

Further records of scuttle flies (Diptera : Phoridae) imprisoned by *Aristolochia baenzigeri* (Aristolochiaceae) in Thailand

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Further records of scuttle flies (Diptera: Phoridae) imprisoned by *Aristolochia baenzigeri* (Aristolochiaceae) in Thailand

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Adults of 202 Phoridae were found in the kettle-trap flowers of *Aristolochia baenzigeri* in N. Thailand in 2008. These represented 23 species in 7 genera. *Dohrniphora nuniemong* Disney, n. sp. is described. *D. fisheri* is reported from Thailand for the first time. One species only known in the female sex is reported in the genus *Dohrniphora*, and a key to the females of this genus reported from the flowers of *A. baenzigeri* is provided, 4 species only known in the female sex in the genus *Megaselia*, 4 in the genus *Woodiphora*, and 2 species, only known from males, in the genus *Puliciphora*. *Spiniphora conspicua* Colyer (1955) is synonymised with *S. genitalis* Schmitz (1940). A key to the males of the Oriental species of *Spiniphora* is provided. 25 flies, males and females, were carrying pollen, 14 out of 93 in main pollinator *D. cornuta*, 6 out of 16 *D. sorora*, 2 out of 8 *Diplonevra peregrina*, 1 each in the new *D. nuniemong* and the remaining three carriers. Together with the previous study, sapromyiophilous *A. baenzigeri* entrapped a total of 35 phorid species of which 15 are confirmed pollen vectors. The taxonomic-faunistic implications for the food-deceptive pollination system of the liana is discussed.

Key words: *Aristolochia*, Diptera, Phoridae, new species, new synonym, food-deceptive pollination, Thailand.

INTRODUCTION

Whereas the original purpose of our studies was to understand the complex pollination mechanism of sapromyiophilous *Aristolochia baenzigeri* Hansen & Phu-phathanaphong, taxonomy of the pollinators turned out to be no less challenging. We have previously reported that of 124 scuttle flies (Phoridae) imprisoned by the liana there were 21 species (at least 8 new to science) in 8 genera, and that *Dohrniphora cornuta* not only represented more than 50 % of these flies but was the species most frequently carrying the pollen of these flowers (Bänziger & Disney 2006). We report below the further collection, by the second author, of another 202 scuttle flies trapped by these flowers in 2008. These serve to corroborate and to extend our knowledge of the species imprisoned by *A. baenzigeri* and to discuss their function in the reproduction of the liana.

MATERIALS AND METHODS

As previously reported (Bänziger & Disney 2006), field work was carried out by the second author in N. Thailand, Mae Hongson Province, Pai District, Pang Mapha, Site 1 (km 131.2), 910 m a.s.l. in June 2008. The specimens were preserved in 70 % ethyl alcohol, those bearing pollen were recorded. The specimens were

then mounted on slides (Disney 2001) and identified by the first author. Specimens are deposited in the Cambridge University Department of Zoology (CUMZ) and the Department of Entomology, Faculty of Agriculture, Chiang Mai University (DEFACU).

RESULTS

SYSTEMATICS (BY R. H. L. DISNEY)

Taxonomy and notes on scuttle flies (Diptera: Phoridae)

The basic keys required for each genus are cited in our previous paper (Bänziger & Disney 2006), which included 8 new species and 7 species represented by females only and were therefore given code letters only until they can be linked to their males. The larger numbers collected in the present study produced small numbers of two species very similar in appearance to *Dohrniphora cornuta* at low magnifications. It is essential, therefore, to examine the hind coxae and femora of all the males of this species complex under a compound microscope. The recognition of the females is discussed below.

Borophaga Enderlein

Many females in this genus can only be named when associated with their males. The females reported below are the same species as previously reported (Bänziger & Disney 2006).

Borophaga (Godavaria) sp.

Material examined. 3 ♀, 22.vi. 2008.

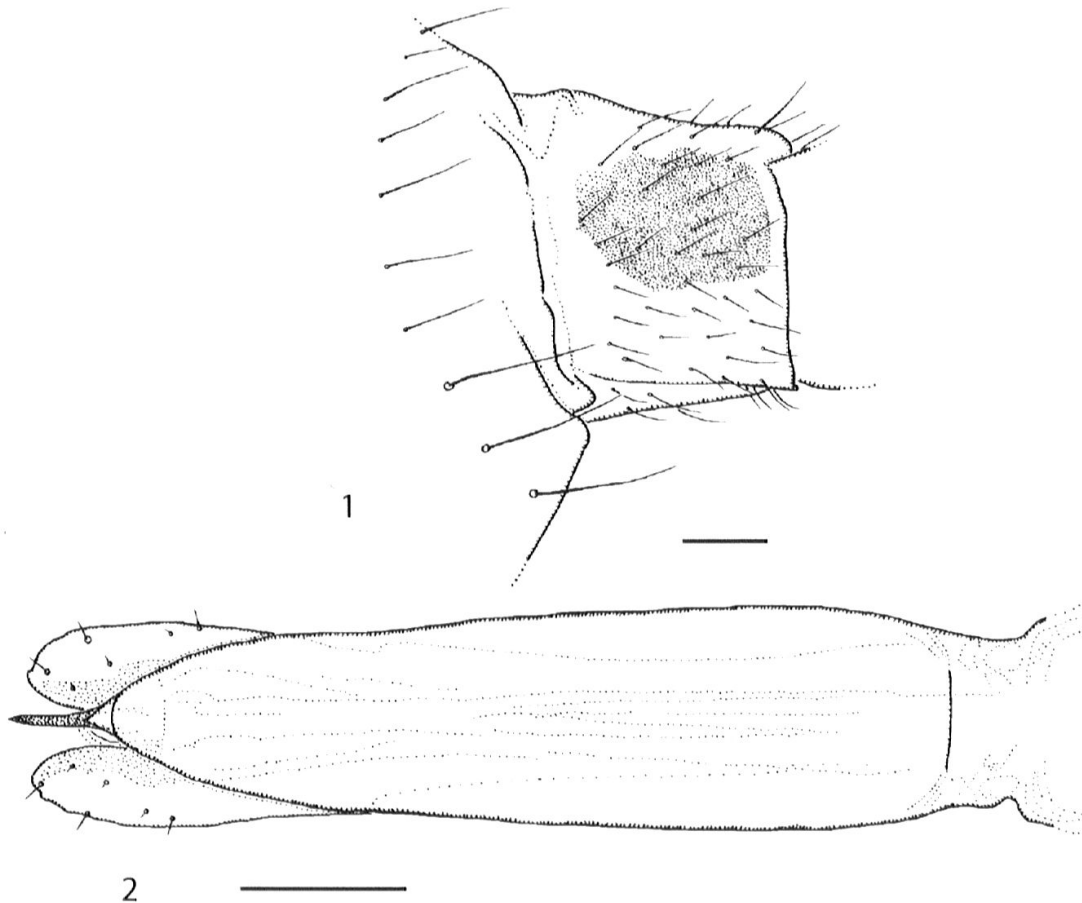
Diplonevra Lioy

Diplonevra peregrina (Wiedemann, 1830)

Material examined. 1 ♀, 22.vi.2008; 4 ♂♂ (1 with pollen), 3 ♀♀ (1 with pollen), 23.vi.2008.

Dohrniphora Dahl

The males of the Oriental species have been keyed (Disney 1990) and for subsequently described species the couplets to which they run down in this key have been indicated (e.g. Bänziger & Disney 2006). No key exists for the females of the Oriental Region, and for many species the females have yet to be described. A further new species is described below. In addition *D. fisheri* is reported from Thailand for the first time. It is a sibling species of *D. cornuta* and its female has not been described. Furthermore not only are the males of *D. cornuta* and *D. fisheri* very similar, but the females of *D. cornuta* and *D. sorora* are very similar, along with the female of the new species and other females reported below. In addition a number of the samples reported below had males of *D. cornuta* associated with females of one or more of these other species. In view of this situation females attributed to *D. cornuta* in our previous study have been critically re-examined and a few are transferred to other species below. A key to the females of this genus recorded in the flowers of *Aristolochia baenzigeri* in Thailand is given below.



Figs 1–2. *Dohrniphora cornuta* ♀. — 1, left face of rear of abdominal segment 6 and of segment 7; — 2, distiproboscis from above. Scale bars = 0.1 mm.

***Dohrniphora cornuta* (Bigot, 1857) (Figs 1–2)**

Once again this was the commonest species visiting the flowers of *A. baenzigeri*.

Material examined. 12 ♂♂, 2 ♀♂ (9 ♂♂ with pollen), 21.vi. 2008; 29 ♂♂, 19 ♀♀ (1 ♀ with pollen), 22.vi.2008; 19 ♂♂ (4 with pollen), 12 ♀♀, 23.vi. 2008.

4 ♀, 7.vi.2004, previously attributed to this species are now referred to *D. sorora*. 1 ♀, 1.viii.1995, likewise is no longer regarded as *D. cornuta*, and its identity is discussed below.

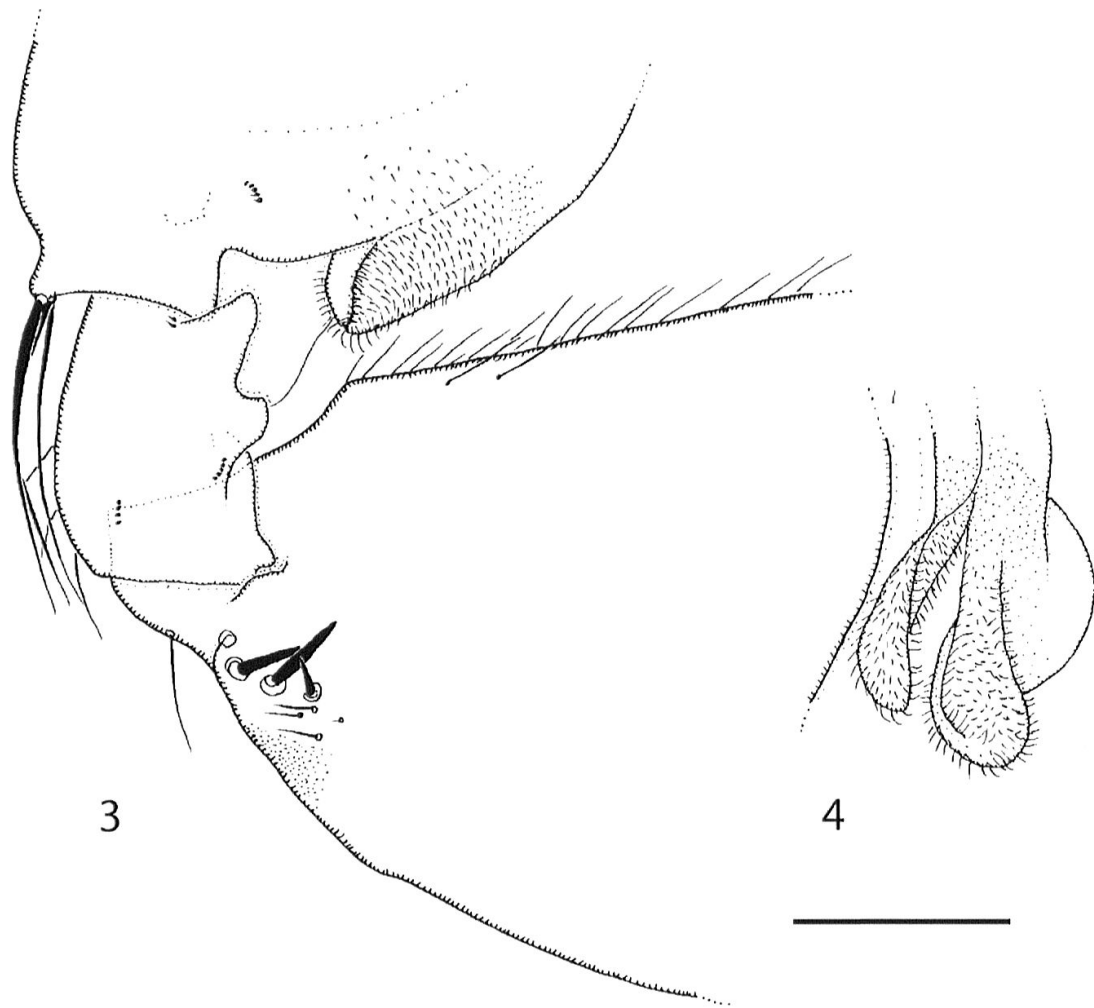
***Dohrniphora fisheri* Disney, 1990**

This is a sibling species of *D. cornuta* and *D. sorora*, and previously only known from Indonesia (Sulawesi) and the Philippines. Its female has not been described, but *Dohrniphora* sp. TH.A (see below) is possibly its female.

Material examined. 1 ♂ (with pollen), 23.vi. 2008.

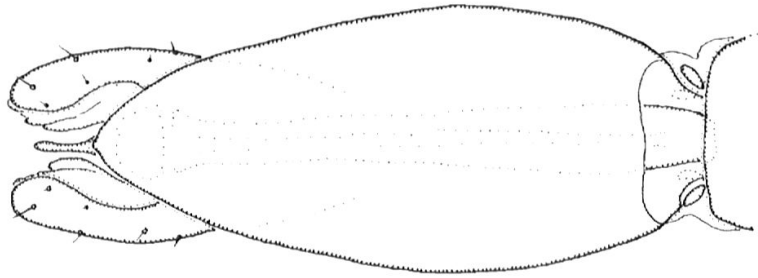
***Dohrniphora nuniemong* Disney, n. sp. (Fig. 3–5)**

In the keys of Disney (1990) this species runs to couplet 14 where it can go either way as some specimens have two pairs of hairs in addition to the pair of bristles on the scutellum, others have only one pair of hairs. Taking the first option

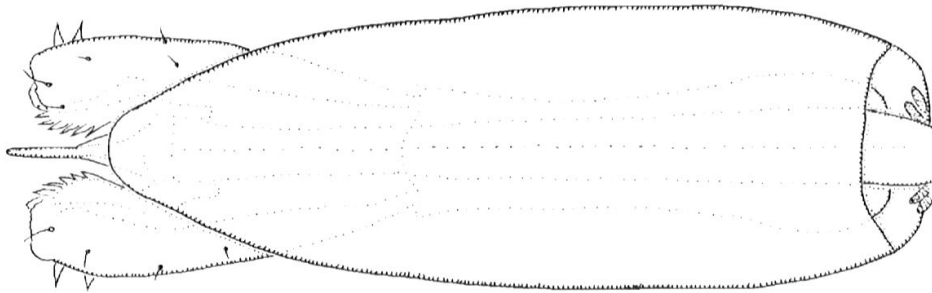


Figs 3–4. *Dohrniphora nuniemong* ♂. — 3, posterior face of tip of hind coxa, trochanter and base of hind femur; — 4, hind coxal lobes from left side. Scale bars = 0.1 mm.

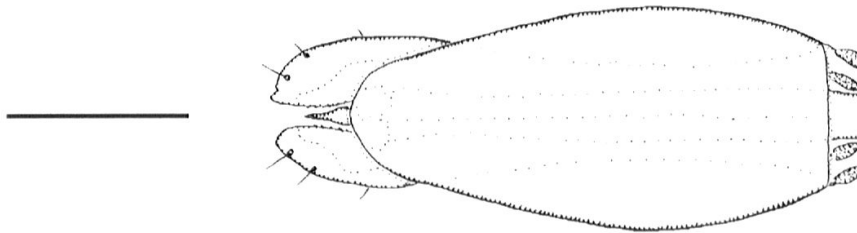
runs on to couplet 15, lead 1 to *D. nepalensis* Borgmeier, which differs in having longer more numerous spinules at the base of the hind femur. Taking the second option from couplet 14, it readily runs on to couplet 26, where the somewhat yellowish brown hind femora could take the first option to couplet 30, which ends with no option applying. Taking the second option it proceeds to couplet 42, where again it partly fits both options, but the entirely brown abdominal tergite 6 rules out the first. Proceeding to couplet 46 both options are excluded as both species have T6 yellow in its anterior half. Likewise two subsequently described species running to the same couplet, *D. malaysiae* Green and *D. sorora* Disney, are excluded on the same grounds. Otherwise it closely resembles *D. thailandensis*, except the hind coxal lobe is rounded apically, the vertical row of smaller spinules at the base of the hind femur are scarcely more robust than the hairs on the anterior face (as opposed to being clearly more robust) and the dorsal hair palisade of the mid tibia ends closer to the first transverse comb in the distal half than to the pair of bristles in the basal half (as opposed ending about midway between these two points in *D. thailandensis*).



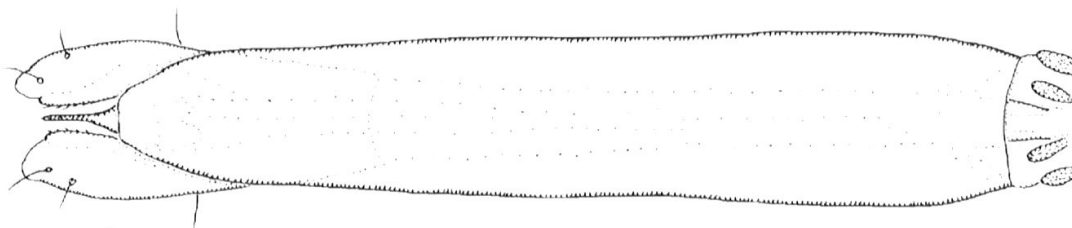
5



6



7



8

Figs 5–8. *Dohrniphora* ♀♀, distiproboscis from above. — 5, *D. nuniemong*; — 6, *D. sorora*; — 7, *D. sp.* TH.B; — 8, *D. sp.* TH.A. Scale bars = 0.1 mm.

♂. Frons brown, with 30–50 hairs and microtrichia vestigial but densely crowded. Postpedicels brown, but not dark, about 1.2x as long as greatest breadth and about 1.5x as wide as palp and labrum, both of which are subequal in width. Palps straw yellow with five short bristles and about a dozen hairs. Labrum and labella coloured as palps. Thorax brown. Scutellum typically with an anterior pair of small hairs, a pair of bristles and a posterior pair of small hairs; but one specimen lacks

the anterior pair of hairs. Abdomen with brown tergites with minute hairs, except at the rear of T5 and T6 where they are a little longer. Venter grey, but not dark, and with small hairs below segments 3–5 plus a longer pair of bristle-like hairs at rear of 5. Hypopygium brown with a straw yellow anal tube. Apart from brown mid coxae, the legs are straw yellow except for hind femur, which is tinged brown along its dorsal edge and in its apical quarter at least. Apart from the usual basal pair on the mid tibia, there are no pre-apical bristles on the tibiae. The front tibia has 3–5 small spines along its dorsal face. The dorsal hair palisade of the mid tibia extends just over half its length. Base of hind femur and hind coxal lobes as Figs 3 and 4. Wing length 1.5–1.8 mm. Costal index 0.49–0.52. Costal ratios 8.4–11.5 : 2.0–2.7 : 1. Costal cilia 0.04 mm long. Thick veins yellowish grey, veins 4–6 grey and 7 only visible with critical lighting. A small hair at base of vein 3. The axillary bristle pale. Haltere knob yellowish brown in basal third, essentially yellow in the distal third but the rim at apex is whitish.

♀. Head similar to male except postpedicel is at most 0.9x as long as greatest breadth, the palps have longer bristles (the longest being subequal to the supra-antennal bristles) and twice as many hairs, and the orange yellow distiproboscis is as Fig. 5. Thorax as male. Abdominal tergites 1–4 pale brown. T3 reduced in size and T4 even more so. No tergites on segments 5 and 6. Venter dark brownish grey, with hairs below segments 3–6 and a pair of longer bristles at the rear of each. Cerci and epiproct pale yellow. Legs as male apart from the lack of hind coxal lobes and the spinules at base of hind femur. Wing length 1.7–1.8 mm. Costal index 0.52–0.53. Costal ratios 8.7 : 2.2–2.3 : 1. Costal cilia 0.04 mm long. Otherwise wing and haltere as male.

Material examined. Holotype ♂, North Thailand, Mae Hongson Province, Pai District, Pang Mapha, Site 1 (km 131.2), 910 m a.s.l., in flower of *A. baenzigeri*, 22.vi.2008, H. Bänziger (CUMZ, 40–12). Paratypes 4 ♂♂, 1 ♀, as holotype except 3 ♂♂ (1 with pollen), 23.vi. 2008.

Etymology. The epithet is a composite word, placed in apposition, in honour of Nunie and her son Mong, Chiang Mai's well-known nature conservationists.

Dohrniphora sorora Disney, 1990 (Fig. 6)

Material examined. 1 ♂, 11 ♀♀ (1 ♂, 5 ♀♀, with pollen), 21.vi. 2008; 1 ♂, 3 ♀♀, 22.vi. 2008.

Dohrniphora thailandensis Disney, 2006

Material examined. 1 ♂, 21.vi. 2008; 1 ♂, 22.vi. 2008.

Dohrniphora sp. TH.A (Fig. 8)

This specimen was not collected from a flower of *Aristolochia baenzigeri*. However, it is possibly the unknown female of *D. fisheri*, which was recorded from such a flower (see above).

♀. Distiproboscis as Fig. 8. Colouring and chaetotaxy as *D. fisheri*. Abdominal tergites 1–4 mainly brown, with small hairs at rear margins of 2–4. Venter greyish brown, with hairs below segments 3–6 and some longer bristly hairs at rear of segments 5 and 6. Cerci and epiproct pale yellow.

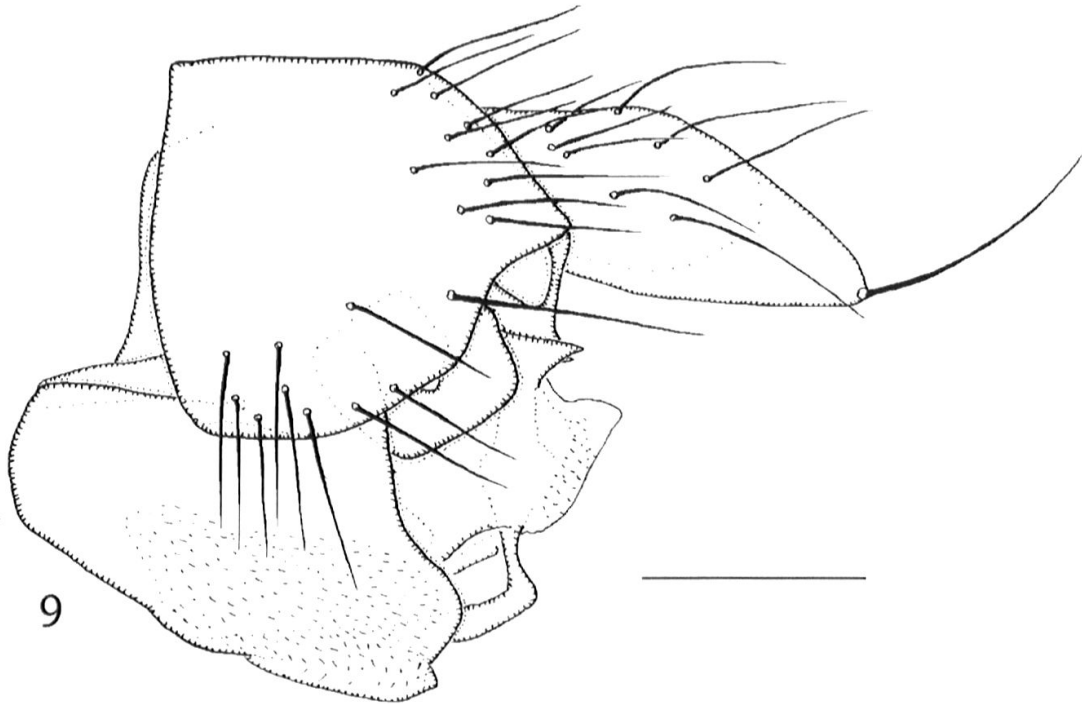


Fig. 9. *Megaselina deningi* ♂, left face of hypopygium. Scale bar = 0.1 mm.

Material examined. 1 ♀, Ranong Province, Hills above Hot Springs, 140 m, on rat faecal pellets, 17.vi.2007, H. Bänziger (CUMZ, 40–15).

***Dohrniphora* sp. TH.B** (Fig. 7)

This species cannot be named until associated with its male.

♀. Frons brown, postpedicels light brown. Palps pale yellow. Distiproboscis as Fig. 7. Thorax yellowish brown. Scutellum with an anterior pair of small hairs and posterior pair of bristles. Abdominal tergites mainly brown, apart from a large triangle of yellow pointing rearwards from front margin of T2. Venter with hairs below segments 3–6 and some longer bristly hairs at rear of segments 5 and 6. Cerci and epiproct pale yellow. Legs yellow, with the only pre-apical bristles being those in the basal third of the mid tibia and the small near-dorsal spines on the front tibia. Wings with yellowish grey thick veins, grey veins 4–6 and 7 obscure. Membrane tinged grey. Haltere knob brownish yellow.

Material examined. 1 ♀ (with pollen), 21.vi. 2008; 1 ♀, 22.vi. 2008.

Key to the females of *Dohrniphora* recorded from the flowers of *Aristolochia baenzigeri* in Thailand.

Note. The species TH.A has not been recorded from *A. baenzigeri*, but it is possibly the unknown female of *D. fisheri*, whose male is recorded from *A. baenzigeri* above.

1. Scutellum with an anterior pair of hairs, a pair of bristles and a posterior pair of hairs. (Distiproboscis as Fig. 5. Thoracic scutum and abdominal tergites 2–4 (T2–T4) brown. The dorsal hair palisade of the mid tibia (t2) ends clearly nearer the uppermost transverse hair comb than the pair of bristles near base *nuniemong* n. sp.
- Scutellum with an anterior pair of hairs and a posterior pair of bristles only 2
2. The dorsal hair palisade of mid tibia ends about midway between the uppermost transverse hair comb and the pair of bristles near base 3
- The dorsal hair palisade of the mid tibia clearly ends nearer the uppermost transverse hair comb than the pair of bristles near base 4
3. Distiproboscis as Fig. 2. (Abdominal segment 7 as Fig. 1) ... *cornuta* (Bigot)
- Not so the unknown female of *thailandensis*
4. Distiproboscis long and slender (Fig. 8). Scutum and abdominal tergite 2 (T2) brown sp. TH.A
- Distiproboscis broader and relatively shorter (Figs 6 and 7). Scutum more orange brown to dusky straw yellow. T2 mainly brown but with a median yellow triangular wedge of yellow extending rearwards from the front margin 5
5. Distiproboscis longer (Fig. 6) *sorora* Disney
- Distiproboscis shorter (Fig. 7) sp. TH.B

Megaselia Rondani

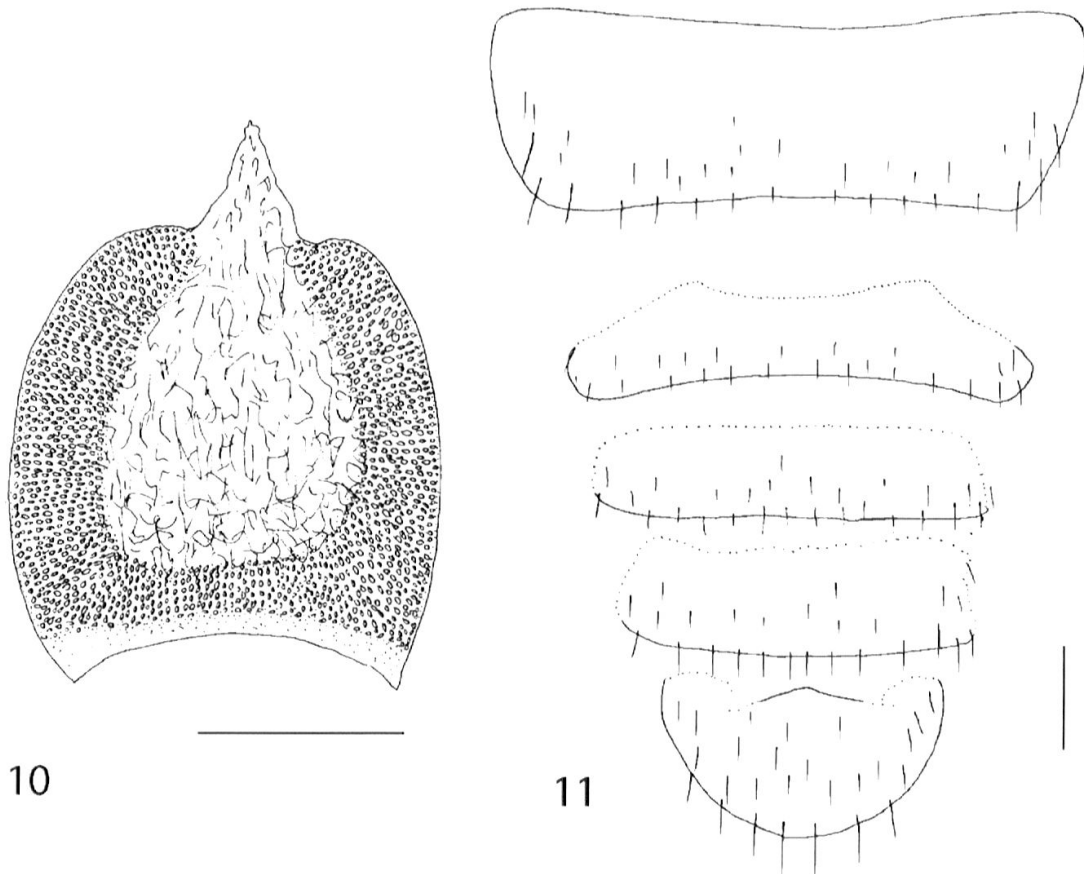
Megaselia deningi Disney, 1982 (Fig. 9)

This species occurs from Japan to Sri Lanka, where its larvae are aquatic in the waters of container habitats such as pitcher plants and bamboo stumps. It is unusually variable. Thus the mesopleuron is normally bare but may have up to half a dozen hairs on one side at least (Disney 1991). The specimen reported below has a single hair present on one side of the mesopleuron. In addition this specimen, as does the one reported previously (Bänziger & Disney 2006), has twice as many SPS vesicles in the postpedicels as is typical for this species. However, the hypopygium of the specimen reported below (Fig. 9) is indistinguishable from that of *M. deningi* (see Fig. 4 in Disney 1991). It is possible that these two specimens from North Thailand represent a distinct subspecies. The procurement of females might support this hypothesis. Otherwise molecular signatures for specimens from different parts of the range of this species might prove to be of interest.

Material examined. 1 ♂, 22.vi. 2008.

Megaselia malaisei Beyrer, 1958

A single female of this species was reported from *A. baenzigeri* in 2005 (Bänziger & Disney 2006). The original description was not illustrated and the males are unknown. However, the abdomen of the female is highly distinctive and has recently been figured (Disney 2009). Previous specimens examined by RHLD have had a few hairs (ranging from 3 to 11) on the mesopleuron. The specimen recorded below has only a single hair on the left mesopleuron and none on the right. If treated as having a bare mesopleuron it will run down to couplet 32 on page 88 of Borgmeier's



Figs 10–11. *Megaselia* sp. TH10 ♀, details of abdomen. — 10, Dufour's crop mechanism; — 11, tergites 2–6. Scale bars = 0.1 mm.

(1967b) keys, instead of couplet 13 on page 206 of his keys to species with a hairy mesopleuron (Borgmeier 1967a).

Material examined. 1 ♀, 21.vi. 2008.

Megaselia scalaris (Loew, 1866)

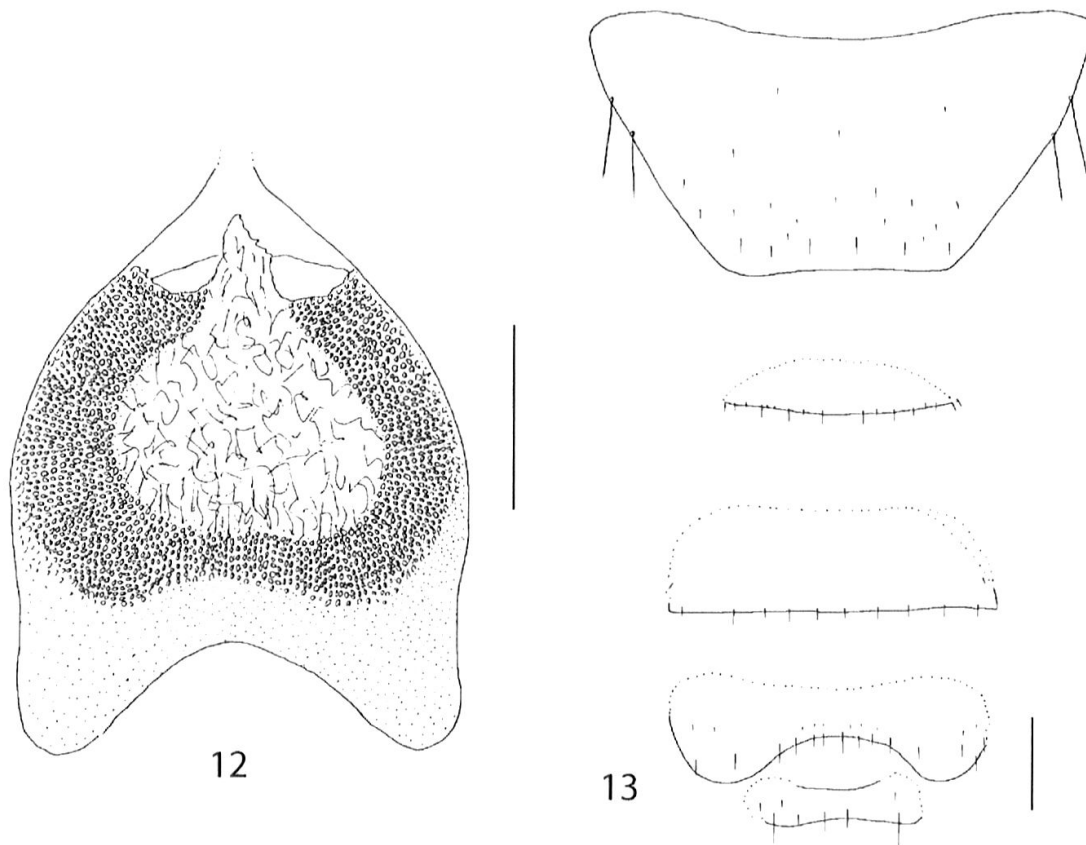
This species has been reported from a wider range of decaying organic materials than any other fly and has been transported across the world by man (Disney 2008). This species has been reported visiting the flowers of *Aristolochia elegans* in Brazil (Borgmeier 1925) and Cuba (Brues 1928) and *A. littoralis* in Florida, and in this case *M. scalaris* was the dominant species with 96 % of these being males (Hall & Brown 1993).

Material examined. 3 ♂♂, 1 ♀, 22.vi. 2008.

Megaselia sp. TH9

This is a badly damaged male with the palps and most of the legs missing. In the keys of Borgmeier (1967b) it tentatively runs to couplet 73, lead 1 on page 90, to *M. reversa* Brues, but is clearly darker than the latter. Its enlarged, spinose labella should distinguish it from many species.

Material examined. 1 ♂, 23.vi. 2008.



Figs 12–13. *Megaselia* sp. TH11 ♀, details of abdomen. — 12, Dufour's crop mechanism; — 13, tergites 2–6. Scale bars = 0.1 mm.

***Megaselia* sp. TH10** (Figs 10–11)

These females will run to couplet 110 on page 92 of Borgmeier's (1967b) keys, but is too small for either species of this couplet. The abdominal tergites (Fig. 11) and Dufour's crop mechanism (Fig. 10) are distinctive. It cannot be named until linked to its male.

Material examined. 4 ♀♀, 22.vi. 2008.

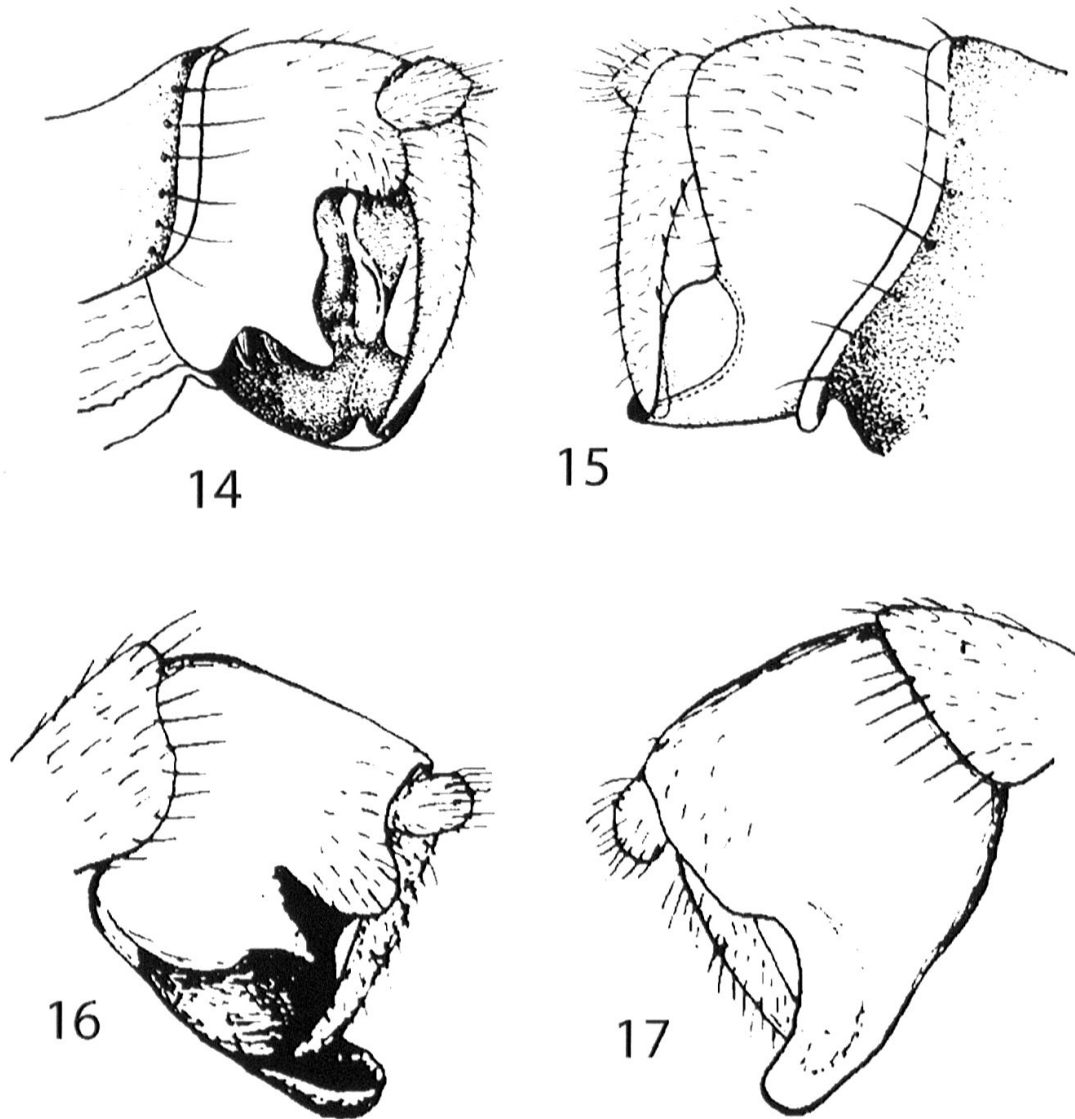
***Megaselia* sp. TH11** (Figs 12–13)

This female will run to couplet 31, lead 1, to *M. curtibarba* Beyer on page 88 of Borgmeier's (1967b) keys, but its yellow abdominal tergites will immediately distinguish it. The abdominal tergites (Fig. 13) and Dufour's crop mechanism (Fig. 12) are distinctive. It cannot be named until linked to its male.

Material examined. 1 ♀, 22.vi. 2008.

***Megaselia* sp. TH12**

These females will run to couplets 73 and 74 on page 90 of Borgmeier's (1967b) keys, but they have paler abdominal tergites of which T3 to T6 are all narrower than the three species of these couplets. The subsequently described *M. belumensis* Disney has paler abdominal tergites but T3 to T6 are wider. Those of species TH12 resemble T3 to T6 of *M. leucopleuralis* Disney, however its female not



Figs 14–17. *Spiniphora* ♂♂, hypopygia of pinned specimens. — 14–15, *S. conspicua* (after Colyer, 1955); — 16–17, *S. genitalis* (after Schmitz, 1940) — 14, 16, left faces; — 15, 17, right faces.

only has darker tergites but its anterior scutellars are much stronger. In addition its spinules in the apical comb of the hind tarsus are all simple, but several are bifid in species TH12, and the latter's wings are paler.

Material examined. 2 ♀♀, 23.vi. 2008.

Pulciphora Dahl

In this genus species recognition is based upon the flightless females in the first instance. Most males cannot be named until associated with their females. One male specimen was reported previously (Bänziger & Disney 2006), which we designate below as species 1.

***Puliciphora* sp. 1**

This species has a large hypopygium and the front legs are pale yellow without dark markings.

Material examined. 2 ♂♂, 22.vi. 2008.

***Puliciphora* sp. 2**

This species has a small hypopygium and the front femur and tibia each have a brown spot.

Material examined. 2 ♂♂, 22.vi. 2008.

***Spiniphora* Malloch**

About two dozen species have been described in this genus, of which seven are recorded from the Oriental Region. However, the difference between the male hypopygia of two of these, *S. conspicua* (Colyer, 1955) and *S. genitalis* (Schmitz, 1940) was not clear from the published figures. This is considered further below.

***Spiniphora genitalis* Schmitz, 1940** (Fig. 14)

Spiniphora conspicua Colyer, 1955. **Syn. nov.**

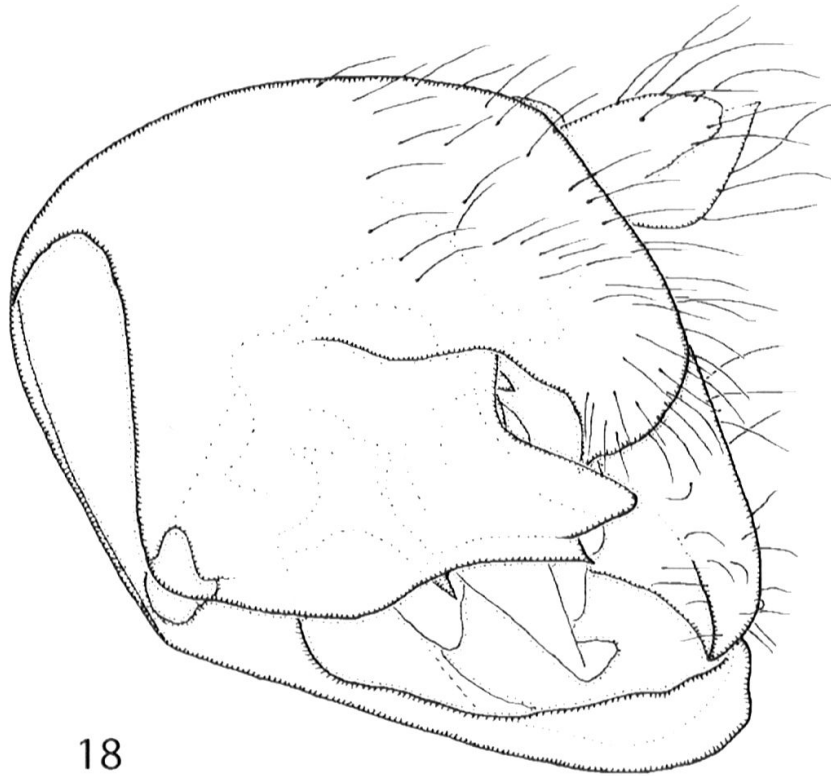
Through the co-operation of Nigel Wyatt (Natural History Museum, London) RHLD has remounted the holotype male of *S. genitalis* and a paratype male of *S. conspicua* on slides. The supposed difference between these two species was based on the latter having the abdominal tergites more extensively yellow and the different appearance of the male hypopygia. Colyer's figures of the hypopygium of *S. conspicua* are reproduced in Figs 14 and 15. Schmitz's figures of the same for *S. genitalis* are reproduced in Figs 16 and 17. Both were based on pinned specimens. From a series in the CUMZ it is evident that the degree of yellow on the abdominal tergites for both sexes varies and is more extensive in freshly emerged specimens. The supposed difference between the hypopygia depends on the tilt with respect to the observer. Figs 18 and 19 depict the hypopygium of a slide mounted specimen from Fiji. It is evident that all these specimens comprise a single species. It is therefore proposed that *S. conspicua* is a synonym of *S. genitalis*.

This species has been reared from dead molluscs.

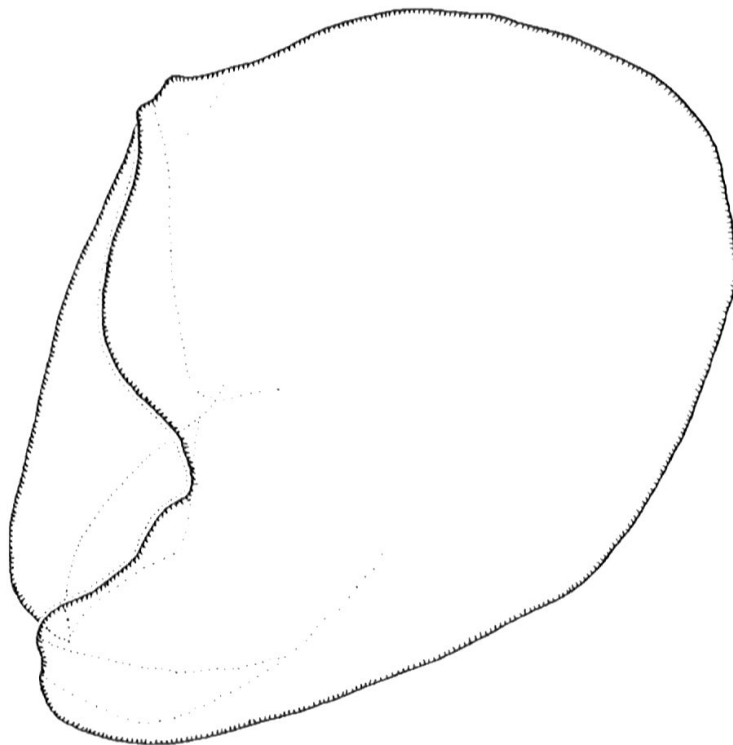
Material examined. 2 ♂♂, 23.vi. 2008.

The males of the Oriental species of *Spiniphora* are keyed below:

- 1. Thoracic scutum dark brown on top 2
- Thoracic scutum yellowish brown or paler on top 4
- 2. Mid and hind femora mainly straw yellow 3
- Mid and hind femora brown, but not dark *apicalis* Brues
- 3. Wing less than 2.8 mm long *bergenstammi* (Mik)
- Wing more than 2.8 mm long *nipponensis* Beyer
- 4. Hind tibia with only 3 bristles apart from apical spurs 5
- Hind tibia with 4 or 5 bristles apart from apical spurs. (Hypopygium as Figs 18–19) *genitalis* Schmitz

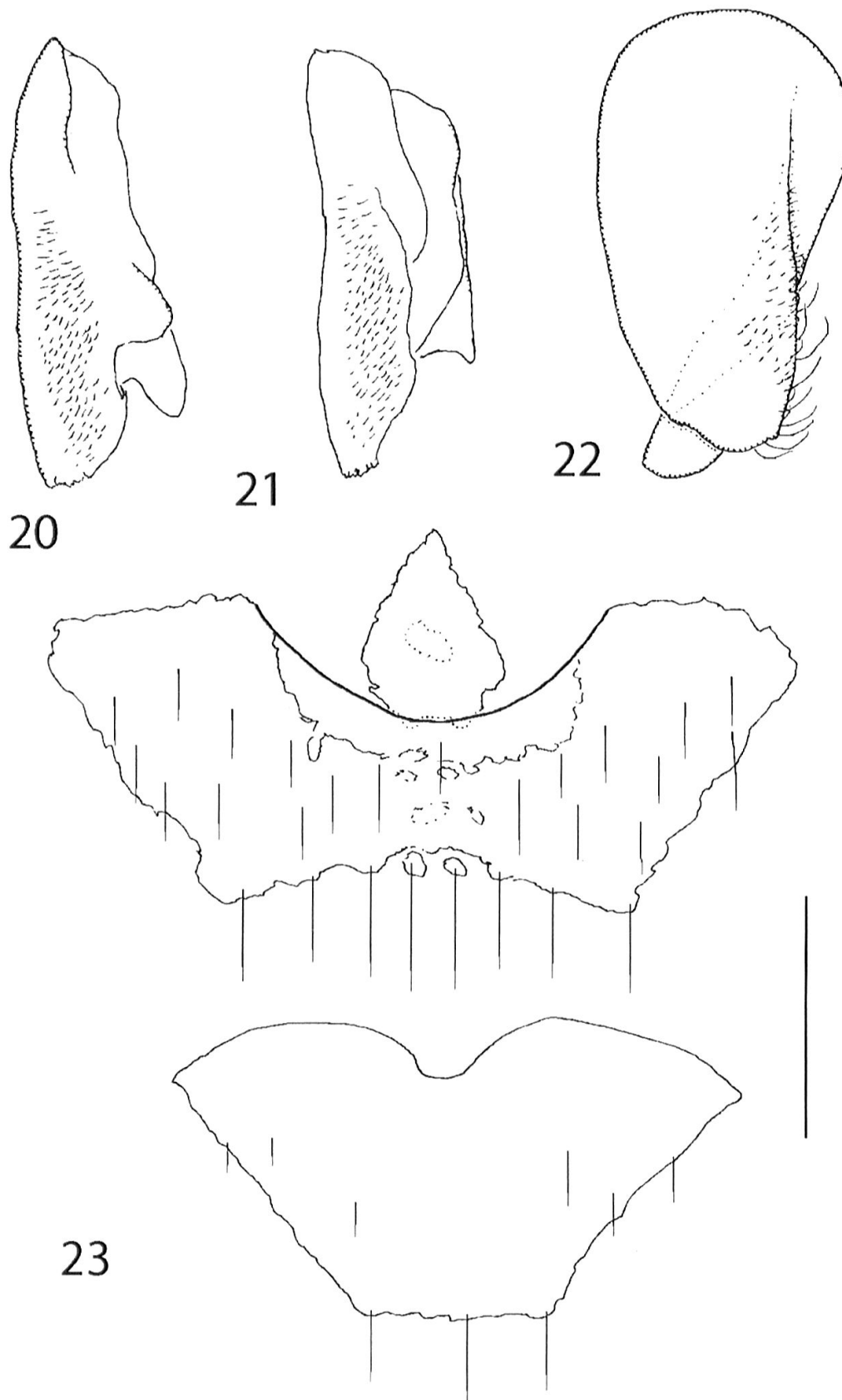


18



19

Figs 18–19. *Spiniphora genitalis* ♂ hypopygium of a slide-mounted specimen. — 18, left face; — 19, right face of epandrium and hypandrium (with hairs omitted). Scale bar = 0.1 mm.



Figs 20–23. *Woodiphora* sp. F, ♀. — 20–22, three different views of furca; — 23, abdominal tergites 6 and 7. Scale bar = 0.1 mm.

5. Hind tibia with 2 apical spurs. Wing more than 2.2 mm long
 *okinawa* Borgmeier
 – Hind tibia with only 1 apical spur. Wing less than 2.2 mm long
 *unicolor* Liu

***Woodiphora* Schmitz**

Prior to the most recent review of the Oriental species (Disney 1989) only 10 species of this genus were known from the region, a further 20 species were then described. Subsequently a further 10 species have been added. We previously reported a number of females of this genus, which were given code letters until they can be linked to their males (Bänziger & Disney 2006). Three more species, represented by females only, are briefly characterized below. This genus is apparently far richer in species than had been supposed in the past and females are evidently regularly trapped by the flowers of *Aristolochia baenzigeri*. However, until linked to their males they cannot be named in our present state of knowledge.

***Woodiphora* sp. B Bänziger & Disney, 2006**

Material examined. 2 ♀♀, 21.vi. 2008; 14 ♀♀, 22.vi. 2008; 16 ♀♀, 23.vi. 2008.

***Woodiphora harveyi* Disney, 1989**

This species was described from Palawan in the Philippines. Its female has a distinctive Dufour's crop mechanism (see Fig. 30 in Disney 1989) and its wing membrane and veins 4–6 are very pale, which contrasts with the females of species B, F, G and H, which were present in the same sample. All four of these have relatively strong veins 4–6 and greyish tinged wing membranes.

Material examined. 1 ♂, 22.vi. 2008.

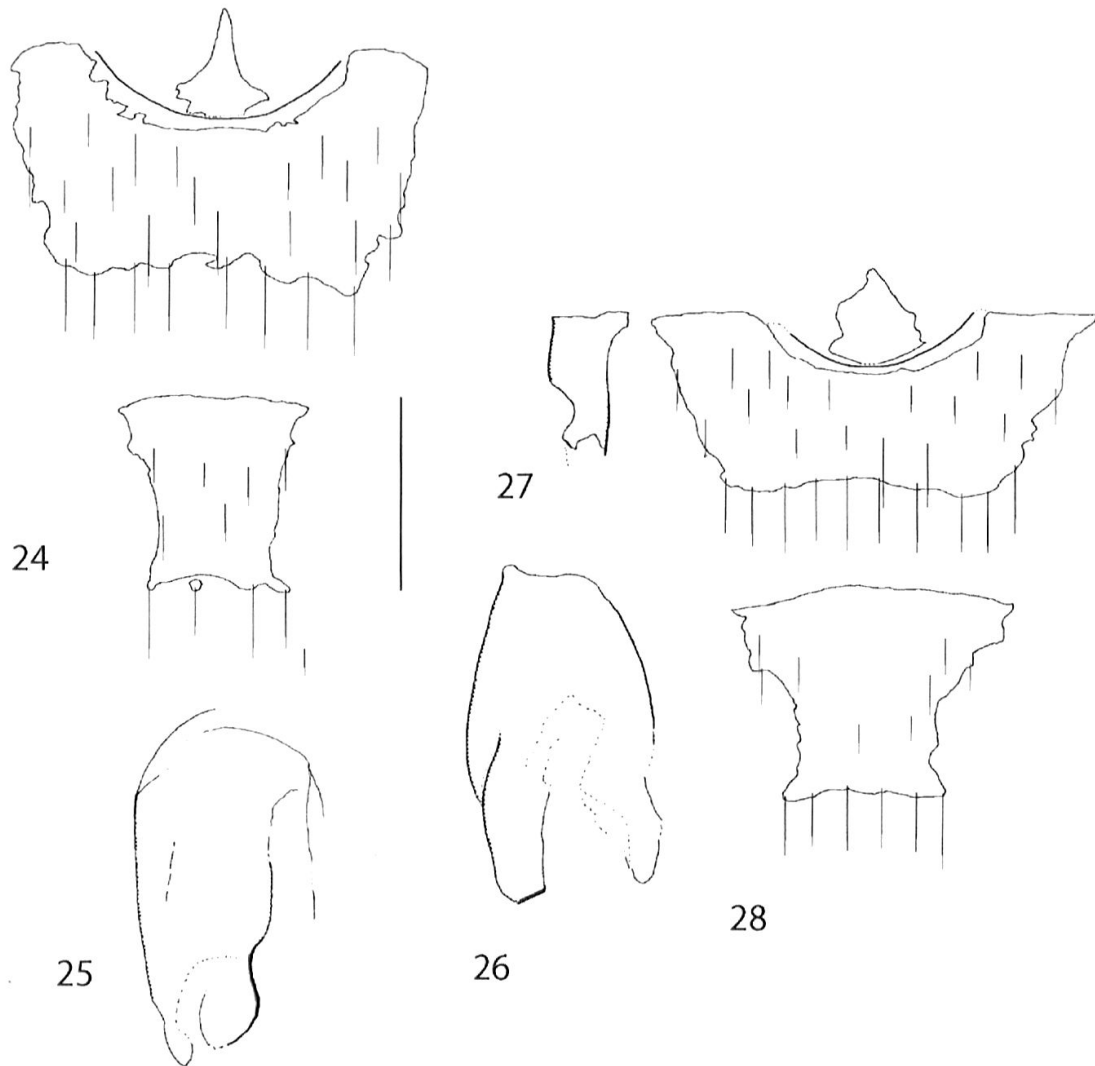
***Woodiphora* sp. F (Figs 20–23)**

In the keys of Disney (1989) the female runs to couplet 43, lead 1 to *W. arunkumari* Disney. Its furca is very similar, as are many other details. However, it is distinctly larger, the wing length in *W. arunkumari* being less than 1.6 mm, but in species F it is at least 1.6 mm, and the lobes at the rear of abdominal sternum 8 are clearly coloured brown in Species F but very pale in *W. arunkumari*. In the key to females previously recorded from flowers of *A. baenzigeri* (Bänziger & Disney 2006) it runs to species E. But the latter has the hairs on the clearly larger furca restricted to the posterior third, instead of the posterior two thirds (Figs 20–22) and the abdominal tergites 5 and 6 of species F differ (Fig. 23).

Material examined. 13 ♀♀, 22.vi. 2008; 2 ♀♀, 23.vi. 2008.

***Woodiphora* sp. G (Figs 24–26)**

In the keys of Disney (1989) the female runs to couplet 45, lead 2, to *W. pallidivervis* Borgmeier. However the latter has much paler veins 4–6, the postpedicel only about 0.8x as wide as the labrum and the furca, depending on the orientation, 1.7 to 2.6x as long as wide. In the key to females previously recorded from flowers of *A. baenzigeri* (Bänziger & Disney 2006) it runs to couplet 3, species C or to cou-



Figs 24–28. *Woodiphora* ♀♀, details of abdomen. — 24, *W. sp. G*, tergites 6 and 7; — 25–26, *W. sp. G*, furca from two different viewpoints; — 27, *W. sp. H*, furca; — 28, *W. sp. H*, tergites 6 and 7. Scale bar = 0.1 mm.

plet 4, depending on the relative heights on the frons of the anterolateral bristles and upper supra-antennals. The ALs are evidently a little variable in position. This suggests the single damaged specimen of species D is possibly just a variant of species C. At couplet 4 the colour of the femora is consistent with species D, but the small sclerite embraced by the anterior embayment of tergite 6 fits species B. However the furca is larger, being almost 0.2 mm long (Figs 25–26) compared with it being less than 0.15 mm in D (and C). Abdominal tergites 5–6 differ strongly from *W. pallidinervis*.

Material examined. 2 ♀♀, 22.vi. 2008.

Woodiphora sp. H (Figs 27–28)

In the keys of Disney (1989) the female runs to couplet 41, lead 1, to *W. santoshi* Disney. However, it differs in the form of the furca (Fig. 27) and abdominal tergites 6 and 7 (Fig. 28), and has darker legs than *W. santoshi*.

Material examined. 1 ♀, 22.vi. 2008.

NATURAL HISTORY (BY H. BÄNZIGER)

Details on the pollination system of *A. baenzigeri*, a liana the flowers of which are sapromyophilous (pollinated by flies lured by visual and olfactory cues imitating decomposing organisms), were given in Bänziger & Disney (2006). Nine of the species listed above were the same as previously reported, twelve were not caught in our new research, while 14 were newly found detained by the flower, bringing the total to 35 species. New are *Dohniphora fisheri*, *Dohniphora* sp. TH.B, *Megaselia scalaris*, *Megaselia* sp. TH9, *Megaselia* sp. TH10, *Megaselia* sp. TH11, *Megaselia* sp. TH12, *Puliciphora* sp. 2, *Spiniphora genitalis*, *Woodiphora harveyi*, *Woodiphora* sp. F, *Woodiphora* sp. G., *Woodiphora* sp. H, besides the newly described *Do. nuniemong*. Since there were so many new records (over 60 %), it is clear that the phorid fauna involved in *A. baenzigeri* is still far from fully known. This biodiversity is even more evident considering that the present study was carried out on the very same liana and an additional one only 50 m distant, during the same month, as the previous research (plants in other areas were not flowering this time; on 3.ix.2008 no flowers remained on both lianas but many fruits had developed).

D. cornuta was again the most common prisoner and carried most of the pollen (14 vectors). However, this time male carriers were far more common than female ones (similarly frequent in the previous study). New pollen vectors were *D. fisheri*, *D. nuniemong*, and *Dohniphora* sp. TH.B, bringing the total to 15 species (both studies). Of the remaining 20 prisoner species, mostly only single or very few specimens were trapped, so lack of pollen in these seems to be accidental.

Noticeable is the overall significantly smaller number of phorids carrying pollen vis-à-vis the previous research, namely 12 % compared to about 90 %, respectively. It is well-known that pollen acquisition can vary strongly but in this study pollen depletion of the anthers could have played an additional role. Close to twice as many scuttle flies were collected in this study during 3 consecutive days at one site, compared to the longer and more spread-out previous survey lasting 8 days during 4 months in 3 years at 3 sites.

Entrapped *Woodiphora* were unusual in the sex ratio. Among the 9 species sequestered all but one of the 77 specimens were females, the only male being *W. harveyi*. There is no apparent morphological reason for failed male entrapments and a difference in feeding habits is a possible cause since the liana does not dissimulate a brood site (see below). Restriction of food source visitation to one sex is known to occur in such guilds as mud puddling, sweat sucking, tear drinking and blood sucking Lepidoptera, Diptera and Hymenoptera (e.g. Bänziger *et al.* 2009, and references therein). Disney (1985, 1986, 1989) reported two *Woodiphora* species in «ghoul» guilds feeding upon injured termites in Sulawesi. Males were lacking among the first and scarce among the second, with no confirmed feeding seen. Disney (pers. comm.) suggested they may have been attracted to the females for mating and the virtually exclusive female presence of *Woodiphora* in *A. baenzigeri* could have had a similar cause. At any rate, in all the many cases mentioned in Bänziger *et al.* (2009), none is due to rendez-vous mating habits, but to various feeding strategies.

Evidence indicates that for scuttle flies the flower is food deceptive and does not fake a brood site. No oviposition was observed and all larvae found crawling on fallen flowers were Cecidomyiidae. Nevertheless, the flower could have lured

gravid females to fall into the trap with intent to lay, but once imprisoned a key oviposition cue might have been missing, forestalling laying. A case in point is *Sapriaram* Bänziger & Hansen (Rafflesiaceae) the flowers of which fake a corpse. Main pollinators are at least 10 species of necrobiodotic *Sarcophaga* (Diptera, Sarcophagidae) which, despite being strongly gravid, do not (or only very exceptionally) larviposit on the flower but readily do so on a real cadaver as soon as this is experimentally placed near by (Bänziger 2004, and unpubl.). But in the case of all the 76 female *Woodiphora* imprisoned, none was gravid, so they were not seeking an oviposition site in *A. baenzigeri*. Conversely, on the other hand, gravidity alone does not necessarily prove that an oviposition site was sought; the female might just have been hungry. This must have been the case in the only fully gravid female found among overall 65 females (one in 3 *D. sorora*) in the previous study. The present survey yielded 8 gravid females among 117 females overall, viz. 3 in 14 *D. sorora*, 2 in 2 *Megaselia* sp. TH12, and one each in 3 *Borophaga* sp., 33 *D. cornuta* and 2 *Dohniphora* sp. TH.B.

Two *Sarcophaga* specimens were lured to the flower entrance but, as in the first study, they were far too large to enter its narrow tube; in the end they flew off, precluding species identification. Unlike previously, no Agromyzidae and Sphaeroceridae adults were found entrapped, confirming that these flies are at best only rarely pollinators.

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