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Seven new species of *Chimarra* (Trichoptera: Philopotamidae) from Malawi

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Abstract

For the first time species of caddisflies in the genus *Chimarra* Stephens 1829 are reported from Malawi. The following new species are described: *Chimarra zombaensis*, *C. flaviseta*, *C. chichewa*, *C. circumverta*, *C. mulanjae*, *C. psittacus* and *C. calidopectoris*. The descriptions add to the knowledge of Afrotropical diversity in the order Trichoptera.

Key words: taxonomy, caddisflies, Afrotropical, insect morphology, species biodiversity

Introduction

With more than 780 described species, the genus *Chimarra* Stephens 1829 is the largest genus of Trichoptera (Morse, personal communication 26 February 2014). The genus is cosmopolitan in distribution with the exception of Antarctica and the highest diversity is found in the Oriental and Neotropical regions (Morse 2013). While *Chimarra* might be the most species-rich Trichoptera genus, only 87 species have been reported from the Afrotropical region (Tobias & Tobias 2008), all in subgenus *Chimarra* (Morse 2013). This can be compared to 299 described species in the Neotropical region and 321 in the Oriental region (Morse 2013); this indicates that the species diversity of *Chimarra* in the Afrotropical region is low or it is largely unknown. This bias is made particularly clear by the fact that the Afrotropical Biogeographic Region is larger than the other two regions; indeed, the density of known species of Trichoptera generally in the Afrotropical Region is the lowest in the world (de Moor & Ivanov 2008; Morse 1997, 2011).

Material and methods

Specimens were collected using a UV or “black” light trap placed near streams at dusk for two to three hours. The locations of the collection sites are mapped in Figure 1. The material was preserved in 95% ethanol. Sorting and determination was executed at the laboratory at the Swedish Museum of Natural History. The individuals were initially grouped based on genital morphology after the abdomen was separated from the rest of the body. Extraction of DNA was carried out on the abdomen with QIAamp® DNA Micro kit (QIAGEN), which also macerated the abdomen. The abdomen was dehydrated in absolute alcohol and temporarily suspended in Euparal on a microscope slide. Illustrations of genitalia were drawn using a Nikon Eclipse 80i light microscope with a Nikon Y-IDT drawing tube. The illustrations were subsequently scanned and finalized in Adobe® Illustrator® 15.1 and Photoshop® 12.1. Wings were temporarily mounted in glycerol on a microscope slide and photographed using a Nikon D700 camera attached to a Nikon Eclipse 80i microscope. For photographing the head region, the specimen was mounted in Euparal and photos were taken with a Lumenera Infinity X camera attached to an

Olympus SZX12 stereo microscope. All photos were cleaned and their background was removed with Adobe® Photoshop® 12.1. After examination and illustration, the abdomen and wings were transferred back to 80% ethanol together with the rest of the specimen. In cases of descriptions based on a single specimen the species are confirmed distinct from all other Malawi species and some other African species based on DNA sequences. Females will eventually be described in a subsequent revisionary analysis involving a wider representation from the Afrotropical region. Terminology of genitalia follows Blahnik (1998). All material is stored in the Swedish Museum of Natural History, Stockholm, Sweden (NHRS).



FIGURE 1. Map of Malawi showing locations of collection. Basemap provided by Esri *et al.* (2013).

Systematics

Family Philopotamidae Stephens 1829

Genus *Chimarra* Stephens 1829

Type species: *Phryganea marginata* Linnaeus 1767: 910.

Diagnosis. The adults of the species in the genus *Chimarra* are distinguished from those in other philopotamid genera by having a spur formula of 1,4,4 and hind wings with vein A2 looped to form a closed cell (Blahnik 1998). Within *Chimarra* the subgenus *Chimarra* Stephens 1829 has a worldwide distribution, while *Chimarrita* Blahnik 1997, *Otarrha* Blahnik 2002, and *Curgia* (Walker 1860) are restricted to the Neotropical region with a few species of *Curgia* represented in the southern Nearctic region. Although 83 species of *Chimarra* have been reported from the Afrotropical Region (Morse 2103), species in the genus have never previously been recorded from Malawi, and from the neighbouring countries only three species are known, one species from each of Tanzania, Zambia and Mozambique.

Chimarra zombaensis, new species

(Figs 2, 7, 14–19)

Diagnosis. The male of this species resembles those of *C. flaviseta*, new species, and *C. somereni* Marlier 1951, from Kenya; these three species are distinguished from other Afrotropical species by the presence of a pair of long, straight anterior phallic spines and one shorter, posteroapical phallic spine. The apex of the apical endothecal spine is bent abruptly dorsad and the lobes of tergum X are wide and blunt in *C. zombaensis*, but the spine is only gradually curved and the lobes of tergum X are very slender in *C. flaviseta*. The lateral lobes of tergum X are triangular in lateral view and the inferior appendages each have a lateral projection in *C. zombaensis*, but the lateral lobes are nearly parallel-sided and the inferior appendages lack lateral projections in *C. somereni*. *Chimarra uvirana* (Marlier 1951), Democratic Republic of the Congo, has a similar posteroapical phallic spine but the anteriorly situated spines are considerably shorter and the posteroventral spine is elongate with a blunt apex.

Description, male. Colour (in alcohol): Head brown, warts pale brown; margins of ocelli black, eyes brown; thorax brown, warts pale brown; forewings dark brown; hind wings brown; abdomen brown. Forewings each 6.0 mm (n=1), length over width ratio 3.5; small pale hyaline spots distributed as in Fig. 7; discoidal cell 3x longer than wide, originating immediately before mid length of wing; median cell shorter than discoidal cell. Base of fork I originating after radial cross-vein at distance equal to length of cross-vein *r*; nygma situated at base of fork II; fork III 4 times longer than its width. Hind wings each 4.5 mm (n=1), length over width ratio 2.7; anterior margin strongly curved.

Male genitalia: Segment IX with pair of posterodorsal processes and pair of posteroventral processes; posterodorsal processes sharply triangular in lateral view, situated immediately below preanal appendages, sclerotized, darkly pigmented, apex setose; posteroventral processes almost trapezoidal in lateral view, large, sharply triangular in lateral view. Preanal appendages each directed dorsad, almost circular in lateral view, situated at mid height of base of tergum X; with scattered setae. Tergum X divided into pair of lateral lobes and pair of mesal lobes; each lateral lobe wide and sharply triangular in lateral view with darkly sclerotized process at mid length of dorsal margin simple and rounded in lateral view, causing tergum X to appear bifurcate in dorsal view; in dorsal view lateral lobe narrow, partly covering its mesal lobe, apically pointed; mesal lobes wide and blunt in lateral view, apically rounded and diverging in dorsal view. Inferior appendages each with sparse setae laterally on apical half, almost parallel-sided in lateral view, with sub-apical projection located at 4/5ths of its length and pointing ventrolaterad; in dorsal and ventral views inner margins of inferior appendages deeply concave, strongly sclerotized; each with apex narrow and sharply curving mesad in ventral and dorsal views and slightly beak-shaped in dorsal view. Phallic apparatus with bulbous anterior half about twice as high and wide as posterior half; apex bending posteroventrad. Phallic apparatus with anterior pair of long, slender endothecal spines parallel in their retracted position, smoothly curved ventrad in lateral view. Single apical endothecal spine almost straight in lateral view, except bent dorsad in right angle immediately before apex.



FIGURES 2–5. Heads, dorsal. 2—*C. zombaensis*, new species, holotype; 3—*C. flaviseta*, new species, holotype; 4—*C. psittaca*, new species, holotype; 5—*C. calidapectoris*, new species, holotype.

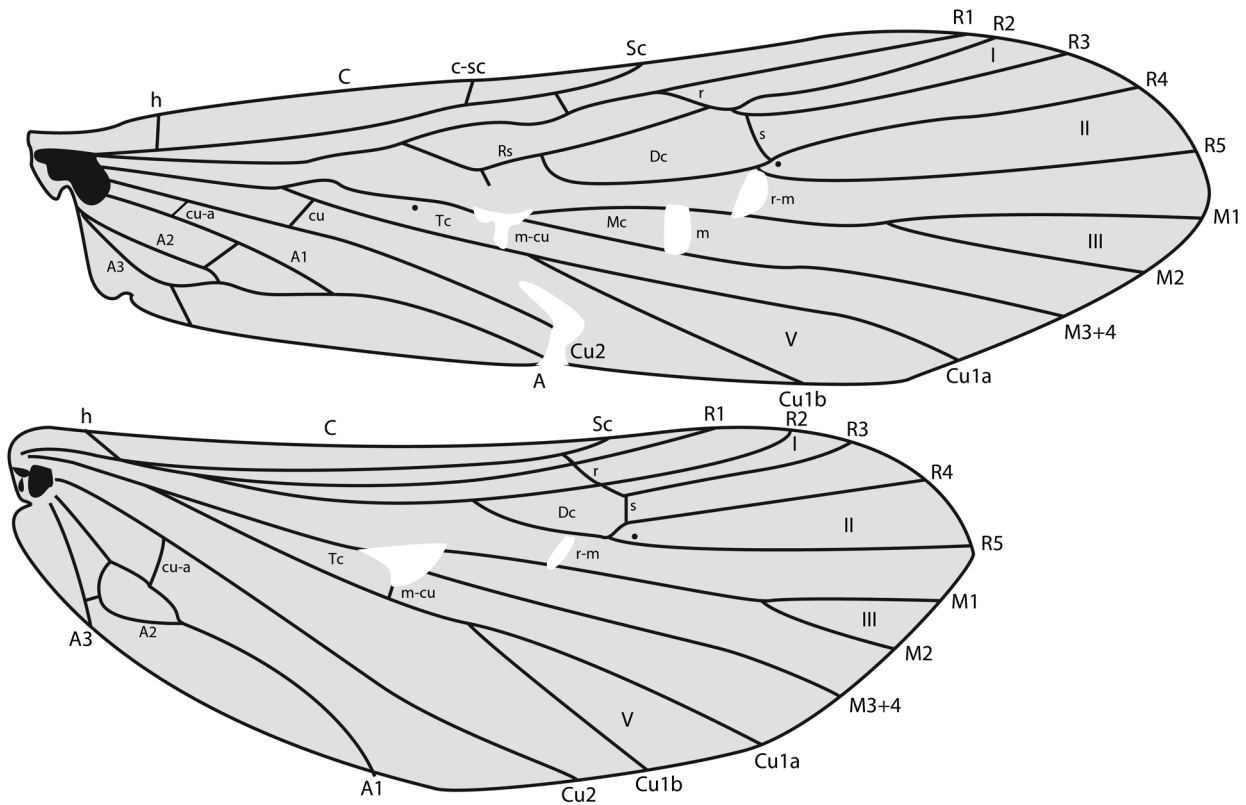


FIGURE 6. Venation characters of a hypothetical *Chimarra* species. Right forewing (upper) and right hind wing (lower), dorsal. Abbreviations based on Comstock–Needham (1898) and Johanson & Oláh (2012): C = costa, Sc = subcosta, R1–5 = radius 1–5, M1–4 = media 1–4, Cu1a = anterior branch of cubitus 1, Cu1b = posterior branch of cubitus 1, Cu2 = cubitus 2, A1–3 = anal veins 1–3, h = humeral crossvein, c-sc = costa-subcosta crossvein, r = radial crossvein, s = sectorial crossvein, r-m = radial-median crossvein, cu = cubital crossvein, cu-a = cubital-anal crossvein, Rs = radial sector, Dc = discoidal cell, Mc = median cell, I–V = forks 1–5.

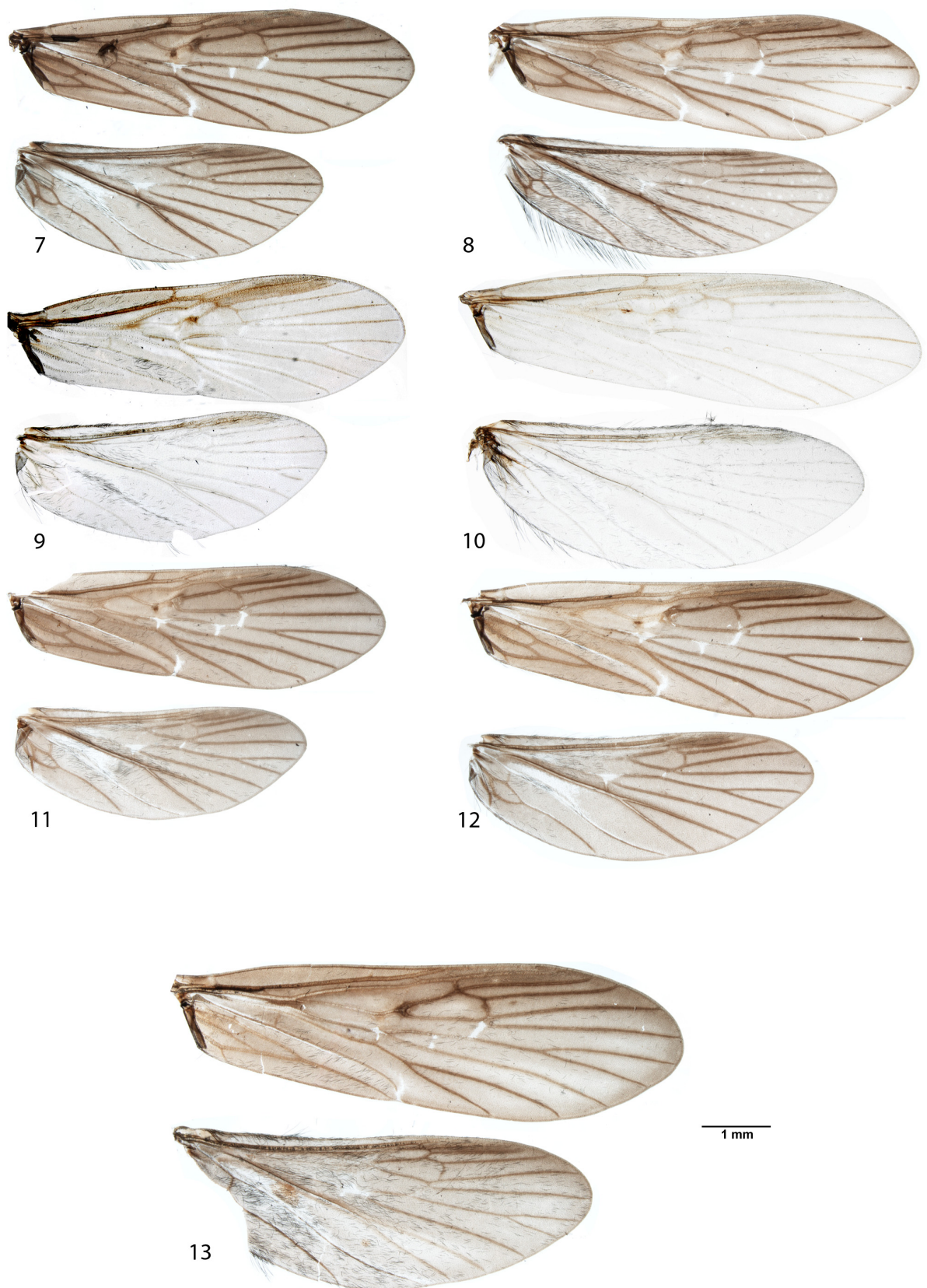
Male holotype: Malawi: Southern Region: Zomba, Old Naisi Road, above old parliament building, John Wilson's garden, S15.37091°, E35.32430°, 1,030 m, [15] November 2012, leg. M. Espeland, S. Dupont and R. Murphy (Fig. 1, locality #1).

Etymology. *Zombaensis* named after the type locality Zomba.

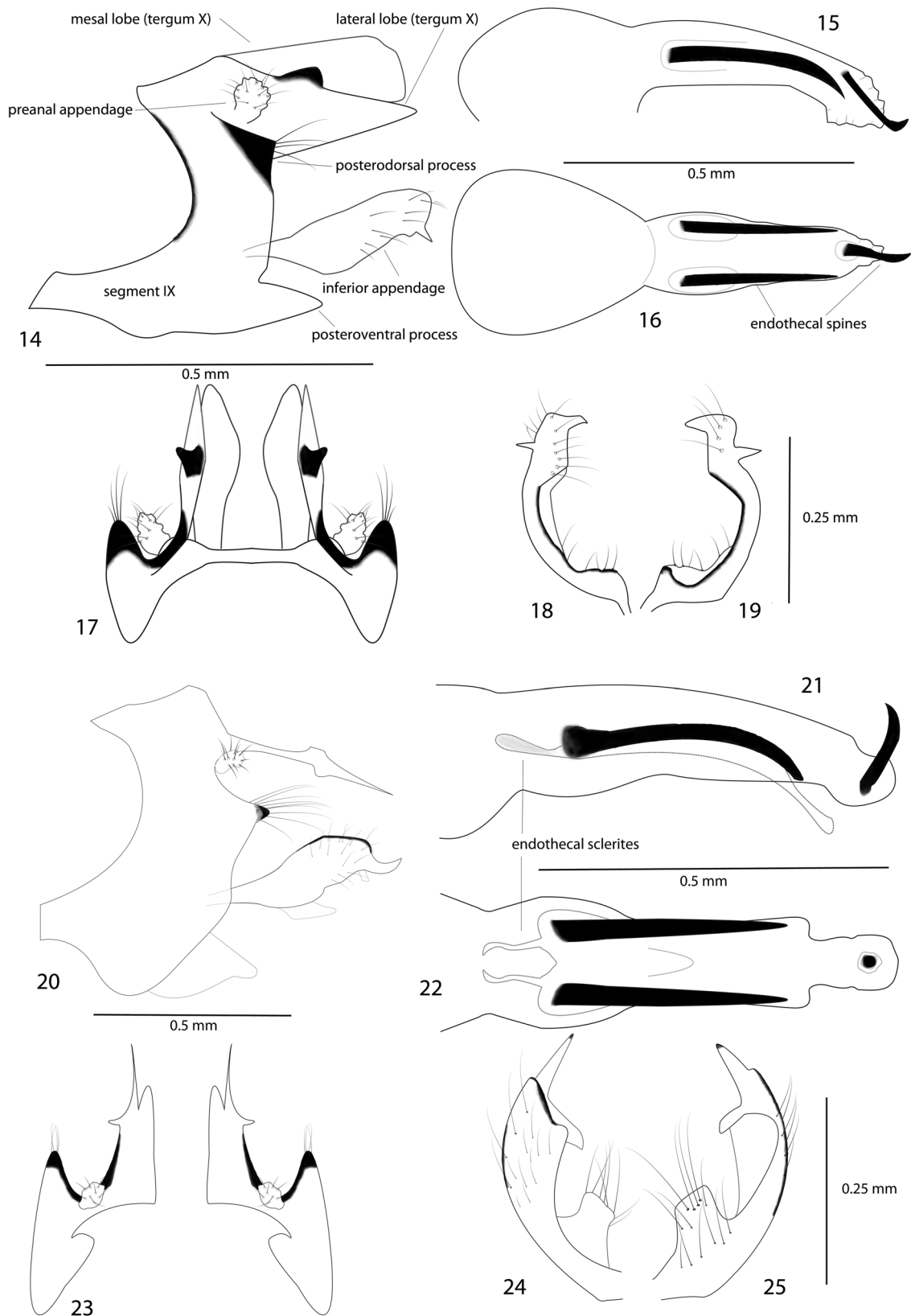
***Chimarra flaviseta*, new species**

(Figs 3, 8, 20–25)

Diagnosis. The male of this species is similar to that of *C. zombaensis*, new species, by the presence of two long anterior endothelial spines and a single apical endothelial spine in the phallus. It can be distinguished from *C. zombaensis* by the presence of tufts of yellow setae on the head and thorax of *C. flaviseta* (such hairs are absent from *C. zombaensis*, Fig. 2). In the genitalia, the phallus also resembles that of *C. somereni*, with a pair of long anterior phallic spines and a single, shorter and more evenly curved phallic spine apically, differing in this respect from *C. zombaensis* in that the apical spine of *C. flaviseta* and *C. somereni* is without an acute angular hook apically. *Chimarra flaviseta* is distinguished from *C. somereni* also by the inferior appendages each having a more prominent rectangular mesobasal process (with two short triangular mesobasal processes on each inferior appendage of *C. somereni*). *Chimarra uvirana* also has an evenly curved apical endothelial spine but the anterior endothelial spines are shorter in that species. Unlike other species, the phallus of *C. flaviseta* has an apicoventral spatulate process and each inferior appendage has a dorsally curving and pointed process at its apex.



FIGURES 7–13. Right wing, dorsal. 7—*C. zombaensis*, new species, holotype; 8—*C. flaviseta*, new species, holotype; 9—*C. chichewa*, new species, holotype; 10—*C. circumverta*, new species, holotype; 11—*C. mulanjae*, new species, holotype; 12—*C. psittacus*, new species, holotype; 13—*C. calidopectoris*, new species, holotype.



FIGURES 14–25. *Chimarra* new species, male genitalia. 14–19, *Chimarra zombaensis*, new species, holotype: 14—genitalia, left lateral; 15—phallic apparatus, left lateral; 16—phallic apparatus, dorsal; 17—genitalia, dorsal; 18—right inferior appendage, dorsal; 19—right inferior appendage, ventral. 20–25, *Chimarra flaviseta*, new species, holotype: 20—genitalia, left lateral; 21—phallic apparatus, left lateral; 22—phallic apparatus, dorsal; 23—genitalia, dorsal; 24—right inferior appendage, dorsal; 25—right inferior appendage, ventral.

Description, male: Colour (in alcohol): Head brown with tufts of yellow setae; eyes black, margins of ocelli black; warts pale brown; thorax brown with tufts of yellow setae; warts pale brown. Wings dark brown. Abdomen brown. Forewings each 6.0 mm (n=1), length over width ratio 3.6; pale hyaline spots distributed as in Fig. 8; posterior branch of Cu1b extending slightly inward toward origin of fork V; discoidal cell 3.8 times longer than wide, originating shortly before mid length of wing; median cell 2/3rds length of discoidal cell; fork I originating after cross-vein *r* at distance of 1.5 times length of cross-vein *r*; nygma situated at base of fork II. Fork III 4.8 times longer than its width. Hind wings each 5.0 mm (n=1), elongate, length over width ratio 3.0; anterior margin curved.

Genitalia: Segment IX with pair of posterodorsal processes and pair of posteroventral processes; posterodorsal processes triangular in lateral view, situated immediate below preanal appendages, each with darkly sclerotized and setose apex; posteroventral processes prominent, subtriangular in lateral view. Preanal appendages each situated at mid height of base of tergum X; setose, small, bean-shaped in lateral view, directed caudad. Tergum X horizontal, directed posterad; divided into lateral and mesal lobes fused up to 3/4ths of their length in dorsal view; apex of each mesal lobe hidden behind its lateral lobe in lateral view, narrowly rounded in dorsal view; apex of each lateral lobe sharply triangular and attenuated, needle-like in lateral and dorsal views, each with barb-like lateral process at mid length of segment. Inferior appendages each with narrow base, sigmoid, apex with long posterior process curved dorsad; dorsal margin strongly sclerotized; scattered setae mainly on distal half laterally; in ventral and dorsal views with lateral margin strongly convex and apical process directed posterad to form L-shape with inner apex; setose inner process square. Phallic apparatus with pair of very long and basally broad, anterior endothecal spines, straight in ventral view, curving ventrad in lateral view; posterior apical endothecal spine about half as long as anterior spines, arising apicodorsally and evenly curving about 60° dorsad and anterad from mid length; endothecal sclerites present; heart-shaped in ventral view with slender and sinuous anterior processes, slightly curving ventrad into ventrally protruding spatulate process apically.

Male holotype: Malawi: Nyika: Juniper forest, S10.75127°, E33.88754°, 2240 m, light trap, 21–23 October 2012, Loc# Ma18, leg. M. Espeland, S. Dupont and R. Murphy (Fig. 1, locality #2).

Paratypes: Same data as holotype: 1 male, 3 females.

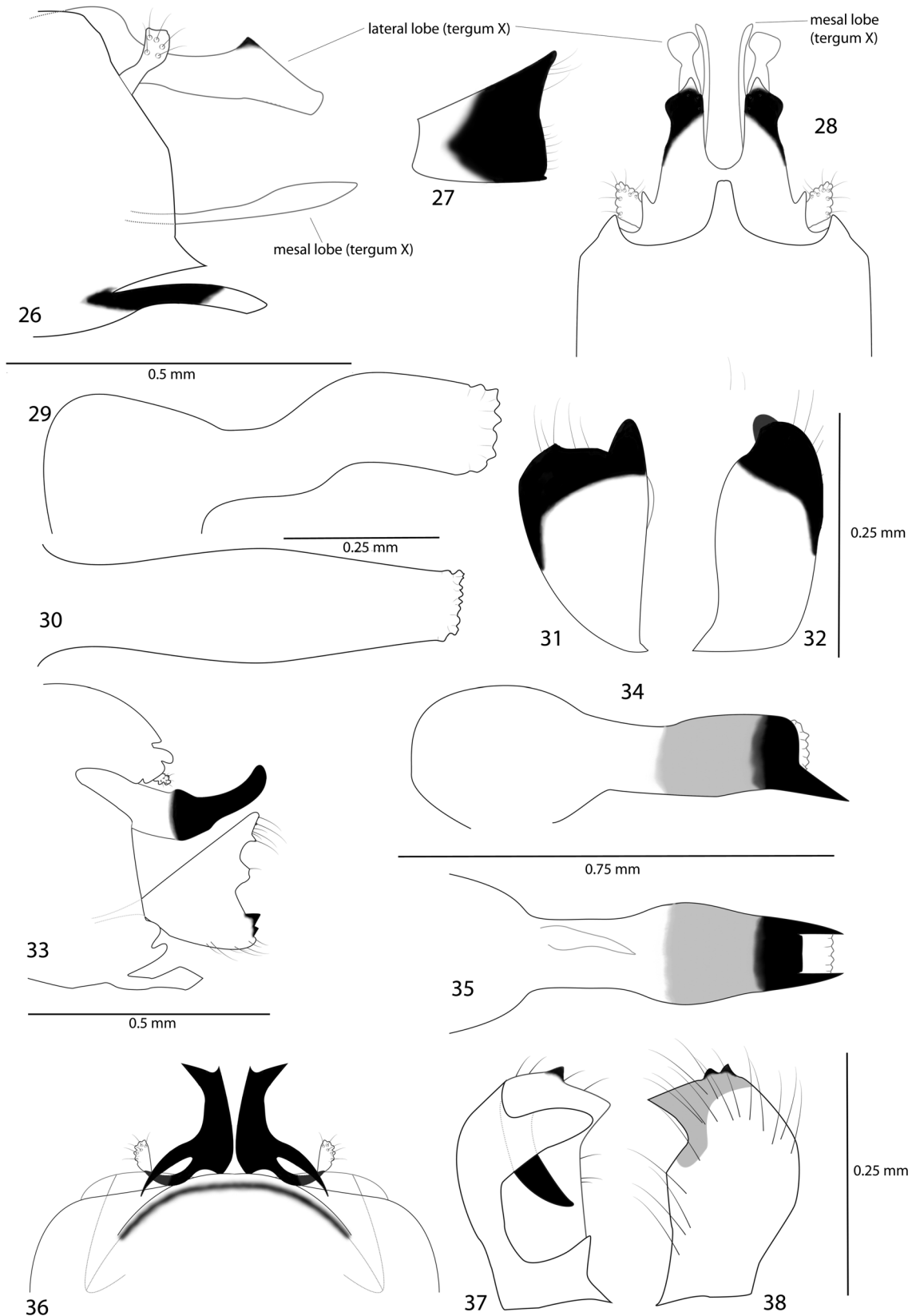
Etymology. *Flaviseta*, from Latin *flavi*, yellow, and *seta*, bristle, referring to the yellow tufts of setae on the head and thorax.

***Chimarra chichewa*, new species**

(Figs 9, 26–32)

Diagnosis. The male of this species is unique in having genitalia with a large vertical distance between the mesal and lateral lobes of tergum X; inferior appendages are short and partly heavily sclerotized, in lateral view they are triangular with very sharp dorsal projection; and phallic endothecal spines are absent. The lobes of tergum X and the posteroventral process resemble those of *C. tamsi* Mosely 1936, São Tomé Island, from which it is distinguished by the less sclerotized lobes of tergum X, longer ventral process of sternum IX, and more nearly triangular inferior appendages with only a short dorsal process in *C. chichewa*. *Chimarra chichewa* also has a darkly sclerotized dorsal tooth on each lateral lobe of tergum X; this tooth is obscure in *C. tamsi*.

Description, male: Colour (in alcohol): Head yellow; eyes black, margins of ocelli black; setal warts pale; antennae brown; thorax yellow, thoracic warts pale; forewings light brown, hind wings slightly paler than forewings; tarsi and tibial spurs brown; abdomen yellowish. Forewings each 6.0 mm (n=1), length over width ratio 2.9; hyaline spots distributed as in Fig. 9; discoidal cell short, 2x longer than wide, originating shortly before mid length of wing; median cell as long as discoidal cell; fork I originating distally of cross-vein *r* at distance equal to length of cross-vein *r*; nygma at base of fork II. Fork III with ratio of length over breadth 3.4. Hind wing each 4.5 mm (n=1); length over width ratio of 2.5; anterior margin slightly curved.



FIGURES 26–38. *Chimarra* new species, male genitalia. 26–32, *Chimarra chichewa*, new species, holotype: 26—genitalia, left lateral; 27—left inferior appendage, left lateral; 28—genitalia, dorsal; 29—phallic apparatus, left lateral; 30—phallic apparatus, dorsal; 31—right inferior appendage, dorsal; 32—right inferior appendage, ventral. 33–38, *Chimarra circumverta*, new species, holotype: 33—genitalia, left lateral; 34—phallic apparatus, left lateral; 35—phallic apparatus, dorsal; 36—genitalia, dorsal; 37—right inferior appendage, dorsal; 38—right inferior appendage, ventral.

Genitalia: Segment IX produced posteriorly on each side into posteroventral and dorsomesal processes; posteroventral process darkly sclerotized at base, originating from invagination of sternum IX, elongate, of uniform thickness, slightly curved with blunt end; dorsomesal process of segment IX triangular, apically blunt, partly covering segment X. Preanal appendages setose, elongate in lateral view, cone-shaped in dorsal view, dorsally partly covered by segment IX. Tergum X divided into pair of mesal lobes and pair of lateral lobes; mesal lobes of tergum X displaced ventrally and situated between inferior appendages, each narrow, elongate and with spatula-shaped apex; lateral lobes each wide, with dorsal sclerotized, sharp tooth; apex blunt in lateral view; outer margins sclerotized at mid length and bulbous posteriorly in dorsal view. Inferior appendages each quadrate in lateral view, with apicodorsal acute projection directed mesad in dorsal view and posterodorsad in lateral view, especially darkly pigmented in distal 3/4ths, fringed with few setae along posterior margin. Phallic apparatus sinuous in lateral view, without visible spines; anteriorly angled ventrad; posteriorly with blunt membranous apex.

Male holotype: Malawi: Mulanje: Ruo River below power station, S15.97188° E35.65463°, 870 m, light trap, 12 November 2012, Loc# Ma40a, leg. M. Espeland, S. Dupont and R. Murphy (Fig. 1, locality #3).

Paratypes: Same data as holotype: 1 female. Same data as holotype, except 9 November 2012, Loc# Ma40: 1 female.

Etymology. *Chichewa*, named after the national language of Malawi.

Chimarra circumverta, new species

(Figs 10, 33–38)

Diagnosis. The male of this species is distinguished from those of other described Afrotropical species by the presence of strongly sclerotized lateral lobes of tergum X, forming a complex of sharply pointed structures curved dorsad and anterad. The inferior appendages are most similar to those of *C. bertrandi* Scott 1974, from Zimbabwe, each with a prominent dorsomesal process, however the dorsomesal process of *C. circumverta* is blunt in contrast to the sharp process of *C. bertrandi*. The inferior appendages of *C. circumverta* each also possess a second mesal process, absent in *C. bertrandi*, partly covered by the dorsomesal process.

Description, male: Colour (in alcohol): Head yellowish; antennae light brown; head setal warts light brown; thorax yellowish; thoracic setal warts light brown; terga light brown; wings pale yellow; foretibiae, -tarsi and -tibial spurs light brown, forefemora and -coxae and other legs yellowish; abdomen yellowish. Forewings each 6.5 mm (n=4) long, length over width ratio 3.2; barely visible opaque, hyaline spots distributed as in Fig. 10, Y-shaped indentation present anteriorly; discoidal cell twice as long as wide, originating shortly before mid length of wing; median cell shorter than discoidal cell; fork I originating after crossvein *r* at distance equal to 1.5 times length of crossvein *r*; fork III twice as long as wide. Hind wings each 5.3 mm (n=4), length over width ratio 2.8; anterior margin slightly curved.

Genitalia: Segment IX with two posteroventral processes elongate, slightly sigmoid, distally robust. Preanal appendages each minute, ellipsoid, setose, partly concealed by tergum IX in lateral view. Tergum X divided into pair of heavily sclerotized, black lobes directed caudad and then curving dorsolaterad in dorsal and lateral views; complex of 2 pairs of basal branches curving laterad with sharp apices; posterodorsal margin of segment IX darkly sclerotized. Inferior appendages each triangular, broad basally, tapered to acute apicodorsal angle in lateral view; posteroventral margin with sharp, darkly pigmented teeth-like processes; in dorsal view large, thumblike dorsomesal process partly covering large, sharp, dark sclerotized second mesal process; in ventral view apicoventral corner of each inferior appendage sharply pointed and triangular, heavily sclerotized; scattered setae on apicoventral surface and apical margins. Phallic apparatus with anterior half bulbous, slightly sclerotized subapically, apical 1/3rd strongly sclerotized, especially apical 1/8th and pair of sharp apical phallosomal spines directed slightly ventrad; short and thick endothelial spine present at mid length of retracted phallic apparatus.

Male holotype: Malawi: Mulanje Mountains: stream near Minunu hut, S15.92481°, E35.63856°, 2014 m, light trap, 11 November 2012, Loc# Ma41a, leg. M. Espeland, S. Dupont and R. Murphy (Fig. 1, locality #4).

Paratypes: Same data as for holotype, except 10 November 2012: 10 males, 5 females.

Etymology. *Circumverta* from the Latin *circum*, around, and *verta*, turned, describing the elaborate and curved lobes of tergum X as well as the inward directed mesal process on each inferior appendage.

Chimarra mulanjeae, new species

(Figs 11, 39–44)

Diagnosis. The male of this species is separated from those of other Afrotropical species by the presence of pairs of short, thick, curved phallic spines. The posterior phallic spines of *C. gassa* Johanson 2010, Madagascar, are similar to those of *C. mulanjeae*, but the anterior phallic spines of *C. gassa* are less sclerotized and lack the dorsal and ventral curving as seen in *C. mulanjeae*; and the inferior appendages of this new species are more elongated, with divided posterior process. The inferior appendages are also similar to those of *C. psittaca*, new species, but in *C. mulanjeae* the inferior appendages have a divided apical process and a blunt subapicomeresal process directed mesad.

Description, male: Colour (in alcohol): Head yellow with dark brown triangle between ocelli, eyes black; head setal warts light brown; antennae brown; thorax yellow; thoracic setal warts light brown; wings, tibia, tibial spurs, tarsi and abdomen dark brown. Forewings each 5.5 mm (n=3) long, length over width ratio 3.0; small; pale hyaline spots distributed as in Fig. 11; discoidal cell about 3 times longer than wide, originating shortly before mid length of wing, median cell slightly shorter; base of fork I originating after crossvein *r* at distance half length of crossvein *r*; nygma situated at base of fork II; fork III 4.4 times longer than its width. Hind wings each 4.5 mm (n=3) long, length over width ratio 2.6; anterior margin strongly curved.

Genitalia: Segment IX ventrally with distinct posteroventral process, posterolateral margins each with small triangular projection immediately beneath preanal appendages. Preanal appendages large, oval, with lobate to crenate margins. Tergum X divided into two pairs of lobes; mesal lobes large, in lateral view almost as tall as long, quadrate; in dorsal view each divided apically into two acuminate branches; lateral lobes sclerotized along lateral margins, in dorsal view curved laterad distally, each with strong sclerotized lateral tooth at mid length. Inferior appendages nearly bean-shaped in lateral view, each with shallow triangular basoventral process; appendages bifurcate apically in dorsal view; margins fringed with setae, inner margins darkly sclerotized; blunt, short, subapical process curved mesad in ventral view. Phallic apparatus with anterior half bulbous; in lateral view distal half parallel-sided; in ventral view distal half narrowing toward apex; with two pairs of spines: anterior pair equal in length with dorsal spine curving dorsad and ventral spine curving ventrad; posterior pair smaller and about half as long as anterior spines, each slightly curved laterad.

Male holotype: Malawi: Mulanje: Ruo River below power station, S15.97188°, E35.65463°, 870 m, light trap, 12 November 2012, Loc# Ma40a, leg. M. Espeland, S. Dupont and R. Murphy (Fig. 1, locality #5).

Paratypes: Same data as holotype: 3 males, 1 female.

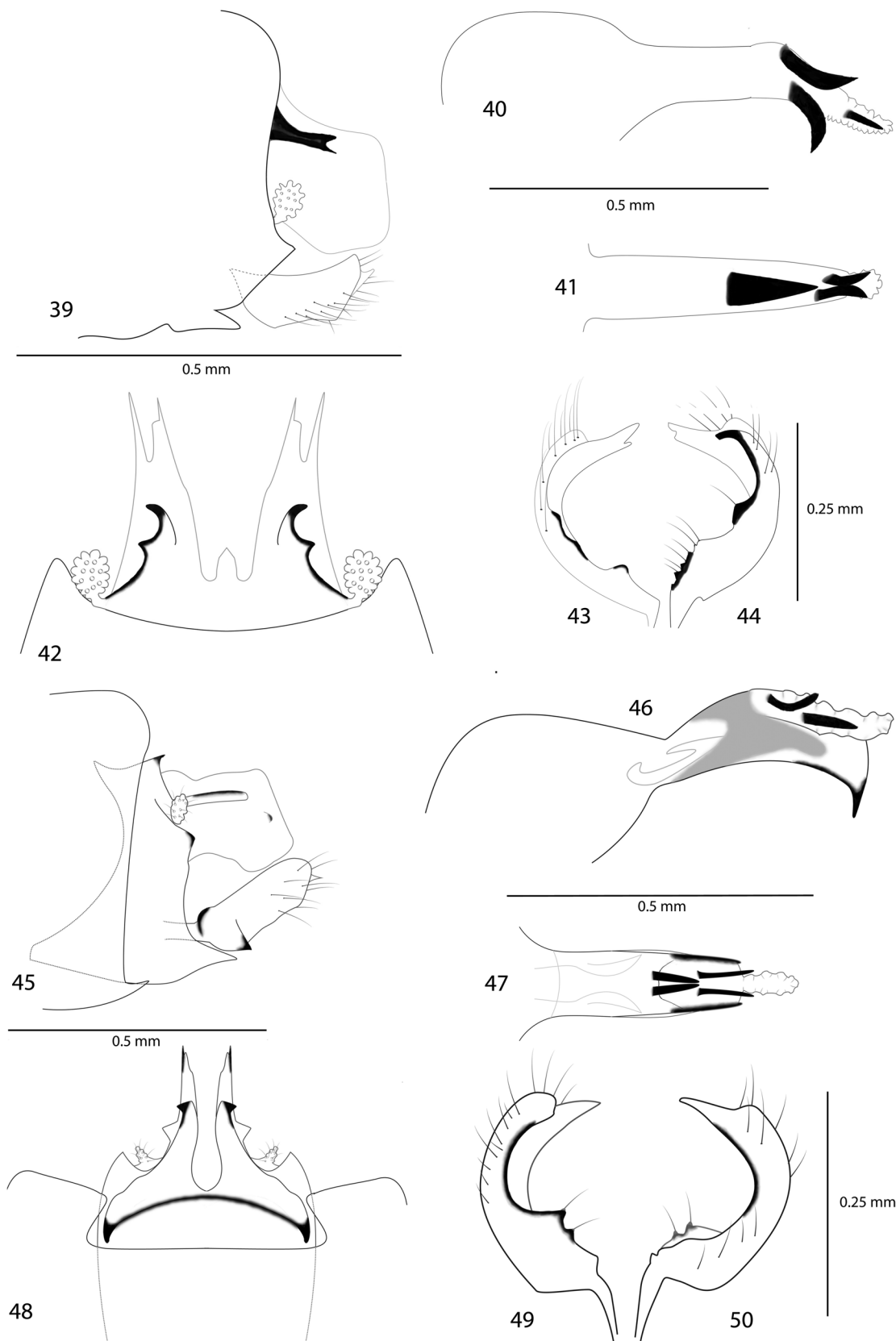
Etymology. *Mulanjae*, after the region of the type locality: Mulanje.

Chimarra psittacus, new species

(Figs 4, 12, 45–50)

Diagnosis. The male of this species has inferior appendages similar to those of *C. mulanjeae*, new species, but is distinguished by the posteroventral process of segment IX that is undivided at the apex in *C. psittacus*. The presence of a beak-like phalotheca with an irregularly sclerotized distal half and ventrally situated tubular endotheca distinguishes the species from other Afrotropical species. It is also similar to *C. mulanjeae* and *C. gassa* in their phallic spine composition and their apicoventrally truncate mesal lobes of tergum X, but the spines of *C. psittacus* are smaller and less curved than in those species. The mesal lobes of tergum X are thin and sharp in dorsal view in *C. psittacus* in contrast to the rounded apices in *C. gassa* and they are not divided apically in dorsal view as in *C. mulanjeae*.

Description, male: Colour (in alcohol): Head yellow; dark brown triangle located between ocelli, eyes light brown; head setal warts light brown; antennae dark brown; pronotum yellow; meso- and metanota brown; wings dark brown; tibiae and tarsi light brown; tibial spurs dark brown; abdomen brown. Forewings each 6.1 mm (n=4), length over width ratio 3.2; pale hyaline spots located as in Fig. 12; discoidal cell about 3 times longer than wide, originating shortly before mid length of wing; median cell two-thirds as long as discoidal cell; fork I originating after crossvein *r* at distance equal to length of crossvein *r*; nygma situated at base of fork II; fork III 4.2 times longer than its width. Hind wings each 4.8 mm (n=4), length over width ratio 2.7; anterior margin strongly curved.



FIGURES 39–50. *Chimarra* new species, male genitalia. 39–44, *Chimarra mulanjeae*, new species, holotype: 39—genitalia, left lateral; 40—phallic apparatus, left lateral; 41—phallic apparatus, dorsal; 42—genitalia, dorsal; 43—right inferior appendage, dorsal; 44—right inferior appendage, ventral. 45–50, *Chimarra psittacus*, new species, holotype: 45—genitalia, left lateral; 46—phallic apparatus, left lateral; 47—phallic apparatus, dorsal; 48—genitalia, dorsal; 49—right inferior appendage, dorsal; 50—right inferior appendage, ventral.

Genitalia: Segment IX with three protruding processes along posterior margin in lateral view: posterodorsal process thorn-shaped in lateral view, darkly sclerotized; process on each side slightly above mid height of segment triangular, with darkly sclerotized apex; posteroventral process large, concave dorsally, with pointed apex. Preanal appendages small, oval in lateral view, cone-shaped in dorsal view. Tergum X divided into two pairs of lobes; mesal lobes large, almost as tall as long in lateral view, with right-angled dorsal margin and truncate apicoventral margin; in dorsal view each mesal lobe with thin, sharply pointed, sclerotized apex and with triangular process situated laterally at one-third length; lateral lobes small, each with darkly sclerotized apicolateral barb; posterodorsal margin of segment IX darkly sclerotized. Inferior appendages each long, nearly oval in lateral view, with darkly sclerotized and convex basodorsal bulge and with darkly sclerotized, triangular basoventral process sharp, curving mesad; distal margins fringed with setae, mesal margins darkly sclerotized. Phallic apparatus bulbous anteriorly, tubular and irregularly sclerotized posteriorly with ventral part of apex curving ventrad, sharply pointed in lateral view, strongly sclerotized; endotheca with two pairs of sclerotized spines: anterior pair curved dorsad in lateral view, straight in ventral view; posterior pair straight in lateral and ventral views; membranous endothecal apex tube-shaped; phallosomal spines not strongly sclerotized.

Male holotype: Malawi: Nyika: North Rukuru River at Chisanga Bridge, S10.53832°, E33.69138°, 1828 m, light trap, 27-28 October 2012, Loc# Ma32, leg. M. Espeland, S. Dupont and R. Murphy (Fig. 1, locality #6).

Paratypes: Same data as holotype: 6 males, 3 females.

Etymology. *Psittacus*, from Latin, “parrot,” a masculine noun in apposition to *Chimarra*, referring to the parrot-beak-shaped phallosoma.

***Chimarra calidopectoris*, new species**

(Figs 5, 13, 51–56)

Diagnosis. The species is unique in the distally widened and apically hooked shape of the inferior appendages, the narrow tergum X in lateral view slightly bending ventrad after mid length and with complex processes along dorsal and lateral surfaces, and the heart-shaped apex of the phallus in dorsal view. It resembles *Chimarra intexta* Mosely 1931, from Sierra Leone, which also possesses hook-shaped processes on the inferior appendages, similar lateral lobes of tergum X, lateral phallosomal processes and a pair of small phallic spines. However, the inferior appendage processes of *C. calidopectoris* are more strongly curved and elongate and the quadrate dorsal process of each lateral lobe of tergum X of *C. calidopectoris* is not present in *C. intexta*. The posteroventral process of segment IX in *C. calidopectoris* is large and triangular, where the posteroventral process of *C. intexta* is small, elongate and rounded.

Description, male: Colour (in alcohol): Head orange; head setal warts pale; antennae light brown; eyes and margins of ocelli black; thorax orange; thoracic setal warts pale; wings brown; tibiae and tarsi light brown; tibial spurs dark brown; abdomen brown. Forewings each 7.0 mm (n=2), length over width ratio 3.3; small pale hyaline spot stretching from arculus to halfway between Cu2 and posterior branch of Cu1b; discoidal cell about 3 times longer than wide, originating shortly before mid length of wing; median cell half as long as discoidal cell; fork I originating at crossvein *r*, wide at base and end, slightly constricted at middle; nygma situated close to base of fork II. Fork III 4.5 times longer than wide. Hind wings each 5.8 mm (n=2), length over width ratio 2.7; anterior margin curved.

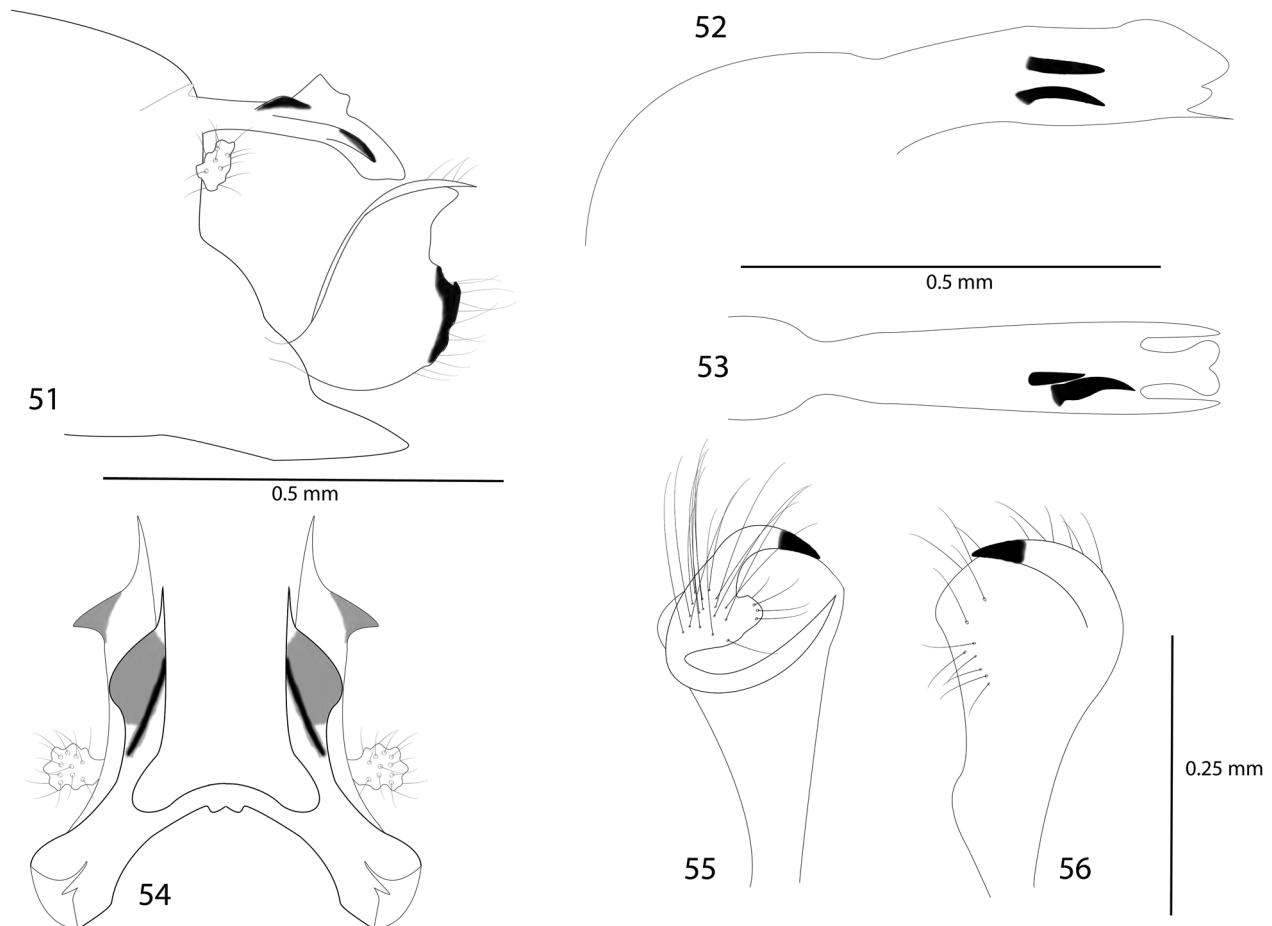
Genitalia: Segment IX with large, triangular posteroventral process. Preanal appendages almost oval in lateral view, circular in dorsal view, setose, situated immediately below base of tergum X. Tergum X divided into two pairs of lobes; in lateral view lateral lobes each with erect quadrate dorsal process at mid length and lobe curving ventrad after mid length; lateral lobes in dorsal view each with subapicolateral, barb-like, slightly sclerotized process; lateral and mesal lobes each with acuminate apex; in dorsal view mesal lobes with convex, semisclerotized subapicolateral process. Tergum IX apical dorsolateral corners curving dorsad, each divided apically into long and short sharp processes directed posterad. Inferior appendages each in lateral view fist-shaped, with dorsal projection thumb-like; posteroventral margin darkly sclerotized; in dorsal view anterior and posterior processes hooked, strongly curved mesad; posterior process with darkly sclerotized apex, visible in ventral view; setae concentrated on intermediate area between processes. Phallic apparatus with anterior part swollen; pair of endothecal spines situated about three-quarters distance from anterior end, as long as narrowest part of phallic apparatus in lateral

view; in lateral view ventral spine curved ventrad, dorsal spine straight; posterior part of phallosome divided into pair of poorly-sclerotized apicoventral spines beside and beneath membranous posterior end of endotheca.

Male holotype: Malawi: Mulanje Mountains: stream near Minunu hut, S15.92481°, E35.63856°, 2014 m, light trap, 10 November 2012, Loc# Ma41, leg. M. Espeland, S. Dupont and R. Murphy (Fig. 1, locality #7).

Paratypes: Same data as holotype: 2 males.

Etymology. *Calidopectoris*, from Latin *calida*, warm, and *pectoris*, heart, refers to the nickname of Malawi: “The Warm Heart of Africa”.



FIGURES 51–56. *Chimarra calidopectoris*, new species, holotype. 51—genitalia, left lateral; 52—phallic apparatus, left lateral; 53—phallic apparatus, dorsal; 54—genitalia, dorsal; 55—right inferior appendage, dorsal; 56—right inferior appendage, ventral.

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