

## WATER MITES OF THE FAMILY LIMNOCHARIDAE (ACARIFORMES, HYDRACHNIDIA) FROM MADAGASCAR

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**ABSTRACT:** Water mites of the family Limnocharidae collected from spring and stream habitats in Madagascar were studied. Five species new to science, *Limnochares fasta* n. sp., *L. connexa* n. sp., *L. simulans* n. sp., *Neolimnochares madagascariensis* n. sp., and *N. longirostris* n. sp., are described and their taxonomic relationships are discussed. New records are given of *L. crinita* Koenike, 1898. A key is provided for the African species of the family.

**KEY WORDS:** Limnocharidae, *Limnochares*, *Neolimnochares*, water mite, new species

### INTRODUCTION

So far, five species of the water mite family Limnocharidae have been recorded from the Ethiopic region (K.O. Viets 1987; Davids et al. 2005). *Limnochares crinita* Koenike, 1898 was first described from Madagascar and later recorded also from scattered areas all over subsaharan Africa; *L. expansipalpis* Cook, 1966 from Liberia; *Neolimnochares tenuiscutata* K. Viets, 1914 was first described from South Africa and later recorded also from Madagascar (Walter, Bader 1953); *N. africana* Cook, 1966 and *N. placophorella* Cook, 1966 are both only known from Liberia. As it is true for all groups of water mites, such very patchy locality records of African limnocharids are not due to a rareness of species of this family, but just reflect our bad state of general knowledge of African freshwater mites. Due to their larval parasitism on hemiptera and coleoptera (Smith, Oliver 1986 — data mostly from temperate areas, probably true also for the circumtropical representatives of the family), Limnocharid water mites have in fact well developed distribution capacities and are probably widespread all over the continent.

The aim of this paper is to make a step towards improvement of our knowledge about mite diversity in Madagascar, describing and discussing species collected in streams and running waters, a habitat type with a so far widely unknown water mite fauna (Goldschmidt, Gerecke 2001; Gerecke 2004).

### MATERIAL AND METHODS

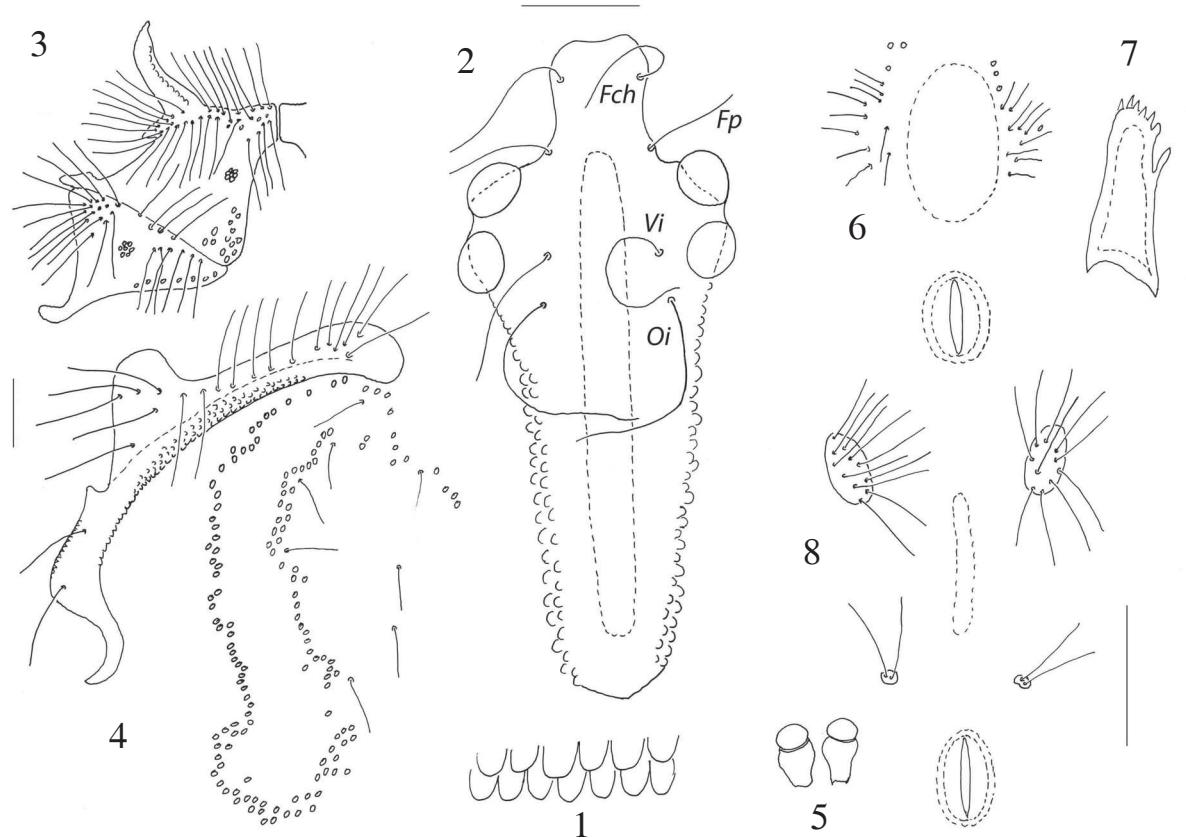
Mites were collected with a hand net from stream substrata, sorted in the field, and conserved in Koenike's fluid by R. Gerecke and T. Goldschmidt. Selected specimens from all collecting sites were prepared, partly detaching mouth parts and legs, and slide-mounted in Hoyer's medium.

The following abbreviations are used: Idiosomal setae are named according to Tuzovsky (1987): *Fch* — frontales chelicarum, *Fp* — frontales pedipalporum, *Vi* — verticales internae, *Oi* — occipitales internae (Fig. 2); *P1–5*, pedipalp segments (trochanter, femur, genu, tibia and tarsus); *I-L-1–6* = first leg, segments 1–6 (trochanter, basifemur, telofemur, genu, tibia and tarsus) i.e. *III-L-4* = genu of third leg; *L* — length, *W* — width, *H* — height; *Cx-I–IV* — coxal plates I–IV; *n* = number of specimens measured. Measurements are given in  $\mu\text{m}$ .

Holotypes and slide-mounted paratypes of species described as new to science, as well as slide mounted specimens of *L. crinita* will be deposited at Senckenberg Museum, Frankfurt (Germany), material in liquid is conservated in coll. Gerecke (Tübingen).

### Limnocharidae Grube, 1859

**Remarks.** Currently, along with Eylaidae, Piersigiidae and Apheviderulicidae, Limnocharidae are placed in the superfamily Eylaioidea. The family is highly distinct, all members being easily recognized by their unique, rod-shaped frontal plate. The medially-shifted lateral eye capsules are fused to this sclerotized plate, a median eye is not developed — the latter a character state generally omitted when a family diagnosis is given. The limnocharid gnathosoma is connected to idiosoma by a more or less protrusible membranous area. In its anterior part, its surface is finely porose, while its enlarged proximal section, especially in the dorsal part is covered by numerous crescent-shaped muscle attachment points; the mouth opening is large, disk-shaped and surrounded by a ring of fine villi; chelicerae are characteristic in their basal segments being fused medially, and their strong, stout claws. Palps are relatively small, in several clades a ten-



Figs. 1–8. *Limnochares crinita*, adults: 1 — fragment of integument; 2 — frontal plate; 3 — anterior coxal group; 4 — posterior coxal group; 5 — acetabula; 6, 8 — genital field; 7 — genital platelets; 1–7 — female, 8 — male. Scale bars: 1–2, 5 = 50; 3, 4 = 100; 6, 8 = 25; 7 = 25.

dency to further reduction in size and segment numbers is observed.

From Madagascar, as also from continental Africa, only representatives of the subfamily Limnocharinae are recorded, possibly a paraphyletic group defined by plesiomorphies (gnathosoma not attached to a protrusible tube, and the palp consisting of 4 or 5 segments). The systematic subdivision within the subfamily, again, divides species in a way that probably does not reflect phylogenetic relations: One of the two genera, *Limnochares* Latreille, 1796, defined by the surely plesiomorphic presence of 5 palp segments, is probably paraphyletic, the other, *Neolimnochares* Lundblad, 1937, with one palp segment reduced, could be mono- or polyphyletic. Finally, the two genera have been subdivided each in one subgenus s. str., characterized by the absence of swimming hairs, and one subgenus, *Limnochares* (*Cyclothrix* Wolcott, 1905) resp. *Neolimnochares* (*Paracyclothrix* Lundblad, 1967), defined the presence of swimming setae on legs.

From the outlined taxonomic scenario it is clear that the system as a whole is surely artificial and in need for revision. A reduction in palp seg-

ment numbers is probably a frequent phenomenon when palp size becomes reduced, and it could have taken place numerous times as a parallel event when small-sized palps evolved in different lineages of the family. In fact, two of the Madagascaran species, *Limnochares crinita* and *Neolimnochares tenuiscutatus*, are rather similar in general morphology and also their palps are similar in shape and differ mostly in fusion or not of segments P-2 and P-3. On the other hand, a nearly identical arrangement of dorsal sclerites is found in *Limnochares anomala* Habeeb, 1965 and one of the *Neolimnochares* species described here as new to science.

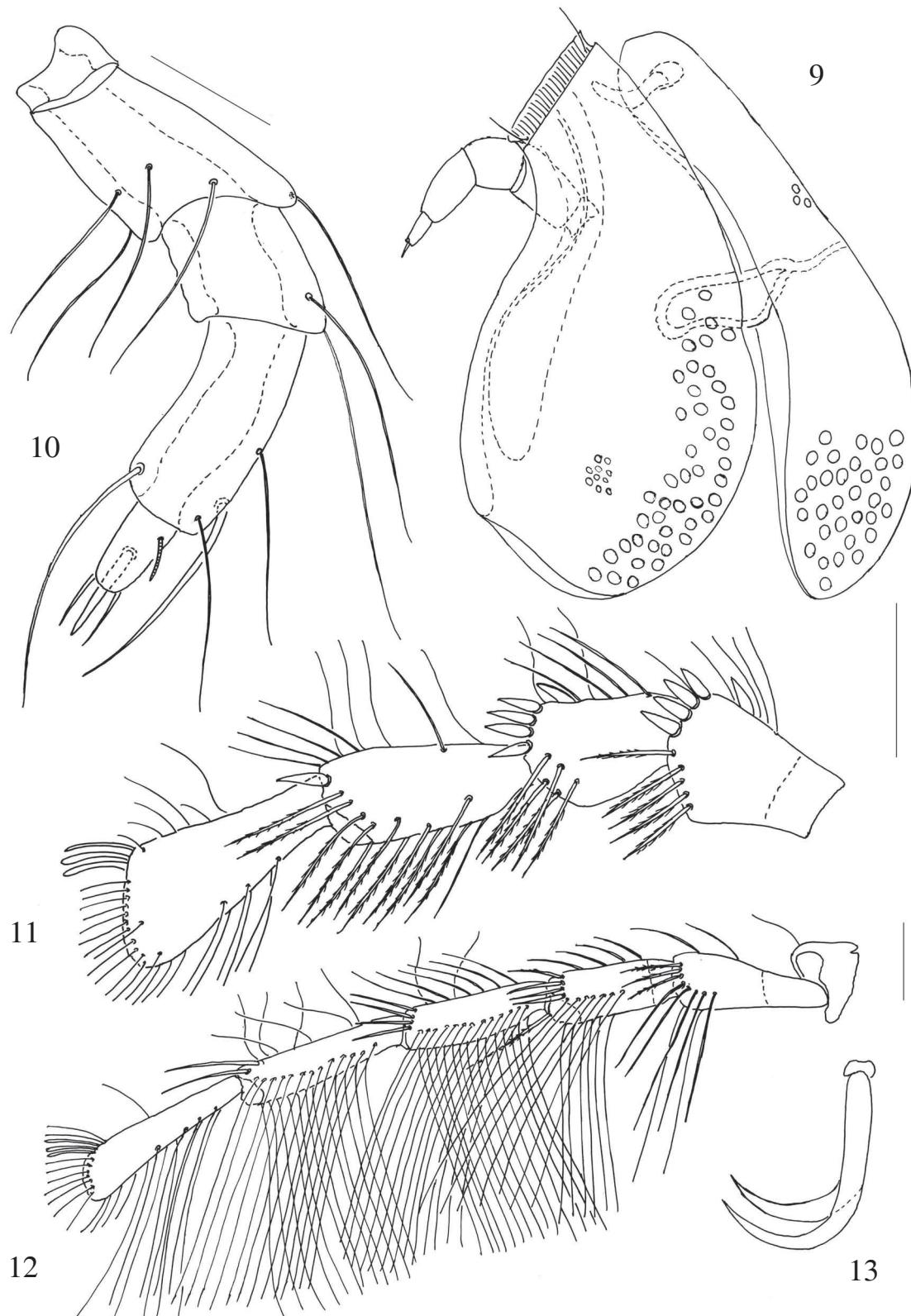
On the background of increasing numbers of species representing new and surprising character combinations, also evidence increases that classification of Limnocharidae merits reconsideration.

#### Genus *Limnochares* Latreille, 1796

*Limnochares* (*Limnochares*) *crinita* Koenike, 1898

Figs. 1–18

Published records from Madagascar: Majunga; Amparangidro; Nossi-Bé (Koenike 1898d); Ankaratra mountains (K.O. Viets 1964); Majunga,

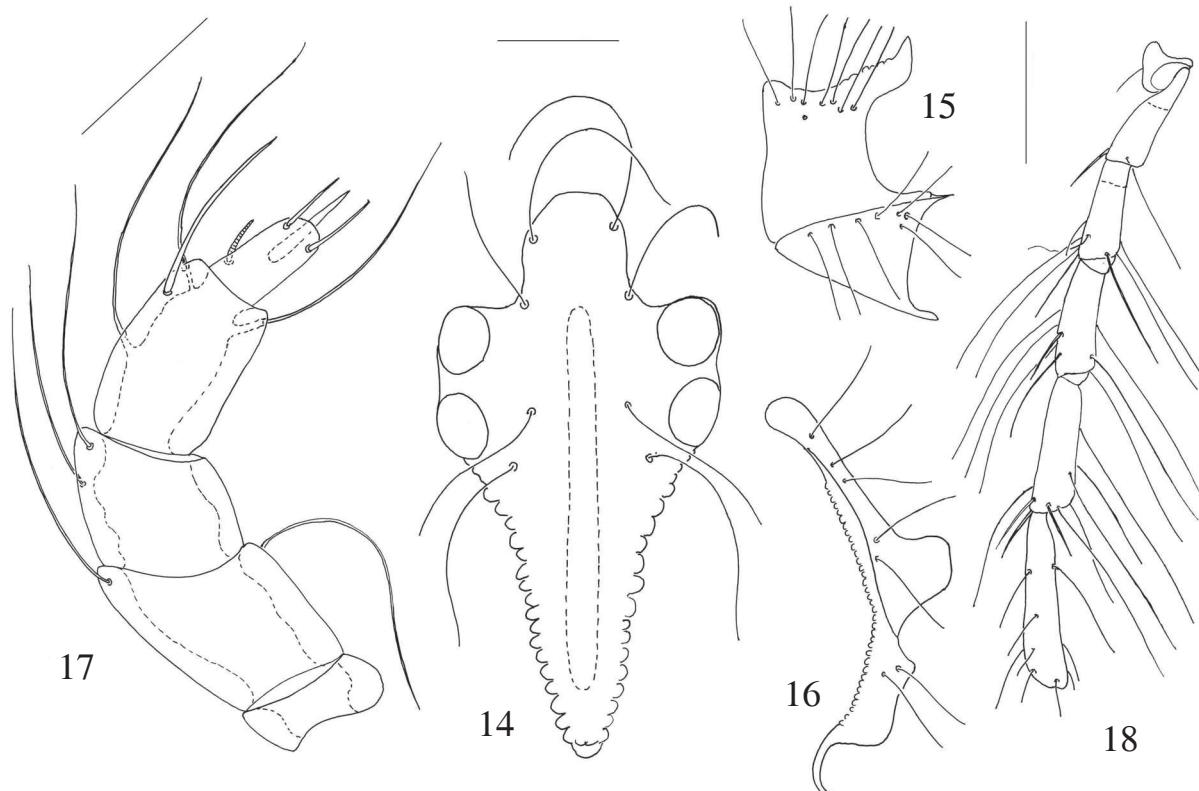


Figs. 9–13. *Limnochares crinita*, female: 9 — gnathosoma, lateral view; 10 — palp, lateral view; 11 — leg I; 12 — leg III; 13 — claws. Scale bars: 9, 11 = 25; 10, 13 = 50; 12 = 100.

Tamatave (K.O. Viets 1968); Antsiranana, Nossi-Bé (Gerecke 2004).

Further records: South Africa (K. Viets 1956; K.O. Viets 1968); Kongo (Bader 1959); Liberia (Cook 1966).

**Material examined.** Madagascar, MD 099, 26.09.2001, Ranohira (Fianarantsoa), left affluent of the stream flowing to Riv. Ihazofotsy upstream ‘Isalo Ranch’, 780 m, 25°C (0/0/1) slide-mounted; MD 151, 13.11.2001, Sambava (Antsiranana),



Figs. 14–18. *Limnochares crinita*, deutonymph: 14 — frontal plate; 15 — Cx-I+II; 16 — Cx-III+IV; 17 — palp, lateral view; 18 — leg III. Scale bars: 14 = 50; 17 = 25; 15–16, 18 = 25.

stream in Vanilla plantations ca. 1 km W from the town, 10 m, 28°C (1/0/3) slide-mounted; (0/2/0) in ethanol.

**Redescription. Both sexes.** Integument with rather high papillae (Fig. 1). Dorsum in addition to frontal plate without sclerotized parts. Frontal plate (Fig. 2) elongate (ratio length/width 2.4), with narrow anterior and wide posterior portions. Bases of setae *Fch* and *Fp* widely separated, setae *Fch* near anterior margin of frontal plate, setae *Fp* near anterior lateral eyes; setae *Vi* between posterior lateral eyes, setae *Oi* behind posterior margin of posterior lateral eyes. All setae on frontal plate thin, hair-like, setae *Fp* shorter than setae *Fch*, setae *Oi* longer than *Vi*. Posterior portion of frontal plate relatively long, its lateral margin with numerous tubercles. Cx-I (Fig. 3) trapezoidal, anterior margin wide, anterolateral projections well-developed, medial margin slightly concave; anteromedial protrusions short and not fused to each other. Cx-II triangular, medially pointed. Cx-III+IV (Fig. 4) relatively short, anterior margin of Cx-III very wide, almost three times as long as posterior margin of Cx-IV. All coxae with rather numerous long, thin setae. Medial edges of Cx-III+IV with numerous small tubercles. All leg claws simple (Fig. 13). Segments of I- (Fig. 11)

and II-L shorter and thicker than those of III- (Fig. 12) and IV-L. Numerous long swimming setae on III-/IV-L-3–5 (material MNHN, anterior/posterior: III-L-4, 6–12/7–12, III-L-5, 5–13/7–12; IV-L-4, 8–16/7–13; IV-L-5, 7–14/7–14). Tarsi of all legs lacking thickened dorsodistal setae. Telofemur and genu of I-L with 5, telofemur and genu of II-L with 4, tibia of I/II-L with one thick short spine(s). Genital field with 137–150 relatively short-stalked acetabula on each side (Fig. 5). Perigenital setae not numerous. Capitulum (Fig. 9) elongate, with rather large base almost six times as long as rostrum. Mouth disk large and turned to ventral side. Basal segment of chelicera thickened, cheliceral stylet very small. Palp (Fig. 10) short, inserting on ventrolateral surface of capitulum; P-1 very short, without setae; P-2 slightly longer than P-3, distally bearing one dorsal and four ventrolateral setae; P-3 with two dorsodistal setae; P-4 with almost straight dorsal and ventral margins, bearing one ventral, long, and three dorsodistal setae, one thick and two thin. P-5 thin, with short proximal solenidion, rather large terminal spine and two short distal setae.

**Male.** Perigenital setae in four groups (Fig. 8), anterior groups with 10–11, posterior groups with two setae on each side.

**Measurements** (n = 1). Idiosoma L about 1600; frontal plate L/W 287/125, anterior portion L/W 50/40, eye capsule L 75; Cx-I medial L 200, Cx-I+II lateral L 335, Cx-I anterior W 175, Cx-II posterior W 210; Cx-III+IV medial L 500, Cx-III anterior W 285, Cx-IV posterior W 110; acetabula diameter 9–11, acetabular stalk L 9–13; capitulum L 300, rostrum 43, mouth disk diameter 75; chelicera basal segment L 335, cheliceral stylet 30; palp segments L (P-1–5): 14, 48, 30, 48, 24; leg segments L (I-L-1–6): 50, 112, 100, 100, 125, 135; (II-L-1–6): 50, 150, 125, 100, 150, 160; (III-L-1–6): 60, 125, 135, 175, 200, 200; (IV-L-1–6): 75, 175, 175, 225, 210, 225.

**Female.** Perigenital setae in two groups, flanking genital opening (Fig. 6). Both genital plates with short distal projections (Fig. 7).

**Measurements** (n = 1). Idiosoma L 2300; frontal plate L 385/160, anterior portion L/W 75/62, eye capsule L 85; Cx-I medial L 250, Cx-I+II lateral L 475, Cx-I anterior W 210, Cx-II posterior W 275; medial margin of Cx-III+IV L 675, Cx-III anterior W 425, Cx-IV posterior W 150; acetabula diameter 9–11, acetabular stalks H 12–16; capitulum L 410, rostrum 62, mouth disk diameter 100; chelicera basal segment L 435, cheliceral stylet L 50; palp segments L (P-1–5): 19, 67, 40, 62, 27; leg segments L (I-L-1–6): 62, 150, 135, 135, 175, 185; (II-L-1–6): 62, 260, 175, 175, 210, 225; (III-L-1–6): 75, 200, 210, 200, 260, 275; (IV-L-1–6): 85, 275, 260, 310, 335, 350.

**Deutonymph.** Frontal plate (Fig. 14) with short posterior portion. Cx-I+II (Fig. 15) and Cx-III+IV (Fig. 16) with a few thin long setae. Genital field with 11–27 acetabula on each side. P-2 with one ventrodistal and one dorsodistal seta, P-3 with two dorsodistal setae, P-4 and P-5 as described for adults (Fig. 17). III-L (Fig. 18) and IV-L with a few long swimming setae.

**Measurements** (n=3). Idiosoma L 860–1170; frontal plate L/W 135–215/85–90, anterior portion L/W 30–38/30–40, eye capsule L 48–52; Cx-I medial L 90–140, Cx-I+II lateral L 150–250, Cx-I anterior W 85–140, Cx-II posterior W 100–150; Cx-III+IV medial L 160–250, Cx-III anterior W 150–215, Cx-IV posterior W 50–175; acetabula diameter 9–13, acetabular stalk L 12–19; capitulum L 125–250, rostrum 32–35, mouth disk diameter 40–65; chelicera basal segment L 170–250, cheliceral stylet 16–29; palp segments L (P-1–5): 14, 48, 30, 48, 24; leg segments L (I-L-1–6): 35–50, 75–100, 50–75, 50–75, 55–90, 80–105; (II-L-1–6): 35–45, 85–140, 60–90, 60–90, 75–115,

100–125; (III-L-1–6): 35–45, 60–125, 80–100, 80–125, 100–150, 130–150; (IV-L-1–6): 40–65, 85–100, 100–120, 100–150, 110–175, 135–200.

## DISCUSSION

*Limnochares crinita* differs from other species of the genus in shape and setation of its frontal plate (elongate, with narrow anterior and wide, relatively long posterior portions, bases of *Fch* and *Fp* widely separated, *Oi* longer than *Vi*) combined with high numbers of leg swimming setae. A female described from Liberia (Cook 1966) differs in a longer idiosoma (L 3100), setae *Vi* and *Oi* approximately subequal in length, palpal femur with 3 distal setae, and anteromedial portion of Cx-III slightly turned to anterior. While the strong difference in size, in limnocharids, could result from intraspecific variability, the other character states suggest that conspecificity of Liberian populations, as well as other populations described under this name from Continental Africa needs confirmation.

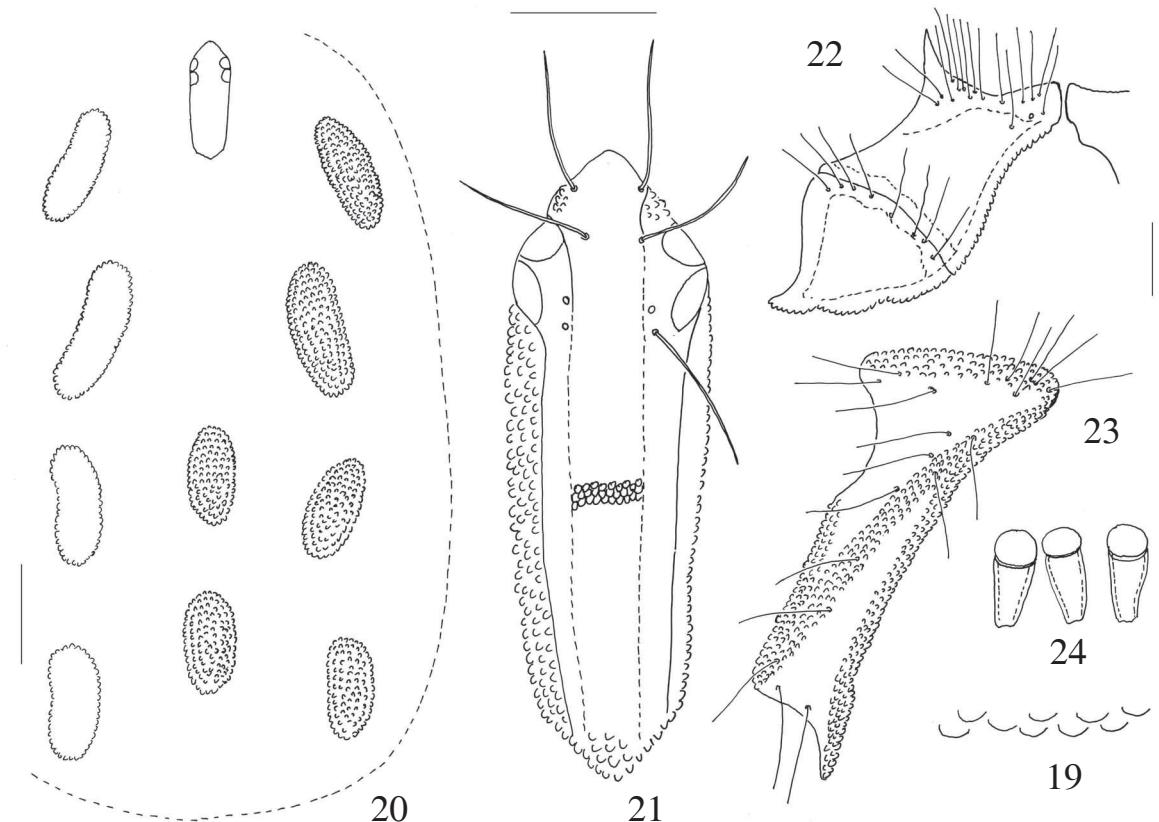
### *Limnochares (Limnochares) fasta* sp.n.

Figs. 19–31

**Type material.** Holotype female, Madagascar, MD 035, 19.08.2001, Ranomena (Fianarantsoa), stream NW from the 1.07 km-railway-tunnel (right affluent of MD 034), 14.8°C, slide-mounted, SMF nr. #\*. Paratypes: MD 40, 21.08.2001, Ranomena (Fianarantsoa), spring at right margin of stream NW from 1.07-km-railway tunnel, 950 m, 14.7°C (0/1/1) in Koenike's fluid; MD 61, 05.09.2001, Tsimelahy (Tulear), "piscine naturelle" below cascades of Riv. Antarantsa, 200 m, 21.0 (surface at mid day 25.8°C) (1/1/1) slide-mounted, SMF nr. #, (0/1/0) in Koenike's fluid.

**Diagnosis.** Dorsum, in addition to frontal plate, with two unpaired median, and four paired lateral plates; frontal plate wide (ratio length/width = 3.0), with smooth setae, setae *Fch* anterior to eye capsules, setae *Fp* between anterior lenses, setae *Vi* between posterior lenses, *Oi* on level of their posterior margin; lenses of lateral eyes close together. Capitulum with short rostrum, mouth disk large; anteromedial corners of Cx-I separate. Cx-II triangular, with medial margin not developed; excretory pore surrounded by sclerotized ring. Legs without swimming setae, all tarsi with bifurcated dorsodistal setae; I/II-L-2–5 with thickened serrated distal setae.

\*Here and elsewhere: The slides will be assigned their respective collection numbers after the article has been published.



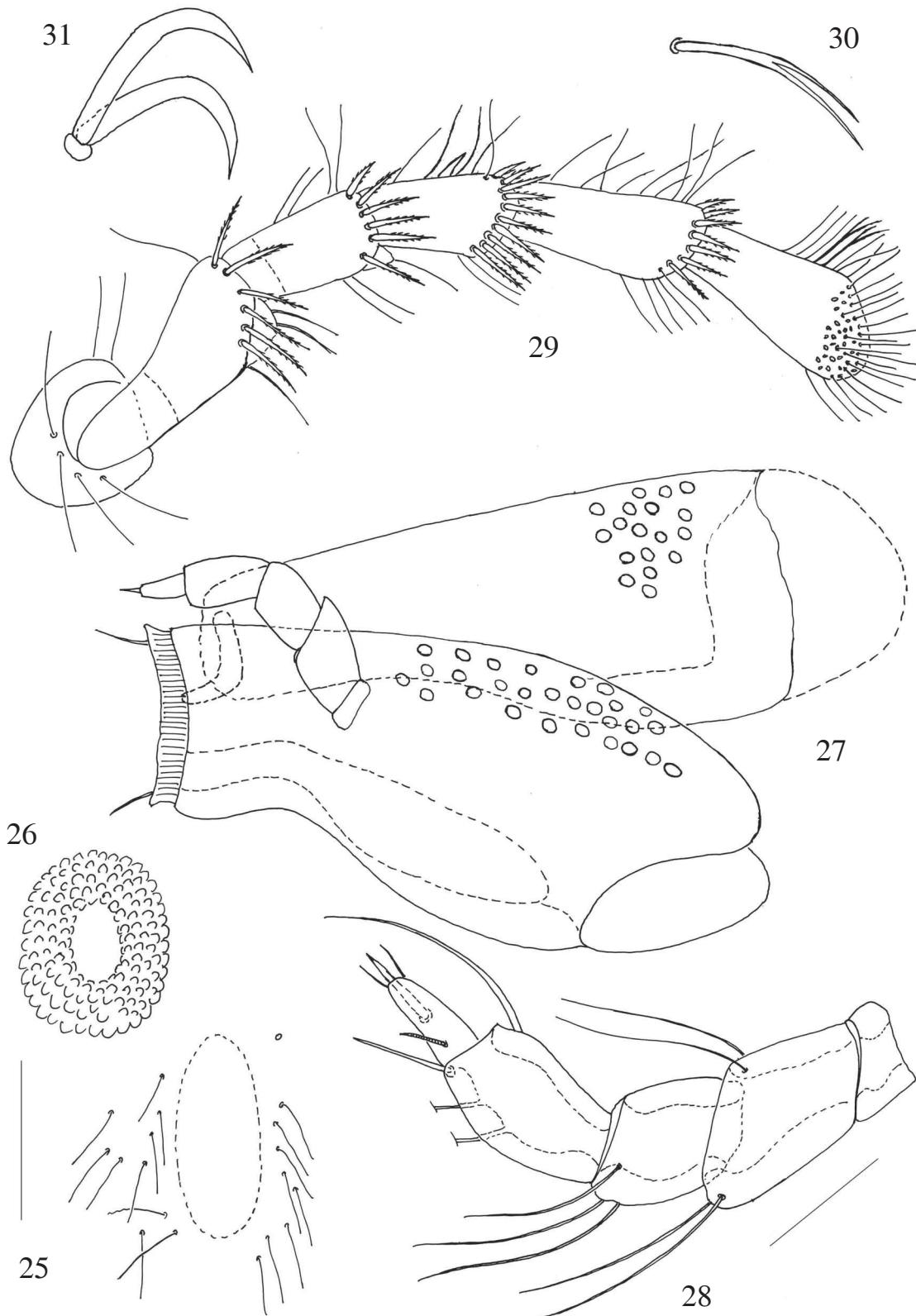
Figs. 19–24. *Limnochares fasta* sp.n., female: 19 — fragment of integument, lateral view; 20 — dorsal plates; 21 — frontal plate; 22 — anterior coxal group; 23 — posterior coxal group; 24 — acetabula. Scale bars: 19, 24 = 50; 20 = 300; 21 = 25; 22, 23 = 100.

**Description. Both sexes.** Integument papillae flat, with convex tips (Fig. 19). Dorsum in addition to frontal plate with two unpaired median, and four paired lateral plates (Fig. 20). All dorsal plates elongate, subequal in size, with numerous small tubercles. Frontal plate (Fig. 21) all over its length rather wide (ratio length/width 3.0) with angular anterior and posterior ends. Setae *Fch* anterior to eye capsules, *Fp* between anterior lenses, *Vi* between posterior lenses, *Oi* at level of their posterior margin — all thin and subequal in length. Posterior portion of frontal plate relatively long, its lateral edges with numerous tubercles. *Cx-I* (Fig. 22) trapezoidal, anterior margin wide and with pointed anterolateral projection, medial margin slightly concave. Anteromedial portions of *Cx-I* not fused to each other. *Cx-II* triangular, medially pointed. *Cx-III+IV* (Fig. 23) elongate, anterior margin of *Cx-III* 1.7 times as long as posterior margin of *Cx-IV*. All coxae with a few long and thin setae. Medial edges of *Cx-I+II* and almost all edges of *Cx-III+IV* with numerous small tubercles. Genital field with rather numerous acetabula (52–54) on each side. Acetabula on rather long stalks (Fig. 24). Anal opening surrounded by scler-

rotized ring (Fig. 26), its surface with numerous small tubercles. Capitulum (Fig. 27) elongate, its rather large base almost 4.5 times as long as rostrum; mouth disk large and directed perpendicular to longitudinal axis. Basal segment of chelicera large, cheliceral stylet very small. Palps inserting at the transition between capitular base and rostrum. P-1 very short and without setae; P-2 and P-3 subequal in length; P-2 with two dorsodistal and two ventrodistal setae, P-3 with three dorsodistal setae; P-4 with convex dorsal margin, bearing one ventral, long, and three dorsodistal setae, one short and two long; P-5 thin, with short proximal solenidion, one rather large terminal and two short distal setae (Fig. 28). I- and II-L shorter and thicker than III- and IV-L. I-II-L-2–5 with thickened serrated distal setae. I-L-6 with 1–2, II-IV-L-6 with 3 bifurcated dorsodistal setae (Fig. 29); all claws simple, hook-like (Fig. 31).

**Male.** Perigenital setae in four groups.

**Measurements** ( $n = 1$ ). Idiosoma L 1000; frontal plate L 200, anterior portion L 45, W at level of lateral eyes 90; eye capsule L 48, *Cx-I* medial L 185, *Cx-I+II* lateral L 220, *Cx-I* anterior W 110, *Cx-II* posterior W 165; *Cx-III+IV* medial



Figs. 25–31. *Limnochares fasta* sp.n., female: 25 — perigenital setae; 26 — anal opening; 27 — gnatosoma, lateral view; 28 — palp, lateral view; 29 — leg I; 30 — bifurcated seta; 31 — claws. Scale bars: 22–27, 29 = 25; 28, 30–31 = 50.

L 350, Cx-III anterior W 170, Cx-IV posterior W 90; acetabula diameter 8–10, stalk H 15–20; capitulum L 250, rostrum 90, diameter of mouth disk 50; chelicera basal segment L 235, chelic-

eral stylet 30; palp segments L (P-1–5): 10, 30, 27, 34, 18.

**Female.** Perigenital setae (9–10), located along genital opening on each side (Fig. 25).

**Measurements** (n=2). Idiosoma L 1500–2500; frontal plate L 275–330, anterior portion L 48–55, W at level of lateral eyes 108–120; eye capsule L 48–60, Cx-I medial L 240–275, Cx-I+II lateral L 320–375, Cx-I anterior W 150–175, Cx-II posterior W 180–212; Cx-III+IV medial L 430–510, Cx-III anterior W 210–225, Cx-IV posterior W 115–125; acetabula diameter 8–13, stalk H 19–26; capitulum L 280–285, rostrum 62–80, diameter of mouth disk 75–100; chelicera basal segment L 310–350, cheliceral stylet 25–38; palp segments L (P-1–5): 15–19, 48–52, 32–33, 48–50, 22–30; leg segments L (n = 1) (I-L-1–6:) 50, 175, 110, 115, 150, 160; (II-L-1–6:) 55, 225, 145, 150, 185, 175; (III-L-1–6:) 50, 205, 150, 160, 210, 200; (IV-L-1–6:) 85, 200, 220, 250, 275, 225.

**Deutonymph.** Dorsum with three pairs of lateral plates. Genital field with 10 pairs of acetabula.

**Measurements** (n = 1). Idiosoma L 700; frontal plate L/W 150/85, anterior portion L 30, eye capsule L 45, Cx-I medial L 125, Cx-I+II lateral L 185, Cx-I anterior W 110, Cx-II posterior W 120; Cx-III+IV medial L 205, Cx-III anterior W 115, Cx-IV posterior W 65; acetabula diameter 8, height of stalk of acetabula 15; capitulum L 190, length of rostrum 75, diameter of mouth disk 40; chelicera basal segment L 210, cheliceral stylet 22; palp segments L (P-1–5): 6, 30, 24, 32, 18.

**Differential diagnosis.** In the presence of tuberculate dorsal sclerite plates, *L. fasta* is similar to the two Nearctic species *L. anomala* Habeeb, 1965 and *L. appalachiana* Smith et Cook, 2005, and the Palaearctic *L. azubi* Gerecke, 2005. These three species differ in shape and setation of the frontal plate (posterior part relatively shorter and strongly narrowed, setae *Vi* and *Oi* located posterior to lateral eyes), posterior dorsum bearing only one unpaired plate, P-2 lacking ventrodistal setae, and a stouter P-4.

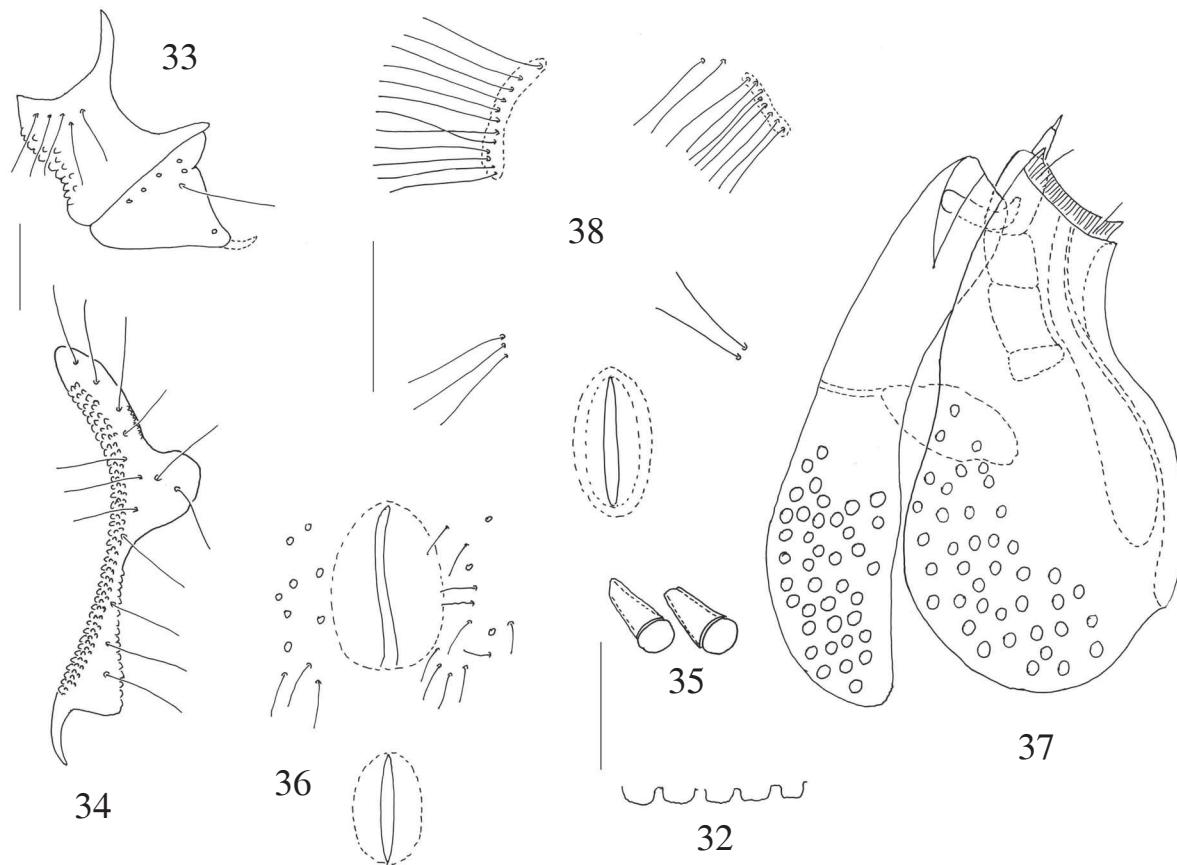
#### *Limnochares (Limnochares) simulans* sp. n.

Figs. 32–45

**Type series.** Holotype female, Madagascar, MD 170b, 29.11.2001, Tampoketsan Ankazobe (Antananarivo), R. Andranofeno Sud at bridge R.N.4, km 130, 1450 m, 22.9°C, slide-mounted, SMF nr. ##. Paratypes: site and date as holotype (1/0/0) slide-mounted, SMF nr. ##, (1/0/0) in Koenike's fluid; MD 61, 05.09.2001, Tsimelahy (Tulear), "piscine naturelle" below cascades of Riv. Antarantsa, 200 m, 21.0 (surface at mid day 25.8°C) (2/7/1) in Koenike's fluid.

**Diagnosis.** Dorsum in addition to frontal plate without sclerotized plates; all frontal plate setae thin and smooth, *Fch* near anterior margin, *Fp* near anterior margin of eye capsules, *Vi* between posterior lenses, *Oi* on the level of their posterior margin; capitulum with short rostrum, mouth disk large; anteromedial corners of Cx-I separated, Cx-II almost triangular, their medial margin slightly developed; anus not sclerotized; III- and IV-L with relatively short swimming setae in low numbers; tarsi of all legs with several lanceolate dorso-distal setae.

**Description. Both sexes.** Integument with short, flat papillae (Fig. 32). Frontal plate (Fig. 39) elongate (ratio L/W 2.3), with narrow anterior and rather wide posterior portions. Bases of *Fch* and *Fp* widely separated, *Fp* shorter than *Fch*, *Oi* longer than *Vi*. Posterior portion of frontal plate relatively long, tapering very little, its lateral margins with numerous tubercles, lenses of lateral eyes closely together. Cx-I (Fig. 33) trapezoidal, anterior margin wide, with well developed anterolateral projection, medial margin slightly concave; anteromedial protrusion of Cx-I short, medially not fused; Cx-II with short medial margin. Cx-III+IV (Fig. 34) relatively small, anterior margin of Cx-III very wide, almost three times as long as posterior margin of Cx-IV; all coxae with a few long, thin setae; medial edge of Cx-III+IV with numerous small tubercles. I/II-L (I-L Fig. 41) segments shorter and thicker than those of III-IV-L (Figs. 42–43); III/IV-L-3–5 bearing swimming setae (anterior/posterior: III-L-4, 1–5/3–7, III-L-5, 2–6/3–8; IV-L-4, 2–6/4–8; IV-L-5, 2–9/5–9); tarsi of all legs with several lanceolate dorsodistal setae (Fig. 44); all claws simple (Fig. 45). Genital field with relatively few acetabula (37–41 on each side) on relatively long stalks (Fig. 35). Anal opening not sclerotized. Capitulum (Fig. 37) with a rather large base, almost five times as long as rostrum; pores ventrally smaller than dorsally; mouth disk large, and slightly turned ventrally. Basal segments of chelicera large, cheliceral stylet very small. Palps (Fig. 40) short, attached to lateral surface of capitulum; P-1 very short, without setae; P-2 slightly shorter than P-3, distally with one ventrolateral and two dorsal setae; P-3 with three dorsodistal setae; P-4 with straight ventral and slightly convex dorsal margins, with one long ventral, and three dorsodistal estae, one thick and two thin; P-5 thin with proximal solenidion and four distal setae, one rather large, three short and thin.



Figs. 32–38. *Limnochares simulans* sp.n., adults: 32 — integument, lateral view; 33 — anterior coxal group; 34 — posterior coxal group; 35 — acetabula; 36, 38 — genital field; 37 — gnathosoma, lateral view; 32–37 — female; 38 — male. Scale bars: 32, 35 = 50; 33–34 = 100; 36–38 = 25.

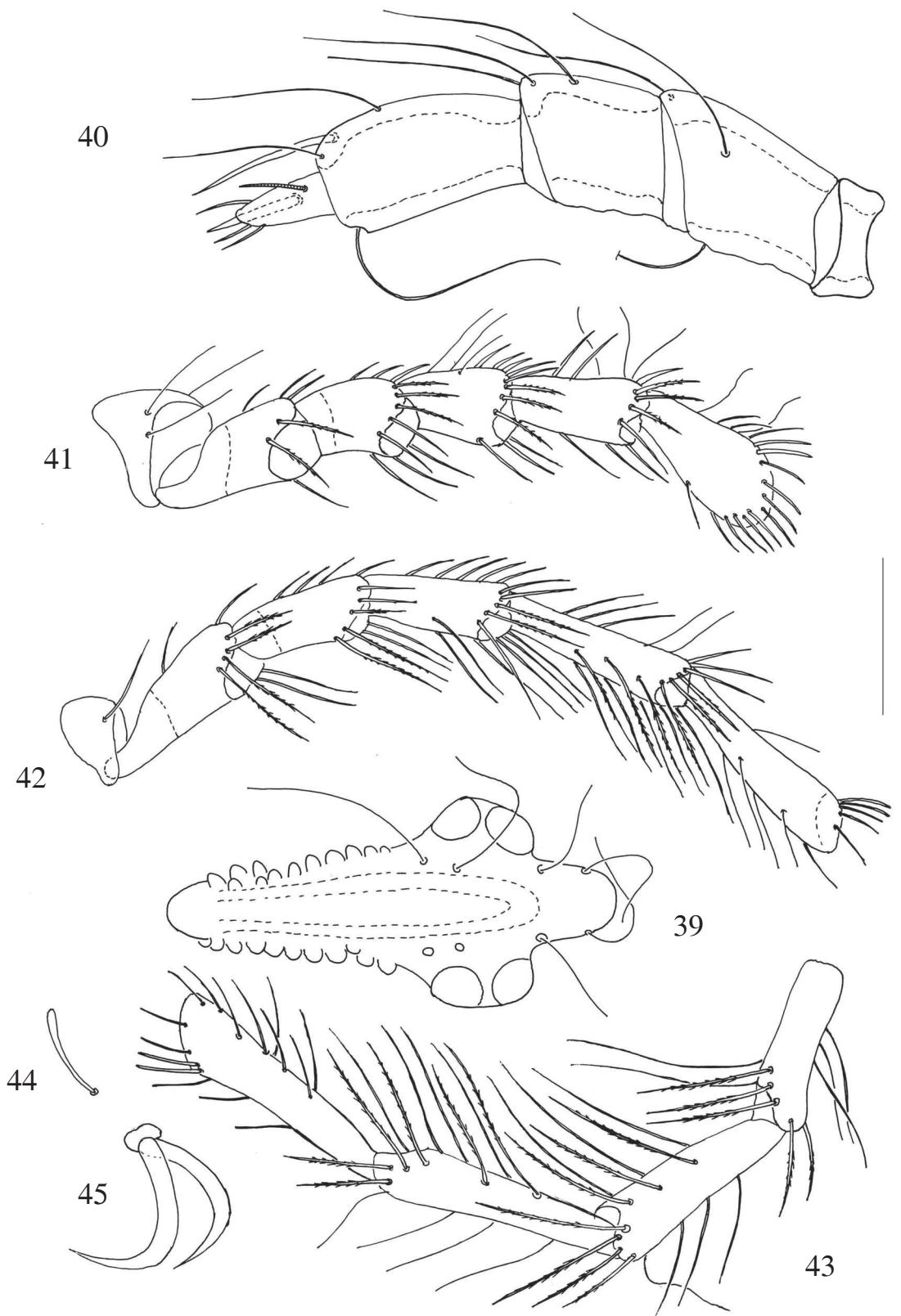
**Male.** Perigenital setae in four groups (Fig. 38), anterior groups with 10–11, posterior groups with two or three setae on each side.

**Measurements** ( $n = 2$ ). Idiosoma L about 1600–1950; frontal plate L/W 235–315/110–130, anterior portion L/W 37/42–60; eye capsule L 55; Cx-I medial L 160–200, Cx-I+II lateral L 285–350, Cx-I anterior W 135–165, Cx-II posterior W 175–215, Cx-III+IV medial L 450–525, Cx-III anterior W 210–290, Cx-IV posterior W 75–100; acetabula diameter 9–13, acetabular stalk L 12–16; capitulum L 290–350, rostrum L 62–75, diameter of mouth disk 75–88; chelicera basal segment L 310–365, rostrum L 62, diameter of mouth disk 160; chelicera basal segment L 335, claw 37; palp segments L (P-1–5): 15, 42, 29, 51, 22; leg segments L (I-L-1–6:) 50–100, 120–150, 75–100, 85–115, 110–140, 110–140; (II-L-1–6:) 50–90, 135–190, 105–125, 110–140, 130–165, 135–175; (III-L-1–6:) 50–75, 105–150, 110–150, 125–165, 150–200, 160–215; (IV-L-1–6:) 60–100, 125–200, 135–190, 160–225, 200–265, 185–240.

**Female.** Perigenital setae (11–14) located along genital opening on each side (Fig. 36).

**Measurements** ( $n = 1$ ). Idiosoma L about 1600; frontal plate L/W 265/112, anterior portion L/W 45/45; eye capsule L 62; Cx-I medial L 180, Cx-I+II lateral L 285, Cx-I anterior W 135, Cx-II posterior W 170; Cx-III+IV medial L 400, Cx-III anterior W 225, Cx-IV posterior W 75; acetabula diameter 9–13, acetabular stalk L 12–16; capitulum L 310, rostrum L 62, diameter of mouth disk 160; chelicera basal segment L 335, claw 37; palp segments L (P-1–5): 15, 42, 29, 51, 22; leg segments L (I-L-1–6:) 50, 135, 100, 105, 135, 150; (II-L-1–6:) 60, 150, 105, 112, 112, 135, 150; (III-L-1–6:) 50, 112, 112, 125, 162, ?; (IV-L-1–6:) 75, 112, 145, 175, 200, 185.

**Differential diagnosis.** In many aspects *L. simulans* resembles to *L. crinita*. In particular, shape and setation of frontal plate and palp indicate a close relationship between the two species. *Limnochares crinita* differs from *L. simulans* in higher numbers of swimming setae (Fig. 12) and coxal setae (Figs. 3–4). Furthermore, integument papillae are more elevated and rounded (Fig. 1).



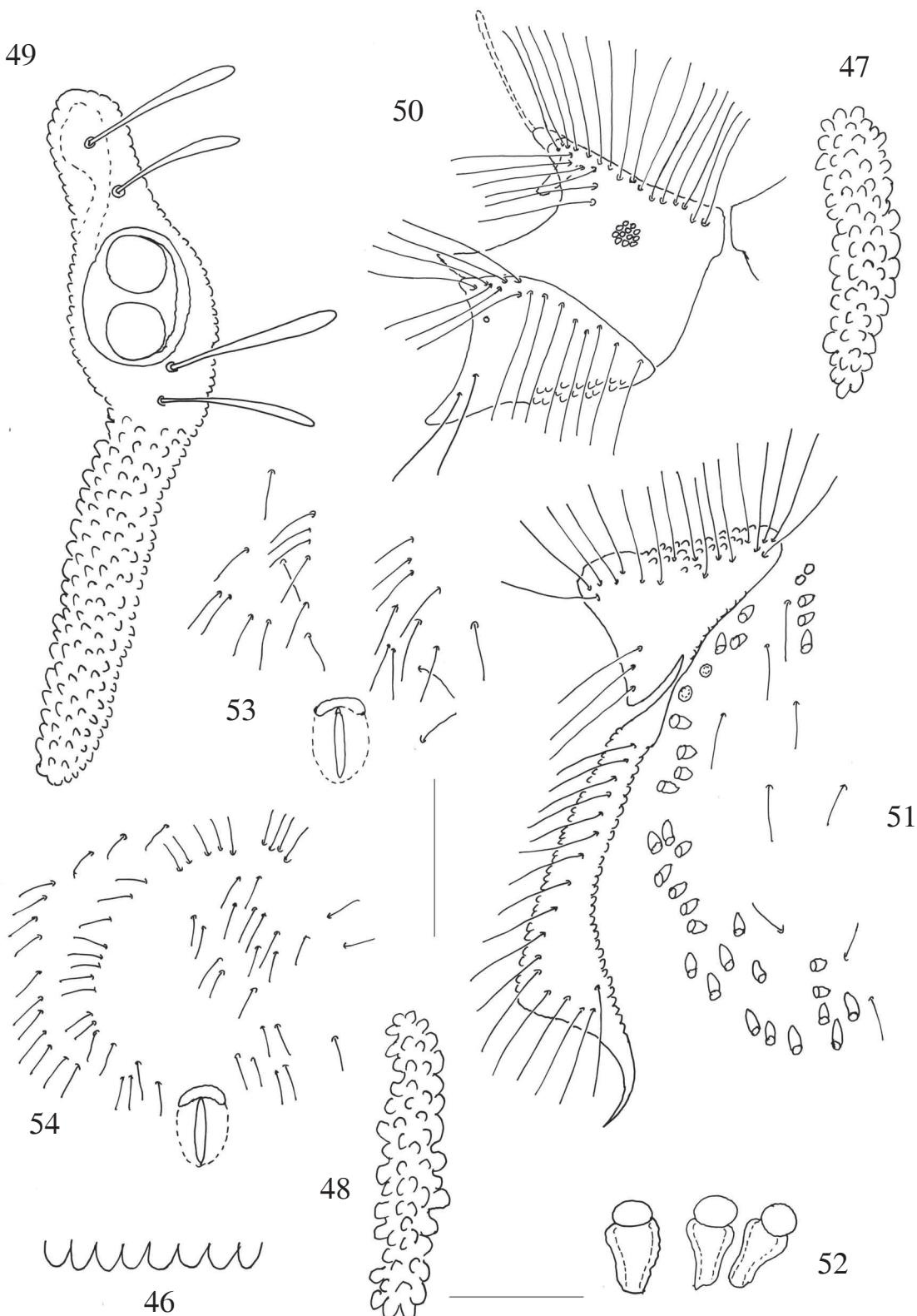
Figs. 39–45. *Limnochares simulans* sp.n., male: 39 — frontal plate; 40 — palp, lateral view; 41 — leg I; 42 — leg III; 43 — telofemur, genu, tibia and tarsus of leg IV; 44 — lance-oblong seta; 45 — claws. Scale bars: 39, 41–43 = 25; 40, 44–45 = 50.

***Limnochares (Limnochares) connexa* sp. n.**

Figs. 46–64

**Type series.** Holotype female, Madagascar, MD 41, 21.08.2001, Ranomena (Fianarantsoa),

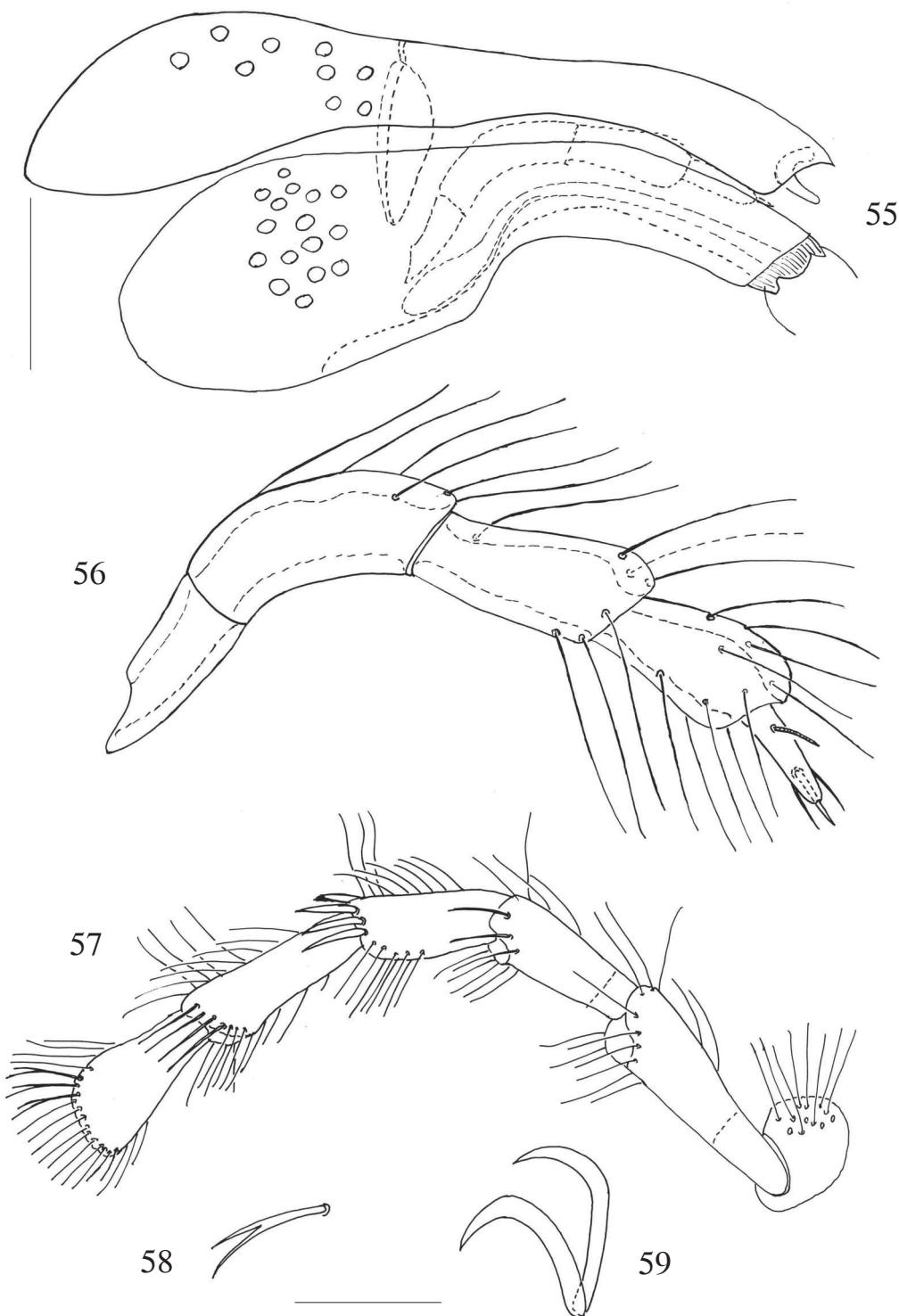
upper course of the stream NW from the 1.07 km-railway-tunnel, 1000 m, 14.8°C, slide-mounted, SMF nr. ##. Paratypes: MD 35, 19.08.2001, Ranomena (Fianarantsoa), stream NW from the



Figs. 46–54. *Limnochares connexa* sp.n., adults: 46 — fragment of integument, lateral view; 47 — anterior dorsal plate; 48 — posterior dorsal plate; 49 — frontal plate; 50 — anterior coxal group; 51 — posterior coxal group; 52 — acetabula; 53–54 — genital field; 46–53 — female, 54 — male. Scale bars: 46–49, 52 = 50; 50–51, 53–54 = 25.

1.07 km-railway tunnel, 14.8°C (0/1/0), slide-mounted, SMF nr. ##; MD 42, Ranomena (Fianarantsoa), riparian spring at MD 41, 14.6°C (1/0/0) slide-mounted, SMF nr. ##.

**Diagnosis.** Dorsum with two pairs of plates; all frontal plate setae lanceolate, *Fch* and *Fp* anterior to, *Vi* at level of posterior margin of, and *Oi* posterior to, lateral eye capsules; capitulum with

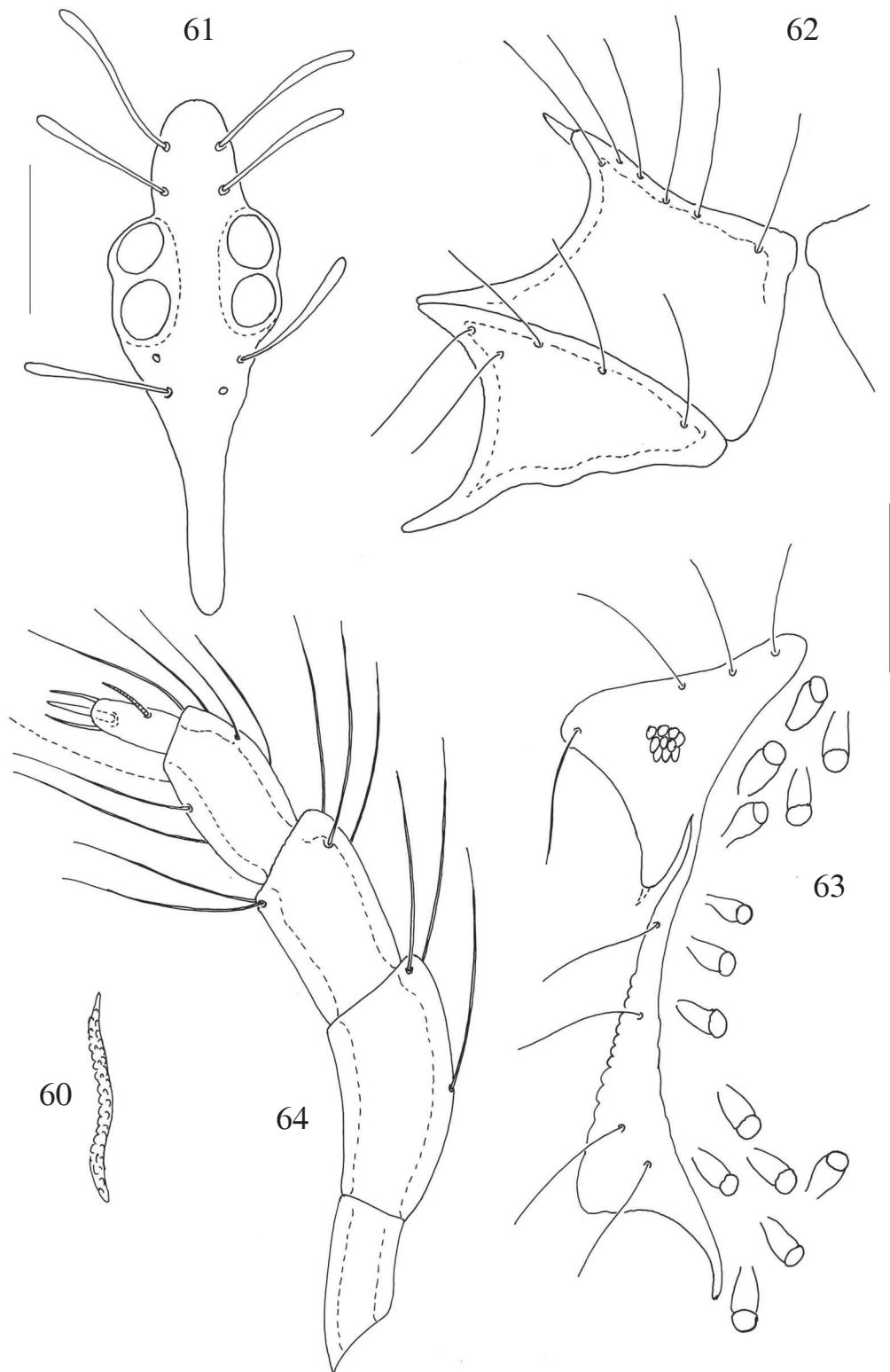


Figs. 55–59. *Limnochares connexa* sp.n., female: 55 — gnathosoma, lateral view; 56 — palp, lateral view; 57 — leg I; 58 — bifurcated seta; 59 — claws. Scale bars: 55, 57 = 25; 56, 58, 59 = 50.

long rostrum (capitular base and rostrum subequal in length); P-1 longer than high; Cx-I triangular, Cx-III+IV connected only medially by a narrow strip, laterally separate from each other; legs without swimming setae, tarsi of all legs with bifurcated distal setae.

**Description. Both sexes.** Integument with rather long rounded papillae (Fig. 46). Dorsum

with frontal plate and two paired lateral plates, anterior ones (Fig. 47) slightly shorter than posterior ones (Fig. 48). Frontal plate (Fig. 49) elongate (ratio length/width 2.4), its posterior portion relatively long, lateral surfaces with numerous tubercles. All setae on frontal plate lanceolate, *Fch*, *Vi* and *Oi* subequal, these slightly longer than *Fp*. Bases of setae *Fch* and *Fp* rather widely separated, located



Figs. 60–64. *Limnochares connexa* sp.n., deutonymphs: 60 — dorsal plate; 61 — frontal plate; 62 — anterior coxal group; 63 — posterior coxal group; 64 — palp, lateral view. Scale bars: 60, 62–63 = 25; 61, 64 = 50.

near anterior margin of frontal plate, *Fp* near anterior lateral eye lenses; *Vi* located at level of posterior margin of eye capsules, *Oi* posterior to eye capsules. *Cx-I* (Fig. 50) trapezoidal, anterior margin wide straight, medial margin slightly concave.

Anteromedial protrusion of *Cx-I* short and not fused to each other. *Cx-II* triangular, without medial margin. *Cx-III+IV* connected to each other only medially by a narrow strip (Fig. 51), anterior margin of *Cx-III* straight, almost 1.3 times as long

as posterior margin of Cx-IV. Coxae of all legs with rather numerous long, thin setae. Anterior and medial margin of Cx-III, and medial and lateral margin of Cx-IV with numerous small tubercles. Genital field with relatively a few acetabula (34–35 on each side) on moderately developed stalks (Fig. 52). Legs without swimming setae. I-/II-L with slightly shorter and thicker segments than III-/IV-L. I-/II-L-3 with some spine-like distal setae, setae of other segments simple. Tarsi of all legs with several bifurcated distal setae (Fig. 58). All claws simple (Fig. 59). Capitulum (Fig. 55) with long rostrum, capitular base and rostrum almost subequal in length; mouth disk slightly turned ventrally. Basal segment of chelicera proximally enlarged, cheliceral stylet very small. Palps (Fig. 56) slender, inserting on ventrolateral surface of capitular base. P-1 without setae, ventral margin relatively longer than dorsal margin. P-2 curved, slightly longer than P-3 and P-4, with six dorsodistal setae; P-3 with one proximal and 5–6 distal setae, P-4 ventral margin straight, dorsal margin slightly convex, bearing 11–16 setae; P-5 thin with short proximal solenidion and three distal setae, one rather large, two shorter.

**Male.** Perigenital setae numerous and located around of genital opening (Fig. 54).

**Measurements** (n = 1). Idiosoma L 1250; frontal plate L 210, anterior portion L 39, laterale eye capsule L 42, Cx-I medial L 125, Cx-I+II lateral L 212, Cx-I anterior W 135, Cx-II posterior W 150; Cx-III+IV medial L 410, Cx-III anterior W 150, Cx-IV posterior W 85; acetabula diameter 9–13, stalk L 19–23; capitulum L 330, rostrum 120, diameter of mouth disk 36; chelicera basal segment L 415, cheliceral stylet 35; palp segments L (P-1–5): 54, 81, 60, 54, 24; leg segments L: (I-L-1–6:) 75, 175, 110, 105, 125, 110; (II-L-1–6:) 75, 185, 120, 135, 160, 130; (III-L-1–6:) 75, 175, 130, 150, 175, 155; (IV-L-1–6:) 75, 210, 180, 200, 225, 200.

**Female.** Genital opening flanked by relatively not numerous perigenital setae on each side (Fig. 53).

**Measurements** (n=2). Idiosoma L 900–1260; frontal plate L 230–245, anterior portion L 50–55, eye capsule L 45–48, Cx-I medial L 120–128, Cx-I+II lateral L 215–230, Cx-I anterior W 135–150, Cx-II posterior W 150–165; Cx-III+IV medial L 360–450, Cx-III anterior W 130–155, Cx-IV posterior W 100–110; acetabula diameter 12–16, stalk L 16–25; capitulum L 360–380, rostrum 125–150, diameter of mouth disk 48–54; chelicera basal

segment L 410–435, cheliceral stylet 30–40; palp segments L (P-1–5): 54–58, 78–96, 55–66, 48–55, 24–28; leg segments L (I-L-1–6:) 48–60, 180–185, 108–120, 105–115, 125–135, 105–115; (II-L-1–6:) 55–60, 175–195, 120–130, 130–140, 160–175, 125–140; (III-L-1–6:) 55–60, 175–185, 130–140, 140–150, 170–180, 150–170; (IV-L-1–6:) 60–65, 220–230, 180–190, 200–210, 220–230, 185–205.

**Deutonymph.** Dorsum with one pair of narrow lateral plates (Fig. 60). Frontal plate (Fig. 61) with relatively wide anterior portion and rounded anterior margin, posterior portion posteriorly strongly narrowed. Coxae (Figs. 62, 63) with a few thin, long setae. Genital field with 11–15 acetabula on each side. P-2 with one proximal and two dorsodistal setae, P-3 with two ventrodistal and three dorsodistal setae, P-4 with three ventrodistal and four dorsodistal setae, P-5 with proximal solenidion and three distal setae, one relatively large, two thin (Fig. 64).

**Measurements** (n = 1). Idiosoma L 685; frontal plate L/W 125/115, anterior portion L/W 27/102, eye capsule L 30, Cx-I medial L 70, Cx-I+II lateral L 145, Cx-I anterior W 102, Cx-II posterior W 115; Cx-III+IV medial L 220, Cx-III anterior W 90, Cx-IV posterior W 55; acetabula diameter 9–11, stalk L 16–19; capitulum L 235, rostrum 78, diameter of mouth disk 30; chelicera basal segment L 270, cheliceral stylet 24; palp segments L (P-1–5): 45, 64, 46, 38, 19; leg segments L: (I-L-1–6:) 70, 220, 145, 145, 175, 160; (II-L-1–6:) 65, 235, 150, 162, 215, 175; (III-L-1–6:) 78, 220, 150, 170, 215, 200; (IV-L-1–6:) 78, 260, 205, 235, 265, 260.

**Differential diagnosis.** *Limnochares connexa* differs from all other species of the genus in the combination of the following characters: (1) Cx-III+IV fused to each other only by a narrow medial strip, laterally separate; (2) frontal plate with lanceolate setae; (3) capitulum with long rostrum (capitular base and rostrum approximately subequal in length); (4) palp slender, with long P-1 and curved P-2.

#### Genus *Neolimnochares* Lundblad, 1937

##### *Neolimnochares* (*Neolimnochares*) *tenuiscutata* K. Viets, 1914

Published record from Madagascar: Tananarive (Walter and Bader 1953).

**Remark.** Following the original description which was based on a specimen from South Africa (Cape province, Vlegbai, K. Viets 1914, no type material in coll. K. Viets, SMF), *N. tenuiscutata* is

rather similar to species at present placed in the genus *Limnochares*, such as *L. crinita* and *L. simulans* (see above). From these, it differs in the name giving slender shape of the posterior portion of the frontal plate and the reduced number of palp segments typical for *Neolimnochares* species. In contrast to other species of the genus, however, the palp is rather large and a partial suture line is visible, indicating that the reduction in segment number was reached by fusion of P-2+3. Thus, *N. tenuiscutata* represents an intermediate situation between the two genera. Furthermore, with regard to material from Madagascar, Walter and Bader (1953) report on a wide variability in the degree to which P-2+P-3 are fused. Our material does not include representatives with characters as described for *N. tenuiscutata*. Moreover, neither in populations of *Limnochares* from field work 2001 nor from MNHN Paris, any individual could be found with P-2+3 tending to fuse. *Neolimnochares tenuiscutata* merits redescription based on material from both, Continental Africa and Madagascar.

***Neolimnochares (Neolimnochares)  
madagascariensis* sp.n.**

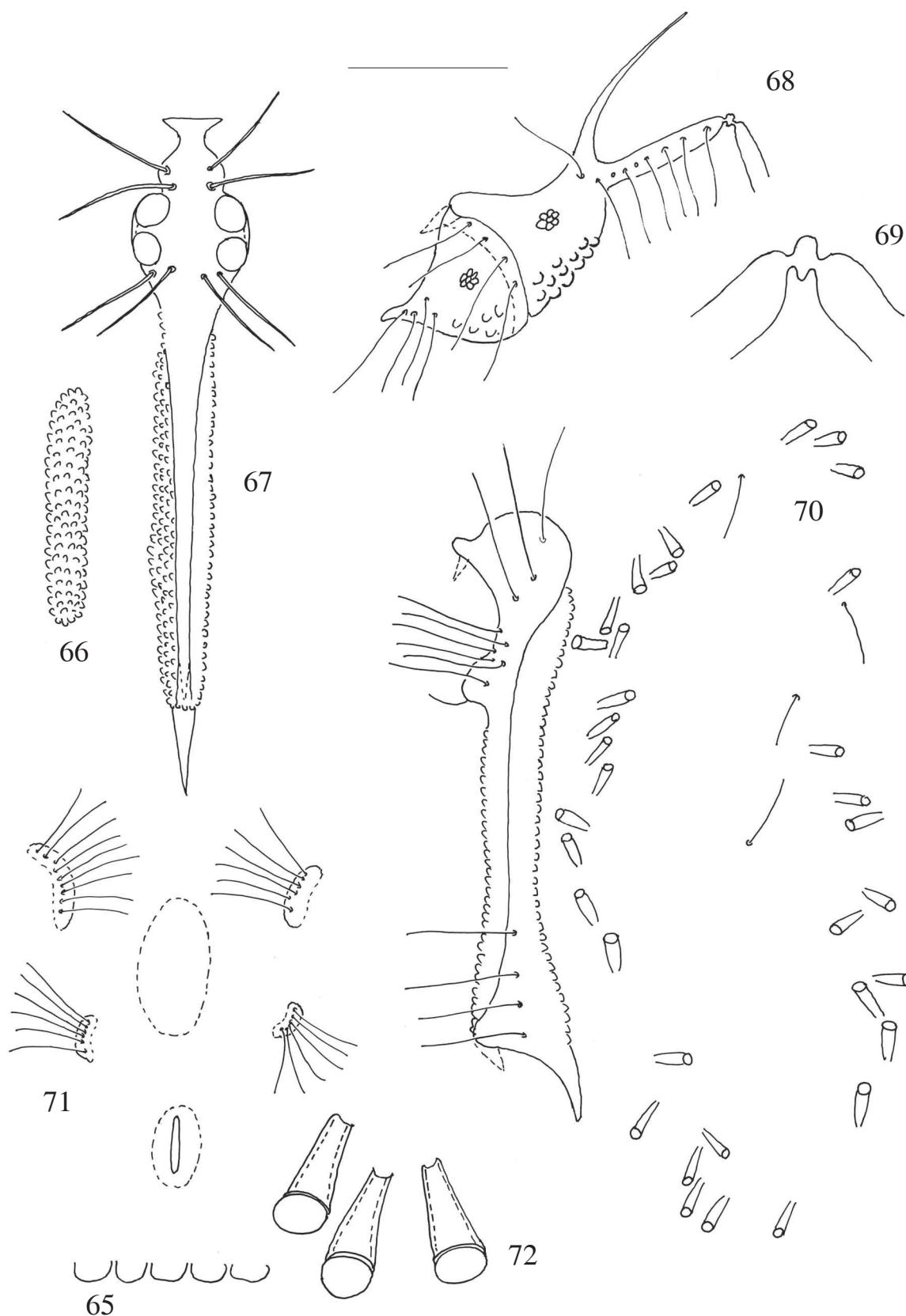
Figs. 65–85

**Type material.** Holotype male, Madagascar, MD 073, 10.09. 2001, Andohahela (Tulear), Isaka, riparian springs near stream crossing RIP 118 at km 34.5, 540 m, 17.3°C, slide-mounted, SMF nr. ##. Paratypes MD 011, 21.07.2001 Anjozorobe (Antananarivo), Ravoandrina, Riv. Ampanakamonty near campsite, 1280 m, 12.8°C (0/2/0) in Koenike's fluid, (0/1/1) slide-mounted, SMF nr. ##; MD 041, 21.08.2001 Ranomena (Fianarantsoa), upper course of the stream NW from the 1.07 km-railway-tunnel (right affluent of MD 034), 1000 m, 14.8°C (4/2/1) slide-mounted, SMF nrs ##, (6/9/1) in Koenike's fluid; MD 042, 21.08.2001, riparian spring at upper course of stream MD 041, 1000 m, 14.6°C (0/1/0) slide-mounted, SMF nr. ##, (2/0/0) in Koenike's fluid; MD 043, 21.08.2001 Ranomena (Fianarantsoa), spring area of stream MD 041, 1100 m, 15.1°C (0/1/0) slide-mounted, SMF nr. ##, (2/0/0) in Koenike's fluid; MD 071, 10.09.2001 Andohahela (Tulear), Isaka, spring area S pass RIP 118 (km 36), 700 m, 16.0–18.4°C (1/0/0) slide-mounted, SMF nr. ##, (0/2/0) in Koenike's fluid; MD 099, 26.09.2001 Ranohira (Fianarantsoa), left affluent of the stream flowing to Riv. Ihazofotsy upstr. 'Isalo Ranch', 780 m, 24.8°C (1/0/0) slide-mount-

ed, SMF nr. ##; MD 162, 20.11.2001, Joffreville (M. d'Ambre, Antsiranana), R. de Manques in Reserve Fontenay, 730 m, 21.5 (0/1/0) in Koenike's fluid; MD 163, 20.11.2001 Joffreville (M. d'Ambre, Antsiranana), R. de Manques in Reserve Fontenay, 580 m, 21.1°C (0/1/0) slide-mounted, SMF nr. ##.

**Diagnosis.** Dorsum in addition to frontal plate with one pair of elongate anterior plates. All frontal plate setae simple, pinnate. Anteromedial protrusions of the facing Cx-I fused to each other (Figs. 68, 69). Acetabula on long stalks; anal pore unsclerotized. Capitular base 3–4 times as long as rostrum, mouth disk slightly turned ventrally. Palps slender; P-2 extremely elongated (L/H 5.0–6.0); P-3 slightly longer than high, with two long and fine setae ventro- and dorsodistally. I–IV-L-6 with several bifurcated dorsodistal setae and simple claws.

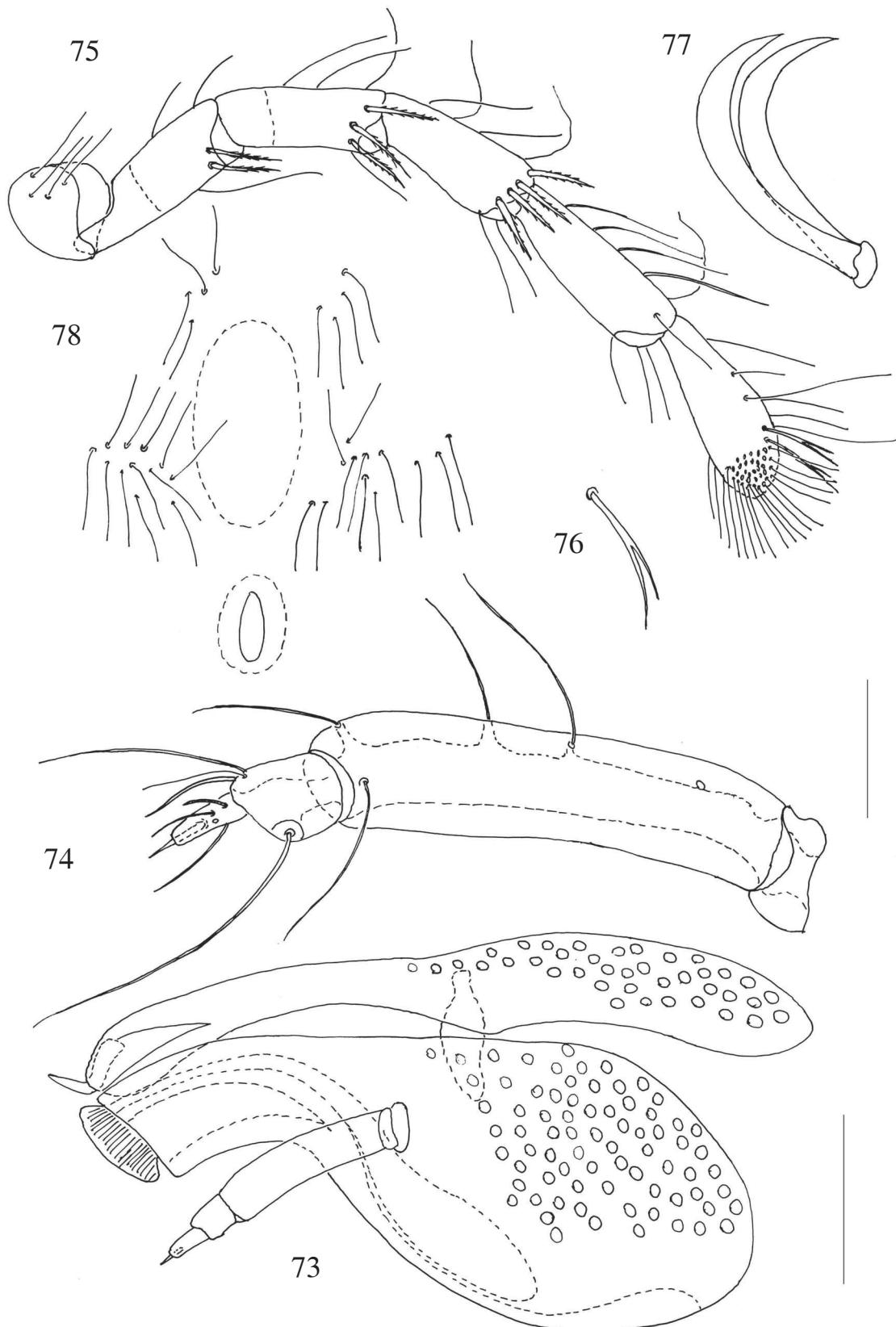
**Description. Both sexes.** Integument with short flat papillae (Fig. 65). Dorsum with frontal plate and one pair of anterior elongate plates (Fig. 66). Frontal plate (Fig. 67) elongate, with straight anterior margin, posterior portion long, laterally tuberculate, ending in a pointed tip; setae on the plate subequal in L — *Fch* and *Fp* closely together anterior to eye capsules, *Vi* and *Oi* closely together on the level of, or behind to, posterior margin of eye capsules. Cx-I (Fig. 68) trapezoidal, with long, narrow anteromedial projection and long, pointed anterolateral projection. Anteromedial projection of facing Cx-I fused to each other (Fig. 69). Cx-II almost triangular, medial margin only little developed. Medial edges of Cx-I+II slightly convex, covered with small tubercles. Cx-III+IV (Fig. 70) elongate, anterior margin of Cx-III and posterior margin of Cx-IV subequal in width. Anterior margin of Cx-III convex with short lateral projection. Lateral margins of Cx-III+IV with numerous small tubercles. All coxae with scattered long and fine setae. I-/II-L shorter and thicker than III-/IV-L (Fig. 75). I-/II-L-2–4 with thickened, serrate setae; I-IV-L-6 with several bifurcated dorsodistal setae (Fig. 76) and simple claws (Fig. 77). Genital field with 33–35 long-stalked acetabula (Fig. 72). Anal opening without sclerotization. Capitulum (Fig. 73) elongate, base rather wide, 3–4 times as long as rostrum. Mouth disk slightly turned ventrally. Basal segment of chelicera long and narrow, cheliceral style very small. Palps (Fig. 74) slender, attached to lateral surface of capitular base near transition to rostrum; P-5 very short, without setae; P-2



Figs. 65–72. *Neolimnochares madagascariensis* sp.n., male: 65 — integument, lateral view; 66 — dorsal plate; 67 — frontal plate; 68 — anterior coxal group; 69 — fragment of median portions of Cx-I; 70 — posterior coxal group; 71 — genito-anal area; 72 — acetabula. Scale bars: 65, 69, 72 = 50; 66–68, 70 = 25.

extremely elongated, with almost straight ventral and dorsal margins, bearing one distolateral and

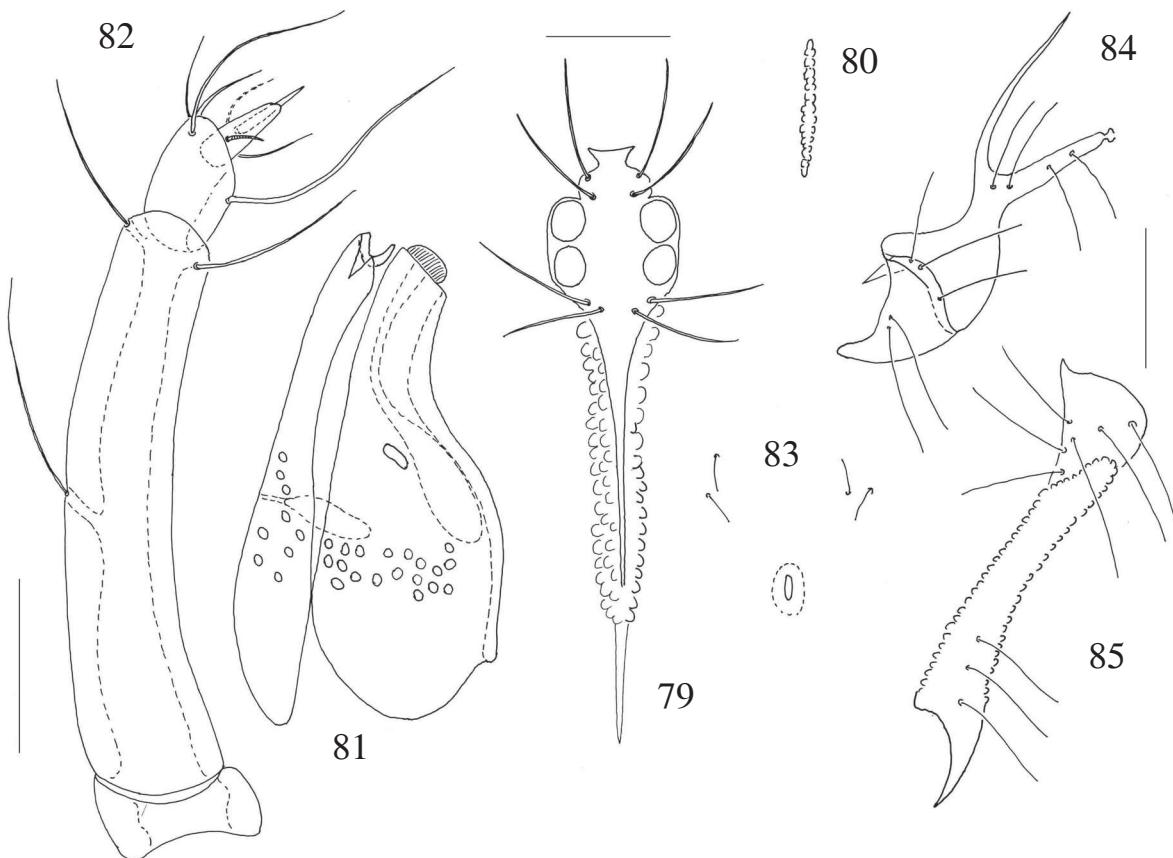
three-four dorsal setae; P-3 short, with long ventrodistal and three unequal dorsodistal setae, the



Figs. 73–78. *Neolimnochares madagascariensis* sp.n., adults: 73 — gnathosoma, lateral view; 74 — palp, lateral view; 75 — leg IV; 76 — bifurcated seta; 77 — claws; 78 — genito-anal area; 73–77 — male, 78 — female. Scale bars: 74, 76–77 = 50; 73, 75, 78 = 25.

longest of them extending far over tip of P-4. P-4 rod-shaped, distally slightly narrowed, with short

proximal solenidion and 3–4 distal setae, one of them thickened, the others thin, unequal in sized.



Figs. 79–85. *Neolimnochares madagascariensis* sp.n., deutonymphs: 79 — frontal plate; 80 — dorsal plate; 81 — gnathosoma, lateral view; 82 — palp, lateral view; 83 — genito-anal area; 84 — Cx-I+II; 85 — Cx-III+IV. Scale bars: 79 = 50; 80, 81, 83–85 = 25, 82 = 40.

**Male.** Perigenital setae (12–15 on each side) in four groups (Fig. 71), anterior groups with more setae than posterior ones.

**Measurements** ( $n = 7$ ). Idiosoma L about 2400; frontal plate L/W 325–440/60–65, anterior portion L/W 25–50/25–37, eye capsule L 50–75; Cx-I medial L 200–265, Cx-I+II lateral L 175–250, Cx-I anterior W 100–150, Cx-II posterior W 110–165; Cx-III+IV medial L 435–540, Cx-III anterior W 85–125, Cx-IV posterior W 85–125; acetabula diameter 10–15, stalk H 25–32; capitulum L 360–450, rostrum 100–125, diameter mouth disk 50–75; chelicera basal segment L 375–500, cheliceral stylet 35–40; palp segments L (P1–4) — 19–23, 125–148, 22–29, 19–23; leg segments L: (I-L-1–6:) 50–87, 125–190, 110–165, 125–165, 125–175, 115–165; (II-L-1–6:) 60–87, 150–215, 135–165, 135–190, 150–200, 130–190; (III-L-1–6:) 50–75, 135–200, 135–190, 150–190, 175–225, 160–200; (IV-L-1–6:) 50–75, 150–215, 150–200, 170–215, 185–240, 160–215.

**Female.** Genital opening surrounded by a few scattered perigenital setae (Fig. 78).

**Measurements** ( $n = 7$ ). Idiosoma L about 2400; frontal plate L/W 435–450/85–100, anterior

or portion L/W 60–65, anterior margin W 60–75; eye capsule L 60–75, Cx-I medial L 245–255, Cx-I+II lateral L 225–250, Cx-I anterior W 120–125, Cx-II posterior W 135–175; Cx-III+IV medial L 460–470, Cx-III anterior W 100–110, Cx-IV posterior W 100–125; acetabula diameter 9–13, stalk H 25–29; capitulum L 435–500, rostrum 110–140, diameter of mouth disk 60–75; chelicera basal segment L 425–525, cheliceral stylet 35–40; palp segments L (P1–4) — 22–26, 120–180, 22–32, 22–26; leg segments L: (I-L-1–6:) 62–75, 160–175, 135–150, 150–165, 150–165, 135–165; (II-L-1–6:) 62–75, 185–200, 160–175, 175–190, 200–215, 160–175; (III-L-1–6:) 60–65, 180–190, 160–175, 180–190, 210–220, 195–205; (IV-L-1–6:) 60–65, 200–215, 185–200, 210–240, 235–250, 220–230.

**Deutonymph.** Anterior portion of frontal plate (Fig. 79) shorter than eye capsules. Paired anterolateral plates very narrow (Fig. 80). Capitular base and basal segment of chelicera with a few large pores (Fig. 81). P-2 very slender (ratio length/height = 5.0–6.0), with single ventrodistal and two dorsal setae, P-3–5 as in adults (Fig. 82). Both coxisternal groups (Figs. 84, 85) with a few thin setae.

Provisional genital field (Fig. 83) with two pairs of perigenital setae.

**Measurements** ( $n = 2$ ). Idiosoma L about 1185; frontal plate L/W 185–275/55–63, anterior portion L/W 18–25/19–25, eye capsule L 45–50, Cx-I medial L 135–150, Cx-I+II lateral L 110–165, Cx-I anterior W 75–113, Cx-II posterior W 75–100; Cx-III+IV medial L 260–300, Cx-III anterior W 62–75, Cx-IV posterior W 62–100; acetabula diameter 10–13, stalk H 19–26; capitulum L 275–315, rostrum 65–88, diameter of mouth disk 35–50; chelicera basal segment L 300–337, cheliceral stylet 25–32; palp segments L (P1–4) — 12–16, 96–102, 17–26, 16–19; leg segments L (I-L-1–6:) 35–50, 100–113, 85–105, 100–105, 100–105; (II-L-1–6:) 35–45, 100–125, 85–105, 95–112, 110–125, 110–125; (III-L-1–6:) 35–50, 112–125, 90–113, 100–125, 125–138, 118–140; (IV-L-1–6:) 45–55, 100–140, 100–125, 110–150, 125–165, 125–165.

**Differential diagnosis.** *Neolimnochares madagascariensis* differs from all other species of the genus in the unique shape of mouthparts, characterized by very slender basal segments of chelicerae and extremely elongated P-2 with straight dorsal and ventral margins. From other African species, it is furthermore easily distinguished by the presence of one pair of dorsolateral sclerites: In addition to the frontal plates, the other species have no (*N. africana* Cook, 1966, *N. tenuiscutata*) or numerous dorsal plates (*N. placophorella* Cook, 1966).

#### *Neolimnochares (Neolimnochares) longirostris* sp.n.

Figs. 86–97

**Type material.** Holotype deutonymph, Madagascar, MD 164, 20.11.2001, Joffreville (M. d'Ambre, Antsiranana), riparian springs at R. de Manques in Reserve Fontenay, 580 m, 21.0°C slide-mounted, SMF nr. #.

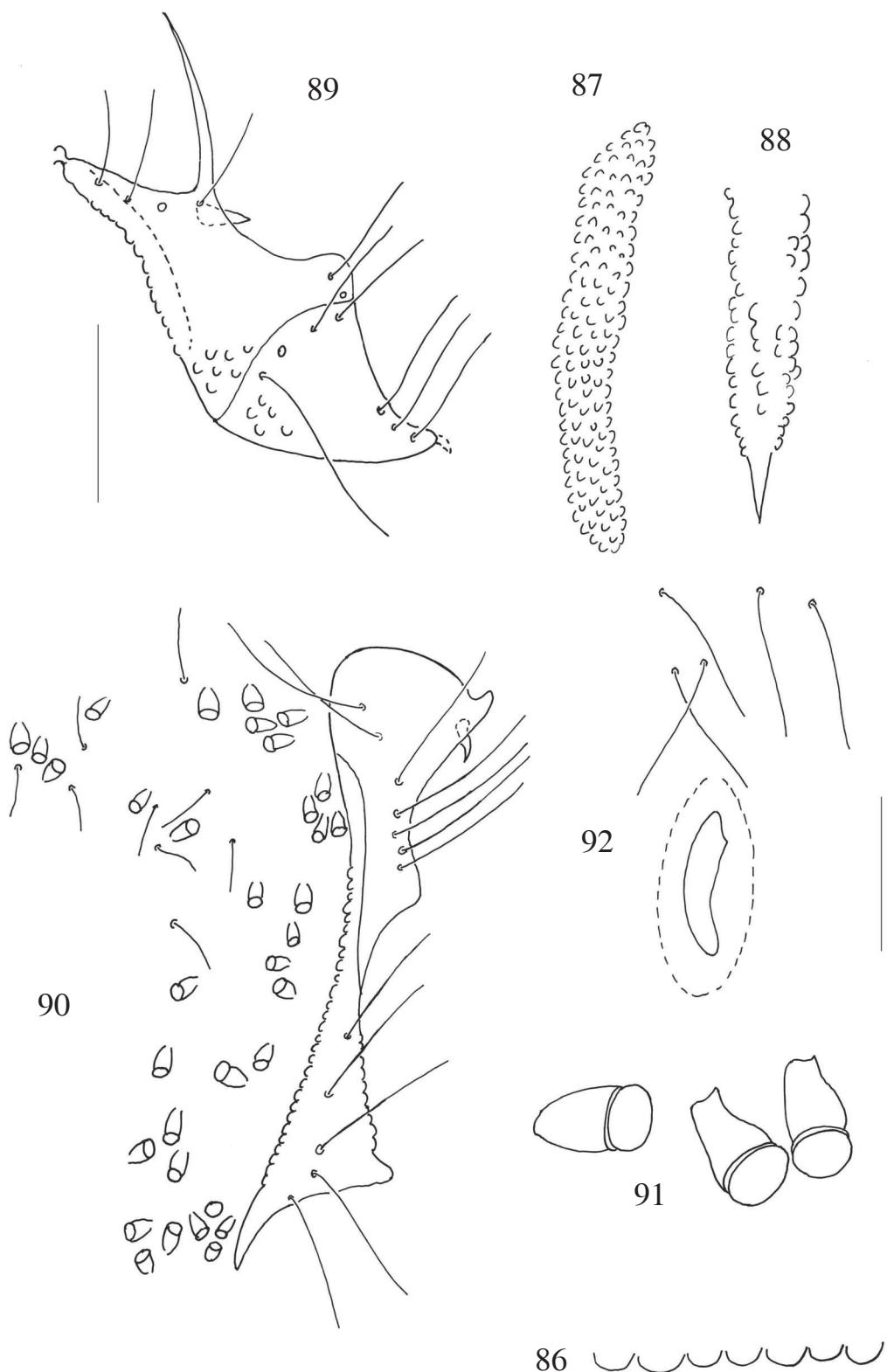
**Diagnosis.** Deutonymph (Adults unknown): Dorsum, in addition to frontal plate, with one pair of anterior plates. Anteromedial protrusions of facing Cx-I fused to each other. I–IV-L-6 with several bifurcated dorsodistal setae. Genital field with about 30 pairs of acetabula on each side and 2–3 perigenital setae. Anus unsclerotized (Fig. 20). Capitular base as long as rostrum. Palps short, inserting on lateral surface of rostrum. P-2 very long and slender (L/H ratio about 5.0)

**Description. Deutonymph.** Integument with short, convex papillae (Fig. 86). Dorsum with frontal plate and one pair of slightly curved, rod-

shaped anterior plates (Fig. 87). Frontal plate lost except for posterior part (Fig. 88). Cx-I (Fig. 89) trapezoidal, with well developed anteromedial protrusion and long anterolateral projection, posterior margin longer than anterior one, medial margin slightly concave and longer than lateral one; anteromedial protrusions of facing Cx-I fused to each other. Cx-II triangular, medial margin not developed. Cx-III+IV (Fig. 90) elongate, anterior margin of Cx-III shorter than posterior margin of Cx-IV; anterior margin of Cx-III convex, with very short lateral projections. All coxae with scattered long and fine setae. Legs approximately subequal in thickness. I–II-L-2–4 with thickened serrate setae (Fig. 95). I–IV-L-6 with several bifurcated dorsodistal setae (Fig. 96) and simple claws (Fig. 97). Genital field on each side with 26–34 of relatively short-stalked acetabula (Fig. 91) and 2–3 perigenital setae, anal opening without sclerotization (Fig. 92). Capitulum (Fig. 93) elongate; rostrum and base subequal in length; mouth opening slightly turned ventrally. Basal segment of chelicera long and narrow, cheliceral stylet very short, air sacs small. Palps (Fig. 94) slender, inserting on lateral surface of rostrum. P-1 very short and without setae; P-2 very long and slender (L/H ratio about 5.0), ventral margin slightly concave, dorsal margin slightly convex, with three or four dorsal, and two ventral setae; P-3 short, with slightly convex dorsal and ventral margins, provided with one ventral and three dorsodistal setae, one thick and two thin; P-5 thin, with proximal solenidion and three distal setae, one of them rather large.

**Measurements** ( $n = 1$ ). Idiosoma L about 1450; Cx-I medial L 185, Cx-I+II lateral L 225, Cx-I anterior W 100, Cx-II posterior W 125; Cx-III+IV medial L 280, Cx-III anterior W 100, Cx-IV posterior W 125; acetabula diameter 12–16, stalk H 19–22; capitulum L 500, rostrum 250, diameter of mouth disk 37; chelicera basal segment L 485, claw 18; palp segments L (P1–4) — 22, 150, 35, 19; leg segments L (I-L-1–6:) 70, 160, 130, 125, 135, 135; (II-L-1–6:) 75, 175, 150, 150, 160; (III-L-1–6:) 75, 160, 145, 150, 175, 175; (IV-L-1–6:) 75, 185, 175, 200, 200, 185.

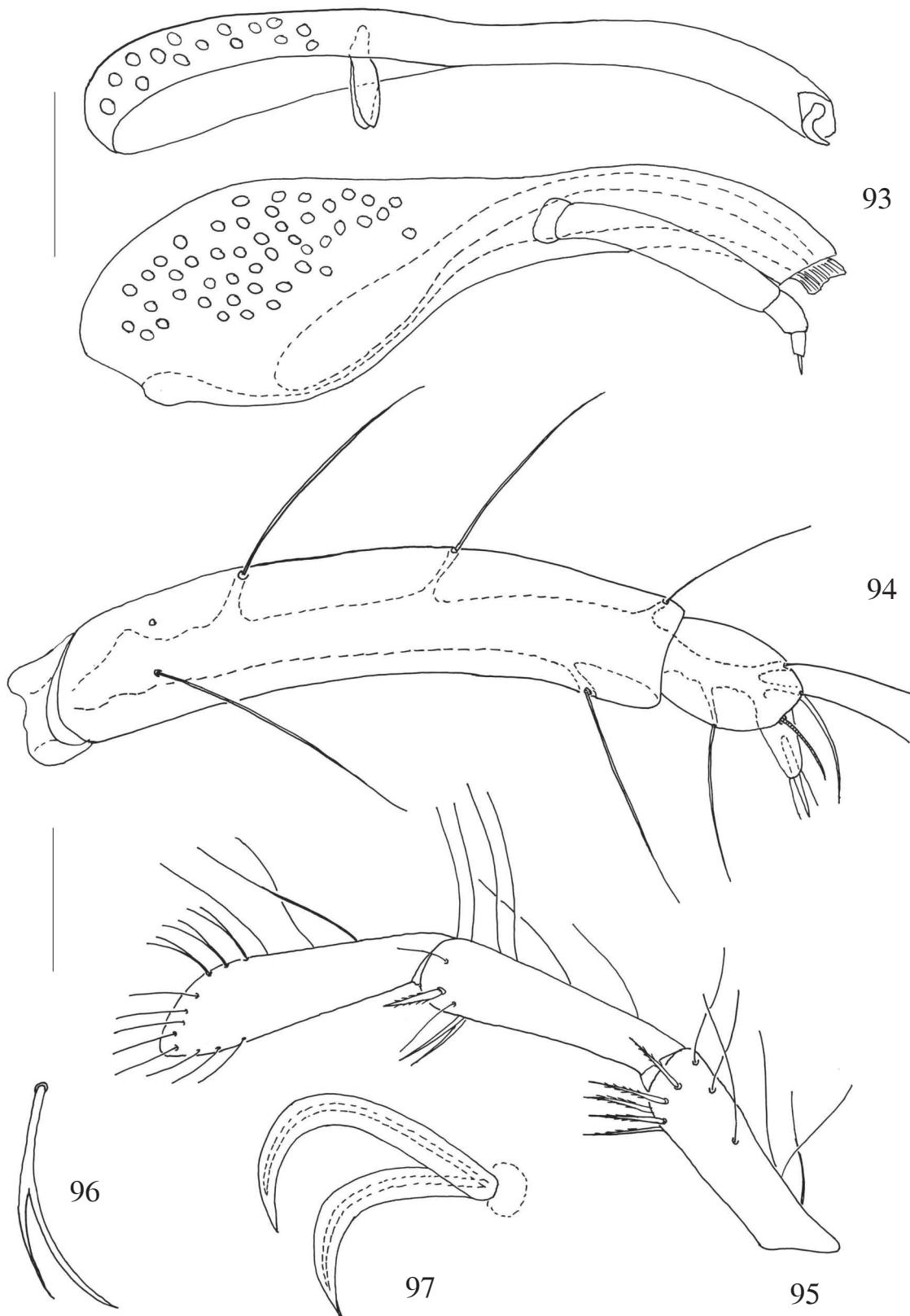
**Differential diagnosis.** *Neolimnochares longirostris* differs from *N. madagascariensis* in the short and enlarged anteromedial protrusion of Cx-I, the capitular base and rostrum subequal in length, with palp inserting in the rostral area, and P-2 bearing a higher number of 5–6 setae. Notwithstanding the fact that the species was found in



Figs. 86–92. *Neolimnochares longirostris* sp.n., deutonymph: 86 — fragment of integument, lateral view; 87 — dorsal plate; 88 — posterior portion of frontal plate; 89 — anterior coxal group; 90 — posterior coxal group; 91 — acetabula; 92 — genito-anal area. Scale bars: 87–88 = 25; 86, 91, 92 = 50.

a single specimen, these considerable differences convinced us to describe it as a representative of a species new to science. *Neolimnochares longimaxillaris* Lundblad, 1969 described from Burma

is similar in the shape of gnathosoma, but differs in absence of paired laterodorsal plates, rostrum shorter than capitular base, P-2 stouter (L/H ratio 2.5) and Cx-I without anterolateral projection.



Figs. 93–97. *Neolimnochares longirostris* sp.n., deutonymph: 93 — gnathosoma, lateral view; 94 — palp, lateral view; 95 — genu, tibia and tarsus of leg IV; 96 — bifurcated seta; 97 — claws. Scale bars: 93, 95 = 25; 94, 96, 97 = 50.

**LIMNOCHARIDAE OF AFRICA,  
KEY TO GENERA AND SPECIES**

1 (12) Palp five-segmented (Fig. 10). ....  
..... genus *Limnochares*

2 (3) P-3 strongly enlarged from base to tip, P-4 extremely inflated oval in shape and bearing numerous pinnate setae. ....  
*Limnochares expansipalpis* Cook, 1966 (Liberia)

- 3 (2) P-3 not, or only little, enlarged from base to tip, P-4 not inflated, without pinnate setae (Fig. 10).  
 4 (9) Dorsum, in addition to frontal plate, with several further plates (Fig. 20), legs without swimming setae.  
 5 (8) In addition to frontal plate, dorsum with four paired and at least one unpaired plate (Fig. 20), Cx-III/IV fused all over their facing sides (Fig. 22).  
 6 (7) Posterior dorsum with two unpaired plates; frontal plate posteriorly longer and not narrowed, setae *Vi* and *Oi* located on the level of lateral eyes (Fig. 21); P-2 with ventrodistal setae (Fig. 28).....  
 .... *Limnochares fasta* sp. nov. (Madagascar)  
 7 (6) Posterior dorsum with one unpaired plate, frontal plate posteriorly shorter and strongly narrowed, setae *Vi* and *Oi* located posterior to lateral eyes; P-2 lacking ventrodistal setae. ....  
 .... *L. azubi* Gerecke, 2005 (Morocco, Europe)  
 8 (5) In addition to frontal plate, dorsum in adults with two pairs, in deutonymphs with one pair of lateral plates, without unpaired plates; Cx-III/IV on each side separated by a long medial indentation, connected only by a narrow lateral strip (Fig. 50), frontal plate setae club-shaped (Fig. 49). ....  
 .... *Limnochares connexa* sp. nov. (Madagascar)  
 9 (4) Dorsum without further plates in addition to frontal plate, legs with swimming setae.  
 10 (11) Legs III–IV with a few swimming setae; coxae with a few setae (Fig. 33), integument with short flat papillae (Fig. 32). ....  
 .... *Limnochares simulans* sp. nov. (Madagascar)  
 11 (10) Legs III–IV with very numerous long swimming setae; coxae with rather numerous setae (Fig. 3); integument with rather long rounded papillae (Fig. 1). .... *Limnochares crinita* Koenike, 1898 (Madagascar, Liberia)  
 12 (1) Palp four-segmented (Fig. 74). ....  
 .... genus *Neolimnochares*  
 13 (16) In addition to frontal plate without dorsal sclerites.  
 14 (15) P-2 with concave ventral margin, bearing a few setae restricted to dorsal side, P-3 subrectangular, distinctly longer than high. ....  
*Neolimnochares tenuiscutata* K. Viets, 1914 (South Africa, Madagascar)  
 15 (14) P-2 with convex ventral margin, bearing numerous (>10) setae scattered all over the distal part, P-3 subquadratic, shorter than high. ....  
*Neolimnochares africana* Cook, 1966 (Liberia)  
 16 (13) Dorsum in addition to frontal plate with further sclerites.  
 17 (18) Dorsum with seven plates, three paired, and one unpaired. P-2 equally enlarged from base to tip, a little shorter than remaining palp segments together. .... *Neolimnochares placophorella* Cook, 1966 (Liberia)  
 18 (17) Dorsum with one pair of (rod-shaped) plates. P-2 dorsal and ventral margins from base to tip parallel, at least two times longer than remaining palp segments together (Figs. 74, 94).  
 19 (20) Cx-I with short and wide anteromedial protrusion (Fig. 89); capitular base and rostrum subequal in length, palp attached to rostrum (Fig. 93). .... *Neolimnochares longirostris* sp. nov. (Madagascar)  
 20 (19) Cx-I with long and narrow anteromedial protrusion (Fig. 68); capitular base almost four times as long as rostrum, palp attached to capitular base (Fig. 81). .... *Neolimnochares madagascariensis* sp. nov. (Madagascar)

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