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Four new species of *Megarthrus* CURTIS, 1829 (Coleoptera, Staphylinidae, Proteininae) from the Bale Mountains, southern Ethiopia

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Four new species of *Megarthrus* from the Bale Mountains, southern Ethiopia, are described: *M. balensis*, *M. danieli*, *M. harennaensis* and *M. oromo*. New records are given for *M. falasha* CUCCODORO & LÖBL, *M. negus* CUCCODORO & LÖBL, and *M. rougemonti* CUCCODORO & LÖBL. The water loading behaviour is reported in *M. balensis*, *M. danieli*, *M. negus* and *M. rougemonti*. The *Megarthrus* species from the Republic of Ethiopia are keyed.

Keywords: Staphylinidae, Proteininae, *Megarthrus*, taxonomy, Ethiopia.

INTRODUCTION

Megarthrus are small saprophagous rove-beetles. They are apparently tied to temperate or mountain habitats. The genus is distributed worldwide, except in Madagascar, New Zealand, Australia and southern South America. In Africa South of Sahara, it is represented by 38 species distributed in four geographically distinct areas (CUCCODORO & LÖBL, 1995): 1) South Africa and Lesotho (1 species), 2) the mountains of the region of the Great Lakes (27 species), 3) the Ethiopian Highlands (9 species) and 4) Cameroon (2 species). Only *M. wittei* CAMERON, 1950, recorded from Cameroon, Zaire and Kenya, is known to occur in more than one of these areas. Three *Megarthrus* species were recorded from the Bale Mountains in the southern Republic of Ethiopia, and they are apparently endemic to the range.

During an expedition to the Bale Mountains National Park, which I carried out with my friend DANIEL ERNE in August 1998, we have collected significant additional material of *Megarthrus*. Seven species of *Megarthrus* were found: four new to science , which are described below, and one unknown from the Bale region. The species of *Megarthrus* from Ethiopia are keyed.

Specimens of four species were maintained alive for a few days. They performed water loading behaviour (CUCCODORO, 1995), as other members of the genus which were observed.

MATERIAL AND METHODS

The present study is based exclusively on adults. Methods used for dissecting specimens follow CUCCODORO & LÖBL (1995). Methods used for observing the water loading behaviour follow CUCCODORO (1999). Vegetation belts in the Bale Mountains are named according to YALDEN *et al.* (1986).

The term frons, as used in the present study, refers to the area anterior of the U-shaped impression, the vertex to the area behind it. The presence of the patches of sensilla on the antennomeres 6 to 10 is observed on slides. Abdominal sternites

and tergites are counted from the first morphological segment. Measurements and ratios are defined as follows: length of specimens = interval from middle of anterior pronotal margin to inner apical angle of elytron; width of specimens = maximum pronotal width; AL = antennal length / pronotal length; EL = elytral sutural length / pronotal length; ET = elytral sutural length / shortest interval between sutural margin and lateral edge of elytron in dorsal view; EW = shortest interval between sutural margin and outer apical angle of elytron in dorsal view / shortest interval between sutural margin and humeral angle of elytron in dorsal view; EY = interval between posterior ocular margin and apex of frons in dorsal view / interval between anterior and posterior ocular margins in dorsal view; GT = posterior width of gula / median length of gula; GW = width of neck / posterior width of gula; HW = maximum pronotal width / interval between posterior ocular margins in dorsal view; ML = median metasternal length / median mesosternal length; MP = length of segment 4 of maxillary palpus / length of segment 3 of maxillary palpus; PT = maximum pronotal width / pronotal length; SP = maximum width of abdominal sternite 8 / width of the basal projection; TPF = interval between basal angle and tip of medioapical projection of female abdominal tergite 8 / lateral length of medioapical projection of female abdominal tergite 8.

Material examined (103 specimens) is deposited in the Muséum d'histoire naturelle, Geneva (MHNG) and in the National Museum, Addis Ababa (NMAA).

TAXONOMY

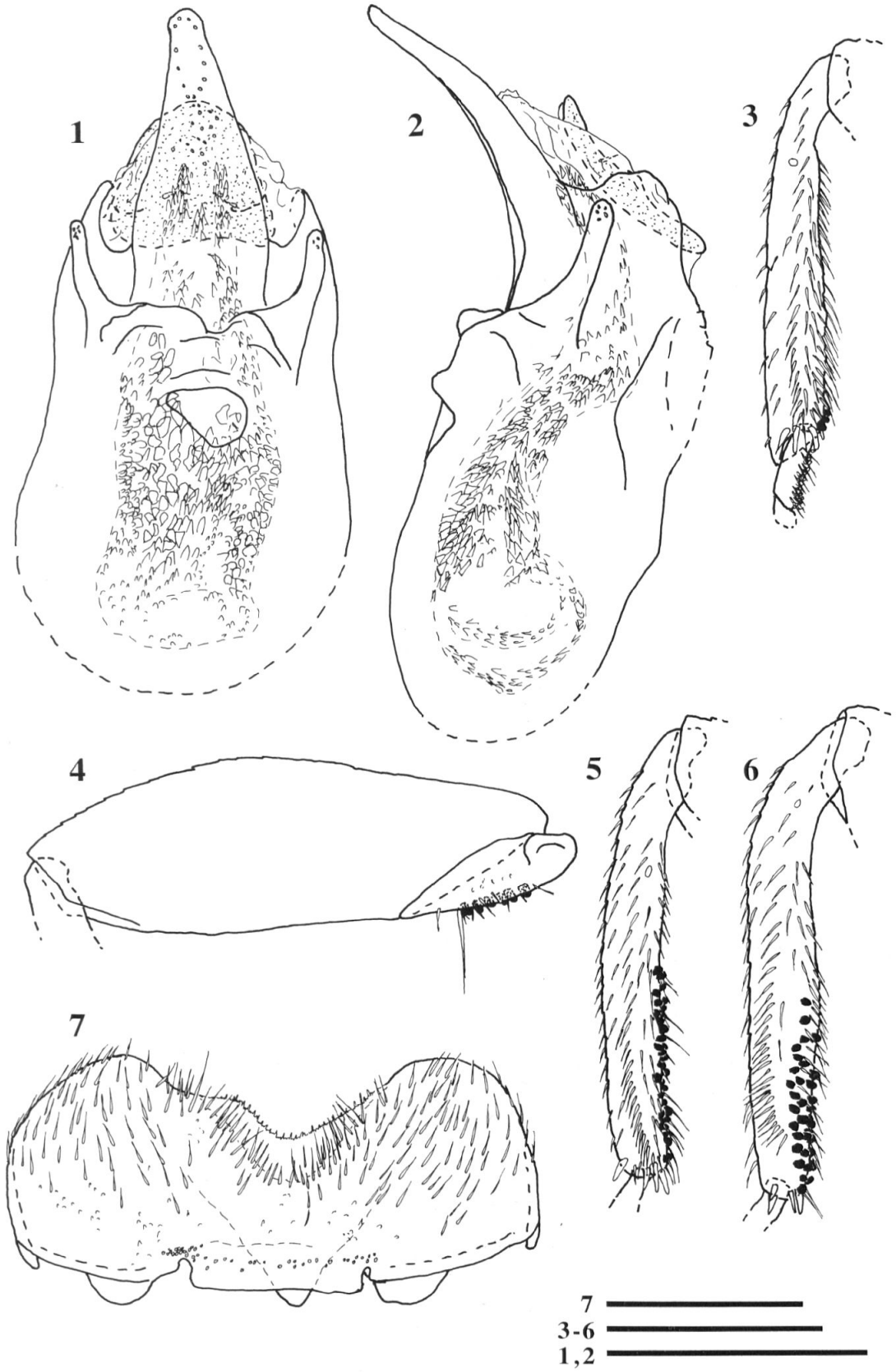
Most Ethiopian *Megarthrus* species are difficult to identify without reference to secondary sexual characters. Therefore, the sexes are keyed separately.

Males may be easily distinguished from females by the divided abdominal tergite 9, which is visible in ventral view. In addition, males bear peg-like setae on the ventral surface of the mesotibia.

Key to males

(not included *M. scotti* and *M. oromo* known in female sex only)

1 Protibia bearing peg-like setae (Figs 3, 17, 31) 2
– Protibia lacking peg-like setae 5
2 Apex of abdomen pointed (Fig. 38) 3
– Apex of abdomen rounded (Figs 14, 28) 10
3 Metatrochanter bearing peg-like setae ..... *M. abessinus* BERNHAUER (Kefa, Gonder, Shewa and Simen regions)
– Metatrochanter lacking peg-like setae 4
4 Protibia bearing peg-like setae grouped in field only on distal quarter (Fig. 31) ..... *M. harennaensis* sp. n. (Bale region)
– Protibia bearing peg-like setae grouped in field on more than distal half ..... *M. magnicaudatus* CUCCODORO & LÖBL (Bale and Gamo Gofa regions)
5 Metatrochanter bearing peg-like setae 6
– Metatrochanter lacking peg-like setae 7
6 Apex of abdomen truncate ..... *M. ras* CUCCODORO & LÖBL (Simen region)
– Apex of abdomen pointed ..... *M. falasha* CUCCODORO & LÖBL (Bale, Gojam, Kefa and Shewa regions)
7 Mesotrochanteral peg-like setae arranged in single row 8
– Mesotrochanteral peg-like setae arranged in double row 11



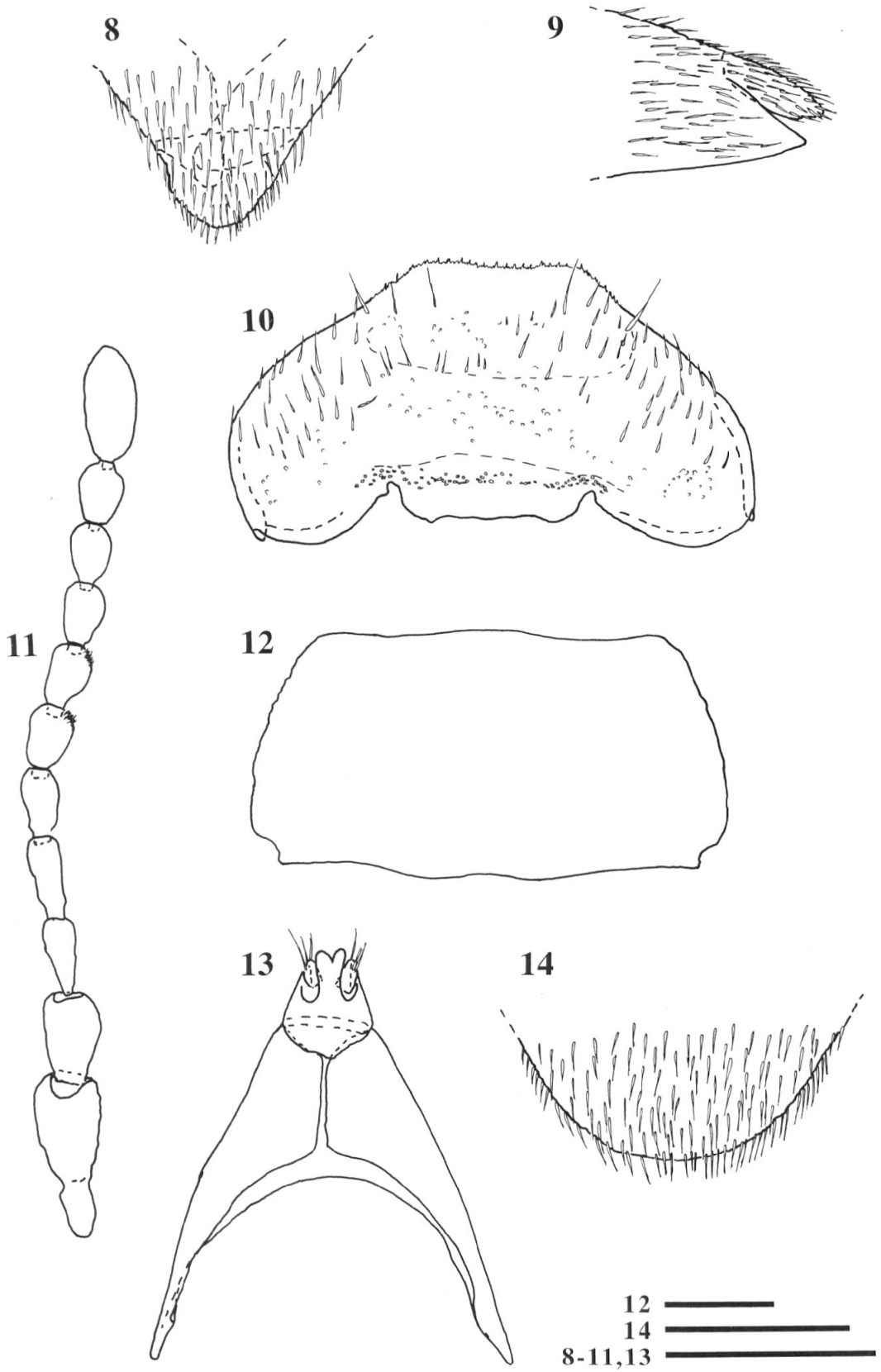
Figs 1–7: *Megarthrus balensis*, male. 1, 2: aedeagus, ventral and lateral; 3: protibia and protarsomere 1; 4: mesofemur (setae omitted) and mesotrochanter; 5: mesotibia; 6 metatibia; 7: abdominal sternite 8. Scale bars = 0.2 mm.

8 Metatibial peg-like setae arranged in single row .... *M. negus* Cuccodoro & Löbl (Bale and Gamo Gofa regions)
– Metatibial peg-like setae partially arranged in field 9
9 Metafemur not incrassate; aedeagal ventral wall with apical portion ridged medially ..... *M. simienensis* Fagel (Simen region)
– Metafemur incrassate; aedeagal ventral wall with apical portion grooved medially 10
10 Aedeagal ventral wall with apical portion arcuate in lateral view (Fig. 2) .... *M. balensis* sp. n. (Bale region)
– Aedeagal ventral wall with apical portion sinuate in lateral view (Fig. 16) ... . *M. danieli* sp. n. (Bale region)
11 Apex of abdomen pointed .. *M. clarkei* Cuccodoro & Löbl (Shewa region)
– Apex of abdomen rounded .... *M. rougemonti* Cuccodoro & Löbl (Arsi and Bale regions)

Key to females

(not included *M. ras* known in male sex only)

1 Inner apical angle of elytron conspicuously projecting (Fig. 49)..... ..... *M. oromo* sp. n. (Bale region)
– Inner apical angle of elytron not conspicuously projecting 2
2 Eighth abdominal tergite more than 8x as long as its medioapical projection ..... *M. falasha* Cuccodoro & Löbl (Bale, Gojam, Kefa and Shewa regions)
– Eighth abdominal tergite not more than 8x as long as its medioapical projection 3
3 Eighth abdominal tergite not more than 2x as long as its medioapical projection *M. magnicaudatus* Cuccodoro & Löbl (Bale and Gamo Gofa regions)
– Eighth abdominal tergite more than 2x as long as its medioapical projection 4
4 Medioapical projection of eighth abdominal tergite with tip forming a sharp angle 5
– Medioapical projection of eighth abdominal tergite with tip rounded, or forming a blunt angle 9
5 Medioapical projection of eighth abdominal tergite triangular 6
– Medioapical projection of eighth abdominal tergite not triangular 7
6 Elytron abruptly narrowed at base .... *M. scotti* Cuccodoro & Löbl (Gamo Gofa region)
– Elytron not abruptly narrowed at base ..... *M. danieli* sp. n. (Bale region)
7 Elytron abruptly narrowed at base .... *M. clarkei* Cuccodoro & Löbl (Shewa region)
– Elytron not abruptly narrowed at base 8
8 Antennomeres 3 and 4 conspicuously paler than antennomeres 5–11 .... *M. abessinus* Bernhauer (Kefa, Gonder, Shewa and Simen regions)
– Antennomeres 3 and 4 not conspicuously paler than antennomeres 5–11 .... *M. harennaensis* sp. n. (Bale region)
9 Antennomeres 3 and 4 conspicuously paler than antennomeres 5–11 .... *M. negus* Cuccodoro & Löbl (Bale and Gamo Gofa regions)
– Antennomeres 3 and 4 not conspicuously paler than antennomeres 5–11 . 10
10 Body predominantly blackish .... *M. rougemonti* Cuccodoro & Löbl (Arsi and Bale regions)
– Body predominantly dark brown 11



Figs 8–14: *Megarthrus balensis*. 8, 9: female, apex of abdominal tergite 8, dorsal and lateral; 10: female, abdominal sternite 8; 11: antenna; 12: pronotum; 13: female, valvifers, gonocoxal plate and styli, dorsal; 14: male, apex of abdominal tergite 8. Scale bars = 0.2 mm.

11 Pronotum 1.05–1.20 mm wide; eighth abdominal tergite not more than 4x as long as its medioapical projection ..... *M. simienensis* FAGEL (Simen region)
– Pronotum 0.75–0.90 mm wide; eighth abdominal tergite more than 4x as long as its medioapical projection ..... *M. balensis* sp. n. (Bale region)

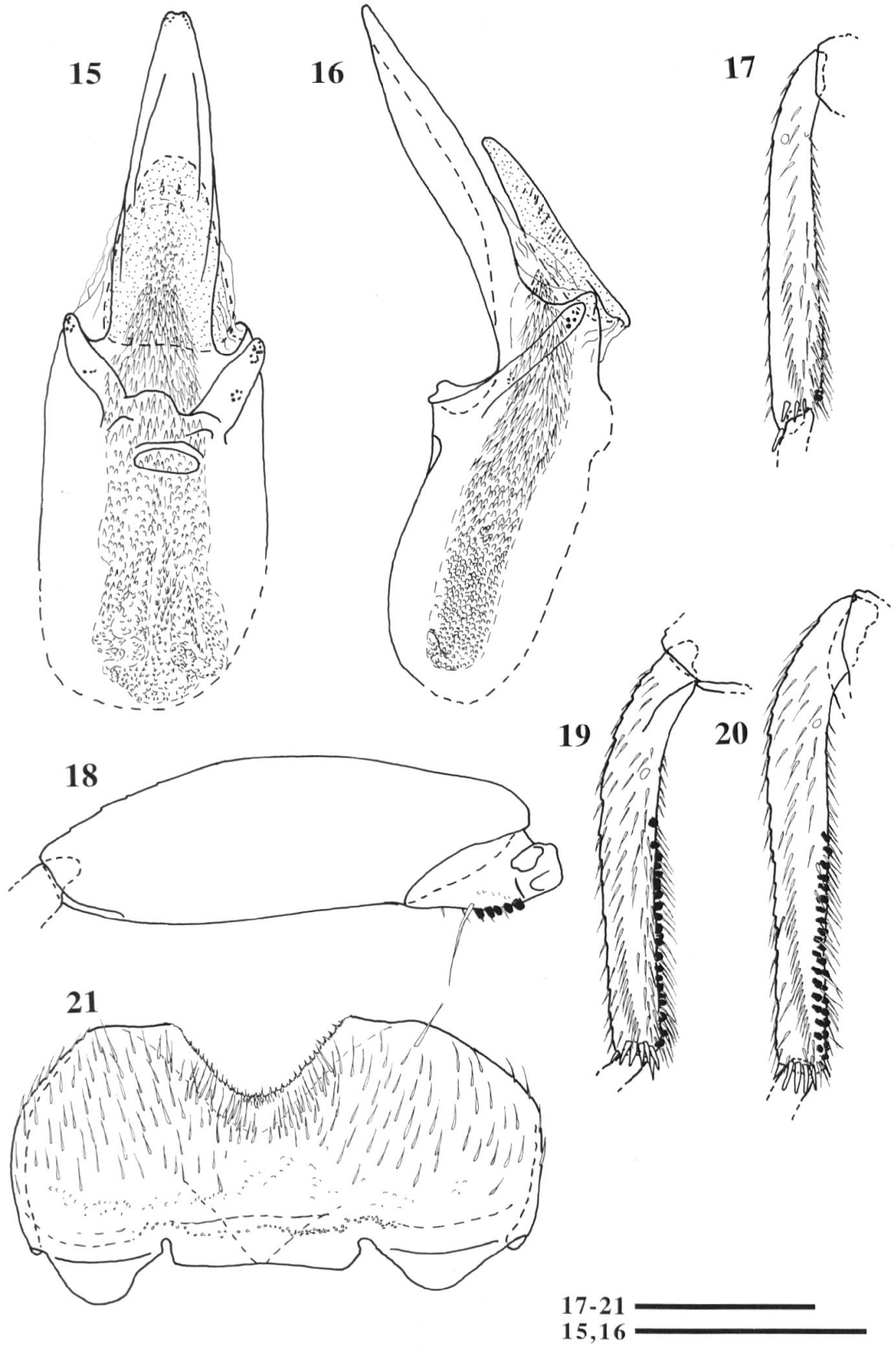
Megarthrus balensis sp. n. (Figs 1–14)

Holotype ♂: Ethiopia, Bale region, Bale Mountains National Park, Dinsho Hill, above National Park Headquarters, 3200 m, 12.viii.1998 (G. CUCCODORO & D. ERNE) # 2a, ex warthog excrements and fungi under isolated *Hagenia abyssinica*, MHNG.
Paratypes (13): same data as holotype, 2♂♂ and 9♀♀ in MHNG, 1♂ and 1♀ in NMAA.

Description. Length 1.20–1.45 mm; width 0.75–0.90 mm. Body predominantly dark brown, appendages slightly paler. Dorsal pubescence fairly uniform, on abdomen denser. Frontal setae converging, anteromedial portion of frons with setae oriented backwards. Elytral setae fairly straight, recumbent. Metasternal setae becoming sparser medioposteriorly and longer medioanteriorly, shorter than prosternal setae. Pubescence of abdominal sternites 4–7 becoming longer and denser near medioapical margins, with a pair of long subapical dark setae on each sternite. Foveopunctation moderate and dense on pronotum, elytra and anterior portion of pronotal hypomeron, fine and dense on abdomen; medioposterior portion of metasternum impunctate. Frons with granulation fine and sparse, on level with, or slightly raised above level of vertex, forming a blunt ridge above clypeus. Anterior frontal edge evenly convex. Frontal impression shallow in middle, laterally indistinct. Eye strongly convex, with highest point slightly below, or reaching, level of vertex; supra-ocular margin sinuate in dorsal view. Temple abruptly narrowed just behind eyes (CUCCODORO & LÖBL, 1995: Fig. 2g). Occipital ridge indistinct. Submentum flat, or weakly convex. Antenna as in Fig. 11; segments 3 and 4 slightly asymmetrical; short and dense pubescence present on antennomeres 5–11. Pronotum (Fig. 12) moderately convex in frontal view, with mesal portion weakly convex in lateral view. Pronotal disc moderately depressed along lateral edge, shallowly depressed beside medial groove, latter shallow, parallel-sided. Anterior prosternal margin bordered by irregular row of fine longitudinal ridges. Protrochanter lacking transverse ridge. Mesosternum with lateral portion of prepectal ridge straight, bifid. Elytron not narrowed, or weakly narrowed basally; base gradually inclined. Humeral callus low. Elytral disc with low swellings, shallowly depressed along lateral edge; lateral edge finely carinate, straight, or somewhat sinuate in dorsal view; sutural area straight, or weakly convex in lareral view; apical margin straight near suture; inner apical angle rectangular. Metasternum with femoral line arcuate in middle; medial ridge large and conspicuous; transverse ridge parallel to posterior edge of metasternum. Abdominal tergite 3 weakly convex, envenly. Sternite 4 flat. Ratios: AL 2.0; EL 1.7–1.8; ET 1.7–1.8; EW 1.2–1.3; EY 2.8–2.9; GT 2.0; GW 1.8; HW 1.7–1.8; ML 1.6–1.7; MP 1.8–2.0; PT 2.0; SP 2.7–3.3; TPF 4.5–5.5.

♂. Protarsomere 1 with tenent setae (Fig. 3). Protibia lacking peg-like setae, or with few subapical peg-like setae (Fig. 3). Mesofemur (Fig. 4) shorter than metafemur. Mesotibia (Fig. 5) shorter than metatibia (Fig. 6). Peg-like setae arranged in a single row on mesotrochanter (Fig. 4), and grouped in field on mesotibia and metatibia. Apex of abdominal tergite 8 as in Fig. 14. Sternite 8 as in Fig. 7. Sternite 9 lacking subbasal protuberance. Aedeagus as in Figs 1, 2.

♀. Abdominal tergite 8 (Figs 8, 9) with medioapical projection. Sternite 8 as in Fig. 10. Valvifers, gonocoxal plate and styli as in Fig. 13.



Figs 15–21: *Megarthrus danieli,* male. 15, 16: aedeagus, ventral and lateral; 17: protibia 1; 18: mesofemur (setae omitted) and mesotrochanter; 19: mesotibia; 20 metatibia; 21: abdominal sternite 8. Scale bars = 0.2 mm.

Comments. Megarthrus balensis shares with *M. negus*, *M. ras*, *M. rougemonti*, and *M. simienensis* the conspicuously dark brown or blackish colouration of the body and the well developped projection of the female abdominal tergite 8. It differs from these species in having the elytral base not narrowed, and in male sexual characters. The water loading behaviour could be observed in *M. balensis*.

Megarthrus danieli sp. n. (Figs 15–28)

Holotype ♂: Ethiopia, Bale region, Bale Mountains National Park, Harenna Forest, Katcha area, 2400 m, 24.viii.1998 (G. Cuccodoro & D. Erne) # 10c, ex broadleaf litter and bushpig droppings and fungi in forest (*Schefflera – Hagenia* belt), MHNG.
Paratypes (10): same data as holotype, 3♂♂ and 1♀ in MHNG, 1♂ and 1♀ in NMAA; same data, but Katcha clearing, # 10b, ex droppings of various mammals on trail, 2♂♂ and 2♀♀ in MHNG.

Description. Similar to *M. balensis* from which it differs as follows: length 1.20–1.45 mm; width 0.75–0.90 mm. Body predominantly red brown, appendages and lateral portion of pronotum slightly paler, head dark brown. Pubescence of abdominal sternites 4–7 uniform, but with a pair of long subapical dark setae on each sternite. Frons with granulation moderate and dense. Eye with highest point slightly below level of vertex. Antenna as in Fig. 22. Pronotum as in Fig. 26. Elytron with apical margin straight near suture; inner apical angle rectangular, or obtuse. Ratios: EY 2.6–2.8; SP 2.2–2.6; TPF 2.3–2.7.

♂. Protarsomere 1 with tenent setae. Mesofemur (Fig. 18) shorter than metafemur. Mesotibia (Fig. 19) shorter than metatibia (Fig. 20). Protibia lacking peg-like setae, or with few subapical peg-like setae (Fig. 17). Peg-like setae arranged in single row on mesotrochanter (Fig. 18), and grouped in field on mesotibia and metatibia. Apex of abdominal tergite 8 as in Fig. 28. Sternite 8 as in Fig. 21. Sternite 9 lacking subbasal protuberance. Aedeagus as in Figs 15, 16.

♀. Abdominal tergite 8 (Figs 23, 24) with medioapical projection. Sternite 8 as in Fig. 25. Valvifers, gonocoxal plate and styli as in Fig. 27.

Comments. Megarthrus danieli and *M. scotti* are the only Ethiopian species of *Megarthrus* possessing a triangular projection of the female abdominal tergite 8. They differ notably in pronotal contours. The water loading behaviour could be observed in *M. danieli*.

The species is named in honour of one of the collectors, Mr. Daniel Erne.

Megarthrus falasha Cuccodoro & Löbl, 1995

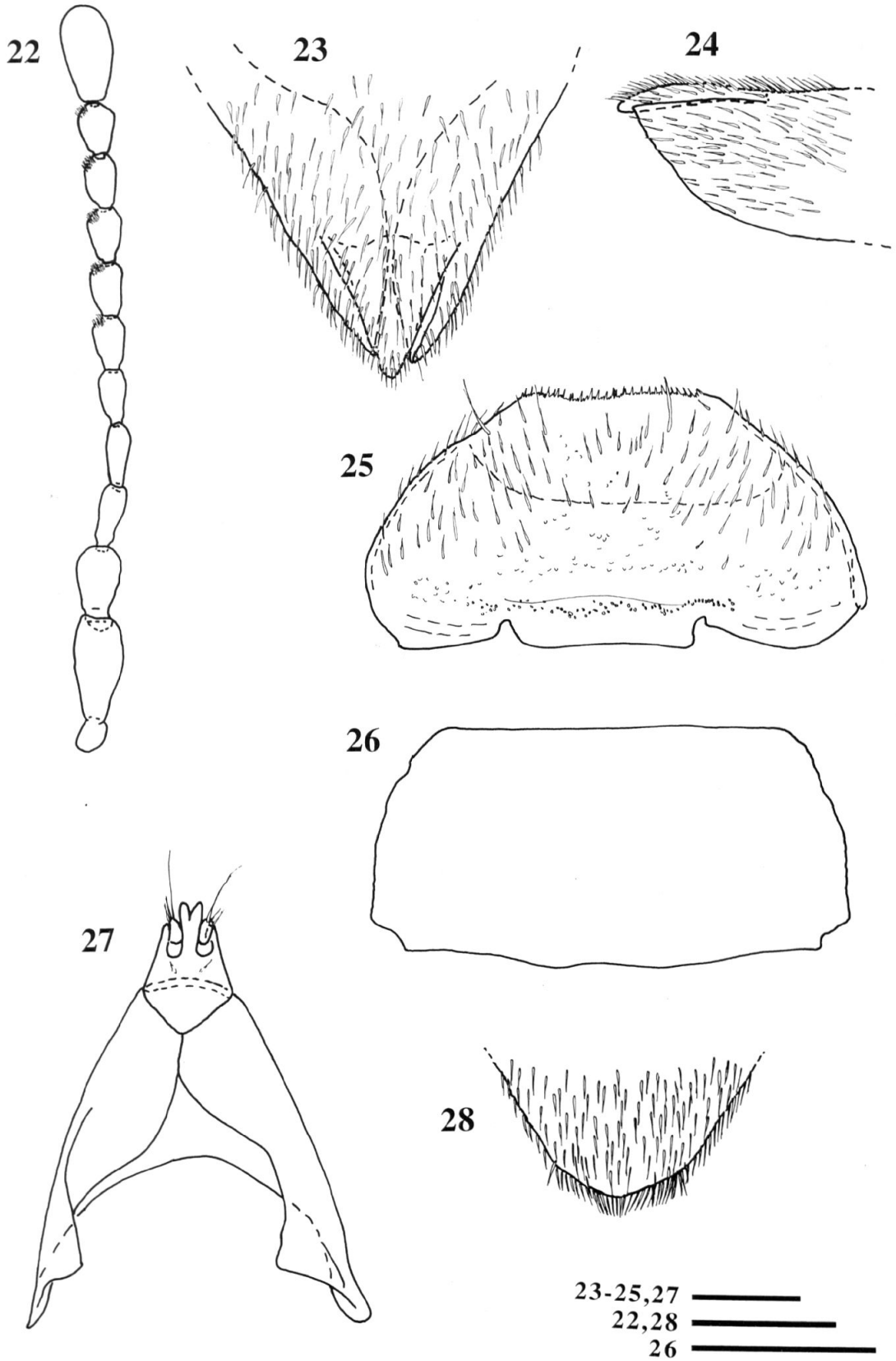
Additional material (2 ♀♀): Ethiopia, Bale region, Bale Mountains National Park, Dinsho Hill, above National Park Headquarters, 3200 m, 12.viii.1998 (G. Cuccodoro & D. Erne) # 2a, ex warthog excrements and fungi under isolated *Hagenia abyssinica*, MHNG; same data, but Harenna Forest, Katcha clearing, 2400m, 24.viii.1998, # 10b, ex droppings of various mammals on trail, MHNG.

Comments. The species is recorded here for the first time from the Bale region.

Megarthrus harennaensis sp. n. (Figs 29–42)

Holotype ♂: Ethiopia, Bale region, Bale Mountains National Park, Harenna Forest, 2km below Rira, 2850 m, 24.viii.1998 (G. Cuccodoro & D. Erne) # 10g, ex wet vegetables debris and moss under decaying trunk in forest (*Hagenia – Schefflera – Hypericum* belt).
Paratypes (3): same data as holotype, 1♂ in MHNG; same data, but 22.viii.1998, # 8, 1♂ in MHNG; same data, but Katcha area, 2400 m, # 10c, ex broadleaf litter and bushpig droppings and fungi in forest (*Schefflera – Hagenia* belt), 1♀ in MHNG.

Description. Similar to *M. balensis* from which it differs as follows: length 1.60–1.70 mm; width 1.10–1.20 mm. Body predominantly red brown, appendages slightly paler, head dark brown. Pubescence of abdominal sternites 4–7 uniform,



Figs 22–28: *Megarthrus danieli*. 22: antenna; 23, 24: female, apex of abdominal tergite 8, dorsal and lateral; 25: female, abdominal sternite 8; 26: pronotum; 27: female, valvifers, gonocoxal plate and styli, dorsal; 28: male, apex of abdominal tergite 8. Scale bars = 0.2 mm.

but with a pair of long subapical dark setae on each sternite. Foveopunctation moderate and sparse on pronotum and elytra, fine and sparse on abdomen; medioposterior portion of metasternum and anterior portion of pronotal hypomeron impunctate. Frons with granulation fine and sparse, slightly raised above level of vertex. Frontal impression shallow in middle and laterally. Eye moderately convex. Antenna as in Fig. 39. Pronotum (Fig. 42) with disc moderately depressed along lateral edge, shallowly depressed posteriorly beside medial groove. Elytron not narrowed basally; lateral edge sinuate in dorsal view. Metasternum with medial ridge narrow and inconspicuous. Ratios: AL 1.8–2.0; EY 2.8–3.0; GW 2.5–2.7; HW 1.6–1.7; ML 1.4–1.6; PT 1.8; SP 3.1–3.8; TPF 2.5.

♂. Protarsomere 1 with tenent setae. Mesofemur (Fig. 32) slightly shorter than metafemur. Mesotibia (Fig. 33) much shorter than metatibia (Fig. 34). Metatrochanter lacking peg-like setae. Peg-like setae on mesotrochanter (Fig. 32) arranged in single row, on metatibia arranged in double row, and grouped in field on protibia and mesotibia. Sternite 8 as in Fig. 35. Aedeagus as in Figs 29, 30.

♀. Abdominal tergite 8 (Figs 36, 37) with medioapical projection. Sternite 8 as in Fig. 40. Valvifers, gonocoxal plate and styli as in Fig. 41.

Comments. Megarthrus harennaensis strongly ressembles *M. abessinus* and *M. magnicaudatus*. The three species differ notably in the sexual characters.

Megarthrus negus CUCCODORO & LÖBL, 1995

Additional material (28): Ethiopia, Bale region, Bale Mountains National Park, Dinsho Hill, above National Park Headquarters, 3200 m, 12.viii.1998 (G. CUCCODORO & D. ERNE) # 2a, ex warthog excrements and fungi under isolated *Hagenia abyssinica,* 2♀♀ in MHNG; same data, but Gurracha river, 5 km S Dinsho, 3250 m, 14–15.viii.1998, # 3a, ex decaying leaves and stems of *Lobelia* sp. and *Kniphofia* sp., 10♂♂ and 23♀♀ in MHNG; same data, but 2 km S Finchaya Habera, 3450 m, 16.viii.1998, # 4b, ex decaying leaves and stems of *Lobelia* sp. and *Kniphofia* sp., 3♀♀ in MHNG.

Comments. The water loading behaviour could be observed in this species.

Megarthrus oromo **sp. n.** (Figs 43–49)

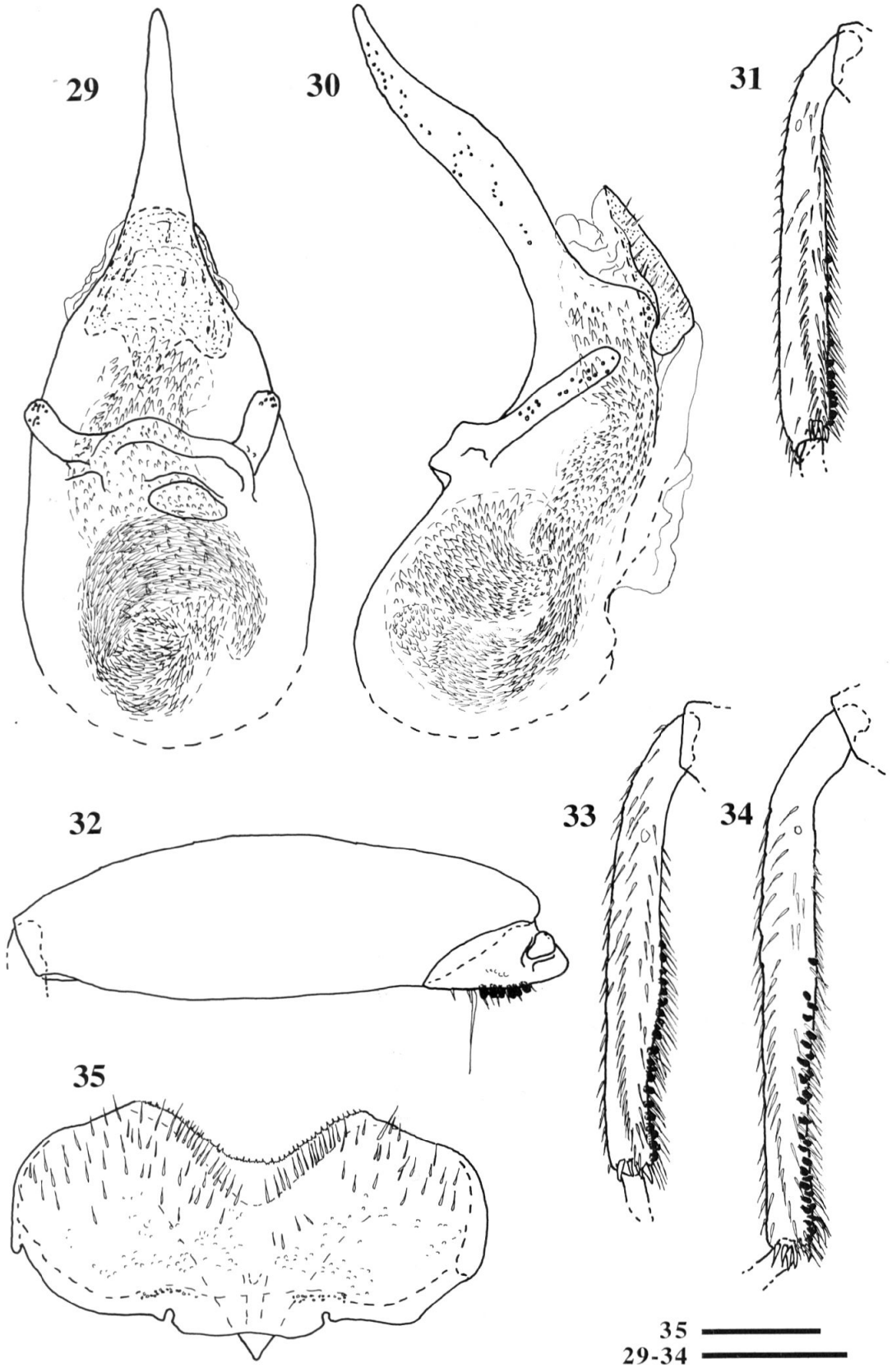
Holotype ♀: Ethiopia, Bale region, Bale Mountains National Park, around Finchaya Habera, 3400 m, 16.viii.1998 (G. CUCCODORO & D. ERNE) # 4a, ex vegetable refutes of giant molerats, MHNG.
Paratype ♀: same data as holotype, in MHNG.

Description. Similar to *M. balensis* from which it differs as follows: length 1.35–1.40 mm; width 0.80–0.85 mm. Body predominantly dark brown, legs slightly paler. Pubescence of abdominal sternites 4–7 uniform, but with a pair of long subapical setae on each sternite. Frons with granulation moderate and dense. Eye with highest point slightly below level of vertex. Antenna as in Fig. 43. Pronotum as in Fig. 44. Elytron not narrowed basally. Humeral callus low. Elytral disc with low swellings, shallowly depressed along lateral edge; lateral edge finely carinate, straight in dorsal view; sutural area straight in lareral view; apical margin as in Fig. 49. Metasternal medial ridge narrow and inconspicuous. Ratios: AL 1.7–1.8; EL 1.9; ET 1.9–2.0; EY 2.3–2.4; PT 1.9; SP 3.2–3.6; TPF 2.5–2.9.

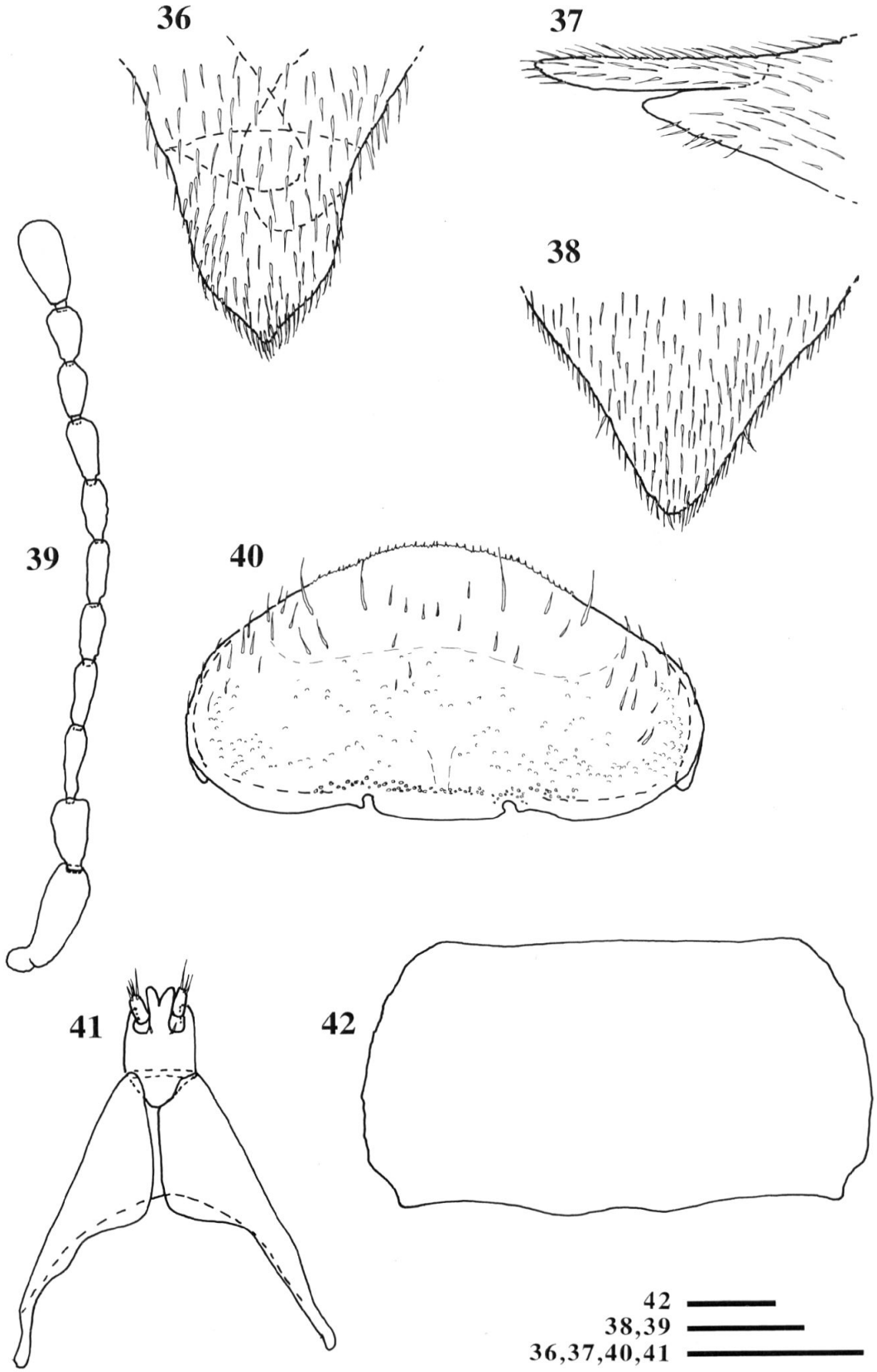
♀. Abdominal tergite 8 (Figs 47, 48) with medioapical projection. Sternite 8 as in Fig. 45. Valvifers, gonocoxal plate and styli as in Fig. 46.

♂. Unknown.

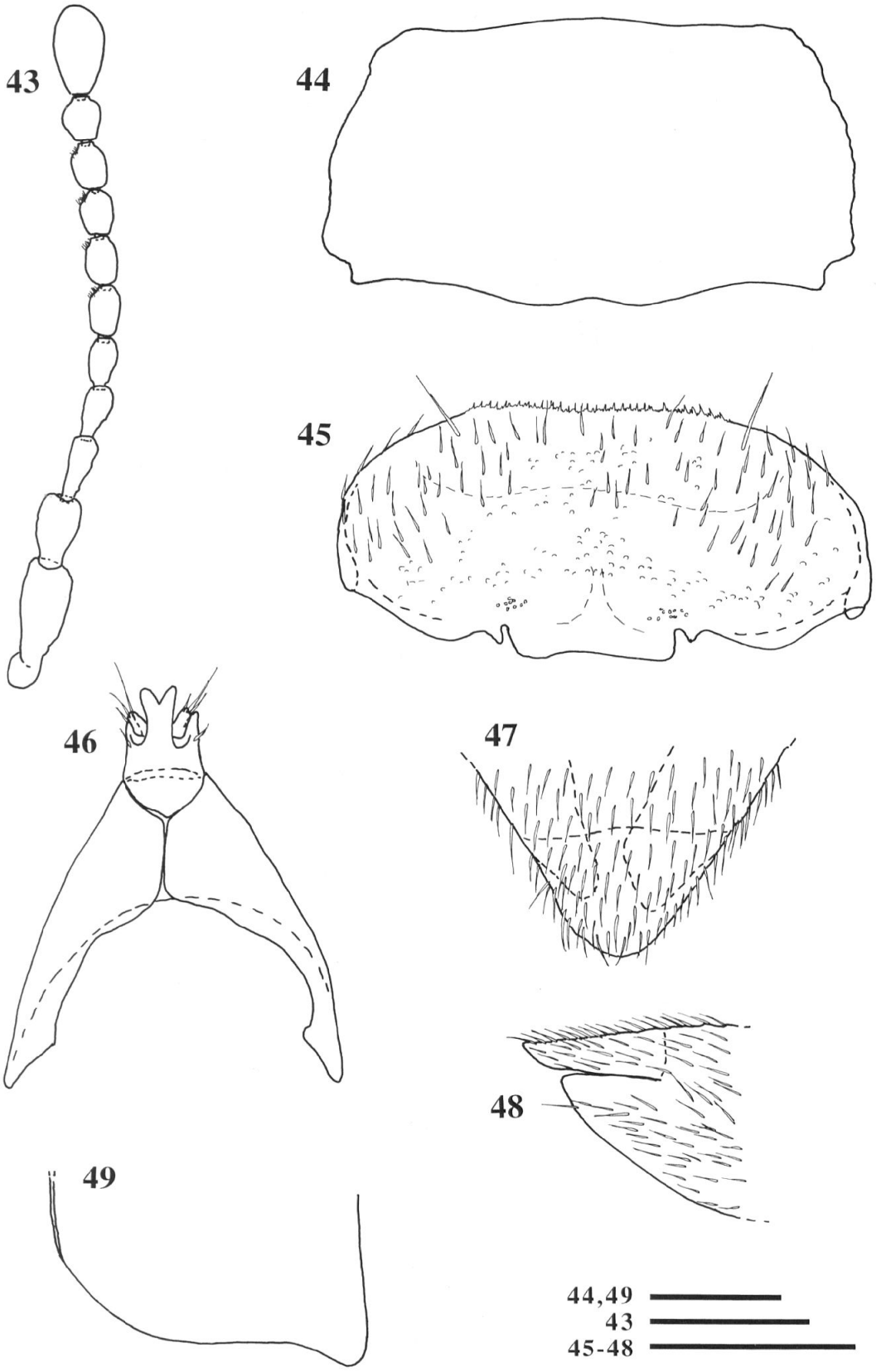
Comments. Megarthrus oromo is the only *Megarthrus* species in which the female has the inner apical angle of elytra conspicuously projecting, in combination with dark brown body colouration and moderately large medioapical projection on the abdominal tergite 8. The water loading behaviour could be observed in this species.



Figs 29–35: *Megarthrus harennaensis,* male. 29, 30: aedeagus, ventral and lateral; 31: protibia 1; 32: mesofemur (setae omitted) and mesotrochanter; 33: mesotibia; 34 metatibia; 35: abdominal sternite 8. Scale bars = 0.2 mm.



Figs 36–42: *Megarthrus harennaensis*. 36, 37: female, apex of abdominal tergite 8, dorsal and lateral; 38: male, apex of abdominal tergite 8; 39: antenna; 40: female, abdominal sternite 8; 41: female, valvifers, gonocoxal plate and styli, dorsal; 42: pronotum. Scale bars = 0.2 mm.



Figs 43–49: *Megarthrus oromo*, female. 43: antenna; 44: pronotum; 45: abdominal sternite 8; 46: female, valvifers, gonocoxal plate and styli, dorsal; 47, 48: apex of abdominal tergite 8, dorsal and lateral; 49: apical contour of left elytron. Scale bars = 0.2 mm.

Megarthrus rougemonti CUCCODORO & LÖBL, 1995

Additional material (42): Ethiopia, Bale region, Bale Mountains National Park, Dinsho Hill, above National Park Headquarters, 3200 m, 12.viii.1998 (G. CUCCODORO & D. ERNE) # 2a, ex warthog excrements and fungi under isolated *Hagenia abyssinica*, 1 ♀ in MHNG; same data, but Gurracha river, 5 km S Dinsho, 3250 m, 14–15.viii.1998, # 3a, ex decaying leaves and stems of *Lobelia* sp. and *Kniphofia* sp., 15 ♂♂ and 14 ♀♀ in MHNG; same data, but 2 km S Finchaya Habera, 3450 m, 16.viii.1998, # 4b, ex decaying leaves and stems of *Lobelia* sp. and *Kniphofia* sp., 1 ♂ in MHNG; same data, but Sanetti Plateau, 2 km W Tullu Konteh, 4050 m, 20.viii.1998, # 6a, ex dry stems of *Lobelia rhynchopetalum*, 1 ♂ in MHNG; same data, but 5 km East of Mt Batu, near summit of Garba Gurracha escarpment, 3950 m, 21.viii.1998, # 7b, ex decaying leaves of *Lobelia rhynchopetalum*, 4 ♂♂ and 5 ♀♀ in MHNG; same data, but Harenna Forest, 2 km below Rira, 2850 m, 22.viii.1998, # 8, ex wet vegetables debris and moss under decaying trunk in forest (*Hagenia – Schefflera – Hypericum* belt), 1 ♀ in MHNG.

Comments. The water loading behaviour could be observed in this species.

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