; body length 5.5–7.0 mm (Fig. 11)
***Macronychia griseola* (Fallén, 1820)**
- Basicosta brown to black; thorax and abdomen with grey microtrichosity and conspicuous dark markings; body length 8.0–12.0 mm..... **18**
18. Posterior part of postgena and occiput with light-coloured setulae. Wing usually conspicuously infuscated in females, antero-distally between veins R₁ and R₄₊₅ and along crossvein dm-cu and distal part of vein M; hyaline or at most slightly infuscated between veins R₂₊₃ and R₄₊₅ in males. Female: ovilarvipositor heavily sclerotised, spine-like***Macronychia dolini* Verves & Khrokalo, 2006 (Fig. 12)**
- Postgena and occiput with black setulae only. Wing entirely hyaline in both sexes, sometimes slightly infuscated around the veins in females. Female: ovilarvipositor inconspicuous or heavily sclerotised, spine-like **19**
19. Abdominal syntergite 1+2 and tergite 3 without median marginal setae, at most tergite 3 with decumbent median marginals.....***Macronychia polyodon* (Meigen, 1824)**
- Abdominal syntergite 1+2 and tergite 3 with median marginal setae..... **20**
20. Female: ovilarvipositor not heavily sclerotised and spine-like. Male: prongs of cerci broadly separated in posterior view***Macronychia agrestis* (Fallén, 1810)**
- Female: ovilarvipositor heavily sclerotised, spine-like. Male: prongs of cerci contiguous almost to tip in posterior view
***Macronychia striginervis* (Zetterstedt, 1838)**
21. Body shiny black with only inconspicuous microtrichosity, particularly on abdomen (Fig. 13); base and anterior part of wing strongly infuscated; wing cell r₄₊₅ usually closed at wing margin; costal spine long, longer than crossvein r-m; tegula and basicosta dark brown/blackish; lower parafacial setae much longer and stronger than upper ones; scutellum with two pairs of marginal setae.....***Nyctia halterata* (Panzer, 1798)**
- Body covered with dense microtrichosity; wing hyaline with at most the base slightly darkened; wing cell r₄₊₅ usually open at wing margin; costal spine absent or distinctly shorter than crossvein r-m; tegula light brown or dark yellow, basicosta yellow; lower parafacial setae only slightly longer and stronger than upper ones; scutellum with three pairs of marginal setae **22**

22. Tegula light brown, distinctly contrasting from light yellow basicosta; costal spine usually absent; katepisternum with 2+1 setae; abdomen covered in grey microtrichosity of normal thickness, with dark areas of tessellation forming a more or less continuous median vitta and somewhat ill-defined, rounded lateral spots on the tergites in posterior view **genus *Agria* Robineau-Desvoidy 23**
- Tegula dark yellow, only slightly contrasting from light yellow basicosta; costal spine usually present, short; katepisternum with 3+1 setae; abdomen covered in thick grey microtrichosity, with dark areas of tessellation forming well-defined, triangular black spots on tergites 3–4 in posterior view..... **24**
23. Male: syntergosternite 7+8 and epandrium with wart-like processes (Fig. 16); surstylus in dorsal view with apical section broad and strongly curved; female: epiproct with up to four setae and up to eight shorter hairs, often divided
..... ***Agria mamillata* (Pandellé, 1896)**
- Male: syntergosternite 7+8 and epandrium without wart-like processes; surstylus in dorsal view with apical section narrower and straighter; female: epiproct with 14–18 setae, never divided..... ***Agria affinis* (Fallén, 1817)**
23. Palpi brown; frons wide, at narrowest point distinctly wider than an eye in strict dorsal view in both sexes (> 1.5x as wide in females); both sexes with proclinate orbital setae; male: mid tibia with a ventral seta; male: claws shorter than 5th tarsomere
..... ***Sarcophila latifrons* (Fallén, 1817) (Fig. 14)**
- Palpi yellow-orange; frons narrower than an eye in strict dorsal view in males, at most 1.2x as wide as an eye in females; males without proclinate orbital setae and without a ventral seta on mid tibia; male claws distinctly longer than 5th tarsomere
..... ***Angiometopa falleni* Pape, 1986 (Fig. 15)**
25. Males. Fronto-orbital plate without proclinate setae; frons at its narrowest point between ca. 0.33 and ca. 1.00 times the width of an eye in strict dorsal view (Fig. 17); head with or without strong outer vertical setae; scutellum usually with apical setae; abdomen gradually tapering from syntergite 1+2 to tip **26**
- Females. Fronto-orbital plate with 2 proclinate setae (Fig. 18); frons wide, at narrowest point between 0.70 and 1.40 times as wide as one eye in strict dorsal view (Fig. 19); head with a pair of strong outer vertical setae, well-differentiated from strongest and longest postocular setae (Fig. 20); scutellum without apical setae (exceptionally one fine seta present); abdomen usually rather broadly rounded in dorsal view..... **73**
26. Posteroventral surface of mid femur with a ctenidium of 5–10 thickened, shortened and laterally flattened blade-like setae distally (Fig. 21); thorax with 2–3 pairs of strong

- presutural acrostichal setae, the longest almost as long as first postsutural dorsocentral setae.....**27**
- Posteroventral surface of mid femur at most with visibly shortened and thickened setae distally (Fig. 22), these never laterally flattened, blade-like; thorax without presutural acrostichal setae or presutural acrostichals fine or strong but visibly shorter than first postsutural dorsocentral setae; if strong and of similar length as first postsutural dorsocentrals, then lowest parafacial setae very strong and long, projecting far beyond anterior margin of parafacial in profile (Fig. 23), or setulae on postgena and occiput mostly black (Fig. 24)**genus *Sarcophaga* Meigen 30**
27. Scutellum without apical setae; abdominal tergite 3 without median marginal setae; frons at its narrowest point about 0.60–0.75 times as wide as an eye in strict dorsal view; apex of pedicel yellow; frontal setae only slightly diverging anteriorly; in frontal view, distance between sockets of last (anteriormost) pair ca. 1.10–1.30 times distance between sockets of third-to-last pair; microtrichosity of head golden-silver; wing without a costal spine; syntergosternite 7+8 and epandrium orange; cerci orange on proximal half, dark brown on distal half; cercus in profile with a more or less straight dorsal margin; phallus without an obvious separation between basi- and distiphallus....
.....***Ravinia pernix* (Harris, 1780)**
- Scutellum with a pair of apical setae; abdominal tergite 3 with or without a pair of median marginal setae; frons at its narrowest point less than half as wide as an eye in strict dorsal view; apex of pedicel light brown; frontal setae more distinctly diverging anteriorly; in frontal view, distance between sockets of last (anteriormost) pair ca. 1.40–1.50 times distance between sockets of third-to-last pair; microtrichosity of head grey-silver; wing with a short costal spine; syntergosternite 7+8 and epandrium orange/red to brown/black; cercus light-brown/brown; distal 1/3–3/5 of cercus distinctly bent posteriorly in profile; distal part of cercus with small spines/spine-like setulae dorsolaterally; phallus with a distinct hinge between basi- and distiphallus
.....**genus *Blaesoxipha* Loew 28**
28. Mid tibia with a strong anteroventral seta on distal half; abdomen covered in thick, yellowish-grey microtrichosity, usually only with a dark median vitta on tergites 3–4 when viewed posteriorly, sometimes with additional, elongated lateral dark spots on those tergites; abdomen usually with strong, erect median marginal setae on tergite 3; syntergosternite 7+8 and epandrium brown/blackish; cercus and phallus slender, brownish.....***Blaesoxipha (Blaesoxipha) plumicornis* (Zetterstedt, 1859)**
- Mid tibia without an anteroventral seta; abdomen covered in grey-silver microtrichosity, with much more extensive dark areas when viewed posteriorly; abdominal tergite 3 with or without median marginal setae; syntergosternite 7+8 and epandrium orange/red; cercus and phallus stouter
.....**subgenus *Blaesoxipha* (*Servaisia* Robineau-Desvoidy) 29**

29. Ventral margin of cercus, distal to surstylus, more or less straight in lateral view; tip of distiphallus short, directed apicoventrally and more or less straight; abdominal tergite 3 always with a pair of strong median marginal setae and usually with strong dorsalmost lateral marginals; frons, at its narrowest point, between 0.35 and 0.45 times the width of an eye in strict dorsal view***Blaesoxipha (Servaisia) erythrura* (Meigen, 1826)**
- Ventral margin of cercus, distal to surstylus, with a kink in lateral view, its tip distinctly downturned; tip of distiphallus arching in a ventral direction; abdominal tergite 3 with or without median marginal setae or with weak median marginals, and usually with weak dorsalmost lateral marginals; frons wider, at its narrowest point between 0.40 and 0.55 times the width of an eye in strict dorsal view
.....***Blaesoxipha (Servaisia) rossica* Villeneuve, 1912**
30. Thorax with 3 strong postsutural dorsocentral setae (Fig. 25); all setulae on gena black, if any light-coloured setulae present then these are few and confined to the posteriormost part of the gena close to the postgena, and the lowermost parafacial setae are very strong and long, projecting well beyond anterior margin of parafacial; outer vertical setae of head strong, distinct from strongest postoculars (Fig. 20), or weak (Fig. 26); wing: vein R₁ with or without setulae on dorsal surface; 4th costal sector shorter than, subequal to or longer than 6th costal sector; costal spine absent to long; distal setae on posteroventral surface of mid femur either visibly shorter and thicker or only slightly shortened and/or thickened; hind trochanter with or without a patch of short, spine-like setae on posteroventral surface**31**
- Thorax with 4 or more postsutural dorsocentral setae, the anteriormost 2 or more usually visibly shorter than the posteriormost 2 (Fig. 27); gena with some to several light-coloured setulae or with dark setulae only; outer vertical setae of head always short and indistinct from postocular setae; wing: vein R₁ bare on dorsal surface; 4th costal sector usually distinctly longer than 6th, or at least of subequal length; costal spine absent or very short; setae on posteroventral surface of mid femur visibly shorter and thicker on distal portion of femur; hind trochanter usually with a patch of very short, spine-like setae on posteroventral surface (Fig. 28)**61**
31. Epandrium shiny black or brownish; hind trochanter with or without modified, spine-like setae on posteroventral surface**32**
- Epandrium orange/red to dark red, at most slightly brownish anteroventrally; hind trochanter with a patch of short, spine-like setae on posteroventral surface**53**
32. Wing vein R₁ with a few (1–3), at least on one wing (Fig. 29), to several (Fig. 30) setulae on dorsal surface; occiput with or without black setulae below first two to three rows**33**

- Wing vein R₁ bare on dorsal surface; all occipital setulae light-coloured below the first two to three rows**38**

- 33. Frons very wide, between 3/4 and 1/1 of width of an eye in strict dorsal view; setulae on wing vein R₁ almost always reaching well beyond level of subcostal bend (Fig. 32); abdominal tergite 3 with a pair of strong, erect median marginal setae; outer vertical setae of head strong and long, easily distinguishable from strongest postocular setae; apical scutellar setae strongly bent upwards, at an angle of approximately 90° compared to the horizontal plane; costal spine conspicuously developed, longer than crossvein r-m; hind trochanter without modified setae; syntergosternite 7+8 covered in thin microtrichosity and without marginal setae; epandrium shiny black; cercus in profile gradually tapering from base to tip and with a distinctly hooked tip; pregonite without long setulae; distiphallus brown, subglobular, juxta as a short, spine-like dorsal projection (Fig. 33).....***Sarcophaga (Krameromyia) anaces* Walker, 1849**
- Frons narrower, at most about 3/5 of width of an eye in strict dorsal view; setulae on wing vein R₁ never reaching beyond level of subcostal bend (Fig. 30); combination of remaining characters not as above**34**

- 34. At the same time: postgena almost entirely covered in black setulae (Figs 24, 35) and costal spine very short or absent; abdominal tergite 3 with a pair of strong, erect median marginal setae; outer vertical setae of head not developed, indistinguishable from strongest postocular setae; posterior region of head above occiput usually entirely covered in black setulae; thorax with 2–3 asymmetric pairs of long, fine presutural acrostichal setae, distinct from ground thoracic setation; wing vein R₁ usually with 1–3 setulae on dorsal surface (Fig. 29), sometimes bare; costal spine absent or extremely short; hind trochanter without modified setae; syntergosternite 7+8 covered in thin microtrichosity and without marginal setae; epandrium shiny black; cercus in profile more or less parallel-sided from base to tip and with a distinctly hooked tip; pregonite without long setulae; distiphallus dark brown, subglobular, with a conspicuous desclerotised area (“window”) laterally (Fig. 34)
.....***Sarcophaga (Mehria) sexpunctata* (Fabricius, 1805)**
- Postgena usually without black setulae; if few to several black setulae are present anteriorly on postgena, then costal spine long, similar to length of crossvein r-m; combination of remaining characters not as above**35**

- 35. Abdominal tergite 3 with a pair of strong, erect median marginal setae; wing vein R₁ usually with several (4–5 or more) setulae on dorsal surface; 4th costal sector usually distinctly shorter than 6th; anterior part of wing from slightly to distinctly darkened; postgena often with few to several black setulae**36**
- Abdominal tergite 3 usually without median marginal setae; if a pair of decumbent or erect marginals is present, then wing vein R₁ at most with 1 isolated setula on dorsal

- surface, often only on one wing; 4th costal sector variable from distinctly longer to slightly shorter than 6th; anterior part of wing never conspicuously darkened; postgena entirely covered in white setulae.....**37**
36. Syntergosternite 7+8 usually with a conspicuous median spot of grey-silver microtrichosity near posterior margin; cercus in profile with a distinct, rounded preapical dorsal hump (Fig. 36); scutellum often lacking scutellar setae or with a single seta at apex; abdominal syntergite 1+2 often with a pair of median marginal setae or with a single seta; outer vertical setae often not well differentiated from strongest postocular setae; pregonite with several long setulae on dorsal surface; juxta of distiphallus with apically widening (spoon-shaped) membranous basal processes, which are longer than median part of juxta in lateral view (Fig. 36).....
.....***Sarcophaga (Heteronychia) depressifrons* Zetterstedt, 1845**
- Syntergosternite 7+8 without microtrichosity, or at most with a tiny median patch of silver microtrichosity near posterior margin; cercus in profile gradually tapering from base to tip; pregonite with several long setulae on dorsal surface; scutellum usually with a pair of apical setae; abdominal syntergite 1+2 without median marginal setae; outer vertical setae usually well differentiated from strongest postocular setae; juxta of distiphallus without membranous basal processes (Fig. 37)
.....***Sarcophaga (Heteronychia) dissimilis* Meigen, 1826**
37. Head with strong outer vertical setae, well differentiated from strongest and longest postocular setae; lower facial margin, in strict lateral view, usually well visible beyond vibrissal angle; scutellum lacking apical setae [NB: exceptions may occur]; hind trochanter with a patch of shortened, spine-like setae on posteroventral surface; costal spine long, usually longer than crossvein r-m; 4th costal sector usually about subequal to or shorter than 6th, rarely longer; syntergosternite 7+8 with or without a small median patch of grey-silver microtrichosity close to posterior margin; epandrium dark brown; cercus deeply hollowed dorsally, with a short, rapidly tapering, downturned tip; juxta of distiphallus with long, apically upturned tubular processes at base (Fig. 59)***Sarcophaga (Heteronychia) pumila* Meigen, 1826**
- Outer vertical setae of head of similar length and thickness as postoculars; lower facial margin not visible beyond vibrissal angle in lateral view; scutellum usually with a pair of apical setae (sometimes with a single apical seta, rarely without apicals); hind trochanter without modified setae; costal spine visibly shorter than crossvein r-m; 4th costal sector usually about subequal to or shorter than 6th, rarely longer; syntergosternite 7+8 with a complete band of grey microtrichosity approximately on posterior half; epandrium shiny black; cercus black, gradually tapering in profile from base to ventrally curved, pointed tip; pregonite short, brown, bare, with a blunt apex; distiphallus large, brown, mostly weakly sclerotised, with a conspicuous vesica (Fig. 64)***Sarcophaga (Bellieriomima) subulata* Pandellé, 1896**

38. Postgena almost entirely covered in black setulae (Fig. 24); abdominal tergite 3 with a pair of strong, erect median marginal setae; outer vertical setae of head not developed, indistinguishable from strongest postocular setae; posterior region of head above occiput usually entirely covered in black setulae; thorax with 2–3 asymmetric pairs of long, fine presutural acrostichal setae, distinct from ground thoracic setation; wing vein R₁ usually with 1–3 setulae on dorsal surface, sometimes bare; costal spine absent or extremely short; hind trochanter without modified setae; syntergosternite 7+8 covered in thin microtrichosity and without marginal setae; epandrium shiny black; cercus in profile more or less parallel-sided from base to tip and with a distinctly hooked tip; pregonite without long setulae; distiphallus dark brown, subglobular, with a conspicuous desclerotised window laterally (Fig. 34)
.....*Sarcophaga (Mehria) sexpunctata* (Fabricius, 1805)
- Postgena at most with a few black setulae anteriorly; combination of remaining characters not as above.....**39**
39. Abdominal tergite 3 with a pair of strong, erect median marginal setae (rarely weak, decumbent, but hind trochanter without modified setae) (Fig. 31).....**40**
- Abdominal tergite 3 without median marginal setae (if a weak, decumbant pair is present (Fig. 40), then scutellum almost always lacking apical setae and hind trochanter with a ventral patch of short, spine-like setae).....**48**
40. Anterior surface of mid femur with a large patch of short, yellow-golden setulae on apical 2/5 (Fig. 41); mid femur with a patch of short, yellow-golden setulae near middle of posterior surface; outer vertical setae of head well developed and differentiated from strongest postocular setae; apical scutellar setae strong and at an angle of about 45° compared to the horizontal plane; costal spine long; small spines on costa reaching from 4/5 to entire length of 6th costal sector; hind trochanter with a patch of shortened, spine-like setae on posteroventral surface; syntergosternite 7+8 without, or with few very weak, marginal setae, and without microtrichosity; epandrium black; cercus mostly bare (rarely a few fine setulae) on apical 2/3 to 1/2, with a few small spines laterally near apex; pregonite bare; distiphallus black, with a well developed, protruding vesica (Fig. 42)*Sarcophaga (Sarcotachinella) sinuata* Meigen, 1826
- Mid femur without patches of yellow-golden setulae; combination of other remaining characters not as above.....**41**
41. Hind trochanter with a patch of shortened, spine-like setae on posteroventral surface (Fig. 28); syntergosternite 7+8 with a broad posterior band of microtrichosity or with a small, round median spot of grey-silver microtrichosity near margin; syntergosternite 7+8 with or without strong marginal setae**42**

- Hind trochanter without modified setae (Fig. 43); syntergosternite 7+8 diffusely microtrichose or bare; syntergosternite 7+8 without, or with weak to very fine, marginal setae.....**43**

- 42. Wing: 4th costal sector shorter than 6th; costal spine long, longer than crossvein r-m; spines on costa reaching approximately 3/4–4/5 of length of 6th costal sector; wing veins generally of a light brown colour (Fig. 44); thorax with 2–3 asymmetric pairs of fine presutural acrostichal setae, distinct from ground thoracic setation; general microtrichosity of thorax and abdomen yellowish-grey; middorsal depression on syntergite 1+2 reaching margin of syntergite; syntergosternite 7+8 with a small, round median spot of grey-silver microtrichosity near margin and with strong marginal setae; epandrium dark brown; cercus brown with a bare patch laterally, gradually broadening in profile from base to a subapical dorsal hump, then rapidly tapering to apex; pregonite long, with several long setulae on dorsal surface, light brown, semi-transparent distally; distiphallus brownish, spindle-shaped (Fig. 45)
.....*Sarcophaga (Heteronychia) filia* Rondani, 1860

- Wing: 4th costal sector longer than (or subequal to) 6th; costal spine shorter than crossvein r-m; spines on costa reaching approximately 2/5–2/3 of length of 6th costal sector; wing veins generally of a dark brown colour (Fig. 46); presutural acrostichal setae more or less undifferentiated from ground setation of thorax; general microtrichosity of thorax and abdomen grey; middorsal depression on syntergite 1+2 usually not quite reaching margin of syntergite; syntergosternite 7+8 with a broad posterior band of microtrichosity; epandrium black; cercus black and thickly covered in fine setulae almost to tip, gradually tapering in profile from base to apex; pregonite short with a few very short setulae on dorsal surface; distiphallus black, with a rounded, ventrally-directed juxta (Fig. 47)
.....*Sarcophaga (Helicophagella) rosellei* Böttcher, 1912

- 43. Lowest parafacial setae very strong and long, projecting far beyond anterior margin of parafacial in profile (Figs 18, 23); thorax with 2–3 asymmetric pairs of strong presutural acrostichal setae, well distinct from ground thoracic setation; gena with or without a few white setulae just anterior to postgena; vein R₄₊₅ with setulae from fork with R₂₊₃ to 4/5–1/1 of distance to crossvein r-m (or beyond); syntergosternite 7+8 without microtrichosity**subgenus *Sarcophaga (Myorhina)* Robineau-Desvoidy 44**

- Lowest parafacial setae of normal thickness and length, at most projecting slightly beyond anterior margin of parafacial in profile (Fig. 48); presutural acrostichal setae undifferentiated from ground setation of thorax or weak; gena entirely covered in black setulae; vein R₄₊₅ with setulae from fork with R₂₊₃ to about 3/4 of the distance to crossvein r-m; syntergosternite 7+8 with a broad posterior band of microtrichosity ..**46**

44. Gena with a few white setulae posteriorly, just anterior to postgena (Fig. 49); juxta of distiphallus not elongated..... **45**
- Gena entirely covered in black setulae (Fig. 18); outer vertical setae of head strong and long, well distinct from strongest postocular setae; scutellum with a pair of strong apical setae; epandrium shiny black; cercus dark brown-black, gradually tapering from base to apex, slightly ventrally curved and with a hooked tip; pregonite bare; juxta of distiphallus as an elongated, ventro-apically directed rostrum (Fig. 50)
..... ***Sarcophaga (Myorhina) villeneuvei* Böttcher, 1912**
45. Juxta of distiphallus with two apical processes (Fig. 51); pregonite bare, with a bulky, three-dimensional tip; postgonite with a flattened, blunt tip; [outer vertical setae of head strong and long, well distinct from strongest postocular setae; scutellum with a pair of strong apical setae; epandrium shiny black; cercus dark brown-black, gradually tapering from base to apex, slightly ventrally curved and with a hooked tip (Fig. 51)]
..... ***Sarcophaga (Myorhina) nigriventris* Meigen, 1826**
- Juxta of distiphallus with a single, ventrally-directed apical process (Fig. 52); pregonite bare, appearing somewhat shortened with a flat, two-dimensional tip; postgonite with a sharp, pointed tip; [outer vertical setae of head strong and long, well distinct from strongest postocular setae; scutellum with a pair of strong apical setae; epandrium shiny black; cercus dark brown-black, gradually tapering from base to apex, slightly ventrally curved and with a hooked tip (Fig. 52)]
..... ***Sarcophaga (Myorhina) soror* Rondani, 1860**
46. Hind femur with only fine setae on anteroventral surface in addition to strong subapical one (Fig. 53); mid femur with only fine setae on posteroventral surface, these somewhat thickening and shortening distally (Fig. 54); abdominal tergite 3 with a pair of short, decumbent median marginal setae; outer vertical setae of head indistinguishable from strongest postoculars; 4th costal sector distinctly longer than 6th; costal spine very short or absent; syntergosternite 7+8 without marginal setae; epandrium shiny black; cercus black, short, gradually tapering in profile from broad base to pointed tip, and covered in long setulae except for very tip; pregonite short, dark brown, with a flattened, blunt tip and with minute setulae on dorsal surface; distiphallus slender and elongated, s-shaped, without any visible processes (Fig. 55).....
..... ***Sarcophaga (Helicophagella) hirticrus* Pandellé, 1896**
- Hind femur with strong setae on anteroventral surface in addition to strong subapical one (Fig. 56); mid femur with strong setae along most of posteroventral surface, these slightly or distinctly shortening distally; median marginal setae on abdominal tergite 3 usually strong and upright, rarely weak, decumbent; outer vertical setae of head indistinguishable from strongest postoculars or somewhat stronger or longer; 4th costal sector shorter than, subequal to or longer than 6th; costal spine short to medium, at most

- about as long as crossvein r-m; syntergosternite 7+8 without or with weak to very fine marginal setae.....**47**
47. Thorax with 1–3 asymmetric pairs of fine presutural acrostichal setae, distinct from ground thoracic setation; frons narrow, between 1/3 and 1/2 of width of an eye in strict dorsal view; prescutellar acrostichal setae well developed; costal spine usually distinctly shorter than crossvein r-m; 4th costal sector distinctly longer than 6th; setae on posteroventral surface of mid femur visibly shorter on distal portion of femur; middorsal depression on syntergite 1+2 reaching margin of syntergite; syntergosternite 7+8 without, or with very fine, marginal setae; epandrium shiny black; cercus black; in profile gradually tapering from base to pointed apex and usually with a distinct ventral curvature; pregonite short, with a pointed tip and with a few very short setulae on dorsal surface; distiphallus longer than wide, with a large, ventrally-directed juxta (Fig. 57) ***Sarcophaga (Helicophagella) agnata Rondani, 1860***
- Presutural acrostichal setae more or less undifferentiated from ground setation of thorax; frons wider, usually more than 1/2 of width of an eye in strict dorsal view; prescutellar acrostichal setae often absent or weak; costal spine longer, often subequal to crossvein r-m; 4th costal sector variable from shorter to longer than 6th costal sector; setae on posteroventral surface of mid femur only slightly shorter on distal portion of femur; middorsal depression on syntergite 1+2 often not reaching margin of syntergite; syntergosternite 7+8 usually with weak marginal setae; epandrium shiny black; cercus black; in profile gradually tapering from base to pointed apex and from slightly curved to flat ventrally; pregonite short, bare, with a pointed tip; distiphallus shorter, about as long as wide, with a smaller juxta (Fig. 58).....
-***Sarcophaga (Helicophagella) crassimargo Pandellé, 1896***
48. Hind trochanter with a patch of shortened, spine-like setae on posteroventral surface (Fig. 28); syntergosternite 7+8 with or without microtrichosity**49**
- Hind trochanter without modified setae (Fig. 43); syntergosternite 7+8 with a broad posterior band of grey microtrichosity**51**
49. Scutellum lacking apical setae (rarely discal setae displaced very close to margin of scutellum and close together, but these are long and never crossed); lower facial margin, in lateral view, usually at least slightly visible beyond vibrissal angle; middorsal depression on syntergite 1+2 not reaching margin of syntergite (very rare exceptions); generally smaller specimens (4–8 mm); outer vertical setae of head strong, well distinguishable from strongest postocular setae; costal spine long, usually longer than crossvein r-m; syntergosternite 7+8 with or without a small median patch of grey-silver microtrichosity close to posterior margin; cercus deeply hollowed dorsally, with a short, rapidly tapering downturned tip; juxta of distiphallus with long, apically upturned tubular processes at base (Fig. 59)

-*Sarcophaga (Heteronychia) pumila* Meigen, 1826
- Scutellum with a pair of apical setae; lower facial margin, in lateral view, usually not visible beyond vibrissal angle; middorsal depression on syntergite 1+2 reaching margin of syntergite; generally larger specimens (8–13 mm); outer vertical setae of head well distinguishable from strongest postocular setae or not; costal spine short, never as long as crossvein r-m; syntergosternite 7+8 with or without microtrichosity; other characters not as above.....50
50. Outer vertical setae of head strong (Fig. 20), well distinguishable from strongest postocular setae; 4th costal sector distinctly longer than 6th; syntergosternite 7+8 shiny black, without microtrichosity or at most with very thin microtrichosity laterally; syntergosternite 7+8 with strong marginal setae; epandrium shiny black; inner margins of processes of sternite 5 v-shaped; processes of sternite 5 with conspicuous patches of tightly-spaced, spine-like setae of equal length near base and brushes of longer, thick setae along inner margins; cercus black, gradually tapering from base to pointed tip in profile; tip with a distinct ventral curvature; pregonite black, short, bare and hook-shaped; distiphallus black, without a lateral desclerotized window and with a ventrally-directed juxta (Fig. 62).....*Sarcophaga (Helicophagella) melanura* Meigen, 1826
- Outer vertical setae of head often indistinguishable from strongest postocular setae; 4th costal sector slightly longer than or subequal to 6th; syntergosternite 7+8 with a broad posterior band of thick, grey microtrichosity; syntergosternite 7+8 without marginal setae, at most with one or two slightly stronger setae at margin; epandrium shiny black; inner margins of processes of sternite 5 broadly u-shaped, with brushes of spine-like setae of irregular length beyond middle; cercus black; in profile more or less parallel-sided up to preapical dorsal hump, then rapidly tapering to a fine, hooked tip; pregonite brown, long, bare, with a blunt apex; distiphallus black with a large lateral desclerotized window; juxta of distiphallus laterally flattened with two flagellum-like processes at base; vesica with long spines (Fig. 63)
-*Sarcophaga (Thyrsocnema) incisilobata* Pandellé, 1896
51. Setae on posteroventral surface of mid femur visibly shorter and thicker on distal 1/2 to 2/5 of femur; underside of scutellum often with numerous short hairs on most of its surface including middle; outer vertical setae of head indistinguishable from strongest postocular setae; 4th costal sector usually distinctly longer than 6th, rarely subequal; hind femur with a few strong setae on anteroventral surface in addition to strong subapical one; syntergosternite 7+8 with strong marginal setae; epandrium shiny black; cercus black, gradually tapering from base to ventrally curved, pointed tip in profile; pregonite short, brown, bare, with blunt apex; distiphallus large, brown, mostly weakly sclerotised, with conspicuous vesica (Fig. 64).....
-*Sarcophaga (Bellieriomima) subulata* Pandellé, 1896

- Setae on posteroventral surface of mid femur only slightly shorter and thicker towards distal end of femur; underside of scutellum with short hairs only laterally, rarely a few isolated hairs close to middle; outer vertical setae of head indistinguishable from or slightly longer and stronger than strongest postocular setae; 4th costal sector from shorter to longer than 6th; hind femur with or without strong setae on anteroventral surface in addition to strong subapical one; syntergosternite 7+8 with or without marginal setae, if present usually weak.....**52**

- 52. Hind femur with strong setae on anteroventral surface in addition to strong subapical one; mid femur with strong setae along most of posteroventral surface, these slightly shortening distally; outer vertical setae indistinguishable from or slightly longer and stronger than strongest postoculars; prescutellar acrostichal setae often absent or weak; 4th costal sector from shorter to slightly longer than 6th; costal spine short to medium, at most about as long as crossvein r-m; middorsal depression on syntergite 1+2 often not reaching margin of syntergite; syntergosternite 7+8 with (usually weak) marginal setae; [epandrium shiny black; cercus black; in profile gradually tapering from base to pointed apex and from slightly curved to flat ventrally; pregonite short, bare, with pointed tip; distiphallus short, about as long as wide, with small juxta (Fig. 65)]***Sarcophaga (Helicophagella) crassimargo* Pandellé, 1896**

- Hind femur without strong setae on anteroventral surface in addition to strong subapical one; mid femur with only fine setae on posteroventral surface, these somewhat thickening and shortening distally; outer vertical setae indistinguishable from strongest postoculars; prescutellar acrostichal setae well developed; 4th costal sector distinctly longer than 6th; costal spine very short or absent; middorsal depression on syntergite 1+2 reaching margin of syntergite; syntergosternite 7+8 without marginal setae; [epandrium shiny black; cercus black, short, gradually tapering in profile from broad base to pointed tip and covered in long setulae except for very tip; pregonite short, dark brown, with a flattened, blunt tip and with minute setulae on dorsal surface; distiphallus slender and elongated, s-shaped, without any visible processes (Fig. 55)].....
..... ***Sarcophaga (Helicophagella) hirticrus* Pandellé, 1896**

- 53. Wing vein R₁ with at least one seta on dorsal surface, at least on one wing**54**

- Wing vein R₁ bare on dorsal surface, on both wings**58**

- 54. Wing vein R₁ with several (usually more than 4) tightly-spaced setulae on dorsal surface (Fig. 30); abdominal tergite 3 with a pair of strong, erect median marginal setae; syntergosternite 7+8 with a conspicuous subcircular median spot of grey-silver microtrichosity near posterior margin; [cercus with a dorsal hump proximal to tip; tip of cercus distal to hump elongated (1/4 or more of total length of cercus) and more or less parallel-sided although slightly narrowing distally (Fig. 38); pregonite with several long setulae on dorsal surface; juxta of distiphallus with apically widening (spoon-

- shaped) membranous basal processes which are shorter than long median process of juxta in lateral view (Fig. 38)]
.....*Sarcophaga (Heteronychia) haemorrhoea* Meigen, 1826¹
- Wing vein R₁ with few (1–3, rarely 4 or more) setulae on dorsal surface (widely-spaced when more than 1); abdominal tergite 3 with or without median marginal setae; syntergosternite 7+8 with a similar median spot of grey-silver microtrichosity or reduced to various degrees from a narrow median patch to absent55
55. Wing vein R₁ usually with 1–3 (rarely 4 or more) setulae on dorsal surface (widely-spaced when more than 1); abdominal tergite 3 almost always with strong, erect median marginal setae, very rarely without median marginals; setae on posteroventral surface of mid femur visibly shorter and thicker on distal portion of femur, the shortened setae being all of subequal length; [syntergosternite 7+8 with a narrow, oblong median patch of grey-silver microtrichosity near margin; cercus with only a small dorsal hump proximal to tip; portion of cercus distal to hump less than 1/4 of total length of cercus and gradually tapering to apex (Fig. 39); pregonite with several long setulae on dorsal surface; juxta of distiphallus without membranous basal processes; ventral membrane at base of distiphallus distinctly swollen, protruding (Fig. 39)]
.....*Sarcophaga (Heteronychia) vagans* Meigen, 1826
- Wing vein R₁ with at most 1 setula on dorsal surface, often only on one wing (exceptions with more than 1 setula may occur); abdominal tergite 3 usually without median marginal setae; setae on posteroventral surface of mid femur only slightly thickened on distal portion of femur and gradually shortening towards apex of femur56
56. Costal spine of medium length, visibly shorter than crossvein r-m; syntergosternite 7+8 with a narrow, sometimes inconspicuous patch of grey-silver microtrichosity near posterior margin; cercus with only a slight dorsal hollowing and with a large bare patch laterally from level of middle of surstylus to tip; pregonite with a pointed, hooked tip (Fig. 61); juxta of distiphallus without tubular basal appendages (Fig. 61); [distiphallus conspicuously elongated]*Sarcophaga (Heteronychia) vicina* Macquart, 1835
- Costal spine long, often longer than crossvein r-m, at most slightly shorter; if visibly shorter, then wing veins light brown and syntergosternite 7+8 with a large median spot of grey-silver microtrichosity near posterior margin; cercus with a deep dorsal hollowing and setulose on entire lateral surface except on tip; pregonite with a blunt, rounded tip; juxta of distiphallus with tubular basal appendages (Figs 59–60).....57

¹ A close relative of *S. (H.) haemorrhoea*, *S. (H.) bulgarica* (Enderlein, 1936), was recently discovered in England (Whitmore *et al.*, unpublished). A provisional couplet distinguishing males of these two species can be found [here](#).

57. Scutellum usually with a pair of apical setae (rarely absent); syntergosternite 7+8 with a large median spot of grey-silver microtrichosity near posterior margin; tip of cercus slightly upturned or straight (Fig. 60)
.....***Sarcophaga (Heteronychia) arcipes* Pandellé, 1896**
- Scutellum usually lacking apical setae (sometimes discal setae displaced very close to margin, but these can be distinguished from apical setae by never being crossed); syntergosternite 7+8 with somewhat more reduced microtrichosity confined to a smaller area close to posterior margin or absent; tip of cercus downturned (Fig. 59)***Sarcophaga (Heteronychia) pumila* Meigen, 1826**
58. Abdominal tergite 3 almost always with strong, erect median marginal setae, very rarely without median marginals; setae on posteroventral surface of mid femur visibly shorter and thicker on distal portion of femur, the shortened setae being all of subequal length; [syntergosternite 7+8 with a narrow, oblong median patch of grey-silver microtrichosity near margin; cercus with only a small dorsal hump proximal to tip; tip of cercus distal to hump less than 1/4 of total length of cercus and gradually tapering to apex (Fig. 39); pregonite with several long setulae on dorsal surface; juxta of distiphallus without membranous basal processes; ventral membrane at base of distiphallus distinctly swollen, protruding (Fig. 39)]***Sarcophaga (Heteronychia) vagans* Meigen, 1826**
- Abdominal tergite 3 usually without median marginal setae; setae on posteroventral surface of mid femur only slightly thickened on distal portion of femur and gradually shortening towards apex of femur**59**
59. Costal spine of medium length, visibly shorter than crossvein r-m; syntergosternite 7+8 with a narrow, sometimes inconspicuous patch of grey-silver microtrichosity near posterior margin; cercus with only a slight dorsal hollowing and with a large bare patch laterally from level of middle of surstylus to tip; pregonite with a pointed, hooked tip (Fig. 61); juxta of distiphallus without tubular basal appendages (Fig. 61); [distiphallus conspicuously elongated]***Sarcophaga (Heteronychia) vicina* Macquart, 1835**
- Costal spine long, often longer than crossvein r-m, at most slightly shorter; if visibly shorter, then wing veins light brown and syntergosternite 7+8 with a large median spot of grey-silver microtrichosity near posterior margin; cercus with a deep dorsal hollowing and setulose on entire lateral surface except on tip; pregonite with a blunt, rounded tip; juxta of distiphallus with tubular basal appendages (Figs 59–60).....**60**
60. Scutellum usually with a pair of apical setae (rarely absent); syntergosternite 7+8 with a large median spot of grey-silver microtrichosity near posterior margin; tip of cercus slightly upturned or straight (Fig. 60)
.....***Sarcophaga (Heteronychia) arcipes* Pandellé, 1896**

- Scutellum usually lacking apical setae (sometimes discal setae displaced very close to margin, but these can be distinguished from apical setae by never being crossed); syntergosternite 7+8 with somewhat more reduced microtrichosity confined to a smaller area close to posterior margin or absent; tip of cercus downturned (Fig. 59) *Sarcophaga (Heteronychia) pumila* Meigen, 1826
- 61. Gena entirely covered in black setulae; epandrium dark brown or black (light brown in old preserved specimens) **62**
- Gena with white setulae on part to most of surface or with at least a few white setulae posteriorly near postgena; epandrium black, dark brown, orange/dark orange or red/dark red **69**
- 62. Base of sternite 5 blade-like, strongly protruding and well visible beyond ventral line of abdomen in lateral view (Fig. 66); microtrichosity of parafacial intensely golden; thorax with 4–5 postsutural dorsocentral setae, the posteriormost two much longer and thicker than the anteriormost two–three; abdominal tergite 3 often with a pair of short, decumbent median marginal setae; general microtrichosity of abdomen with a somewhat bluish hue; syntergosternite 7+8 covered in thick, grey microtrichosity and without marginal setae; epandrium shiny black; cercus dark brown; in profile parallel-sided from base to rapidly tapering, short, pointed tip; pregonite well sclerotised, dark brown, short, gently curved and with pointed apex; distiphallus with well-developed and ventrally-protruding vesica and harpes and ventrally-directed juxta (Fig. 66) *Sarcophaga (Rosellea) aratrix* Pandellé, 1896
- Base of sternite 5 not strongly protruding, at most slightly visible in lateral view; microtrichosity of parafacial variable from grey-silver to golden-silver or intensely golden; thorax with postsutural dorsocentral setae as above (sometimes up to 5–6) or with 4 setae, the anteriormost two shorter or distinctly shorter than the posteriormost two; abdominal tergite 3 with or without median marginal setae; general microtrichosity of abdomen variable **63**
- 63. Abdominal tergite 3 usually with a pair of strong, erect (sometimes weak and/or decumbent) median marginal setae, rarely with a single (weak) median marginal seta; thorax usually with 4 postsutural setae, the anteriormost two of subequal thickness and about 3/5 of length of the posteriormost two; rarely an additional, shorter seta is present anterior to or among the other four, rarely one or two of the four setae can be much finer than the others; sternite 5 with an elongated (longer than wide) desclerotised triangular area at base (Fig. 67) and with fine setae along inner margins of processes; parafacial wide, usually from more than 2/5 to 3/5 of shortest eye diameter in strict lateral view; syntergosternite 7+8 shiny black (brown in old preserved specimens) with only very thin microtrichosity and usually with weak marginal setae; cercus dark brown/black; in profile more or less parallel-sided from base to 3/4–4/5 of length, then

- rapidly tapering to a pointed, hooked tip; cercus with preapical ventral hump proximad to hooked tip; pregonite bare, long, with blunt apex.....
- **subgenus *Sarcophaga* (*Sarcophaga* Meigen) 64**
- Abdominal tergite 3 without median marginal setae or with a pair of short, weak, decumbant median marginals; thorax with 4–6 postsutural dorsocentral setae, increasing in length from the (shortest) anteriormost to the (longest) posteriormost, sometimes with additional shorter setae among them; sternite 5 with a small (shorter than wide) desclerotised (rarely sclerotised) triangular area at base and usually with brushes of distinctly thickened, tightly-spaced setae along inner margins of processes (Fig. 68); parafacial from 1/5 to less than 2/5 of shortest eye diameter in strict lateral view; colour of syntergosternite 7+8 variable; syntergosternite 7+8 with thick grey microtrichosity over much of its surface..... **66**
64. Tangent line between ventral margin of cercus at level of surstylus and margin of ventral preapical hump usually not intercepting hooked tip of cercus; basal plate of distiphallus small, occupying ca. 1/5 (always less than 1/4) of total length of distiphallus; vesica of distiphallus very large, occupying ca. 3/5 of total length of distiphallus; lateral styli short, slightly angled ventrally at tip and covered by large membranous juxta (Fig. 69)
- ***Sarcophaga* (*Sarcophaga*) *subvicina* Rohdendorf, 1937**
- Tangent line between ventral margin of cercus at level of surstylus and margin of ventral preapical hump usually intercepting hooked tip of cercus; basal plate of distiphallus large, occupying more than 1/3 of total length of distiphallus; vesica of distiphallus smaller, occupying ca. 2/5 of total length of distiphallus; lateral styli longer and ventroapically angled from their base **65**
65. Distiphallus (Figs 71, 151): tangent line between margin of ventral plate (*) and margin of vesica (#) passing well clear of tip of lateral styli (a) (Fig. 151); juxta (b) usually without a protuberance at base and with a narrow apex not arching over sides of lateral styli..... ***Sarcophaga* (*Sarcophaga*) *caritaria* (Linnaeus, 1758)**
- Distiphallus (Figs 70, 152–153): tangent line between margin of ventral plate (*) and margin of vesica (#) crossing tip of lateral styli (fig. 2) or passing very close to tip (fig. 3); juxta often with a more or less right-angled protuberance at base (c), and broadly arching over sides of lateral styli apically (d)
- ***Sarcophaga* (*Sarcophaga*) *variegata* (Scopoli, 1763)**
66. Sternite 5 with at most slightly thickened, irregular setation along inner margins; hind trochanter with only slightly shortened and thickened setae among long setulae on posteroventral surface; syntergosternite 7+8 with marginal setae; general microtrichosity of body slightly bluish, particularly on lateral surface of abdominal tergites; epandrium black; cercus black; in profile gradually tapering from base to

- pointed tip and with a distinct ventral curvature; pregonite brown, of medium length, bare, with a blunt tip and with a small spine-like process lateroventrally near base; distiphallus well sclerotised, dark brown, with large desclerotised lateral window and large, sickle-shaped harpes and protruding vesica; juxta of distiphallus, in lateral view, large, ventrally directed and with forked apex (Fig. 72); processes of juxta curving inwards towards apex, joining together so as to form an almost closed circle in apical view ***Sarcophaga (Robineauella) caerulea* Zetterstedt, 1838**
- Sternite 5 with more or less regular brushes of shortened and thickened setae along inner margins of processes; hind trochanter with a patch of very short, spine-like setae on posteroventral surface; syntergosternite 7+8 without marginal setae; combination of remaining characters not as above **67**
67. Parafacial with numerous unarranged short setulae on upper half, also anteriorly; thorax with symmetrical pair of fine, long presutural acrostichal setae just anterior to suture (Fig. 73) in addition to 1–2 asymmetric pairs of fine presutural acrostichals distinct from ground thoracic setation; epandrium black; cercus dark brown, somewhat irregular in profile, more or less parallel sided before rapidly tapering to curved pointed tip; cercus with deep dorsal hollowing becoming visible laterally at tip; cercus with long setulae only on basal half, with preapical tuft of short setulae dorsally and short spines laterally on distal third; pregonite light brown, apparently bare or with minute setulae dorsally, and with blunt apex; distiphallus light brown, with large lateral desclerotised window and an elaborate, C-shaped vesica; juxta of distiphallus in profile large, apicoventrally directed and with blunt tip; processes of juxta incurving and with joining tips in apical view (Fig. 74)..... ***Sarcophaga (Varirosellea) uliginosa* Kramer, 1908**
- Parafacial with few unarranged short setulae on upper half, at most with a few scattered setulae anteriorly; thorax without presutural acrostichal setae or at most with a 1–2 asymmetric pairs of fine presutural acrostichals slightly distinct from ground thoracic setation; combination of remaining characters not as above **68**
68. Thorax with 5–6 postsutural dorsocentral setae increasing in length from anteriormost to posteriormost, sometimes with additional shorter setae among them; abdominal tergite 3 without median marginal setae or with a pair of short, weak, decumbant median marginals; syntergosternite 7+8 brown; cerci dark brown, separated distally in dorsal view by about 1/3 of their total length; cercus in profile gradually tapering from base to pointed tip and with a ventral curvature; pregonite brown, of medium length, with pointed apex and a few minute setulae on dorsal surface; distiphallus light brown and rather desclerotised; juxta hood-shaped, with two long tubular processes at base; vesica with two, tapering pointed processes (Fig. 75)
..... ***Sarcophaga (Pandelleisca) similis* Meade, 1876**
- Thorax usually with 4 (sometimes 5) postsutural dorsocentral setae: the anteriormost two subequal in length and short, ca. 1/2 length of posteriormost seta; abdominal tergite

3 without median marginal setae; cerci black, separated distally in dorsal view by more than 2/5 of their total length; cercus rather narrow in profile, gradually tapering from base to slightly hooked tip and with a slight ventral curvature; pregonite dark brown, long, broad from base almost to hooked apex; distiphallus ventrally with a conspicuously developed, desclerotised harpes with distinct twist at apex; juxta of distiphallus well sclerotized with short, pointed hood-like tip and long forked processes arising from base (Fig. 76).....

..... *Sarcophaga (Liosarcophaga) portschinskyi* (Rohdendorf, 1937)

69. Syntergosternite 7+8 with few to several weak to strong marginal setae; in doubtful cases where marginal setae are extremely weak, then microtrichosity on syntergosternite 7+8 confined to a broad median patch on distal half, only marginally reaching sides of segment, and white setulae reaching all the way to anterior margin of gena (black setulae confined to upper anterior portion of gena); distiphallus with or without a desclerotised window **70**

- Syntergosternite 7+8 without marginal setae and with thick microtrichosity also laterally; white setulae on gena not reaching anterior margin, at most a few isolated white setulae near lower anterior margin; distiphallus with conspicuous desclerotised window laterally..... **71**

70. White setulae reaching anterior margin of gena, lower anterior margin with at most a few isolated black setulae at or near margin; desclerotised area at base of sternite 5 large, wider than long; syntergosternite 7+8 with row of marginal setae, these sometimes very weak, and with microtrichosity confined to a broad median patch on distal half, only marginally reaching sides of segment; epandrium variable from orange/light red to dark red; cercus brown, bare on approximately apical 1/3, which is partly desclerotised, semi-transparent; cercus broad in profile, with a dorsal saddle and preapical hump; tip of cercus slightly ventrally directed and blunt; pregonite light brown with minute setulae on dorsal surface and blunt apex; distiphallus large, elaborate, with large desclerotised dorsal window and well-developed vesica, harpes and basal processes of juxta (Fig. 77)..... *Sarcophaga (Liopygia) argyrostoma* (Robineau-Desvoidy, 1830)²

- White setulae on gena not reaching anterior margin, at most a few isolated white setulae near lower anterior margin; desclerotised area at base of sternite 5 conspicuous but smaller, about as long as wide; syntergosternite 7+8 with a few (often just two) strong marginal setae, and with thick microtrichosity also laterally; epandrium variable from orange/light red to black; cercus dark brown with a slight dorsal hollowing; in profile with a deep notch at about proximal third; apical 2/3 gradually tapering to hooked tip, sinuous; pregonite dark brown with broad base and hooked tip and with minute setulae on dorsal surface; distiphallus dark brown, strongly sclerotised and without a

² The closely related species *S. (L.) crassipalpis* Macquart, 1839 was recently collected in southern England (Whitmore & Hall, unpublished). Distinguishing characters between males of these two species are mainly in the distiphallus (see Richet *et al.* 2011: 239–240).

desclerotised window; vesica and juxta at a right angle compared to main axis of distiphallus, somewhat “spanner-shaped” (Fig. 78).....

.....*Sarcophaga (Bercaea) africa* (Wiedemann, 1824)

71. Epandrium red/dark red, usually darkened at anterior margin; desclerotised area at base of sternite 5 large, distinctly longer than wide; cercus black, gradually tapering in profile from base to slightly hooked tip, and with a slight ventral curvature; pregonite brown, of medium length, with hooked tip and minute setulae on dorsal surface; distiphallus with well developed vesica, longer than harpes in lateral view; harpes desclerotised with small apical twist; apical portion of juxta small with an elongated hood-shaped tip; juxta with long, apically-forked basal processes (Fig. 79).....

.....*Sarcophaga (Liosarcophaga) jacobsoni* (Rohdendorf, 1937)

- Epandrium dark brown/black; desclerotised area at base of sternite 5 large or small, never longer than wide; combination of remaining characters not as above **72**

72. White setulae on gena confined to posteriormost part of gena near postgena (Fig. 80); thorax usually with 4 (sometimes 5) postsutural dorsocentral setae: the anteriormost two subequal in length and short, ca. 1/2 length of posteriormost seta (Fig. 81); triangular desclerotised area at base of sternite 5 small, about as wide as postpedicel in strict lateral view (Fig. 68); cercus black; in profile with a more or less straight dorsal margin from base almost to tip, only very slightly tapering from base to rapidly tapering, slightly hooked tip; pregonite dark brown, shorter than postgonite, virtually bare and with blunt apex; degree of sclerotisation of distiphallus decreasing from heavily sclerotised base to desclerotised, apically-directed and widening tip of juxta; distiphallus with a sclerotised, apically-directed vesica and with large lateral styli well visible in lateral view; juxta with blunt-tipped basal processes (Fig. 82).....

.....*Sarcophaga (Liosarcophaga) teretirostris* Pandellé, 1896

- Gena with white setulae on large parts of posterior surface and along lower margin, sometimes almost reaching anterior margin; thorax with 5–6 (rarely 4) postsutural dorsocentral setae increasing in length and thickness from anteriormost to posteriormost, sometimes with additional shorter setae among them; triangular desclerotised area at base of sternite 5 larger, about 1.3 times as wide as postpedicel in strict lateral view; cercus black; in profile with a distinct kink at about 3/5 of its length, portion distal to kink gradually tapering to a slight tip; pregonite brown, longer than postgonite, virtually bare and with blunt apex; distiphallus largely desclerotised with large, elaborate, pedunculate vesica; processes of juxta incurved in apical view, with joining tips (Fig. 83)..... *Sarcophaga (Parasarcophaga) albiceps* Meigen, 1826

73. Frons in strict dorsal view parallel-sided or slightly narrowing from inner posterior corner of eye to about 1/2–3/5 of eye length; if slightly widening then body covered in thick,

- yellowish-grey microtrichosity and abdomen with only a thin median dark vitta (and sometimes faint lateral spots) on tergites 3–4 when viewed posteriorly
..... **genus *Blaesoxipha* Loew 74**
- Frons in strict dorsal view distinctly widening from inner posterior corner to anterior corner of eye (Fig. 19); if somewhat parallel sided posteriorly then thorax and abdomen not as above..... **76**
74. Thorax and abdomen covered in thick, yellowish-grey microtrichosity (Fig. 84); abdomen with only a thin median dark vitta on tergites 3–4 and sometimes some lateral dark spots on those tergites when viewed posteriorly; tergite 6 dark in ground colour and covered in the same yellowish-grey microtrichosity as preceding tergites; brown, elongated ovilarvipositor (“piercer”), covered in only a thin layer of microtrichosity, visible in ventral view between sternite 5 and lateral margins of tergite 6 (Fig. 85); piercer often visible also in lateral view, with concave ventral margin and small, blunt tip protruding beyond margin of tergite 6 (Fig. 84)
..... ***Blaesoxipha (Blaesoxipha) plumicornis* (Zetterstedt, 1859)**
- Thorax and abdomen covered in grey-silver microtrichosity; abdomen with much more extensive dark areas when viewed posteriorly; tergite 6 red/orange, without microtrichosity; piercer usually well visible in lateral view as an anteriorly curved, spine-like protrusion (Fig. 86); piercer also well visible, blade-like and ventrally directed, in posterior view (Fig. 87).....
..... **subgenus *Blaesoxipha (Servaisia)* Robineau-Desvoidy 75**
75. Abdomen: in ventral view, visible portion of sternite 6 of approximately same length as visible portion of sternite 5; tergite 3 with pair of strong median marginal setae and usually with strong dorsalmost lateral marginals (Fig. 88).....
..... ***Blaesoxipha (Servaisia) erythrura* (Meigen, 1826)**
- Abdomen: in ventral view, visible portion of sternite 6 visibly shorter than visible portion of sternite 5; tergite 3 usually with weak median marginal setae or without median marginals and usually with weaker and shorter dorsalmost lateral marginals (Fig. 89)..... ***Blaesoxipha (Servaisia) rossica* Villeneuve, 1912**
76. Frontal setae at most slightly diverging anteriorly, with anteriormost seta situated approximately on same vertical line as preceding setae; thorax with 1–3 pairs of strong presutural acrostichal setae, the longest about as long as first postsutural dorsocentral seta; mid femur without a mid femoral organ on posterior surface; tergite 6 undivided, dark orange/brownish in ground colour and covered in thick grey microtrichosity; tergite 7 well developed, orange, well visible in posteroventral view beyond tergite 6 and M-shaped in posterior view; sternite 7 orange, elongated and concave, overlapping

- sternite 8, which is also orange and often well visible in lateral view, protruding beyond last tergites and cerci ***Ravinia pernix* (Harris, 1780)**
- Frontal setae distinctly diverging anteriorly, with anteriormost 2–3 setae arranged in a diagonal line across the upper parafacial (Fig. 19); thorax without presutural acrostichal setae or presutural acrostichals fine or strong but visibly shorter than first postsutural dorsocentral seta; if strong and of similar length as first postsutural dorsocentral, then lowest parafacial setae very strong and long, projecting far beyond anterior margin of parafacial in profile, or setulae on postgena and occiput mostly black; mid femur with or without a mid femoral organ on posterior surface; tergite 6 undivided, divided into two hemitergites or partly divided by a more or less extensive desclerotised area; tergite 7 absent or reduced (often divided into two small hemitergites), at most only slightly visible below tergite 6 in undissected specimens and brown/dark brown
.....**genus *Sarcophaga* Meigen 77**
77. Thorax with 3 strong postsutural dorsocentral setae; all setulae on gena black, if any light-coloured setulae present then these are few and confined to posteriormost part of gena near postgena, and the lowermost parafacial setae are very strong and long, projecting well beyond anterior margin of parafacial; lowermost setae on parafacial often strong and long, protruding beyond anterior margin of parafacial; mid femur with or without a mid femoral organ on posterior surface; wing vein R₁ with or without short setulae on dorsal surface; 4th costal sector from shorter to longer than 6th costal sector; costal spine from absent to long **78**
- Thorax with 4 or more postsutural dorsocentral setae, the anteriormost 2 or more usually visibly shorter than the posteriormost 2; gena with or without few to several light-coloured setulae; lowermost setae on parafacial fine, never protruding beyond anterior margin of parafacial; mid femur with mid femoral organ on posterior surface (Figs 91–92, 95); wing vein R₁ bare on dorsal surface; 4th costal sector usually distinctly longer than 6th; costal spine absent or of short-medium length..... **98**
78. Mid femur with mid femoral organ on posterior surface, short (less than 1/2 of total length of femur), located in middle to distal portion of femur (Fig. 91), often dark and inconspicuous but sometimes reddish and well visible **79**
- Mid femur without a mid femoral organ..... **87**
79. Tergite 6 orange/red, sometimes with darkened (brownish) lateral and/or anterior margins; tergite 6 undivided, slightly desclerotised medially or divided into two hemitergites separated by a desclerotised median strip, slightly or conspicuously pleated at posterior margin; wing vein R₁ with or without short setulae on dorsal surface; **80**
- Tergite 6 black or brown, sometimes with light brown posterior edges and always divided into two hemitergites separated by a more or less broad, desclerotised median

- strip usually conspicuously pleated at posterior margin; wing vein R₁ bare on dorsal surface83
80. Wing vein R₁ with several (usually more than 4) tightly-spaced setulae on dorsal surface; abdominal tergite 3 with a pair of strong, erect median marginal setae; mid femoral organ situated in lower distal portion of femur just basad to subapical posterior setae, sometimes black and inconspicuous but often reddish, well visible (Fig. 92); tergite 6 orange/red, undivided and normally sclerotised (but lacking marginal setae) medially (Fig. 93).....*Sarcophaga (Heteronychia) haemorrhoea* Meigen, 1826³
- Wing vein R₁ bare on dorsal surface or with few (1–4, rarely more) widely-spaced setulae; abdominal tergite 3 with or without a pair of strong marginal setae, these sometimes weak, decumbent; mid femoral organ situated in lower distal portion of femur just basad to subapical posterior setae, usually black and inconspicuous, sometimes reddish; tergite 6 variable from orange to dark red, interrupted medially by a wide desclerotised strip or undivided but somewhat desclerotised posteromedially; posterior margin of tergite 6 with a small to distinct median pleat (Fig. 94); if median margin of tergite 6 hidden beneath tergite 5, then tergite 6 always appearing as divided81
81. Wing vein R₁ usually with 1–4 (rarely more) widely-spaced setulae on dorsal surface, very rarely bare; abdominal tergite 3 with pair of strong, erect median marginal setae (rarely absent); mid femoral organ present, occupying lower posterior distal 2/5 of femur and usually blackish, sometimes dark-brown to blackish brown (Fig. 95); body of overall dark appearance; microtrichosity of abdomen grey/silver with a slight bluish tinge; tergite 6 varying from entirely orange/red to orange/red with darkened (brownish) distal portions, rarely more diffusely darkened; tergite 6 divided into two hemitergites separated by a wide desclerotised strip and with a distinct median pleat on posterior margin (Fig. 96); tergite 8 (“vaginal plate” in Richet *et al.* 2011) strongly sclerotised, subpentagonal [dissection required].....
-*Sarcophaga (Heteronychia) vagans* Meigen, 1826
- Wing vein R₁ usually bare on dorsal surface, rarely with 1 isolated setula; abdominal tergite 3 usually without median marginal setae; mid femoral organ in a similar position to that of *S. vagans* but area occupied variable in length and of a leathery brown to red colour; body dark as in *S. vagans* or a much lighter yellowish-grey; tergite 6 variable from orange to dark red and variably darkened towards lateral and anterior margins, interrupted medially by a wide desclerotised strip or undivided but somewhat desclerotised posteromedially; posterior margin of tergite 6 with a small to distinct median pleat; tergite 8 not strongly sclerotised and not of a subpentagonal shape [dissection required].....82

³ A close relative of *S. (H.) haemorrhoea*, *S. (H.) bulgarica* (Enderlein, 1936), was recently discovered in England (Whitmore *et al.*, unpublished). A couplet with distinguishing characters for females of these two species will be added to a future version of this key.

82. Thorax and abdomen of an overall dark appearance, covered in grey-silver microtrichosity; underside of abdomen very dark, almost apruinose and with a bluish hue; lower facial margin visible in lateral view but below vibrissal angle; mid femoral organ usually conspicuous, reddish and large, occupying ca. basal 2/3 of distal 1/2 of femur (Fig. 97); tergite 6 light to dark red, usually visibly darkened laterally and anteriorly; tergite 6 undivided but slightly desclerotised medially, with a small median pleat on posterior margin (Fig. 94); tergite 8 elongated, subtriangular [dissection required]
.....*Sarcophaga (Heteronychia) vicina* Macquart, 1835
- Thorax and abdomen of lighter appearance, covered in yellowish-grey microtrichosity; underside of abdomen covered in similar light-coloured microtrichosity; lower facial margin visible in lateral view also at level of vibrissal angle; mid femoral organ less conspicuous, from leathery brown to slightly reddish, and smaller, occupying ca. basal 2/3 of distal 1/3 of femur (Fig. 98); tergite 6 light to dark red, irregularly darkened anteriorly; tergite 6 divided into two hemitergites separated by a wide desclerotised strip and with a distinct median pleat on posterior margin (Fig. 99); tergite 8 short, semicircular [dissection required]
.....*Sarcophaga (Heteronychia) arcipes* Pandellé, 1896
83. Anterior surface of mid femur with patch of short, yellow-golden setulae on approximately distal 2/5 (Fig. 41); mid femur with small patch of similar setulae right in the middle of posterior surface, just above a very small, usually reddish but sometimes inconspicuous mid femoral organ (Fig. 100); wing with long costal spine, longer than crossvein r-m; short spines on margin of costa usually reaching beyond 6th costal sector or ending exactly with 6th costal sector; abdominal tergite 3 with pair of strong, erect median marginal setae; tergite 6 black, divided by broad desclerotised median strip forming an M-shaped pleat at posterior margin (Fig. 101)
.....*Sarcophaga (Sarcotachinella) sinuata* Meigen, 1826
- Mid femur without patches of yellow-golden setulae; costal spine short-medium or long; short spines on margin of costa not reaching 6th costal sector; abdominal tergite 3 with or without median marginal setae **84**
84. Mid femoral organ situated on lower middle portion of posterior surface of mid femur, either dark and inconspicuous or red and well visible **85**
- Mid femoral organ situated within distal half of posterior surface of mid femur, usually at least slightly light-coloured **86**
85. Abdominal tergite 3 with a pair of strong, erect median marginal setae; mid femoral organ usually occupying just under 1/3 of height of femur and of a striking reddish-brown

- colour, neatly contrasting with rest of femur (Fig. 91); tergite 6 black, covered in thick grey microtrichosity and with a long, well-defined median pleat (Fig. 102); vestiges of (divided) tergite 7 usually well visible between tergite 6 and genital opening in posterior view (Fig. 102).....***Sarcophaga (Helicophagella) rosellei* Böttcher, 1912**
- Abdominal tergite 3 without median marginal setae; mid femoral organ usually occupying about 1/4 of height of femur and often dark, concolourous with rest of femur or at most light-brown in middle (Fig. 103); tergite 6 brown with light brown margins, without micritrichosity and with a shorter, somewhat irregular median pleat (Fig. 104); tergite 7 absent ***Sarcophaga (Thyrsoctema) incisilobata* Pandellé, 1896**
86. Frons usually distinctly wider than an eye in strict dorsal view; prescutellar acrostichal setae well developed; mid femoral organ brownish-red, neatly contrasting with rest of femur; mid femoral organ long, occupying most of distal half of femur up to level of second preapical posterior seta (Fig. 105); and broad, about half of total height of femur; abdominal tergite 3 without median marginal setae or with a pair of weak, decumbent median marginals; tergite 7 not visible between tergite 6 and genital opening in posterior view (Fig. 106)..... ***Sarcophaga (Helicophagella) hirticrus* Pandellé, 1896**
- Frons about as wide as an eye in strict dorsal view, at most slightly wider; prescutellar acrostichal setae often absent or weak; mid femoral organ mostly indistinct and concolourous with femur but often with a reddish centre; mid femoral organ shorter, occupying ca. proximal 1/2–3/5 of distal half of femur (Fig. 107); abdominal tergite 3 with or without median marginal setae or with a pair of weak, decumbent median marginals; vestiges of (divided) tergite 7 usually visible between tergite 6 and genital opening in posterior view (Fig. 108).....
.....***Sarcophaga (Helicophagella) crassimargo* Pandellé, 1896**
87. Wing vein R₁ with few to several setulae on dorsal surface or postgena predominantly covered in black setulae; abdominal tergite 3 with pair of strong, erect median marginal setae..... **88**
- Wing vein R₁ bare on dorsal surface; if with 1 isolated setula then postgena entirely covered in white setulae; abdominal tergite 3 with or without marginal setae **91**
88. Postgena and back of head from eye margin to occiput entirely covered in black setulae or with a few light-coloured setulae in posterior part of postgena and close to occiput (Fig. 24); costal spine short/medium, never as long as crossvein r-m; vein R₁ with 1–3 setulae (sometimes bare) on dorsal surface; tergite 6 black, divided into two hemitergites separated by a desclerotised strip with a median pleat on posterior margin (Fig. 109)***Sarcophaga (Mehria) sexpunctata* (Fabricius, 1805)**
- Postgena and back of head from eye margin to occiput usually with at least a few light-coloured setulae in posterior part of postgena and close to occiput; costal spine long,

- usually longer than crossvein r-m; vein R₁ with few to several setulae on dorsal surface; tergite 6 black, undivided or divided into two hemitergites.....**89**
89. Frons wide, between 1.1 and 1.4 times the width of an eye in strict dorsal view; setulae on wing vein R₁ almost always reaching well beyond level of subcostal bend (Fig. 32); postgena entirely covered in white setulae, at most with one or two black setulae anteriorly near mouth margin; anterior part of wing not visibly darker than rest; abdominal syntergite 1+2 without median marginal setae; tergite 6 black, divided into two hemitergites (Fig. 110).....***Sarcophaga (Krameromyia) anaces* Walker, 1849**
- Frons narrower, at most slightly wider than an eye in strict dorsal view; setulae on wing vein R₁ never reaching beyond level of subcostal bend; postgena often with few to several black setulae; anterior part of wing usually visibly darker than rest; abdominal syntergite 1+2 with or without median marginal setae; tergite 6 black, undivided**90**
90. Abdomen almost entirely black when viewed posteriorly, with only small patches of silver-grey microtrichosity in anterolateral corners of tergites 3–5, sometimes with silver-grey patches anteriorly on tergites 3–5 lateral to midline of abdomen (Fig. 111); thorax and abdomen with a slight bronze hue (Fig. 112); postgena at most with few black setulae anteriorly; abdominal syntergite 1+2 without median marginal setae; tergite 6 (Fig. 113, posterior view) at most slightly visible beyond tergite 5 in lateral view (Fig. 114)***Sarcophaga (Heteronychia) dissimilis* Meigen, 1826**
- Abdomen when viewed posteriorly with noticeable bands of grey-silver microtrichosity on tergites 3–5, usually reaching posterior margins of tergites (Fig. 115); thorax and abdomen without a bronze hue; postgena usually with few to several black setulae; abdominal syntergite 1+2 often with a pair of strong median marginal setae or sometimes a single seta; tergite 6 (Fig. 116, posterior view) well visible beyond tergite 5 in lateral view (Fig. 117).....
-***Sarcophaga (Heteronychia) depressifrons* Zetterstedt, 1845**
91. Thorax with 2–3 pairs of strong presutural acrostichal setae, the longest about as long as, or at least as thick as, notopleural setae; lowest parafacial setae very thick and long, in profile projecting far beyond anterior margin of parafacial (Fig. 23); abdominal tergite 3 with a pair of strong, erect median marginal setae; tergite 6 black, divided into two hemitergites**subgenus *Sarcophaga (Myorhina)* Robineau-Desvoidy) 92**
- Thorax without presutural acrostichal setae or presutural acrostichals short and fine, not comparable to notopleural setae; lowest parafacial setae only slightly thicker and longer than upper ones, usually decumbant and at most only slightly protruding beyond anterior margin of parafacial; if thicker and distinctly protruding beyond parafacial then lower facial margin visible in lateral view at vibrissal angle; abdominal tergite 3 with or without median marginal setae; tergite 6 brown or black, undivided or divided into two hemitergites**94**

92. Gena with a few white setulae posteriorly just anterior to postgena (Fig. 49)
 ..*Sarcophaga (Myorhina) nigriventris* Meigen, 1826 or *S. (M.) soror* Rondani, 1860
 [females not identifiable to species level]
- Gena entirely covered in black setulae (Fig. 18).....
 Sarcophaga (Myorhina) villeneuvei Böttcher, 1912
94. Abdominal tergite 3 with pair of strong, erect median marginal setae; thorax with 4–5 pairs of short presutural acrostichal setae; tergite 6 undivided or divided into two hemitergites **95**
- Abdominal tergite 3 without median marginal setae or at most with a pair of weak, decumbent setae; thorax with or without presutural acrostichal setae; tergite 6 divided into two hemitergites **96**
95. Lower facial margin well visible in lateral view at or just below vibrissal angle; frons wide, up to 1.2 times the width of an eye in strict dorsal view; general microtrichosity of thorax and abdomen yellowish-grey, giving the body a light-coloured overall appearance; tergite 6 dark brown, undivided but often with a median pleat on posterior margin (Fig. 118) and usually well visible beyond tergite 5 in both dorsal and lateral views or at least in lateral view; tergite 7 absent
Sarcophaga (Heteronychia) filia Rondani, 1860
- Lower facial margin at most slightly visible in lateral view below vibrissal angle; frons narrower, about as wide as an eye in strict dorsal view; general microtrichosity of thorax and abdomen grey-silver, slightly bluish, giving the body a darker overall appearance; tergite 6 black, divided into two hemitergites and at most slightly visible beyond tergite 5 in lateral view; vestiges of (divided) tergite 7 usually visible between tergite 6 and genital opening in posterior view (Fig. 119)
 Sarcophaga (Helicophagella) agnata Rondani, 1860
96. 4th costal sector shorter than, or at most subequal to, 6th; costal spine long, usually visibly longer than crossvein r-m; lower facial margin well visible in lateral view at or just below vibrissal angle; generally smaller specimens (4–8 mm); tergite 6 dark brown, divided into two hemitergites separated by a narrow desclerotised patch and with a median pleat at posterior margin (Fig. 120)
Sarcophaga (Heteronychia) pumila Meigen, 1826
- 4th costal sector distinctly longer than 6th; costal spine shorter, rarely about as long as crossvein r-m; lower facial margin at most slightly visible in lateral view below vibrissal

- angle; generally larger specimens (9–12 mm); tergite 6 dark brown/black, divided into two hemitergites separated by a wide sclerotised or desclerotised area **97**
97. Frons very wide, between 1.2 and 1.4 times the width of an eye in strict dorsal view; wing vein R₁ of a yellowish, light brown colour; underside of scutellum usually with short black hairs only laterally, rarely with hairs closer to midline; thorax and abdomen covered in thick, light-grey-silver microtrichosity, leaving relatively small dark patches on abdomen when viewed posteriorly; hemitergites of tergite 6 separated by a wide, heavily sclerotised concave area (Fig. 121); tergite 6 protruding well beyond tergite 5 in lateral view, subtriangular (Fig. 122).....
.....***Sarcophaga (Helicophagella) melanura* Meigen, 1826**
- Frons narrower, about as wide as an eye in strict dorsal view; wing vein R₁ of a darker brown colour; underside of scutellum usually with short black hairs over its entire surface including middle (Fig. 123); thorax and abdomen covered in darker grey-silver microtrichosity leaving relatively large dark patches on abdomen when viewed posteriorly; hemitergites of tergite 6 separated by a wide membranous area (Fig. 124); tergite 6 at most slightly protruding beyond tergite 5 in lateral view
.....***Sarcophaga (Bellieriomima) subulata* Pandellé, 1896**
98. Gena entirely covered in black setulae **99**
- Gena with white setulae on part to most of its surface or with at least a few white setulae posteriorly near postgena **104**
99. Tergite 6 black, divided into two hemitergites; well visible beyond tergite 5 in lateral and posterodorsal views, subtriangular in lateral view with strong marginal setae (Fig. 125); in posterodorsal view, hemitergites divided longitudinally by a narrow, desclerotised strip and contiguous until tip (Fig. 126); parafacial with bright golden microtrichosity; a generally rather dark species, usually with a distinct bluish hue at least on abdomen; mid femoral organ long and narrow and on lower part of femur, but usually dark and indistinct (Fig. 127).....***Sarcophaga (Robineauella) caerulea* Zetterstedt, 1838**
- Tergite 6 divided or undivided and of variable colour, usually not distinctly visible in either lateral or posterodorsal view; if slightly visible, subtriangular, in lateral view, then with weak marginal setae only; microtrichosity on parafacial varying from grey-silver to bright golden; abdomen usually without a bluish hue; mid femoral organ variable..... **100**
100. Tergite 6 brown, divided into two hemitergites broadly separated in posterior view by a distance comparable to distance between subapical scutellar setae (Fig. 128); tergite 6 usually at least slightly visible, subtriangular, in lateral view beyond tergite 5; mid

femoral organ indistinct, brownish, narrow, mostly in distal half of femur (Fig. 129); sternite 7 [sometimes visible without dissection] with a pair of glossy tubercles near base and with an indentation on posterior margin

..... ***Sarcophaga (Pandelleisca) similis* Meade, 1876**

- Hemitergites of tergite 6, if divided, only slightly separated in posterior view; margin of tergite 6, if visible in lateral view, more or less parallel to margin of tergite 5 and hence not subtriangular; mid femoral organ variable; sternite 7 not as above..... **101**

101. Abdominal tergite 3 usually with pair of strong, erect median marginal setae, rarely weak and/or decumbent or absent; parafacial wide, at narrowest point usually between 2/5 and 3/5 of shortest eye diameter in strict lateral view; gena broad, from 2/5 to 4/7 of eye height in strict lateral view; parafacial covered in usually bright golden microtrichosity; thorax usually with 2–3 pairs of fine presutural acrostichal setae, at least somewhat differentiated from ground thoracic setation; mid femoral organ dark brown/black and very long, occupying area from approximately basal 1/10 to level of the first preapical posterior seta (Fig. 130); fore femur usually with distinct fore femoral organ (shiny black/dark brown) over most of distal 2/3 of posterior surface (Fig. 131); tergite 6 light to dark brown, divided into two hemitergites separated by a median desclerotised area (Fig. 132).....

.....**subgenus *Sarcophaga (Sarcophaga)* Meigen** [♀♀ not identifiable to species]

- Abdominal tergite 3 without median marginal setae; if with a pair of weak decumbent median marginals then parafacial narrow, less than 1/3 of shortest eye diameter in strict lateral view at its narrowest point; parafacial at its narrowest point from less than 1/4 to just over 2/5 of shortest eye diameter in strict lateral view; gena narrower, from 1/4 to just over 2/5 of eye height in strict lateral view; microtrichosity of parafacial variable from grey-silver to golden-silver, rarely bright golden; thorax with or without fine presutural acrostichal setae; mid femoral organ dark brown/black but shorter, at most starting at about basal 1/5 of femur; fore femur with at most a small, indistinct fore femoral organ on posterior surface; tergite 6 divided or undivided..... **102**

102. Thorax with 2–3 pairs of fine presutural acrostichal setae, at least somewhat differentiated from ground thoracic setation, and with pair of thicker and longer (though still relatively fine), widely separated acrostichal setae just anterior to suture (Fig. 73); costal spine usually absent (Fig. 133), extremely short if present; mid femoral organ brownish, narrow, occupying area between proximal 1/3 and distal 1/4 of femur (Fig. 134); tergite 6 dark brown, more or less completely divided into two hemitergites by a narrow desclerotised area (Fig. 135)

..... ***Sarcophaga (Varirosellea) uliginosa* Kramer, 1908**

- Thorax without differentiated presutural acrostichal setae; costal spine usually present, short; mid femoral organ similar to above or much longer; tergite 6 usually a lighter

- brown, similar to above or undivided with just a very narrow desclerotised median strip **103**
103. Frons wide, between 1.00 and 1.20 times as wide as an eye in strict dorsal view; mid femoral organ black, long, occupying area from proximal 1/5 of femur to just distad of first preapical posterior seta (Fig. 90); abdomen with grey-silver microtrichosity, without a bluish hue; tergite 6 light brown, undivided but very slightly desclerotised medially with a small cleft on posterior margin; tergite 8 well sclerotised, convex and well visible just dorsad of cerci in posterior view (Fig. 136)
..... ***Sarcophaga (Liosarcophaga) portschinskyi (Rohdendorf, 1937)***
- Frons narrower, usually between 0.80 and 0.90 times as wide as an eye in strict dorsal view; mid femoral organ brown, shorter, occupying area covering approximately middle third of femur (Fig. 137); abdomen usually with a slight light-bluish hue; tergite 6 brown/dark brown, more or less completely divided into two hemitergites by a narrow desclerotised area; tergite 8 not visible in posterior view (Fig. 138)
..... ***Sarcophaga (Rosellea) aratrix Pandellé, 1896***
104. Tergite 6 entirely orange-red or at least slightly red at margin; last sclerotised abdominal sternites orange-red or brown; mid femoral organ long, occupying most of apical 2/5 of femur **105**
- Tergite 6 dark brown/blackish; last sclerotised abdominal sternites brown; mid femoral organ long or shorter, occupying area from approximately middle of femur to level of first preapical posterior seta **107**
105. Tergite 6 orange-red, divided into two hemitergites the margins of which diverge posteriorly forming a deep cleft in posterior/posterodorsal view (Fig. 139); fore femur with distinct fore femoral organ distally on posterior surface; sternite 7 orange-red, strongly convex (bulging) posteriorly and usually well visible in lateral view (Fig. 140)
..... ***Sarcophaga (Bercaea) africa (Wiedemann, 1824)***
- Tergite 6 entirely orange-red or dark red at least along median posterior margin, undivided; fore femur with or without a fore femoral organ distally on posterior surface; sternite 7 not convex **106**
106. White setulae on gena usually reaching lower anterior margin of gena (Fig. 141); frons about 0.85 to 1.00 times as wide as an eye in strict dorsal view; fore femur with a distinct fore femoral organ distally on posterior surface (Fig. 142); sternite 7 orange, with a strong posterior indentation with one or two strong setae symmetrically on either side

of indentation (Fig. 143); tergite 8 not visible in posterior view; [terminalia in posterior view in Fig. 144] .. *Sarcophaga (Liopygia) argyrostoma* (Robineau-Desvoidy, 1830)⁴

- White setulae on gena not reaching anterior margin of gena; frons wider, about 1.10 to 1.30 times as wide as an eye in strict dorsal view; fore femur without a fore femoral organ; sternite 7 brown, with a distinct posterior indentation but with at most a few irregular marginal setae; tergite 8 well-sclerotised, convex and well visible just dorsad of cerci in posterior view (Fig. 145).....
.....*Sarcophaga (Liosarcophaga) jacobsoni* (Rohdendorf, 1937)

107. White setulae on gena confined to posteriormost part of gena near postgena; mid femoral organ reddish, long, occupying most of apical 2/5 of femur (Fig. 146); tergite 6 dark brown/blackish, divided into two hemitergites separated by a desclerotised strip (Fig. 147); sternite 7 [often at least partly visible without dissection] with a distinct posterior indentation and with at most a few fine marginal setae

..... *Sarcophaga (Liosarcophaga) teretirostris* Pandellé, 1896

- Gena with white setulae on large parts of posterior surface and along lower margin, sometimes almost reaching anterior margin; mid femoral organ dark brown/blackish, shorter, occupying area from approximately middle of femur to level of first preapical posterior seta (Fig. 148); tergite 6 dark brown, undivided but somewhat desclerotised medially and with a large median pleat on posterior margin (Fig. 149); sternite 7 [usually visible without dissection] without a posterior indentation and with a transverse row of thick setae close to margin (Fig. 150).....
..... *Sarcophaga (Parasarcophaga) albiceps* Meigen, 1826

Discussion

With 65 species, the flesh fly fauna of the British Isles compares to those of other northern European regions such as Scandinavia, but it is considerably smaller than those of comparably-sized Central-Eastern European countries or countries with a Mediterranean coastline. Pape (1987) reported a combined total of 87 species for Denmark, Norway, Sweden and Finland. Pape & Merz (1998) and Merz *et al.* (2001) listed 124 species for Switzerland, whereas Rudzinski (1999) listed 130 species for Germany. Species numbers noticeably increase in the Mediterranean region with, e.g., 148 species recently listed for the relatively smaller-sized Croatia (Krčmar *et al.* 2019), 174 species known from France (Pape 2004) and approximately 200 species known from Italy (Pape 2004; Whitmore *et al.*, unpublished).

⁴ The closely related species *S. (L.) crassipalpis* Macquart, 1839 was recently collected in southern England (Whitmore & Hall, unpublished). Distinguishing characters between females of these two species are mainly in the last abdominal sternites (see Richet *et al.* 2011: 239–240).

Despite the overall good state of knowledge of British and Irish Sarcophagidae, the checklist has grown by over 20% since the publication of van Emden's (1954) handbook and by over 10% since Chandler's (1998) first Diptera checklist. Some recently discovered species (e.g., *Metopia tschernovae*, *Taxigramma hilairella* and *Sarcophaga bulgarica*) may have simply been overlooked due to rarity or close resemblance to other species, whereas others (e.g., *Sarcophaga crassipalpis*) may have arrived in southern England as part of a northerly expansion of their ranges due to rising average temperatures.

The widespread collection and identification of British and Irish flesh flies has been limited compared to other Diptera families (e.g., Syrphidae, Tachinidae). This is partly due to lower popularity with biological recorders and biodiversity enthusiasts, but has also been due to the general perception that their identification to species level is difficult (males) or impossible (females), this being particularly true for the largest and most common genus *Sarcophaga*. For this reason, sarcophagid samples are often left unidentified by collectors and female *Sarcophaga* are often discarded due to being considered unidentifiable. One of the objectives of the present key is to reduce the bias towards a somewhat excessive use of characters of the male genitalia for species identification, especially in the genus *Sarcophaga*, and provide characters for reliably identifying females of 88% of all British species without any need for special preparation or dissection of specimens. For this reason, emphasis was placed on externally visible characters in the key, while still providing detailed descriptions and images of diagnostic features of the genitalia of both sexes. Male genitalia in particular can be very useful for a final confirmation of a species' identity; however, exclusively relying on them for identification can lead to errors. It is typical for identifiers of male sarcophagids to simply "flick through" images of all known species until one matching the specimen under the microscope is found. While this is understandable due to the unique shape of the genital structures of most species (particularly of the distiphallus of most Sarcophaginae), it can lead to the misidentification of similar-looking, rarely collected or previously unrecorded species.

The present updated key and the recent launch of a BRC Sarcophagidae Recording Scheme (Whitmore *et al.* 2020) are expected to significantly boost our knowledge of species distributions as well as increase the potential for new species discoveries.

Acknowledgements

We thank the Dipterists Forum for encouraging the preparation of this key and the launch of a recording scheme for the family. Several users of previous versions of the key provided important feedback that helped improve the present version. Sérgio Henriques (ZSL, London) provided useful comments on the manuscript.

References

- Assis-Fonseca, ECM d' (1953) An important character in the identification of females of *Sarcophaga* species (Dipt., Calliphoridae). *Journal of the Society for British Entomology*, 4: 167–168.

- Ball, S. (2017) Introduction to the families of British Diptera. Part 2: Key to Families. v.7.2 February 2017. Dipterists Forum website Membership Area at <https://www.dipterists.org.uk/for-members> [Accessed 23 June 2020]
- Chandler, PJ (1998) *Checklists of Insects of the British Isles (New Series), Part 1: Diptera (incorporating a list of Irish Diptera)*. Handbooks for the Identification of British Insects 12: xx + 234 pp. Royal Entomological Society.
- Chandler, PJ (2020a) *Checklists of Insects of the British Isles (New Series), Part 1: Diptera (incorporating a list of Irish Diptera)*. Handbooks for the Identification of British Insects 12, xx + 234pp. Royal Entomological Society, London. [Version at 1 May 2020, available at <https://www.dipterists.org.uk/checklist>.]
- Chandler, PJ (2020b) *Metopia tschernovae* Rohdendorf (Diptera, Sarcophagidae) an overlooked British species? *Dipterists Digest (Second Series)*, 27 (1): 100.
- Courtney, GW, Pape, T, Skevington, JH & Sinclair, BJ (2017) Biodiversity of Diptera, pp. 229–278. In: Footitt, RG & Adler, PH (Eds.), *Insect Biodiversity: Science and Society. Vol. 1, 2nd Edition*. Wiley-Blackwell, Chichester.
- Cumming, JF & Wood, DM (2017) Adult morphology and terminology, pp. 89–133. In: Kirk-Spriggs, AH & Sinclair, BJ (Eds.), *Manual of Afrotropical Diptera. Vol. 1. Suricata 4*. South African National Biodiversity Institute Graphics & Editing, Pretoria.
- Day, CD & Assis-Fonseca, ECM d' (1955) A key to the females of the British species of *Sarcophaga* (Dipt., Calliphoridae). *Journal of the Society for British Entomology*, 5: 119–123.
- Emden, FI van (1954) Diptera Cyclorrhapha Calyptrata (I), Section (a). Tachinidae and Calliphoridae, pp. 1–133. In: *Handbooks for the Identification of the British Insects, Vol. X, Part 4(a)*. Royal Entomological Society of London, London.
- Falk, SJ & Pont, AC (2017) A provisional assessment of the status of calypterate flies in the UK. *Natural England. Commissioned Reports*, 234: 1–265.
- Krčmar, S, Whitmore, D, Pape, T & Buenaventura, E. (2019) Checklist of the Sarcophagidae (Diptera) of Croatia, with new records from Croatia and other Mediterranean countries. *ZooKeys*, 831: 95–155.
- Merz, B, Bächli, G & Haenni, J-P (2001) Erster Nachtrag zur Checkliste der Diptera der Schweiz. *Mitteilungen der Entomologischen Gesellschaft Basel*, 51: 110–140.
- NBN Atlas 2020. NBN Atlas website available at <http://www.nbnatlas.org> [Accessed 23 June 2020].
- Ooesterbroek, P (2006) *The European families of the Diptera. Identification, diagnosis, biology*. KNNV Publishing, Utrecht, 205 pp.
- Pape, T (1987) The Sarcophagidae (Diptera) of Fennoscandia and Denmark. *Fauna Entomologica Scandinavica*, 19: 1–203 + 2 pls.

- Pape, T (1996) Catalogue of the Sarcophagidae of the world (Insecta: Diptera). *Memoirs on Entomology, International*, 8: 1–558.
- Pape, T (2004) Fauna Europaea: Sarcophagidae. In: Pape, T. (Ed.), *Fauna Europaea: Diptera Brachycera*. Fauna Europaea version 1.1, formerly available at <http://www.faunaeur.org> as version 2.2 of June 3rd 2010 [Accessed October 2010].
- Pape, T, Beuk, P, Pont, AC, Shatalkin, AI, Ozerov, AL, Woźnica, AJ, Merz, B, Bystrowski, C, Raper, C, Bergström, C, Kehlmaier, C, Clements, DK, Greathead, D, Kameneva, EP, Nartshuk, E, Petersen, FT, Weber, G, Bächli, G, Geller-Grimm, F, Van de Weyer, G, Tschorsnig, H-P, de Jong, H, van Zuijlen, JW, Vaňhara, J, Roháček, J, Ziegler, J, Majer, J, Hůrka, K, Holston, K, Rognes, K, Greve-Jensen, L, Munari, L, de Meyer, M, Pollet, M, Speight, MCD, Ebejer, MJ, Martinez, M, Carles-Tolrá, M, Földvári, M, Chvála, M, Barták, M, Evenhuis, NL, Chandler, PJ, Cerretti, P, Meier, R, Rozkošný, R, Prescher, S, Gaimari, SD, Zatwarnicki, T, Zeegers, T, Dikow, T, Korneyev, VA, Richter, VA, Michelsen, V, Tanasijtshuk, VN, Mathis, WN, Hubenov, Z & de Jong, Y (2015) Fauna Europaea: Diptera – Brachycera. *Biodiversity Data Journal*, 3: e4187.
- Pape, T & Merz, B (1998) 104. Sarcophagidae, pp. 338–341. In: Merz, B, Bächli, G, Haenni, J-P & Gonseth, Y (Eds.) *Diptera – Checklist. Fauna Helvetica*, 1: 1–369.
- Richet, R, Blackith, RM & Pape T (2011). *Sarcophaga of France (Diptera: Sarcophagidae)*. Pensoft Publishers, Sofia: pp. 5–327.
- Whitmore, D, Griffiths, C & Jones, NP (2020) NEW Sarcophagidae Recording Scheme. *Bulletin of the Dipterists Forum*, 89: 7–10.
- Whitmore, D, Pape, T & Cerretti, P (2013) Phylogeny of *Heteronychia*: the largest lineage of *Sarcophaga* (Diptera: Sarcophagidae). *Zoological Journal of the Linnean Society*, 169: 604–639.
- Whitmore, D & Perry, I (2018) *Macronychia striginervis* (Zetterstedt) new to Britain, and the misidentification of *M. dolini* Verves & Khrokalo (Diptera, Sarcophagidae). *Dipterists Digest (New Series)*, 25 (1): 91–97.

FIGURES 1–8. 1–2. Hind coxae. 3. *Metopia campestris* (Fallén, 1810), male fore tarsus. 4. *Metopia staegerii* Rondani, 1859, male fore tarsus. 5. *Oebalia cylindrica* (Fallén, 1810), male habitus. 6. *Amobia signata* (Meigen, 1824), head. 7. *Miltogramma punctata* Meigen, 1824, male fore tarsus. 8. *Pterella grisea* (Meigen, 1824), habitus.

FIGURES 9–16. 9. *Senotainia conica* (Fallén, 1810), male habitus. 10. *Brachicoma devia* (Fallén, 1820), male habitus. 11. *Macronychia griseola* (Fallén, 1820), habitus. 12. *Macronychia dolini* Verves & Khrokalo, 2006, female habitus. 13. *Nyctia halterata* (Panzer, 1798), male habitus. 14. *Sarcophila latifrons* (Fallén, 1817), male habitus. 15. *Angiometopa falleni* Pape, 1986, male habitus. 16. *Agria mamillata* (Pandellé, 1896), abdomen in posterior view.

FIGURES 17–24. 17. *Sarcophaga*, male head in dorsal view. 18. *Sarcophaga*, female head in lateral view. 19. *Sarcophaga*, female head in dorsal view. 20. *Sarcophaga*, male head in frontal view. 21. *Blaesoxipha*, male mid femur. 22. *Sarcophaga*, male mid femur. 23. *Sarcophaga* (*Myorhina*), male head and thorax in lateral view. 24. *Sarcophaga sexpunctata* (Fabricius, 1805), detail of head.

FIGURES 25–32. 25. *Sarcophaga*, detail of thorax. 26. *Sarcophaga*, male head in frontal view. 27. *Sarcophaga*, detail of thorax. 28. *Sarcophaga*, hind trochanters in ventral view. 29. *Sarcophaga*, detail of wing. 30. Same. 31. *Sarcophaga filia* Rondani, 1860, male abdomen in lateral view. 32. *Sarcophaga*, detail of wing.

FIGURES 33–40. 33. *Sarcophaga anaces* Walker, 1849, male terminalia. 34. *Sarcophaga sexpunctata* (Fabricius, 1805), male terminalia. 35. Same, detail of head. 36. *Sarcophaga depressifrons* Zetterstedt, 1845, male terminalia. 37. *Sarcophaga dissimilis* Meigen, 1826, male terminalia. 38. *Sarcophaga haemorrhhoa* Meigen, 1826, male terminalia. 39. *Sarcophaga vagans* Meigen, 1826, male terminalia. 40. *Sarcophaga*, detail of abdomen.

FIGURES 41–48. 41. *Sarcophaga sinuata* Meigen, 1826, male mid femur. 42. Same, male terminalia. 43. *Sarcophaga*, hind trochanters in ventral view. 44. *Sarcophaga filia* Rondani, 1860, wing. 45. Same, male terminalia. 46. *Sarcophaga rosellei* Böttcher, 1912, wing. 47. Same, male terminalia. 48. *Sarcophaga*, head in lateral view.

FIGURES 49–56. 49. *Sarcophaga* (*Myorhina*), detail of head. 50. *Sarcophaga villeneuvei* Böttcher, 1912, male terminalia. 51. *Sarcophaga nigriventris* Meigen, 1826, male terminalia. 52. *Sarcophaga soror* Rondani, 1860, male terminalia. 53. *Sarcophaga hirticrus* Pandellé, 1896, male hind femur. 54. Same, male mid femur. 55. Same, male terminalia. 56. *Sarcophaga*, male hind femur.

FIGURES 57–64. 57. *Sarcophaga agnata* Rondani, 1860, male terminalia. 58. *S. crassimargo* Pandellé, 1896, male terminalia. 59. *S. pumila* Meigen, 1826, male terminalia. 60. *S. arcipes* Pandellé, 1896, male terminalia. 61. *S. vicina* Macquart, 1835, male terminalia. 62. *S. melanura* Meigen, 1826, male terminalia. 63. *S. incisilobata* Pandellé, 1896, male terminalia. 64. *S. subulata* Pandellé, 1896, male terminalia.

FIGURES 65–72. 65. *Sarcophaga crassimargo* Pandellé, 1896, male terminalia. 66. *S. aratrix* Pandellé, 1896, male terminalia. 67. *S. (Sarcophaga)*, male 5th sternite. 68. *Sarcophaga*, male 5th sternite. 69. *S. subvicina* Rohdendorf, 1937, male terminalia. 70. *S. variegata* (Scopoli, 1763), male terminalia. 71. *S. carnaria* (Linnaeus, 1758), male terminalia. 72. *S. caerulescens* Zetterstedt, 1838, male terminalia.

FIGURES 73–80. **73.** *Sarcophaga uliginosa* Kramer, 1908, detail of thorax. **74.** Same, male terminalia. **75.** *S. similis* Meade, 1876, male terminalia. **76.** *S. portschinskyi* (Rohdendorf, 1937), male terminalia. **77.** *S. argyrostoma* (Robineau-Desvoidy, 1830), male terminalia. **78.** *S. africa* (Wiedemann, 1824), male terminalia. **79.** *S. jacobsoni* (Rohdendorf, 1937), male terminalia. **80.** *S. teretirostris* Pandellé, 1896, detail of head.

FIGURES 81–88. **81.** *Sarcophaga teretirostris* Pandellé, 1896, detail of thorax. **82.** Same, male terminalia. **83.** *S. albiceps* Meigen, 1826, male terminalia. **84.** *Blaesoxipha plumicornis* (Zetterstedt, 1859), female habitus. **85.** Same, piercer in ventral view. **86.** *Blaesoxipha* (*Servaisia*), piercer in lateral view. **87.** Same, abdomen in posterior view. **88.** *Blaesoxipha erythrura* (Meigen, 1826), female abdomen in dorsal view.

FIGURES 89–96. 89. *Blaesoxipha rossica* Villeneuve, 1912, abdomen in dorsal view. 90. *Sarcophaga portschinskyi* (Rohdendorf, 1937), mid femoral organ. 91. *S. rosellei* Rondani, 1860, mid femoral organ. 92. *S. haemorrhoea* Meigen, 1826, mid femoral organ. 93. Same, female terminalia. 94. *S. vicina* Macquart, 1835, female terminalia. 95. *S. vagans* Meigen, 1826, mid femoral organ. 96. Same, female terminalia.

FIGURES 97–104. 97. *Sarcophaga vicina* Macquart, 1835, mid femoral organ. 98. *S. arcipes* Pandellé, 1896, mid femoral organ. 99. Same, female terminalia. 100. *S. sinuata* Meigen, 1826, mid femoral organ. 101. Same, female terminalia. 102. *S. rosellei* Rondani, 1860, female terminalia. 103. *S. incisilobata* Pandellé, 1896, mid femoral organ. 104. Same, female terminalia.

FIGURES 105–112. **105.** *Sarcophaga hirticrus* Pandellé, 1896, mid femoral organ. **106.** Same, female terminalia. **107.** *S. crassimargo* Pandellé, 1896, mid femoral organ. **108.** Same, female terminalia. **109.** *S. sexpunctata* (Fabricius, 1805), female terminalia. **110.** *S. anaces* Walker, 1849, female terminalia. **111.** *S. dissimilis* Meigen, 1826, female abdomen in posterior view. **112.** Same, female abdomen in lateral view.

FIGURES 113–120. **113.** *Sarcophaga dissimilis* Meigen, 1826, female terminalia in posterior view. **114.** Same, female terminalia in lateral view. **115.** *S. depressifrons* Zetterstedt, 1845, abdomen in posterior view. **116.** Same, female terminalia in posterior view. **117.** Same, female terminalia in lateral view. **118.** *S. filia* Rondani, 1860, female terminalia. **119.** *S. agnata* Rondani, 1860, female terminalia. **120.** *S. pumila* Meigen, 1826, female terminalia.

FIGURES 121–128. **121.** *Sarcophaga melanura* Meigen, 1826, female terminalia in posterior view. **122.** Same, female terminalia in lateral view. **123.** *S. subulata* Pandellé, 1896, scutellum in posterior view. **124.** Same, female terminalia. **125.** *S. caerulescens* Zetterstedt, 1838, female terminalia in lateral view. **126.** Same, female terminalia in posterior view. **127.** Same, mid femoral organ. **128.** *S. similis* Meade, 1876, female terminalia.

FIGURES 129–136. **129.** *Sarcophaga similis* Meade, 1876, mid femoral organ. **130.** *Sarcophaga* (*Sarcophaga*), mid femoral organ. **131.** Same, fore femoral organ. **132.** Same, female terminalia. **133.** *S. uliginosa* Kramer, 1908, wing. **134.** Same, mid femoral organ. **135.** Same, female terminalia. **136.** *S. portschinskyi* (Rohdendorf, 1937), female terminalia.

FIGURES 137–144. 137. *Sarcophaga aratrix* Pandellé, 1896, mid femoral organ. 138. Same, female terminalia. 139. *S. africa* (Wiedemann, 1824), female terminalia in posterior view. 140. Same, female terminalia in lateral view. 141. *S. argyrostoma* (Robineau-Desvoidy, 1830), head in lateral view. 142. Same, fore femoral organ. 143. Same, female terminalia in ventral view. 144. Same, female terminalia in posterior view.

FIGURES 145–153. 145. *Sarcophaga jacobsoni* (Rohdendorf, 1937), female terminalia. 146. *S. teretirostris* Pandellé, 1896, mid femoral organ. 147. Same, female terminalia. 148. *S. albiceps* Meigen, 1826, mid femoral organ. 149. Same, female terminalia in posterior view. 150. Same, female terminalia in ventral view. 151. *S. carnaria* (Linnaeus, 1758), male terminalia. 152. *S. variegata* (Scopoli, 1763), male terminalia. 153. Same, different specimen.