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Scuttle flies (Diptera: Phoridae) reared from fungi in Benin

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ABSTRACT

Ten species of Phoridae reared from fungi in Benin are reported, including the descriptions of the following: *Megaselia cakpoae* Disney, sp. n., *Megaselia fuscilobulorum* Disney, sp. n., *Megaselia kurinai* Disney, sp. n. and *Megaselia tedersooi* Disney, sp. n. *Megaselia termitomyca* Disney, 1989 is synonymised with *Megaselia labiata* Borgmeier, 1967.

KEY WORDS: Afrotropical, Diptera, Phoridae, fungi, new species, new synonymy.

INTRODUCTION

The larvae of many scuttle flies are associated with fungi, some feeding on the fungus, others preying upon or parasitizing the larvae of other fungus feeding Diptera (e.g. Disney 1994). The species associated with fungi in the Afrotropical Region have been little studied, mainly because they mostly belong to the huge genus *Megaselia* Rondani.

Of species reared from fungi the best known are the pest species of cultivated mushrooms. The latter include *M. sandhui* Disney, which is abundant in the Afrotropical part of Arabia, and the introduced *Megaselia halterata* (Wood). Both species are serious pests of cultivated agaric mushrooms, such as *Agaricus bisporus* (Disney 1981, 2008*b*), but *M. halterata* larvae feed on the mycelium whereas those of *M. sandhui* feed on the sporophore. The larvae of some species, such as *Dohrniphora diminuens* (Schmitz), have been reported feeding on the fungus combs of *Termitomyces* species (Lyophyllaceae) in termite nests (Disney & Kistner 1989). The sporophores of these fungi are exploited by a different suite of species, such as *Megaselia labiata* Borgmeier (= *M. termitomyca* Disney, see below) and *M. zariaensis* Disney (Disney 1989). Decaying fungus sporophores are exploited by other species such as *M. scalaris* (Loew) (Disney 2008*a*) and *Chonocephalus fletcheri* Schmitz (Disney 2005).

In this paper we report on species reared by LT and YC from fungus sporophores in Benin (Table 1). The Phoridae were sorted from the other reared Diptera by OK and have been identified by RHLD, who describes four new species below.

MATERIAL AND METHODS

The sporophores of various fungi were collected from the following localities in Central Benin: Kpessou, 9.600°N 2.185°E, 30 June 2010 and 2 July 2010; Ouari Maro, 9.030°N 2.393°E, 1 July 2010; and Koussanzamou, 10.211°N 1.447°E, 5 July 2010. The fungi were collected from miombo woodlands that are dominated by *Isoberlinia* spp.

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TABLE 1

Summary of numbers of Phoridae reared from fungi in Benin
(numbers of fungus species in brackets indicate the minimum numbers)

Fly species	**No. of flies**		**Fungi**		
	♂	♀	**Family**	**genera**	**species**
Megaselia awadi	2	2	Agaricacaeae	1	1
"	3	3	Amanitaceae	1	2
"	20	24	Lycoperdaceae	1	1
"	0	1	Russulaceae	1	1
Megaselia cakpoae **sp. n.**	1	4	Amanitaceae	1	1
"	20	27	Boletaceae	>1	>1
"	1	0	Hygorphoraceae	1	1
"	0	2	Russulaceae	1	2
Megaselia fuscilobulorum **sp. n.**	0	3	Amanitaceae	1	1
"	1	3	Boletaceae	1	1
"	1	2	Lycoperdaceae	1	(1)
"	61	130	Russulaceae	2	>6
Megaselia kurinai **sp. n.**	50	66	Boletaceae	2	2
Megaselia labiata	4	2	Lyophyllaceae	1	1
Megaselia orgaoa	3	3	Lycoperdaceae	1	1
Megaselia scalaris	0	4	Boletaceae	2	(2)
"	1	3	Russulaceae	1	3
Megaselia sokotrana	1	0	Russulaceae	1	1
Megaselia tedersooi **sp. n.**	1	5	Boletaceae	2	2
Metopina heselhausi	0	1	Russulaceae	1	1
Totals	170	285	7	10	(19)

(Fabaceae). Fresh sporophores were wrapped in aluminium foil to prevent desiccation and placed in 750 ml plastic containers covered with nylon gauze to ensure air circulation. Mixed hardwood sawdust was used as a pupation substrate for emerging insects. The adults that emerged were preserved in 70% alcohol and RHLD subsequently mounted them in Berlese Fluid on slides (Disney 2001).

Approximately 25% of the fresh sporophores of each fungus species was removed from the incubated sample, air-dried at 35 °C, labelled and deposited in the Herbarium of the Tartu University (TU). The DNA extracted from each sample was subjected to PCR amplification and sequencing of the rDNA Internal Transcribed Spacer region as described in Tedersoo *et al*. (2011). Metadata of all sporophores are deposited in the public UNITE database (Abarenkov *et al*. 2010*a*, *b*). As many of the fungi in our study area are undescribed they are identified to different taxonomic levels.

The type material and other voucher specimens of Phoridae are deposited in the University of Cambridge Museum of Zoology (UCMZ). These are all mounted on slides. For the new species, other specimens remaining in alcohol are given in brackets but are not treated as being part of the type series. Each fungal fruit body is supplemented by a corresponding voucher number of the sample from the same fruit body in the TU. The reference numbers on the slide labels, e.g. 42-6, refer to RHLD's notebook (42) and page (6).

TAXONOMY

Genus *Megaselia* Rondani, 1856

All but one specimen belong to the genus *Megaselia.* The recognition of the species in this huge genus is based on the male hypopygium in the first instance. Beyer has

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described many Afrotropical species culminating in a monograph (Beyer 1965). However, he either fails to illustrate the hypopygia or his figures are sketchy and often misleading. Indeed it has been generally judged to be difficult to use Beyer's keys with confidence. This is partly due to runs of couplets being based on male features only interspersed with couplets based on female characters only. Furthermore, Beyer described some species from females only, including cases where he described the male as a separate species. In addition his keys are notable for errors and omissions, such as the species from the Seychelles described by Collin, apart from there being many subsequently described species.

Both sexes of the four new species run to *M. ahmedseifi* Disney, 2009 in the keys to Arabian species (Disney 2009*b*). With it these five species form a distinct species group. A key to all five species is given below. Otherwise the way the species run down in Beyer's (1965) keys are indicated for each of the new species.

Megaselia awadi Disney, 2009

This species was previously known from Arabia. Both sexes are keyed by Disney (2009*b*).

Material examined: 1♀ Kpessou, ex *Lactarius flammans* Verbeken (TU116003), 3.vi, emerged 14.vii (42-10); 2♂ 2♀ (28♂ 37♀) same locality, ex *Agaricus* sp. (TU116023), 30.vi, emerged 10–12.vii (42-11); 2♂ 1♀ (18♂ 23♀) same locality, ex *Bovista* sp. (TU116065), 4.vii, emerged 13.vii (42-11); 1♂ same locality, ex *Amanita craseoderma* Bas (TU116070), 4.vii, emerged 13.vii (42-12); 1♀ (2♂ 2♀) same locality, ex *Amanita masasiensis* Härk & Saarim (TU116072), 4.vii, emerged 13–20.vii (42-12).

Megaselia cakpoae Disney, sp. n.

Figs 1–6

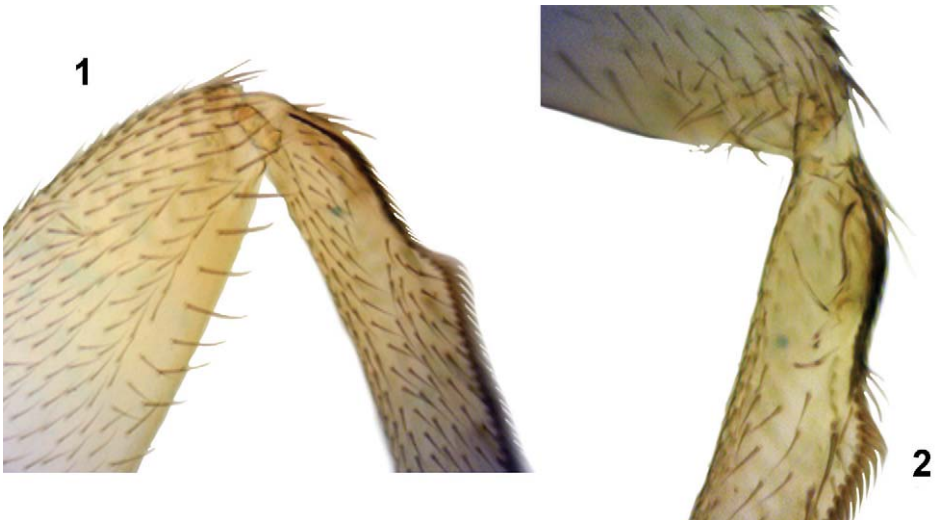
Etymology: Named for Yvonne Cakpo.

Description:

Male.

Frons yellow to orange brown, clearly broader than long, with 40–60 hairs and dense but very fine microtrichia. Only 2 SAs. Antials lower on frons than ALs, and about as far from SAs as either is from AL. Pre-ocellars at most as far apart as SAs and closer together than either is from ML bristle, which is at about the same height on frons. Cheek with 0–2 bristles and jowl with 2 longer bristles. Subglobose postpedicels yellow, without subcutaneous pit sensilla (SPS vesicles). Palps pale yellow, only about 0.2× as broad as postpedicel and 1.1–1.2× as long as breadth of latter, with 4 short bristles (longest, apical, bristle being 0.08–0.09 mm) and up to twice as many hairs. Labrum pale yellow and about 0.7× as wide as postpedicel. Labella coloured as palps, with 2 or 3 hairs on each above and very few short spinules below. Thorax yellow apart from brown patch on pteropleuron. Three notopleural bristles and no cleft in front of these. Mesopleuron bare. Scutellum with anterior pair of fine hairs (subequal to those in middle of scutum) and posterior pair of bristles. Abdominal tergites yellow apart from brown areas on outer thirds of T3 and T4. T1 to T6 with small hairs, mainly at hind margins and towards the sides, and being longest posterolaterally from T2 onwards and at rear of T6. Venter yellow, with minute hairs on the sides behind spiracles and with small hairs below on segments 3–6. Hypopygium (Fig. 6) mainly brown, with yellow anal tube.

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Figs 1, 2. *Megaselia cakpoae* sp. n., ♂, base of hind tibia, anterior (1) and posterior (2) faces.

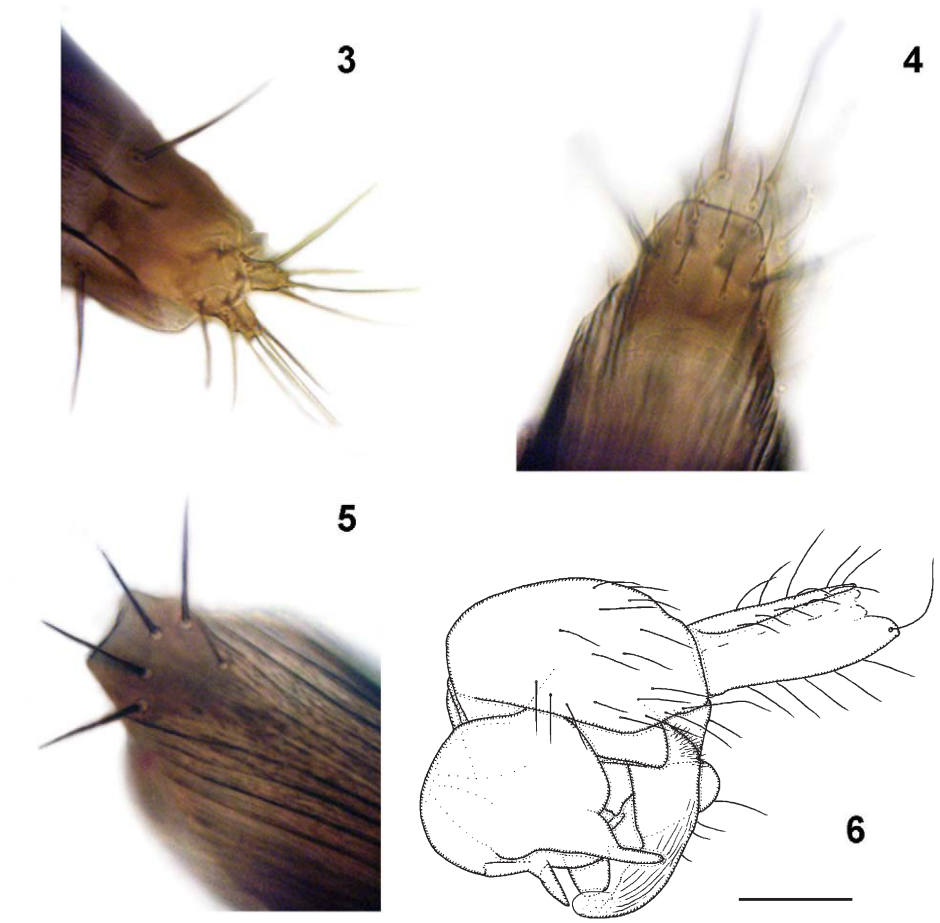
Legs yellow apart from brown patches on mid coxae. Fore tarsus with *pd* hair palisade on segments 1–5, segment 5 very slightly longer than 4. Dorsal hair palisade of mid tibia extends just over 0.75× of its length. Last segment of mid tarsus longer than 4th (similar to Fig. 19). Hairs below basal half of hind femur longer than those of *av* row of outer half. Base of hind tibia as Figs 1 & 2, with 6 or 7 differentiated *pd* hairs beyond the modified basal region and spinules of apical combs simple. Wings 1.60–1.76 mm long. Costal index 0.45–0.47. Costal ratios 3.4–4.9:1.4–2.1:1. Costal cilia (section 3) 0.06–0.07 mm long. No hair at base of vein 3. With 2 axillary bristles, the outer being longer than costal cilia. Sc not reaching R1. Thick veins yellowish grey, thin veins 4–6 grey and 7 pale. Membrane only lightly tinged grey (not obviously evident to naked eye when viewed against a white background). Haltere knob yellow.

Female.

Head similar to male but with 2 or 3 bristles on cheek. Palps up to 1.4× as long as width of postpedicel and with 5 bristles. Labrum 0.9× as wide as diameter of postpedicel. Thorax as male. Abdominal tergites yellow, progressively a little narrower from T2 to T6. Venter yellow, with hairing of segments 3–6 similar to male. Segments 7 and 8 brown, elongated and retractile. Light brown tergite 7 about 4.5× as long as broad, with a pair of longer hairs at rear end and half a dozen shorter ones further forward. Sternite 7 light brown, about 4× as long as broad and with hairing similar to T7. Single lobe at rear of sternum 8 as Figs 5, 6. Cerci and epiproct as Fig. 3. Four rectal papillae. Furca not evident. Dufour's crop mechanism about 4× as long as broad and almost parallel sided with a rounded rear end. Legs similar to male except 5th segment of mid tarsus being shorter than 4th; hind tibia not modified in its basal section, so there are about a dozen differentiated posterodorsal hairs. Wing as male except length is 1.61–1.92 mm. Costal index 0.44–0.47. Costal ratios 3.6–4.5:1.5–2.2:1. Costal cilia 0.07 mm. Haltere as male.

Holotype: ♂ BENIN: Kpessou, ex Boletaceae sp. (TU116073), 4.vii, emerged 15–20.vii (UCMZ, 42-12).

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Figs 3–6. *Megaselia cakpoae* sp. n., ♀ (3–5) and ♂ (6): (3) epiproct and cerci, (4, 5) lobe at rear of sternum 8 in two different specimens, (6) left face of hypopygium. Scale bar = 0.1 mm.

Paratypes and other material examined: 1♂ 1♀ same data as holotype (42-12); 1♀ same locality, ex *Russula* sp. (TU116063), 4.vii, emerged 20–24.vii (42-11); 1♀ (1♂ 4♀) same locality, ex *Amanita masasiensis* Härk & Saarim (TU116072), 4.vi, emerged 13–20.vii (42-12); 1♂ Koussanzamou, ex *Hygrocybe* sp. (TU116083), 5.vii, emerged 20.vii (42-8); 1♀ same locality, ex *Russula* sp. (TU116095), 5.vii, emerged 21.vii (42-8); 2♂ 1♀ (15♂ 21♀) same locality, ex *Tylopilus* sp. (TU116106), 5.vii, emerged 17–20.vii (42-5); 3♀ same locality, ex Boletaceae sp. (TU116118), 5.vii, emerged 17–19.vii (42-4); 1♂ 1♀ same locality, ex Boletaceae sp. (TU116120), 5.vii, emerged 15–20.vii (42-5).

Remarks: In Beyer's (1965) keys the male runs to page 54, couplet 28 to *M. tergatula* Beyer, 1965, only known from the female, but the latter has brown postpedicels. Proceeding the male runs to couplet 30, lead 2, to *M. nubila* Colyer, 1952, but the latter has brown legs. The female on page 54 runs on to couplet 22, to *M. incrassaticosta* Bridarolli, 1951, only known from the male, but its thorax is brown rather than yellow. Proceeding to couplets 24 to 26 based on males only, one can continue on the basis of the costal index or costal cilia being too short for the species of these couplets. It then runs to couplet 30 to *M. nubila* again.

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Megaselia fuscilobulorum Disney, sp. n.

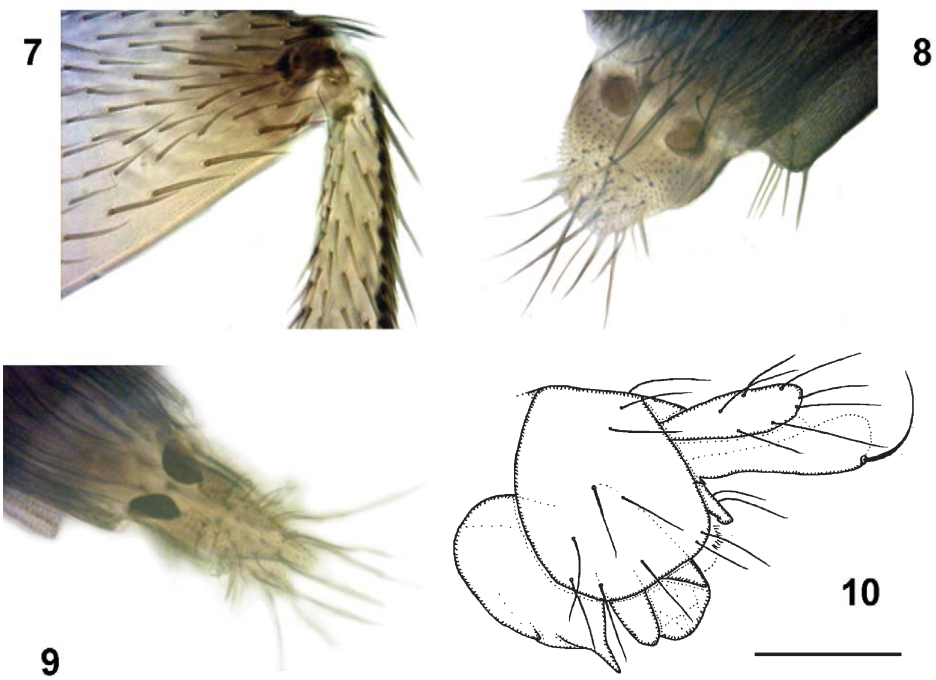
Figs 7–10

Etymology: From Latin *fuscus* (dark) and *lobus* (lobe), with reference to the female's dark, sclerotised lobes at the rear of abdominal sternum 8.

Description:

Male.

Frons brown, clearly broader than long, with 60–90 hairs and dense but very fine microtrichia. SAs with lower pair shorter than longest bristles on palps. The antials lower on frons than ALs, and further from upper SAs as either is from AL. Pre-ocellars about as far apart as upper SAs, and as either is from ML, which is very slightly higher on frons. Cheek with 1 or 2 (usually 2) bristles and with two longer ones on jowl. Subglobose postpedicels pale dusky yellow without subcutaneous pit sensilla (SPS vesicles), but unusually with irregular basal rims surrounding the pedicels. Palps pale yellow, 1.6× as broad as labrum but slightly longer than breadth of postpedicel, with 5 or 6 bristles (longest being longer than lower SAs) and half as many hairs. Labrum pale yellow and about ⅔ as wide as postpedicel. Labella coloured as palps, each with 2 hairs above and with very few short spinules below. Thorax with orange to yellowish brown scutum, a darker scutellum and paler pleural regions apart from brown on pteropleura. Three notopleural bristles and no cleft in front of these. Mesopleuron bare. Scutellum with



Figs 7–10. *Megaselia fuscilobulorum* sp. n., ♂ (7, 10) and ♀ (8, 9): (7) anterior face of base of hind tibia, (8, 9) lobes at rear of sternum 8 in two different specimens, (10) left face of hypopygium. Scale bar = 0.1 mm.

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anterior pair of hairs (about equal to those in middle of scutum) and posterior pair of bristles. Abdominal tergites partly brown, and partly yellow. Typically T1 entirely brown, T2 and T6 yellow in their anterior halves at least, and T3 to T5 with variably yellow median patches in their anterior halves at least. Hairs tend to be most numerous towards hind margins and posterolaterally, and longest at T6 hind margin. Venter yellow, and with conspicuous hairs on segments 3–6. Hypopygium (Fig. 10) brown, with yellow anal tube. Right lobe of hypandrium vestigial. Legs yellow apart from brown patches on mid coxae and tips of hind femora. Fore tarsus with *pd* hair palisade on segments 1–5, but that on 5 is abbreviated, and segment 5 about as long as 4. Dorsal hair palisade of mid tibia extends almost 0.75× of its length. Segment 4 of mid tarsus longer than segment 5. Hairs below basal half of hind femur longer than those of *av* row of outer half. Hind tibia with 3 or 4 differentiated hairs in basal region (Fig. 7) and a dozen weakly differentiated *pd* setae apart from a stronger one just beyond mid point; spinules of apical combs simple. Wings 1.0–1.3 mm long. Costal index 0.42–0.46. Costal ratios 4.0–5.0:2.4–3.6:1. Costal cilia (section 3) 0.06–07 mm long. No hair at base of vein 3. With 2 axillary bristles, outer being longer than costal cilia. Sc not reaching R1. Thick veins yellowish grey, thin veins 4–6 grey and 7 pale. Membrane lightly tinged grey (just evident to naked eye when viewed against a white background). Haltere knob yellow.

Female.

Head similar to male but labrum about 1.1× as wide as a postpedicel and inner edges of labella with 5 teeth. Thorax as male. Abdominal T1–5 with anterior halves to two thirds yellow and the rest brown, but T6 largely yellow with a little brown at rear. Small hairs on all tergites but 1 or 2 longer ones towards sides of T2 and at rear of T6. T7 subrectangular, but very slightly tapered, and largely light brown; and about 1.5× as long as broad with a dozen hairs in its rear half and 4 longer ones at its hind margin. Venter yellowish grey, with conspicuous hairs below on segments 3–6. Sternite 7 brown, 1.6–1.7× as long as broad, tapering forwards in anterior half, with about 10 hairs and 4 longer setae at rear margin. Lobes at rear of sternum 8 brown to almost black and as Figs 8 & 9. Cerci pale, 2.2–2.5× as long as greatest breadth, epiproct small. With 4 rectal papillae. Furca not evident. Dufour's crop mechanism about 1.4× as long as greatest breadth and with a straight to slightly convex hind margin. Legs similar to male but hind tibia with about 10 differentiated *pd* hairs, last 3 being stronger than the rest. Wing as male except 1.2–1.5 mm long. Costal index as male. Costal ratios 3.7– 5.8:2.4–3.6:1. Costal cilia as male. Haltere as male.

Holotype: ♂ BENIN: Koussanzamou, ex *Russula* sp. 2 (TU116098), 5.vii, emerged 15–18.vii (UCMZ, 42-9).

Paratypes and other material examined: 1♀ (5♂ 38♀) same data as holotype (42-9); 2♂ same locality, ex *Russula* sp. 5 (TU116101), 5.vii, emerged 17–18.vii (42-9); 1♀ same locality, ex Boletaceae sp. (TU116120), 5.vii, emerged 15–20.vii (42-5); 1♂ 1♀ (2♂ 1♀) Kpessou, ex *Lactarius flammans* Verbeken (TU116003), 30.vi, emerged 14.vii (42-10); 1♂ (4♂ 6♀) same locality, ex *Russula* sp. (TU116010), 30.vi, emerged 12–19.vii (42-11); 1♀ same locality, ex *Russula* sp. (TU116010), 30.vi, emerged 12–19.vii (42-10); 1♂ 1♀ (3♂ 3♀) same locality, ex *Russula oleifera* Buyck (TU116042), 2.vii, emerged 13–14.vii (42-6); 1♂ 1♀ (1♂ 1♀) same locality, ex *Russula* sp. 1 (TU116043), 2.vii, emerged 13.vii (42-6); 1♂ 1♀ (17♂ 47♀) same locality, ex *Russula* sp. 2 (TU116044), 2.vii, emerged 13–20.vii (42-7); (1♂ 3♀) same locality, ex Boletaceae sp. (TU116047), 2.vii, emerged 10–13.vii (42-6); 1♂ 1♀ (12♂ 10♀) same locality, ex *Russula* sp. (TU116060), 4.vii, emerged 14–22.vii (42-6); (2♀) same locality, ex *Russula* sp. (TU116061), 4.vii, emerged 13.vii (42-6); 1♂ 1♀ same locality, ex *Bovista* sp. (TU116065), 4.vii, emerged 13.vii (42-11); 1♀ (2♂ 4♀) Ouari Maro, ex *Lactarius gymnocarpoides* Verbeken (TU116025), 1.vii, emerged 12–15.vii (42-10); 1♀ (1♀) same locality, ex *Russula* sp. 1 (TU116026), 1.vii, emerged 12–16.vii (42-7); (1♂ 7♀) same locality, ex

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Russula sp. 1 (TU116031), 1.vii, emerged 13–19.vii (42-7); 1♂ same locality, ex *Russula* sp. 2 (TU116 032), 1.vii, emerged 13–19.vii (42-7); (2♀) same locality, ex *Russula* sp. 4 (TU116034), 1.vii, emerged 12–15.vii (42-7); (3♀) same locality, ex *Amanita pulverulenta* Beeli (TU116037), 1.vii, emerged 12–15.vii (42-8).

Remarks: In Beyer's (1965) keys the male runs to page 54, couplet 28 to *M. tergatula*, only known from the female, but the latter has brown postpedicels. Proceeding the male runs to couplet 30, lead 2, to *M. nubila*, but the latter has brown legs. Some males with a costal index of less than 0.44 will run down on page 56 to couplet 4, but its haltere knob being yellow not brown one proceeds to couplet 5. Its thorax being paler not dark brown means one then proceeds to couplet 10, where the yellow legs and thorax exclude both species. The female on page 54 runs to couplet 22, to *M. incrassaticosta*, only known from the male, but its thorax is dark brown rather than pale brown at most. Proceeding to couplets 24 to 26 based on males only, one can continue on the basis of the costal index or costal cilia being too short for the species of these couplets. It then runs to couplet 30 to *M. nubila* again.

Megaselia kurinai Disney, sp. n.

Figs 11–16

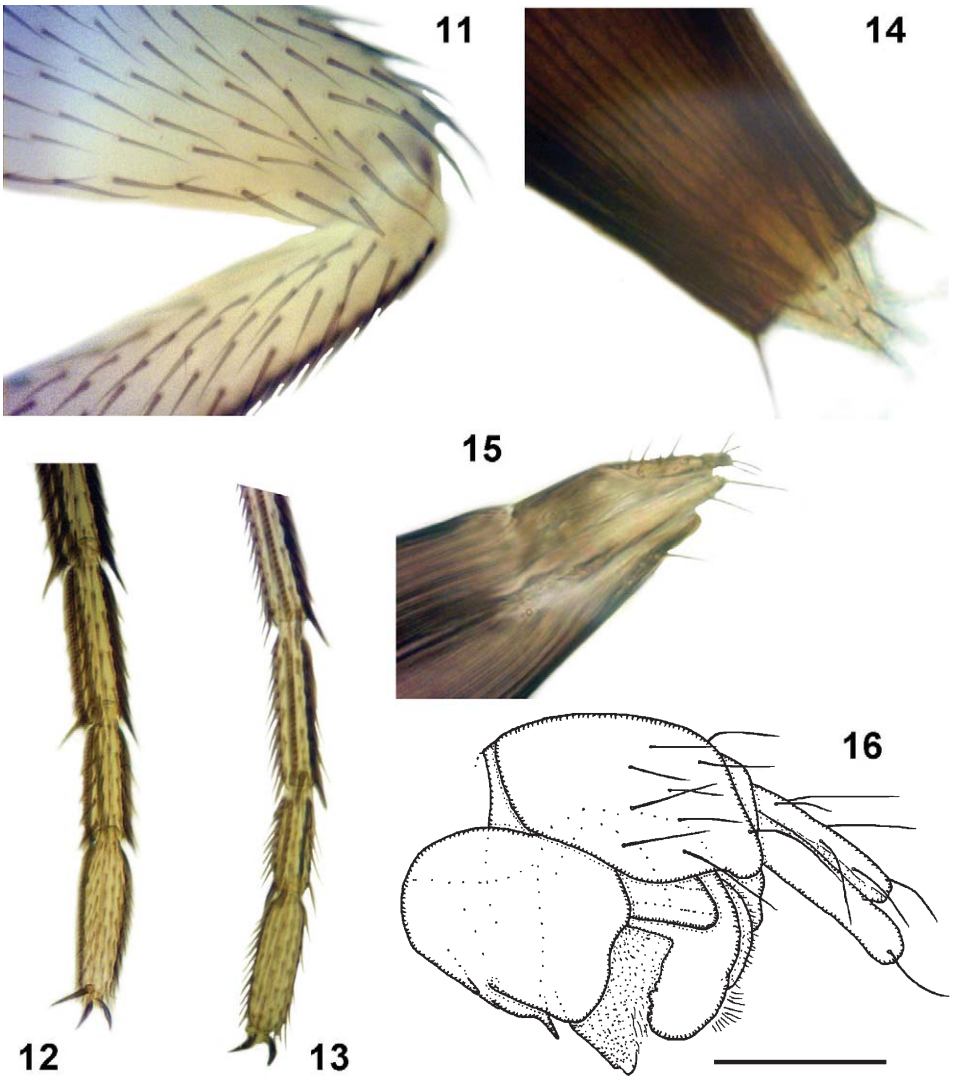
Etymology: Named for Olavi Kurina.

Description:

Male.

Frons brown, clearly broader than long, with 28–52 hairs and dense but very fine microtrichia. Supra-antennal bristles (SAs) very unequal, lower pair being at most 0.75× as long as apical bristles of palps. The antials lower on frons than ALs and further from upper SAs as either is from AL. Pre-ocellars about as far apart than either is from ML, which is about the same level on frons. Cheek with 4–6 bristles and jowl with two longer ones. The subglobose postpedicels yellow, without subcutaneous pit sensilla (SPS) vesicles. Palps yellow, only about 0.2× as broad as postpedicel but at least as long as breadth of latter, with 4–6 bristles and as many hairs. Labrum pale yellow and about 3× as wide as a palp. Labella coloured as palps and with only a few short spinules below. Thorax yellow. Three notopleural bristles and no cleft in front of these. Mesopleuron bare. Scutellum with anterior pair of hairs (about as long as those in middle of scutum) and posterior pair of bristles. Abdominal T1 and T2 largely yellow but with brown patches in rear of outer thirds at most. T3 and T4 largely brown with yellow median bands. T5 yellow with small brown smudges at front in outer thirds. T6 entirely yellow. All tergites with fine hairs, which are longest at rear of T6. Venter yellow, with a few small hairs on segment 6 only. Hypopygium largely brown, with yellowish brown anal tube; right lobe of hypandrium small (Fig. 16). With 4 rectal papillae. Legs yellow apart from brown patches on mid coxae and slightly brown tips to hind femora. Fore tarsus with *pd* hair palisade on segments 1–5, and segment 5 about as long as 4. Dorsal hair palisade of mid tibia extends about ⅔ of its length. Segments 3–5 of mid tarsus as Fig. 12. Hairs below basal half of hind femur longer than those of *av* row of outer half. Base of hind tibia as Fig. 11, with about a dozen differentiated *pd* hairs and spinules of apical combs simple. Segments 3–5 of hind tarsus as Fig. 13. Wings 1.1–1.4 mm long. Costal index 0.42–0.46. Costal ratios 3.7–4.2:2.4–2.7:1. Costal cilia (section 3) 0.05–0.07 mm long. No hair at base of vein 3. With 2 axillary bristles, outer being longer than costal cilia.

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Figs 11–16. *Megaselia kurinai* sp. n., ♂ (11–13, 16) and ♀ (14, 15): (11) anterior face of base of hind tibia, (12) segments 3–5 of mid tarsus, (13) segments 3–5 of hind tarsus, (14) lobes at rear of abdominal sternum 8, (15) left face of tip of abdomen, (16) left face of hypopygium. Scale bar = 0.1 mm.

Sc not reaching R1. Thick veins yellowish grey, thin veins 4–6 grey and 7 very pale. Membrane lightly tinged grey (only just evident to naked eye when viewed against a white background). Haltere knob brown.

Female.

Head similar to male but labrum about 0.9× as wide as diameter of postpedicel but 3× as wide as a palp. Thorax as male. Abdominal tergites yellow with hairs mainly at hind margins and longest at rear of T6. Venter yellow and with a few hairs at rear of segment 6. Retractile terminal segments dark. Tergite and sternite 7 represented by a few hairs

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only. Posterolateral lobes at rear of sternum 8 with narrow, dark and bare tips (Figs 14, 15). Cerci vestigial (Fig. 15). With 4 rectal papillae. Furca not evident. Dufour's crop mechanism at least twice as long as broad and rounded behind. Legs similar to male but segments 5 of the mid and hind tarsi shorter than 4th segments. Wing as male except 1.4–1.5 mm long. Costal index 0.45–0.46. Costal ratios 4.3–5.3:2.9–3.0:1. Haltere as male.

Holotype: ♂ BENIN: Koussanzamou, ex *Russula* sp. 2 (TU116098), 5.vii, emerged 15–18.vii (UCMZ, 42-9).

Paratypes and other material examined: 1♀ same data as holotype (42-9); 1♂ same locality, ex *Tylopilus* sp. (TU116106), 5.vii, emerged 17–20.vii (42-5); 2♂ 1♀ (47♂ 65♀) same locality, ex Boletaceae sp. (TU116120), 5.vii, emerged 15–20.vii (42-5); 1♂ 1♀ (1♂ 4♀) Kpessou, ex *Russula* sp. (TU116010), 30.vii, emerged 12–19.vii (42-11); 1♂ (1♂) same locality, ex Boletaceae sp. (TU116073), 4.vii, emerged 15–20.vii (42-12).

Remarks: In Beyer's (1965) keys both sexes run to the same couplets on page 54 as the previous species, to *M. nubila*, and is likewise distinguished from this species. Specimens with the costal index less than 0.44 will run to couplet 10 on page 57, but the combination of yellow legs and postpedicels and 3 bristles on the notopleuron rules out the two species of this couplet.

Megaselia labiata Borgmeier, 1967

Megaselia labiata: Borgmeier 1967: 420.
Megaselia termitomyca Disney, 1989: 46. **Syn. n.**

This species was described from the Congo, where it was associated with termites (Borgmeier 1967). Having been described after Beyer's (1965) keys, it was included in Borgmeier's (1968) catalogue. However, many of Beyer's species were omitted from this catalogue as Beyer declined to send Borgmeier a copy of his 1965 monograph. This was because Beyer had been upset by Borgmeier's criticisms of his work. Beyer's monograph only became known to Borgmeier in March 1969 when it was abstracted by the *Zoological Record* (Borgmeier 1971). Consequently Borgmeier was unable to indicate how *M. labiata* runs down in Beyer's keys. It was only when RHLD belatedly annotated these 1965 keys to include subsequently described species that it revealed *M. termitomyca* to be a synonym of *M. labiata*. This species is not covered by any key. In Beyer's (1965) keys both sexes run to couplet 19 on page 54. The male runs to lead 2, to *M. nigricauda* Beyer, 1965, but is immediately distinguished by its enlarged labella of the proboscis (Borgmeier 1967: fig. 2). The female of *M. labiata* fits neither option in couplet 19, as the thorax is too pale for lead 2 and the frons too wide for lead 1.

It was previously reared from the stipes of *Termitomyces* sp. in Zaria, Nigeria (Disney 1989).

Material examined: 2♂ 2♀ (2♂) Kpessou, ex *Termitomyces medius* R. Heim & Grassé (TU116021), 30.vi, emerged 10.vii (42-10).

Megaselia orgaoa Disney, 1991

This species has proved to be widespread and both sexes are included in recent keys (Disney 2009*a*, *b*). It has previously been reported from the Cape Verde Islands, Arabia and the Seychelles.

Material examined: 1♂ 2♀ Koussanzamou, ex *Russula compressa* Buyck (TU116097), 5.vii, emerged 15.vii (42-9); 1♂ Kpessou, ex *Russula* sp. 2 (TU116044), 2.vii, emerged 13–20.vii (42-7); 1♀ (3♂ 2♀) same locality, ex *Bovista* sp. (TU116065), 4.vii, emerged 13.vii (42-11).

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Megaselia scalaris (Loew, 1866)

The larvae of this cosmopolitan species feed on a wide range of decaying organic materials and are occasionally facultative secondary feeders on fungi already spoiled by other fungus feeding insects (Disney 2008*a*). Both sexes are included in recent keys (Disney 2009*b*).

Material examined: 1♀ Koussanzamou, ex *Russula* sp. 2 (TU116098), 5.vii, emerged 15–18.vii (42-9); 2♀ same locality, ex *Russula* sp. 3 (TU116099), 5.vii, emerged 10.vii (42-9); 2♀ same locality, ex *Veloporphyrellus africanus* Watling (TU116108), 5.vii, emerged 10.vii (42-5); 1♀ same locality, ex Boletaceae sp. (TU116116), 5.vii, emerged 17–19.vii (42-5); 1♀ Kpessou, ex Boletaceae sp. (TU116074), 4.vii, emerged 10.vii (42-12); 1♂ Ouari Maro, ex *Russula* sp. 5 (TU116035), 1.vii, emerged 8.vii (42-8).

Megaselia sokotrana Beyer, 1965

This species was originally described from the female only and an error in the description caused the male to be described as a new species. Both sexes are keyed by Disney (2009*b*). It has previously been recorded from Arabia and the Cape Verde Islands.

Material examined: 1♂ Ouari Maro, ex *Russula* sp. 5 (TU116035), 1.vii, emerged 8.vii (42-8).

Megaselia tedersooi Disney, sp. n.

Figs 17–22

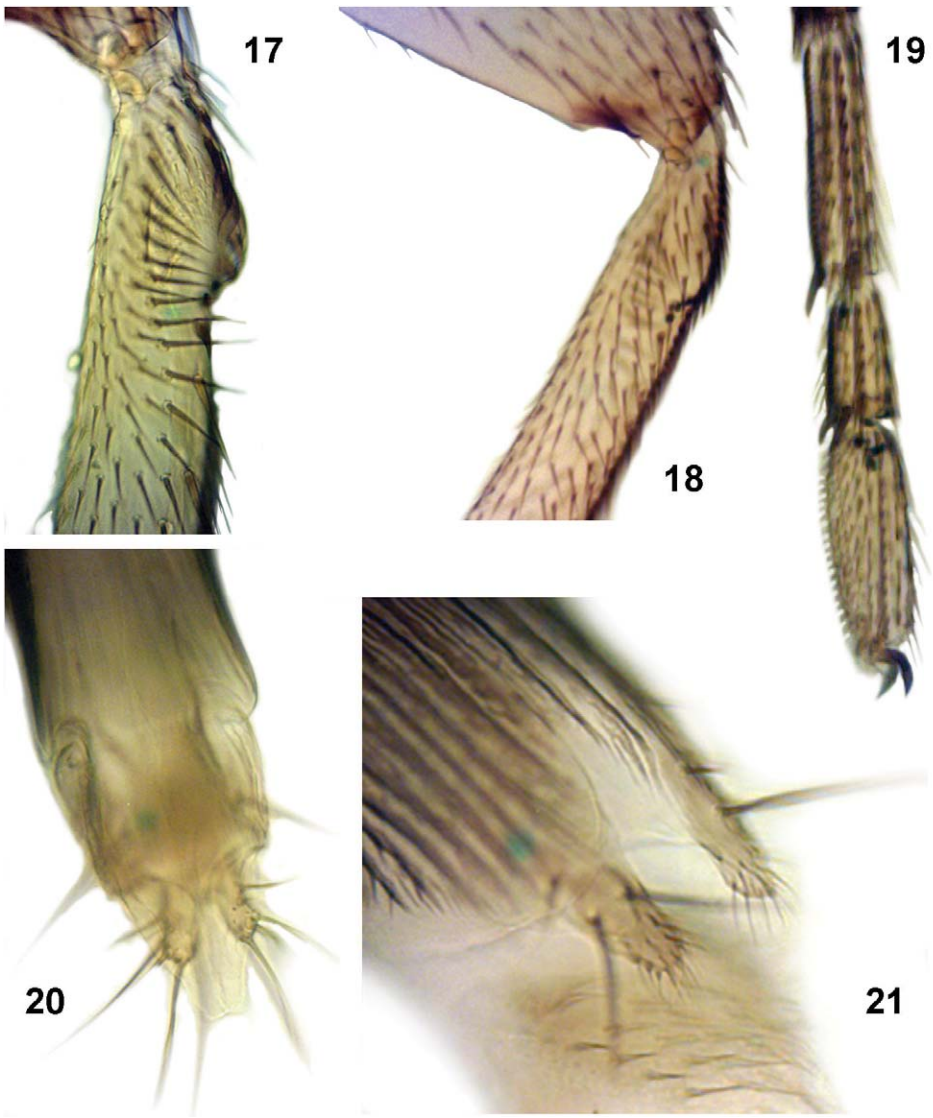
Etymology: Named for Leho Tedersoo.

Description:

Male.

Frons brown, clearly broader than long, with 38–40 hairs and dense but very fine microtrichia. Supra-antennal bristles (SAs) very unequal, lower pair being a little shorter than apical bristles of palp. Antials lower on frons than ALs and further from upper SAs than either is from AL. Pre-ocellars slightly closer together than either is from ML, all 4 bristles at about the same level on frons. Cheek with 4 bristles and jowl with 2 longer ones. The subglobose postpedicels yellow, without subcutaneous pit sensilla (SPS) vesicles. Palps pale yellow, about 0.2× as broad as postpedicel but about as long as breadth of latter, with 6 bristles and as many hairs. Labrum pale yellow and about 0.7× as wide as a postpedicel. Labella coloured as palps and with only a few short spinules below. Thorax yellow. Three notopleural bristles and no cleft in front of these. Mesopleuron bare. Scutellum with anterior pair of hairs (about as strong as those in middle of scutum) and posterior pair of bristles. Abdominal T1, T5 and T6 yellow, T2 yellow with brown at rear margin in outer thirds, T3 and T4 brown with a median yellow stripe. All tergites with small hairs, mainly near hind margins, but some longer ones towards sides of T2 and clearly longer ones at rear of T6. Venter dusky yellow and with conspicuous hairs on segments 3–6. Hypopygium (Fig. 22) mainly brown, with yellowish brown anal tube, hypandrial lobes being vestigial. With 4 rectal papillae. Legs yellow except for brown patches on mid coxae. Fore tarsus with *pd* hair palisade on segments 1–5, segment 5 about as long as 4. Dorsal hair palisade of mid tibia extends about ⅔ of its length. Segments 3–5 of mid tarsus as Fig. 19. Hairs below basal half of hind femur longer than those of *av* row of outer half. Base of hind tibia as Figs 17 & 18, with 7 or 8 differentiated *pd* hairs beyond this modified region (the first and base of

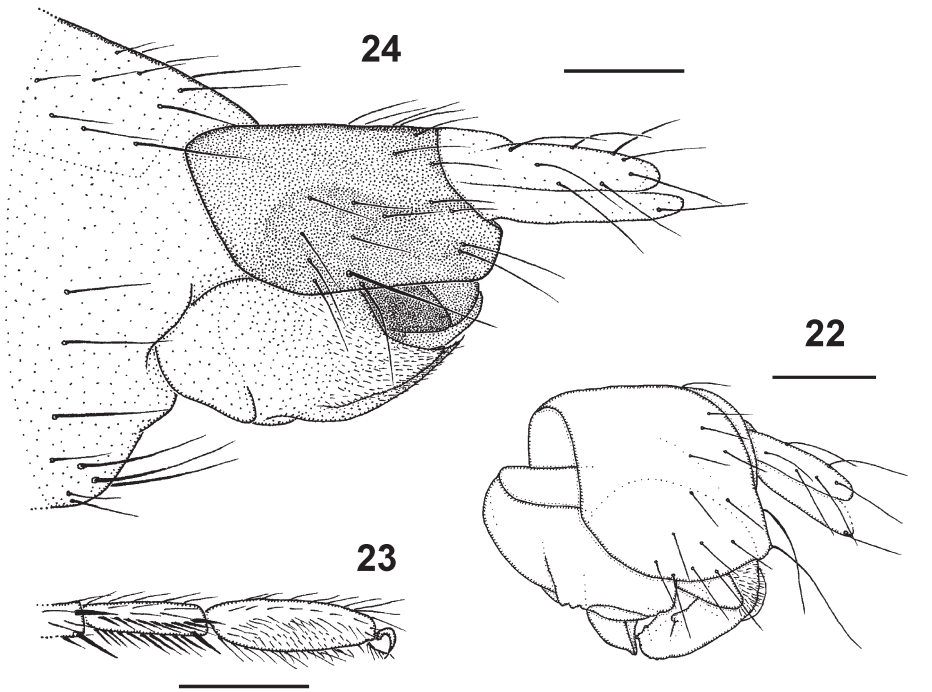
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Figs 17–21. *Megaselia tedersooi* sp. n., ♂ (17–19) and ♀ (20, 21): (17) posterior face of base of hind tibia, (18) anterior face of same, (19) segments 3–5 of mid tarsus, (20) cerci, (21) lobes at rear of abdominal sternum 8.

the second of these are evident in Fig. 17), and spinules of apical combs simple. Segment 5 of hind tarsus almost as long as segment 4. Wings 1.48–1.49 mm long. Costal index 0.44–0.45. Costal ratios 3.7:2.4–2.5:1. Costal cilia (section 3) 0.06–0.07 mm long. No hair at base of vein 3. With 2 axillary bristles, outer being longer than costal cilia. Sc not reaching R1. Thick veins yellowish grey, thin veins 4–6 grey and 7 pale. Membrane lightly tinged grey (just evident to naked eye when viewed against a white background). Haltere knob yellow.

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Figs 22–24. (22) *Megaselia tedersooi* sp. n., left face of hypopygium; (23, 24) *Megaselia ahmedseifi*: (23) segments 4 and 5 of mid tarsus, (24) left face of hypopygium. Scale bars = 0.1 mm.

Female.

Head similar to male but labrum about 0.9× as wide as diameter of postpedicel. Thorax as male. Abdominal tergites yellow, with small hairs apart from a few longer ones towards sides of T2. Venter dusky yellow and with about a dozen hairs below segments 3–6. Segment 7 onwards darkened and retractile. Posterolateral lobes at rear of sternum 8 as Fig. 21. Cerci as Fig. 20. With 4 rectal papillae. Furca not evident. Dufour's crop mechanism at least 3× as long as broad and rounded behind. Legs similar to male but fifth segment of mid tarsus is slightly shorter than fourth and base of hind tibia not modified, so that there are about a dozen posterodorsal differentiated hairs. Wing as male except 1.5–1.8 mm long. Costal index 0.44–0.49. Costal ratios 4.0–5.4:2.5–3.5:1. Haltere as male.

Holotype: ♂ BENIN: Koussanzamou, ex *Pulveroboletus* sp. (TU116119), 5.vii, emerged 19–22.vii (UCMZ, 42-4).

Paratypes: 4♀ same data as holotype (42-4); 1♀ same locality, ex Boletaceae sp. (TU116118), 5.vii, emerged 17–19.vii (42-4).

Remark: In Beyer's (1965) keys both sexes run to the same couplets on page 54 as the previous species, to *M. nubila*, and is likewise distinguished from this species.

Key to the *Megaselia ahmedseifi* species group

1 Males 2
– Females 6

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2 Segment 5 of mid tarsus longer than segment 4 (e.g. Figs 19, 23) 3
– Segment 5 of mid tarsus shorter than segment 4. (Hypopygium as Fig. 10. Base of hind tibia as Fig. 7)..... **fuscilobulorum** sp. n.

3 Base of hind tibia modified (Figs 1, 2, 17, 18). (Haltere knob yellow) 4
– Base of hind tibia normal (Fig. 11) 5

4 Base of hind tibia as Figs 17, 18. Hypopygium as Fig. 22 .....**tedersooi** sp. n.
– Base of hind tibia as Figs 1, 2. Hypopygium as Fig. 6 ..... **cakpoae** sp. n.

5 Haltere brown. Segment 5 of hind tarsus longer than segment 4 (Fig. 13). Hypopygium as Fig. 16. (Segments 3–5 of mid tarsus as Fig. 12)..... **kurinai** sp. n.
– Haltere knob yellow. Segment 5 of hind tarsus shorter than segment 4. Hypopygium as Fig. 24 ..... **ahmedseifi**

6 With <8 differentiated longer hairs below basal half of hind femur.....7
– With >8 such hairs. (Haltere knob yellow)..... unknown ♀ of **ahmedseifi**

7 Abdominal venter with <30 hairs on segments 3–6. Abdominal tergites uniformly yellow to dusky yellow 8
– Venter with >60 hairs on segments 3–6. Tergites 2–5 yellow with brown hind margins. (Lobes at rear of sternum 8 as Figs 8, 9) ..... **fuscilobulorum** sp. n.

8 Haltere knob yellow. Venter with >10 hairs. Cerci normal but short.....9
– Haltere brown. Venter with <10 hairs. Cerci vestigial, being largely reduced to a fine bristle (Fig. 15). (Lobes at rear of sternum 8 with narrow bare tips, Figs 14, 15) .... **kurinai** sp. n.

9 Cerci at least 2× as long as broad (Fig. 20) and lobes at rear of sternum 8 as Fig. 21 .....**tedersooi** sp. n.
– Cerci shorter (Fig. 3) and with single broad lobe at rear of sternum 8 with a straight or slightly concave hind margin (Figs 4, 5) ..... **cakpoae** sp. n.

Genus *Metopina* Macquart, 1835
Metopina heselhausi Schmitz, 1924

This species has previously been recorded from Europe, Israel, the Azores, Canary Islands and Yemen. It is included in the keys for the Arabian species (Disney 2006).
Material examined: 1♀ Kpessou, ex *Russula* sp. 2 (TU116044), 2.vii, emerged 13–20.vii (42-7).

DISCUSSION

The fact that four out of the nine species of *Megaselia* obtained were new species underlines our current ignorance of Afrotropical species of this huge genus. Furthermore, these four species evidently belong to a distinctive complex of sibling species. The dominance of female flies, at 62.6%, is striking. These females could only be named because they were associated with their males in reared series. Indeed such associations, apart from pairs caught mating, are required for the identification of most females of Afrotropical species of *Megaselia.* In this case unassociated females could only have been assigned to the sibling species complex and not to the individual species represented by their males. When collections from a locality include specimens of both sexes belonging to different species complexes it is often possible to link females to their males on the basis of small details (e.g. Disney 2009*a*, *b*), but the use of molecular barcodes is likely

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to prove useful in the future (e.g. Boehme *et al*. 2010). Our records highlight a similar current ignorance of Afrotropical fungi.

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REFERENCES

Abarenkov, K., Nilsson, R.H., Larsson, K.-H., Alexander, I.J., Eberhardt, U., Erland, S., Høiland, K., Kjøller, R., Larsson, E., Pennanen, T., Sen, R., Taylor, A.F.S., Tedersoo, L., Ursing, B., Vrålstad, T., Liimatainen, K., Peintner, U. & Kõljalg, U. 2010*a*. The UNITE database for molecular identification of fungi – recent updates and future perspectives. *New Phytologist* **186**: 281–285.

Abarenkov, K., Tedersoo, L., Nilsson, R.H., Vellak, K., Saar, I., Veldre, V., Parmasto, E., Prous, M., Aan, A., Ots, M., Kurina, O., Ostonen, I., Jõgeva, J., Halapuu, S., Põldmaa, K., Toots, M., Truu, J., Larsson, K.-H. & Kõljalg, U. 2010*b*. PlutoF – a web based workbench for ecological and taxonomic research, with an online implementation for fungal ITS sequences. *Evolutionary Bioinformatics* **6**: 189–196.

Beyer, E.M. 1965. Phoridae (Diptera Brachycera). *Exploration du Parc National Albert, Mission G. F. De Witte (1933–1935)* **99**: 1–211.

Boehme, P., Amendt, J., Disney, R.H.L. & Zehner, R. 2010. Molecular identification of carrion-breeding scuttle flies (Diptera: Phoridae) using COI barcodes. *International Journal of Legal Medicine* **124**: 577–581.

Borgmeier, T. 1967 (1966). Ueber einige afrikanische, bei Termiten gefundene Phoriden, nebst Bemerkungen ueber die Gattung *Termitophorides* (Diptera, Phoridae). *Studia Entomologica, Petropolis* **9**: 417–428.

———1968. A catalogue of the Phoridae of the world (Diptera, Phoridae). *Studia Entomologica, Petropolis* **11**: 1–367.

———1971. Supplement to 'A Catalogue of the Phoridae of the World (Diptera, Phoridae)'. *Studia Entomologica, Petropolis* **14**: 177–224.

Disney, R.H.L. 1981. *Megaselia sandhui* sp. n. (Diptera: Phoridae), a pest of cultivated mushrooms in India. *Bulletin of Entomological Research* **71**: 509–512.

———1989. Two new species of *Megaselia* (Dipt., Phoridae) reared from termite-mound fungus in Nigeria. *Entomologist's Monthly Magazine* **125**: 45–48.

———1994. *Scuttle Flies: The Phoridae*. London: Chapman & Hall.

———2001. The preservation of small Diptera. *Entomologist's Monthly Magazine* **137**: 155–159.

———2005. Revision of Afrotropical *Chonocephalus* Wandolleck (Diptera: Phoridae). *Journal of Natural History* **39**: 393–430.

———2006. Insects of Arabia scuttle flies (Diptera: Phoridae) Part I: all genera except *Megaselia. Fauna of Arabia* **22**: 473–521.

———2008*a*. Natural history of the scuttle fly, *Megaselia scalaris. Annual Review of Entomology* **53**: 39–60.

———2008*b*. The identification of *Megaselia sandhui* Disney and *M. agarici* (Lintner), scuttle fly pests (Diptera: Phoridae) of cultivated mushrooms (Agaricales: Agaricaceae). *Entomologist's Gazette* **59**: 243–249.

———2009*a*. Superfamily Platypezoidea Family Phoridae. *In*: Gerlach, J., ed., *Seychelles Fauna Monographs. The Diptera of the Seychelles islands.* Pensoft Series Faunistica, Vol. 85. Sofia–Moscow: Pensoft, pp. 167–236.

———2009*b*. Insects of Arabia scuttle flies (Diptera: Phoridae) Part II: the genus *Megaselia. Fauna of Arabia* **24**: 249–357.

Disney, R.H.L. & Kistner, D.H. 1989. Phoridae from termite colonies in Africa, including two new species (Diptera; Isoptera, Termitidae). *Sociobiology* **16**: 75–90.

Tedersoo, L., Bahram, M., Jairus, T., Bechem, E., Chinoya, S., Mpumba, R., Leal, M., Randrianjohany, E., Razafimandimbison, S., Sadam, A., Naadel, T. & Kõljalg, U. 2011. Spatial structure and the effects of host and soil environments on communities of ectomycorrhizal fungi in wooded savannas and rain forests of Continental Africa and Madagascar. *Molecular Ecology* **20**: 3071–3080.

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