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SCUTTLE FLIES (DIPTERA: PHORIDAE) FROM CAVES IN MEGHALAYA, INDIA

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Abstract: Four scuttle fly species (family Phoridae) were collected from caves in Meghalaya, India, of which one was from deep inside the caves, while the others were restricted to the vicinity of the cave entrances. Illustrated notes are provided to aid future recognition of these species.

Introduction

Since the early 1990s the Meghalayan Adventurers Association (based in Shillong), in partnership with European speleologists, has conducted a series of expeditions with the objective of mapping and documenting caves in Meghalaya, India. To date, over 280 km of cave passages have been surveyed, but much more remains to be discovered. The quantity and length of caves in Meghalaya exceed that of any other known karst region of India. Due to a major expansion of the limestone-extraction industry in recent years in the Jaintia Hills, there is a strong case for documenting the biospeleology of the region before significant loss or damage occurs. During the course of these investigations, a number of scuttle flies (Diptera: Phoridae) were collected. Dr. Dan Harries (School of Life Sciences, Heriot-Watt University, Edinburgh) passed these samples on to me for identification.

Methods

The specimens were preserved in alcohol and subsequently mounted on slides in Berlese Fluid (Disney, 2001). Voucher specimens have been deposited in the Cambridge University Museum of Zoology.

The Species

Conicera kempi Brunetti 1924

This species was described from the female only, but its male has since been described (Disney, 1982), its critical features as shown in Figures 1 and 2. A key to the Oriental species of *Conicera* Meigen (Disney, 1990b) only allows identification of males and likewise using the key to the species recorded from China (Liu, 2001).

Females can normally only be named when associated with their males. Three species whose females have been described (Disney, 1990b; Bänziger and Disney, 2006) differ from *C. kempi* in one or more of the following features. The labrum is devoid of longitudinal ridges in the median band or more. The postpedicel is clearly shorter, and/or the abdominal tergite 6 (T6) is of a different shape. Other species, whose females are unknown, can be excluded because there is a hair at the base of vein 3 in their males. The females reported below have been compared with a female from Nepal that had previously been compared with the type material of *C. kempi* (Disney, 1982). In this species, while the female postpedicel is not as long as in the male (Fig. 3), it is unusually long for a female (Fig. 4). The labrum is as shown in Figure 5 and T5 and T6 are as shown in Figure 6.

Material

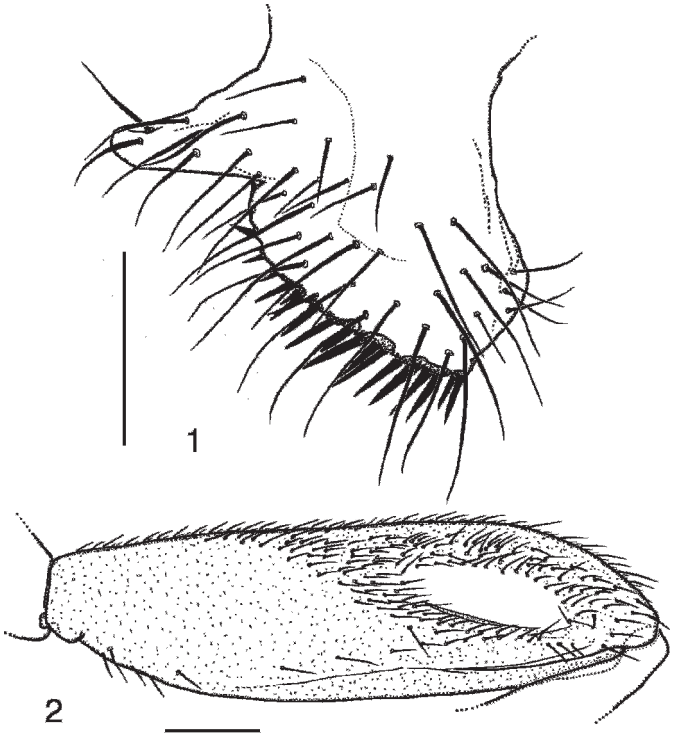
Twenty females, 6 larvae, Krem Shynrong Labbit (25°21′1.2″N, 92°30′105″E) collected >500 m into the cave and 200 m below surface on February 17, 2001 (KSL4 and KSL4.2 (larvae), CUMZ, 38–55). Five females, Krem Kotsati Lawan (25°10′46″N, 92°22′29″E) collected about 85 m from the cave entrance on February 18, 2002 (KUL2, CUMZ, 38–56). Two females, Liat Prah (25°22′31.5″N, 92°32′18.6″E) collected about 50 m into the cave, February 26, 2002 (LP5.4, CUMZ, 38–55). Five females were collected at the same locality, but about 10 m from the cave entrance, on February 26, 2002 (LP5.2, CUMZ, 38–56). Twenty females were collected at the same locality, but about 1000 m from the cave entrance, on February 26, 2002 (LP3.1, CUMZ, 38–56).

Natural History

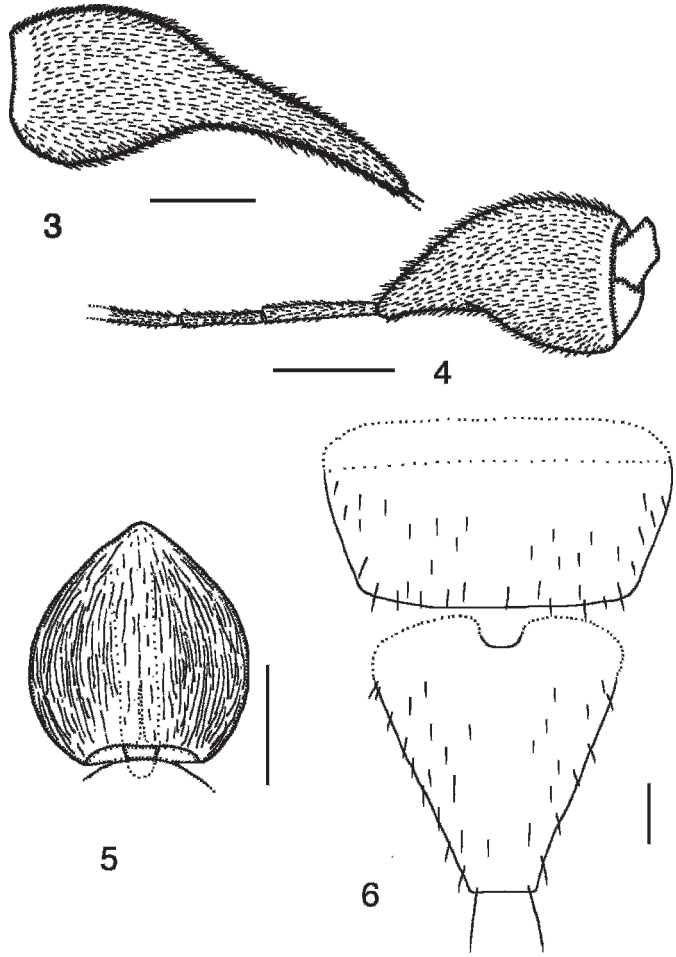
Brunetti (1924) recorded six females collected 120–150 m from the entrance of Siju Cave. The new material confirms that this species is a cave dweller. Furthermore, it was sometimes common near bat roosts. Mature eggs are about 0.84-mm-long and 0.27-mm-wide with a surface microsculpture of numerous short ridges. Gravid females with about 50 eggs. Most specimens had an infestation of worms in the abdomen. These are blunt at each end, colorless, featureless (at 240× magnification) and are more than 2-mm-long but only about 0.001-mm-wide. They look like miniature hairworms, rather than Nematoda.

Diplonevra Species IC

Species recognition is primarily based on the male sex in the genus *Diplonevra* Lioy. However, a key covering the Oriental species (Disney, 1990a) included some poorly known species only known in the female sex. The species below runs to couplets 11 and 12 with the former based on species only known in the female sex, and the latter based only on the male sex. In couplet 11, the female of *D.*



Figures 1–2. *Conicera kempi* male. 1, right clasper of hypopygium; 2, posterior face of mid femur. Scale bars = 0.1 mm.



Figures 3–6. *Conicera kempi*. 3, male, right postpedicel; 4, female, left postpedicel; 5, female, labrum; 6, female abdominal tergites 5 and 6. Scale bars = 0.1 mm.

evanescens (Brues) differs by having a more yellowish wing membrane and a broader abdominal tergite 3. *D. fasciiventris* (Brues), has much darker hind femora and tibiae, and lacks a hair at the base of vein 3. In couplet 12, the female of *D. assmuthi* (Schmitz) was described under its synonym *D. ater* (Brunetti). It is immediately distinguished by having its distiproboscis clearly longer than the basiproboscis (see figure in Schmitz, 1931). *D. varians* Beyer (1958) was described from a series of males from Burma. The species below could be the hitherto unknown female of this species. Until the two sexes are associated, this cannot be resolved. The species characterized below could not be run down in Liu's (2001) key to Chinese species.

Female

Frons orange brown to more yellowish in the lower part with about 40 small hairs (which are absent from median band) and minute microsetae. The supra-antennal bristles almost as long as antials, which are closer to anterolaterals than to midline, with the ALs being slightly higher on the frons. The bristles of the middle row almost equally spaced but mediolaterals a little lower on frons than pre-ocellars. A short, but robust, bristle on cheek and a much longer one on jowl. The yellowish brown postpedicels are small (both the length and greatest breadth being about 0.18 mm). The straw yellow palps appear dusky in distal third or more because of the dense dark pubescence. They measure about 0.41-mm-long, the second segment being about 0.36-mm-long (and its greatest breadth being about 0.11 mm), with five bristles at tip and up to 30 hairs below. The basiproboscis is yellowish brown, but with narrow dark brown bands at sides of the basal half. The length is about 0.59 mm and the maximum breadth is about 0.26 mm. The distiproboscis colored as postpedicels and about 0.50-mm-long and 0.32 mm at its greatest width. The combined width of the pale labella is only slightly greater. Thorax orange brown, but darker on top. Each side of scutum with a humeral, a notopleural, a prealar, an intra-alar, a postalar, and a pre-scutellar dorsocentral bristle. Scutellum with four bristles. Abdomen dark greyish brown apart from the tergites and the yellow tip and cerci. The tergites are mainly orange brown with minute hairs, but T1 is more straw yellow in the middle. T2, as shown in Figure 7, with the missing anteromedian band grey and the anterolateral wings straw yellow until they encounter a brown patch on the pleural region. T3 (Fig. 7) and T4 greatly reduced and T5 and T6 absent. Legs with coxae, mid and hind femora and hind tibia largely orange brown; the rest straw yellow. Front tibia with a neardorsal bristle near middle and 4–7 short spines in distal third to quarter. Front

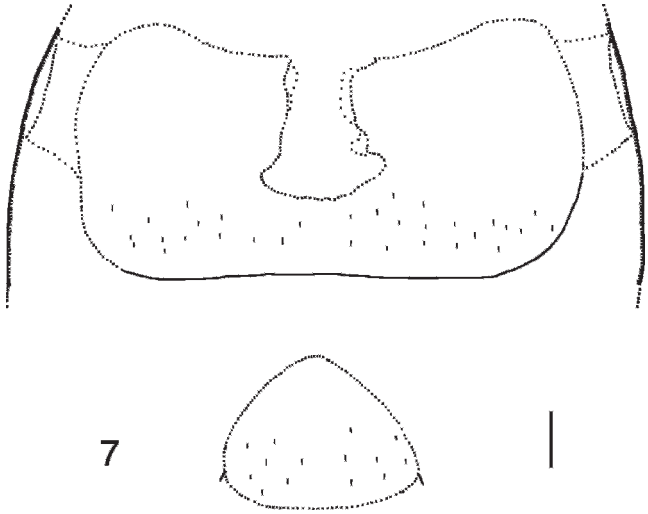


Figure 7. *Diplonevra* species IC female, abdominal tergites 2 and 3. Scale bar = 0.1 mm.

tarsus with posterodorsal hair palisades on segments 1–3 and 5 longer than 4. Mid tibia with the normal pair of bristles at end of basal quarter, and apart from the dorsal hair palisade, there is an anterodorsal one that ends at the start of the distal third, which has a series of anterodorsal transverse combs. Hind femur with hairs below basal half not differentiated from those of anterior face. Hind tibia with two anterodorsal bristles, one just before the end of the basal third and the other a little before the end of the middle third. Wing about 1.8 mm long. The costal index is about 0.6. The costal ratios about 6:3.5:1. The costal cilia (of section 3) are 0.07–0.08-mm-long. The thick veins yellowish brown. Veins 4–6 fine and grey. Vein 7 very pale. Vein 4 originates well before fork of vein 3 and is evenly concave towards the front in the basal four fifths and then runs straight to the margin in the last fifth. Sc reduced and only evident at extreme base. A fine hair at base of vein 3. With five bristles on axillary ridge. Membrane almost colorless. Haltere knob brown.

Material

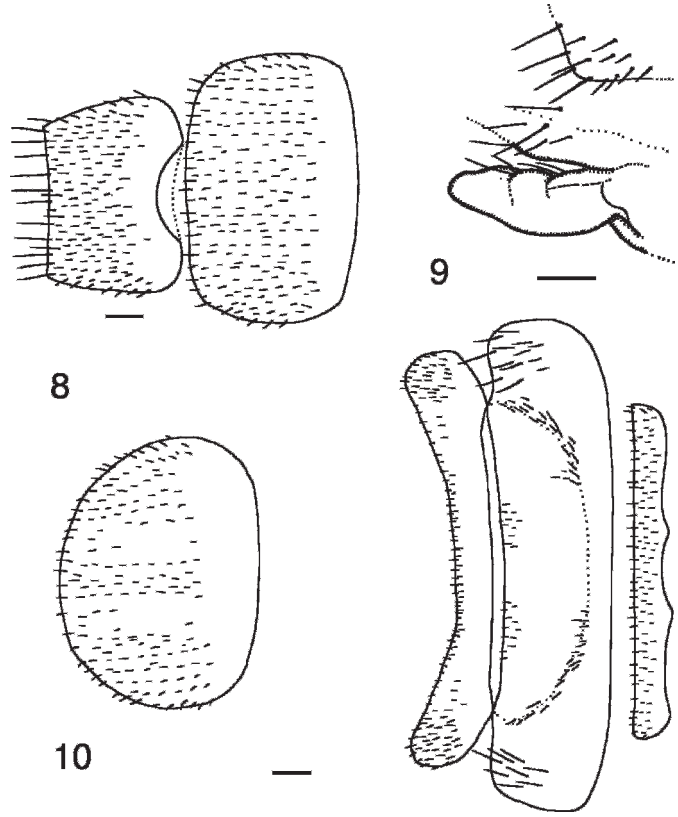
Five females, Krem Kotsati Lawan (25°10′46″N, 92°22′29″E) were collected at the cave entrance. Collection was on February 18, 2002 (KUL1, CUMZ, 38–56).

Natural History

This species was only procured at a cave's entrance and was probably only sheltering there. It is probably not a specialist cave dweller. Mature eggs with a smooth surface and about 0.87-mm-long and 0.34-mm-wide. Gravid females with about 22–24 eggs.

Megaselia malaisei Beyer 1958

This species was described from a series of females from Burma and has subsequently been reported from Thailand in a flower of *Aristochia baenzigeri* Hansen and Phuphathanaphong (Bänziger and Disney, 2006). The male



Figures 8–10. *Megaselia malaisei* female, details of abdomen; 8, tergites 5 and 6; 9, right retractile lobe of segment 6; 10, tergites 1–4. Scale bars = 0.1 mm.

remains unknown. Beyer's description was not illustrated, so the distinctive abdominal tergites 1–6 are illustrated here (Figs. 8 and 10) and also the pair of retractile, finger-like processes on the sides of segment 6 (Fig. 9), which Beyer failed to observe (as they are likely to have been withdrawn in a pinned specimen).

Material

One female, Krem Pyrda (25°20′29″N, 92°29′23″E) was collected about 50 m into the cave on February 10, 2001 (KP3, CUMZ, 38–55). One female, Liat Prah (25°22′31.5″N, 92°32′18.6″E) was collected about 50 m into the cave on February 26, 2002 (LP5.4, CUMZ, 38–55).

Natural History

This species was only procured close to the entrance of the caves and was probably only sheltering there. It is probably not a specialist cave dweller. One female retained eight mature eggs, but this was probably an incomplete batch following the deposition of some eggs. These eggs have a smooth surface and are about 0.58-mm-long and 0.22-mm-wide.

Megaselia species IC

Apart from species described from females only in the past (such as the distinctive species above), the recognition

of species in the giant genus *Megaselia* Rondani is now based on the males for the first time. The species characterized below cannot be named until associated with its male. In the key covering the relevant Group VII of the Oriental species (Borgmeier, 1967) it readily runs to couplet 65, which is based on the relative darkness of the antennal postpedicels. Taking the first option at couplet 66 the distinction is based on the male sex only. However, the female of its first option, *M. palpella* Beyer, is smaller (wing length <2 mm), and it has a well-elongated abdominal tergite 6. Taking the second lead of couplet 66 one then proceeds to couplet 70, to *M. apposita* Brues. The latter's female is immediately distinguished by its yellow, as opposed to brownish grey, abdominal venter. If one takes the second option of couplet 65, one readily proceeds to couplet 89, where the distinction is based on the degree of darkening of the thorax. The first option leads to couplet 94 to *M. tetricifrons* Beyer, which has the costal section one less than the combined lengths of 2+3 (as opposed to more) and half as many differentiated posterodorsal hairs on the hind tibia. Taking the second lead of couplet 89, one runs to couplet 110, where neither lead applies but the first option, *M. rutilipes* Beyer (only known in the male sex) is closest, but it has a darker frons and darker legs.

Female

Frons brown, but not dark, and clearly broader than long, with 20–24 hairs and dense, but very fine, microsetae. The supra-antennal bristles unequal in length, the lower pair being a little shorter and less robust. The antials slightly lower on frons than anterolaterals, which are about level with the upper SAs, and closer to the ALs than to the upper SAs. Pre-ocellars about as far apart as either is from a mediolateral bristle, which is very slightly higher on frons. Cheek with four bristles and jowl with two longer bristles. The subglobose postpedicels light brown, about 0.12-mm-wide, and with about three dozen SPS vesicles, which are a little smaller than sockets of lower SA bristles. Palps are about 0.21-mm-long and 0.04-mm-wide, pale straw yellow, and with five bristles and 7–10 hairs (of which 1–2 are a little stronger than the rest). Labrum a little darker than palps and about 0.45-mm-wide. Labella greyish white and at most with only a dozen short spinules below. Thorax brown. Two notopleural bristles and no cleft in front of these. Mesopleuron bare. Scutellum with an anterior pair of hairs (subequal to those in middle of scutum) and a posterior pair of bristles. Abdominal tergites brown. T4–T7 as shown in Figure 11. Venter brownish grey, and with small hairs below segments 3–6. Sternite 7 as long as T7 but a narrow isosceles triangle with two longer hairs at its rear margin and half a dozen smaller ones further forward. Posterolateral lobes at rear of sternum eight short, but broad and with three long hairs near rear margin. Cerci whitish grey and about twice as long as broad. With four rectal papillae. Furca not evident. Dufour's crop mechanism about 0.40-mm-long, but the posterior part is 0.15 mm and comprises a pair of pale

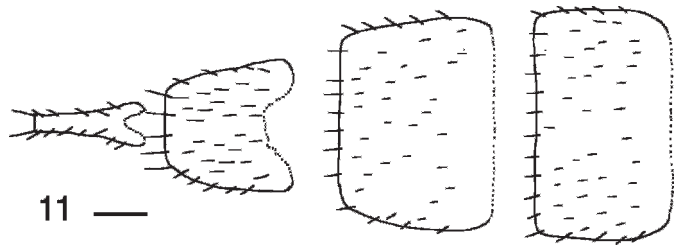


Figure 11. *Megaselia* species IC female, abdominal tergites 4–7. Scale bar = 0.1 mm.

divergent lobes. The greatest breadth of anterior part is about 0.25 mm. Legs straw yellow apart from brown patch on mid coxa and a light brown tip to hind femur. Fore tarsus with posterodorsal hair palisade on segments 1–5 and 5 longer than 4. Dorsal hair palisade of mid tibia extends almost two thirds of its length. Hairs below basal half of hind femur clearly longer than those of anteroventral row of outer half. Hind tibia with 17–20 differentiated posterodorsal hairs and spinules of apical combs simple. Wings 2.0–2.4-mm-long. Costal index 0.54–0.56. Costal ratios 3.4–3.7:2.1–2.5:1. Costal cilia (of section 3) 0.07-mm-long. No hair at base of vein 3. With 4–6 axillary bristles, all of which are longer than costal cilia. Sc strong and its tip fused to R1. Thick veins yellowish grey, thin veins grey, but 7 paler. Vein 4 originates beyond fork of vein 3 and is distinctly recurved at its base. Membrane lightly tinged grey. Haltere brown.

Material

One female, Krem Pyrda (25°20′29″N, 92°29′23″E) was collected about 50 m into the cave, on February 10, 2001 (KP3, CUMZ, 38–55). Two females, Krem Kotsati Lawan (25°10′46″N, 92°22′29″E) were collected at the cave entrance on February 18, 2002 (KUL1, CUMZ, 38–56). Six females, Liat Prah (25°22′31.5″N, 92°32′18.6″E) were collected about 10 m into the cave on February 26, 2002 (LP5.4, CUMZ, 38–54); 16 females were collected at the same locality but about 50 m into the cave on February 26, 2002 (LP5.2, CUMZ, 38–56).

Natural History

This species was only procured close to the entrance of caves and was probably only sheltering there. It is probably not a specialist cave dweller. Mature eggs with a smooth surface and about 0.61-mm-long and 0.24-mm-wide. Twenty to twenty-four eggs are matured at a time.

Acknowledgements

Thanks are due to Nigel Wyatt (Natural History Museum, London) for the loan of a female of *Conicera kempi.* My studies of Phoridae are currently supported by a grant from the Balfour-Browne Trust Fund (University of Cambridge).

Postscript

Since the acceptance of this manuscript, a general review of these caves has been published (Harries et al., 2008).

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