

## Description of four new *Lepthyphantes* species from Africa, with a redescription of *L. biseriatus* Simon & Fage and *L. tropicalis* Tullgren

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### Summary

Four new species are described in this paper, viz. *Lepthyphantes simiensis* sp.n., *L. acuminifrons* sp.n., *L. bituberculatus* sp.n., and *L. tullgreni* sp.n.; *L. tropicalis* Tullgren and *L. biseriatus* Simon & Fage (= *L. salti* syn.n.) are redescribed. For the last 5 species a new group is proposed (the *tropicalis* group) and a diagnosis given. Relationships with other groups in the genus *Lepthyphantes*, and their zoogeographical affinities, are discussed.

### Introduction

During a stay of three weeks in the Ethiopian Simien Mountains (NE Ethiopia) in 1974, the author caught spiders, especially litter-dwelling species. Surprisingly, no erigonids were present in the material, whereas three linyphiid species were collected. These are described below, and all three appear to belong to the genus *Lepthyphantes*.

Within the Linyphiidae, the genus *Lepthyphantes* is one of the largest. It is very rich in species, especially in Europe, Asia and North America. Only a few species have been described from other parts of the world, and for Africa, this number only amounts to about ten. In 1910, Tullgren described the first *Lepthyphantes* species from the Ethiopian region, viz. *L. tropicalis* and *L. kilimandjaricus*. Further species described were *L. biseriatus* and *L. perexiguus* by Simon & Fage in 1922, *L. mauensis* by di Caporiacco in 1949 and *L. salti* by Denis in 1950. Locket (1968) described 7 further species, but for 5 of these only the female is known; some of them will no doubt prove to belong to other genera. He also established the genus *Metalepthyphantes* for *L. perexiguus* Simon & Fage.

Several authors have tried to divide this large genus into natural groups. Considering the European species

only, Simon (1884), Wiehle (1956) and Wanless (1973) all distinguished approximately the same five groups. Only group 1a of Wanless has been thoroughly revised by van Helsdingen, Thaler & Deltshv (1977), who called it the *tenuis* group.

One of the species described in this paper, *L. simiensis* sp.n. can be placed into group 1c of Wanless. Two other species, *L. acuminifrons* sp.n. and *L. bituberculatus* sp.n. show no affinities with any of the groups described by Wanless, and a new group, the *tropicalis* group, is proposed for them. In addition to *acuminifrons* and *bituberculatus*, it contains *tropicalis* Tullgren, *biseriatus* Simon & Fage and *tullgreni* sp.n. (the last species was present in Tullgren's type material of *tropicalis*). In order to obtain a good diagnosis for the new group, *tropicalis* and *biseriatus* are redescribed in this paper.

### Descriptions of the species

All measurements in mm. For the chaetotaxy, the following method has been used. Spines are referred to as dorsal (d), prolateral (pl), retrolateral (rl), proventral (pv) and retroventral (rv). On the tibiae there are two groups each containing a maximum of one of each of these 5 spines. On Ti I, the normal sequence of the spines has been given, e.g. (d-pl-pv-rv-rl) meaning that the dorsal spine is the most proximal, and the retrolateral the most distal etc. If one of the group of five is lacking on the other tibiae (for instance the retroventral spine), this is indicated by (d-pl-pv- -rl). Missing segments are indicated by a dash. The nomenclature used by van Helsdingen (1965) has been followed for the epigyne descriptions, and that of Merrett (1963) for the palp descriptions.

### *Lepthyphantes simiensis* sp.n. (Figs. 1-13)

#### Types

♂ holotype from Ethiopia, Simien Mountains, 3550 m, 20 September 1975, among dead *Lobelia rhynchopetalum* stems along the Djinbar Wanz river, collected with 1♂ and 2♀ paratypes (deposited in the Museum voor Midden-Afrika, Tervuren).

#### Male holotype

Total length 2.68; cephalothorax 1.27 long, 1.01 wide; sternum 0.71 long, 1.01 wide; chelicerae 0.55



Figs. 1-13: *Lepthyphantes simiensis* sp.n.

1 Male cephalothorax, lateral view; 2 Idem, dorsal view; 3 Right male chelicera, frontal view; 4 Right male palp, lateral view; 5 Left male palp, ventral view; 6 Radix of right palp, ventrolateral view; 7 Median apophysis and part of tegulum, dorsal view; 8 Embolus, ventral view; 9 Lamella and terminal apophysis, lateral view; 10 Epigyne, ventral view; 11 Idem, lateral view; 12 Idem, posterior view; 13 Vulva. Scale lines: 0.5 mm.

long; clypeus 0.22 high; abdomen 1.46 long.

**Colour.** Cephalothorax yellowish brown, with fovea, radiating lines and margin darker. Sternum yellowish brown suffused with dark brown. Legs and chelicerae yellowish brown. Abdomen grey, darker towards the top, posterior third with an indication of pale grey spots.

**Carapace** (Figs. 1-2). In dorsal view evenly rounded at the sides; cephalic groove moderately marked; in lateral view gently curved over the back, descending in an obtuse angle just behind posterior eyes; clypeus concave below the eyes, protruding.

**Eyes.** Anterior and posterior rows both slightly recurved. AM separated by their radius, and from AL by 1.5 times diameter of AM. PM separated from each other and from PL by slightly less than their diameter, laterals touching, protuberant. AM much smaller than PM (diameters 0.05 and 0.11). Median ocular quadrangle 1.15 times as wide as long.

**Chelicerae** (Fig. 3). Anterior margin with 3 teeth, middle one the strongest; posterior margin with 4 much smaller teeth. Stridulating file distinct, with about 30 ridges, lying closely together. Posteriorly with two tubercles, which bear some short hairs.

**Sternum.** Slightly reticulated.

**Legs.** Rather long. See also Table 1. Measurements:

	Fe	Pt	Ti	Mt	Ta	Total
I	1.49	0.37	1.53	1.33	0.92	5.64
II	1.41	0.33	1.42	1.23	0.84	5.42
III	1.25	0.31	1.06	0.98	0.65	4.25
IV	1.38	0.32	—	—	—	—
palp	0.59	0.18	0.21	—	0.55	—

**Chaetotaxy:**

	Fe	Pt	Ti	Mt
I	pl	d	(d) (pl-d-rl)	d
II		d	(d) ( -d-rl)	d
III		d	(d) ( -d- )	d
IV		d	—	—

The left tibia has three additional retrolateral spines, which are not present in the male paratype or in the females.

**Male palp** (Figs. 4-9). Cymbium with a short basal horn and with two dorsolateral ridges. Paracymbium strong, proximal arm with a few erect hairs near its dorsal margin and with a short tooth posteriorly; median part with a bifurcate, blunt

posteriorly-directed tooth; distal arm rather broad, curving forwards over the subtegulum in a blunt angle. Median apophysis (Fig. 7) straight, narrow at the base and gradually converging to a sharp tip, basally with two prongs at the point of attachment to the tegulum. Embolus (Fig. 8) broad, flattened and strongly convex, minutely serrate along its lateral margin, with a sharp tip, the sperm duct opening some distance from it through a black tubercle. Lamella (Fig. 9) not very pronounced, curved and sharply pointed, fused at the base to the terminal apophysis which has a membranous distal part. Tip of embolus protected by the embolic membrane. Fickert's gland very prominent.

#### Female

Total length 3.14; carapace 1.32 long, 1.02 wide; sternum 0.82 long, 0.74 wide; chelicerae 0.60 long; clypeus 0.23 high; abdomen 1.97 long.

Colour, eyes, chelicerae, chaetotaxy as in the male.

**Palp.** Tarsus without a claw (usually with a claw in *Lepthyphantes*).

**Legs.** Measurements:

	Fe	Pt	Ti	Mt	Ta	Total
I	1.59	0.37	1.63	1.43	0.97	5.99
II	1.39	0.33	1.4	1.2	0.86	5.18
III	1.21	0.33	1.16	1.07	0.69	4.45
IV	1.67	0.37	—	—	—	—
palp	0.45	0.17	0.39	—	0.62	—

**Epigyne** (Figs. 10-12). Scape flexible, sigmoid, with a distinct scapoid base. Anterior part in the form of a pentagon, elongated towards the stretcher. Posterior part with distinct lateral lobes, and a long, slender stretcher. Lateral walls of epigynal cavity gently rounded. Anterior part of scape 0.21 wide, 0.23 long; posterior median plate 0.27 wide.

**Vulva** (Fig. 13). Bursa copulatrix situated in middle of posterior part of scape; the long sperm ducts run throughout the length of the organ. In the anterior part, they follow the margin of the organ, at the base of which they pass laterally to the spermathecae.

#### Diagnosis

*Lepthyphantes simiensis* belongs to group 1c of

Wanless (1973), although the other representatives of this group have ventral spines. In the secondary genital organs, it generally resembles *L. leprosus* (Ohlert), but is easily distinguished by the paracymbium, lamella and embolus in the male, and by the shape of the scape in the female.

*L. simiensis* sp.n. shows some affinities with *Troglohyphantes* species, in having relatively short legs, and in having Mt longer than Ti. Fage (1919) and Zorsch (1937) use these features as diagnostic characters at generic level. Nevertheless the species is placed in the genus *Lepthyphantes* because of the general structure of its secondary genitalia. The male has typical teeth on the paracymbium (lacking in *Troglohyphantes*) and the sperm duct opens subterminally (terminally in *Troglohyphantes*); in the female, the scape has a distinct stalk, whereas in *Troglohyphantes* the scape is only as broad as the stalk.

#### Diagnosis of the *tropicalis* group

Medium-size (2.4-3.7 mm) in comparison with the other species groups. Abdomen with dorsal pattern of paired, dark grey blotches, and one or two longitudinal dark grey lateral bands. Cheliceral teeth variable in number, 3 to 6 in anterior row and 3 to 4 in posterior row. Stridulating file always present. Femur I with one prolateral spine, in *tullgreni* however with an additional dorsal spine on femora I-III. Tibia I with two groups of 5 spines each, some of these sometimes lacking.

Metatarsi with one dorsal and two lateral spines, except for MtIII, which has only one lateral spine. TmI 0.11-0.22 and FeI 1.2-1.8 times as long as cephalothorax. Metatarsi generally longer than tibiae in males, but shorter in females. Male palpal tibia with one dorsal spine, not so strong as the patellar spine. Cymbium always with a postero-dorsal projection, otherwise not modified. Paracymbium simple, proximal arm rather broad, distal arm slender, ending in a pointed tooth; middle section with one or two teeth. Median apophysis with a sharp or blunt, mostly curved tooth, situated on its mesal side. Radix elongate and with a mesal concavity towards the distal end, which has a central pit. Lamella flat, straight or slightly curved, with a strong base, and with a distal incision. Terminal apophysis consisting of two or three chitinous or membranous processes,

partly covering the embolus. Embolus narrow at its base, abruptly widening into a broad lobe, mesally of which the sperm duct opens subterminally through a short curved tooth. Embolic membrane covering the sperm duct tooth. At the turning point of the sperm duct in the radix, no distinct Fickert's gland as in the other species; sometimes, it is slightly swollen there.

Atrium of the epigyne surrounded anteriorly and laterally by unmodified, sclerotized walls, posteriorly bordered by posterior median plate, which is deeply incised medially, as in the species of group 1a; lateral walls of the plate indicated by two darker fertilisation ducts. Atrium more or less covered by scape, which can be broad to very narrow. Scape mostly simple, derived from sigmoid type, with usually only the anterior part well developed, and the median and posterior or curved part reduced in different degrees. Scape never with a stretcher.

In the cleared epigyne, the sperm ducts can be seen running from the spermathecae parallel with the anterior margin of the genital atrium, then passing through the scapoid base. Bursa copulatrix atrium-like, situated at base of scape. In *tullgreni* however, the sperm ducts enter the postero-dorsal projection of the scape, and the bursa copulatrix is situated in this part.

#### *Lepthyphantes acuminifrons* sp.n. (Figs. 14-36)

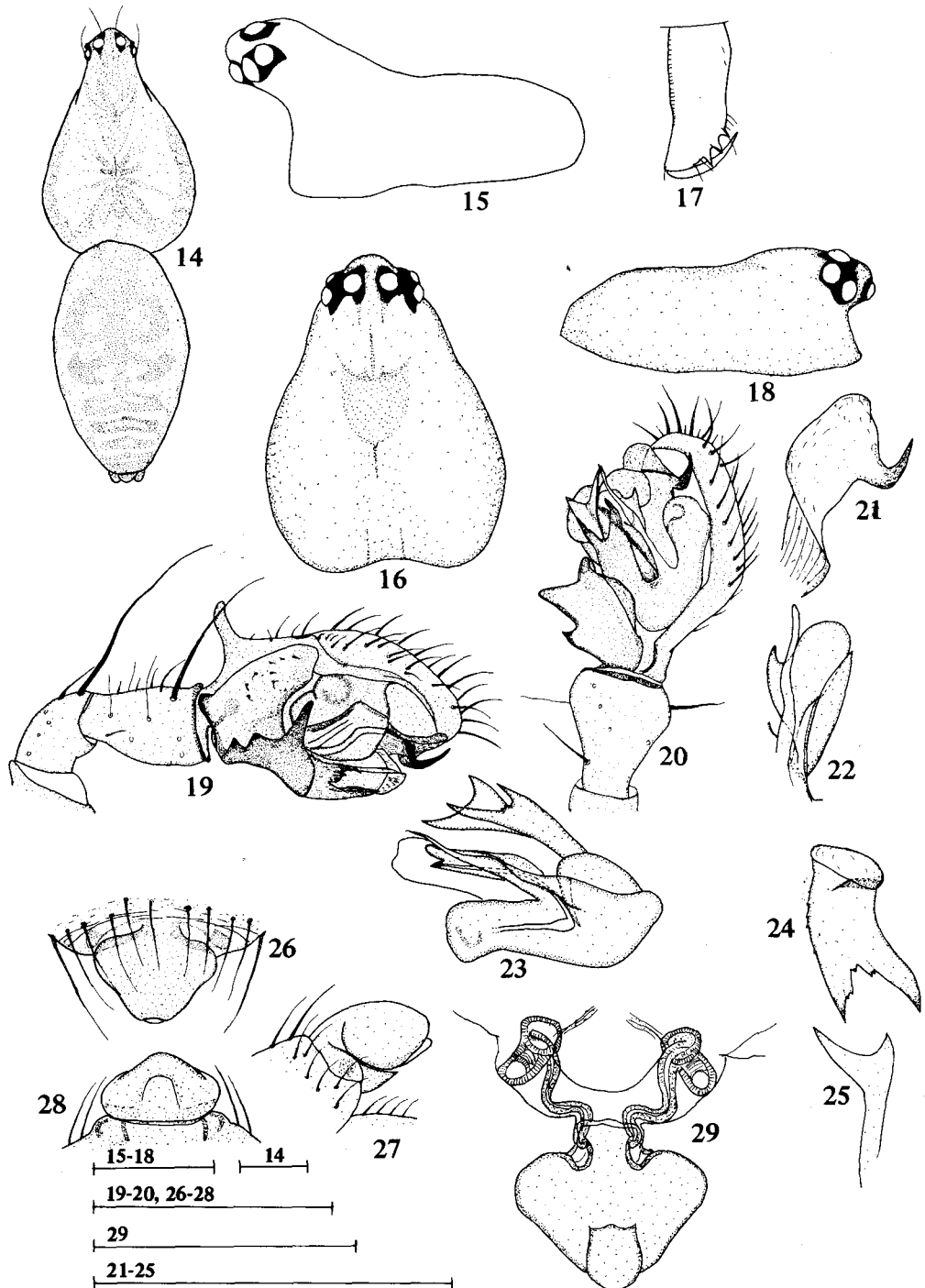
##### *Types*

♂ holotype from Ethiopia, Simien Mountains, 3550 m, 20 September 1975, among dead *Lobelia rhynchopetalum* stems along the Djinbar Wanz-river, collected with 1♂, 2♀, 2 subadult ♀ paratypes (deposited in the Museum voor Midden-Afrika, Tervuren).

##### *Male holotype*

Total length 3.43; cephalothorax 1.58 long, 1.23 wide; sternum 0.79 long, 0.74 wide; chelicerae 0.62 long; clypeus 0.64 high; abdomen 1.95 long.

*Colour.* Carapace generally pale yellowish, with head, fovea, striae and margin darkened; abdomen grey, with a row of paired, grey and white blotches, a dorsolateral band of the same colour (which is in parts connected with the dorsal blotches) and two



Figs. 14-29: *Lepthyphantes acuminifrons* sp.n.

14 Dorsal aspect of male; 15 Male cephalothorax, lateral view; 16 Idem, dorsal view; 17 Right male chelicera, frontal view; 18 Female cephalothorax, lateral view; 19 Right male palp, lateral view; 20 Idem, ventral view; 21 Median apophysis of left palp, dorsal view; 22 Terminal apophysis and embolus, ventrolateral view; 23 Radical complex of left palp, ventral view; 24-25 Lamella, lateral view; 26 Epigyne, ventral view; 27 Idem, lateral view; 28 Idem, posterior view; 29 Vulva. Scale lines: 0.5 mm.

ventrolateral longitudinal spots; sternum greyish brown; chelicerae and legs pale yellowish, distal ends of tibiae and metatarsi slightly darkened.

*Carapace* (Figs. 14-15). Viewed from above elongate with the sides gently rounded, without constriction; head prominent. Viewed from the side gently rounded at the back, with a strong concavity in the middle, ascending rather steeply to the prominent head. Clypeus strongly concave.

*Eyes*. Anterior row straight, AM slightly smaller than radius of AL, separated from each other and from AL by about their diameter. Posterior row strongly recurved; PM separated by slightly more than their diameter, and from PL by slightly less than their diameter. Median ocular quadrangle longer than broad (1.1x).

*Chelicerae* (Fig. 17). Rather long, with many distinct stridulating ridges; anterior margin with 3 almost equal teeth, posterior margin with 4 much smaller teeth, the 3 laterals forming a close group.

*Sternum*. Rugose, with distinct elevations.

*Legs*. Long, see also Table 1. Measurements:

	Fe	Pt	Ti	Mt	Ta	Total
I	2.06	0.45	1.96	1.98	1.28	7.73
II	1.82	0.43	1.84	1.84	1.11	7.14
III	1.47	0.35	1.28	1.32	0.78	5.2
IV	2.02	0.41	1.88	1.96	1.13	7.4
palp	0.66	0.21	0.27		0.60	

Chaetotaxy:

	Fe	Pt	Ti	Mt
I	d	d	(d-pl-pv-rv-rl)	(pv-pl-d-rl-rv) d-pl-rl
II		d	(d-pl- )	( -pl-d-rl-rv) d-pl-rl
III		d	(d- )	( -pl-d-rl- ) d-pl
IV		d	(d-pl-pv-rv- )	( -pl-d-rl- ) d-pl-rl

*Palp* (Figs. 19-25). Cymbium basally with a strong, pointed horn. Paracymbium with a flat, broad proximal arm, with some erect hairs dorsally, posterior margin with a bluntly pointed tooth and distally with a concavity; distal arm forming three triangular teeth, a sharp posterior, a bluntly pointed median, and a sharp, slender distal tooth, bent over the subtegulum. Median apophysis (Fig. 21) lamellar, terminating in a curved, black tooth, very conspicuous from the side. Radix elongate, expanded towards distal end, curved dorsally, and with a central pit at distal end. Lamella with a short, inward-curved tooth at the base, not visible in the unexpanded palp; it consists of a short,

relatively broad ventral part (Fig. 24), which is deeply incised, the incision with 5 smaller teeth, and a slender, elongate dorsal piece (Fig. 25), broader and with a smooth curved incision distally. Terminal apophysis lying very close to embolus, consisting of a slender elongate piece, membranous distally and covering the terminal lobe of the embolus, and a strong pointed piece, lying parallel with and very close to the embolus. Embolus broad and lobed, the sperm duct opening subterminally through a pointed tooth. Fickert's gland indicated by a swelling of the sperm duct.

*Female*

Total length 3.17; cephalothorax 1.31 long, 0.93 wide; sternum 0.65 long, 0.65 wide; chelicerae 0.57 long; clypeus 0.37 high; abdomen 2.13 long. Colour generally as in the male.

*Carapace* (Figs. 16, 18). Strongly different from the male. In dorsal view elongate, constricted at the side; cephalic portion protruding; fovea deeply incised; AM not visible from above. In lateral view with a concavity in the middle, head protruding; clypeus strongly concave below anterior eyes.

*Eyes*. Both rows recurved. AM smaller than the others, separated by their diameter and from AL by 1.5x their diameter. PM separated by their diameter and from PL by their radius. Lateral eyes touching, on common tubercles. Median ocular quadrangle 1.1x as wide as long.

*Chelicerae*. Rather long, with distinct stridulating ridges. Anterior margin with 3 equal teeth, posterior margin with 4 smaller teeth.

*Sternum*. Rugose, with some elevations.

*Legs*. Measurements:

	Fe	Pt	Ti	Mt	Ta	Total
I	1.72	0.39	1.77	1.62	1.14	6.64
II	1.57	0.36	1.53	1.37	1.02	5.85
III	1.27	0.22	1.10	1.00	0.75	4.43
IV	1.71	0.36	1.52	1.59	0.93	6.61
palp	0.42	0.15	0.36		0.58	

Chaetotaxy:

	Fe	Pt	Ti	Mt
I	pl	d	(d-pl-pv-rv-rl)	(pv-pl-d-rl-rv) d-pl-rl
II		d	(d-pl-pv-rv-rl)	(pv-pl-d-rl-rv) d-pl-rl
III		d	(d-pl-pv- )	( -pl-d-rl- ) d-pl-rl
IV		d	(d-pl-pv- )	( -pl-d-rl- ) d-pl-rl

*Palp.* Tarsus with a claw.

*Epigyne.* (Figs. 26-28). Simple; scape narrow at base, suddenly widening into reversed rhomboid plate, with posterior margin slightly incised. From under the plate, a broad process protrudes, anteriorly fused with it, probably representing the posterior part of the scape. Posterior median plate strongly protruding. Anterior part of scape 0.25 wide, 0.21 long; posterior median plate 0.19 wide.

*Vulva* (Fig. 29). Bursa copulatrix opening at base of scape, connected by relatively short sperm ducts (which do not pass through the scape) with the spermathecae.

### Diagnosis

*Lepthyphantes acuminifrons* sp.n. is related to *L. biseriatus*, and is diagnosed easily by the cymbial horn, paracymbium and lamella in the male and by the shape of the epigyne in the female. The strong sexual dimorphism in the shape of the head, is also very characteristic.

### *Lepthyphantes bituberculatus* sp.n. (Figs. 30-36)

#### Types

♂ holotype from Ethiopia, Simien Mountains, 3300 m, 20 September 1974, in damp rock crevices between Diuhara and Dirni (deposited in the Museum voor Midden-Afrika, Tervuren).

#### Male holotype

Total length 2.45; cephalothorax 1.03 long, 0.8 wide; sternum 0.57 long, 0.57 wide; chelicerae 0.48 long; clypeus 0.8 high; abdomen 1.39 long.

*Colour.* Cephalothorax yellowish brown, margin and a narrow median stripe only slightly darkened. Chelicerae and maxillae yellowish brown. Sternum greyish brown. Legs pale yellowish. Abdomen grey and black, pattern much like *L. acuminifrons* sp.n., with dorsal elongate spots, connected in the middle, a lateral longitudinal band and the venter blackish.

*Cephalothorax* (Figs. 30-31). In dorsal view evenly rounded in front, cephalic groove hardly indicated. In lateral view with a concavity just in front of the fovea. Clypeus concave below the eyes.

*Eyes.* Anterior row slightly recurved, AM separated by their diameter and from AL by 1.5x

their diameter. Posterior row recurved, equal and separated by  $\frac{3}{4}$  their diameter. Lateral eyes touching and on common tubercles. Median ocular quadrangle  $\pm$  as long as wide.

*Chelicerae* (fig. 32). With a slight lateral concavity distally. Stridulating organ very distinct, consisting of about ten oblique ridges. Anterior margin of fang groove with 3 teeth, the exterior remote from the two interior; posterior row with 3 small teeth.

*Maxillae.* Slightly truncate distally.

*Sternum.* Smooth.

*Legs.* Only femora and patellae are present. Fe I has one prolateral spine. Measurements:

	Fe	Pt	Ti	Mt	Ta
I	1.56	0.37	—	—	—
II	1.44	0.33	—	—	—
III	1.40	0.31	—	—	—
IV	1.50	0.33	—	—	—
palp	0.39	0.15	0.14	—	0.42

See also Table 1.

*Palp* (Figs. 33-36). Femur cylindrical. Patella convex dorsally, with a stout dorsal spine which is about twice as long as that on the tibia. Tibia slightly longer than patella, convex dorsally and ventrally, lateral distal margin slightly excised. Cymbium with two basal blunt processes, directed dorsomesally and dorsolaterally, the former longer and more slender, the latter broader and with two anteriorly directed hairs. Paracymbium with a broad, proximal arm, a broad median part and a slender distal arm ending in a simple point. Anterior part of proximal arm with about 9 hairs, and with a sharp tooth at posterior side. Median apophysis broad and lamellar, with only a very small, subterminal, laterally-directed tooth. Radix elongate, with a mesal concavity towards distal end, which has a pit. Lamella flat and straight, deeply incised, terminating in 4 sharp and slender teeth. Terminal apophysis consists of a rather short, pointed, basal process and an elongate, membranous distal process, which partially covers the embolus. Embolus narrow at its base, suddenly widening into a broad, rounded lobe, mesally of which the sperm duct opens subterminally through a small, curved tooth. At its turning point in the radix, the sperm duct is slightly swollen.

*Female.* Unknown.

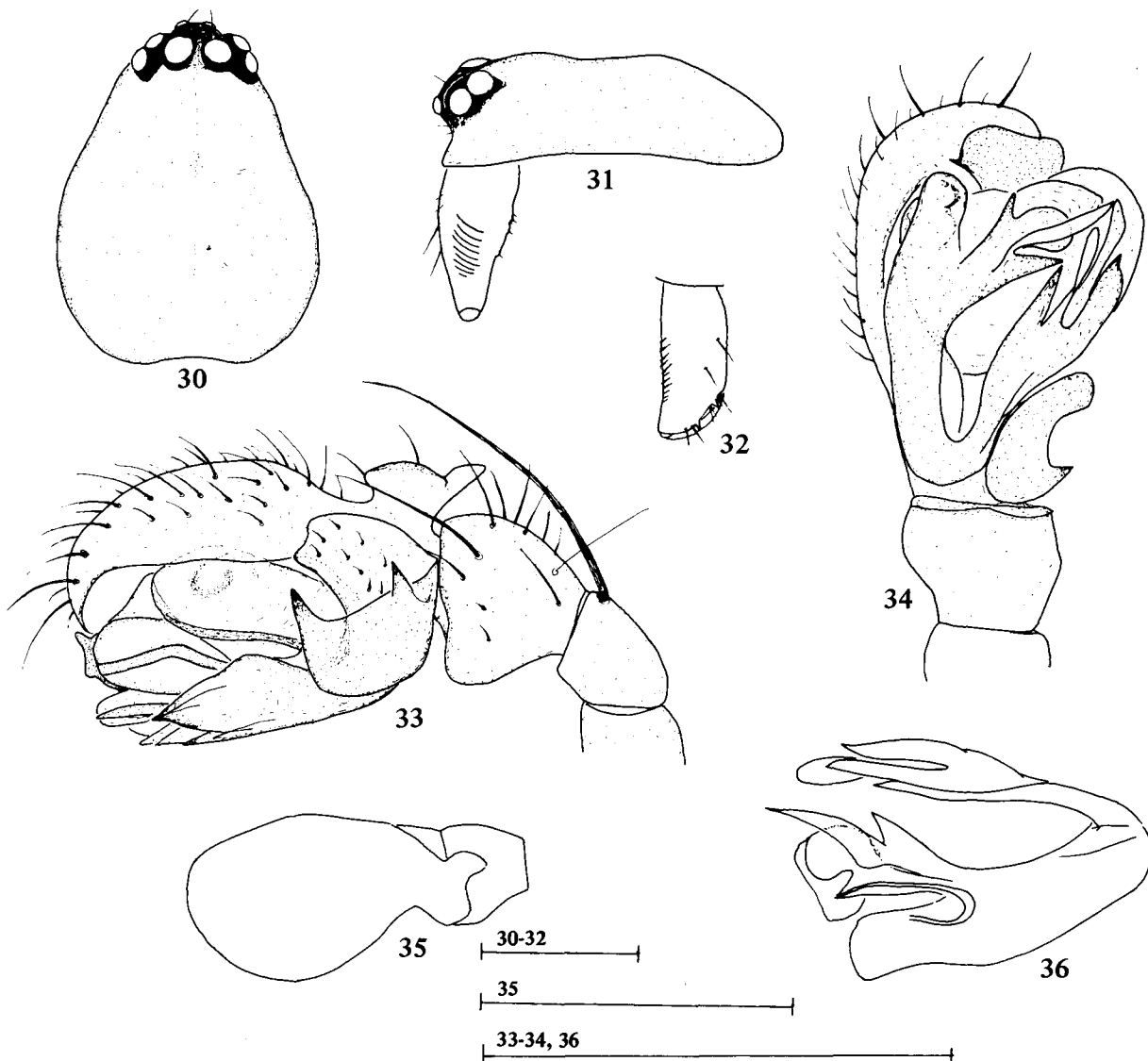
*Diagnosis*

*Lepthyphantes bituberculatus* sp.n. is easily recognised by the shape of the basal cymbial tubercle; the paracymbium and lamella also provide satisfactory diagnostic characters.

*Lepthyphantes biseriatus* Simon & Fage (Figs. 37-48)*Material*

*Lepthyphantes biseriatus* Simon & Fage 1922, ♂ ♀, (types in the Muséum d'Histoire Naturelle, Paris, examined).

*Lepthyphantes salti* Denis 1950, ♀. *Syn.nov.* (type in the British Museum (Natural History), examined).



Figs. 30-36: *Lepthyphantes bituberculatus* sp.n.

30 Male cephalothorax, dorsal view; 31 Idem, lateral view; 32 Right male chelicera, frontal view; 33 Left male palp, lateral view; 34 Idem, ventral view; 35 Idem, dorsal view; 36 Radical complex, ventral view. Scale lines: 0.5 mm.



The following description has been made from specimens taken by the author in Kenya, Mt Kenya, 3350 m, among *Alchemilla* in the Sirimon valley, 2 August 1975 (3♂, 4♀), which were in a much better condition than the types.

### Male

Total length 2.85; cephalothorax 1.43 long, 1.09 wide; sternum 0.78 long, 0.74 wide; chelicerae 0.60 long; clypeus 0.22 high; abdomen 1.67 long.

**Colour.** Carapace yellowish brown, with the sides, a narrow median stripe and a triangular patch in front of the fovea darker. Chelicerae and maxillae yellowish brown, the latter greyish mesally towards the distal end. Sternum greyish brown. Legs pale yellowish, the distal ends of femora, tibiae and metatarsi slightly and narrowly darkened. Abdomen greyish, dorsally with a double row of dark grey spots, and laterally with two longitudinal dark grey stripes, the dorsal one being connected with the posterior dorsal spots; venter grey.

**Cephalothorax** (Figs. 37-38). In dorsal view evenly rounded, slightly constricted at the cervical groove. In lateral view moderately convex behind the ocular area, then gently descending to the fovea. Clypeus strongly concave. Cephalic portion with a median and two lateral rows of strong, anteriorly-directed spines.

**Eyes.** Anterior row slightly recurved; AM separated by their radius, and from AL by slightly more than diameter of AL. Posterior row straight, PM separated by slightly more than radius, and from PL by 1.5x their diameter. Lateral eyes touching, on common tubercles. Median ocular quadrangle slightly longer than wide (1.1x).

**Chelicerae** (Fig. 39). Rather long, slightly concave laterally. Anterior margin of fang groove with 4 teeth, posterior row with 3-4 small teeth. Stridulating organ distinct, with about 22 ridges.

**Sternum.** Smooth, with sparse black hairs.

**Legs.** Long, Mt I slightly swollen in its basal third. See also Table 1. Measurements:

	Fe	Pt	Ti	Mt	Ta	Total
I	1.79	0.43	1.72	1.97	1.17	7.08
II	1.70	0.39	1.58	1.80	1.03	6.50
III	1.4	0.5	1.21	1.35	0.76	5.07
IV	1.76	0.39	1.62	1.76	0.94	6.47
palp	0.43	0.18	0.22		0.54	

### Chaetotaxy:

	Fe	Pt		Ti		Mt
I	pl	d	(d-pv-rv-pl-rl)	(pv-rv-d-pl-rl)		d-pl-rl
II		d	(d- rv-pl-rl)	(pv-rv-d-pl-rl)		d-pl-rl
III		d	(d- pl- )	(pv-rv-d- rl)		d-pl-rl
IV		d	(d- pl-rl)	(pv- d-pl-rl)		d-pl-rl

**Palp** (Figs. 41-44). Cymbium with a distinct basal laterally-directed horn; in lateral view posterior margin of the horn convex; distal margin straight, with a small elevation at its base. Paracymbium slender, proximal arm with a median, transverse ridge, and dorsally with about 13 erect hairs; distal arm with a posterior sharp tooth, and ending in a straight, bluntly pointed tooth. Median apophysis (Fig. 43) broad at its base, ending laterally in a strong, arched and sharp tooth, clearly visible from the side. Radix elongate, with an incision distally on its mesal margin; with a pit distally. Lamella broad and flattened, seen from the side distinctly concave dorsally towards distal end and ending in two, sharply pointed small teeth; in ventral view (Fig. 44) with its mesal margin gently rounded, with a blunt tooth at its base. Terminal apophysis bifid, with two pointed processes. Embolus broad and lobed, sperm duct opening through a small curved tooth lying at the mesal side of the lobe. Sperm duct widened at its turning point in the radix, but no distinct Fickert's gland.

### Female

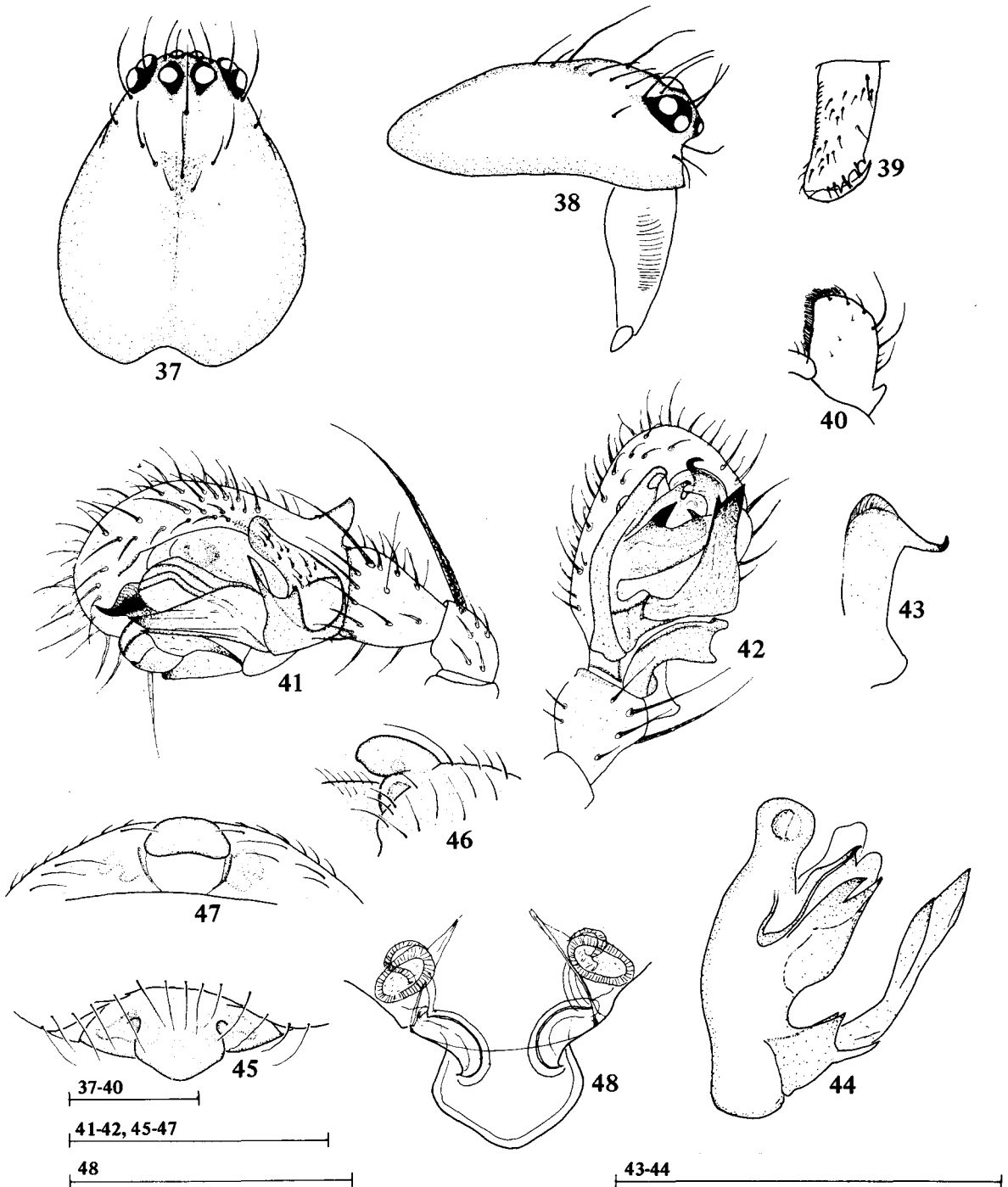
General form and colour as in the male. Total length 3.38; cephalothorax 1.63 long, 1.28 wide; sternum 0.90 long, 0.82 wide; chelicerae 0.78 long; clypeus 0.28 high; abdomen 2.37 long.

**Legs.** Chaetotaxy as in the male, but in addition having a first proventral spine on Ti II, Ti III and Ti IV and a second prolateral spine on Ti III. Measurements:

	Fe	Pt	Ti	Mt	Ta	Total
I	2.11	0.51	2.12	2.03	1.25	8.02
II	1.97	0.43	1.83	1.81	1.17	7.21
III	1.64	0.39	1.40	1.44	0.88	5.75
IV	2.01	0.41	1.85	1.95	1.09	7.31
palp	0.53	0.18	0.40		0.74	

Female palp with a claw.

**Epigyne** (Figs. 45-47). Anterior wall of genital atrium gently rounded; scape in the form of a broad,



Figs. 37-48: *Leptyphantès biseriatus* Simon & Fage.

37 Male cephalothorax, dorsal view; 38 Idem, lateral view; 39 Right male chelicera, frontal view; 40 Left male maxilla, ventral view; 41 Left male palp, lateral view; 42 Idem, ventral view; 43 Median apophysis, dorsal view; 44 Radical complex, ventral view; 45 Epigyne, ventral view; 46 Idem, lateral view; 47 Idem, posterior view; 48 Vulva. Scale lines 0.5 mm.

rhombic plate, convex ventrally, concave dorsally, and covering the whole genital atrium; anteriorly slightly narrowed into a broad stalk, and posteriorly rounded or more pointed; posterior part of scape not developed.

*Vulva* (Fig. 48). Sperm duct opening laterally at the base of the stalk, then turning inwards, posteriorly and laterally to the receptacula seminis.

#### Diagnosis

A species from the *tropicalis*-group, which closely resembles *tropicalis*, but differs in the shape of the cymbial horn, being more pointed; the shape of the median and terminal apophyses is also different. The scape is a simple plate, as in *tropicalis*, but its posterior border is much more rounded.

#### *Lepthyphantes tropicalis* Tullgren (Figs. 49-58)

##### Material

*Lepthyphantes tropicalis* Tullgren 1910, ♂. One male selected as lectotype from Tullgren's collection from Tanzania, Meru, rain forest, 2 ♂, 2 ♀ paralectotypes. Other locality: Kilimandjaro, Kibosho, 4 ♂, 2 ♀, 1 subadult ♂ (Naturhistoriska Riksmuseet, Stockholm).

Tullgren's type collection from Tanzania contained two species, *L. tropicalis* and *L. tullgreni* sp.n. (see later). In his description of *tropicalis*, Tullgren clearly figured a male palp belonging to this species. His drawing of the epigyne however could refer to either species present in the collection. He erroneously took a female of *tullgreni* for his description of the female of *tropicalis*, which is proved by the fact that he mentions six cheliceral teeth in the anterior row for *tropicalis*, a feature occurring only in *tullgreni*. The female of *tropicalis* is thus described here for the first time.

##### Male lectotype

Total length 2.75; cephalothorax 1.31 long, 1.03 wide; sternum 0.74 long, 0.63 wide; chelicerae 0.66 long; clypeus 0.27 high; abdomen 1.64 long.

*Colour*. Cephalothorax yellowish brown, with dorsal median stripe and margins of thoracic part dark greyish; chelicerae and maxillae yellowish

brown; sternum grey; legs pale yellowish, distal parts of segments greyish, femora and tibiae with an annulation in the middle (by bleaching of the specimens, this feature is no longer easily visible); abdomen greyish, with a dorsal row of paired dark grey spots, and a lateral dark grey, longitudinal band, posteriorly connected with the row of dorsal spots; venter grey.

*Cephalothorax* (Figs. 49-50). Length/width 1.27, laterally evenly rounded, cephalic groove hardly marked; dorsal profile gradually descending posteriorly. Clypeus concave below eyes. Cephalic portion with some anteriorly-directed spines.

*Eyes*. Anterior row straight, AM slightly less than half diameter of AL; AM separated by 2/3 their diameter, and from AL by slightly less than twice their diameter. Posterior row slightly recurved, equal, and about 2/3 their diameter apart. Median ocular quadrangle slightly broader than long (1.05). Lateral eyes touching, on common tubercles.

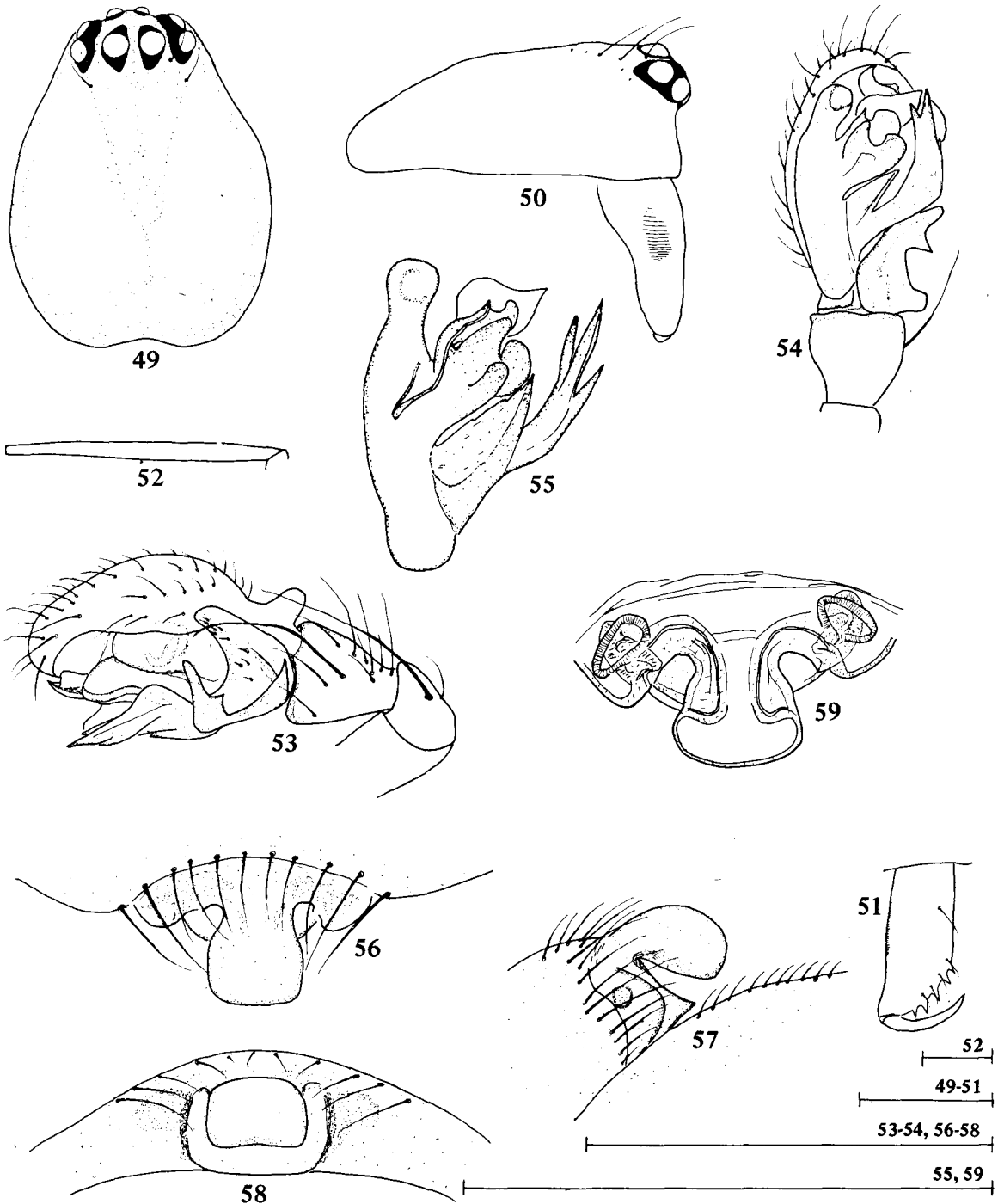
*Chelicerae* (Figs. 50-51). Long, incised laterally towards distal end. Fang groove with 5 anterior and 4 small posterior teeth (none of the specimens has 6 anterior teeth, as mentioned by Tullgren). Stridulating ridges distinct, about 17 in number.

*Sternum*. Smooth.

*Legs*. Mt I swollen in its basal third (Fig. 52). The loss of segments, spines and trichobothria has been very severe in all the males. Therefore, no complete measurements and no chaetotaxy can be given. The females however are much better preserved, and can be described more accurately. Only Fe I has a pro-lateral spine. See also Table 1. Measurements:

	Fe	Pt	Ti	Mt	Ta
I	2.13	0.41	2.15	1.97	—
II	2.03	0.39	—	—	—
III	1.54	0.33	1.37	1.44	—
IV	1.99	0.35	1.87	2.01	1.11
palp	0.41	0.15	0.18		0.51

*Palp* (Figs. 53-55). Tibia widened distally, medio-laterally with a small tooth. Cymbium with a basal bluntly pointed horn. Proximal arm of paracymbium with a transverse ridge in the middle and posteriorly with a sharply pointed, dorsally-directed tooth; distal arm slender, basally with a posterior sharp tooth, and ending in a slightly curved, blunt tooth. Median apophysis mesally with a rather short, curved tooth, broad at its base. Radix elongate, indented mesally



Figs. 49-59: *Leptyphantes tropicalis* Tullgren.

49 Male cephalothorax, dorsal view; 50 Idem, lateral view; 51 Right male chelicera, frontal view; 52 Male metatarsus I, lateral view; 53 Left male palp, lateral view; 54 Idem, lateral view; 55 Radical complex, ventral view; 56 Epigyne, ventral view; 57 Idem, lateral view; 58 Idem, posterior view; 59 Vulva. Scale lines: 0.5 mm.

towards distal end, which has a pit. Lamella flat and curved, dorsolateral margin convex in the middle, as seen in lateral view; distally with two small teeth, and mesally at the base with a broad tooth. Terminal apophysis trifold, the mesal process more pointed, the lateral process broadly truncate; in the middle at the base with a shorter, blunt process. Embolus broad and lobed, sperm duct opening subterminally through a short, curved tooth. No Fickert's gland.

#### Female

Total length 3.20; cephalothorax 1.50 long, 1.16 wide; sternum 0.80 long, 0.77 wide; chelicerae 0.83 long; clypeus 0.24 high; abdomen, 1.99 long.

*Palp.* Tarsus with a claw.

*Legs.* Measurements:

	Fe	Pt	Ti	Mt	Ta	Total
I	2.07	0.43	2.11	1.91	1.35	7.87
II	1.91	0.41	1.83	1.74	1.13	7.02
III	1.35	0.31	0.94	0.98	0.78	4.36
IV	1.87	0.39	—	—	—	—
palp	0.52	0.15	0.38		0.68	

#### Chaetotaxy:

	Fe	Pt	Ti	Mt
I	pl	d	(d-pl-pv-rv-rl)	(pl-pv-rv-rl-d) d-pl-rl
II		d	(d-pl-pv-rv-rl)	(pl-pv-rv-rl-d) d-pl-rl
III		d	(d-pl-pv- )	(pl-pv-rv-rl-d) d-pl
IV		d	(d-pl-pv- )	(pl-pv-rv-rl-d) d-pl-rl

*Epigyne* (Figs. 56-58). Consists of a broad, rhomboid plate, concave dorsally and convex ventrally, attached by a broad stalk to the anterior wall of the genital atrium. Seen from the side, the scape is strongly convex longitudinally, and the posterior median plate protrudes strongly. Anterior wall of genital atrium distinctly bordered. Scape 0.13 wide, 0.14 long; posterior median plate 0.16 wide.

*Vulva* (Fig. 59). Simple. Bursa copulatrix in the form of an atrium, situated in the middle of the scape; the sperm ducts turn posteriorly then laterally to the spermathecae.

#### Diagnosis

This species is closely related to *biseriatus* from Mt Kenya, but differs from it in the shape of the

cymbial horn, the median and terminal apophyses, and in the shape of the scape in the female.

#### *Lepthyphantes tullgreni* sp.n. (Figs. 60-69)

##### Material

*Lepthyphantes tropicalis* Tullgren 1910, ♀. Male holotype; from Tullgren's collection. Tanzania, rain forest, January 1906, 2 ♂, 28 ♀, 5 juveniles, paratypes. Other locality: Kilimandjaro, Kibonoto, kulturzone, October 1905, 1 ♂ (deposited in the Naturhistoriska Riksmuseet, Stockholm).

##### Male holotype

Total length 2.37; cephalothorax 1.12 long, 0.88 wide; sternum 0.61 long, 0.59 wide; chelicerae 0.48 long; clypeus 0.20 high; abdomen 1.33 long.

*Colour.* Cephalothorax pale yellowish brown, with margins and median stripe greyish. Chelicerae and legs pale yellowish, with both ends of the femora and distal ends of the tibiae and metatarsi darkened; femora and tibiae with an annulation in the middle. Abdominal pattern as *L. acuminifrons* sp.n. with dorsal paired blotches, connected in the middle by a longitudinal stripe, and a lateral grey band; venter grey.

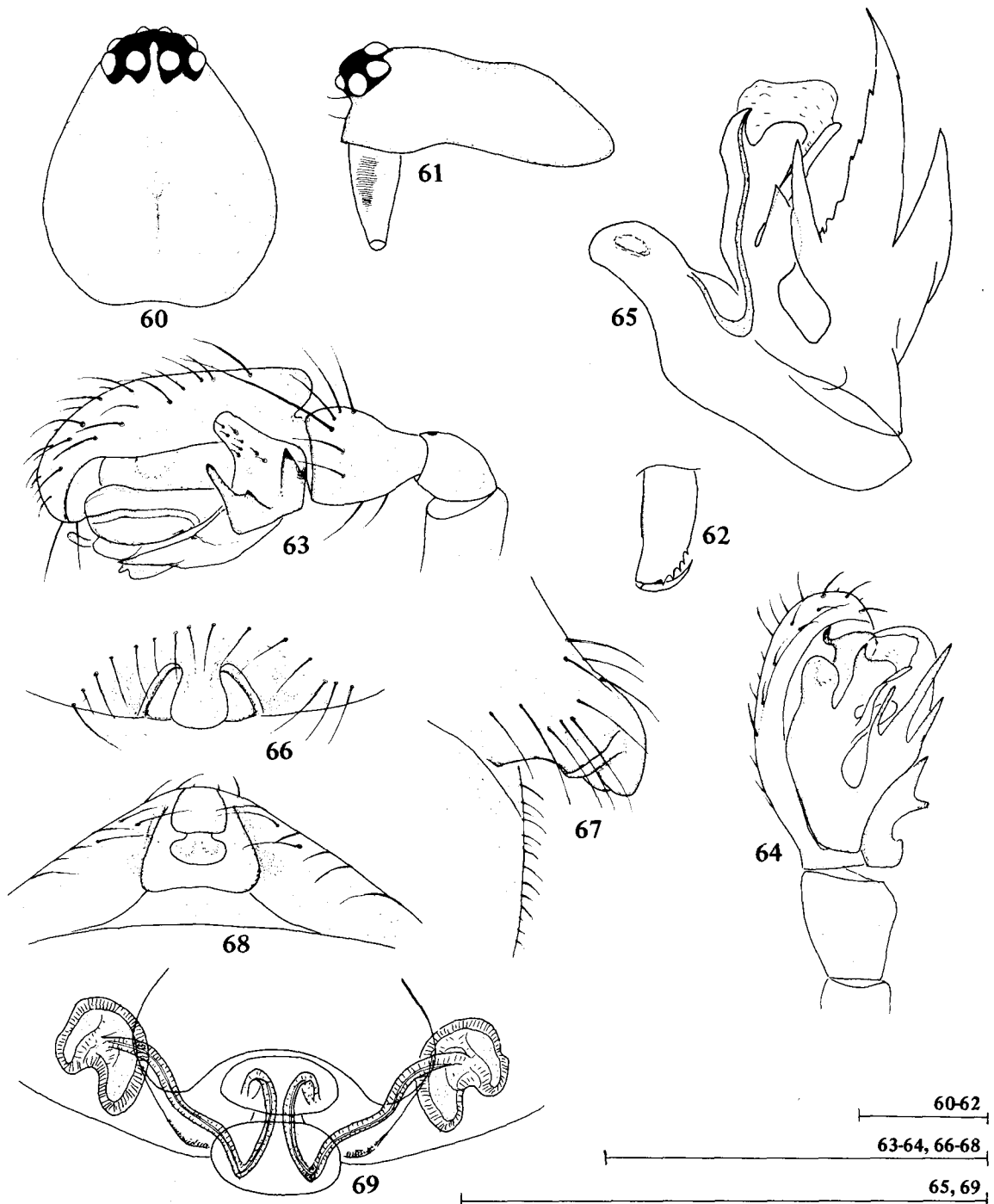
*Cephalothorax* (Figs. 60-61). Length/width 1.3. In dorsal view gently rounded in front, with hardly any indication of the cephalic groove. In lateral view with a marked concavity in the middle. Clypeus concave below anterior median eyes.

*Eyes.* Anteriors in a straight line, posteriors slightly procurved. Close together, all separated by about their radius. Median ocular quadrangle as long as broad.

*Chelicerae* (Figs. 61-62). With a lateral concavity distally. Anterior margin of fang groove with 5 teeth, posterior margin with 4 closely set teeth (some of the paratypes have an additional, smaller lateral 6th anterior tooth). Stridulating organ consisting of about 25 well developed ridges.

*Sternum.* Slightly rugose, with some elevations.

*Legs.* Because of the great loss of spines, the chaetotaxy of the male cannot be given, but this is described from the female paratype. Fe I has one prolateral spine and Fe I-III one dorsal spine. See also Table 1. Measurements:



Figs. 60-69: *Leptyphantes tullgreni* sp.n.

60 Male cephalothorax, dorsal view; 61 Idem, lateral view; 62 Right male chelicera, frontal view; 63 Left male palp, lateral view; 64 Idem, ventral view; 65 Radical complex, ventrolateral view; 66 Epigyne, ventral view; 67 Idem, lateral view; 68 Idem, posterior view; 69 Vulva. Scale lines: 0.5 mm.

	Fe	Pt	Ti	Mt	Ta
I	2.03	0.35	2.18	2.13	—
II	1.76	0.33	1.83	1.76	—
III	1.52	0.29	—	—	—
IV	1.70	0.29	1.62	—	—
palp	0.57	0.14	0.16	—	0.36

*Palp* (Figs. 63-65). Cymbium with a distinct basal elevation, then gently descending to the distal end of the palp; thus, the basal tubercle is not so pronounced as in the other species. Paracymbium slender; proximal arm with a pointed posterior tooth, and with about 8 dorsal hairs anteriorly; distal arm with a sharp posterior tooth, and ending in a rounded, parallel-sided process. Median apophysis at its mesal side with a parallel-sided, curved process, rounded at the tip. Radix elongate, with a concavity mesally towards distal end. Lamella straight, narrow at its base, then widening in its distal half and furcated into 3 teeth, the middle one being the longest. Terminal apophysis consists of a rather broad, short blunt process and a longer membranous slender ventral process. Embolus narrow at its base, widening into a broad lobe, with a sharp sperm duct tooth mesal to it. No distinct Fickert's gland.

#### Female

General colour and shape as in the male. Total length 2.87; cephalothorax 1.49 long, 1.35 wide; sternum 0.74 long, 0.80 wide; chelicerae 0.30 long; clypeus 0.28 high; abdomen 1.96 long.

*Eyes*. Both rows nearly straight; further apart than in the male (about 3/4 their diameter).

*Chelicerae*. Anterior margin with 5 teeth (6 in many paratypes).

#### Legs. Measurements:

	Fe	Pt	Ti	Mt	Ta	Total
I	1.99	0.45	2.11	1.97	—	—
II	1.85	0.39	1.58	1.77	1.05	6.64
III	1.37	0.33	1.21	1.27	0.70	4.88
IV	1.83	0.35	1.64	1.68	0.88	6.38
palp	0.53	0.14	0.39	—	0.64	—

#### Chaetotaxy:

	Fe	Pt	Ti	Mt
I	pl-d	d	(d-pl-pv-rv-rl)	(pv-rv-pl-rl-d)
II	-d	d	(d-pl-rv-rl)	(pv-rv-pl-rl-d)
III	-d	d	(d-pl- )	(pv-rv-pl-rl-d)
IV		d	(d-pl- )	(pv- -pl-rl-d)

Tarsus of palp with a claw.

*Epigyne* (Figs. 66-68). Lateral walls of the epigynal cavity well developed, and anterior genital sclerite pronounced. Scape not protruding much from epigynal cavity, relatively narrow, covering less than half of epigynal cavity. It is more complicated than in the related species. Visible part of scape gradually widened distally; this part has a mediodorsal, posteriorly directed process, which is at first much narrower than the underlying part of the scape and thus not visible in ventral view. Distally it is suddenly widened into a rounded truncate knob. Anterior part of scape 0.075 wide, 0.09 long; posterior median plate 0.16 wide, indented on its posterior margin.

*Vulva* (Fig. 69). Sperm ducts run throughout the length of the organ. Bursa copulatrix situated in terminal knob-like part of scape.

#### Diagnosis

*Lepthyphantes tullgreni* sp.n. is diagnosed by its

	<i>L. simiensis</i>		<i>L. acuminifrons</i>		<i>L. bituberculatus</i>	<i>L. biseriatus</i>		<i>L. tropicalis</i>		<i>L. tullgreni</i>	
	♂	♀	♂	♀		♂	♀	♂	♀	♂	♀
Trichobothrium on Mt I	0.11	0.15	0.17	0.21	—	0.18	0.17	0.22	—	0.12	0.16
First dorsal spine on Ti I	0.2	0.25	0.26	0.24	—	0.19	0.24	0.25	0.22	0.24	0.27
Second dorsal spine on Ti I	0.58	0.66	0.7	0.74	—	0.83	0.71	0.75	0.70	0.76	0.8
Length/width Ti I	11.1	11.2	12.4	11.5	—	11.8	12.6	15.0	12.0	18.1	12.6
Length first dorsal spine/width Ti I	2.5	3.1	—	—	—	2.23	3.5	—	—	—	—
Length Fe I/cephalothorax length	1.7	1.2	1.3	1.31	1.5	1.25	1.29	1.6	1.38	1.81	1.33
Length leg I/cephalothorax length	4.0	4.5	4.9	5.01	—	4.95	4.92	—	5.25	—	—

Table 1: Additional measurements of the species described in this paper.

dorsal spine on Fe I-III, which is lacking in all related species. In the male, the cymbium, paracymbium and median apophysis, and in the female the epigyne, also provide further satisfactory diagnostic characters.

#### Distribution of the representatives of the new (*tropicalis*) group

*Lepthyphantes acuminifrons* sp.n.: Ethiopia, Simien Mountains, 3550 m.

*L. bituberculatus* sp.n.: Ethiopia, Simien Mountains, 3550 m.

*L. biseriatus* Simon & Fage: Kenya, Mt Kenya, 3350 m.

*L. tropicalis* Tullgren: Tanzania, Meru and Kilimandjaro, 3000 m.

*L. tullgreni* sp.n.: Tanzania, Meru and Kilimandjaro, 3000 m.

The representatives of this group are thus so far limited to the African highlands.

The species described by Locket (1968) from Angola probably belong to other groups, as the females possess a well developed, sigmoid scape, as in the representatives of group I of Wanless; the male palpal sclerites are not described accurately enough to make comparison possible.

*L. mauensis* Di Caporiacco (1949) could belong to this group, but the type was not available for study. *L. salti* Denis (1950) is a synonym of *L. biseriatus*. *L. kilimandjaricus* Tullgren (1910) has a totally different epigyne, and is probably closely related to the *Lepthyphantes* species described by Locket (1968).

In a future paper, some further representatives of this group from Kenya, Mt Kenya will be described.

#### Affinities with the groups of Wanless

The African group shows the closest affinities with group V of Wanless (group II of Wiehle, 1956), containing *Lepthyphantes expunctus* (O. P.-Cambridge) and *L. mughi* (Fickert). Both these species also have ventral spines on the tibiae. In the males of these species, the cymbium has a more or less well modified basal tubercle and the patellar spine is stronger than the tibial spine, as in the African group. The paracymbium, median apophysis and the radical complex however are all of a totally different type. In the females of group V, the scape has the form of a sideways capital letter H, the median part of the

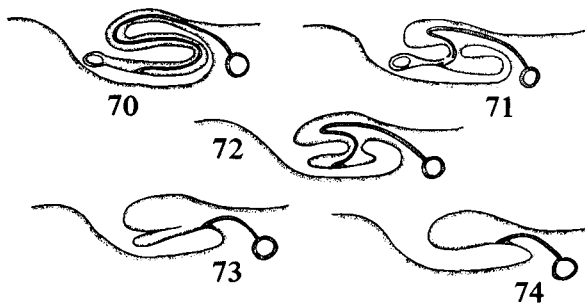
scape being much reduced. In *L. tullgreni* the reduction goes still further, the scape having the form of a sideways small letter h, while in the other species the scape is reduced to a simple plate.

#### Zoogeographical affinities

*Lepthyphantes bituberculatus*, *L. acuminifrons*, *L. tropicalis*, *L. biseriatus* and *L. tullgreni* belong to a group which is so far strictly Ethiopian in its distribution, as discussed above. It is interesting to note that the European species which are most closely related to this group (*L. expunctus*, *L. mughi*) are also montane species. *Lepthyphantes simiensis* however belongs to group 1c, a Holarctic group. It thus seems that, as in other taxonomic groups (Aves, Mammalia), the spider fauna of the NE Ethiopian Mountains is a mixture of Ethiopian and Palaearctic elements.

#### Evolutionary line in the *tropicalis* group (Figs. 70-74)

Whereas in the males, no evolutionary line can be traced, in the females a distinct simplification in the secondary genital organs occurs. In this way, a simple straight scape can be derived from the complicated, sigmoid scape of the European species of group 1 of Wanless. In *Lepthyphantes flavipes* (Blackwall) (group 1a of Wanless) and *simiensis* (belonging to group 1c of Wanless), the scape has a typical sigmoid shape, the sperm ducts running throughout its length and the bursa copulatrix being situated in its posterior part (Fig. 70). In *expunctus* the median part of the scape has been reduced (Fig. 71). In *tullgreni*,



Figs. 70-74: Schematic diagrams of epigynes in lateral view. 70 *L. flavipes* (Blackwall) and *L. simiensis* sp.n.; 71 *L. expunctus* (O. P.-Cambridge); 72 *L. tullgreni* sp.n.; 73 *L. acuminifrons* sp.n.; 74 *L. biseriatus* Simon & Fage and *L. tropicalis* Tullgren.



the anteriorly-directed part of the posterior part of the scape has been reduced (Fig. 72); in both these species, the bursa is situated in the posterior part. In *acuminifrons*, the anteriorly-directed part has disappeared, and the bursa is no longer situated in the posterior part of the scape: it now lies in the anterior part (Fig. 73). In *tropicalis* and *biseriatus*, the posterior part is totally lost (Fig. 74).

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