

**RECORDS OF *Woodiphora* Schmitz (DIPTERA:  
PHORIDAE) FROM ANIMAL CARCASSES IN BANGI,  
MALAYSIA**

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**ABSTRACT**

Four species of *Woodiphora* Schmitz were collected from rabbit carcasses placed in concealed environments in Bangi, Malaysia. A male *Woodiphora distans* (Borgmeier) was collected from a rabbit carcass placed inside a luggage case. The other three female *Woodiphora* were recorded from a rabbit carcass placed inside a water tank and could not be named until linked to their males. This report extends the knowledge of *Woodiphora* in this region and its association with animal carcasses.

**Keywords:** scuttle fly, Phoridae, *Woodiphora*, animal carcass, decomposition

## ABSTRAK

Sebanyak empat spesies *Woodiphora* Schmitz dikutip daripada bangkai arnab yang diletakkan di persekitaran tertutup di Bangi, Malaysia. Satu *Woodiphora distans* (Borgmeier) jantan dikutip daripada bangkai arnab yang diletakkan di dalam beg pakaian. Tiga yang lain adalah *Woodiphora* betina yang dikutip daripada bangkai arnab yang diletak di dalam tangki air dan tidak dapat dinamakan sehingga dikaitkan dengan pasangan jantan mereka. Laporan ini memperluaskan pengetahuan *Woodiphora* di wilayah ini serta hubungkaitnya dengan bangkai haiwan.

**Kata kunci:** lalat mencalai, Phoridae, *Woodiphora*, bangkai haiwan, pereputan

## INTRODUCTION

In Malaysia, there are more scuttle flies (Diptera: Phoridae) species likely to feature in forensic cases than had previously reported from Oriental region. Among the species recorded from studies using rabbit carcasses were the huge genus *Megaselia* Rondani, i.e. *M. curtineura* (Brues) and *M. spiracularis* Schmitz, both of which were reported in human carcasses in Malaysia by Thevan et al. (2010). Recent findings include new records and an undescribed female species that cannot be named in our present state of knowledge until linked to their males (Zuha et al. 2017). There were also three species of the genus *Puliciphora* Dahl (Zuha et al. 2014) and *Gymnoptera simplex* (Brues) (Zuha & Disney 2014) recorded from rabbit carcasses in concealed environments. In this paper, we report on specimens of *Woodiphora* Schmitz attracted to our rabbit carcasses.

## MATERIAL & METHODS

The study took place at a Forensic Science Simulation Site, Universiti Kebangsaan Malaysia, Bangi, Selangor (2.918° N, 101.798° E). This fieldwork facility is surrounded by secondary forest and research buildings. Scuttle fly specimens were collected from two separate studies. The first study conducted from 4 October 2010 to 22 January 2011. Male rabbit carcasses (*Oryctolagus cuniculus*), weighing between 2.07-2.95 kg were used to simulate the decomposition process and each was placed in a black polycarbonate garbage bin (42.6 mm top diameter, 46.0 cm height), a luggage case (58.5 cm, 42.0 cm and 22.4 cm dimensions) and a cage with direct exposure to the environment. Garbage bin and luggage case were placed in an open environment and inside conditions were dark. Sampling procedure was performed by bringing in the garbage bin or luggage case into a modified Malaise trap located inside a portable cabin unit. This step was to avoid contamination of insects from outside and to prevent scuttle flies escaping to the environment during samplings. For carcasses placed in the cage, sampling was performed by using a sweep net. Samplings were carried out daily during the first 11 days, every alternate day from 11th day until 27th day and every two days from 27th day until 40th day. During sampling, the garbage bin lid or luggage was opened, and this allowed the flying insects to disperse in the Malaise trap. Trapped flying insects were aspirated into a jar and killed with chloroform.

In the second study, carcasses weighing between 2.50-2.90kg were placed in separate transparent water tanks (60 cm, 30 cm and 35 cm dimensions) from 3 March until 2 April 2014. One carcass was drowned in 10 l of water (aquatic) while another was placed in a dry environment (non-aquatic). However, the non-aquatic water tank was subsequently half-filled with water due to rainfall from 14<sup>th</sup> day. Both water tank openings were covered with two layers of metal wire mesh, the

upper layer with 1 cm holes to avoid scavenging by animals and the lower layer with approximately 2 mm holes to permit the entrance of scuttle flies and block the presence of larger common forensic flies such as blowflies and flesh flies. The water tanks were placed side by side on plastic benches (approximately 0.5 m from the ground) and left exposed in the outdoor environment. Adult scuttle flies trapped in the water tanks were aspirated into a jar and killed with chloroform. Samplings were carried out daily during the first 14 days and every alternate day until 30<sup>th</sup>. All phorid specimens were preserved in 70% ethanol. They were subsequently mounted on slides in Berlese Fluid (Disney, 2001). The slide mounted specimens are deposited in the University of Cambridge, Museum of Zoology (UCZM).

## RESULTS

The only male specimen was preserved individually in relatively large volumes of ethanol, with the unfortunate result that they had faded by the time they were slide mounted in 2014. Fortunately, photos were taken of some of the intact flies before this, so that the colours were apparent before this deterioration.

Since the key of Borgmeier (1967) to the species of *Woodiphora* then known more than three dozen species have been added to this cosmopolitan genus. A problem with Borgmeier's key is that several species were only known in one sex. Currently only males that are new are described and named and females not linked to their males are given code letters only. The Australasian and Oriental species were keyed by Disney (1989), supplemented by Disney (1997, 2005), Bänziger & Disney (2006), Zhu & Liu (2009) and Disney & Bänziger (2009). Liu (2001) covers the then known Chinese species.

***Woodiphora distans* (Borgmeier) (Fig. 1)**

*Haplophleba distans* Borgmeier, 1961: 236.

**Material.** ♂, MALAYSIA: Selangor, Bangi, Universiti Kebangsaan Malaysia, rabbit carcass, 12.i.2011 (UCZM, 41-44). This species has previously been reported from Fiji, Indonesia (Sulawesi), Papua New Guinea and New Hebrides.

***Woodiphora* species A****Female only.**

Frons about 1.5 times broader than long. The lower supra-antennal bristles (SAs) clearly shorter than upper SAs. The antials about level with upper SAs or slightly lower. Anterolateral bristles clearly higher on frons than upper SAs. The mediolaterals clearly wider apart than either is from a mediolateral (ML), about as wide apart as antials and lower on frons than MLs. Postpedicels brown, almost as broad a labrum and with SPS vesicles. Palp and proboscis as Fig. 2. Thorax brown, with 2 bristles on notopleuron and 4 almost equal bristles on scutellum. Abdominal tergites brown, T5 and T6 as Fig. 3. Venter gray with numerous hairs on segment 3-6, and sternum 6 to 8 as Fig. 4. Dufour's crop mechanism as Fig. 5. Furca as Fig. 6. Legs brown but front legs paler and as Fig. 7. Hind femur, tibia and basitarsus as Fig. 8, the tibia lacking a dorsal hair palisade. Wing 1.2-1.3 mm long. Costal index 0.49. Costal ratios 4.7-4.8 : 2.9 : 1. Costal cilia 0.04 mm long. With 2 axillary bristles, the outer being 0.09-0.10 mm long. The costa and other thick veins brown, vein 2 being widely divergent from 3; veins 4-7 pale and likewise the membrane. Haltere brown.

**Recognition.** In the key of Borgmeier (1967) this will run to couplets 2 and 3, to *W. magnipalpis* (Alodrich) or *W. retroversa* (Wood). The former is redescribed by Borgmeier (1963). Both species have a costal index exceeding 0.5. The costal ratios of

*W. magnipalpis* are 3.3 : 3 : 1 and it has yellow haltere knobs. The female of *W. retoversa* has abdominal tergite 6 much narrower compared with T5.

In the key of Disney (1989) species A will run to couplet 40, lead 2. Two subsequently described species differ in the details of tergites 6 and 7. A note indicates that the unknown female of *W. rtickardi* Disney is likely to run out here. If one proceeds to couplet 41 a note refers to the probable female of *W. palawanensis* Disney, whose tergite 7 and the lobes at rear of sternum 8 differ, and to the unknown female of *W. spinifemora* Disney, whose costal index exceeds 0.51 and it has 3 axillary bristles. Proceeding to couplet 45, the two-species covered differ in their tergites 7 and furcas (sternites 9). Likewise, the subsequently described *W. longicauda* Disney & Michailovskaya (2002) runs out here, but it has grayish wings with veins 4-6 dark. It is possible that species A is the hitherto unknown female of *W. rtickardi*, that was described from two males from Indonesia (Sulawesi) but the following species B also runs out the same (see below).

**Material.** ♀, MALAYSIA: Selangor, Bangi, Universiti Kebangsaan Malaysia, rabbit carcass, 23.iii.2014, Jenarathanan Lai (UCZM, 41-44).

### ***Woodiphora* species B**

#### **Female only.**

Frons at least 1.2 times as wide as midline length. Supra-antennals almost equal, the upper pair being about 1.2 times as long as lower SAs. Antials about level with upper SAs and about midway between the latter and anterolaterals, which are clearly higher on frons. Pre-ocellars about 2.6 times further apart than either is from a mediolateral bristle and about 1.8 times further apart than upper SAs. Proboscis and palps as Fig. 9.

Postpedicels brown, with SPS vesicles, and only about 0.8 times as wide as labrum. Thorax brown, with 2 bristles on notopleuron, and 4 bristles on scutellum of which the anterior pair are a little shorter. Abdominal tergites brown, with T5 to T7 as Fig. 10. Venter brownish gray, with numerous hairs and sternite 7, sternum 8 and cerci as Fig. 11. Dufour's crop mechanism as Fig. 12. The pale furca as Fig. 13. Legs brown, but front legs paler and tarsi of latter whitish and with a posterodorsal hair palisade on all five segments. Hind femur as Fig. 14 and hind femur and tibia without a dorsal hair palisade. Wing as Fig. 15, being 1.14 mm long. Costal index 0.52. Costal ratios 4.5-4.6 : 2.51 : 1. Costal cilia 0.03-0.04 mm long. The outer of the 2 axillary bristles 0.07-0.08 mm long. Haltere brown.

**Recognition.** In the key of Borgmeier (1967) this will run to couplets 2 and 5, to *W. magnipalpis* (Alodrich) or *W. orientalis* Schmitz. The former is redescribed by Borgmeier (1963). Its costal ratios are 3.3: 3: 1 and has yellow haltere knobs. The wing of *W. orientalis* is immediately distinguished by having at least 6 axillary bristles.

In the key of Disney (1989) species B will run to couplet 40, lead 2. Two subsequently described species differ in having a much narrower tergite 7 and also the dimensions of T6 different. A note indicates that the unknown female of *W. rtickardi* Disney is likely to run out here. If one proceeds to couplet 41, lead 2 a note refers to species 'B', the probable female of *W. palawanensis* Disney, whose T7 is not as wide and its bristly hairs at the rear of sternum 7 are far fewer. Either species A or B is likely to be the unknown female of *W. palawanensis*.

**Material.** ♀, MALAYSIA: Selangor, Bangi, Universiti Kebangsaan Malaysia, rabbit carcass, 6.iii.2014, Jenarthanan Lai (UCZM, 41-44).

### *Woodiphora* species C

#### **Female only.**

Frons brown and about 2.3 times as wide as long. The supra-antennal bristles unequal, the lower pair being shorter. Antials about level with upper SAs and midway between them and anterolaterals, which are clearly higher on frons. Pre-ocellars about 1.9 times further apart than upper SAs but mediolaterals only about a third of this distance from a P-O but higher on frons. Palps proboscis and postpedicels as Fig. 16. Thorax brown, with 2 bristles on notopleuron and 4 on scutellum. Abdominal tergites brown, with T5-T7 as Fig. 17. Venter brownish gray (Fig. 17) and with numerous hairs on segments 3 to 6. Sternum 7 and 8 and cerci as Fig. 18. The furca as Fig. 19. Dufour's crop mechanism as Fig. 20. Legs probably somewhat faded, but were probably at least brownish yellow, with a darker tip to hind femur, and with the front legs being paler. Front tarsus as Fig. 21, with posterodorsal hair palisades on segments 1-4 only. Hind femur as Fig. 22, the tibia without a dorsal hair palisade. Wing as Fig. 23 and 1.5-1.6 mm long. Costal index 0.54. Costal ratios 6.0 : 3.6 : 1. Costal cilia 0.03 mm long. Two axillary bristles 0.11 mm long. Haltere brown.

**Recognition.** In the key of Borgmeier (1967) this will run to couplets 2, 9 or 10. At couplet 2 lead I it runs to *W. magnipalpis* (Alodrich), whose costal ratios are 3.2 : 3 : 1, and its haltere knob is yellow. At couplet 8 the division is between wings that are "grayish" as opposed to "with turbidity". The first option runs to couplet 9 lead 2, to *W. pallidinervis* Borgmeier, which is instantly distinguished by its distinctive, 'ribbed', dorsal abdominal glands (Fig. 24). The second option at couplet 9 runs



to couplet 10 lead 1, to *W. prorsa* Schmitz. However, its costal ratios are 3.5-4.0 : 2.5-3.25 : 1. In the key of Disney (1989) this species runs to couplets 43 and 44 where the furca immediately rules out these species. The tergites 5-7 differ from two

subsequently described Chinese species that run to these couplets and the subsequently published *W. longicauda* Disney & Michailovskaya (2002) will key out here. Its tergite 7 has the rear margin clearly narrower than its front margin and its furca is not evident.

**Material.** ♀, MALAYSIA: Selangor, Bangi, Universiti Kebangsaan Malaysia, rabbit carcass, 25.iii.2014, Jenarathanan Lai (UCZM, 41-44).

## DISCUSSION

The occurrence on Phoridae in forensic cases has been reviewed (Disney et al. 2014; Disney & Manlove 2005; Disney 1994). New records and occurrences of scuttle flies associated with corpses and animal carcasses in Malaysia expand the knowledge on the diversity of this group (Thevan et al. 2010; Zuha et al. 2014, Zuha & Disney 2014). However, the association between *Woodiphora* species with animal carcasses is scarce. In this study, *W. distans* was collected from a rabbit carcass placed inside a luggage case during early dry decay stage. Specimens of *Woodiphora* species A, B and C were collected from a wet, decomposed rabbit carcass in a tank half-filled with rainwater. Prior to rainfall, this carcass was already in a post decay stage and appeared dry with the presence of *M. scalaris* (Loew), *M. curtineura*, *P. beckeri* Meijere and *Dohniphora cornuta* (Bigot).

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Decomposition study of rabbit carcasses in garbage bin and luggage case) and FSK/BIOMED/2014/ZUHA/20-MAR./578-MAR.-2014-JUNE-2014-AR-CAT2 (Decomposition study of rabbit carcasses in water tank). Authors are grateful to the help by Prof. Dr. Baharudin Omar and See Huong Wen of the Biomedical Science Program and Jenarthanai Lai Xiong Qi of the Forensic Science Program, Faculty of Health Sciences, Universiti Kebangsaan Malaysia.

## REFERENCES

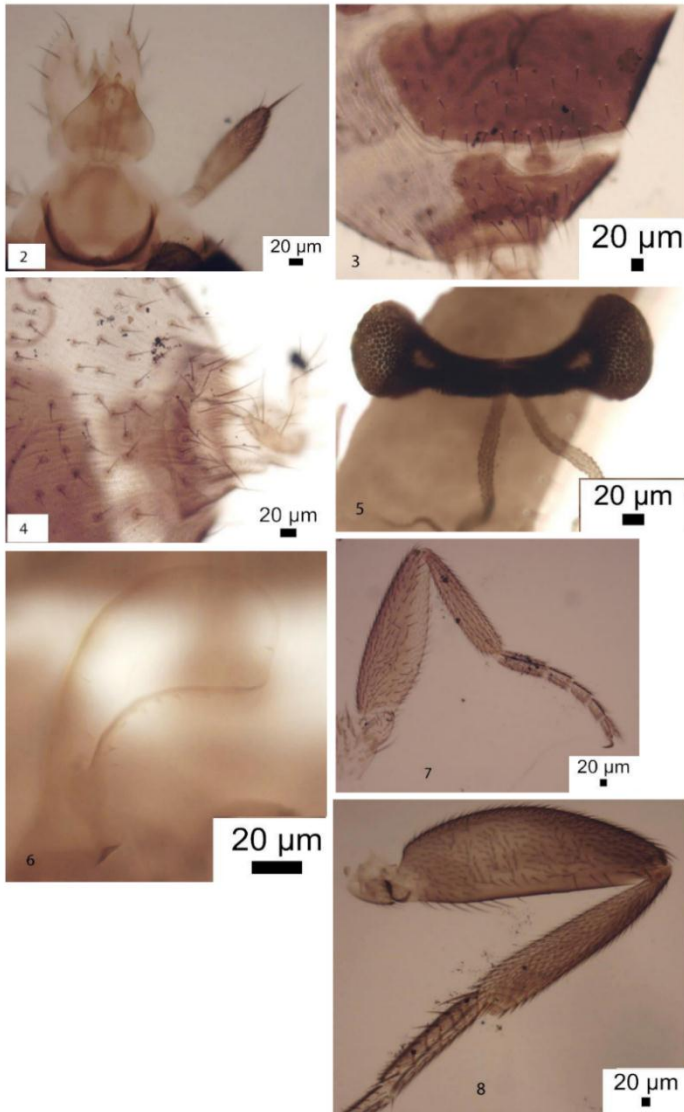
- Bänziger, H. & Disney, R. H. L., 2006. Scuttle flies (Diptera: Phoridae) imprisoned by *Aristolochia baenzigeri* (Aristolochiaceae) in Thailand. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* 79: 29-61.
- Borgmeier, T., 1961. Two new phorid flies from eastern Asia. *Pan-Pacific Entomologist* 37: 233-238.
- Borgmeier, T., 1963. Revision of the North American phorid flies. Part I. The Phorinae, Aenigmatiinae and Metopininae, except *Megaselia* (Diptera, Phoridae). *Studia Entomologica, Petropolis* 6: 1-256.

- Borgmeier, T., 1967. Studies on Indo-Australian phorid flies, based mainly on material of the Museum of Comparative Zoology and the United States National Museum. Part II. *Studia Entomologica, Petropolis* 10: 81-276.
- Disney, R. H. L., 1989. A key to Australasian and Oriental *Woodiphora* (Diptera: Phoridae), affinities of the genus and descriptions of new species. *Journal of Natural History* 23: 1137-1175.
- Disney, R. H. L., 1994. *Scuttle Flies: The Phoridae*. London, Chapman & Hall.
- Disney, R. H. L., 1997. The Micronesian *Megaselia curtissima* Beyer (Dipt., Phoridae) is a species of *Woodiphora*. *Entomologist's Monthly Magazine* 133:115-116.
- Disney, R. H. L., 2001. The preservation of small Diptera. *Entomologist's Monthly Magazine* 137: 155-159.
- Disney, R. H. L. 2005. The 'distinctive' *Woodiphora parvula* Schmitz (Dipt., Phoridae) is a sibling species complex. *Entomologist's Monthly Magazine*. 141:143-150.
- Disney, R. H. L. & Bänziger, H. 2009. Further records of scuttle flies (Diptera: Phoridae) imprisoned by *Aristolochia baenzigeri* (Aristolochiaceae) in Thailand. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* 82: 233-251.
- Disney, R. H. L., Garcia-Rojo, A., Lindström, A. & Manlove J. D., 2014. Further occurrences of *Dohnriphora cornuta* (Bigot) (Diptera, Phoridae) in forensic cases indicate likely importance of this species in future cases. *Forensic Science International* 241: e20-e22.

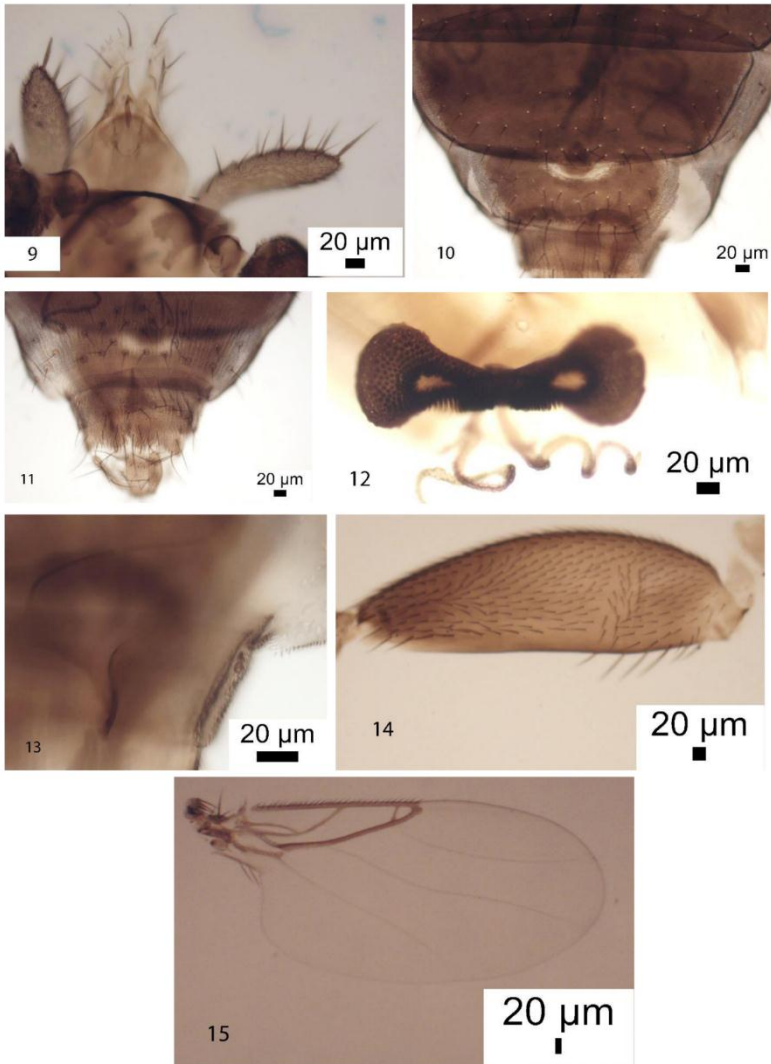
- Disney, R. H. L. & Manlove, J. D., 2005. First occurrences of the phorid, *Megaselia abdita*, in forensic cases in Britain. *Medical and Veterinary Entomology* 19: 489-491.
- Disney, R. H. L. & Michailovskaya, M. V., 2002. New species of Phoridae (Diptera) from Russia. *Entomologist's Monthly Magazine* 138: 225-236.
- Liu, G., 2001. *A Taxonomic Study of Chinese Phorid Flies Diptera: Phoridae (part 1)*. China: Neupress. 292 pp.
- Thevan, K, Disney, R. H. L. & Ahmad, A. H., 2010. First records of two species of Oriental scuttle flies (Diptera: Phoridae) from forensic cases. *Forensic Science International* 195: e5-e7.
- Zhu, W & Liu G-C., 2009. Two new species of *Woodiphora* Schmitz (Diptera, Phoridae) from China. *Acta Zootaxonomica Sinica* 34: 457-459.
- Zuha, R. M. & Disney, R. H. L. 2014. A scuttle fly (Diptera: Cyclorrhapha, Phoridae) that omits sclerotization of the puparium. *Studia Dipterologica*. 21(2): 173-176.
- Zuha, R. M., See, H. W., Disney, R. H. L. & Omar, B., 2014. First record of genus *Puliciphora* Dahl (Diptera: Phoridae) associated with rabbit carcasses placed in concealed environments in Malaysia. *Forensic Science International* 245: e36-e37.
- Zuha R.M., See, H-W, Disney, R. H. L, Omar, B. 2017. Scuttle flies (Diptera: Phoridae) inhabiting rabbit carcasses confined to plastic waste bins in Malaysia include new records and an undescribed species. *Tropical Life Science Research* 28(1):131-143.



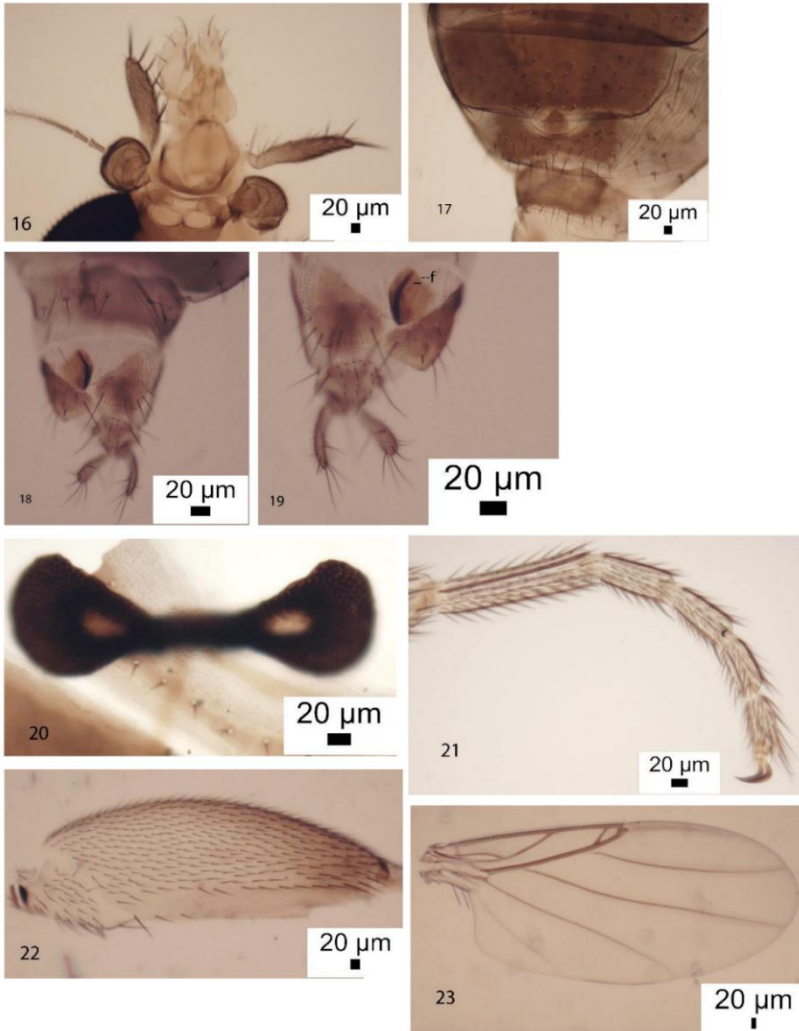
Fig. 1. *Woodiphora distans* male.



Figs 2-8. *Woodiphora* Species A female. 2, palp and proboscis; 3, abdominal tergites 5 and 6; 4, ventral face of abdomen from segment 6; 5, Dufour's crop mechanism; 6, furca; 7, front leg; 8, hind femur, tibia and basitarsus.



Figs 9-15. *Woodiphora* Species B female. 9, proboscis and palps; 10, abdominal tergites 5 and 6; 11, sternite 7 and sternum 8; 12, Dufour's crop mechanism; 13, furca; 14, hind femur; 15, wing.



Figs 16-23. *Woodiphora* Species C female. 16. Palps, postpedicels and proboscis; 17, abdominal tergites 5-7; 18, sternum 7 and 8; 19, furca (f); 20, Dufour's crop mechanism; 21, front tarsus; 22, hind femur; 23, wing.



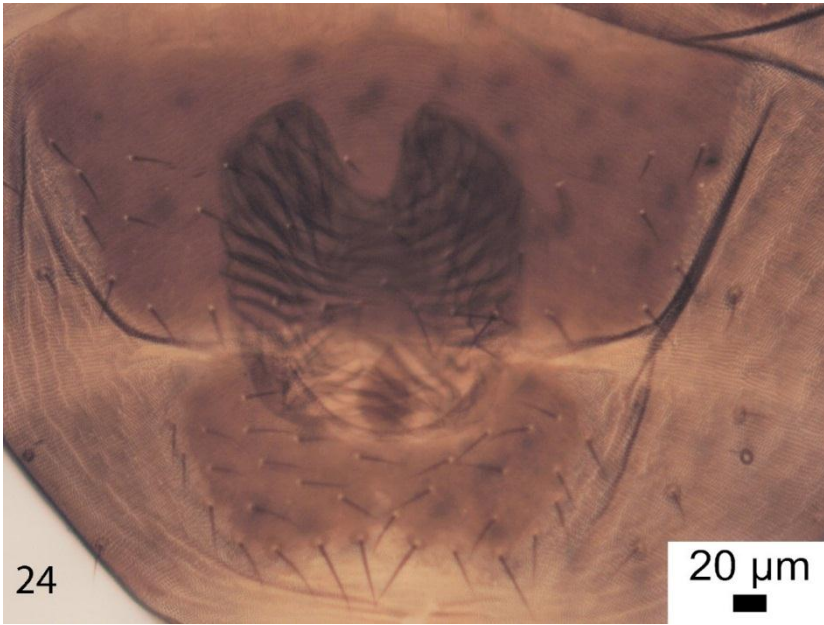


Fig. 24. *Woodiphora pallidinervis*, abdominal tergites 5 and 6 overlying the dorsal abdominal glands.