NEW RECORDS OF *Woodiphora biroi* (BRUES, 1907) AND A POSSIBLE SIBLING SPECIES OF *Woodiphora parvula* SCHMITZ, 1927 (DIPTERA: PHORIDAE) FROM PENINSULAR MALAYSIA

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ABSTRACT

Scuttle flies (Diptera: Phoridae) can be found in various habitats with important roles in the ecosystem as parasites, predators and decomposers. Currently there are more than 270 genera of Phoridae worldwide and *Woodiphora* has been recognized as one of the most prevalent group in the Australasian and Oriental region. Previous decomposition studies using animal carcasses indicated there were more species likely to be discovered from Malaysia. In this paper, the first occurrence of *Woodiphora biroi* (Brues, 1907) from Peninsular Malaysia and a possible sibling species complex of *Woodiphora parvula* Schmitz, 1927 which could not be named until linked to its male were reported. The latter has different abdominal tergites and furca from previously described species. Samples were collected from baited-flight traps placed at selected locations in Bangi, Selangor, as prescribed herein. This report extends our knowledge on the distribution and bionomics of *Woodiphora* from this region.

Keywords: Scuttle fly, Dufour's crop mechanism, taxonomy, saprophagous

ABSTRAK

Lalat mencalai (Diptera: Phoridae) boleh ditemui di pelbagai habitat dan memainkan peranan penting dalam ekosistem sebagai parasit, pemangsa dan agen pereputan. Kini terdapat lebih 270 genus Phoridae di seluruh dunia dan *Woodiphora* dikenalpasti sebagai salah satu kumpulan yang paling prevalen di wilayah Australasia dan Timur. Kajian pereputan terdahulu menggunakan bangkai haiwan menunjukkan lebih banyak spesies daripada kumpulan ini boleh dijumpai di Malaysia. Dalam artikel ini, kehadiran *Woodiphora biroi* (Brues, 1907) dari Semenanjung Malaysia dan satu spesies kompleks kepada *Woodiphora parvula* Schmitz, 1927 yang tidak dapat dinamakan sehingga ia dihubung kait dengan pasangan jantannya dilaporkan. Spesies ini memiliki tergit abdomen dan furca yang berlainan daripada spesies yang pernah direkodkan sebelum ini. Sampel dikutip daripada perangkap air berumpan yang diletakkan di

lokasi pilihan di Bangi, Selangor, seperti dihuraian. Laporan ini turut mengembangkan pengetahuan mengenai taburan dan bionomik *Woodiphora* dari wilayah ini.

Kata kunci: Lalat mencalai, mekanisme tembolok Dufour, taksonomi, saprofagus

INTRODUCTION

Woodiphora has been reported as the most abundant group of Phoridae, after *Megaselia,* in selected forest habitats of Peninsular Malaysia (Idris & Sajap 2002). Prior to the findings, this genus was apparently abundant in the Oriental to Australasian and the occurrence was reported by Borgmeier (1967a) with a total of 10 species and two were recorded from Peninsular Malaysia, i.e. *W. dentifemur* Borgmeier and *W. parvula* Schmitz. According to Zhu and Liu (2009), the genus *Woodiphora* is established from the European type species *Aphiochaeta retroversa* (Wood) by Schmitz (1926). The male can be recognized by the combination of a notopleural cleft, noticeably short costal cilia, well-developed subcostal vein, relatively short anal tube and the lacking posterodorsal dorsals. Females, on the other hand, have the distinctive characters of Dufour's crop mechanism (DCM) as well as the abdominal sternite 9 (Disney 1989; Disney 1994).

Disney (1989) further added 20 species to the region including *W. harveyi* Disney and *W. malaysiae* Disney from Penang. Further investigation discovered a male *W. distans* (Borgmeier) and three other unnamed female species from rabbit carcasses in enclosed environments in Bangi, Selangor (Zuha & Disney 2017). The three other species were given temporary codename as reference i.e. *Woodiphora* sp. A, *Woodiphora* sp. B and *Woodiphora* sp. C, and will be named after they are linked to respective males. Elsewhere in the Oriental, Disney (2005) recognized another two species, *W. chaoi* Disney from Taiwan and *Woodiphora* sp. TH-A from Thailand. Further eight *Woodiphora* species have been reported imprisoned in kettle-trap flower in Thailand consisting of *W. harveyi* Disney and others were also given the codenames, i.e. *Woodiphora* sp. TH-A and *Woodiphora* sp. B to H (Banziger & Disney 2006; Disney & Banziger 2009). *Woodiphora* from China has been described by Liu (2001) with further two new species have been added to the list i.e., *W. lageniformis* Liu *et* Zhu and *W. fasciaria* Liu *et* Zhu (Zhu & Liu 2009). In this paper, we report the first record of *W. biroi* and a possible sibling species complex of *W. parvula* from Peninsular Malaysia and the sample collected from Bangi, Selangor by using baited-flight traps.

MATERIALS AND METHODS

Sampling Location

This study was part of an ongoing biodiversity survey of Malaysian phorids in Bangi, Selangor, since 2014. It was conducted at Forensic Science Simulation Site (FS), Faculty of Health Sciences, Universiti Kebangsaan Malaysia, Bangi (2.91ºN, 101.79ºE) and Garden Homes Section 15 (GH), Bandar Baru Bangi (2.93ºN, 101.77ºE). FS is an outdoor research facility, covering approximately 7000 m^2 secondary forest and open area with three working units of portable cabins. Approximately 50 m to the west is the nearest molecular biology research building while to the southeast is an oil palm plantation, bordered by a water canal. GH is a residential area, consisting of 400 units of double-story houses with estimation of 2000 residents. Langat River flows at the southeast of the housing vicinity whilst a water treatment plant is located approximately 100 m to the northeast. The specific housing unit used in this research belongs to the first author as part of pilot study to observe the efficacy of phorid traps.

Sampling Method

A total of three flight-baited traps were used at each location. Baits consisted of approximately 30 g decomposed cow's liver placed in a sterile universal container (Shafe'i & Zuha 2016). Openings of the containers were covered with a 2 mm gauze to allow entry of adult scuttle flies but to prevent other sarcosaprophagous insects from ovipositing on the decomposed animal tissue. The baits were then placed in a 20 cm diameter yellow plate, half-filled with water and set on the ground. At FS, each trap was placed approximately 3 m apart while at GH, traps were placed at the back of the house at 1 m apart. After three days, trapped specimens were collected and preserved in 70% ethanol.

Species Dissection and Identification

The head, left wing, thorax, abdomen and legs of scuttle flies were dissected and mounted on slides in Berlese fluid and covered with 6 mm rounded cover slips (Disney 2001). Particularly for genus *Woodiphora*, the abdomens were carefully dissected to observe the DCM. The slide mounted specimens were deposited in the Centre for Insect Systematics, UKM. Identification was based on key to Australasian and Oriental *Woodiphora* (Disney 1989).

RESULTS

Woodiphora biroi (Brues, 1907) (Figure 1)
Aphiochaeta biroi Brues, 1907: 405.
Aphiochaeta pertubans Malloch, 1935; 335. Synonymized by Borgmeier, 1967b: 266.
Woodiphora parvula (in part) Borgmeier, 1962: 484, nec Schmitz, 1927.
Woodiphora biroi (Brues) Borgmeier, 1967a: 158.
Woodiphora unileata Borgmeier, 1967a, 163. Synonymized by Disney, 1989:1159.

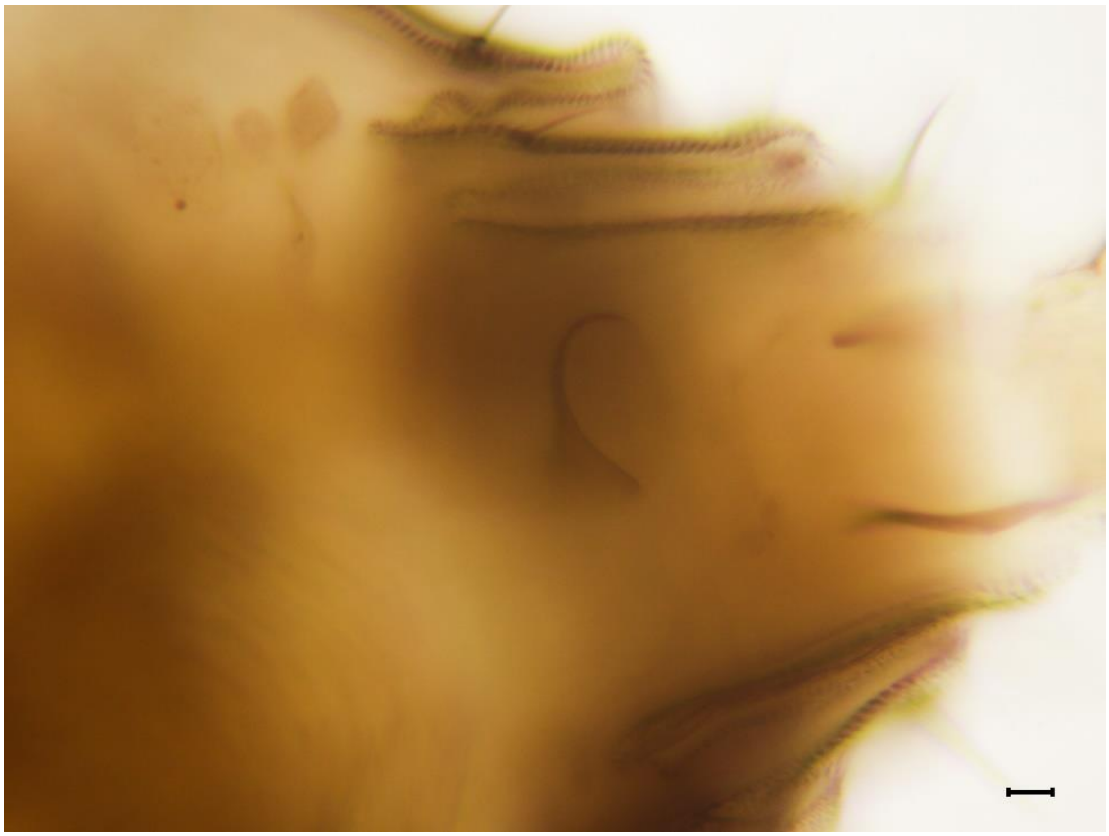

Figure 1. Furca of *Woodiphora biroi* female. (Scale bar = 0.01 mm)

Description

Female. Frons 0.28 mm wide and 0.22 mm long with 56-60 hairs divided by a strong median line. Suprantennal bristles subequal. Lower pair just slightly lower than antials. Upper pairs lower than anterolaterals. Preocellar bristles about as wide apart as antials and aligned with mediolaterals. Postpedicels brown with SPS vesicles. Palps pale brown with 6 bristles on apical half. Thorax brown with 2 notopleural bristles. Scutellum with 4 subequal bristles. Mesopleuron bare. Abdominal tergite brown. Abdominal venter greyish with hairs on segment 3 to 6. DCM is heavily pigmented. Internal sternite 9 as Figure 1. Wing length 1.45 mm long. Costal index 0.54. Costal ratios 2.0: 1.5: 1. Costal cilia short, 0.02-0.03 mm long, with 2 axillary bristles. The costa and other thick veins brown. Halter knobs greyish brown. Legs pale brown. Apical third of hind femur progressively brown. Mid tibia without hair palisade. Hind tibia with a single, complete dorsal palisade. Hind femur with 7-8 longer hairs below basal half.

Material examined

1♀, MALAYSIA: Selangor, Bangi, Universiti Kebangsaan Malaysia, 12.xi.2015 (CISUKM, Wo-2015-002).

Distribution

This species has previously been recorded from Papua New Guinea (Borgmeier 1967a; Disney 1989) and Samoa (Borgmeier 1967a).

Remarks

In the key of Australasian and Oriental *Woodiphora* (Disney 1989), *W. biroi* is distinguished by the absence of longitudinal hair palisades on the mid tibia, a single, complete dorsal hair palisade on the hind tibia and distinctive features of the abdominal sternite 9 and DCM. Shorter wing (<1.5 mm) differentiates this species from *W. grootaerti* Disney and *W. trigona* Disney.

***Woodiphora* species D**

Figure 2-8. *Woodiphora* sp. D female. 2, frons; 3, abdominal tergites 5-7; 4, Dufour's crop mechanism; 5, internal sternite 9 (furca); 6, mid tibia; 7, hind femur and tibia; 8, left wing (Scale bar = 0.1 mm, except 5, scale bar = 0.01 mm).

Description

Female. Frons 0.25 mm wide and 0.20-0.22 mm long (Figure 2). Approximately 56-64 hairs divided by a strong median line. Suprantennal bristles subequal. Lower pair just slightly lower than antials. Upper pairs almost the same level as anterolaterals. Preocellar bristles as wide apart as antials but lower than mediolaterals. Postpedicels brown with SPS vesicles. Palps brown with 6-7 bristles on apical half. Thorax brown with 2 notopleural bristles. Scutellum with 4 bristles with anterior pair slightly shorter. Mesopleuron bare. Abdominal tergite brown, T5 and T6 as Figure 3. Abdominal venter grey with hairs on segment 4 to 6. DCM as Figure 4. Internal sternite 9 ring-shaped, as Figure 5. Wing length 1.54-1.64 mm long (Figure 8). Costal index 0.53-0.54. Costal ratios 4.2-5.0: 3.0-3.4: 1. Costal cilia short, 0.02-0.03 mm long, with 2 axillary bristles. The costa and other thick veins brown. Halteres greyish brown but paler in older specimens. Legs pale brown. Apical half of hind femur progressively brown. Mid tibia with longitudinal hair palisade extending two-thirds of length of dorsal face (Figure 6). Hind tibia with a complete dorsal palisade and an incomplete palisade on the anterior face (Figure 7). Hind femur with 8 longer hairs below basal half.

Materials examined

1♀, MALAYSIA: Selangor, Bangi, Universiti Kebangsaan Malaysia, 12.xi.2015 (CISUKM, Wo-2015-001). 1♀, MALAYSIA: Selangor, Bangi, Universiti Kebangsaan Malaysia, 13.xi.2015 (CISUKM, Wo-2015-002). 1♀, MALAYSIA: Selangor, Bandar Baru Bangi Section 15 housing area, 9.viii.2020 (CISUKM, Wo-2020-001).

Remarks

In the key of Borgmeier (1967a) and Disney (1989), this species will run to *W. parvula* based on dorsal hair palisades on tibia and a single hair palisade on anterior face of apical half. In Borgmeier (1967a), the costal ratio of females was 3.3: 2.5: 1. In Disney (1989), abdominal tergites 5-7 (Figure 9) and internal sternite 9 (Figure 10) of *W. parvula* clearly rule out this species. This species was given a code letter based on genetic sequence from previously unknown *Woodiphora* species from Bangi (Zuha & Disney 2017).

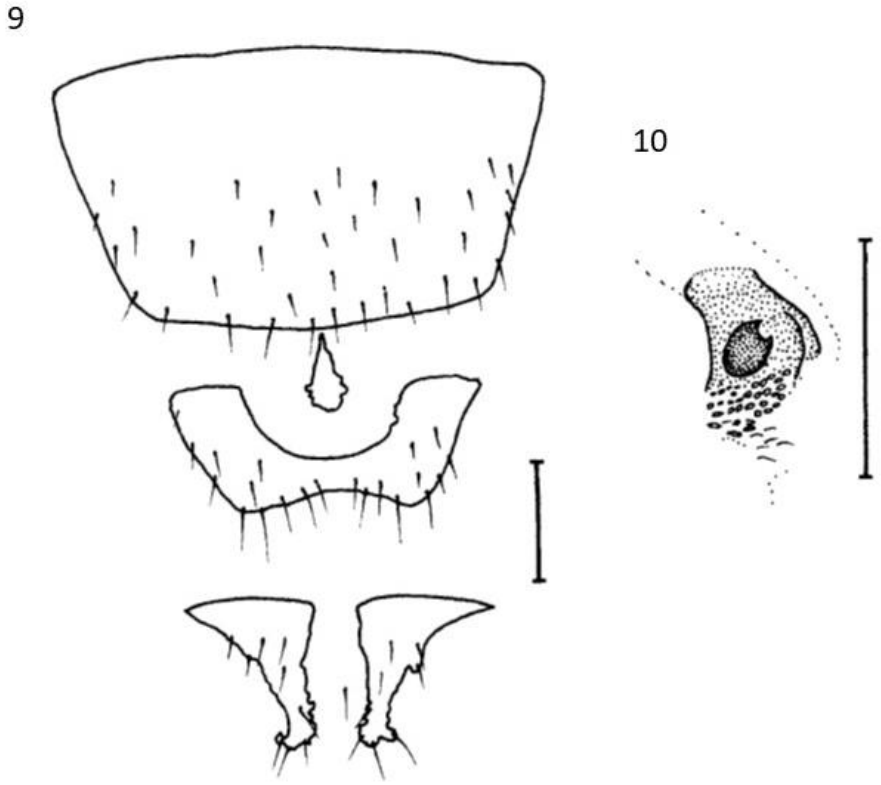

Figure 9-10. *Woodiphora parvula* female. 9, abdominal tergite 5-7; 10, furca. (Scale bar = 0.1 mm) (Source: Disney 2005)

DISCUSSION

Female *W. biroi* was perhaps common in Papua New Guinea (Borgmeier 1967a; Brues 1907; Disney 1989) and Samoa (Malloch 1935) but the life history and bionomics of this species are still unknown. The current result extends the distribution of this species but its preference towards decomposing animal tissue could not be ascertained as only one sample was collected without the presence of eggs or larvae on the decomposed animal tissue.

In *W. parvula*, the single dorsal hair palisade on the mid tibia and an incomplete anterior hair palisade on the hind tibia (Figure 7) were diagnostic (Borgmeier 1967a; Disney 1985, 1989; Liu 2001). However, distinct characteristics of mainly the abdominal tergites and furca revealed four species complex from Afrotropical, Oriental and Australasia (Disney 2005). Abdominal tergite 6-7 of *Woodiphora* species D was almost as similar as *W. collini* Disney from Seychelles and *Woodiphora* TH-A from Thailand, but furca was different. Costal section 1 and 2 were also obviously larger than costal section 3 in *Woodiphora* species D. Another possible sibling species complex from Papua New Guinea has entirely different abdominal tergite 6-7 and furca.

Compared to other genera, the modified abdominal tergite 6 and DCM in females are recognizable features in *Woodiphora* (Disney 1989). Other than *Woodiphora*, DCM also occurs in few other genera including the giant genus *Megaselia* which was suggested to

function as both valve and gland to secrete digestive enzymes (Disney 1987). The varying forms of DCM combined with features of the furca, can be of taxonomic value at the species level for *Woodiphora* (Disney 1989).

In the current study, the presence of *W. biroi* on the flight-baited trap did not show any evidence of oviposition activities. Females were found more frequent than the males to be trapped, possibly attributed to their feeding habits (Disney & Banziger 2009). However, the occurrence of various *Woodiphora* using decomposed animal tissues, including those have previously been recorded from animal carcasses (Zuha & Disney 2017), warranted further studies on their role as decomposers.

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