Original Article

Keys to the flesh flies of Sarawak, East Malaysia, with descriptions of two new genera and eight new species (Diptera: Sarcophagidae)

Hiromu KURAHASHI^{*, 1)}, Siew Hwa TAN²⁾ and Moi Ung LEH³⁾

*Corresponding author: MLB15110@nifty.com

¹⁾ Department of Medical Entomology, National Institute of Infectious Diseases,
Toyama 1–23–1, Shinjuku-ku, Tokyo 162–8640, Japan

²⁾ Genetics and Molecular Biology, Institute of Biological Sciences, Faculty of Science, University of Malaya,
Kuala Lumpur, 50603, Malaysia

³⁾ Sarawak Museum Department, Jalan Tun Abang Haji Openg, 93566 Kuching, Sarawak, Malaysia

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Abstract: The present revisional work is based on very large collections made by the first and second authors during the course of studies. Most specimens of sarcophagid flesh flies were made by the authors during the field surveys programmed by the Sarawak Museum Department, Kuching, Malaysia from 2005 to 2019. A total of 24 genera and 59 species is recorded. Two new genera, *Omarisca* gen. nov. and *Zulisca* gen. nov. are established for two peculiar species found in mangroves. Also eight new species are described: *Myorhina miyagii* sp. nov., *M. tomiae* sp. nov., *Burmanomyia barioensis* sp. nov., *B. pseudoborneensis* sp. nov., *Sarcorohdendorfia kerohi* sp. nov., *S. okazawai* sp. nov., *Hosarcophaga palustris* sp. nov., and *H. puteri* sp. nov. The following seven species are newly recorded from Malaysia: *Senotainia albifrons* (Rondani, 1859), *Burmanomyia aureomarginata* (Shinonaga & Tumrasvin, 1979), *Hosarcophaga auricauda* (Ho, 1938), *H. serrata* (Ho, 1938), *Parasarcophaga idmais* (Séguy, 1934), *P. montiblensis* (Sugiyama, 1990) and *P. walshi* (Ho, 1938), Revised identification keys to the Malaysian species are provided.

Key words: flesh flies, keys, new species, Sarcophagidae, Sarawak, Malaysia

INTRODUCTION

The Oriental Sarcophagidae were first reviewed by Senior-White et al. (1940) who gave keys down to four genera and 63 species which were mainly recorded from British India and including its adjacent countries. Since then, the last review of the flesh flies in the Oriental Region was by Nandi (2002), but there was no record from Sarawak in Malaysia in his revision. The flesh flies of Sarawak were recorded in very few papers such as Sugiyama et al. (1990a) (1 Gen., 3 spp.) and Kurahashi and Leh (2007) (10 Gen., 21 spp.). After these, Kurahashi and Leh (2008), Kurahashi and Tan (2012) and Kurahashi et al. (2015) described a total of 5 new species from Sarawak. A new revision is thus required since generic concepts and current systematics have changed and enough additional new species were discovered.

The present revisional study has been based on very large collections mainly made by the first (HK) and second (SHT) authors during field surveys in the project entitled “Study on taxonomy and bionomics of two-winged flies, Diptera in Sarawak, East Malaysia”. The project was conducted with the coordination and cooperation with the Sarawak Museum in Kuching. It was initiated in 2005 when the Japanese team (Representative: Dr. I. Miyagi) collected and identified mosquitoes and flies for the Sarawak Museum Reference Collection and its database. It was our sincere intention to assist the Sarawak Museum (Sarawak Government) in collecting and documenting the complete fauna and bionomics of two-winged flies in Sarawak over the years. The research was carried out in various habitats such as primary forests, farms, mangroves and beaches including some parts of National Parks from 2005 to 2012. We already published some results of surveys in 2005 and 2006 (Kurahashi and Leh, 2007). The present paper deals with a partial result of the surveys mainly made from 2007 to 2019, and presents 24 genera and 59 species of Sarcophagidae. Of these, two new genera and eight new species are described and 7 are newly recorded from Malaysia. Revised identification keys are provided.

MATERIALS AND METHODS

The collected samples were mounted with insect pins in good order. All specimens were sorted into subfamilies

and preserved in insect boxes for unidentified materials. Identified specimens are mostly preserved in the Sarawak Museum (as Natural History Reference Collection), Kuching (SM). Some were shared and deposited in several museums and institutions such as National Museum of Nature and Science, Tsukuba (NSMT); International Department of Dipterology, Tokyo (IDD); Forestry Department Sarawak (FDS); University of Malaya, Kuala Lumpur (UM); Bishop Museum, Honolulu (BPBM); Biosystematics Laboratory, Faculty of Social & Cultural Studies, Kyushu University, Fukuoka (BLKU), and Personal Collection of S. H. Tan (PCSHT). Name of museums, institutions and private collections are indicated in () in the list of species in Appendix III.

GENERAL MORPHOLOGY, TERMINOLOGY AND DEFINITION

Morphological terminology generally follows the traditional ones which previous authorities used in their works (Rohdendorf, 1937; Senior-White et al., 1940; Fan, 1965; Kano et al., 1967; Lopes, 1977; Verves, 1979 & 1980; Verves, 1980; Pape, 1987; Nandi, 2002), and some synonyms were selected for practical purpose. The adult morphology and the terminology used for descriptions are explained in Figs 1–20 in Appendix II. The modern and morphological terminology proposed is adopted from Manual of Nearctic Diptera (McAlpine, 1981) and followed by Rognes (1991), Pape (1994) and Verves (1998). The new terminology is also important in reading and understanding the description of their recent papers. These new morphological terms are shown in []. For details, we referred to a text book such as Borror and DeLong's Introduction to the Studies of Insects, 7th edition where a comparison of these two terminologies is given. Other important synonyms used by different authorities are also cited in (). The term "frons index" is the same as Fan's index and measurement of frons was performed in a similar manner to Fan (1965). Male and female sexual organs and terminology are illustrated and named mainly after Sugiyama and Kano (1984). All figures of general morphology in Appendix II are drawn by the second author with representatives of the most common species, *Boettcherisca karnyi* Hardy, 1927 of Malaysian Sarcophagidae.

External anatomy

The body of sarcophagid flies consists of head, thorax and abdomen provided with their relative appendages. As observed in other Diptera, an extraordinary development of the mesothorax and its appendages "two-wings". The metathoracic wings have been reduced to small knob-like organs called "halteres". The mouth-parts are haustrial and the genitalia caudal.

The **Head** takes the form of a hemispherical capsule with the compound eyes laterally. Its flat side towards the thorax, and connected thereto by a narrow and extremely mobile neck.

The **Eye** (Compound eye) is the most conspicuous feature, and may occupy more than one-third of its surface in many species of the subfamily Miltogrammatinae. The eyes are widely separated by the frons or anterodorsal surface of the head capsule, a condition to which the term dichoptic is applied. In the males of some species, the eyes may be closely approximated on the frons, a condition which is termed subholoptic to distinguish it from the completely approximated or holoptic condition generally found in the male of Calliphoridae. The degree of separation of the eyes may be useful to the identification of species. The presence or absence of hairs on the surface of the eye may be useful for identification.

The **Antenna** is paired, and the most noticeable appendage of the head. Its base is arisen from the middle of the anterior convex surface of the head. The antenna consists of three segments, the basal one "*first antennal segment* or *antennal segment 1, AS₁*" being smallest and terminal one "*third antennal segment* or *antennal segment 3, AS₃*" [first flagellomere] the largest. The **Arista** (style, flagellum) is a filiform appendage of the third antennal segment. The arista may be bare or haired, in which latter case the hairs bear on a dorsal and ventral surface, a condition which termed "plumose" to distinguish it from the condition hairs in a dorsal row alone "pectinate". A leaf-like flattened arista observed in the male of *Phylloteles* is one of peculiar cases.

The **Ocellar triangle** is a small raised area of the dorsal surface of the head-capsule.

The **Ocellus** is a simple eye. Usually three ocelli are developed and arranged close together within the ocellar triangle. The size of anterior ocellus and the width of ocellar triangle (or a distance between posterior two ocelli) are often used for comparing the width of frons changed with the development of eyes.

The **Ptilinal suture** (frontal suture) is a suture in the form of an inverted U lying close to the base of antennae. The arms of the U are extending down on either side of antennae. This is the most important characteristic of the Muscomorpha to distinguish it from other higher taxa of Diptera. The Muscomorphous fly accomplishes this suture by evagination of a sack-like ptilinum after the fly is emerging from the puparium. After eclosion, the evagination is completely withdrawn, but the suture remains clearly visible.

The **Peristome** (epistome, epistoma, stoma) is the lower edge of the head-capsule immediately surrounding the buccal cavity, to which, incidentally, the term peristome has often been applied. The term *Epistome* best restricted to actual rim of the face in front view. The mouth-parts consist of a soft and retractile proboscis and the *Palpus*

whose shape, size and colour often offer very useful taxonomic characters.

The *Occiput* is the whole surface of the back of the head towards the thorax. Some authors restrict the term to that part of this surface which lies above a horizontal line drawn through the foramen of the neck, and in this case the term *Succiput* is applied to the lower portion.

The *Frons* is the anterodorsal surface of the head capsule extending from the upper margin of the occiput, around the ocellar triangle, forward and down between the compound eyes to the ptilinal suture. It may be taken to end at a line drawn horizontally through the bases of antennae although there is no morphological character to define its lower limits. The frons is subdivided into several regions for the sake of taxonomic description.

The *Vertex* is that part of the frons on the top of the head immediately around the ocellar triangle and in front of the occiput. Its posterior margin joins the vertical margin of the occiput. Its anterior margin is not clearly defined.

The *Frontal stripe* (frontal vitta, frontalia) is a clearly defined part of the frons running down from the vertex in front of the ocellar triangle to the ptilinal suture. Its shape and colouration are important to distinguished species. In some cases of males, it is reduced to a fine median line passing down at the middle of the frons. The ratio of its width to adjacent parts is sometimes noted for description.

The *Parafrontal* [fronto-orbital plate] (one of parafrontalia, parafrontale, orbit) constitutes the rest of frons on either side, and extend from the vertex down between the eye and the frontal stripe to an arbitrary line drawn horizontally through the bases of the antennae.

The *Parafacial* (one of parafacialia, parafaciale) is that areas joining the parafrontal below an arbitrary line drawn horizontally through the antennal bases which is bounded by the ptilinal suture and the anterior margin of the eye.

The *Face* is the region of the head-capsule which, bearing the antennae, is enclosed by the ptilinal suture and limited ventrally by the epistome or the anterior margin of the peristome. The part just above the insertion of the antennae is called the *Lunule* (Lunula). The antennae are sometimes separated by the *Facial carina* (median carina, keel). The *Facial ridge* (one of facialia) is lateral to the antennae and extends downwards along ptilinal suture towards the epistome.

The *Gena* (jowl, bucca, cheek) is that area on either side of the head-capsule lying above the peristome and below the parafacial. The *Postgena* (metacephalon) is the hairy narrow part at the posterior lower corner of head capsule. The *Mediana* is a term that has been applied to a naked part between parafacial and anterior part of gena. The *Vibrissarium* is a term that has been applied to a setulosed part around *Vibrissa*.

The *Postorbit* is the narrow stripe of head-capsule behind the compound eyes and in front of the occiput joining up the gena below and the parafrontal and the vertex above.

The ***Thorax*** is morphologically composed of three segments. These are the *Prothorax*, bearing the anterior pair of legs, the *Mesothorax*, with the middle pair of legs and the wings, and the *Metathorax*, bearing the hind legs and the halteres. The entire visible dorsal surface is composed of what is morphologically the mesotergite although it is usually referred to as the *Mesonotum* (dorsum, disc). The mesonotum is superficially divided into three distinct parts which serve as useful information in describing the features of the thoracic dorsum.

The *Scutellum* is the hindmost section of the dorsal surface of the thorax. The *Postscutellum* (postnotum, metanotum) is a convexity of the thoracic wall beneath scutellum and above the junction of the thorax with the abdomen. The relatively undeveloped condition of postscutellum is one of the characteristics of Sarcophagidae.

The *Scutum* is that portion of the thorax which is anterior to the scutellum, from which it is demarcated by a deep groove. The scutum also has a shallow groove on its surface named as the *Transverse suture*. The anterior portion or presutural area is sometimes named as the *Prescutum* to distinguish it from the postsutural one, and in this case the term scutum is applied to the posterior one. The transverse suture is very important as a reference point in describing the features of the thorax.

The *Spiracle* (one of stigmata, one of stomata) is the opening on the tracheal system. There are two on the lateral walls of the thorax, the *Mesothoracic* (prothoracic) and *Metathoracic spiracles*. The colouration of spiracles, actually of flaps is of taxonomical importance.

The *Propleuron* [proepisternum] is the area of the lateral wall of the thorax just anterior to the mesothoracic spiracle. The hairy or naked conditions of this plate must be noted for classification.

The *Pteropleuron* [anepimeron] is a large, somewhat convex plate beneath the root of the wing. The bristles on the pteropleuron are more or less important in classification.

The *Mesopleuron* [anepisternum] is also a large plate in front of the pteropleuron. The arrangement of bristles and pollinosity on it are also become important in classification.

The *Sternopleuron* [katepisternum] is a large, triangular, slightly convex plate at the root of the mid leg. The arrangement of the *Sternopleural bristles* is characteristic of Sarcophagidae.

The *Hypopleuron* [katepimeron+meron] is another lateral area just behind the pteropleuron. The presence of bristles on it is an important character to separate Sarcophagidae from Scathophagidae, Anthomyiidae and

Muscidae.

The *Prealar knob* (subalar knob) is a small knob that can be seen just below the wing. The prealar knob is a part of the pteropleuron, but its shape and the presence or absence of hairs on it have systematic significance.

The *Postalar declivity* is a kind of trough found below the edge of the scutellum, running up from the root of the wing above the line of attachment of the squama. The presence or absence of hairs on it should be noted.

The *Suprasquamal ridge* is a ridge that runs along the ventral side of the postalar declivity. The squama appears to attach to it

The *Supraspiracular convexity* [katatergite] is a convex bulge which locates just above the metathoracic spiracle. The hairiness on it is important to distinguish some groups in the Calliphoridae.

The *Pleurotergite* [anatergite] is another bulge below the thoracic squama and above the base of halter. The presence or absence of setulose hairs on it is sometimes useful for taxonomy.

The **Wings**: Only fore pair of the *Wings* is developed as in all winged Diptera. The hind pair is replaced by the *Halteres* which possess specialized sensory functions, but have no taxonomic value other than those of colour. The venation of the wing seems to be very constant within the family Sarcophagidae as shown in Appendix II (Fig. 16). However, good specific characters are often found in the rows of setulae which exist on the upper or lower sides, or both, of certain veins. Proportions of the costal sections (CS) and colourations of the *Epaulet* [tegula] and the *Basicoستا* are good characters and must be examined for description. Colouration of the wing membrane into patterns is rarely found in the genus *Phyloteles*, Miltogrammatinae. An accessory lobe of wing, the *Alar squama* (upper squama), is developed near its root and joins a more broad lobe, the *Thoracic squama* (lower squama) at base. The thoracic squama covers the halter, and its shape and hairiness on upper surface have some systematic value.

Three pairs of **Legs**, *Fore*, *Mid* and *Hind legs*, are well developed, but show remarkably few modifications in Sarcophagidae. It is only in the chaetotaxy of the legs that useful characters are found. In describing the chaetotaxy of a dipteran leg, certain conventions are required. The leg is considered as if spread out at right angles to the longitudinal axis of the body, and as if each segment was of square, and not of round, or elliptical in cross section. There are thus anterior and posterior, dorsal (superior) and ventral (inferior) sides, and positions for bristles are simply shown as the anterodorsal bristle (*ad*), even in case of intermediate positions between the four main surfaces. Individual species, moreover, show special developments, often sexual dimorphisms, in this respect. In some species in the Miltogrammatinae, the male has fine long hairs on the fore tarsus. In many species of the tribe Sarcophagini, the male has strong hair fringes on the ventral (inferior) surface of the hind femur and tibia, sometimes also on the mid femora and tibia. The hair fringes often become double and develop on both anteroventral and posteroventral surfaces of femora and tibiae.

The **Abdomen** consists of four visible segments in Sarcophagidae. The dorsal part of the visible surface consists of the *Tergites* which pass well down the sides of the abdomen and on to the ventral surface. The median part of the ventral surface morphologically consists of smaller sclerites or the *Sternites*. The first visible segment consists of the combined tergite 1+2 and sternites 1 and 2 in the sarcophagids. The sternite 2 is enlarged and overlapping tergite 1+2 in Sarcophagidae, and not reduced and submerged beneath the tergite 1+2 as in Tachinidae. The shape and the vesture of bristles or spines on sternite 5 are very useful to identify the male of sarcophagids. The visible tergites bear marginal and discal bristles whose positions may be important in the sarcophagid classification. The remaining segments comprise the postabdomen which is modified to the sexual organs for copulation and larviposition. The male postabdomen shows the modification and differentiation among the subfamilies Sarcophagidae. In the subfamily Sarcophaginae, the first large dorsal sclerite behind the tergite 5 is usually termed the *First genital segment* (GS₁) in taxonomical descriptions and has been morphologically considered the circumvented and combined sternite 7+8. The following dorsal sclerite is taxonomically called the *Second genital segment* (GS₂) and morphologically named the *Epandrium*. The tergite 6 is disappeared between tergite 5 and GS₁ in the subfamily Sarcophaginae whereas it remains developed in front of GS₁ in the Miltogrammatinae. The tergite 6 is amalgamated with GS₁ in the subfamily Paramacronychiinae. Both states of the tergite 6 are considered to be derived from that of the subfamily Miltogrammatinae in a different way of evolution. The sexual organs are called the *Genitalia* and often collectively called the *Hypopygium* (terminalia). The genitalia highly modified in both sexes, and in the male afford characters of the greatest value in separating species in the Sarcophaginae which are often inseparable by the other external ones. The female genitalia are greatly modified to lay larvae in the sarcophagids, and also afford good characters in identifying the problematic species. They will be considered below.

Male genitalia

Examination of the *Male genitalia* is of preeminent importance to identify the sarcophagine species which have a very similar external appearance to each other. Their external structure must be referred in some details to understand the phylogenetic relationships among the species groups in the family. Fundamentally, they consist of

modifications of the tergites 6–10 and their appendages. The tip of the abdomen has a pair of processes, the *Cerci* (mesolobes, inner forceps, superior claspers) which are apparently identical with the anal cerci of the primitive insects. They are highly chitinized and downwardly directed in most species of Sarcophagidae, but bent posteriorly at median portion in the tribe Protodexiini. The anus opens above them. The *Surstylus* (paralobe, outer forceps, accessory clasper) is more or less developed exterior and slightly anterior to the cercus, but not developed at all in certain genera. The surstylus is always much less strongly chitinized than the cercus, and are morphologically considered to be outgrowth of the pleural margin of epandrium. The first genital segment (GS_1) serves as a sheath for the *Aedeagus* (phallosome, penis), and retracted into the body of the abdomen, appearing from outside as a small and frequently glossy, chitinous knob at apex. The tips of cerci are likewise inserted beneath the aedeagus, into the cavity of GS_1 .

The *Aedeagus* is the general term for the copulatory and ejaculatory apparatus. The aedeagus consists of three parts, apodeme, theca and phallus.

1. The *Apodeme* is observed in the second genital segment (GS_2) after dissecting and removing male genitalia. The *Ejaculatory apodeme* attaches the end of the vas deferens. The shape of the ejaculatory apodeme is characteristic in some species, but its sclerotization changes according to age after eclosion. The *Aedeagal apodeme* is connected with the base of theca.
2. The *Theca* [basiphallus] (phallophore) is a sclerotized tube uniting the aedeagal apodeme to the phallus. The theca is generally articulated with the corpus of phallus, but totally amalgamated in some tribes such as Paramacronychiini, Goniophytini and Raviniini.
3. The *Phallus* [distiphallus] (phallosome) is placed at the apex of the theca and usually articulated with it. Several important structures are developed for copulation and modified in different species. The detailed illustration of the following components is very useful for identification of species and understanding the phylogenetic relationships.
 - a) The *Corpus* [paraphallus] is the posterior part of outer wall of the phallus. It is symmetrically sclerotized but the median portion is usually membranous or less sclerotized. The degree of sclerotization varies in species.
 - b) The *Juxta* [acrophallus] (apical plate) is a shovel-like sclerotization at apicoposterior part of the phallus. The juxta is usually distinguished from the corpus by the membranous zone, but sometimes both are amalgamated to become one piece of sclerite. The aedeagus of the subfamily Miltogrammatinae lacks the juxta.
 - c) The *Juxtal process* (process of apical plate) is a paired prolongations projected anteriorly from the base of the juxta, but sometimes not developed in groups and species.
 - d) The *Ventralia* [hypophallic lobe] (vesica of some authors) is the antero-proximal flap-like appendage of the phallus projecting forward from basal membranous portion of the phallus. The size, degree of sclerotization and number of lobes is varied by groups and species. The ventralia is usually a single paired structure, but rarely bifid at its base.
 - e) The *Vesica* [ventral plate] (harpe of some authors) is an anterior- to anteroventral extension of sclerous corpus. It usually arises at anterior extension of corpus.
 - f) The *Harpe* [paraphallus] is a posteroventral extension of sclerous corpus.
 - g) The *Median process* is an internal structure between the base of the right and left styli, and attached to the median portion of inner surface of the juxta as generally observed in the tribe Sarcophagini. The tribes Raviniini and Protodexiini lack this structure. The median process is important to understand the phylogeny of the subfamily Sarcophaginae. The apical prolongation of median process is sometimes specified and called as *Capitis* (Roback, 1954).
 - h) The *Cap* is a paired symmetrical sclerotization curved into the phallus from the base of ventralia. The cap is developed in some species of the tribe Sarcophagini.
 - i) The *Stylus* (lateral filament) is a paired ejaculatory apparatus observed beside median process in the phallus. The base of stylus is usually coil-like in appearance and its body is often slender sclerous tube in the tribe Sarcophagini. This tube is made of two thin rounded sclerous stripes. The Raviniini lack stylus. In the Protodexiini, it is a paired small process projecting from the base of juxta. The stylus is also important to consider the phylogeny of the subfamily Sarcophaginae.
 - j) The *Dorsal rod* is a paired sclerotized rods arising from lateral sides of the phallic tube to the base of ventralia. This sclerotization is observed only in the tribe Raviniini. The dorsal rod is considered to be an advanced form of ventral sclerotization.
 - k) The *Phallic tube* is a prolongation of membranous phallus and located between dorsal rods and its orifice is sclerotized. It is observed in the primitive sarcophagine flies such as the tribe Raviniini.
 - l) The *Ventral sclerotization* is a paired sclerotized plate observed in the hypothetical phallus of the family Sarcophagidae. The basal end is attached to the apex of corpus. Each arm runs medially and anteriorly. The ventral sclerotization seems to be modified in differentiation of each tribe.

Female genitalia

The female postabdomen, which is modified to form the so-called *Ovipositor* or *Larvipositor*, almost without exception appears to have the four visible segments. The first segment has the well sclerotized tergite 6 (T_6) and sternite 6 (S_6/ST_6), accompanying two pairs of spiracles (sp 6 & sp. 7). The second, third and fourth segments usually have more or less developed tergites 7–8 (T_7 – T_8) and sternites 7–8 (S_7 – S_8/ST_7 – ST_8), but tergite 9 and sternite 9 are disappeared. The last sternite, probably sternite 10 has been named the *Subanal plate* (SBAP). In most species of sarcophagid flies, the subanal plate has no *Lingula* which surrounds the genital pore and may be derived from the sternite 9. The last tergite is named supraanal plate (SPAP), which seems to be derived from tergite 10 or tergite 9+10. Exterior to the supraanal plate are the *Cerci*. The anus opens between SPAP and cerci. The genital pore opens apparently between ST_8 and SBAP in most species of Sarcophagidae while it is found between ligulae of SBAP in the oviparous flies of Calliphoridae.

Abbreviations of morphological terms used in text and/ or figures

General morphology:

AS_1 , AS_2 , AS_3 =first, second, third antennal segment

CS_1 , CS_2 , CS_3 =first, second, third costal section

C=costa

ce=cercus

GS_1 , GS_2 =first, second genital segment

hy=hypandrium

ep=epandrium (= GS_2)

S_1 – S_{10}/ST_1 – ST_{10} =abdominal sternites 1–10

ss=surstylus

T_1 – T_{10} =abdominal tergites 1–10

Wing venation:

R_1 =first longitudinal vein

R_{2+3} =second longitudinal vein

R_{4+5} =third longitudinal vein

r-m=anterior cross vein

M or M_{1+2} =fourth longitudinal vein

CuA_1 =fifth longitudinal vein

$A_1 + CuA_2$ =sixth longitudinal vein

A_2 =axillary vein

dm-cu=posterior cross vein

Male terminalia:

a=aedeagus

dr=dorsal rod

aa=aedeagal apodeme

h=harpe(s)

ea=ejaculatory apodeme

mp=median process

p=phallus

cap=cap

c=corpus

s=stylus

j=juxta

pt=phallic tube

jp=juxtal process(es)

t=theca

v=vesica

vs=ventral sclerotization

vn=ventralia

Abbreviations for chaetotaxy:

Head:

acoc=accessory ocellar bristle (s)
iv=inner vertical bristle(s)
oc=ocellar bristle(s)
occ=occipital hair-like seta(e)
ori=frontal bristle(s)
ors=fronto-orbital bristle(s)
ov=outer vertical bristle(s)
poc=postoccipital bristle(s)
pooc=postocellar/ postvertical bristle(s)
poor=postorbital/ postocular bristle(s)

Thorax:

ac=acrostichal bristle(s)
dc=dorsocentral bristle(s)
h=humeral bristle(s)
ia=intra-alar bristle(s)
n=notopleural bristle(s)
pa=postalar bristle(s)
ph=posthumeral bristle(s)
pp=propleural bristle(s)
prs=presutural bristle(s)
pst=prostigmatal bristle(s)
sa=supra-alar bristle(s)
sc=scutellar bristle(s)
st=sternopleural bristle(s)
hp=hypopleural bristle(s)
dsc=discal scutellar bristle(s)
msc=marginal scutellar bristle(s)

Legs:

a=anterior/anterolateral bristle(s)
ad=anterodorsal bristle(s)
av=anteroventral bristle(s)
d=dorsal bristle(s)
p=posterior/ posterolateral bristle(s)
pd=posterodorsal bristle(s)
pv=posteroventral bristle(s)
v=ventral bristle(s)

Abdomen:

db=discal bristle(s)
mb=marginal bristle(s)

Width, height, length and angle:

WF=width of frons
 WH=width of head/ head width
 WE=width of eye/ eye width
 WP=width of parafacial
 WAS3=width of 3rd antennal segment
 HE=height of eye/ eye height
 HG=height of gena
 HH=height of head/ head height
 LE=length of eye/ eye length
 LH=length of head/ head length
 AF=frontal angle
 AV=vibrissal angle

Ratio and index:

frons index = WF/WH

ratio of WAP = ratio of width of anterior to posterior part of frontal stripe

Definition of Armature and Ornament (mainly followed after Fan, 1992)

The *Hair*: Generally smaller and thinner than the bristle, however it can be bent.

The *Bristle*: Straight and thick hair. Hair socket is found at the base, usually the base is thicker than the tip. Position, number, length and tendency are fixed and clear; however, there are variations. If the bristle is broken, tendency can be determined by the edge of hair socket; the edge where hair socket grow higher is the bristle growth direction.

The *Seta*: Hard and straight hair, the big one can be as big as bristle, while the small one can be as small as the hair at the vein of wing; smaller seta called setula. Some of the researchers used "seta" as bristle.

The *Macrochaeta*: Huge hair, is a combination of bristle and big seta.

The *Microchaeta*: Tiny hair, usually only able to be observed under the dissecting microscope with enlargement of high magnification.

The *Fringe*: Thin and long hair, curl at the tip, usually grow in high density and in row; for example the hair of tibia, hind leg of Sarcophagidae. Sometimes "fringe" is used as hair at edge of certain body part and this named as "marginal fringe".

The *Soft hair*: Soft hair with high density, for example, body hairs in "*Hypoderma*".

The *Villi*: High density, short and soft hair.

The *Cilia*: Very thin and small hair, however, able to be observed under the dissecting microscope with lower magnification.

The *Pubescence*: Unclear thin, soft with high density hair when observe under the dissecting microscope with enlargement of low magnification.

The *Tomentum*: Two meanings. First, independent curly hair like soft hair of sheep. Second, modified scales, short and flat hair, usually small and overlap to each other, however, independent hair structure can be observed after enlargement, this named "scaled hair".

The *Pollen/ Pollinosity/ Pruinosity/ Tessellation*: Very tiny with high density small scales, forming a piece of outer surface powdered patch. These patches will reflect differently under different light intensity, for example the greyish pollinosity on abdomen usually produces a checkered/ tessellate pattern/tessellation in the Sarcophagidae.

The *Pile/ Pilosity*: Hair which grow to become pieces at the outer surface of the body.

The *Piliferous spots/ Setigerous spots*: When hair which grow on the pollen, pollinosity or pruinosity, spot surrounding of the hair socket which lack of pollen, pollinosity or pruinosity.

The *Spine*: Very big, thick, hard and straight structure; smaller one called spinula.

The *Ctenidium*: Rows of short, straight and with high density of thorn-like bristles; for example on mid femur of some males in Sarcophagidae.

The *Teeth*: Structure of teeth-shape or calcareous projection on the body wall; for example this structure often observed on ventral surface of fore femur in *Hydrotaea* (Diptera: Muscidae).

The *Patch*: Pieces of regular or irregular markings. Formation of marking is because the surface of the body having different colour based, and also due to lack of or having high or low density; thick or thin of various structures (e.g. pile, scaled hair, pollen) on the body surface. The colour of pollen, stripe and band, especially at the dorsal of thorax and abdomen, will change with different light intensity, therefore, for the description of marking colour, the light source must be directed to the fly at 90 degrees. So that, both sides (left and right) of fly receive equal light intensity and the observant must look from top of the fly at 90 degrees (same direction with light source). The black and white checkerboard-like pattern on the abdomen of Sarcophagidae is an example of marking of pollen. The marking formed by the dense villi is called "marking of villi". The marking formed by dense cilia is called "marking of cilia" while the marking formed by the dense seta is called "marking of setae/bristles". Lastly, the marking formed by dense spine is called "marking of spines".

The *Stripe/ Vitta*: The marking formed parallel (elongated) with the body.

The *Band/ Fascia*: The marking formed across (90 degrees) the body.

Diagnosis of Sarcophagidae

The family Sarcophagidae can be recognized by the combination of following characteristics:

Head: dichoptic in both sexes, but frons of male usually more or less narrower than that of female; eyes never closely approximated at narrowest point of frons, consist of almost uniform facets in ♂; ptilinal or frontal suture distinct; antennae consist of 3 segments, 2nd segment (AS_2) with longitudinal cleft on outer surface; 3rd segment (AS_3) largest and bearing arista as terminal style.

Thorax: black, not metallic, more or less greyish pollinose, with more or less distinct dark longitudinal stripes, usually 3 broad black ones, with complete transverse suture; postscutellum not developed, not convexed; outer posthumeral bristle (*ph*) located even with or mesad of presutural bristle (*prs*); notopleural bristles (*n*) generally 4, rarely 2; hypopleuron with row of bristles (*hp*) along posterior margin.

Wings: well developed, longer than thorax; sixth longitudinal vein ($A_1 + CuA_2$) extending more than 1/2 way to wing margin, but not reaching margin; fourth longitudinal vein (M, M_{1+2}) bend forward with an angle and meet third longitudinal vein (R_{4+5}); 1st posterior cell (r_{4+5}, r_5) narrowed or closed apically; thoracic or lower squama well developed, lobulate, concealing halter.

Legs: tip of tarsus with two pulvilli and claws, without pulvilliform empodium.

Abdomen: black, not metallic, more or less covered with greyish pollinosity which usually produces a tessellate pattern; sternite 2 (ST_2) enlarged and overlapping tergites.

Female—Larviparous.

These characters are important criteria to distinguish the Sarcophagidae from other two-winged flies or Diptera.

TAXONOMIC KEYS

Key to the subfamilies of East Malaysian Sarcophagidae

1. Hind coxa hairy on posterior surface; *n* 4, two strong primary bristles, two smaller subprimary bristles; sternites 3 to 4 fully exposed and overlapping ventral margins of corresponding tergite. Subfamily SARCOPHAGINAE
- Hind coxa bare on posterior surface; *n* 2; sternites 3 to 4, more or less concealed by ventral margin of corresponding tergite 2
2. Arista plumose or pubescent; hypopygium large; GS_1 amalgamated with tergite 6 with row of erect marginal bristles [No record from Malaysia and Singapore] Subfamily PARAMACRONYCHIINAE
- Arista bare or pubescent; hypopygium small; tergite 6 free, not amalgamated with GS_1 Subfamily MILTOGRAMMATINAE

Subfamily MILTOGRAMMATINAE

Key to the tribes and genera

1. Fore tibia with 3–4 *p*, rarely 2; metathoracic spiracle open, without operculum; legs long, bristly, with elongated claws in ♂; parafacial and gena broad, hairy; oral margin in profile not projecting forward; body covered with pale dusting, sometimes having long ovipositor extruded; length 5–10 mm Tribe **Macronychiini**, *Macronychia* Rondani, *M. malayana* Kurahashi & Pape
- Fore tibia with 1–2 *p*; metathoracic spiracle covered with operculum; legs short, usually with short claws, sometimes with elongated ones in ♂ of *Senotainia*; but in this case epistomal margin in profile angulate, and body length not more than 6 mm; colouration variable, often with pale spots in contrast with black bands and spots. 2
2. Head hemi-spherical; eyes very large; numerous fine proclinate and 1–2 strong reclinate fronto-orbital bristles (*ors*) present (Kurahashi, 1970: 95, Fig. 1C). Tribe **Amobiini**, *Amobia* Robineau-Desvoidy, *A. quatei* Kurahashi
- Head subquadrate or conical; eyes usually normal or very large in size; 0–4 (proclinate) + 1–3 (reclinate) *ors* (Kurahashi, 1970: 95, fig. 1A & B). 3
3. Head conical; eyes very large; *ors* 2 + 3 (Kurahashi, 1970: 95, fig. 1D) Tribe **Metopiini**, *Metopia* Meigen (3 spp.)
- Head subquadrate; eyes usually normal in size; *ors* 0–4 + 1–2 (Kurahashi, 1970: 95, fig. 1A, B) 4
4. Fore tibia with 2 *p*; claws and pulvilli long in both sexes (Kurahashi, 1970: 97, fig. 2A), sometimes normal in ♀; abdominal tergites with three spots on dorsum Tribe **Senotainiini**, *Senotainia* Macquart (2 spp.)
- Fore tibia with 1 *p*; claws and pulvilli normal in both sexes (Kurahashi, 1970: 97, fig. 2B); abdominal tergites either with three spots or dark marginal band, or with three spots and dark marginal bands forming mountain-shaped marks, or tessellate, sometimes with three dark spots 5
5. Eye bare; arista not flattened, usually elongate or rod-like; abdominal tergites with dark marginal band or tessellation Tribe **Miltogrammatini**. . . 7
- Eye hairy, if bare, then arista flattened, leaf-like in ♂; abdominal tergites with three dark spots Tribe **Phyllotelini**. . . 6
6. Arista not flattened in ♂; abdominal tergites with three black elongated, round or triangular spots [No record from Malaysia and Singapore] *Hoplacephala* Macquart
- Arista flattened, leaf-like in ♂; abdominal tergites with three dark spots [No record from Malaysia and Singapore]. *Phylloteles* Loew
7. Facial ridge with row of black bristles on more than 1/2 way from vibrissa to antennal base

- *Craticulina* Bezzi, *C. tabaniformis* (Fabricius)
 — Facial ridge bare, rarely with a few small bristles just above vibrissa 8
 8. Vibrissa present on vibrissal angle high above oral margin. *Protomiltogramma* Townsend
 — Vibrissa absent *Miltogramma* Meigen

Key to the species of *Amobia*

1. Basicosta black; thoracic dorsum without three longitudinal black stripes; presutural *ac* developed.
 A. quatei Kurahashi
 — Basicosta yellow; thoracic dorsum with three longitudinal black stripes; presutural *ac* absent [Sabah, No record from Sarawak] *A. auriceps* (Baranov)

Key to the species of *Protomiltogramma*

1. Parafrontal and parafacial silver-white pollinose; thoracic dorsum greyish pollinose, with three broad black longitudinal stripes which become more distinct when viewed behind; tergite 5 with tuft of bristles on posteroventral corner in ♂ *P. puteri* Kurahashi & Leh
 — Parafrontal and parafacial golden pollinose; thoracic dorsum blackish, dark brown pollinose entirely, without distinct black longitudinal stripes; posteroventral corner of tergite 5 without tuft of bristles in ♂
 P. parafacialis Kurahashi & Leh

Key to the species of *Miltogramma*

1. Third antennal segment (AS₃) largely orange yellow [Sabah, No record from Sarawak]
 M. angustifrons (Townsend)
 — AS₃ entirely or largely fuscous brown to black, especially on outer surface *M. iberica* Villeneuve

Key to the species of *Senotainia*

1. Propleuron hairy *S. navigatrix* (Meijere)
 — Propleuron bare **S. albifrons* (Rondani)

Key to the species of *Metopia*

1. Basicosta black 2
 — Basicosta yellow 3
 2. Vein R₁ bare *M. sauteri* (Townsend)
 — Vein R₁ setulose [Sabah, No record from Sarawak] *M. nudibasis* (Malloch)
 3. Tergite 1+2 with erect, sometimes decumbent median *mb*; alar and thoracic squamae whitish; parafrontal and parafacial silver-dusted in ♀; body silver-grey pollinose. *M. argyrocephala* (Meigen)
 — Tergite 1+2 without median *mb*; alar and thoracic squamae yellowish; parafrontal and parafacial yellowish-silver pollinose in ♀; body yellowish-pollinose *M. suifenhoensis* Fan

Subfamily SARCOPHAGINAE

Key to tribes and genera

1. Arista pubescent, hairs not exceed width of arista; *st* 1+1; body densely silver-grey dusted; abdomen weakly tessellated *Leucomyia* Brauer & Bergenstamm
 — Arista long plumose, plumose hairs longer than width of arista; *st* 1+1+1, rarely median one weakly developed or absent in *Shinonagaella urceola*; body more or less darkened, grey pollinose, abdominal pollinosity produce irregular checkered patterns or tessellation, but sometimes dark spots and median stripe in ♀ of *Blaesoxipha* spp. 2
 2. Row of *ori* nearly straight in dorsal view [No record from Malaysia]
 Tribe **Raviniini**, *Ravinia* Robineau-Desvoidy
 — Row of *ori* distinctly diverging at lunule 3
 3. Presutral *ac* strong, usually arranged in distinct row anteriorly to posteriorly: male cerci distinctly bent back, female sternites 7–8 fused and often form sclerotized ovipositor shovel-shaped, blade-like, or recurving beneath abdomen; SPAP vestigial, but with pair or pairs of setulae; male sternite 5 without spine-like bristles along inner margins of lateral lobes Tribe **Protodexiini**, *Blaesoxipha* Loew, *B. rufipes* (Macquart)
 — Presutural *ac* absent, at most relatively weakly developed; *ac* present on anterior and / or posterior prescutellar areas; ♂: sternite 5 usually with spine-like bristles along inner margins of lateral lobes; cerci usually curving anteriorly. ♀: sternites 7–8 of separate sclerites and form short ovipositor for larviposition; SPAP usually absent Tribe **Sarcophagini**. . . 4

4. Gena entirely clothed with yellowish white hairs 5
- Gena clothed with black hairs at least in part, often largely on anterior part, or sometimes entirely 6
5. Propleuron clothed with yellowish white hairs; sternites 1–2 clothed with yellowish hairs in ♂ and ♀; GS₁ black in ♂; tergites 6–7 and sternites 6–7 black in ♀; AS₃ black; *st* 1+1, sometimes 1+1(fine)+1 *Omarisca* gen. nov., *O. longifolia* (Salem) comb. n.
- Propleuron bare; sternites 1–2 clothed with black hairs in ♂ and ♀; GS₁ red in ♂; tergites 6–7 & sternites 6–7 red in ♀; AS₃ orange; *st* 1+1+1 *Liopygia* Enderlein, *L. ruficornis* (Fabricius)
6. Postsutural *dc* 3 or 4, each bristle subequal in length (Figs. b, c in Appendix I) 7
- Postsutural *dc* 5, sometimes 6–7, anterior 3–5 bristles fine, less developed than posterior two and gradually decreased in length toward transverse suture; number without counting the subprimary fine interstitials and additional (Figs. a1, a2 in Appendix I) 14
7. Postsutural *dc* 3 *Myorhina* Robineau-Desvoidy
- !Number without counting the subprimary fine interstitials x and additional y (Fig. b in Appendix I)
- Postsutural *dc* 4 (Fig. c in Appendix I) 8
8. Propleuron bare 11
- Propleuron hairy 9
9. Tergite 3 with strong, erect *mb*; Tergite 6 in ♂ with small lateral sclerites with *mb* [No record from Sarawak] *Shinonagaella* Verves stat. n.
- Tergite 3 without *mb*; Tergite 6 in ♂ divided into broad lateral sclerites with *mb*. 10
10. Yellowish white hairs on gena not extending forward to line drawn from posterior margin of eye; male sternite 4 usually with posterior pad of dense shorter clothing setae or adjacent upstanding long hairs; aedeagus with slender stylus; pregonite bifurcated. *Sarcorohdendorfia* Baranov
- Yellowish white hairs on gena extending forward to line drawn from posterior margin of eye; male sternite 4 without pad or upstanding long hairs posteriorly; aedeagus with stout stylus; pregonite not branched *Lioproctia* Enderlein
11. Fronto-orbital bristles (*ors*) 0+2 in ♂, 2+2 in ♀, posterior two *ors* reclinate and not cruciate, *ori* inclinate and cruciate, anterior 2 proclinate in ♀ (Kurahashi and Samerjai, 2018, fig. 1a); medium sized flies, 8.5–10.0 mm in length; body slender; hind tibia without fringe; female T₈ of two separated vestigial sclerites; female ST₈ membranous, with setulose hairs; presutural *ac* developed, usually arranged in distinct row anteriorly and posteriorly in ♂, only single prescutellar *ac* distinctly developed in ♀ *Sarcosolomonina* Baranov
- Fronto-orbital bristles (*ors*) 0+1 in ♂, 2+1 in ♀, posterior one reclinate, anterior 2 in ♀ proclinate (Kurahashi and Samerjai, 2018, fig. 1b); large sized flies; body rather stout, more than 11 mm; male hind tibia with fringe well developed on both antero- and postero-ventral surfaces; presutural *ac* not developed, if there are some, they are never arranged in distinct row in ♂, at most only with single pair of distinct prescutellar *ac* 12
12. Distance between first and third postsutural *dc* subequal to that between third and fourth *Sinonipponia* Rohdendorf, *S. hainanensis* (Ho)
- Distance between first and third postsutural *dc* more than that between third and four 13
13. Male sternite 5 with small chitinous protuberance on middle part of ventral surface; gena clothed with black hairs, but intermixed with yellow hairs posteriorly (Tumrasvin and Kano, 1979: fig. 44) *Phallosphaera* Rohdendorf
- Male sternite 5 without such small chitinous protuberance on middle of ventral surface; gena clothed with black hairs only. *Burmanomyia* Fan
14. Propleuron bare 18
- Propleuron hairy 15
15. Vein R₁ setulose *Alisarcophaga* Fan & Chen, *A. gressitti* (Hall & Bohart)
- Vein R₁ bare 16
16. Postsutural *ac* absent or rarely present, but fine or weak; mid tibia usually fringed in ♂, sometimes not fringed in less nutritious males *Zulisca* gen. n., *Z. aquila* (Sugiyama) comb. n.
- Postsutural *ac* present; mid tibia fringed or not fringed in ♂ 17
17. Scutellum without discal scutellar bristle (*dsc*); male sternite 4 without remarkable hairs on median part of posterior margin; ventralia not globose, without serration; hind tibia with well developed fringe on posteroventral surface in ♂ *Hosarcophaga* Shinonaga & Tumrasvin
- Scutellum with one pair of *dsc*; male S4 with rather long hairs on median part of posterior margin; ventralia large, globose, with serration and numerous minute spines; hind tibia without developed fringe on posteroventral surface in ♂, rarely with poorly developed fringe in part *Boettcherisca* Rohdendorf/*Rosellea* Rohdendorf

18. Mid tibia without fringe in ♂ *Parasarcophaga* Johnston & Tiegs
 — Mid tibia with fringe more or less developed in ♂; female tergite 6 developed, of complete plate, with row of strong marginal bristles 19
19. Gena largely clothed with black hairs anteriorly; sternite 4 with or without mat of hairs in ♂ 20
 — Gena largely clothed with yellowish white hairs; sternite 4 without mat of hairs, but entirely with fine long hairs in ♂ [Peninsular Malaysia, No record from Sarawak] *Iranihindia* Rohdendorf
20. Sternite 4 with mat of hairs in ♂; mid tibia with 2 *ad*, median and submedian in ♂; hind tibia with well developed fringe in ♂ *Seniorwhitea* Rohdendorf
 — Sternite 4 without mat of hairs in ♂; hind tibia with weakly developed fringe on apical 2/3 in ♂ *Harpagophala* Rohdendorf, *H. kempfi* (Senior-White)

The postsutural *dc* 3 group

Key to the species of *Myorhina*

1. Thoracic squama partly fuscous on disc 2
 — Thoracic squama entirely whitish 3
2. Mid tibia with *v* at apical 1/4 *M. (Bellieriomima) globovesica* (Ye)
 — Mid tibia without *v* *M. tomae* sp. nov.
3. Presutural *ac* present, at least pair in front of transverse suture developed; hind tibia more or less fringed on anteroventral and posteroventral surfaces, rarely not fringed in case of less nutritious individuals
 M. (Pseudothyrsocnema) borneensis Shinonaga & Lopes
 — Presutural *ac* absent or weak; hind tibia usually not fringed at all, with 1–2 strong *av* in ♂, 3 *av* in ♀ 4
4. Tergite 3 without erect median *mb*; CS₅ setulose along anterior margin on basal 1/2 *M. miyagii* sp. nov.
 — Tergite 3 with erect median *mb*; CS₅ setulose along anterior margin almost entirely 5
5. Upper and lower lobes of ventralia projecting forward in parallel direction in lateral view; male ST₅ with small setulose protuberance on middle part of ventral surface [No record from Malaysia]
 M. (Pseudothyrsocnema) caudagalli (Böttcher)
 — Upper and lower lobes of ventralia projecting to different direction, directed at right angle in lateral view
 M. (Pseudothyrsocnema) crinitula (Quo)

The postsutural *dc* 4 group

Key to the species of *Sarcosolomonina*

1. Vein R₁ setulose *S. rohdendorfi* Nandi
 — Vein R₁ bare *S. crinita* (Parker)

Key to the species of *Burmanomyia*

1. Hind tibia in ♂ fringed on anteroventral and posteroventral surfaces, with 1 *av* 2
 — Hind tibia in ♂ not fringed, with 2 *av* on apical 1/2 *B. barioensis* sp. nov.
2. Mid tibia with fringe of short hairs on apical 1/2 of posteroventral surface, hairs exceeding tibial diameter; mid femur with 3 *pd-d* apically *B. pseudoborneensis* sp. nov.
 — Mid tibia without fringe; mid femur with 2 *pd-d* apically **B. aureomarginata* (Shinonaga & Tumrasvin)

Key to the species of *Phallosphaera*

1. Parafacial densely golden pollinose; alar squama with tuft of fuscous hairs on lower inner margin
 P. amicoides Kurahashi & Tan
2. Parafacial densely grey pollinose, rarely with yellow tinge; alar squama with pale hairs on lower inner margin
 P. barioensis Kurahashi & Tan

Key to the species of *Lioproctia*

1. Abdomen with yellowish golden pollinosity on tergites 4–5 *L. saprianovae* Pape & Bänziger
 — Abdomen with ordinary greyish pollinosity on tergites 4–5 *L. pattoni* (Senior-White)

Key to the species of *Sarcorohdendorfia*

1. Male sternite 4 with posterior pad of dense shorter clothing setae 2
 — Male sternite 4 without such pad or tuft of setae or hairs, at most with tuft of long hairs
 S. curvicercus (Sugiyama)
2. Wing largely yellowish tinged at base; alar and thoracic squamae both yellowish-orange ... *S. seniorwhitei* (Ho)
 — Wing hyaline, more or less dark brown tinged at base; alar and thoracic squamae both whitish 3

3. Supraspiracular convexity clothed with long, upstanding, fine hairs anteriorly. 4
- Supraspiracular convexity bare *S. okazawai* sp. nov.
4. Thoracic squama entirely whitish including disc; tergites 3–5 with ordinary greyish pollinosity; postgonite sharp pointed at apex; stylus shorter than juxta *S. inextricata* (Walker)
- Thoracic squama partly fuscous on disc; tergites 3–5 with golden yellow pollinosity; postgonite with broad flange near apex; stylus longer than juxta. *S. kerohi* sp. nov.

The postsutural *dc* 5 group

Key to the species of *Boettcherisca* / *Rosellea*

1. Abdomen golden-yellow pollinose at least on tergites 4–5 in ♂, on tergite 5 in ♀ 2
- Abdomen not golden-yellow pollinose, with usual grey pollinosity in ♂ and ♀ 4
2. Abdomen golden-yellow dusted on tergites 3–4 in ♂ and ♀; GS₂ blackish in ♂; hind tibia without fringe.
- *Rosellea*, *R. notabilis* (Kano & Lopes)
- Abdomen golden-yellow dusted on tergites 4–5 in ♂, on tergite 5 in ♀; GS₂ reddish in ♂; hind tibia with short fringe on posteroventral surface of apical 2/3 3
3. Sternite 4 in ♂ with long hairs on lateral sides posteriorly; cercus broad, flat, with tubercle basally in ♂; body somewhat elongate in ♂ *Boettcherisca zuli* Kurahashi, Tan & Leh
- Sternite 4 in ♂ clothed with hairs normal sized; cercus narrow, rod-like, without tubercle in ♂; body a little bit stout in ♂ *B. krathonmai* Pape & Bänziger
4. Gena largely clothed with black hairs, but with some yellowish white ones on posterior part; spines on apical part of cercus not extending to dorsal surface in ♂ pregonite slender, longer than postgonite 5
- Gena entirely clothed with black hairs, without yellowish white hairs; spines on apical part of cercus extending to dorsal side in ♂; pregonite and postgonite stout, subequal to each other in length 6
5. Hind tibia not fringed, with a few long hairs on posteroventral surface, usually with 1 *av*; occipital dilatation yellowish pollinose; pregonite with broad flange near apex *B. karnyi* (Hardy)
- Hind tibia poorly fringed, with more than 8 long fine hairs, with 2 *av*, sometimes 1 *av*; occipital dilatation grey pollinose; pregonite long, curved apically, with pointed, sometimes rounded apices.
- *B. peregrina* (Robineau-Desvoidy)
6. GS₂ reddish in ♂; ventralia reduced to small rounded lobe *B. javanica* Lopes
- GS₂ blackish in ♂; ventralia largely lobulated, with small dorsal expansion [No record from Malaysia] *B. nathani* Lopes

Key to the species of *Hosarcophaga* (♂)

1. Sternopleural bristles (*st*) 1+1: *ors* 0+1, reclinate *ors* (preverticals); tergite 3 with decumbent median *mb*.
- *H. puteri* sp. nov.
- *St* 1+1+1; *ors* 0+2; tergite 3 without median *mb* 2
2. Hind tibia with fringe well developed on anteroventral and posteroventral surfaces, posteroventral hairs longer than those on anteroventral surface **H. auricauda* (Ho)
- Hind tibia without fringe, at most with several fine rather long hairs medially on anteroventral surface 3
3. Male genitalia as shown in Fig. 9. *H. palustris* sp. nov.
- Male genitalia as shown in Ho, 1938: 121, fig. 7 **H. serrata* (Ho)

Key to the species of *Parasarcophaga* (♂♂)

1. Gena clothed with black hairs only The group 1 entirely black haired on gena
- Gena largely black haired, but partly with yellowish white hairs, usually along posterior margin 2
2. Genal black hairs limited to anterior extremity; palpus reddish or brownish on apical 1/3; hind femur with fringe on posterior surface, but longest hairs subequal to width of femur; body medium in size, less than 14.0 mm, 9.5–13.5 mm in length. The group 2 largely yellow haired on gena
- Genal black hairs more or less extended to posterior 1/2 of upper part; palpus entirely blackish; hind femur with developed fringe on posterior surface, longest hairs longer than width of femur; body large, usually more than 14.0 mm in length. The group 3 largely black haired on gena

Key to the species of “the species-group 1” entirely black haired on gena

1. Parafrontal, parafacial and mediana golden yellow pollinose; tergites 4–5 with golden yellow pollinosity; thoracic squama largely fuscous on dorsal surface, but pale brown along posterior margin [Sabah, No record from Sarawak] *P. javana* (Macquart)
- Parafrontal, parafacial and mediana silver grey to grey pollinose; tergites 4–5 with silver grey to grey

- pollinosity; thoracic squama largely pale brown. 2
2. Alar and thoracic squamae with fuscous hairs on lower inner and outer margins; tergite 3 with rather long median *mb*, length longer than 1/2 that of tergite 3 3
- Alar and thoracic squamae with white hairs on lower inner and outer margins 4
3. Male genitalia as shown in Kurahashi and Leh, 2007: 270, fig. 2a–c *P. omari* Kurahashi & Leh
- Male genitalia as shown in Ho, 1938: 126, fig. 11 **P. walshi* (Ho)
- Male genitalia as shown in Sugiyama et al., 1990a: 88, figs. 16–19 *P. quinquerosa* (Sugiyama)
- Male genitalia as shown in Sugiyama et al., 1990a: 89, figs. 21–24 *P. robustispinosa* (Sugiyama)
4. Male genitalia as shown in Verves, 1980: 38, fig. 2B *P. lopesi* Verves
- Male genitalia as shown in Nandi, 2002: 294, figs. 508–512 *P. scopariiformis* (Senior-White)
- Male genitalia as shown in Sugiyama et al., 1990b: 95, figs. 4–7 **P. montiblensis* (Sugiyama)

Key to the species of “the species-group 2” largely black haired on gena

1. Hind tibia with 2 *av* in ♂; hind femur with fringe on posterior surface, but longest hairs subequal to width of femur *P. (Parasarcophaga) misera* (Walker)
- Hind tibia without *av* in ♂; hind femur with well developed fringe on posterior surface, longest hairs longer than width of femur. *P. (Parasarcophaga) taenionota* (Wiedemann)

Key to the species of “the species-group 3” largely yellow haired on gena

1. Black genal hairs located only in anterior 1/2 of upper part; cercus with distinct beak-shaped apex. *P. (Liosarcophaga) brevicornis* (Ho)
- Black genal hairs extending beyond anterior 1/2 of gena; cercus slender, pointed at apex. 2
2. Male genitalia as shown in Nandi, 2002: 265, figs. 467–468 **P. (Liosarcophaga) idmais* (Séguy)
- Male genitalia as shown in Nandi, 2002: 272, figs. 475–478 *P. (Liosarcophaga) dux* (Thomson)
- Male genitalia as shown in Nandi, 2002: 342, figs. 580–585 *P. (Parasarcophaga) albiceps* (Meigen)
- Male genitalia as shown in Nandi, 2002: 331, figs. 561–566 *P. (Parasarcophaga) hirtipes* (Wiedemann)
- Male genitalia as shown in Sugiyama et al., 1990a: 86, figs. 13–15 *P. mimobrevicornis* (Sugiyama)

Key to the species of *Seniorwhitea*

1. *ov* not developed, rarely weakly developed in male; alar and thoracic squamae with yellowish-white hairs on lower inner and outer margins; pregonite long and slender; ventralia not globulose . . . *S. princeps* (Wiedemann)
- *ov* well developed in male; alar and thoracic squamae with fuscous hairs on lower inner and outer margins; pregonite with broad flanged from base; ventralia membranous, highly globulose and formed a big bulge *S. orientalis* (Parker)

NEW TAXA

Omarisca gen. nov.

(Fig. 1)

Type species: *Sarcophaga longifilia* Salem, 1946

Etymology

The name (gender: feminine) is composed of the word “Omar”, the name of Professor Baharudin Omar, Department of Biomedical Sciences, Faculty of Health Sciences, National University of Malaysia, and suffix “isca” derives from Latin word “Musca”, meaning “fly”. It means “Omar’s fly”.

Diagnosis

Flies having body elongate in ♂, but stout in ♀; genae and propleura clothed with yellowish white hairs.

♂: Head dichoptic in both sexes; frons index 0.19–0.21 ($M=0.21$, $n=4$) in *O. longifilia*; antenna long, but not reaching to vibrissa; arista long-plumose; body mostly clothed with yellowish white hairs, especially pleura and sternites; propleuron and prosternum hairy; *ac* 0+0; only 1 hindmost postsutural *dc* strongly developed, but anterior ones not developed, hardly distinguished from ground hairs; *st* 1+1+1, median *st* fine and shorter than anterior and posterior ones, located closer to anterior one; vein R_1 bare; mid tibia not fringed; hind tibia fringed on apical 2/3 of antero- and posteroventral surfaces; tergite 3 (T_3) without median *mb*; sternite 5 (ST_5) of Y-shaped; T_6 vestigial, of two left and right narrow sclerites with row of *mb* and some hairs. Male genitalia: theca of normal shape; membranous region between theca and harpe; juxta well differentiated, lateral processes elongated and bend to form arc; apical part of processes curved like hook; vesica (lateral plate) strongly sclerotized and pigmented; ventralia of simply structured lobe, small, less sclerotized and not spinose; stylus elongate, longer than length of

juxta, coiled at base; shape of aedeagus very characteristic, well represented as good criteria of the present genus.

♀: Frons index 0.30 in *O. longifilia*; abdomen broad, oval (habitus photograph in Appendix V); terminalia (larvipositor) characteristic as shown in Fig. 1; T_6 intermediate between single complete sclerite and two separate ones, with large incision posteriorly; T_8 (probably 7+8+9 combined tergite) disappeared; ST_6 and ST_7 of single sclerite; ST_8 disappeared, with several setulose hairs; ST_9 of two sclerites (Fig. 1).

Affinity

The type species clearly represents a new genus of the tribe Sarcophagini (Subfamily Sarcophaginae). It seems to have a relationship with *Sarcorhodendorfia* and *Sarcosolomonina*, but male and female genitalia are characteristic and it is easily distinguished from these two genera.

Zulisca gen. nov.

(Fig. 2)

Type species: *Sarcophaga aquila* Sugiyama, 1990

Etymology

The name (gender: feminine) is composed of the word “Zul”, a nickname for Professor Zulqarnain M., Genetics and Molecular Biology, Institute of Biological Sciences, Faculty of Science, University of Malaya, and suffix “isca” derives from Latin word “Musca”, meaning “fly”. It means “Zulqarnain’s fly”.

Diagnosis

Flies having body elongate in ♂, but stout in ♀; genae clothed with black, brown and yellow hairs; propleura clothed with fuscous black hairs.

♂: Head dichoptic in both sexes; frons index 0.18–0.20 ($M=0.18$, $n=9$) in *Z. aquila*; antenna long, but not reaching to vibrissa; arista long-plumose; propleuron clothed with blackish hairs; prosternum hairy; *ac* 0+0–1 (very fine); only 1 hindmost postsutural *dc* strong, but anterior ones not developed, hardly distinguished from ground hairs; *st* 1+1+1, median *st* fine and shorter than anterior and posterior ones, located close to anterior one; vein R_1 bare; mid tibia fringed more than apical 1/2; hind tibia fringed on entire length of anteroventral and

Fig. 1. *Omarisca longifilia* (Salem, 1946) comb. nov., female genitalia.—a, larvipositor, caudal view; b, spermatheca, one of three illustrated.

Fig. 2. *Zulisca aquila* (Sugiyama, 1990) comb. nov., female genitalia.—a, larvipositor, caudal view; b, spermatheca, one of three illustrated.

posteroventral surfaces; tergite 3 (T_3) without median *mb*; sternite 5 (ST_5) of Y-shaped; T_6 vestigial, with two left and right narrow sclerites with row of several *mb*. Male genitalia: theca of normal shape; membranous region present between theca and harpe; juxta well differentiated, with two lateral processes lobulated; apical part of processes round; vesica (lateral plate) of narrow sclerotized projection, somewhat pigmented; ventralia of simply structured membranous lobe, small, less sclerotized and not spinosed; stylus elongate, longer than length of juxta, with coiled base; vesica (lateral plate) very simple, curved; aedeagus simply structured, but well represented as good criteria of the present genus.

♀: Frons index 0.26–0.28 ($M=0.26$, $n=3$); abdomen broad, oval; terminalia (larvipositor) characteristic as shown in Fig. 2; T_6 intermediate between single complete sclerite and two separate ones, with large incision posteriorly, with two rows of lateral *mb*; T_7 of two narrow sclerite; T_8 of single narrow sclerite, without *mb*; ST_6 single sclerite, with 3 strong lateral *mb*; ST_7 single sclerite, with 2 *mb*; ST_8 single sclerite, vestigial, bare, without *mb*, amalgamated with ST_7 ; ST_9 single plate-like sclerite; spermatheca elongate, sculpture, with smooth, round head.

Affinity

The type species clearly represents a new genus of the tribe Sarcophagini (Subfamily Sarcophaginae). It seems to be close to *Papesarcophaga* Kurahashi & Kakinuma, but the new *Zulisca* has a hairy propleuron.

Myorhina miyagii sp. nov.

(Fig. 3)

♂.—Head: dichoptic; eye large, bare; frons broad; frons index 0.16–0.18 ($M=0.17$, $n=3$) just in front of anterior ocellus; frontal stripe parallel sided, narrowed toward vertex, black, slightly more than 2.0x width of parafrontal at level of in front of anterior ocellus; parafrontal and parafacial black, densely silver-grey pollinose, clothed with fine black hairs along eye margin; parafrontal provided with *ca.* 10 *ori*; 1 reclinate *ors* developed; mediana narrow, not distinguishable; gena narrow, black, densely grey pollinose, entirely clothed with black hairs; postgena black, densely grey pollinose, clothed with yellowish brown hairs; antenna black; 3rd antennal segment (AS_3) about 2.5x as long as 2nd (AS_2); arista long plumose, black. Palpus normal sized, slender, black, with short and bristly black hairs.

Thorax: blackish, more or less covered with grey or silver-grey pollinosity; 3 broad, dark longitudinal stripes distinct on dorsum; humerus and postalar callus concolorous with dorsum; scutellum concolorous with dorsum; prosternum hairy, usually with 2–3 fine hairs; propleuron bare; notopleuron sparsely haired around *n*; hypopleuron hairy; sternopleuron clothed with black hairs; suprspiracular convexity bare; mesothoracic spiracle fuscous black; metathoracic spiracle small in size, fuscous black. Chaetotaxy: *ac* 4 (fine) + 1; *dc* 3–4 + 3; *ia* 0 + 2–3; *ph* 2–3; *prs* 1; *h* 3; *n* 4; *sa* 3; *pa* 2; *st* 1 + 1 + 1; *sc* 3 + 1 (fine), with fine apical marginal *sc*.

Wing: hyaline, vein fuscous brown; epaulet blackish; basicosta yellow; vein R_1 bare; node of R_{2+3} and R_{4+5} with a few black setulae above and below; vein R_{4+5} setulose 1/2 from node to cross vein r-m above; vein M bent with sharp angle; cross vein dm-cu sigmoid, slightly curved posteriorly. Alar squama with tuft of pale white hairs on inner lower margin. Thoracic squama large, bare on dorsal surface, pale brownish white on disc. Halter brown with fuscous knob.

Legs: blackish, more or less grey pollinose on coxae and femora; fore femur with 2 regular rows of long bristles on dorsal and posterodorsal surfaces, with row of long and strong *pv* on apical 2/3; fore tibia with 1 *p* at apical 1/3 and 2–3 *ad* basally; mid femur with 2–3 strong *av* and 3 strong *pv* medially; some hairy bristles on posteroventral and anteroventral surfaces entirely, with row of several short *av* and *pv* apically, with 2–3 *a* medially, with 2 *p*–*pd* preapically; mid tibia with 1–2 submedian *ad*, 1 *pd*, 2 *p*, 1 *v*; hind femur with 1 regular and 1 short rows of *ad*, with 3–4 *av* medially, with 2 *av* preapically, with 2 fine and 1 strong *pv* medially, and clothed with fine short and long hairy bristles on anteroventral and posteroventral surfaces, with 2 *p*–*pd* preapically; hind tibia not fringed, with 2 *ad* and 2 *pd*, 1 apical *d*, 2 *av*, 1 apical *av*.

Abdomen: black, tessellate, more or less grey to silver-grey pollinose on tergites 1 + 2, tessellated on T_{3-5} , more or less covered with grey to silver pollinosity; T_{4-5} with row of strong *mb*, fine bristles on posteroventral margin of T_5 . Hypopygium less prominent, black; GS_1 not prominent, with brownish-grey pollinosity; GS_2 black subshining. Male genitalia as shown in Fig. 3a–f.

♀. Unknown.

Length: 9.0–12.0 mm.

Type material. Holotype ♂, 'Holotype [laser-printed on red card]//MALAYSIA: BORNEO/ Sarawak State,/ Miri Division, Pa Lungan,/ Tudal Hill, 1,271 m,/ hill top, 4.ix.2009/ Coll. H. Kurahashi// *Myorhina* ♂/*miyagii* sp. nov./ Det. H. Kurahashi [laser-printed on white card with red perimeter], with a small tube containing dissected genitalia. Paratypes: 2♂, with "Paratype [laser-printed on yellow card]" and identification label "*Myorhina* ♂/*miyagii* sp. nov./ Det. H. Kurahashi [laser-printed on white card with blue perimeter]" // MALAYSIA: BORNEO: 2♂, same data as holotype.

Fig. 3. *Myorhina miyagii* sp. nov., male genitalia.—a, fifth sternite, ventral view; b, hypopygium, lateral view; c, cerci and surstyli, caudal view; d, pregonite and postgonite, lateral view; e, aedeagus lateral view; f, surstylus and cercus, lateral view.

Type depository. Holotype ♂ (NSMT-I-DIP22743) and 1 paratype ♂ (NSMT-I-DIP22744) are deposited in National Museum of Nature and Science, Tsukuba (NSMT); 1 paratype ♂ in Sarawak Museum Department, Kuching (SM).

Etymology. The specific epithet is named after Dr. I. Miyagi, Leader of the project, Professor emeritus, University of the Ryukyu, Japan for offering an opportunity to study the fly fauna of Sarawak, Malaysia.

Remarks. The present new species is similar to *M. tomæ* sp. nov., but easily distinguished by having no fringe on hind tibia in ♂. Male genitalia is also characteristic in the shape of aedeagus and cercus. Forest species.

Distribution. Malaysia (Borneo, Sarawak)

Bionomics. Male flies were found at hill top of montane forests.

***Myorhina tomæ* sp. nov.**
(Fig. 4)

♂.—Head: dichoptic; eye large, bare; frons broad; frons index 0.17–0.19 ($M = 0.18$, $n = 9$) just in front of anterior ocellus; frontal stripe parallel sided, narrowed toward vertex, black, slightly more than 2.0x width of parafrontal at level of in front of anterior ocellus; parafrontal and parafacial black, densely silvery-grey pollinose, clothed with black hairs along eye margin; parafrontal provided with *ca.* 13 *ori*; 1 reclinate *ors* developed; mediana narrow, not distinguishable; gena narrow, black, densely grey pollinose, entirely clothed with black hairs; postgena black, densely grey pollinose, clothed with yellowish brown hairs; antenna black; 3rd antennal segment (AS_3) about 3.0x as long as 2nd (AS_2); arista long plumose, black except for median part brownish. Palpus normal sized, slender, black, with short and long bristly black hairs.

Thorax: blackish, more or less covered with grey or silver-grey pollinosity; 3 broad, dark longitudinal stripes

Fig. 4. *Myorhina tomae* sp. nov., male genitalia.—a, fifth sternite, ventral view; b, hypopygium, lateral view; c1, cerci and surstyli, caudal view; c2, cercus and surstylus, lateral view; d, pregonite and postgonite, lateral view; e, aedeagus, lateral view; f, surstylus and cercus, lateral view.

distinct on dorsum; humerus and postalar callus concolorous with dorsum; scutellum concolorous with dorsum; prosternum hairy; propleuron bare; notopleuron sparsely haired around *n*; hypopleuron hairy; sternopleuron clothed with black hairs; suprspiracular convexity bare; mesothoracic spiracle fuscous black; metathoracic spiracle medium in size, fuscous black. Chaetotaxy: *ac* 0+1; *dc* 3–4+3; *ia* 1(fine)+2–3; *ph* 2; *prs* 1; *h* 3; *n* 4; *sa* 3, *pa* 2; *st* 1+1+1; *sc* 3+1, with apical marginal *sc*.

Wing: hyaline, vein fuscous brown; epaulet blackish; basicosta yellowish brown; vein *R*₁ bare; node of *R*₂₊₃ and *R*₄₊₅ with a few black setulae above and below; vein *R*₄₊₅ setulose more than 4/5 from node to cross vein *r-m* above; vein *M* bent with sharp angle; cross vein *dm-cu* sigmoid, slightly curved anteriorly and posteriorly. Alar squama with tuft of pale white hairs on inner lower margin. Thoracic squama large, bare on dorsal surface, dark brownish spot on disc. Halter brown.

Legs: blackish, more or less grey pollinose on coxae and femora; fore femur with 2 complete regular rows of long bristles on dorsal and posterodorsal surfaces, with row of fine, long and strong *pv* on entire length; fore tibia with 1 *p* at apical 1/3 and 2 *ad* basally; mid femur without strong *av* and *pv* medially, short hairy bristles on posteroventral and anteroventral surfaces entirely, with row of several short *av* and *pv* apically, with row of 4–5 strong *a* medially, with 2 *p-pd* preapically; mid tibia with 1 submedian *ad*, 1 *pd* and 2 *p*, without *v*; hind femur with irregular rows of *ad*, with 1 strong *av* preapically, clothed with fine long hairy bristles on anteroventral and posteroventral surfaces, with 3–4 *p-pd* preapically; hind tibia fringed, with 2 *ad* and 2 *pd*, 1 preapical *av*.

Abdomen: black, tessellate, more or less grey to silver-grey pollinose on tergites 1+2, silver-grey pollinose, tessellate on *T*_{3–5}; *T*₄ with median strong and 3 strong lateral *mb*; *T*₅ with row of *mb*. Hypopygium prominent,

black; GS₁ retracted in T₅, with brownish-grey pollinosity, without *mb*; GS₂ black, subshining. Male genitalia as shown in Fig. 4a–f.

♀. Unknown.

Length: 8.0–11.0 mm.

Type material. Holotype ♂, 'Holotype [laser-printed on red card]//MALAYSIA: BORNEO/ Sarawak State, Miri Division, Bario, Prayer Mountain, 1,428 m, hill top, 9.ix.2009/ Coll. H. Kurahashi// Myorhina ♂/tomae sp. nov./ Det. H. Kurahashi [laser-printed on white card with red perimeter]' with a small tube containing dissected genitalia. Paratypes: 8♂, with "Paratype [laser-printed on yellow card]" and identification label "Myorhina ♂/tomae sp. nov./ Det. H. Kurahashi [laser-printed on white card with blue perimeter]" // MALAYSIA: BORNEO: 3♂, same data as holotype; 5♂, same locality as holotype, 11–12.ix.2009, H. Kurahashi.

Type depository. Holotype ♂ (NSMT-I-DIP22745); 5 male paratypes (NSMT type series NSMT-I-DIP22746–22750) are deposited in National Museum of Science and Nature, Tsukuba (NSMT); 3♂ paratypes in Sarawak Museum Department, Kuching (SM).

Etymology. The specific epithet is named after Dr. T. Toma, a member of the project, Professor, University of the Ryukyu, Japan for her kind help to study the fly fauna of Sarawak, Malaysia.

Remarks. The present new species is similar to *Myorhina miyagii* sp. nov., but easily distinguished by having mid femur without strong *av* and *pv* medially, hind femur without *av* medially and hind tibia not fringed in ♂. Male genitalia is also characteristic in the shape of aedeagus and cercus. Forest species.

Distribution. Malaysia (Borneo, Sarawak)

Bionomics. Male flies were found at hill top of montane forests.

***Burmanomyia barioensis* sp. nov.**

(Fig. 5)

♂.—Head: dichoptic; eye large, bare; frons narrow; frons index 0.12–0.13 ($M=0.12$, $n=3$) just in front of anterior ocellus; frontal stripe parallel sided, somewhat narrowed toward vertex, fuscous black, less than 2.0× width of parafrontal at level of in front of anterior ocellus; parafrontal and parafacial narrow, black, densely silver-grey pollinose, clothed with black hairs along eye margin; parafrontal provided with *ca.* 13 *ori*; 1 reclinate *ors* developed; mediana narrow, not distinguishable; gena narrow, black, densely grey pollinose, entirely clothed with black hairs; postgena black, densely grey pollinose, clothed with black hairs except for several yellowish white ones on posterior extremity; antenna black; 3rd antennal segment (AS₃) about 2.0× as long as 2nd (AS₂); arista long plumose, black. Palpus normal sized, slender, black, with short and bristly black hairs.

Thorax: blackish, more or less covered with grey or silver-grey pollinosity; 3 broad, dark longitudinal stripes distinct on dorsum; humerus and postalar callus concolorous with dorsum; scutellum concolorous with dorsum; prosternum hairy; propleuron bare; notopleuron sparsely haired around; hypopleuron hairy; sternopleuron clothed with black hairs; suprascutellar convexity bare; mesothoracic spiracle fuscous black; metathoracic fuscous black. Chaetotaxy: *ac* 5 (strong)+1; *dc* 4+4; *ia* 1+2–3; *ph* 2; *prs* 1; *h* 3; *n* 4; *sa* 3, 1st one (*pra*) almost same length with 4th *n*; *pa* 2; *st* 1+1+1; *sc* 4 (2 strong)+1, with fine apical marginal *sc*.

Wing: hyaline, vein fuscous brown; epaulet blackish; basicosta yellowish white; vein R₁ bare; node of R₂₊₃ and R₄₊₅ with a few black setulae above and below; vein R₄₊₅ setulose more than 1/2 way from node to cross vein *r-m* above; vein M bent with right angle; dm-cu sigmoid, slightly curved. Alar squama with tuft of pale white hairs on inner lower margin. Thoracic squama large, bare on dorsal surface, pale brownish white on disc. Halter brown, darken toward tip, with black knob.

Legs: blackish, more or less grey pollinose on coxae and fore femora; fore femur with 2 regular rows of strong bristles on dorsal and posterodorsal surfaces, with row of long and strong *pv* on entire length; fore tibia with 2–3 *ad* basally, 1 submedian *pv*, 1 *pd* apically and 1 *pv* at apical; mid femur with row of fine, long hairy bristles on posteroventral and anteroventral surfaces entirely, with row of 2–3 short *av* and *pv* medianly, with 3–4 *a* medially, with 3 *p-pd* preapically; mid tibia with 2 submedian *ad*, a row of short *pd*, apical 1/3 of 1*p* and 1*v*; hind femur with 1 regular and 1 irregular and incomplete rows of *ad*, with 2 *d* at apical 1/3, 1 *p* preapically, and clothed with fine long hairy bristles on anteroventral and posteroventral surfaces, with 2–3 strong *av* medially and 1 strong *av* preapically; hind tibia not fringed, with sparse row of long and short *ad*, 2 *pd* submedially, 1 apical *d*, 2–3 *av* at apical 1/3, 1 *av* apically.

Abdomen: black, tessellate, more or less grey to silver-grey pollinose on tergites 1+2–3, tessellated on T_{4–5} more or less covered with yellowish-brown pollinosity; T₃ without median *mb*; T₄ with erect median strong and 3 strong lateral *mb*; T₅ with row of strong *mb*, fine bristles on posteroventral margin; sternites 1+2–3 with long strong upstanding hairs at posterior margin. Hypopygium prominent, fuscous black; GS₁ prominent, with brownish-grey pollinosity; GS₂ black, shining. Male genitalia as shown in Fig. 5a–f.

♀. Unknown.

Fig. 5. *Burmanomyia barioensis* sp. nov., male genitalia.—a, fifth sternite, ventral view; b, hypopygium, lateral view; c, cerci and surstyli, caudal view; d, pregonite and postgonite, lateral view; e, aedeagus, lateral view; f, surstylus and cercus, lateral view.

Length: 10.5 mm.

Type material. Holotype ♂, 'Holotype [laser-printed on red card]//MALAYSIA: BORNEO/ Sarawak State,/ Miri Division, Bario,/ Prayer Mountain, 1,428 m,/ hill top, 11–12.ix.2009/ Coll. H. Kurahashi// *Burmanomyia* ♂/ *barioensis* sp. nov./ Det. H. Kurahashi [laser-printed on white card with red perimeter]', with a small tube containing dissected genitalia. Paratypes: 1 ♂, with "Paratype [laser-printed on yellow card]" and identification label "*Burmanomyia* ♂/*barioensis* sp. nov./ Det. H. Kurahashi [laser-printed on white card with blue perimeter]" // same locality as holotype, 9.ix.2009/ Coll. H. Kurahashi//; 1 ♂, [Malaysia/Sabah]/ Crocker Range/ Inobong/ 2.v.2004/ T. Tachi//.

Type depository. Holotype ♂ (NSMT-I-DIP22751), 1 ♂ paratype (NSMT-I-DIP22752) in National Museum of Nature and Science, Tsukuba (NSMT); 1 ♂ paratype in Biosystematics Laboratory, Faculty of Social & Cultural Studies, Kyushu University, Fukuoka (BLKU).

Etymology. The specific epithet "*barioensis*" is derived from the locality name "Bario" where holotype specimen was collected.

Remarks. The present new species is similar to *Burmanomyia aureomarginata* (Shinonaga & Tumrasvin, 1979), but easily distinguished by having no fringe on hind tibia in ♂. Male genitalia is also characteristic in the shape of aedeagus and cercus. Montane forest species.

Distribution. Malaysia (Borneo, Sarawak and Sabah)

Bionomics. Male flies were found around sunny spots of montane forest more than 1,400 m, especially at hill top area.

Burmanomyia pseudoborneensis sp. nov.

(Fig. 6)

♂.—Head: dichoptic; eye large, bare; frons broad; frons index 0.18 ($M=0.18$, $n=2$) just in front of anterior ocellus; frontal stripe parallel sided, somewhat narrowed toward vertex, fuscous black, less than 2.0x width of parafrontal at level of in front of anterior ocellus; parafrontal and parafacial black, densely silver-grey pollinose, clothed with black hairs along eye margin; parafrontal provided with *ca.* 15 *ori*; 1 reclinate *ors* developed; mediana narrow, not distinguishable; gena narrow, black, densely grey pollinose, entirely clothed with black hairs; postgena black, densely grey pollinose, clothed with black hairs except for several yellowish white ones on posterior extremity; antenna black; 3rd antennal segment (AS_3) about 2.0x as long as 2nd (AS_2); arista long plumose, black. Palpus normal sized, slender, black, with short and bristly black hairs.

Thorax: blackish, more or less covered with grey or silver-grey pollinosity; 3 broad, dark longitudinal stripes distinct on dorsum; humerus and postalar callus concolorous with dorsum; scutellum concolorous with dorsum; prosternum hairy; propleuron bare; notopleuron sparsely haired around; hypopleuron hairy; sternopleuron clothed with black hairs; suprspiracular convexity bare; mesothoracic spiracle fuscous black; metathoracic fuscous black. Chaetotaxy: *ac* 4–6 (strong) + 1; *dc* 3–4 + 4; *ia* 1 + 2–3; *ph* 2–3; *prs* 1; *h* 3; *n* 4; *sa* 4–5, 1st one (*pra*) almost same length with 4th *n*; *pa* 2; *st* 1 + 1 + 1; *sc* 3–4 (2 strong) + 1, with fine apical marginal *sc*.

Wing: hyaline, vein fuscous brown; epaulet blackish; basicosta yellowish white; vein R_1 bare; node of R_{2+3} and

Fig. 6. *Burmanomyia pseudoborneensis* sp. nov., male genitalia.—a, fifth sternite, ventral view; b, hypopygium, lateral view; c, cerci and surstyli, caudal view; d, pregonite and postgonite, lateral view; e, aedeagus, lateral view; f, surstylus and cercus, lateral view.

R_{4+5} with a few black setulae above and below; vein R_{4+5} setulose more than 1/2 way from node to cross vein r-m above; vein M bent with right angle; dm-cu sigmoid, slightly curved. Alar squama opaque white at basal part and with tuft of brown hairs on inner lower margin. Thoracic squama large, bare on dorsal surface. Halter brown with black knob.

Legs: blackish, more or less grey pollinose on coxae and fore femora; fore femur with 2 regular rows of strong bristles on dorsal and posterodorsal surfaces, many fine long setulae on whole posterior surface, with row of long and strong v on entire length; fore tibia with 3 ad basally, 1 p at apical 1/3, 1 pv apically and 1 d at apical; mid femur with row of fine, long hairy bristles on posteroventral and anteroventral surfaces entirely, with row of 3–4 short av medially and row of short pv apically, with 2–3 a medially and 3 p – pd preapically; mid tibia with 1 submedian ad , a row of short pd , apical 1/3 with 1 p , short fringe on anteroventral and posteroventral surfaces, with 1 strong pv and av at apically; hind femur with 1 regular and 1 irregular and incomplete rows of ad , with 3–4 d at apical 1/3, 1 p preapically, and clothed with fine long hairy bristles on anteroventral and posteroventral surfaces, with row of strong av and pv ; hind tibia fringed on anteroventral and posteroventral surfaces, with sparse row of long and short ad , 2 pd submedially, 1 preapical d , 1 av at apical 1/3, 1 apical av .

Abdomen: black, tessellate, more or less grey to silver-grey pollinose on tergites 1+2–3, tessellated on T_{4-5} more or less covered with yellowish-brown pollinosity; T_3 without median mb ; T_4 with erect median and 3–4 strong lateral mb ; T_5 with row of strong mb , fine bristles on posteroventral margin; ventral surface of tergites and sternites clothed with long hairs (the length as along as sternite). Hypopygium prominent, fuscous black; GS_1 prominent, with brownish-grey pollinosity; GS_2 black, shining. Male genitalia as shown in Fig. 6a–f.

♀. Unknown.

Length: 13.0–13.5 mm.

Type material. Holotype ♂, 'Holotype [laser-printed on red card]//MALAYSIA: BORNEO/ Sarawak State,/ Miri Division, Bario,/ Arur Dalan, 1,235 m,/ forest, 7.ix.2009/ Coll. H. Kurahashi// Burmanomyia ♂/ pseudoborneensis sp. nov./ Det. H. Kurahashi [laser-printed on white card with red perimeter]', with a small tube containing dissected genitalia. Paratype: 1 ♂, with "Paratype [laser-printed on yellow card]" and identification label "Burmanomyia ♂/ pseudoborneensis sp. nov./ Det. H. Kurahashi [laser-printed on white card with blue perimeter]" // MALAYSIA: MALAYA: 1 ♂, Cameron Highland/ 16 mL from Tapah/ 400 m, 28.X.1991/ Col. R. Kano & K. Inder Singh//.

Type depository. Holotype ♂ (NSMT-I-DIP22753), 1 ♂ paratype (NSMT-I-DIP22754) are deposited in National Museum of Nature and Science, Tsukuba (NSMT).

Etymology. The specific epithet "*pseudoborneensis*" is derived from this form having a similar appearance of *Myorhina borneensis* (Shinonaga & Lopes).

Remarks. The present new species is similar to *Myorhina borneensis* (Shinonaga & Lopes, 1975), but easily distinguished by having 4 postsutural dc on thorax. Male genitalia is also characteristic in the shape of aedeagus and cercus. Montane forest species.

Distribution. Malaysia (Malaysia, Malaya and Borneo)

Bionomics. Male flies were found in montane forests of more than 400 m.

***Sarcorohdendorfia kerohi* sp. nov.**

(Fig. 7)

♂.—Head: dichoptic; eye large, bare; frons broad; frons index 0.20–0.21 ($M=0.20$, $n=9$) just in front of anterior ocellus; frontal stripe parallel sided, slightly narrowed toward vertex, fuscous brown, slightly more than $3\times$ width of parafrontal at level of in front of anterior ocellus; parafrontal and parafacial black, densely silvery-brown pollinose, clothed with black hairs along eye margin; parafrontal provided with *ca.* 12 *ori*; 1 prevertical bristle developed; mediana narrow, not distinguishable; gena narrow, black, densely silvery-grey pollinose, largely clothed with black hairs except for several yellowish hairs posteriorly; postgena black, densely silvery-grey pollinose, clothed with yellowish white hairs; antenna black except for median part brownish; 3rd antennal segment (AS_3) slightly more than $2.5\times$ as long as 2nd (AS_2); arista long plumose, blackish. Palpus normal sized, slender, blackish, with short and bristly black hairs.

Thorax: blackish, more or less covered with silver-grey pollinosity, sometimes with yellowish brown tinge; 3 broad, dark longitudinal stripes distinct on dorsum; humerus and postalar callus concolorous with dorsum; scutellum concolorous with dorsum; prosternum and propleuron hairy; notopleuron clothed with a few small black hairs; hypopleuron hairy; sternopleuron largely clothed in black hairs; suprascapular convexity haired anteriorly; mesothoracic spiracle fuscous black; metathoracic spiracle fuscous black. Chaetotaxy: *ac* 6–7(fine)+1; *dc* 4–5+4; *ia* 1(fine)+2; *ph* 2; *prs* 1; *h* 3; *n* 4; *sa* 3–4; *pa* 2; *st* 1+1+1; *sc* 4–5+1(fine).

Wing: hyaline, sometimes slightly yellow tinged; vein fuscous brown; epaulet blackish; basicosta yellowish brown; vein R_1 bare; node of R_{2+3} and R_{4+5} with a few black setulae above and below; vein R_{4+5} setulose more than

Fig. 7. *Sarcorohdendorfia kerohi* sp. nov., male genitalia.—a, fifth sternite with posterior part of fourth one, ventral view; b, hypopygium, lateral view; c, cerci and surstyli, caudal view; d, pregonite and postgonite, lateral view; e, aedeagus, lateral view; f, surstylus and cercus, lateral view.

1/2 way from node to cross vein r-m above; vein M bent with right angle; dm-cu sigmoid, slightly curved. Alar squama with tuft of pale white hairs on inner lower margin. Thoracic squama large, bare on dorsal surface, pale white. Halter brown.

Legs: blackish, more or less grey pollinose on coxae and femora; fore femur with 2 rows of long bristles on dorsal and posterodorsal surfaces, with row of strong *pv* on apical 1/2; fore tibia with 1 *p* and 3 *ad* basally; mid femur with row of several *pv* on apical 1/3, with row of *av* on apical 1/2, with 2–3 *p-pd* preapically; mid tibia with 1–2 submedian *ad*, 1 *pd*, 1 *p*, 1 *v*; hind femur with 2 rows of strong *av*, 1 row from basal to preapical, 1 from submedian to apical, with a few strong *av* apically, with many fine long setulae on anteroventral and posteroventral surfaces, with 1–2 strong *av* preapically, 2–3 *pd* and 1 *p-pd* preapically, no characteristic bristle on posterior surface; hind tibia fringed on anteroventral and posteroventral surfaces, with row of short *ad*, with 2–3 strong submedian *ad*, 1 apical *d*, 2 *pd*, 1 *av*, 1 apical *av*.

Abdomen: blackish on tergites 1+2–3, more or less reddish on tergites 4–5 and GS_{1-2} ; T_{4-5} more or less covered with yellowish-grey to golden pollinosity; T_4 with erect median and 3–4 strong lateral *mb*; T_5 with row of strong *mb*, fine bristles on posteroventral margin; ST_4 with conspicuous tuft of condensed black hairs at posterior margin. Hypopygium prominent, reddish; GS_1 with yellowish-grey pollinosity; GS_2 reddish brown, shining. Male genitalia as shown in Fig. 7a–f.

♀.—similar to male in general appearance except for broader frons and more stout abdomen; frons index 0.27–0.30 ($M=0.29$, $n=4$), presence of two proclinate and one reclinate fronto-orbital bristles (*ors* 2+1); *ov* developed; abdomen more robust and yellowish-grey to gold pollinosity on tergites. Ovipositor short, similar to that of *S.*

antelope: tergite 6 of dome-like, divided into two parts by median narrow membranous portion, left and right sclerites, with row of *mb*, haired along posterior margin on more than 1/2 of total length; tergites 7–9 disappear; no secondary pigmented area; sternite 6 of single plate, without incision, with complete row of *mb*, largely haired on posterior margin; sternite 7 of single plate, without distinct incision, with complete row of *mb*, haired more than 1/2 posteriorly; sternite 8 disappeared at site, without *mb*; sternite 9 disappeared.

Length: 8.0–14.5 mm.

Type material. Holotype ♂, 'Holotype [laser-printed on red card]//MALAYSIA: BORNEO/ Sarawak, Lanjak-/ Entimau Wildlife/ Sanctuary, Engkari R./ forest, 29.vi-3.vii.2012/ Coll. H. Kurahashi//, *Sarcorohdendorfia* ♂/ *kerohi* sp. nov./ Det. H. Kurahashi [laser-printed on white card with red perimeter]', with a small tube containing dissected genitalia. Paratypes: 2♂, with "Paratype [laser-printed on yellow card]" and, identification label "Sarcorohdendorfia *kerohi* sp. nov./ Det. H. Kurahashi [laser-printed on white card with blue perimeter]" // same data as holotype; 1♂, "MALAYSIA: BORNEO/ Sarawak State,/ Sibu Division,/ Katibas River, Batu Gong/ forest, 9.ix.2011/ Col. H. Kurahashi//; 2♂, MALAYSIA: BORNEO/ Sarawak State,/ Sibu Division,/ Katibas River,/ Batu Gong, forest, 9.ix.11/ Coll. S. H. Tan//; 1♂, MALAYSIA: BORNEO/ Sarawak State,/ Sibu Division,/ Lanjak Entimau Wildlife/ Sanctuary, Helipod,/ hilltop, 161 m, 7–8.ix.2011/ Col. H. Kurahashi//; 1♂, MALAYSIA: BORNEO/ Sarawak State,/ Miri Division, Bario,/ Prayer Mountain, 1,428 m,/ hill top, 9.ix.2009/ Coll. H. Kurahashi//; 1♂1♀, MALAYSIA: BORNEO/ Sarawak State,/ Miri Division, Bario,/ Arur Dalan, 1,235 m,/ forest, 10.ix.2009/ Coll. H. Kurahashi//1♂, MALAYSIA: BORNEO/ Sarawak State,/ Miri Division,/ Bario Highlands,/ Mt. Prayer,/ hill top, 1428 m, 11.ix.09/Coll. S. H. Tan// 1♀, same locality, 11.ix.09/ Coll. S. H. Tan//; 1♀, MALAYSIA: BORNEO/ Sarawak State, Miri Division, Bario,/ Prayer Mountain, 1,428 m,/ hill top, 11–12.ix.2009/ Coll. H. Kurahashi// 1♀, MALAYSIA: BORNEO, Sarawak State,/ Miri Divbision, Bario, Pa Ukat, 1,020 m,/ forest, 7.ix.2007/ Coll. Hiromu Kurahashi".

Type depository. Holotype ♂ (NSMT-I-DIP22755), and 3♂1♀ paratypes (NSMT-I-DIP22756–22758) are deposited in National Museum of nature and Science, Tsukuba (NSMT); 3♂1♀ paratypes in Sarawak Museum Department, Kuching (SM); 3♂1♀ in Bishop Museum, Honolulu (BPBM).

Etymology. The specific epithet is named after the late Mr. Keroh Anak Janting, a staff of Forestry Department Sarawak, who assisted us in our field survey in Lanjak Entimau Wildlife Sanctuary and to commemorate him for his support and assistant during the collections.

Remarks. The present new species is similar to *Sarcorohdendorfia multivillosa* Shinonaga & Tumrasvin, 1975 from Thailand, but its abdominal tip is reddish and usually covered with yellowish golden pollinosity on tergites 4–5. Male genitalia also characteristic in the shape of stylus long. Forest species. The female specimen examined is a mother fly which deposited one larva. This larva was successfully raised to adulthood of one male fly after pupal stage of 17 days. Therefore, female identity was confirmed by its male progeny and DNA analysis.

Distribution. Malaysia (Borneo, Sarawak)

Bionomics. Male flies were collected in sunny spots often on the top of hill and lowland forests.

Sarcorohdendorfia okazawai sp. nov.

(Fig. 8)

♂.—Head: dichoptic; eye large, bare; frons broad; frons index 0.19–0.21 ($M=0.20$, $n=8$) just in front of anterior ocellus; frontal stripe parallel sided, narrowed toward vertex, black, slightly more than 2× width of parafrontal at level of in front of anterior ocellus; parafrontal and parafacial black, densely golden-yellow pollinose, clothed with black hairs; parafrontal provided with *ca.* 14 *ori*; 1 prevertical *ors* developed; mediana narrow, not distinguishable; gena narrow, black, densely grey pollinose with yellow tinge anteriorly, largely clothed with black hairs except for several yellowish hairs posteriorly; postgena black, densely grey pollinose, clothed with yellowish white hairs; antenna blackish; 3rd antennal segment (AS_3) slightly more than 3× as long as 2nd (AS_2); arista long plumose, blackish. Palpus normal sized, slender, blackish, with short and bristly black hairs.

Thorax: blackish, more or less covered with yellowish or brownish-grey pollinosity; 3 broad, dark longitudinal stripes distinct on dorsum; humerus and postalar callus concolorous with dorsum; scutellum concolorous with dorsum; prosternum and propleuron hairy; notopleuron largely clothed with black hairs; hypopleuron hairy; sternopleuron clothed in black hairs; suprascapular convexity bare; mesothoracic spiracle fuscous black; metathoracic spiracle fuscous black. Chaetotaxy: *ac* 6–7+1; *dc* 4–5+4; *ia* 1(fine)+2–3; *ph* 2; *prs* 1; *h* 3; *n* 4; *sa* 5, 1st and 3rd ones fine; *pa* 2; *st* 1+1+1; *sc* 4+1(fine).

Wing: hyaline; vein fuscous brown; epaulet blackish; basicosta yellowish brown; vein R_1 bare; node of R_{2+3} and R_{4+5} with a few black setulae above and below; vein R_{4+5} setulose more than 1/2 way from node to cross vein r-m above, 1–2 hairs along line below; vein M bent with right angle; dm-cu sigmoid, slightly curved. Alar squama with tuft of dark brown hairs on inner lower margin. Thoracic squama large, bare on dorsal surface, dark brown on disc. Halter brown.

Fig. 8. *Sarcorohdendorfia okazawai* sp. nov., male genitalia.—a, fourth and fifth sternites, ventral view; b, hypopygium, lateral view; c, cerci and surstyli, caudal view; d, pregonite and postgonite, lateral view; e, aedeagus, lateral view; f, surstylus and cercus, lateral view.

Legs: blackish, more or less grey pollinose on coxae and femora; fore femur with 2 rows of long bristles on dorsal and posterodorsal surfaces, with row of long and strong *pv* on entire length, clothed with fine long hairs on entire posterior surface; fore tibia with 1 *p* and 2–3 *ad* basally; mid femur with row of 2–3 *av* medially, with 2 rows of short and strong *av* and *pv* on apical 1/3, with 3–5 *a* medially, with 3 *p-pd* preapically; mid tibia with 1 submedian *ad*, 1 *pd*, 1 *p*, 1 *v*; hind femur with irregular row of strong *ad* on entire length, with a few strong long *av* on apical 1/3, clothed with fine and long hairs on ventral surfaces, with 3–4 *p-pd* preapically; hind tibia fringed on anteroventral to posteroventral surfaces, with row of short *ad*, with 2 strong submedian *ad*, 1 apical *d*, 2 *pd* (strong), 1 *av*, 1 apical *av*.

Abdomen: black, tessellate, more or less grey to yellowish-grey pollinose on tergites 1+2–3, tessellated on T_{4-5} more or less covered with yellowish-grey to golden pollinosity; T_4 with erect median and 3–4 strong lateral *mb*; T_5 with row of strong *mb*, fine bristles on posteroventral margin; ST_4 with conspicuous tuft of condensed black hairs at posterior margin. Hypopygium prominent, black; GS_1 with yellowish- or brownish-grey pollinosity. Male genitalia as shown in Fig. 8a–f.

♀. Unknown.

Length: 11.0–15.0 mm.

Type material. Holotype ♂, 'Holotype [laser-printed on red card]//MALAYSIA: BORNEO/ Sarawak State,/ Miri Division, Bario,/ Prayer Mountain, 1,428 m,/ hill top, 9.ix.2009/ Coll. H. Kurahashi// *Sarcorohdendorfia* ♂/ *okazawai* sp. nov./ Det. H. Kurahashi [laser-printed on white card with red perimeter]'; with a small tube containing dissected genitalia. Paratypes: 7♂, with "Paratype [laser-printed on yellow card]" and identification label "*Sarcorohdendorfia okazawai*/ sp. nov./ Det. H. Kurahashi [laser-printed on white card with blue perimeter]" // MALAYSIA: BORNEO: 4♂ same data as holotype; 3♂, Sarawak State, Miri Division, Bario, Arur Dalan, 1,235 m, forest, 10.ix.2009, Coll. H. Kurahashi.

Type depository. Holotype ♂ (NSMT-I-DIPT22759), and 4♂ paratypes (NSMT-I-DIPT22760–22763) are deposited in National Museum of Nature and Science, Tsukuba (NSMT); 3♂ paratypes in Sarawak Museum Department, Kuching (SM).

Etymology. The specific epithet is named after Professor Dr. Takao Okazawa, Kanazawa University, a member of the Miyagi's project for his kind guidance and encouragement.

Remarks. The present new species is similar to *Sarcorohdendorfia kerohi* sp. nov., but easily distinguished by the bare supraspiracular convexity and black male hypopygium. Male genitalia is also characteristic in the shape of stylus long. Montane forest species.

Distribution. Malaysia (Borneo, Sarawak)

Bionomics. Male flies were found around sunny spots in montane forests and often on the top of hill.

***Hosarcophaga palustris* sp. nov.**

(Fig. 9a–f)

♂.—Head: dichoptic; eye large, bare; frons broad; frons index 0.15–0.16 ($n=2$) just in front of anterior ocellus; frontal stripe parallel sided, narrowed toward vertex, black, slightly more than width of parafrontal at level of in front of anterior ocellus; parafrontal and parafacial black, densely silver-grey pollinose, clothed with black hairs; parafrontal provided with *ca.* 9 *ori*; 2 reclinate *ors* developed; mediana narrow, not distinguishable; gena narrow, black, densely grey pollinose, entirely clothed with black hairs; postgena black, densely grey pollinose, clothed with yellowish white hairs; antenna blackish; 3rd antennal segment (AS_3) slightly more than $2.5\times$ as long as 2nd (AS_2); arista long plumose, largely blackish except for some yellowish brown in part. Palpus normal sized, slender, blackish, with short and bristly black hairs.

Thorax: blackish, more or less covered with yellowish or brownish-grey pollinosity; 3 broad, dark longitudinal stripes distinct on dorsum; humerus and postalar callus concolorous with dorsum; scutellum concolorous with dorsum; prosternum and propleuron hairy; notopleuron with several black hairs around *n*; hypopleuron hairy; sternopleuron clothed in black hairs; supraspiracular convexity bare; mesothoracic spiracle fuscous black; metathoracic spiracle brown to fuscous black. Chaetotaxy: *ac* 0+1 (fine); *dc* 4+5; *ia* 1(fine)+2; *ph* 2; *prs* 1; *h* 3; *n* 4; *sa* 3–4, 1st one (*pra*) shorter than 4th *n*; *pa* 2; *st* 1+1+1; *sc* 3+1(fine).

Wing: hyaline, largely brownish tinged; vein fuscous brown; epaulet blackish; basicosta yellowish brown; vein R_1 bare; node of R_{2+3} and R_{4+5} with a few black setulae above and below; vein R_{4+5} setulose more than 1/2 way from node to cross vein *r-m* above; vein *M* bent with right angle; *dm-cu* sigmoid, slightly curved. Alar squama with tuft of pale brown hairs on inner lower margin. Thoracic squama large, bare on dorsal surface, dark brown on disc. Halter brown.

Legs: blackish, more or less grey pollinose on coxae and femora; fore femur with 2 rows of long bristles on dorsal and posterodorsal surfaces, with row of long and strong *pv* on entire length; fore tibia with 1 *p* at apical 1/3 and 2 *ad* submedially; mid femur with row of fine, long hairy bristles on posteroventral surface medially, with row of several short *pv* on apical 1/3, with 2–3 *a* medially, with 3 *p-pd* preapically; mid tibia with 1 submedian *a*, 1 *pd*, 1 *p*, 1 *v* at apical 1/3 and with 2 *pd* basally; hind femur with two rows of strong *ad* on entire length, with 2 *av* medially, 1–2 *av* preapically, and clothed with fine hairs on ventral surfaces, with 2 *p-pd* preapically; hind tibia not fringed, with row of short *ad*, with 2 strong submedian *ad*, 1 apical *d*, 2 strong submedian *pd*, 1 submedian and 1 apical *av*.

Abdomen: black, tessellate, more or less grey to silver-grey pollinose on tergites 1+2–3, tessellated on T_{4-5} more or less covered with grey to silver pollinosity; T_3 with fine median *mb*; T_4 with erect median and 3 strong lateral *mb*; T_5 with row of strong *mb*, fine bristles on posteroventral margin. Hypopygium prominent, fuscous black; GS_1 with brownish-grey pollinosity; GS_2 black, shining. Male genitalia as shown in Fig. 9a–f.

♀. Unknown.

Length: 8.5–10.0 mm.

Type material. Holotype ♂, 'Holotype [laser-printed on red card]//MALAYSIA: BORNEO/ Sarawak State,/ Kuching Division,/ Jabatan Perhutang,/ swamp, <1m, 18.ix.2007/ Coll. Hiromu Kurahashi// *Hosarcophaga* ♂/ *palustris* sp. nov./ Det. H. Kurahashi [laser-printed on white card with red perimeter]', with a small tube containing dissected genitalia. Paratype: 1♂, with "Paratype [laser-printed on yellow card]" and identification label "*Hosarcophaga* ♂/*palustris* sp. nov./ Det. H. Kurahashi [laser-printed on white card with blue perimeter]" // MALAYSIA: BORNEO: 1♂, Sarawak State,/ Kuching Dist.,/ Regional Forestry/ Office Kuching,/ swamp, 18.ix.2007/ Coll. S. H. Tan// [S-SWK-176, unknown, DNA analyzed by S. H. Tan, 2008].

Type depository. Holotype ♂ (NSMT-I-DIP22764) and 1 ♂ paratype (NSMT-I-DIP22765) are deposited in National Museum of Nature and Science, Tsukuba (NSMT); 1 paratype in Sarawak Museum, Kuching (SM).

Etymology. The specific epithet is derived from a swampy place "palustris" in Latin.

Remarks. The present new species is similar to *Hosarcophaga auricauda* (Ho), but easily distinguished by having

Fig. 9. *Hosarcophaga palustris* sp. nov., male genitalia.—a, fifth sternite, ventral view; b, hypopygium, lateral view; c, cerci and surstyli, caudal view; d, pregonite and postgonite, lateral view; e, aedeagus, lateral view; f, surstylus and cercus, lateral view.

no fringe on hind tibia in ♂. Male genitalia is also characteristic in the shape of aedeagus and cercus. Swamp species.

Distribution. Malaysia (Borneo, Sarawak)

Bionomics. Male flies were found in a swampy place of mangrove forests around river mouths.

***Hosarcophaga puteri* sp. nov.**

(Fig. 10a–f)

♂.—Head: dichoptic; eye large, bare; frons broad; frons index 0.22–0.23 ($n=2$) just in front of anterior ocellus; frontal stripe parallel sided, somewhat narrowed toward vertex, black, less than 2.0x width of parafrontal at level of in front of anterior ocellus; parafrontal and parafacial, black, densely silver-grey pollinose, clothed with black hairs; parafrontal provided with *ca.* 8 *ori*; 1 reclinate *ors* developed; *ov* developed; mediana narrow, not distinguishable; gena narrow, black, densely grey pollinose, entirely clothed with black hairs; postgena black, densely grey pollinose, clothed with black hairs except for several yellowish white ones on posterior extremity; antenna black; 3rd antennal segment (AS_3) about 2.0x as long as 2nd (AS_2); arista long plumose, black. Palpus normal sized, slender, black, with short and bristly black hairs.

Thorax: blackish, more or less covered with grey or silver-grey pollinosity; 3 broad, dark longitudinal stripes distinct on dorsum; humerus and postalar callus concolorous with dorsum; scutellum concolorous with dorsum;

Fig. 10. *Hosarcophaga puteri* sp. nov., male genitalia.—a, fourth and fifth sternites, ventral view; b, hypopygium, lateral view; c, cerci and surstyli, caudal view; d, pregonite and postgonite, lateral view; e, aedeagus, lateral view; f, surstylus and cercus, lateral view.

prosternum and propleuron hairy; notopleuron bare; hypopleuron bare except for row of strong *hp* posteriorly; sternopleuron hairy; supraspiracular convexity bare; mesothoracic spiracle fuscous black; metathoracic spiracle small in size, yellowish-brown. Chaetotaxy: *ac* 3–4+3–4 in irregular rows short; *dc* 2–4+4–5; *ia* 1(fine)+2–3; *ph* 2; *prs* 1; *h* 3; *n* 4; *sa* 3, 1st one (*pra*) subequal to 4th *n*; *pa* 2; *st* 1+1; *sc* 2–3(2 strong)+1(fine), without or with apical marginal *sc*.

Wing: hyaline, vein fuscous brown; epaulet blackish; basicosta yellowish brown; vein R_1 bare; node of R_{2+3} and R_{4+5} with a few black setulae above and below; vein R_{4+5} setulose more than 1/2 way from node to cross vein r-m above; suberect and long costal spine present; vein M bent with right angle; dm-cu sigmoid, almost straight and slightly curved at middle. Alar squama with tuft of pale white hairs on inner lower margin. Thoracic squama large, bare on dorsal surface, pale brownish white on disc. Halter brown.

Legs: blackish, more or less grey pollinose on coxae and femora; fore femur with 1 regular and 1 irregular rows of long bristles on dorsal and posterodorsal surfaces, with row of long and strong *pv* on entire length; fore tibia with 1 *p* at apical 1/3 and 2 *ad* basally; mid femur with row of fine hairy bristles on posteroventral (long) and anteroventral (short) surfaces entirely, with row of several short *av* and *pv* apically, with 2–3 *a* medially, with 2 *p*–*pd* preapically; mid tibia with 2 submedian *ad*, 1 *pd*, 1 *p*, 1 *v*; hind femur with 1 regular and 1 irregular and incomplete rows of *ad*, with 2 *av* medially, 1–2 *av* preapically, and clothed with fine long hairy bristles on anteroventral and posteroventral surfaces, with 2–3 *p*–*pd* preapically; hind tibia not fringed, with sparse row of

long and short *ad*, 2 strong submedian *pd*, 2 submedian *av*, 1 apical *d*, 1 apical *av*.

Abdomen: black, tessellate, more or less grey to silver-grey pollinose on tergites 1+2–3, tessellated on T_{4–5} more or less covered with grey to silver pollinosity; T₃ with fine median *mb*; T_{4–5} with row of strong *mb*, fine bristles on posteroventral margin. Hypopygium less prominent, fuscous black; GS₁ not prominent, with brownish-grey pollinosity; GS₂ black, shining, with silvery-grey pollinosity laterally. Male genitalia as shown in Fig. 10a–f.

♀. Unknown.

Length: 6.0–6.5 mm.

Type material. Holotype ♂, 'Holotype [laser-printed on red card]//MALAYSIA: BORNEO/ Sarawak State, Kuching Division, Santubong, mangrove, <1m, 27.vii.2018/ H. Kurahashi leg.// Hosarcophaga ♂/ puteri sp. nov./ Det. H. Kurahashi [laser-printed on white card with red perimeter], with a small tube containing dissected genitalia. Paratype: 1 ♂, with "Paratype [laser-printed on yellow card]" and identification label "Hosarcophaga ♂/ puteri sp. nov./ Det. H. Kurahashi [laser-printed on white card with blue perimeter]" // MALAYSIA: BORNEO: 1 ♂, Sarawak State, i/ Kuching Division, Santubong, <1m, swamp, 14.ix.2007/ Coll. Hiromu Kurahashi//.

Type depository. Holotype ♂ (NSMT-I-DIP22766) is deposited in National Museum of Nature and Science, Tsukuba (NSMT); 1 ♂ paratype in Sarawak Museum, Kuching (SM).

Etymology. The specific epithet "puteri" is named after the type locality "Pantai Puteri" (Puteri mangrove beach) in Santubong.

Remarks. The present new species is similar to *Hosarcophaga auricauda* (Ho), but easily distinguished by having no fringe on hind tibia in ♂. Male genitalia is also characteristic in the shape of aedeagus and cercus. Swamp species.

Distribution. Malaysia (Borneo, Sarawak)

Bionomics. Male flies were found in mangrove forests around river mouths.

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APPENDIX I

Row and number of postsutural *dc* found in thoracic chaetotaxy, dorsolateral view.—x, and y showing subprimary additional and interstitials, respectively.

Parasarcophaga unguitigris Rohdendorf, a representative of postsutural *dc* 5.

Liopygia ruficornis (Fabricius), an aberrant of postsutural *dc* 5.

Myorhina kanekoi (Kano & Field), an aberrant of postsutural *dc* 3.

Sarcorohdendorfia antilope (Böttcher), a representative of postsutural *dc* 4.

APPENDIX II

General morphology, terminology and abbreviation of sarcophagid flies. One of common Malaysian species, *Boettcherisca karnyi* Lopes, was examined and illustrated for studies.

- Fig. 1. Head, lateral view.
- Fig. 2. Head, anterior view.
- Fig. 3. Male head, dorsal view.
- Fig. 4. Female head, dorsal view.
- Fig. 5. Measurement of the head, anterior view (adopted from Fan, 1992).
- Fig. 6. Measurement of the head, lateral view (adopted from Fan, 1992).
- Fig. 7. Thorax, dorsal view.
- Fig. 8. Thorax, lateral view.
- Fig. 9. Female abdomen, dorsal view.
- Fig. 10. Male abdomen, dorsal view.
- Fig. 11. Female abdomen, ventral view.
- Fig. 12. Male abdomen, ventral view.
- Fig. 13. Fore leg, dorsal view.
- Fig. 14. Mid leg, dorsal view.
- Fig. 15. Hind leg, dorsal view.
- Fig. 16. Wing, dorsal view.
- Fig. 17. Male genitalia, lateral view.
- Fig. 18. Female genitalia, caudal/ posterior view, with an inset of spermatheca, one of three illustrated.
- Fig. 19. Aedeagus, lateral view.
- Fig. 20. Schematic arrangement of parts of sarcophagine aedeagus in general, lateral view.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Figs. 1–4. *Boettcherisca karnyi*, head.

Fig. 5

Fig. 6

Fig. 7

Figs. 5–7. *Boettcherisca karnyi*, measurements of head and thorax, dorsal view

Fig. 8

Fig. 8. *Boettcherisca karnyi*, thorax, lateral view

Fig. 9

Fig. 10

Fig. 11

Fig. 12

Figs. 9–12. *Boettcherisca karnyi*, abdomen.

Fig. 13

Fig. 14

Fig. 15

Figs. 13–15. *Boettcherisca karnyi*, legs.

Fig. 16

Fig. 16. *Boettcherisca karnyi*, wing.

Fig. 17

Fig. 18

Fig. 19

Fig. 20

Figs. 17–20. *Boettcherisca karnyi*, male and female genitalia.

APPENDIX III

East Malaysian (Borneo: Sarawak) sarcophagid species and specimens examined (Diptera) are listed. New country records are marked with an asterisk (*). All materials available were identified by HK and SHT. In the cases of no available material, the previous records were cited in the list below the scientific name.

Subfamily MILTOGRAMMATINAE

Tribe **Macronychiini*****Macronychia malayana*** Kurahashi & Pape, 1996, n. rec. to Sarawak

BORNEO: 1 ♀, Sarawak State, Sibu Division, Katibas River, Batu Gong, forest, 9.ix.2011, H. Kurahashi (SM); 1 ♀, Sarawak State, Sibu Division, Katibas River, Batu Gong, forest, 9.ix.2011, S. H. Tan (UM).

Tribe **Amobiini*****Amobia quatei*** Kurahashi, 1974

BORNEO: 2 ♂ 1 ♀, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, H. Kurahashi (IDD); 2 ♀, Sarawak State, Sibu Division, Katibas River, Dujau River, forest, 10.ix.2011, H. Kurahashi (SM); 1 ♂, Sarawak State, Sibu Division, Katibas River, Makut River, 23 m, rocky shore, 5.ix.2011, S. H. Tan (UM); 1 ♀, Sarawak State, Sibu Division, Katibas River, Menyarin River, forest, 9.ix.2011, H. Kurahashi (SM).

Tribe **Miltogrammatini*****Craticulina tabaniformis*** (Fabricius, 1805)

BORNEO: 1 ♂, Sarawak State, Kuching District, Santubong, <10 m, beach, 13.xi.2019, H. Kurahashi (IDD); 1 ♂, Sarawak State, Kuching Division, Santubong, <1 m, beach, 19.ix.2011, H. Kurahashi (SM); 1 ♀, Sarawak State, Miri Division, Bario to Pa Lungan., 1,020 m, forest, 9.ix.2007, H. Kurahashi (IDD); 1 ♂, Sarawak State, Kuching Division, Lundu District, Mount Pueh, forest, 2,120 m, 3–4.ix.2010, S. H. Tan (PCSHT).

Miltogramma iberica Villeneuve, 1912

BORNEO: 54 ♂, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, H. Kurahashi (IDD); 2 ♂, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, Lily Sir (FDS); 11 ♂, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 31.viii.–1.ix.2008, H. Kurahashi (SM); 12 ♂, Sarawak State, Sibu Division, Katibas River, Batu Gong, forest, 9.ix.2011, H. Kurahashi (SM); 7 ♂, Sarawak State, Sibu Division, Katibas River, Menyarin River, forest, 9.ix.2011, H. Kurahashi (SM); 11 ♂, Sarawak State, Sibu Division, Katibas River, Tupang River, forest, 11.ix.2011, H. Kurahashi (SM); 5 ♂, Sarawak State, Sibu Division, Lanjak Entimau Wildlife Sanctuary, Helipad., 12.ix.2011, H. Kurahashi (SM); 3 ♂, Sarawak State, Sibu Division, Lanjak Entimau Wildlife Sanctuary, Helipad, 161 m, hill top, 7–8.ix.2011, S. H. Tan (UM); 29 ♂, Sarawak State, Sibu Division, Lanjak Entimau Wildlife Sanctuary, Helipad, 161 m, hill top, 7–8.ix.2011(24 ♂), 12.ix.2011(5 ♂), H. Kurahashi (SM); 5 ♂, Sarawak State, Sri Aman Division, Ulu Engkari, Nanga Talong, forest, 4.vii.2012, H. Kurahashi (IDD).

Protomiltogramma parafacialis Kurahashi & Leh, 2008

BORNEO: 1 ♀, Sarawak State, Kuching Division, Borneo Highlands, 1,034 m, forest, 16–18.ix.2011, H. Kurahashi (SW); 1 ♂, Sarawak State, Kuching Division, Borneo Highlands, 1,034 m, forest, 16–18.ix.2011, S. H. Tan (UM); 2 ♂, Sarawak State, Kuching Division, Matang National Park, <50 m, forest, 28.viii.2007, H. Kurahashi (SM); 4 ♂, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, H. Kurahashi (IDD); 2 ♂, Sarawak State, Limbang Division, Bakelalang, 900 m, forest, 21–26.viii.2008, H. Kurahashi (SM); 3 ♂, Sarawak State, Limbang Division, Lawas Dist., Ba' Kelalan to Pa' Rabata, 1,215 m, forest, 10.vi.2013, H. Kurahashi (SM); 1 ♂, Sarawak State, Limbang Division, Lawas Dist., Ba' Kelalan to Pa' Rabata, 1,215 m, forest, 10.vi.2013, S. H. Tan (IDD); 1 ♂, Sarawak State, Miri Division, Bario to Pa Lungan, 1,151 m, forest, 31.viii.2009, H. Kurahashi (SM); 12 ♂, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 31.viii.–1.ix.2008, H. Kurahashi (SM); 19 ♂ P, Sarawak State, Miri Division, Bario, Pa Lungan, 1,020 m, forest, 4.ix.2007(8 ♂), 9.ix.2007(11 ♂), H. Kurahashi (SM); 1 ♂ H, 28 ♂ P, Sarawak State, Miri Division, Bario, Pa Ukut, 1,020 m, forest, 3.ix.2007(22 ♂), 9.ix.2007(7 ♂), H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Bario, Pa Umur, 1,062 m, forest, 6.ix.2009, (SM); 4 ♂ P, Sarawak State, Miri Division, Bario, Stone cutting site, 1,020 m, forest, 11.ix.2007, H. Kurahashi (SM); BORNEO: 9 ♂, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,103 m, forest, 28.viii.2009, H. Kurahashi (SM); 2 ♂, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,121 m, forest, 8.ix.2009, H. Kurahashi (SM); 3 ♂, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,020 m, forest, 28.viii.–1.ix.2008, H. Kurahashi (SM); 7 ♂, Sarawak State, Miri Division, Pa Lungan to Bario, 1,151 m, forest, 5.ix.2009, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Pa Lungan to Pa Terutun, 1,140 m, forest, 3.ix.2009, H. Kurahashi (SM); 1 ♂, Sarawak State, Sibu Division, Katibas River, Batu Gong, forest, 9.ix.2011, H. Kurahashi (SM).

Protomiltogramma puteri Kurahashi & Leh, 2008

BORNEO: 2 ♂, Sarawak State, Kuching Division, Sampadi, <1 m, sandy beach, 8.ix.2008, H. Kurahashi (SM); 5 ♀, Sarawak State, Kuching Division, Santubong, <1 m, mangrove, 27.vii.2018, H. Kurahashi (IDD); 11 ♂, Sarawak State, Kuching Division, Santubong, <1 m, beach, 19.ix.2011, H. Kurahashi (SM).

****Senotainia albifrons*** (Rondani, 1859)

BORNEO: 1 ♂, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, H. Kurahashi (IDD).

***Senotainia navigatrix* (Meijere, 1910)**

BORNEO: 1 ♀, Sarawak State, Kuching Division, Borneo Highlands, ca. 150 m, forest, 7.vii.2012, H. Kurahashi (IDD); 1 ♂, Sarawak State, Kuching Division, Jabatan Perhutang, <1 m, swamp, 18.ix.2007, H. Kurahashi (SM); 8 ♂ 1 ♀, Sarawak State, Kuching Division, Matang National Park, <50 m, forest, 21–22.ix.2008, H. Kurahashi (SM); 1 ♂, Sarawak State, Kuching Division, Rambungan, <1 m, swamp, 9.ix.2008, H. Kurahashi (SM); 2 ♂, Sarawak State, Kuching Division, Santubong, <1 m, swamp, 14.ix..2007, H. Kurahashi (SM); 3 ♂, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, H. Kurahashi (IDD); 1 ♂, Sarawak State, Limbang Division, Bakelalang, 900 m, forest, 21–26.viii.2008, H. Kurahashi (SM); 2 ♂, Sarawak State, Miri Division, Bario, Stone cutting site, 1,020 m, forest, 11.ix.2007, H. Kurahashi (SM); 2 ♂ 4 ♀, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 31.viii.–1.ix..2008, H. Kurahashi (SM); 2 ♂ 1 ♀, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 9.ix..2007, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 9.ix..2007, H. Kurahashi (SM); 2 ♂ 1 ♀, Sarawak State, Miri Division, Bario to Pa Lungan., 1,151 m, forest, 31.viii.2009, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Bario to Pa Lungan., 1,020 m, forest, 9.ix.2007, H. Kurahashi (IDD); 1 ♀, Sarawak State, Miri Division, Bario, Arur Dalan, 1,235 m, forest, 10.ix.2009, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Bario, Arur Dalan, 1,062 m, forest, 7.ix.2009, H. Kurahashi (SM); 8 ♂, Sarawak State, Miri Division, Bario, Pa Umor, 1,020 m, forest, 29.viii.2008, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Bario, Pa Umor, 1,020 m, forest, 8.ix..2007, H. Kurahashi (SM); 5 ♂, Sarawak State, Miri Division, Bario, Pa Umur, 1,072 m, forest, 29–30.viii.2009(4 ♂), 6.ix.2009(1 ♂), H. Kurahashi (SM); 4 ♂ 1 ♀, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,020 m, forest, 11.ix.2007, H. Kurahashi (SM); 6 ♂, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,103 m, forest, 28.viii.2009, H. Kurahashi (SM); 4 ♂ 1 ♀, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,020 m, forest, 28.viii.–1. ix.2008, H. Kurahashi (SM); 9 ♂, Sarawak State, Miri Division, Bario, Town, 1,020 m, garden, 1.ix.2007(4 ♂), 10.ix..2007(5 ♂), H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Pa Lungan to Bario, 1,151 m, forest, 5.ix.2009, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Pa Lungan, Tudeal Hill, 1,271 m, hill top, 4.ix.2009, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Pa Umor, 1,020 m, forest, 8.ix.2007, H. Kurahashi (IDD); 4 ♂, Sarawak State, Sibul Division, Katibas River, Batu Gong, forest, 9.ix.2011, H. Kurahashi (SM); 1 ♂, Sarawak State, Sibul Division, Katibas River, Dujau River, forest, 10.ix.2011, H. Kurahashi (SM); 1 ♂, Sarawak State, Sri Aman Division, Ulu Engkari, Nanga Talong, forest, 4.vii.2012, H. Kurahashi (IDD).

Tribe Metopiini***Metopia argyrocephala* (Meigen, 1824)**

BORNEO: 1 ♂ 3 ♀, Sarawak State, Miri Division, Bario to Pa Lungan, 1,151 m, forest, 31.viii.2009, H. Kurahashi (SM); 1 ♀, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 31.viii.–1.ix..2008, H. Kurahashi (SM); 2 ♀, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 4.ix..2007, H. Kurahashi (SM); 1 ♀, Sarawak State, Miri Division, Bario Town, 1,020 m, garden, 1.ix..2007, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Bario, Arur Dalan, 1,235 m, forest, 7.ix.2009, H. Kurahashi (SM); 3 ♀, Sarawak State, Miri Division, Bario, Pa Umur, 1,072 m, forest, 29–30.viii.2009, H. Kurahashi (SM); 1 ♀, Sarawak State, Miri Division, Bario, Power St., 1,020 m, forest, 5.ix..2007, H. Kurahashi (SM); 1 ♀, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,020 m, forest, 11.ix..2007, H. Kurahashi (SM); 3 ♂, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,103 m, forest, 28.viii.2009, H. Kurahashi (SM); 1 ♀, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,020 m, forest, 28.viii.–1. ix.2008, H. Kurahashi (SM); 2 ♂ 1 ♀, Sarawak State, Miri Division, Pa Lungan to Bario, 1,151 m, forest, 5.ix.2009, H. Kurahashi (SM); 2 ♂, Sarawak State, Miri Division, Pa Lungan to Pa Terutun, 1,140 m, forest, 3.ix.2009, H. Kurahashi (SM); 1 ♂ 2 ♀, Sarawak State, Santubong 30 kN of Kuching., 19–20.xi.1975, S. Shinonaga and S. Hiroshi (NSMT).

***Metopia sauteri* (Townsend, 1932)**

BORNEO: 1 ♂, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, H. Kurahashi (IDD); 2 ♂, Sarawak State, Limbang Division, Bakelalang, 900 m, forest, 21–26.viii.2008, H. Kurahashi (SM); 5 ♀, Sarawak State, Miri Division, Bario to Pa Lungan, 1,151 m, forest, 31.viii.2009, H. Kurahashi (SM); 2 ♂ 13 ♀, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 31.viii.–1.ix..2008, H. Kurahashi (SM); 1 ♀, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 9.ix..2007, H. Kurahashi (SM); 1 ♀, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,103 m, forest, 28.viii.2009, H. Kurahashi (SM); 1 ♂ 4 ♀, Sarawak State, Miri Division, Pa Lungan to Bario, 1,151 m, forest, 5.ix.2009, H. Kurahashi (SM).

***Metopia suifenhoensis* Fan, 1965**

BORNEO: 3 ♂, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, H. Kurahashi (IDD); 5 ♂, Sarawak State, Limbang Division, Bakelalang, 900 m, forest, 21–26.viii.2008, H. Kurahashi (SM); 3 ♂, Sarawak State, Limbang Division, Lawas Dist., Ba' Kelalan to Pa' Rabata, 1,215 m, forest, 10.vi.2013, H. Kurahashi (SM); 4 ♂ 2 ♀, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 31.viii.–1.ix..2008, H. Kurahashi (SM); 7 ♂ 5 ♀, Sarawak State, Miri Division, Bario, Arur Dalan, 1,235 m, forest, 7.ix.2009(4 ♂ 4 ♀), 10.ix.2009(3 ♂ 1 ♀), H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Bario, Arur Dalan, 1,020 m, forest, 30.viii.2008, H. Kurahashi (SM); 11 ♂, Sarawak State, Miri Division, Bario, Arur Dalan, 1,020 m, forest, 6.ix.2007, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Bario, Pa Ukat, 1,020 m, forest, 7.ix.2007, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Bario, Pa Ukat, 1,020 m, forest, 3.ix..2007, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Bario, Power St., 1,020 m, forest, 5.ix..2007, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Bario, Power St., 1,020 m, forest, 2.ix..2007, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Bario, Power St., 1,020 m, forest, 2.ix.2007, H. Kurahashi (IDD); 1 ♂, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,121 m, forest, 8.ix.2009, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,103 m, forest, 28.viii.2009, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Pa Lungan to Arur Kiran, 1,105 m, nr swamp, 1–2.ix.2009, H. Kurahashi (SM).

Subfamily SARCOPHAGINAE**Tribe Protodexiini*****Blaesoxipha rufipes* (Macquart, 1839), n. rec. to Sarawak**

BORNEO: 3 ♂ 6 ♀, Sarawak State, Sibul Division, Lanjak Entimau Wildlife Sanctuary, Helipad, 161 m, hill top, 12.ix.2011, H. Kurahashi (SM)

Tribe Sarcophagini

Omarisca longifilia (Salem, 1946) comb. nov.

BORNEO: 3 ♂ 1 ♀, Sarawak State, Kuching Division, Santubong, mangrove, <1m, 27.vii.2018, S. Kakinuma and H. Kurahashi (IDD); 3 ♂, Sarawak State, Kuching Division, Santubong, swamp, 70 m, 27.vii.2018, S. H. Tan (SM).

The postsutural *dc* 3 group

Myorhina borneensis (Shinonaga & Lopes, 1975)

BORNEO: 7 ♂ 4 ♀, Sarawak State, Kuching Division, Borneo Highlands, 1,034 m, forest, 16–18.ix.2011, S. H. Tan (UM); 2 ♂, Sarawak State, Kuching Division, Borneo Highlands, 1,034 m, forest, 16–18.ix.2011, H. Kurahashi (SM); 2 ♂, Sarawak State, Kuching Division, Borneo Highlands, 1,200 m, forest, 28–29.vii.2018, H. Kurahashi (IDD); 1 ♂, Sarawak State, Limbang Division, Bakelalan, 900 m, forest, 21–26.viii.2008, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Bario to Pa Lungan, 1,151 m, forest, 31.viii.2009, H. Kurahashi (SM); 2 ♀, Sarawak State, Miri Division, Bario, Arur Dalan, 1,235 m, forest, 10.ix.2009, H. Kurahashi (IDD); 1 ♀, Sarawak State, Miri Division, Bario, Arur Dalan, 1,235 m, forest, 10.ix.2009, H. Kurahashi (SM); 1 ♀, Sarawak State, Miri Division, Bario, Arur Dalan, 1,235 m, forest, 7.ix.2009, H. Kurahashi (IDD); 2 ♂, Sarawak State, Miri Division, Bario, Arur Dalan, 1,235 m, forest, 7.ix.2009, H. Kurahashi (SM); 3 ♂, Sarawak State, Miri Division, Bario, Arur Dalan, 1,020 m, forest, 30.viii.2008, H. Kurahashi (SM); 2 ♂, Sarawak State, Miri Division, Bario, Pa Ukat, 1,020 m, forest, 3.ix.2007, H. Kurahashi (SM); 3 ♂, Sarawak State, Miri Division, Bario, Power St., 1,020 m, forest, 2.ix.2007(2 ♂); 5.ix.2007(1 ♂), H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Bario, Power St., 1,020 m, forest, 2.ix.2007, H. Kurahashi (IDD); 1 ♂ 2 ♀, Sarawak State, Miri Division, Bario, Prayer Mountain, 1,428 m, hill top, 11–12.ix.2009, H. Kurahashi (SM); 1 ♀, Sarawak State, Miri Division, Bario, Prayer Mountain, 1,428 m, hill top, 11–12.ix.2009, H. Kurahashi (IDD); 11 ♂, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,121 m, forest, 8.ix.2009, H. Kurahashi (SM); 3 ♂, Sarawak State, Miri Division, Pa Lungan to Pa Terutun, 1,140 m, forest, 3.ix.2009, H. Kurahashi (SM); 1 ♂, Sarawak State, Sri Aman Division, Ulu Engkari, Nanga Talong, forest, 4.vii.2012, H. Kurahashi (IDD).

Myorhina globovesica (Ye, 1980)

BORNEO: 6 ♂, Sarawak State, Miri Division, Bario, Prayer Mountain, 1,428 m, hill top, 11–12.ix.2009, H. Kurahashi (SM).

The postsutural *dc* 4 group

**Burmanomyia aureomarginata* (Shinonaga & Tumrasvin, 1979)

BORNEO: 1 ♀, Sarawak State, Miri Division, Bario, Pa Ukat, 1,020 m, forest, 7.ix.2007, H. Kurahashi (IDD); 1 ♂, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,121 m, forest, 8.ix.2009, H. Kurahashi (IDD); 1 ♂ 1 ♀, Sarawak State, Sibu Division, Katibas River, Dujau River, forest, DNA analyzed by S. H. Tan, 2011, 10.ix.2011, S. H. Tan (IDD).

Lioproctia pattoni (Senior-White, 1924)

BORNEO: 2 ♂, Sarawak State, Kuching Division, Borneo Highlands, ca. 150 m, forest, 7.vii.2012, H. Kurahashi (IDD); 1 ♂, Sarawak State, Limbang Division, Bakelalan, 900 m, forest, 21–26.viii.2008, H. Kurahashi (SM); 27 ♂ 14 ♀, Sarawak State, Miri Division, Bario, Pa Umor, 1,020 m, forest, 8.ix.2007, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Bario, Pa Umur, 1,072 m, forest, 29–30.viii.2009, H. Kurahashi (SM); 3 ♀, Sarawak State, Miri Division, Bario, Pa Umur, 1,072 m, forest, 29–30.viii.2009(1 ♀), 6.ix.2009(2 ♀), H. Kurahashi (IDD); 5 ♂, Sarawak State, Miri Division, Bario, Prayer Mountain, 1,428 m, hill top, 9.ix.2009(1 ♂), 11–12.ix.2009(4 ♂), H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Pa Lungan to Arur Kiran, 1,105 m, nr swamp, 1–2.ix.2009, H. Kurahashi (SM).

Lioproctia saprianovae (Pape & Bänziger, 2000)

BORNEO: 1 ♂, Sarawak State, Kuching Division, Borneo Highlands, ca. 150 m, forest, 7.vii.2012, H. Kurahashi (IDD); 2 ♀, Sarawak State, Kuching Division, Borneo Highlands, 650 m, forest, 29.viii.2007, H. Kurahashi (SM); 31 ♂ 20 ♀, Sarawak State, Kuching Division, Borneo Highlands, 1,034 m, forest, 16–18.ix.2011, H. Kurahashi (IDD); 1 ♂, Sarawak State, Kuching Division, Matang National Park, <50 m, forest, 28.viii.2007, H. Kurahashi (SM); 1 ♂ 2 ♀, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, Lily Sir (FDS); 19 ♂ 7 ♀, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, H. Kurahashi (IDD); 1 ♂, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 31.viii.–1.ix.2008, H. Kurahashi (SM); 1 ♂ 3 ♀, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 9.ix.2007, H. Kurahashi (SM); 2 ♀, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 4.ix.2007(1 ♀); 9.ix.2007(2 ♀), H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Bario, Arur Dalan, 1,020 m, forest, 6.ix.2007, H. Kurahashi (SM); 1 ♀, Sarawak State, Miri Division, Bario, Pa Ukat, 1,020 m, forest, 7.ix.2007, H. Kurahashi (SM); 5 ♀, Sarawak State, Miri Division, Bario, Power St., 1,020 m, forest, 2.ix.2007(1 ♀); 5.ix.2007(4 ♀), H. Kurahashi (SM); 2 ♂, Sarawak State, Miri Division, Bario, Prayer Mountain, 1,428 m, hill top, 9.ix.2009, H. Kurahashi (SM); 6 ♂ 12 ♀, Sarawak State, Miri Division, Bario, Power St., 1,020 m, forest, 5.ix.2007, H. Kurahashi (SM); 4 ♂ 13 ♀, Sarawak State, Miri Division, Bario, Power St., 1,020 m, forest, 5.ix.2007, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Pa Lungan to Arur Kiran, 1,105 m, nr swamp, 1–2.ix.2009, H. Kurahashi (SM); 1 ♂, Sarawak State, Miri Division, Pa Lungan to Pa Terutun, 1,140 m, forest, 3.ix.2009, H. Kurahashi (SM).

Phallosphaera amicoides Kurahashi & Tan, 2012

Phallosphaera amicoides Kurahashi & Tan, 2012: 323. BORNEO: Sarawak State, HT} was examined.

Phallosphaera barioensis Kurahashi & Tan, 2012

Phallosphaera barioensis Kurahashi & Tan, 2012: 320. BORNEO: Sarawak State, HT} and 6 paratypes were examined.

***Sarcorohdendorfia curvircus* (Sugiyama, 1990)**

BORNEO: 1♂ 1♀, Sarawak State, Limbang Division, Lawas Dist., Lepo Bunga, 1,709m, forest, 11.vi.2013, H. Kurahashi (SM); 1♀, Sarawak State, Limbang Division, Lawas Dist., Mt. Murud, JoyBridge, 2,089 m, forest, 14.vi.2013, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Power St., 1,020 m, forest, 2.ix.2007, H. Kurahashi (IDD); 16♂, Sarawak State, Miri Division, Bario, Prayer Mountain, 1,428 m, hill top, 9.ix.2009, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Prayer Mountain, 1,428 m, hill top, 9.ix.2009, H. Kurahashi (IDD); 1♂, Sarawak State, Miri Division, Pa Lungan, Tudeal Hill., 1,271 m, hill top, 4.ix.2009, H. Kurahashi (SM).

***Sarcorohdendorfia inextricata* (Walker, 1859)**

BORNEO: 1♂, Sarawak State, Sibul Division, Ju River, 90 m, forest, 12.iii.2014, S. H. Tan (PCSHT); 1♂, Sarawak State, Sibul Division, Katibas River, Tupang River, forest, 11.ix.2011, H. Kurahashi (SM); 1♂, Sarawak State, Sibul Division, Lanjak Entimau Wildlife Sanctuary, Helipad, 161 m, hill top, 7–8.ix.2011, H. Kurahashi (SM); 1♂, Sarawak State, Sibul Division, Lanjak Entimau Wildlife Sanctuary, Ju Station, Helipad, 142 m, hill top, 6.iii.2014, S. H. Tan (PCSHT).

***Sarcorohdendorfia seniorwhitei* (Ho, 1938)**

BORNEO: 2♂, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, H. Kurahashi (IDD); 3♀, Sarawak State, Miri Division, Bario Highlands, Mt. Prayer, 1,428 m, hill top, 12.ix.2009, S. H. Tan (IDD); 1♂, Sarawak State, Miri Division, Bario Highlands, Pa Lungan, Tudal Hill, 1,271 m, hill top, 4.ix.2009, S. H. Tan (PCSHT); 2♀, Sarawak State, Miri Division, Bario to Pa Lungan., 1,020 m, forest, 4.ix.2007(1♀); 9.ix.2007(1♀), H. Kurahashi (SM); 10♂ 1♀, Sarawak State, Miri Division, Bario, Arur Dalan, 1,235 m, forest, 7.ix.2009, H. Kurahashi (SM); 4♂ 1♀, Sarawak State, Miri Division, Bario, Arur Dalan, 1,235 m, forest, 10.ix.2009, H. Kurahashi (SM); 1♂ 1♀, Sarawak State, Miri Division, Bario, Arur Dalan, 1,020 m, forest, 6.ix.2007, H. Kurahashi (SM); 1♂ 1♀, Sarawak State, Miri Division, Bario, Pa Ukut., 1,020 m, forest, 3.ix.2007(1♀), 7.ix.2007(1♂), H. Kurahashi (SM); 1♂ 1♀, Sarawak State, Miri Division, Bario, Pa Umur, 1,072 m, forest, 29–30.viii.2009, H. Kurahashi (SM); 8♂ 3♀, Sarawak State, Miri Division, Bario, Prayer Mountain, 1,428 m, hill top, 9.ix.2009(8♂2♀), 11–12.ix.2009(1♂1♀), H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Pa Lungan, Tudal Hill., 1,271 m, hill top, 4.ix.2009, H. Kurahashi (IDD); 1♂, Sarawak State, Sibul Division, Katibas River, Dujau River, forest, 10.ix.2011, H. Kurahashi (SM).

***Sarcosolomonina crinita* (Parker, 1917)**

BORNEO: 1♂ 5♀, Sarawak State, Kota Samarahan Division, Sadong Jaya, coconut plan., 8.vii.2012, H. Kurahashi (IDD); 1♀, Sarawak State, Kuching District, Matang Natang National Park, <50 m, forest, 26.vii.2018, H. Kurahashi (IDD); 1♀, Sarawak State, Kuching District, Santubong, <1 m, mangrove, 27.vii.2018, H. Kurahashi (IDD); 2♀, Sarawak State, Kuching Division, Bako N. P., mangrove, 26.ix.2005, H. Kurahashi (SM); 1♂, Sarawak State, Kuching Division, Borneo Highlands, ca. 150 m, forest, 7.vii.2012, H. Kurahashi (IDD); 1♂ 1♀, Sarawak State, Kuching Division, Borneo Highlands, 650 m, forest, 29.viii.2007, H. Kurahashi (SM); 10♂ 6♀, Sarawak State, Kuching Division, Jabatan Perhutang, <1 m, swamp, 18.ix.2007, H. Kurahashi (SM); 1♀, Sarawak State, Kuching Division, Kampung Tarat, <200 m, forest, 15.ix.2007, H. Kurahashi (SM); 1♀, Sarawak State, Kuching Division, Kuching City, Sarawak Museum, <5 m, garden, 31.viii.2007, H. Kurahashi (SM); 7♂ 5♀, Sarawak State, Kuching Division, Matang National Park, <1 m, forest, 21–22.ix.2007, H. Kurahashi (SM); 2♂, Sarawak State, Kuching Division, nr Serian, Kampung Tarat, <200 m, forest, 25.vii.2018, H. Kurahashi (IDD); 1♀, Sarawak State, Kuching Division, Rambungan, <1 m, swamp, 9.ix.2008, H. Kurahashi (SM); 1♂, Sarawak State, Kuching Division, Sampadi, <1 m, sandy beach, 8.ix.2008, H. Kurahashi (SM); 1♀, Sarawak State, Kuching Division, Santubong, <1 m, beach, 19.ix.2011, H. Kurahashi (SM); 1♂ 1♀, Sarawak State, Kuching Division, Santubong, <1 m, swamp, 14.ix.2007, H. Kurahashi (SM); 1♀, Sarawak State, Limbang Division, Bakelalan, 900 m, forest, 21–26.viii.2008, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario Town, 1,020 m, garden, 10.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Prayer Mountain, 1,428 m, hill top, 11–12.ix.2009, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,121 m, forest, 8.ix.2009, H. Kurahashi (SM); 2♂, Sarawak State, Miri Division, Pa Lungan to Pa Terutun, 1,140 m, forest, 3.ix.2009, H. Kurahashi (SM); 2♂, Sarawak State, Miri Division, Pa Lungan, Tudeal Hill., 1,271 m, hill top, 4.ix.2009, H. Kurahashi (SM); 3♂ 1♀, Sarawak State, Miri Division, Sungai Liku, S47, S55, S47, S56, 9.v.2016(2♂), 10.v.2016(1♂1♀), T. Tachi (PCTT); 4♂, Sarawak State, Sibul Division, Lanjak Entimau Wildlife Sanctuary, Helipad, 161 m, hill top, 12.ix.2011, H. Kurahashi (SM); 1♂, Sarawak State, Sri Aman Division, Ulu Engkari, Nanga Talong, forest, 4.vii.2012, H. Kurahashi (IDD).

***Sinonipponia hainanensis* (Ho, 1936)**

BORNEO: 2♂ 1♀, Sarawak State, Kuching Division, Jabatan Perhutang, <1 m, swamp, 18.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Kuching Division, Jabatan Perhutang, <1 m, swamp, 18.ix.2007, H. Kurahashi (IDD).

The postsutural *dc* 5 group***Alisarcophaga gressitti* (Hall & Bohart, 1948)**

BORNEO: 8♂ 1♀, Sarawak State, Kuching Division, Kampung Sampadi, <1 m, beach, 17.ix.2007, H. Kurahashi (SM); 2♀, Sarawak State, Kuching Division, Sampadi, <1 m, sandy beach, 8.ix.2008, H. Kurahashi (SM); 2♂, Sarawak State, Kuching Division, Santubong, <1 m, mangrove, 27.vii.2018, H. Kurahashi (IDD); 3♂ 1♀, Sarawak State, Kuching Division, Santubong, <1 m, beach, 19.ix.2011, H. Kurahashi (SM); 1♂ 6♀, Sarawak State, Kuching Division, Santubong, <1 m, swamp, 14.ix.2007, H. Kurahashi (SM).

***Boettcherisca javanica* Lopes, 1961**

BORNEO: 4♂, Sarawak State, Kuching Division, Borneo Highlands, ca. 150 m, forest, 7.vii.2012, H. Kurahashi (IDD); 1♂, Sarawak State, Kuching Division, Borneo Highlands, 650 m, forest, 29.viii.2007, H. Kurahashi (SM); 2♂, Sarawak State, Kuching Division, Jabatan Perhutang, <1 m, swamp, 18.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Kuching Division, Kampung Tarat, <200 m, forest, 15.ix.2007, H. Kurahashi (IDD); 1♂, Sarawak

State, Kuching Division, Matang National Park, <50 m, forest, 21–22.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Kuching Division, nr Serian, Kampung Tarat, <200 m, forest, 25.vii.2018, H. Kurahashi (IDD); 2♂, Sarawak State, Kuching Division, Santubong, <1 m, mangrove, 27.vii.2018, H. Kurahashi (IDD); 2♂, Sarawak State, Kuching Division, Telega Air, <1 m, swamp, 9.ix.2008, H. Kurahashi (SM); 2♀, Sarawak State, Kuching, Bako N. P., mangrove, 26.ix.2005, H. Kurahashi (SM); 1♀, Sarawak State, Kuching, Matang, Wildlife Centre, 28.ix.2005, H. Kurahashi (SM); 1♂, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, 11.iii.2011, M. Octavia (SM); 9♂ 2♀, Sarawak State, Limbang Division, Bakelalan, 900 m, forest, 21–26.viii.2008, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 4.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Arur Dalan, 1,235 m, forest, 7.ix.2009, H. Kurahashi (SM); 4♂ 1♀, Sarawak State, Miri Division, Bario, Arur Dalan, 1,020 m, forest, 6.ix.2007, H. Kurahashi (SM); 50♂ 59♀, Sarawak State, Miri Division, Bario, Pa Umor, 1,020 m, forest, 8.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Pa Umor, 1,020 m, forest, 8.ix.2007, H. Kurahashi (SM); 10♂, Sarawak State, Miri Division, Bario, Pa Umur, 1,072 m, forest, 29–30.viii.2009(8♂), 6.ix.2009(2♂), H. Kurahashi (SM); 3♂ 1♀, Sarawak State, Miri Division, Bario, Power St., 1,020 m, forest, 2.ix.2007(2♂ 1♀), 5.ix.2007(1♂), H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,020 m, forest, 11.ix.2007, H. Kurahashi (SM); 7♂, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,103 m, forest, 28.viii.2009(6♂), 8.ix.2009(1♂), H. Kurahashi (SM); 1♀, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,020 m, forest, 28.viii–1.ix.2008, H. Kurahashi (SM); 3♂, Sarawak State, Miri Division, Bario, Town, 1,020 m, garden, 1.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Pa Lungan to Pa Terutun, 1,140 m, forest, 3.ix.2009, H. Kurahashi (SM); 5♂, Sarawak State, Sibiu Division, Ju River, 87 m, forest, 8.iii.2014, S. H. Tan (PCSHT); 5♂, Sarawak State, Sibiu Division, Ju River, 90 m, forest, 12.iii.2014, S. H. Tan (PCSHT); 2♂, Sarawak State, Sibiu Division, Ju River, Ju Mit River, 112 m, forest, 11.iii.2014, S. H. Tan (PCSHT); 3♂, Sarawak State, Sibiu Division, Ju River, Lepong Bidai, 130 m, forest, 10.iii.2014, S. H. Tan (PCSHT); 5♂, Sarawak State, Sibiu Division, Ju River, Nyamuk River, forest, 7.iii.2014, S. H. Tan (PCSHT); 7♂, Sarawak State, Sibiu Division, Ju River, Nyamuk River, 127 m, forest, 15.iii.2014, S. H. Tan (PCSHT); 2♂, Sarawak State, Sibiu Division, Ju River, Serumau River, 118 m, forest, 13.iii.2014, S. H. Tan (PCSHT); 1♂, Sarawak State, Sibiu Division, Ju River, Tuga Ungik, forest, 7.iii.2014, S. H. Tan (PCSHT); 6♂, Sarawak State, Sibiu Division, Katibas River, Tupang River, forest, 11.ix.2011, H. Kurahashi (SM); 4♂, Sarawak State, Sibiu Division, Lanjak Entimau Wildlife Sanctuary, Helipad, 161 m, hill top, 7–8.ix.2011(2♂), 12.ix.2011(2♂), H. Kurahashi (SM); 15♂ 14♀, Sarawak State, Sibiu Division, Lanjak Entimau Wildlife Sanctuary, Helipad, 161 m, hill top, 12.ix.2011, H. Kurahashi (SM); 5♂, Sarawak State, Sibiu Division, Lanjak Entimau Wildlife Sanctuary, Ju Station, Helipad, 142 m, hill top, 6.iii.2014, S. H. Tan (PCSHT); 2♂, Sarawak State, Sri Aman Division, Ulu Engkari, Nanga Talong, forest, 4.vii.2012, H. Kurahashi (IDD).

***Boettcherisca karnyi* (Hardy, 1927)**

BORNEO: 4♂, Sarawak State, Kota Samarahan Division, Sadong Jaya, coconut plan., 8.vii.2012, H. Kurahashi (IDD); 1♂, Sarawak State, Kuching Division, Borneo Highlands, ca. 150 m, forest, 7.vii.2012, H. Kurahashi (IDD); 42♂ 4♀, Sarawak State, Kuching Division, Jabatan Perhutang, <1 m, swamp, 18.ix.2007, H. Kurahashi (SM); 12♂ 1♀, Sarawak State, Kuching Division, Kampung Rambungan, <1 m, swamp, 16.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Kuching Division, Matang National Park, <50 m, forest, 21–22.ix.2007, H. Kurahashi (SM); 1♀, Sarawak State, Kuching Division, nr Serian, Kampung Tarat, <200 m, forest, 25.vii.2018, H. Kurahashi (IDD); 2♂, Sarawak State, Kuching Division, Rambungan, <1 m, swamp, 9.ix.2008, H. Kurahashi (SM); 3♂, Sarawak State, Kuching Division, Santubong, <1 m, mangrove, 27.vii.2018, H. Kurahashi (IDD); 3♂, Sarawak State, Kuching Division, Santubong, <1 m, swamp, 14.ix.2007, H. Kurahashi (SM); 2♂, Sarawak State, Kuching Division, Telega Air, <1 m, swamp, 9.ix.2008, H. Kurahashi (SM); 2♀, Sarawak State, Kuching, Bako N. P., sand beach, 5.ix.2006, H. Kurahashi (SM); 3♂, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, 27.ii.2011(2♂), 11.iii.2011(1♂), M. Octavia (SM); 4♂, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, H. Kurahashi (IDD); 1♂ 4♀, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, Lily Sir (FDS); 1♂, Sarawak State, Miri Division, Bario, Pa Umur, 1,072 m, forest, 29–30.viii.2009, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Power St., 1,020 m, forest, 5.ix.2007, H. Kurahashi (IDD); 3♂, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,103 m, forest, 28.viii.2009, H. Kurahashi (SM); 3♂ 1♀, Sarawak State, Miri Division, Sungai Liku, S20, S22, S21, S27, 9.v.2016, T. Tachi (PCTT); 4♂, Sarawak State, Sibiu Division, Ju River, 90 m, forest, 12.iii.2014, S. H. Tan (PCSHT); 6♂, Sarawak State, Sibiu Division, Ju River, Ju Mit River, 112 m, forest, 11.iii.2014, S. H. Tan (PCSHT); 3♂, Sarawak State, Sibiu Division, Ju River, Nyamuk River, 127 m, forest, 7.iii.2014(1♂), 15.iii.2014(2♂), S. H. Tan (PCSHT); 1♂, Sarawak State, Sibiu Division, Katibas River, Ngaranau River, forest, 10.ix.2011, S. H. Tan (IDD); 3♂, Sarawak State, Sibiu Division, Lanjak Entimau Wildlife Sanctuary, Helipad, 161 m, hill top, 7–8.ix.2011, H. Kurahashi (SM); 1♂, Sarawak State, Sibiu Division, Lanjak Entimau Wildlife Sanctuary, Ju Station, Helipad, 142 m, hill top, 6.iii.2014, S. H. Tan (PCSHT); 1♀, Sarawak State, Sri Aman Division, Ulu Engkari, Nanga Talong, forest, 4.vii.2012, Lily Sir (FDS).

***Boettcherisca krathonmai* Pape & Bänziger, 2000**

BORNEO: 11♂ 9♀, Sarawak State, Kuching Division, Borneo Highlands, 1,200 m, forest, 28–29.vii.2018, H. Kurahashi (IDD); 1♂, Sarawak State, Kuching Division, Borneo Highlands, 1,034 m, forest, 16–18.ix.2011, H. Kurahashi (SM); 2♂, Sarawak State, Kuching Division, Kampung Tarat, <200 m, forest, 15.ix.2007, H. Kurahashi (SM); 1♂ 1♀, Sarawak State, Kuching Division, Matang National Park, <50 m, forest, 21–22.ix.2007, H. Kurahashi (SM); 1♀, Sarawak State, Kuching Division, Matang Wildlife Centre, 12 m, forest, 4–5.ix.2008, H. Kurahashi (SM); 2♂, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, 11.iii.2011, M. Octavia (SM); 5♂ 3♀, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, Lily Sir (FDS); 28♂ 11♀, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, H. Kurahashi (IDD); 6♂ 1♀, Sarawak State, Limbang Division, Bakelalan, 900 m, forest, 21–26.viii.2008, H. Kurahashi (SM); 1♂, Sarawak State, Limbang Division, Lawas Dist., Ba' Kelalan to Pa' Rabata, 1,215 m, forest, 10.vi.2013, H. Kurahashi (SM); 13♂ 8♀, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 4.ix.2007(13♂ 7♀), 9.ix.2007(1♀), H. Kurahashi (SM); 3♂ 4♀, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 4.ix.2007(1♂ 1♀), 9.ix.2007(2♂ 3♀), H. Kurahashi (SM); 2♂, Sarawak State, Miri Division, Bario, Arur Dalan, 1,020 m, forest, 30.viii.2008, H. Kurahashi (SM); 3♂, Sarawak State, Miri Division, Bario, Arur Dalan, 1,020 m, forest, 6.ix.2007, H. Kurahashi (SM); 7♂, Sarawak State, Miri Division, Bario, Arur Dalan, 1,235 m, forest, 7.ix.2009(1♂), 10.ix.2009(4♂), H. Kurahashi (SM); 1♀, Sarawak State, Miri Division, Bario, Arur Dalan, 1,235 m, forest, 10.ix.2009, H. Kurahashi (IDD); 1♂, Sarawak State, Miri Division, Bario, Pa Umor, 1,020 m, forest, 8.ix.2007, H. Kurahashi (SM); 6♂ 2♀, Sarawak State, Miri Division, Bario, Power St., 1,020 m, forest, 2.ix.2007(3♂ 1♀), 5.ix.2007(3♂ 1♀), H. Kurahashi (SM); 2♂ 1♀, Sarawak State, Miri Division, Bario, Prayer Mountain, 1,428 m, hill top, 11–12.ix.2009, H. Kurahashi (SM); 1♂ 1♀, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,020 m, forest, 11.ix.2007, H. Kurahashi (SM); 1♀, Sarawak State, Miri Division, Lambir Hills National Park, T130, 13.v.2016, T. Tachi (PCTT); 1♀,

Sarawak State, Miri Division, Pa Lungan to Arur Kiran, 1,105 m, nr swamp, 1–2.ix.2009, H. Kurahashi (SM); 1♂ 1♀, Sarawak State, Miri Division, Pa Lungan, Tudal Hill., 1,271 m, hill top, 4.ix.2009, H. Kurahashi (SM); 1♂, Sarawak State, Sibü Division, Ju River, 117 m, forest, 9.iii.2014, S. H. Tan (PCSHT); 3♂, Sarawak State, Sibü Division, Ju River, 87 m, forest, 8.iii.2014, S. H. Tan (PCSHT); 2♂, Sarawak State, Sibü Division, Ju River, Ju Mit River, 112 m, forest, 11.iii.2014, S. H. Tan (PCSHT); 1♂, Sarawak State, Sibü Division, Ju River, Nyamuk River, 127 m, forest, 15.iii.2014, S. H. Tan (PCSHT); 1♂, Sarawak State, Sibü Division, Ju River, Nyamuk River, forest, 7.iii.2014, S. H. Tan (PCSHT); 2♂, Sarawak State, Sibü Division, Ju River, Segä River, 119 m, forest, 17.iii.2014, S. H. Tan (PCSHT); 3♂, Sarawak State, Sibü Division, Ju River, Tuga Ungik, forest, 7.iii.2014, S. H. Tan (PCSHT); 3♂, Sarawak State, Sibü Division, Katibas River, Batu Gong, forest, 9.ix.2011, H. Kurahashi (SM); 3♂, Sarawak State, Sibü Division, Katibas River, Dujau River, forest, 10.ix.2011, H. Kurahashi (SM); 9♂ 1♀, Sarawak State, Sibü Division, Lanjak Entimau Wildlife Sanctuary, Helipad, 161 m, hill top, 7–8.ix.2011, H. Kurahashi (SM).

***Boettcherisca peregrina* (Robineau-Desvoidy, 1830)**

BORNEO: 1♀, Sarawak State, Borneo Highlands, 4.ix.2006, H. Kurahashi (SM); 1♂, Sarawak State, Kuching Division, Matang Nationhal Park, ca. <500 m, forest, 28.viii.2007, H. Kurahashi (SM); 2♀, Sarawak State, Limbang Division, Bakelalan, 900 m, forest, 21–26.viii.2008, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Pa Umor., 1,020 m, forest, 29.viii.2008, H. Kurahashi (SM); 2♀, Sarawak State, Miri Division, Bario, Pa Umor., 1,020 m, forest, 8.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Power St., 1,020 m, forest, 5.ix.2007, H. Kurahashi (SM); 2♂, Sarawak State, Miri Division, Bario, Town, 1,020 m, garden, 10.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Pa Lungan to Arur Kiran, 1,105 m, nr swamp, 1–2.ix.2009, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Pa Lungan to Pa Terutun, 1,140 m, forest, 3.ix.2009, H. Kurahashi (SM); 1♀, Sarawak State, Miri Division, Sungai Liku, S25, 9.v.2016, T. Tachi (PCTT); 2♀, Sarawak State, nr Serian, Mt. Sedong, Kampung Tarat., 9.ix.2006, H. Kurahashi (SM).

***Boettcherisca zuli* Kurahashi, Tan & Leh, 2015**

Boettcherisca zuli Kurahashi, Tan & Leh, 2015: 277. BORNEO: Sarawak State, 1 paratype was examined.

****Hosarcophaga auricauda* (Ho, 1938), comb. nov.**

BORNEO: 1♂, Sarawak State, Kuching, Matang Wildlife Centre, 28.ix.2005, H. Kurahashi (IDD); 1♂ 1♀, Sarawak State, Kuching Dist., Regional Foresrory Office Kuching, swamp, 18.ix.2007, S. H. Tan (IDD);

****Hosarcophaga serrata* (Ho, 1938)**

BORNEO: 1♂, Sarawak State, Kuching, Kubah N. P., <50 m, 28.viii.2006, H. Kurahashi (IDD); 1♂, Sarawak State, Borneo Highlands, 30.ix.2006, H. Kurahashi (SM); 2♂, Sarawak State, Kuching Division, Matang Wildlife Centre, 12 m, forest, 4–5.ix.2008, H. Kurahashi (SM); 2♂, Sarawak State, Kuching, Matang, Wildlife Centre, 28.ix.2005, H. Kurahashi (SM).

***Liopygia ruficornis* (Fabricius, 1794)**

BORNEO: 3♂ 3♀, Sarawak State, Kuching Division, Kuching City, Sarawak Museum, <5 m, garden, 31.viii.2007, H. Kurahashi (SM)

***Parasarcophaga albiceps* (Meigen, 1826)**

BORNEO: 2♂, Sarawak State, Kota Samarahan Division, Sadong Jaya, coconut plan., 8.vii.2012, H. Kurahashi (IDD); 1♂, Sarawak State, Kuching Division, Borneo Highlands, ca. 150 m, forest, 7.vii.2012, H. Kurahashi (IDD); 1♂, Sarawak State, Kuching Division, Matang Nationhal Park, <50 m, forest, 26.vii.2018, H. Kurahashi (IDD); 2♂, Sarawak State, Kuching Division, Matang Nationhal Park, <50 m, forest, 21–22.ix.2007, H. Kurahashi (SM); 2♂, Sarawak State, Kuching Division, nr Serian, Kampung Tarat, <200 m, forest, 25.vii.2018, H. Kurahashi (IDD); 1♂, Sarawak State, Kuching Division, Rambungan, <1 m, swamp, 9.ix.2008, H. Kurahashi (SM); 2♂ 2♀, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, H. Kurahashi (IDD); 1♀, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, Lily Sir (FDS); 10♂, Sarawak State, Limbang Division, Bakelalan, 900 m, forest, 21–26.viii.2008, H. Kurahashi (SM); 1♀, Sarawak State, Limbang Division, Lawas Dist., Ba' Kelalan View Point, 1,099 m, forest, 16.vi.2013, H. Kurahashi (SM); 2♂, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 31.viii.–1.ix.2008, H. Kurahashi (SM); 2♂, Sarawak State, Miri Division, Bario, Arur Dalan, 1,020 m, forest, 30.viii.2008, H. Kurahashi (SM); 3♂, Sarawak State, Miri Division, Bario, Pa Lungan, 1,020 m, forest, 4.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Pa Umor., 1,020 m, forest, 29.viii.2008, H. Kurahashi (SM); 4♂, Sarawak State, Miri Division, Bario, Pa Umor., 1,020 m, forest, 8.ix.2007, H. Kurahashi (SM); 1♀, Sarawak State, Miri Division, Bario, Prayer Mountain, 1,428 m, hill top, 11–12.ix.2009, H. Kurahashi (IDD); 2♂, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,020 m, forest, 28.viii.–1.ix.2008, H. Kurahashi (SM); 1♂, Sarawak State, Sibü Division, Katibas River, Batu Gong, forest, 9.ix.2011, H. Kurahashi (SM); 1♂, Sarawak State, Sibü Division, Katibas River, Dujau River, forest, 10.ix.2011, H. Kurahashi (SM); 3♂, Sarawak State, Sri Aman Division, Ulu Engkari, Nanga Talong, forest, 4.vii.2012, H. Kurahashi (IDD); 1♂, Sarawak State, Miri Division, Bario, Arur Dalan, 1,235 m, forest, 7.ix.2009, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Pa Umur, 1,062 m, forest, 6.ix.2009, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Pa Umur, 1,072 m, forest, 29–30.viii.2009, H. Kurahashi (SM); 6♂, Sarawak State, Miri Division, Bario, Prayer Mountain, 1,428 m, hill top, 9.ix.2009(2♂), 11–12.ix.2009(4♂), H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,121 m, forest, 8.ix.2009, H. Kurahashi (SM); 2♂, Sarawak State, Miri Division, Pa Lungan to Bario, 1,151 m, forest, 5.ix.2009, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Pa Lungan to Pa Terutun, 1,140 m, forest, 3.ix.2009, H. Kurahashi (SM).

***Parasarcophaga brevicornis* (Ho, 1934)**

BORNEO: 2♂, Sarawak State, Kuching Division, Jabatan Perhutang, <1 m, swamp, 18.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Kuching Division, Kampung Sampadi, <1 m, beach, 17.ix.2007, H. Kurahashi (SM); 2♂, Sarawak State, Kuching Division, Kuching City, Sarawak Museum, <5 m, garden, 31.viii.2007, H. Kurahashi (SM); 1♂, Sarawak State, Kuching Division, Matang Nationhal Park, <50 m, forest, 21–22.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Kuching Division, nr Serian, Kampung Tarat, <200 m, forest, 25.vii.2018, H. Kurahashi (IDD); 1♂, Sarawak State,

Kuching Division, nr Serian, Kampung Tarat, <200 m, forest, 25.vii.2018, H. Kurahashi (IDD); 3♂, Sarawak State, Kuching Division, Santubong, <1 m, swamp, 14.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, H. Kurahashi (IDD); 1♂, Sarawak State, Miri Division, Bario Town, 1,020 m, garden, 1.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Power St., 1,020 m, forest, 5.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,103 m, forest, 28.viii.2009, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Pa Lungan to Bario, 1,151 m, forest, 5.ix.2009, H. Kurahashi (SM); 1♂, Sarawak State, Sibu Division, Katibas River, Tupang River, forest, 11.ix.2011, H. Kurahashi (SM); 2♂, Sarawak State, Sibu Division, Lanjak Entimau Wildlife Sanctuary, Ju Station, Helipad, 142 m, hill top, 6.iii.2014, S. H. Tan (PCSHT); 3♂, Sarawak State, Sibu Division, Lanjak Entimau Wildlife Sanctuary, Helipad, 1,034 m, hill top, 7–8.ix.2011(2♂), 12.ix.2011(1♂), H. Kurahashi (SM).

***Parasarcophaga dux* (Thomson, 1869)**

BORNEO: 1♂, Sarawak State, Kuching Division, Jabatan Perhutang, <1 m, swamp, 18.ix.2007, H. Kurahashi (SM); 7♂ 3♀, Sarawak State, Kuching Division, Kampung Rambungan, <1 m, swamp, 16.ix.2007, H. Kurahashi (SM); 6♂ 4♀, Sarawak State, Kuching Division, Kampung Sampadi, <1 m, beach, 17.ix.2007, H. Kurahashi (SM); 6♂, Sarawak State, Kuching Division, Kuching City, Sarawak Museum, <5 m, garden, 31.viii.2007, H. Kurahashi (SM); 1♂, Sarawak State, Kuching Division, Matang Nationhal Park, <50 m, forest, 21–22.ix.2007, H. Kurahashi (SM); 16♂, Sarawak State, Kuching Division, Rambungan, <1 m, dry swamp, 8–9.ix.2008, H. Kurahashi (SM); 5♂, Sarawak State, Kuching Division, Sampadi, <1 m, sandy beach, 8.ix.2008, H. Kurahashi (SM); 4♂ 3♀, Sarawak State, Kuching Division, Santubong, <1 m, mangrove, 27.vii.2018, H. Kurahashi (IDD); 7♂ 2♀, Sarawak State, Kuching Division, Santubong, <1 m, swamp, 14.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Kuching Division, Telega Air, <1 m, swamp, 9.ix.2008, H. Kurahashi (SM); 1♂, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, H. Kurahashi (IDD); 1♂, Sarawak State, Limbang Division, Lawas Dist., Ba' Kelalan View Point, 1,099 m, forest, 16.vi.2013, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Town, 1,020 m, garden, 10.ix.2007, H. Kurahashi (SM).

***Parasarcophaga hirtipes* (Wiedemann, 1830)**

BORNEO: 1♂, Sarawak State, Miri Division, Pa Lungan to Bario, 1,151 m, forest, 5.ix.2009, H. Kurahashi (SM).

****Parasarcophaga idmais* (Séguy, 1934)**

BORNEO: 1♂, Sarawak State, Kuching Division, Mt. Pueh, 33 m, forest, 3.ix.2008, H. Kurahashi (SM).

***Parasarcophaga lopesi* Verves, 1980**

BORNEO: 3♂, Sarawak State, Kuching Division, Rambungan, <1 m, dry swamp, 8–9.ix.2008, H. Kurahashi (SM); 3♂, Sarawak State, Kuching Division, Santubong, <1 m, swamp, 14.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Kuching Division, Santubong, <1 m, swamp, 14.ix.2007, H. Kurahashi (IDD).

***Parasarcophaga mimobrevicornis* (Sugiyama, 1990) n. rec. to Sarawak**

BORNEO: 1♂, Sarawak State, Kuching Division, Santubong, <1 m, mangrove, 26.vii.2018, H. Kurahashi (IDD).

***Parasarcophaga misera* (Walker, 1849)**

BORNEO: 1♂, Sarawak State, Kota Samarahan Division, Sadong Jaya, coconut plan., 8.vii.2012, H. Kurahashi (IDD); 11♂ 8♀, Sarawak State, Kuching Division, Jabatan Perhutang, <1 m, swamp, 18.ix.2007, H. Kurahashi (SM); 1♀, Sarawak State, Kuching Division, Kampung Sampadi, <1 m, beach, 17.ix.2007, H. Kurahashi (SM); 3♂ 3♀, Sarawak State, Kuching Division, Kuching City, Sarawak Museum, <5 m, garden, 31.viii.2007, H. Kurahashi (SM); 2♀, Sarawak State, Kuching Division, Matang Nationhal Park, <50 m, forest, 21–22.ix.2007, H. Kurahashi (SM); 3♂ 1♀, Sarawak State, Kuching Division, Rambungan, <1 m, dry swamp, 8–9.ix.2008, H. Kurahashi (SM); 1♀, Sarawak State, Kuching Division, Sampadi, <1 m, sandy beach, 8.ix.2008, H. Kurahashi (SM); 2♂ 2♀, Sarawak State, Kuching Division, Santubong, <1 m, mangrove, 27.vii.2018, H. Kurahashi (IDD); 1♀, Sarawak State, Kuching Division, Santubong, <1 m, beach, 19.ix.2011, H. Kurahashi (SM); 1♂ 1♀, Sarawak State, Kuching Division, Santubong, <1 m, swamp, 14.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Kuching Division, Telega Air, <1 m, swamp, 9.ix.2008, H. Kurahashi (SM); 1♀, Sarawak State, Miri Division, Bario, Pa Ukut., 1,020 m, forest, 3.ix.2007, H. Kurahashi (SM); 1♂ 1♀, Sarawak State, Miri Division, Bario, Pa Umor., 1,020 m, forest, 8.ix.2007, H. Kurahashi (SM); 1♂ 2♀, Sarawak State, Miri Division, Bario, Pa Umur, 1,072 m, forest, 29–30.viii.2009, H. Kurahashi (SM); 2♂, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,020 m, forest, 11.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,121 m, forest, 8.ix.2009, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Town, 1,020 m, garden, 10.ix.2007, H. Kurahashi (SM); 1♀, Sarawak State, Miri Division, Bario, Town, 1,020 m, garden, 1.ix.2007, H. Kurahashi (SM); 1♀, Sarawak State, Miri Division, Pa Lungan to Pa Terutun, 1,140 m, forest, 3.ix.2009, H. Kurahashi (SM); 1♂ 1♀, Sarawak State, Miri Division, Sungai Liku, S23, S26, 9.v.2016, T. Tachi (PCTT); 1♂, Sarawak State, Sibu Division, Katibas River, Ngaranau River, forest, 10.ix.2011, H. Kurahashi (SM); 10♂, Sarawak State, Sibu Division, Katibas River, Tupang River, forest, 11.ix.2011, H. Kurahashi (SM); 1♂, Sarawak State, Sibu Division, Lanjak Entimau Wildlife Sanctuary, Ju Station, Helipad, 161 m, hill top, 12.ix.2011, S. H. Tan (IDD); 5♂, Sarawak State, Sibu Division, Lanjak Entimau Wildlife Sanctuary, Helipad, 161 m, hill top, 7–8.ix.2011(3♂), 12.ix.2011(2♂), H. Kurahashi (SM); 1♂, Sarawak State, Sri Aman Division, Ulu Engkari, Nanga Talong, forest, 4.vii.2012, H. Kurahashi (IDD).

****Parasarcophaga montiblensis* (Sugiyama, 1990), comb. nov.**

BORNEO: 2♂, Sarawak State, Kuching Division, nr Serian, Kampung Tarat, <200 m, forest, 25.vii.2018, H. Kurahashi (IDD); 1♂, Sarawak State, nr Serian, Mt. Kampung Tarat, 1.ix.2006, H. Kurahashi (SM)

***Parasarcophaga omari* Kurahashi & Leh, 2007**

BORNEO: 2♂, Sarawak State, Kuching Division, Borneo Highlands, 1,034 m, forest, 16–18.ix.2011, H. Kurahashi (SM); 1♂, Sarawak State,

Kuching Division, Kampung Tarat, <200 m, forest, 15.ix.2007, H. Kurahashi (IDD); 2♂, Sarawak State, Kuching Division, Mt. Pueh, 33 m, forest, 3.ix.2008, H. Kurahashi (SM); 1♂, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, H. Kurahashi (IDD); 1♂, Sarawak State, Sibü Division, Katibas River, Tupang River, forest, 11.ix.2011, H. Kurahashi (SM).

***Parasarcophaga quinqueramosa* (Sugiyama, 1990), comb. nov.**

BORNEO: 24♂ 22♀, Sarawak State, Kuching Division, Jabatan Perhutang, <1 m, swamp, 18.ix.2007, H. Kurahashi (SM); 22♂ 9♀, Sarawak State, Kuching Division, Kampung Rambungan, <1 m, swamp, 16.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Kuching Division, Rambungan, <1 m, swamp, 15.ix.2009, H. Kurahashi (IDD); 8♂ 6♀, Sarawak State, Kuching Division, Rambungan, <1 m, dry swamp, 8–9.ix.2008, H. Kurahashi (SM); 1♂, Sarawak State, Kuching Division, Santubong, <1 m, swamp, 14.ix.2007, H. Kurahashi (IDD); 1♂, Sarawak State, Kuching Division, Telega Air, <1 m, swamp, 9.ix.2008, H. Kurahashi (SM); 10♂ P 2♀ P, Sarawak State, Santubong 30 k N of Kuching., 19–10.xi.1975, S. Shinonaga and H. Shima (NSMT).

***Parasarcophaga taenionota* (Wiedemann, 1819)**

BORNEO: 2♂, Sarawak State, Kuching Division, Jabatan Perhutang, <1 m, swamp, 18.ix.2007, H. Kurahashi (SM); 4♂, Sarawak State, Kuching Division, Rambungan, <1 m, dry swamp, 8–9.ix.2008, H. Kurahashi (SM); 2♂, Sarawak State, Kuching Division, Santubong, <1 m, mangrove, 27.vii.2018, H. Kurahashi (IDD); 1♀, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, Lily Sir (FDS); 1♂ 1♀, Sarawak State, Sri Aman Division, Ulu Engkari, Nanga Talong, forest, 4.vii.2012, Lily Sir (FDS).

****Parasarcophaga walshi* (Ho, 1938), comb. nov.**

BORNEO: 1♂, Sarawak State, Kuching Division, Santubong, <1 m, beach, 19.ix.2011, S. H. Tan (PCSHT); 3♂, Sarawak State, Kuching Division, Santubong, swamp, 14.ix.2007, S. H. Tan (PCSHT).

***Rosellea notabilis* (Kano & Lopes, 1969), comb. nov.**

BORNEO: 2♂ 3♀, Sarawak State, Kuching Division, Borneo Highlands, 1,200 m, forest, 28–29.vii.2018, H. Kurahashi (IDD); 1♀, Sarawak State, Kuching Division, Matang National Park, <50 m, forest, 26.vii.2018, H. Kurahashi (IDD); 1♂ 1♀, Sarawak State, Lanjak-Entimau Wildlife Sanctuary, Engkari R., forest, 29.vi.–3.vii.2012, H. Kurahashi (IDD); 1♂, Sarawak State, Limbang Division, Bakelalan, 900 m, forest, 21–26.viii.2008, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 31.viii.–1.ix.2008, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 4.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario to Pa Lungan, 1,020 m, forest, 4.ix.2007 (1♂ 1♀), 9.ix.2007 (2♂ 3♀), (); 1♀, Sarawak State, Miri Division, Bario, Pa Ukut., 1,020 m, forest, 7.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Prayer Mountain, 1,428 m, hill top, 9.ix.2009, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Bario, Prayer Mountain, 1,235 m, forest, 10.ix.2009, H. Kurahashi (SM); 6♂ 4♀, Sarawak State, Serian, Mt. Sedong, Kampung Tarat., 1–3.x.2005, H. Kurahashi (SM); 1♂, Sarawak State, Sibü Division, Lanjak Entimau Wildlife Sanctuary, Helipad, 161 m, hill top, 7–8.ix.2011, H. Kurahashi (SM).

***Seniorwhitea orientalis* (Parker, 1917)**

BORNEO: 1♂ 1♀, Sarawak State, Kuching Division, Matang National Park, <50 m, forest, 21–22.ix.2007, H. Kurahashi (SM); 2♂, Sarawak State, Miri Division, Bario to Pa Lungan, 1,151 m, forest, 31.viii.2009, H. Kurahashi (SM); 1♂ 1♀, Sarawak State, Miri Division, Bario, Pa Umur, 1,062 m, forest, 6.ix.2009, H. Kurahashi (SM); 2♂ 2♀, Sarawak State, Miri Division, Bario, Stone-cutting site, 1,103 m, forest, 28.viii.2009, H. Kurahashi (SM); 2♂, Sarawak State, Miri Division, Pa Lungan to Bario, 1,151 m, forest, 5.ix.2009, H. Kurahashi (SM); 1♂, Sarawak State, Miri Division, Pa Umor, 1,020 m, forest, 8.ix.2007, H. Kurahashi (SM); 1♂, Sarawak State, Sri Aman Division, Ulu Engkari, Nanga Talong, forest, 4.vii.2012, H. Kurahashi (IDD); 3♂, Sarawak State, Kuching Division, Regional Forestry Office Kuching, swamp, 18.ix.2007, S. H. Tan (PCSHT); 1♂, Sarawak State, Miri Division, Bario Town, Quarry, 1,103 m, forest, 8.ix.2009, S. H. Tan (PCSHT).

***Seniorwhitea princeps* (Wiedemann, 1830)**

BORNEO: 4♂, Sarawak State, Sibü Division, Lanjak Entimau Wildlife Sanctuary, Helipad, 1,034 m, hill top, 7–8.ix.2011, H. Kurahashi (SM).

***Zulisca aquila* (Sugiyama, 1990), comb. nov.**

BORNEO: 1♂, Sarawak State, Kuching Division, Bako N. P., mangrove, 5.ix.2006, H. Kurahashi (SM); 1♂, Sarawak State, Kuching Division, Rambungan, <1 m, swamp, 15.ix.2009, H. Kurahashi (IDD); 3♂ 2♀, Sarawak State, Kuching Division, Rambungan, <1 m, swamp, 8–9.ix.2008, H. Kurahashi (SM); 11♂ 4♀, Sarawak State, Kuching Division, Kampung Rambungan, <1 m, swamp, 16.ix.2007, H. Kurahashi (SM); 2♂ 1♀, Sarawak State, Kuching Division, Santubong, <1 m, swamp, 14.ix.2007, H. Kurahashi (IDD); 1♂, Sarawak State, Kuching Division, Telega Air, <1 m, swamp, 9.ix.2008, H. Kurahashi (SM); 3♂, Sarawak State, Santubong, <1 m, mangrove, 27.vii.2018, H. Kurahashi (IDD).

APPENDIX IV

Habitus photographs of eight new species described in dorsal and lateral views, with labels.

HT ♂ = Holotype male.

Myorhina miyagii sp. nov., HT ♂

Myorhina tomiae sp. nov., HT ♂

Burmanomyia pseudoborneensis sp. nov., HT♂

Burmanomyia barioensis sp. nov., HT♂

Hosarcophaga palustris sp. nov., HT♂

Hosarcophaga puteri sp. nov., HT♂

Sarcorohdendorfia kerohi sp. nov., HT♂

Sarcorohdendorfia okazawai sp. nov., HT♂

APPENDIX V

Habitus photographs of 11 previously known and newly recorded species from Sarawak, with collection labels.

Alisarcophaga gressitti ♂

Boettcherisca javanica ♀

Boettcherisca krathonmai ♂

Burmanomyia aureomarginata ♂

Hosarcophaga serrata ♂

Myorhina borneensis ♂

Omarisca longifilia ♂ comb. n.

Omarisca longifilia ♀ comb. n.

Parasarcophaga mimobrevicornis ♂

Parasarcophaga montiblensis ♂

Parasarcophaga quinquerosa ♂