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Redelimitation of the Subfamily Micronetinae HULL, 1920 and the Genus *Lepthyphantes* MENGE, 1866 with Descriptions of Some New Genera

(Aranei, Linyphiidae)

by

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Synopsis: The subfamily Micronetinae HULL, 1920 and the genus *Lepthyphantes* MENGE, 1866 are redelimited with special reference to the secondary genital organs. The genus *Lepthyphantes* has been limited to five species only. The following eight new genera have been created for 89 of the remaining species of the former *Lepthyphantes: Improphantes* n. gen. (type-species *Lepthyphantes improbulus* SIMON, 1929), *Mansuphantes* n. gen. (type-species *Linyphia mansueta* THORELL, 1875), *Piniphantes* n. gen. (type-species *Lepthyphantes pinicola* SIMON, 1884), *Tenuiphantes* n. gen. (type-species *Linyphia tenuis* BLACKWALL, 1852), *Anguliphantes* n. gen. (type-species *Linyphia angulipalpis* WESTRING, 1851), *Flagelliphantes* n. gen. (type-species *Lepthyphantes flagellifer* TANASEVITCH, 1987), *Decipiphantes* n. gen. (type-species *Linyphia decipiens* L. KOCH, 1879), *Formiphantes* n. gen. (type-species *Taranucnus lephthyphantiformis* STRAND, 1907). Three genera, i.e. *Oryphantes* HULL, 1932 gen. rev. (type-species *Linyphia angulata* O. PICKARD-CAMBRIDGE, 1881), *Bolephthyphantes* STRAND, 1901 gen. rev. (type-species *Linyphia index* THORELL, 1856), and *Agnyphantes* HULL, 1932 gen. rev. (type-species *Linyphia expuncta* O. PICKARD-CAMBRIDGE, 1875), are revalidated. The following generic and species-level synonyms as well as new status are established: *Centromerita* DAHL, 1912 = *Centromerus* DAHL, 1886 n. syn., *Tapinasta* SIMON, 1895 = *Syedra* SIMON, 1884 n. syn., *Lepthyphantes beticus* DENIS, 1957 = *Lepthyphantes improbulus* SIMON, 1929 n. syn., *Lepthyphantes leruthi* DENIS, 1952 = *Lepthyphantes alacris* (BLACKWALL, 1853) n. syn., *Acanthoneta* ESKOV et MARUSIK, 1992 (= subgen. of *Poeciloneta* KULCZYNSKI, 1894) n. stat., *Stygohyphantes* KRATOCHVIL, 1948 (= subgen. of *Troglohyphantes* JOSEPH, 1882) n. stat., *Troglodytia* DEELEMAN-REINHOLD, 1978 (= subgen. of *Troglohyphantes*) n. stat. The basic pattern of the secondary genital organs of both sexes has been revised and figured. The nomenclature of the elements of the male palp and epigyne is discussed and augmented.

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1. Introduction:

In our earlier paper (SAARISTO & TANASEVITCH 1993) devoted to a reclassification of the genus *Lepthyphantes*, we presented a survey of its history, nomenclature, and current systematics. We also stated that *Lepthyphantes* is an extremely heterogeneous and polyphyletic genus. Using a typological approach based on the structure of the secondary genital organs (in general, the conformation of the embolus as the most stable part of the copulatory organs), we then split the genus into 31 monophyletic or monotypic species complexes mainly concerning the Palaearctic fauna only. Almost all of these complexes are separate genera, and some of them even belong to another subfamily.

This paper is devoted to a taxonomic redelimitation of the subfamily Micronetinae HULL, of the genus *Lepthyphantes* in particular, as well as to a review of the structure and nomenclature of the micronetid genitalia of both sexes.

Regrettably, as will be shown below, only a minor fraction (five) out of the almost 450 formal *Lepthyphantes* known to date appear to be actually congeneric with the type-species *L. minutus* (BLACKWALL, 1833), thus representing *Lepthyphantes* s. str. The remaining 99 % must be transferred elsewhere, often requiring new genera for their incorporation. Over 440 new combinations is a serious problem in itself, let alone about two hundred of these concerning widely used names.

Abbreviations:

The following abbreviations have been used in the text and figures:

ap	apical part of paracymbium
apo	anterior pocket of paracymbium
appo	apical pocket of paracymbium
aw	anterior wall of epigyne
ax	apex of embolus
bc	bursa copulatrix
bf	basal fould of embolus
c	column
ca	carina
cl	cleft
cw	cavity wall
dps	distal part of scape
e	embolus
eg	entrance groove
ep	embolus proper
es	embolic sulcus
et	embolic tooth
fg	fertilization groove
fgl	Fickert's gland
lc	lamella characteristica
ll	lateral lobe of epigyne
lw	lateral wall of epigyne
ma	membranous area of radix
ml	median lobe of epigyne
mm	median membrane
mp	middle part of paracymbium
mps	median part of scape
ph	pit hook
pi	pit
pmp	posterior median plate
po	pocket of lateral lobe
pp	proximal part of paracymbium
ppo	posterior pocket of paracymbium
pps	proximal part of scape
ps	proscapus
pss	pseudoscape
pw	posterior wall of epigyne
r	radix
re	receptacula
sa	suprategular apophysis
sb	scapoid base
se	serrate area of embolus
sh	special hair (on patella or tibia)
sp	secondary proscapus

st	stretcher	ta	terminal apophysis
su	suprategulum	th	thumb
t	tegulum	tr	trichobothrium (on tibia)

In the text the chaetotaxy is given in the following formula: Ti I: 2-1-1-0 which means that the first tibia has two dorsal, one prolateral and one retrolateral spine, ventral spines absent (the apical spines have been disregarded). All measurements cited below are in millimetres.

2. Structure of the secondary genital organs in Micronetinae:

It has been stated on several occasions (e.g. SAARISTO 1973, WANLESS 1971) that the studies of VAN HELSDINGEN (1965) on *Lepthyphantes leprosus* (OHLERT) have fundamentally contributed in our understanding of the complicated functional relationship of the male palp and female epigyne in Micronetinae, at least. Also it now seems to be a general attitude of the majority of the authors that these organs are of fundamental importance also when delimiting the taxa above the species level. However, time after time the quite simple, meristic characters such as chaetotaxy in practice seem to have surpassed the importance of the secondary genital organs. This is still more astonishing when one considers the structural complexity of these organs which evidently must also mean a much more complicated genetic background compared with such a simple character state as the existence or nonexistence of a certain spine.

After the paper of VAN HELSDINGEN (1965) it has been quite safe to state that the male palp and female epigyne of *Lepthyphantes* as well as its relatives function as a lock-and-key system. Accordingly it may be inferred that, in a broad sense, these organs are structurally like mirror images of each other or like a mold and a cast. Theoretically this means that if we knew all the smallest details of the correlations between the structures and functions of the secondary genital organs we would be able to predict the structure of the palp of an unknown male merely by studying the epigyne of the female or vice versa. In fact, within certain limits this is already possible. Thus for example the shape of the embolus reflects the shape of the apical part of the scape as well as the positions of the openings of the entrance ducts in relation to the lateral pockets. Likewise the absence of a pit is correlated with the loss of a pit hook and so on. On the other hand very careful analyses of the secondary genital organs are needed to avoid the misleading effect of parallelism. In many cases species which are fairly remote relatives may possess superficially quite similar secondary genital organs, especially in females. Thus the so-called heart-shaped epigyne is commonly found in many *Lepthyphantes* species, e.g. *L. flavipes, L. decolor,* and *L. holmi* and also in species which are more closely related to *Bolyphantes* C.L. KOCH, 1833 than *Lepthyphantes,* e.g. *L. mughi* and its relatives. There are numerous other examples of this kind of parallelism. Furthermore, especially reduction of various parts of the secondary genital organs creates another kind of difficulties. The above stated "mirror-image" of the palp and epigyne is also important in that it gives a theoretic basis for studying the relationships of different species using only one of the two sexes and even only some parts of the secondary genital organs. Thus WANLESS' (1971) grouping of the species solely on the basis of the female secondary genital organs has its justification. Although there are several papers dealing with the structure of secondary genital organs of the Micronetinae (MERRETT 1963, VAN HELSDINGEN 1965, SAARISTO 1971, 1973, MILLIDGE 1977) several new terms (bold in text) are needed to describe all the small details.

2.1. Male palp Figs 1 - 5):

Femur usually unmodified and only in a few cases there may be special structures on it like in the genus *Tennesseellum* PETRUNKEVITCH, 1925. Patella and tibia both with one special dorsal hair (sh 1 and sh 2 in Fig. 1). In the patella it is situated apicodorsally and in the tibia me-

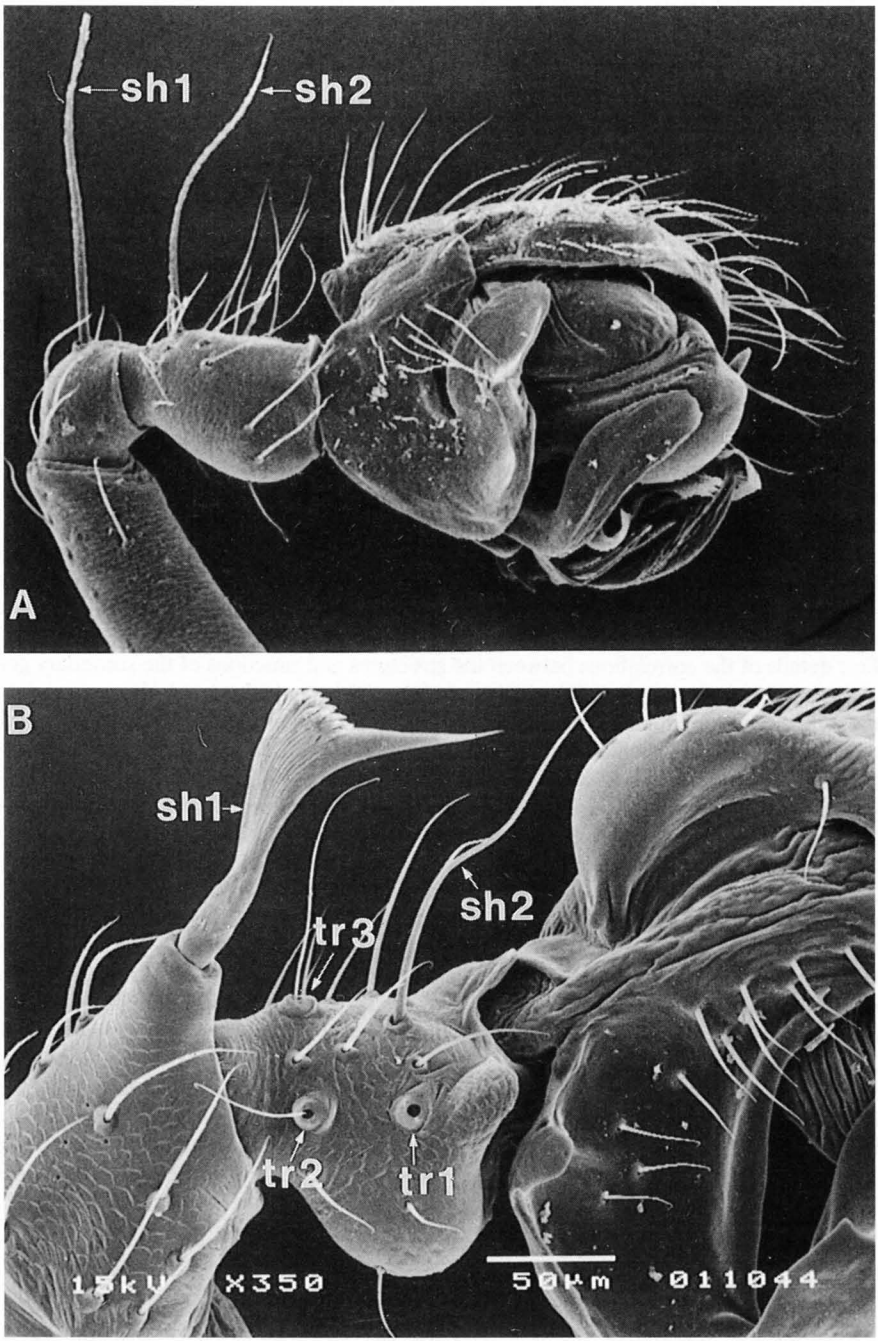


Fig. 1: Right male palp.
A: *Lepthyphantes alacris* (BLACKWALL). – B: *Parawubanoides marusiki* (TANASEVITCH).

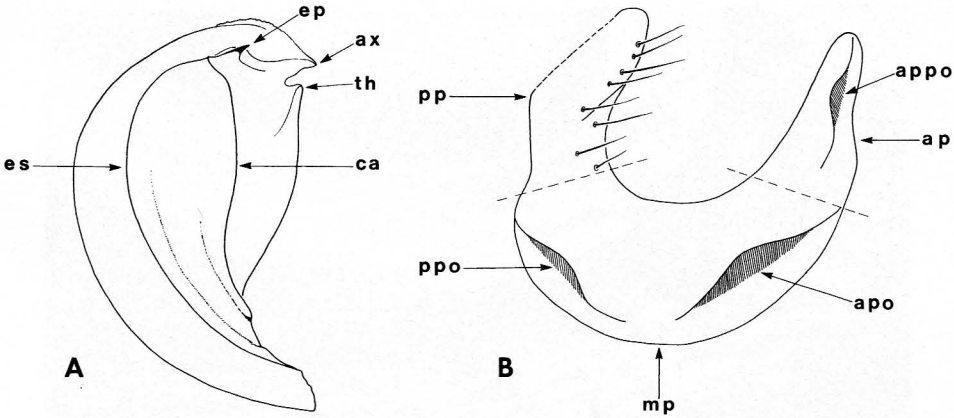


Fig. 2: A: Embolus of *Lepthyphantes minutus* (BLACKWALL). – B: Generalized paracymbium of Micronetinae.

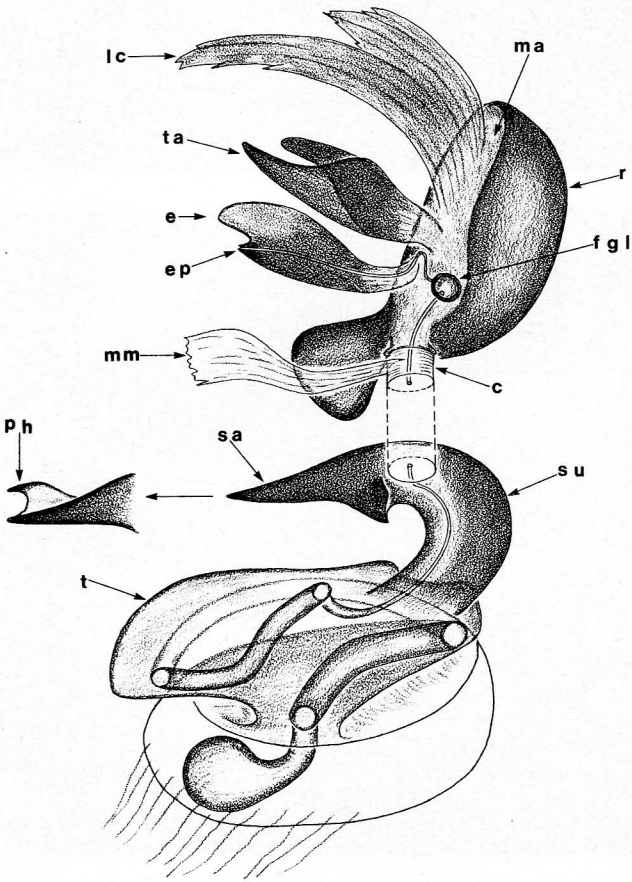


Fig. 3: Generalized palp of Micronetinae.

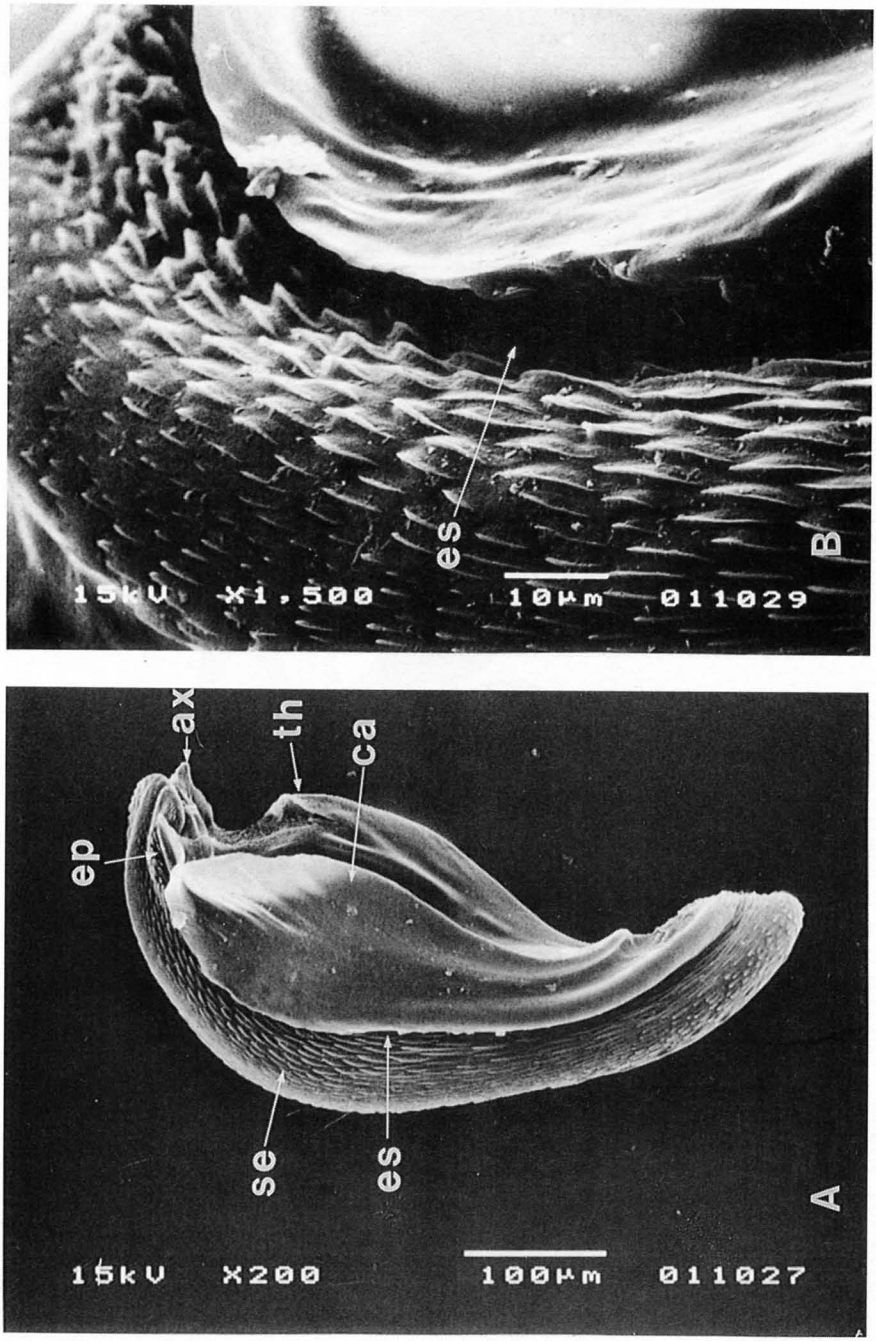


Fig. 4: Embolus of *Lepthyphantes minutus* (BLACKWALL) dorsally.
A: Total view. – B: Embolic sulcus.

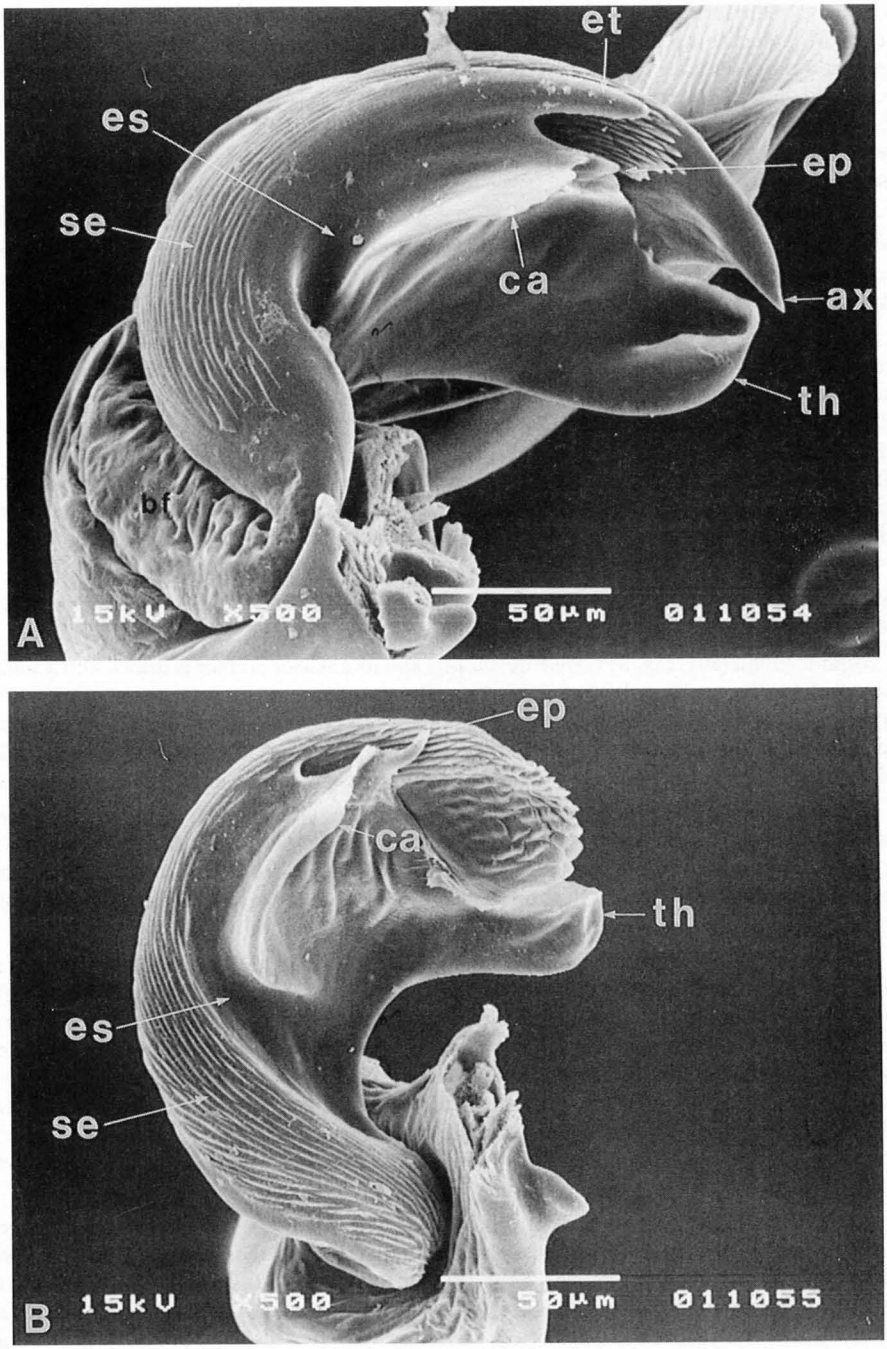


Fig. 5: Embolus dorsally.
A: *Mansuphantes mansuetus* (THORELL). – B: *Improphantes decolor* (WESTRING).

diodorsally. In the former case it is frequently prominently modified and quite often with swollen base. In the later case it is usually long and thin and often bent more or less abruptly in one or two places. In some cases there is an extra special hair on the patella close to the previously mentioned one. Originally there are three trichobothria on the tibia (Fig. 1); two retrolateral (tr 1 and tr 2) and one mediodorsal (tr 3). In a few cases the apical one (tr 1) of the two retrolateral trichobothria may be lost. Not so seldom certain areas of the tibia may be modified to form apophysis-like structures.

Cymbium, which is a transformed tarsus, has several special structures in different genera. At the present they will not be discussed here. Like in all spiders the cymbium bears on its ventral side the bulbus which includes the reservoir and sperm duct as well as certain accessory elements to fasten the bulbus on the epigyne.

In the family Linyphiidae also another important structure called paracymbium (pc) is associated with the cymbium. Its shape and complexity vary within the family but basically it is a separate, well-sclerotized structure articulating via a membranous area with the cymbium on its retro-lateral side near the base. The paracymbium (Fig. 2: B) is U-shaped in lateral view. It may be divided into tree regions: (1) a proximal part (pp) with some hairs on its external surface while on its internal surface there is a membranous area by which the paracymbium articulates with the cymbium, (2) a middle part (mp) with two depressions, the posterior pocket (ppo) and anterior pocket (apo), and (3) an apical part (ap) with an apical pocket (appo).

The bulbus may be divided in the following four regions: (1) subtegulum, (2) tegulum, (3) suprategulum, and (4) embolic division. In locating the palpal structures in the expanded palp we have used the terms employed by MERRETT (1963).

Suprategulum (su) (Fig. 3) is well-developed and its anterior surface is drawn into a wedge-like projection, the suprategular apophysis (sa). The tip of the suprategular apophysis is pushed into the stretcher pit of the epigyne during copulation. It is our opinion that this is the original state of this structure. Later it has been further modified and out of its dorsal surface a special pit hook (ph) has been formed to take over the function of the tip of the suprategular apophysis.

The embolic division is connected to the suprategulum with a short, membranous column. A prominent median membrane (mm) arises from the column. Its apical part is in a close association with the apical part of the embolus. In several cases the anteroproximal part of the median membrane is strongly chitinized. Quite often this sclerotized area is armed with tooth-like projections like in the genus *Centromerus* DAHL, 1886.

The embolic division is of the complex type (MERRETT 1963), consisting of the radix (r), which bears on its mesal side embolus (e), terminal apophysis (ta) and lamella characteristica (lc). The part of the radix to which the three last mentioned sclerites are attached is less sclerotized than the rest of the radix and is here called membranous area (ma). Inside the radix, at the site of the embolic base the sperm duct is dilated forming the so called FICKERT's gland (fgl) which is thought to be an ancestral feature, present already in the members of the evolutionary lineage leading to the subfamily Micronetinae. In certain cases this gland has been lost which sometimes is compensated by a secondary dilation inside the embolus like for example in some *Agyneta* HULL, 1911 species.

It may be supposed that the ancestral micronetid embolus was a fairly complicated, more or less sickle-shaped structure comparable to those now found e.g. in the genus *Agyneta* or *Lepthyphantes minutus* and its close relatives. Thus, using the embolus of *L. minutus* as an example the following structures may be named in it (Figs 2: A; 4: A, B)): basal fold (bf), embolic sulcus (es), carina (ca), embolus proper (ep), apex (ax), and thumb (th) (see also Fig. 5: A, B). Functionally it corresponds to WIEHLE's (1956) "Anschluss-Embolus" or joint-type embolus. In practice this means that the main body of the embolus follows the contours of the median and apical parts

of the scape and only the tooth-like embolus proper which bears the opening of the sperm duct is thrust inside the bursa copulatrix.

The integument of the basal fold is very thin and unsclerotized while the rest of the embolus is more or less strongly sclerotized. The main body of the embolus can be removed fairly easily from the embolic division at the border of the unsclerotized and sclerotized part of the embolus which is here called cut area. The basal fold then remains with the embolic division. Originally the embolic sulcus starts at the cut area running along the posterodorsal side of the embolus up to the base of the embolus proper. The carina is a thin, ridge-like structure starting from the proximal part of the embolus running up to the embolus proper. The thumb is the part of the apical part of the embolus separated from the apex by a curved incision.

2.2. Epigyne (Figs 6 - 9):

There has been some confusion as to the terms epigyne and vulva. Thus, e.g. WANLESS (1973) called vulva all the female secondary genitals collectively. In the Linyphiids this issue is, admittedly, somewhat confusing because the structures via which the sperm passes to the vagina or perhaps more precisely near the opening of it, are U-shaped invaginations of the epigynal integument (SAARISTO 1972 & 1975) and thus integral parts of the epigyne.

There are no well bordered sclerites or plates in the epigyne, except the posterior median plate (SAARISTO 1971: 465). Therefore there are certain difficulties in describing the epigyne. In the following a generalized picture is given of the micronetid epigyne with some remarks on certain special derivatives.

The middle part of the epigyne is depressed so that a fairly deep epigyneal cavity with a roundish aperture is formed (Fig. 6: A, B). The integument lining the epigynal cavity is here called cavity wall (cw). The integument surrounding the cavity is divided into anterior (aw), lateral (lw) and posterior walls (pw). From the border of anterior and cavity walls arises a posteriorly projecting scape or scapus. In the posterior part of the epigyne there are two deep clefts (cl) that make the lateral borders of the posterior median plate (pmp). Starting from the apex of the scape (Fig. 7: B) the entrance grooves (eg) run along the both sides of cavity wall to the clefts. At this point each entrance groove joins a darkly pigmented body, the receptaculum (re). From both receptacula starts a short fertilization groove (fg) running along the posterior wall to the vicinity of the vaginal opening.

It is assumed that the scape is an extension of the cavity wall rather than of the anterior wall and hence hairless. Originally its starting point, scapoid base (sb), was somewhat inside the cavity, the anterior wall extending as an arch over the scapoid base. The ancestral scape was presumably S-shaped and can be divided into three parts: proximal part (pps) or proscapus (= proscape) (ps) [= scapus auct.], median (mps) and distal part (dps). Quite often it is just the shape of the proscapus that gives the epigyne its characteristic outlook when studied in ventral view.

The border of the proscapus and the median part of the scape is marked by a change in the path of the entrance grooves. In the distal and median parts of the scape they run along the outer surface of the scape but when reaching the proscapus they pass over on its inner surface. The border of median and distal parts is more indefinite. However, it may be said that the apical part is composed of the stretcher (st) (Fig. 7: B), the lateral lobes (ll) and the median lobe (ml). The apical part of the scape also bears the starting points of the entrance ducts, viz. the bursa copulatrix (bc). On the outer surface of the stretcher there is a small hollow, the pit (pi). Margins of the lateral lobes are so built that they form pocket-like structures. The median lobe is an unpaired ridge-like structure between the lateral lobes. It is well possible that the bursae were originally situated on each side of the median lobe. — Note: WANLESS (1971) used the term median lobe for a flap-like structure covering the bursa copulatrix.

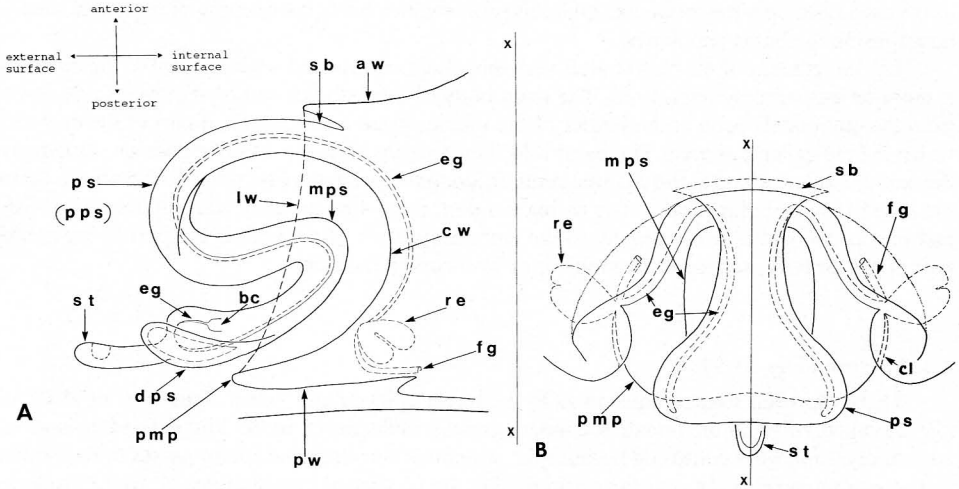


Fig. 6: Generalized epigyne of Micronetinae.
A: Lateral view. – B: Ventral view.

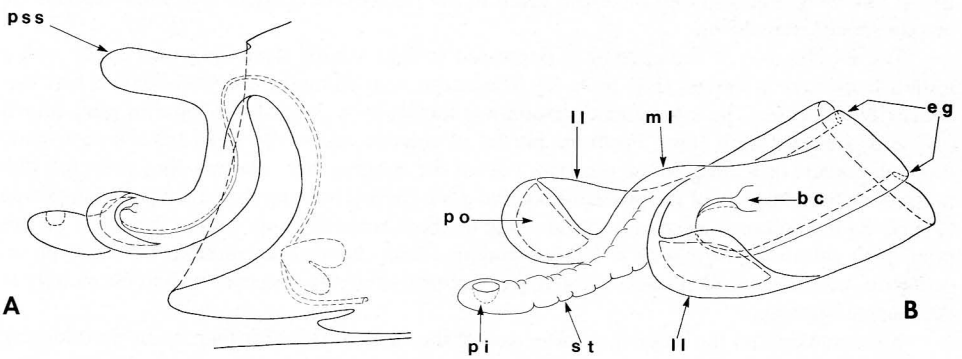
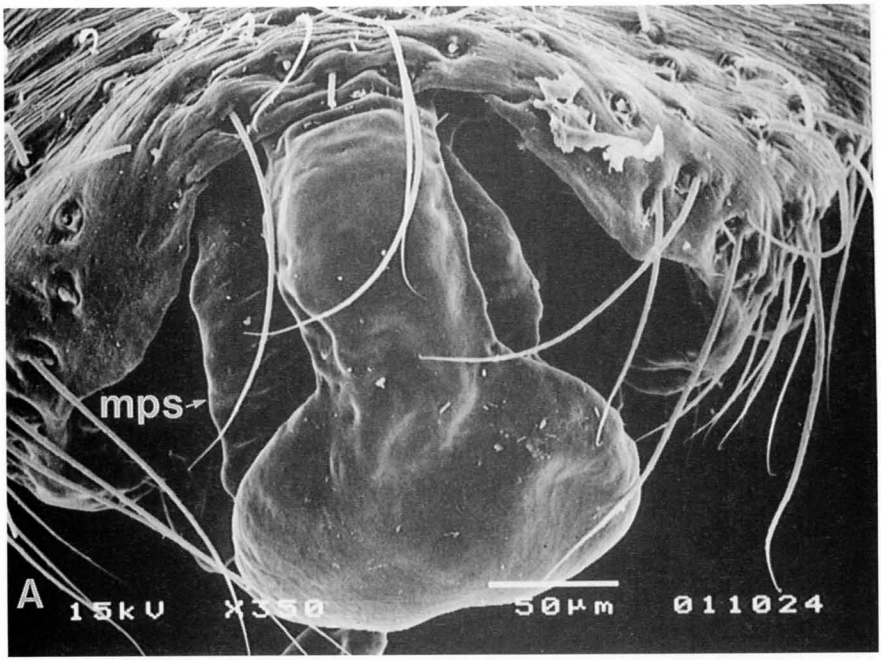


Fig. 7: Generalized epigyne of Micronetinae.
A: Lateral view. – B: Distal part of scapus (ventrolateral view).

The above presented description is thought to be the ancestral state of the micronetid epigyne. This basic pattern of the epigyne has changed in numerous ways within the Micronetinae. However, in this only a couple of special secondary structures of the epigyne, viz. pseudoscapus (pss) (= pseudoscape – Fig. 7: A) and secondary proscapus (sp) (Figs 8: B; 9: A) will be mentioned. The former is a more or less pronounced posteriorly pointing projection at the base of proscapus on its external surface. The pseudoscape is always devoid of entrance grooves and also of hairs. The secondary proscape is formed from the area in front of the scapoid base and thus bears hairs on its external surface and entrance grooves on its internal surface.



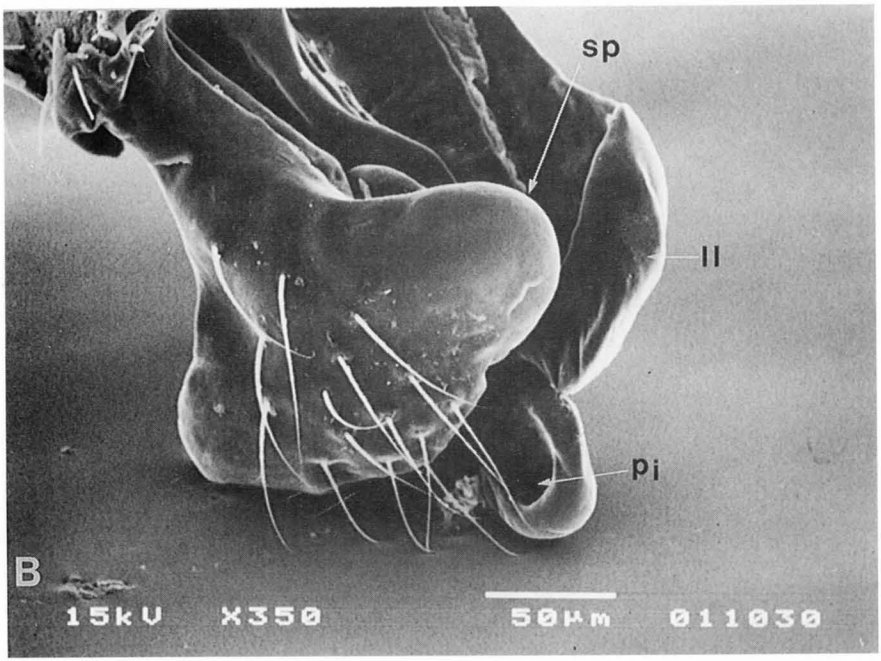
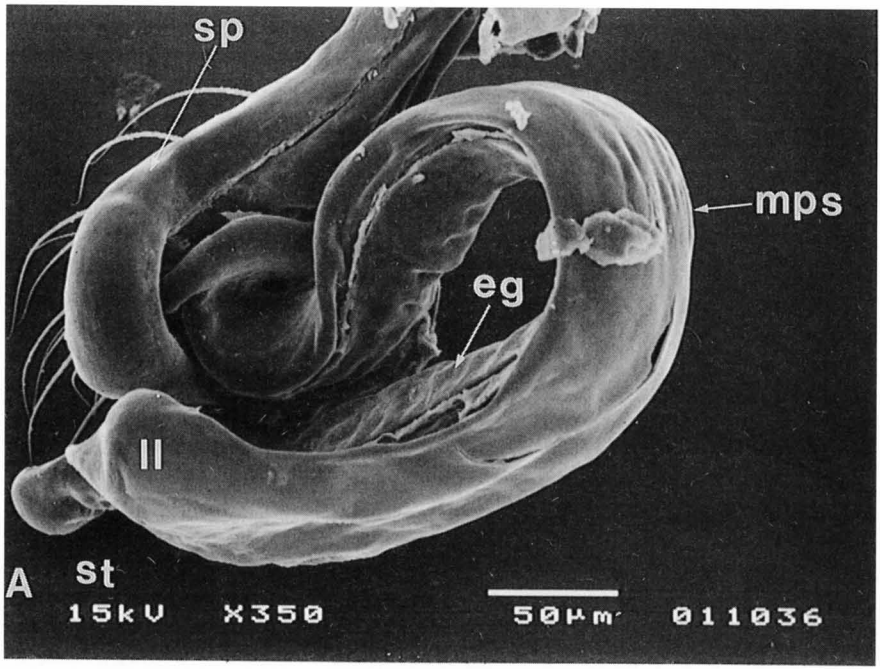


Fig. 8: A: Epigyne of *Tenuiphantes alacris* (BLACKWALL). –
B: Scapus of *Formiphantes lephthyphantiformis* (STRAND).



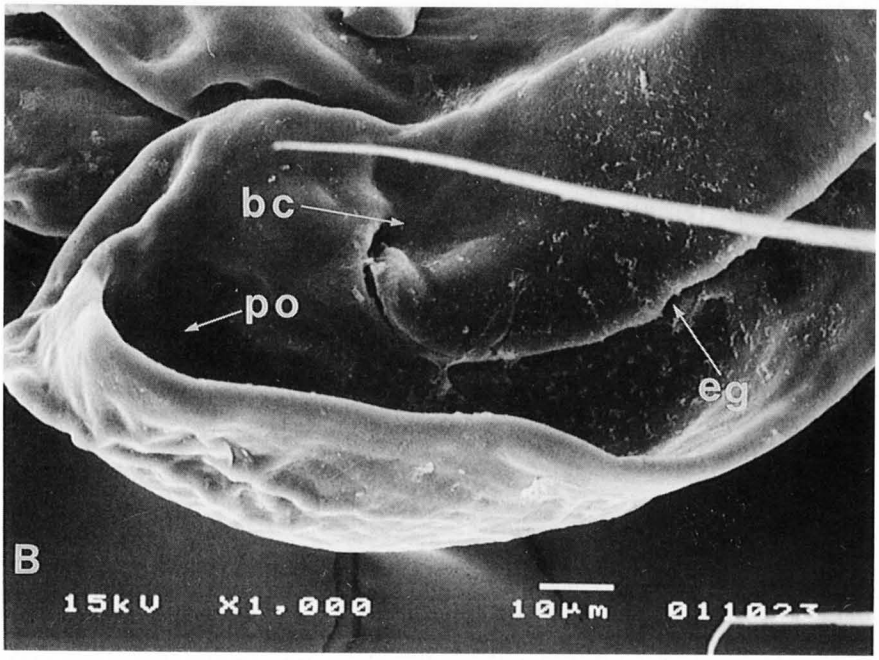


Fig. 9: Scapus. – (A): *Formiphantes lephthyphantiformis* (STRAND) (lateral view). – B: *Tenuiphantes alacris* (BLACKWALL) (distal part of scapus).

3. Redelimitation of the subfamily Micronetinae HULL, 1920:

Linyphiinae HULL, 1920 (ad partem: *Centromerus* DAHL, 1886, *Lepthyphantes, Bolyphantes, Troglohyphantes* JOSEPH, 1882). Vasculum 6: 8.
Micronetinae HULL, 1920. Vasculum 6: 8.
Mengiinae HULL, 1920 (ad partem: *Tapinopa* WESTRING, 1851, *Floronia* SIMON, 1887, *Drapetisca* MENGE, 1866, *Poeciloneta* KULCZYNSKI, 1894). Vasculum 6: 8.
Hilairinae HULL, 1920 (ad partem: *Oreonetides* STRAND, 1901, *Macrargus* DAHL, 1886). Vasculum 6: 8.
Erigoninae HULL, 1920 (ad partem: *Maro* O. PICKARD-CAMBRIDGE, 1906). Vasculum 6: 9.
Tennesseellinae PETRUNKEVITCH, 1928 **n. syn.**
Lepthyphanteae SIMON, 1929. Les Arachnides de France 6 (3): 534.
Centromereae SIMON, 1929. Les Arachnides de France 6 (3): 534 **n. syn.**
Microneteae SIMON, 1929. Les Arachnides de France 6 (3): 534.
Microneteae WIEHLE, 1956. Die Tierwelt Deutschlands 10: 14.
Lepthyphanteae WIEHLE, 1956. Die Tierwelt Deutschlands 10: 14.
Centromereae WIEHLE, 1956. Die Tierwelt Deutschlands 10: 14 **n. syn.**
Syedruleae MERRETT, 1963. Proc. Zool. Soc. London 140: 464 **n. syn.**
Centromerini LEHTINEN et SAARISTO, 1972. Ann. Zool. Fennici 9: 265.
Lepthyphantinae SAARISTO, 1973. Ann. Zool. Fennici 10: 388.
Maroini SAARISTO, 1977. Rep. Dept. Zool., Univ. Turku 5: 11 **n. syn.**
Linyphiinae HULL, 1920 (ad partem: *Maro*) MILLIDGE, 1984. Bull. Br. Arachnol. Soc.6 (6): 214.
Drapetiscinae MILLIDGE, 1984. Bull. Br. Arachnol. Soc. 6 (6): 245 **n. syn.**
Micronetinae MILLIDGE, 1984. Bull. Br. Arachnol. Soc. 6 (6): 246.

Genera included: *Acanthoneta* ESKOV et MARUSIK, 1992 (= subgen. of *Poeciloneta* KULCZYNSKI, 1894) **n. stat.,** *Agyneta* HULL, 1911, *Agnyphantes* HULL,1932 **gen. rev.**[1)] (type-species *Linyphia expuncta* O. PICKARD-CAMBRIDGE, 1875), *Anibontes* CHAMBERLIN, 1924, *Anthrohyphantes* DUMITRESCU, 1971, *Arcuphantes* CHAMBERLIN et IVIE, 1943, *Birgerius* SAARISTO, 1973, *Bolephthyphantes* STRAND,1901 (= *Bolyphantes* auct.) **gen. rev.**[2)] (type-species *Linyphia index* THORELL, 1856), *Bolyphantes* C.L. KOCH, 1833, *Bordea* BOSMANS, 1995, *Centromerus* DAHL, 1886 (= *Centromerita* DAHL, 1912 **n. syn.**), *Centrophantes* MILLER et POLENEC, 1975, *Cornicephalus* SAARISTO et WUNDERLICH, 1995, *Crispiphantes* TANASEVITCH, 1992, *Doenitzius* OI, 1960, *Drapetisca* MENGE, 1866, *Episolder* TANASEVITCH, 1995, *Fageiella* KRATOCHVIL, 1934, *Floronia* SIMON, 1887, *Herbiphantes* TANASEVITCH, 1992, *Himalaphantes* TANASEVITCH, 1992, *Incestophantes* TANASEVITCH, 1993, *Labullula* STRAND, 1913, *Lepthyphantes* MENGE, 1866, *Locketidium* JOCQUE, 1981, *Macrargus* DAHL, 1886, *Maorineta* MILLIDGE, 1988, *Maro* O. PICKARD-CAMBRIDGE, 1906, *Martensinus* WUNDERLICH, 1973, *Metalepthyphantes* LOCKET, 1968, *Microneta* MENGE, 1869, *Midia* SAARISTO et WUNDERLICH, 1995, *Neonesiotes* MILLIDGE, 1991, *Nesioneta* MILLIDGE, 1991, *Nippononeta* ESKOV, 1992, *Notophantes* MERRETT & STEVENS, 1995, *Oreonetides* STRAND, 1901, *Oreophantes* ESKOV, 1984, *Oryphantes* HULL, 1932 **gen.rev.** (type-species *Linyphia angulata* O. PICKARD-CAMBRIDGE, 1881), *Parameioneta* LOCKET, 1982, *Parawubanoides* ESKOV et MARUSIK, 1992, *Poeciloneta* KULCZYNSKI, 1894, *Rhabdoria* HULL, 1911, *Saaristoa* MILLIDGE, 1978, *Stygohyphantes* KRATOCHVIL, 1948 (= subgen. of *Troglohyphantes* JOSEPH, 1882) **n. stat.,** *Syedra* SIMON, 1884 (= *Tapinasta* SIMON, 1895 **n. syn.**), *Tallusia* LEHTINEN et SAARISTO, 1972, *Tapinopa* WESTRING, 1851, *Theoa* SAARISTO, 1995, *Tennesseellum* PETRUNKEVITCH, 1925, *Theoneta* ESKOV et MARUSIK, 1991, *Theonina* SIMON, 1929, *Troglodytia* DEELEMAN-REINHOLD, 1978 (= subgen. of *Troglohyphantes* JOSEPH, 1882.) **n. stat.,** *Troglohyphantes* JOSEPH, 1882.

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1) Other species included: *A. arboreus* (EMERTON, 1915) **n. comb.** ex *Lepthyphantes* MENGE, 1986.
2) Other species included: *B. indexoides* (TANASEVITCH, 1989) and *B. caucasicus* (TANASEVITCH, 1990), both **n. comb.** ex *Bolyphantes* C.L. KOCH, 1833.

Note: Inclusion of a particular genus in the Micronetinae is based on the characters of its type-species. Therefore, as most of the included genera are still unrevised it is not necessary that all members of certain genera are representatives of Micronetinae, e.g. only the type-species of the genus *Saaristoa* is a micronetid and the other species included in this genus, viz. *S. firma* represents another subfamily.

Diagnosis: Micronetids may be recognized by the complex type of the embolic division as described above. Also the presence of the outward pointing suprategular apophysis just below the tip of the cymbium in the unexpanded palp is often diagnostic (for more detail see SAARISTO 1973 & 1977).

4. Revised and new genera:

4.1. Genus *Lepthyphantes* MENGE, 1866 (Fig. 10: A-D):

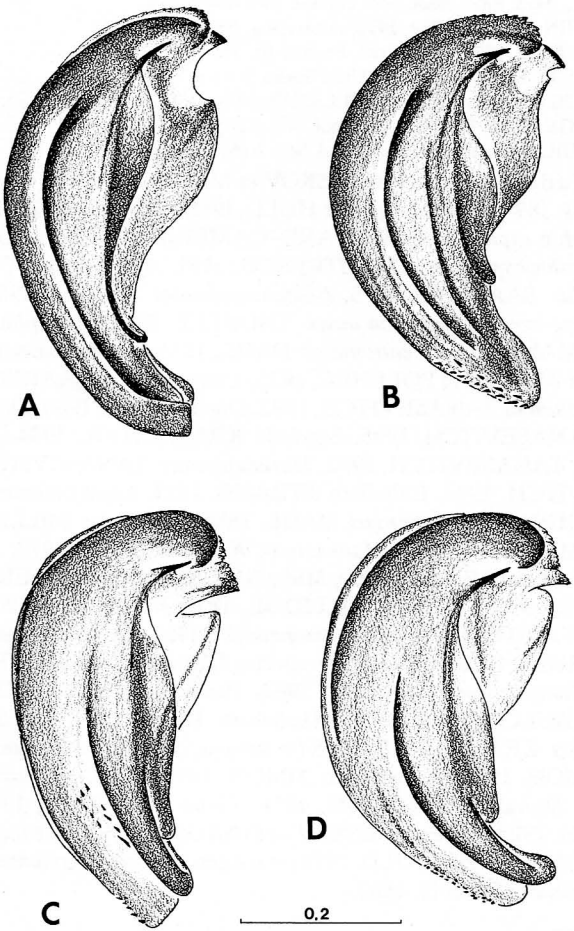

Fig. 10: Embolus of *Lepthyphantes* spp.
A: *L. minutus* (BLACKWALL). – B: *L. leprosus* (OHLERT). –
C: *L. cruentatus* (TANASEVITCH). – D: *L. iranicus* (SAARISTO & TANASEVITCH).

Lepthyphantes MENGE, 1866. Schr. Naturfr. Ges. Danzig 1: 131.

Type-species: By subsequent designation (SIMON 1884: 265) *Lepthyphantes muscicola* MENGE, 1866 = *Linyphia minuta* BLACKWALL, 1833.

Species included: *L. cruentatus* TANASEVITCH, 1987, *L. iranicus* SAARISTO et TANASEVITCH, 1995, *L. leprosus* (OHLERT, 1865), *L. minutus* (BLACKWALL, 1833), *L. simiensis* BOSMANS, 1978.

Diagnosis: Species belonging to *Lepthyphantes* may be easily recognized in the male sex by the massive, sickle-shaped embolus with tight sulcus and large carina (Fig. 10: A-D) and in female sex by the well developed scape arising far from the inside of the epigyneal cavity.

Description: Large to medium-sized linyphiids; total length 2.50-4.50. Legs without dark bands. Chaetotaxy: Fe I: 0-1-0-0, Fe II-IV: 0-0-0-0; Ti I: 2-1-1-2(3), II: 2-0-1-2, III: 2-0-0-1, IV: 2-0-0-1(2); Mt I: 1-1-1-1(0), II: 1-1-1-0, III-IV: 1-1-0-0. The above is the chaetotaxy of *L. minutus.* In other species the number of ventral spines is variably reduced and the smaller species, *L. cruentatus* and *L. iranicus* have in all metatarsi only one dorsal spine while *L. simiensis* has lost it even from the metatarsi IV. Tm I 0.18-0.23; no trichobothria on metatarsus IV. Palp: Patella with a special spine (*L. minutus*) or none. Cymbium with proximal outgrowth(s). Paracymbium relatively large. Embolus (Fig. 10: A-D) massive, sickle-shaped in lateral view. Embolic sulcus and carina well developed. Epigyne: The scapus is sigmoid, posterior median plate not hypertrophied. Abdomen with a distinct pattern.

Remarks: The 5 known species of *Lepthyphantes* are here placed in three species groups. The *minutus*-group is characterized by the bowl-shaped proscapus with a pair of elongated depressions and includes *cruentatus, iranicus,* and *minutus.* In the *leprosus*-group, which includes only one species, the proscapus is quite narrow with parallel sides and dilated apical part. Finally in the *simiensis*-group, which also includes only one species, the proscapus is almost as wide as long.

4.2. Genus *Improphantes* n. gen. (Fig. 11: A-G):

Type-species: *Lepthyphantes improbulus* SIMON, 1929.

Species included: *I. biconicus* (TANASEVITCH, 1992), *I. complicatus* (EMERTON, 1882), *I. decolor* (WESTRING, 1862), *I. falcatus* (BOSMANS, 1979), *I. flexilis* (TANASEVITCH, 1986), *I. furcabilis* (WUNDERLICH, 1989), *I. geniculatus* (KULCZYNSKI, 1898), *I. holmi* (KRONESTEDT, 1975), *I. improbulus* (SIMON, 1929) (= *Lepthyphantes beticus* DENIS, 1957 **n. syn.**), *I. mauensis* (DI CAPORIACCO, 1949), *I. montanouralensis* (ESYUNIN et EFIMIK, 1991), *I. multidentatus* (WUNDERLICH, 1989), *I. nitidus* (THORELL, 1875), *I. pamiricus* (TANASEVITCH, 1989), *I. potanini* (TANASEVITCH, 1989). All **n. comb.** ex *Lepthyphantes.*

Diagnosis: Species belonging to *Improphantes* may be easily recognized in the male sex by the sickle-shaped embolus with open sulcus and slightly reduced carina (Fig. 11: A-G). At present, no unambiguous character state common for the females of the included species could be found.

Description: Small linyphiids: 1.45-1.90; females occasionally longer than 2 mm. Legs without dark bands. Chaetotaxy: Fe I: 0-1-0-0, II-IV: 0-0-0-0; Ti I: 2-1-1-0, II: 2-0-1-0, III-IV: 2-0-0-0; Mt I-IV: 1-0-0-0. TmI — 0,17-0,23; no trichobothria on metatarsus IV. Male palp: Patella and tibia unmodified. Cymbium without basal process. Paracymbium with 1-2 teeth or without any. Lamella characteristica a long stripe. Embolus (Fig. 11: A-G) sickle-shaped with open sulcus and slightly reduced carina. Epigyne with a strongly protruding epigyneal area and markedly hypertrophied posterior median plate, lining the epigynal cavity like a second floor. Abdomen grey to black, abdominal pattern absent.

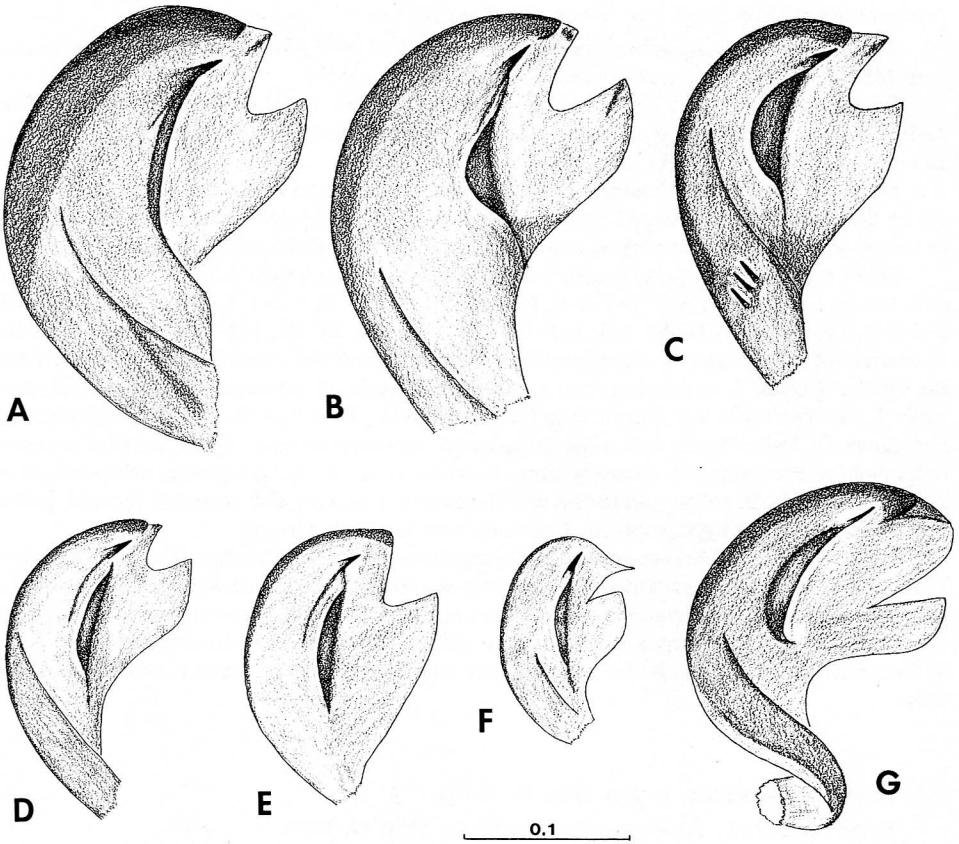

Fig. 11: Embolus of *Improphantes* spp. – A: *I. improbulus* (SIMON). – B: *I. complicatus* (EMERTON). – C: *I. flexilis* (TANASEVITCH). – D: *I. potanini* (TANASEVITCH). – E: *I. nitidus* (THORELL). – F: *I. holmi* (KRONESTEDT). – G: *I. decolor* (WESTRING).

Remarks: Although the males of this genus apparently have very similar emboli the structure of the epigyne seems to differ considerably. It is thus possible that pending on future studies the genus may be split still further. At present, no attempt to place the included species in separate species groups was made. This genus is closely related to *Piniphantes* **n. gen.,** but well recognizable by the large embolus without finger-like protrusions at the proximal part of the embolus.

4.3. Genus *Mansuphantes* n. gen. (Fig. 12: A-D):

Type-species: *Linyphia mansueta* THORELL, 1875.

Species included: *M. arciger* (KULCZYNSKI, 1882), *M. aridus* (THORELL, 1875), *M. auruncus* BRIGNOLI, 1979, *M. fragilis* (THORELL, 1875), *M. gladiolus* (SIMON, 1884), *M. korgei* (SAARISTO et TANASEVITCH, 1995), *M. mansuetus* (THORELL, 1875), *M. ovalis* (TANASEVITCH, 1987), *M. parmatus* (TANASEVITCH, 1990), *M. pseudoarciger* (WUNDERLICH, 1985), *M. rectilamellus* (DELTSHEV, 1988), *M. rossii* (DI CAPORIACCO, 1927), *M. simoni* (KULCZYNSKI, 1894). All **n. comb.** ex *Lepthyphantes.*

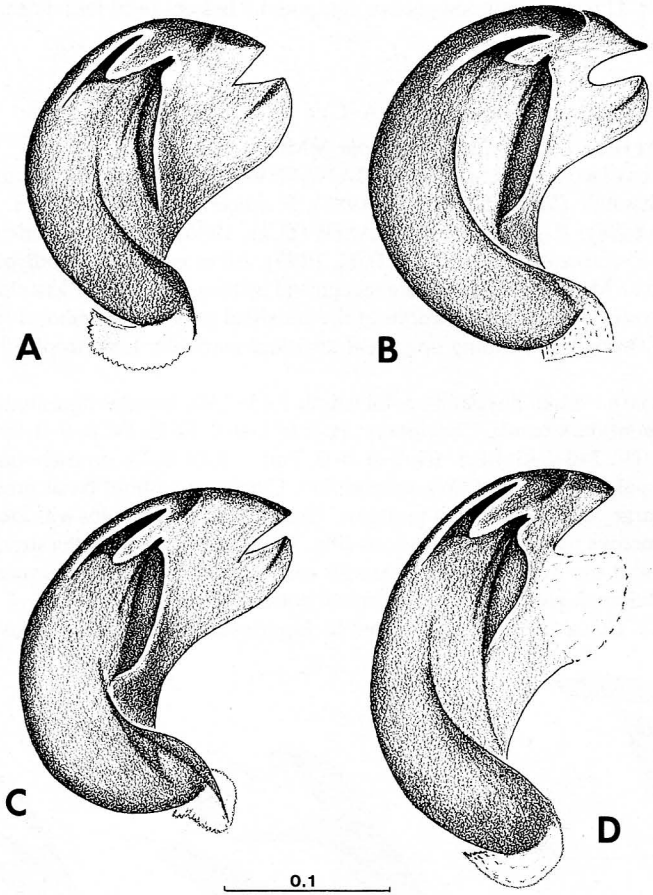

Fig. 12: Embolus of *Mansuphantes* spp.
A: *M. mansuetus* (THORELL). – B: *M. korgei* (SAARISTO & TANASEVITCH). – C: *M. fragilis* (THORELL). – D: *M. parmatus* (TANASEVITCH).

Diagnosis: Species belonging to *Mansuphantes* may be easily recognized in the male sex by the sickle-shaped embolus with a strong tooth close to the embolus proper (Fig. 12: A-D) and in the female sex by a more or less oval proscape with narrow proximal part which covers entirely all other parts of the scape. Posterior median plate at least moderately hypertrophied.

Description: Small to medium-sized linyphiids: total length 1,70-2,20. Legs without dark bands. Chaetotaxy: Fe I: 0-1-0-0, II-IV: 0-0-0-0; Ti I: 2-1-1-0, II: 2-0-1-0, III-IV: 2-0-0-0 (in *L. auruncus:* Ti II-III: 2-0-1-0); Mt I-III: 1-0-0-0 (in *L. ovalis, L. pseudoarciger, L. mansuetus, L. auruncus, L. parmatus* and *L. arciger*), the other species have: Mt I-IV: 1-0-0-0. TmI – 0,16-0,23; no trichobothria on metatarsus IV. Male palp: Tibia usually with a knob-like outgrowth distally. Paracymbium large, with a marginal tooth (except *L. parmatus*), and one or two teeth in the middle part. Embolus (Fig. 12: A-D) sickle-shaped with a strong tooth close to the embolus proper. Embolus proper terminally bifid. Epigyne: Proscapus well sclerotized, wide, rounded or slightly elongated. Abdomen grey to black, abdominal pattern absent.

Remarks: This is a very homogenous genus and it has not been found necessary to divide it into species-groups.

4.4. Genus *Piniphantes* n. gen. (Fig. 13: A-C):

Type species: *Lepthyphantes pinicola* SIMON, 1884.

Species included: *P. cinereus* (TANASEVITCH, 1986), *P. cirratus* (THALER, 1986), *P. himalayensis* (TANASEVITCH, 1987), *P. macer* (TANASEVITCH, 1986), *P. pinicola* (SIMON, 1884), *P. plumatus* (TANASEVITCH, 1986), *P. uzbekistanicus* (TANASEVITCH, 1983), *P. zonsteini* (TANASEVITCH, 1989). All **n. comb.** ex *Lepthyphantes.*

Diagnosis: Males of this genus are recognized by having a more or less elongated projection with numerous finger-like protrusions at the proximal part of the embolus (Fig. 13: A-C). Females have a strongly protruding epigyneal area and markedly hypertrophied posterior median plate.

Description: Small linyphiids: total length 1,45-1,90, females occasionally longer than 2 mm. Legs without dark bands. Chaetotaxy: Fe I: 0-1-0-0, Fe II-IV: 0-0-0-0; Ti I: 2-1-1-0, II: 2-0-1-0, III-IV: 2-0-0-0; Mt I-III: 1-0-0-0. TmI – 0,19-0,25; no trichobothria on metatarsus IV. Male palp: Patella and tibia unmodified. Cymbium without basal process. Paracymbium relatively large, with 1-2 teeth or toothless. Proximal part of embolus with elongated projection bearing numerous finger-like protrusions (Fig. 13: A-C). Epigyne witha strongly protruding epigyneal area, and the hypertrophied posterior median plate lines the epigyneal cavity like a second floor. Abdomen grey to black, abdominal pattern absent.

Remarks: This genus is closely related to *Improphantes* **n. gen.,** see above.

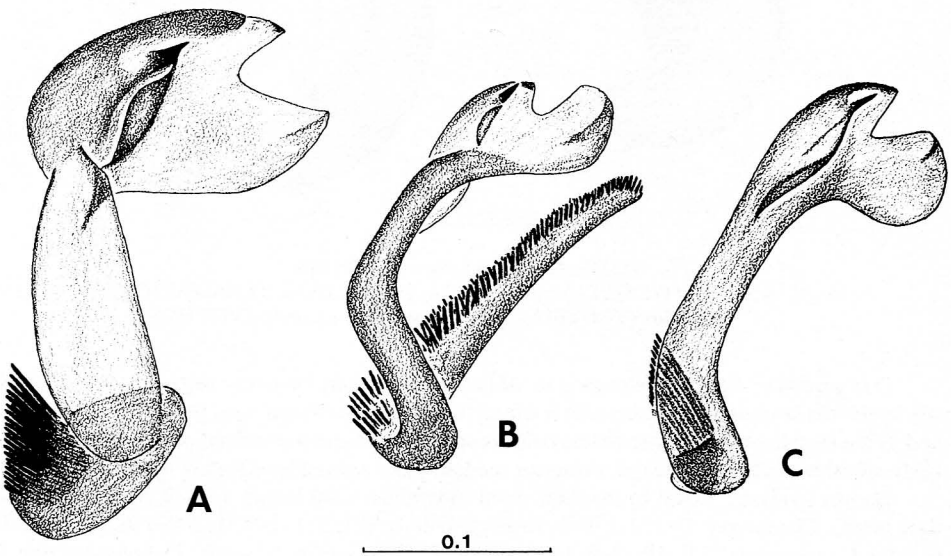

Fig. 13: Embolus of *Piniphantes* spp.
A: *P. pinicola* (SIMON). – B: *P. plumatus* (TANASEVITCH). – C: *T. macer* (TANASEVITCH).

4.5. Genus *Tenuiphantes* n. gen. (Fig. 14: A-I):

Type-species: *Linyphia tenuis* BLACKWALL, 1852.

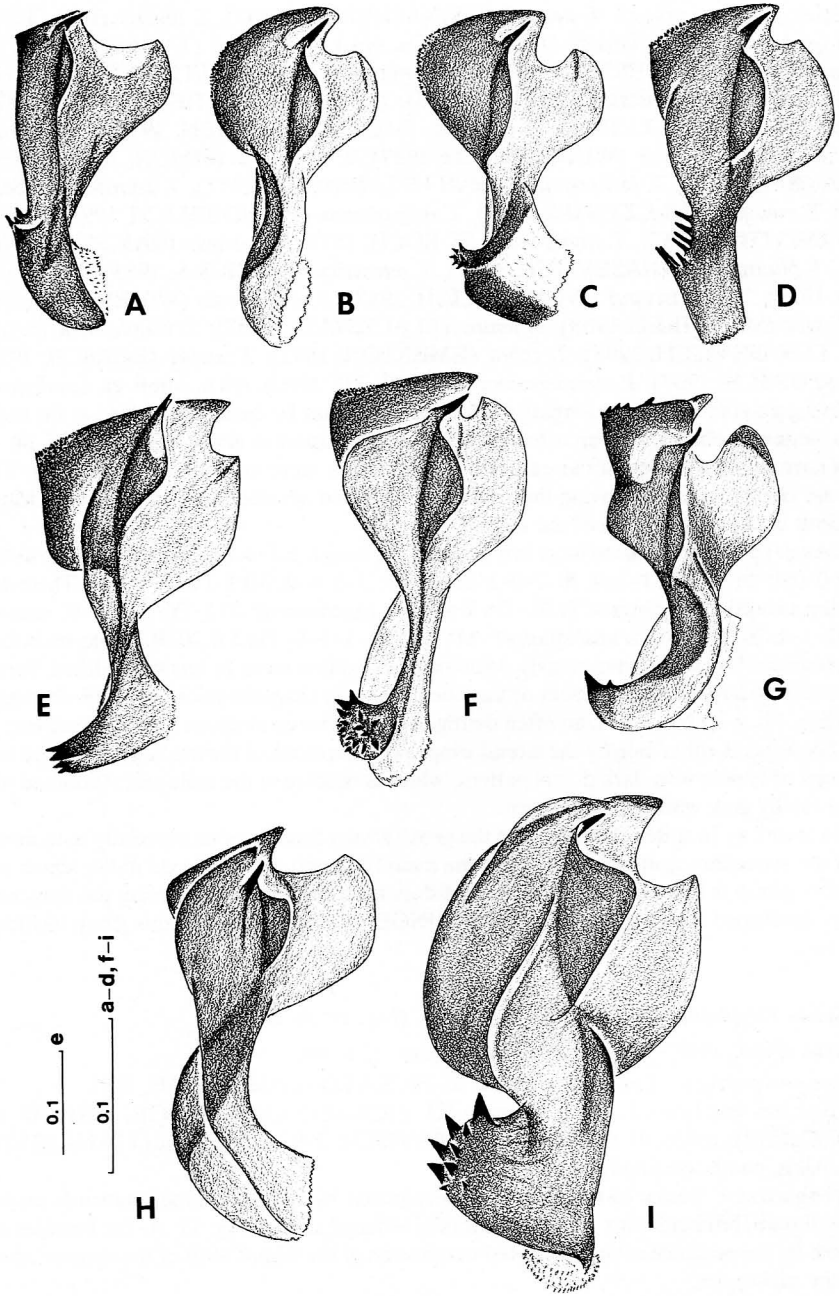

Fig. 14: Embolus of *Tenuiphantes* spp. – A: *T. tenuis* (BLACKWALL). – B: *T. mengei* (KULCZYNSKI). – C: *T. mengei* (KULCZYNSKI) (specimen from Caucasus). – D: *T. zebra* (EMERTON). – E: *T. contortus* (TANASEVITCH). – F: *T. morosus* (TANASEVITCH). – G: *T. wunderlichi* (SAARISTO & TANASEVITCH). – H: *T. ateripes* (TANASEVITCH). – I: *T. alacris* (BLACKWALL).

Species included: *T. aequalis* (TANASEVITCH, 1987), *T. alacris* (BLACKWALL, 1853) (= *Lepthyphantes leruthi* DENIS, 1952 **n. syn.**), *T. ateripes* (TANASEVITCH, 1988), *T. canariensis* (WUNDERLICH, 1987), *T. contortus* (TANASEVITCH, 1986), *T. cracens* (ZORSCH, 1937), *T. cristatus* (MENGE, 1866), *T. drenskyi* (VAN HELSDINGEN, 1977), *T. flavipes* (BLACKWALL, 1854), *T. floriana* (VAN HELSDINGEN, 1977), *T. fogarasensis* (WEISS, 1986), *T. fulvus* (WUNDERLICH, 1987), *T. herbicola* (SIMON, 1884), *T. jacksoni* (SCHENKEL, 1925), *T. jacksonoides* (VAN HELSDINGEN, 1977), *T. leprosoides* (SMITH, 1975), *T. mengei* (KULCZYNSKI, 1887), *T. miguelensis* (WUNDERLICH, 1991), *T. morosus* (TANASEVITCH, 1987), *T. nigriventris* (L. KOCH, 1879), *T. perseus* (VAN HELSDINGEN, 1977), *T. plumipes* (TANASEVITCH, 1987), *T. retezaticus* (RUZICKA, 1985), *T. spiniger* (SIMON, 1929), *T. striatiscapus* (WUNDERLICH, 1987), *T. tenebricola* (WIDER, 1834), *T. tenebricoloides* (SCHENKEL, 1938), *T. tenuis* (BLACKWALL, 1852), *T. wunderlichi* (SAARISTO et TANASEVITCH, 1995), *T. zebra* (EMERTON, 1882), *T.zelatus* (ZORSCH, 1937), *T. zibus* (ZORSCH, 1937), *T. zimmermanni* (BERTKAU, 1890). All **n. comb.** ex *Lepthyphantes.*

Diagnosis: Species belonging to *Tenuiphantes* may be easily recognized in the male sex by the sinuous embolus with an often dentigerous protrusion at about halfway (Fig. 14: A-I); after a narrow middle section the embolus widens into a more voluminous apical part. The females are characterized by having the proscapus bordered at either side by the lateral wing-like extensions of the median part of the scapus.

Description: Small to large linyphiids: total length 1.7-4.1. Chaetotaxy: Fe I: 0-1-0-0; II-IV: 0-0-0-0; Ti I: 2-1-1-0, II: 2-0-1-0, III-IV: 2-0-0-0; Mt I-IV: 1-0-0-0. There are the following exceptions: *cristatus*: Ti III-IV: 2-0-1-0, *fogarasensis*: Ti I-IV: 2-1-1-0, *retezaticus*: Ti: 2-1-1-1, Ti II: 2-01-1, and *spiniger*: Mt I-IV: 1-1-1-0. Tm I 0.20-0.30; no trichobothria on metatarsus IV (except *retezaticus*!). Male palp: Cymbium more or less unmodified. Paracymbium relatively large with 1 - 3 teeth or unarmed. Lamella characteristica usually S-shaped. Embolus (Fig. 14: A-I) large, with an often dentigerous protrusion at about halfway. Epigyne: Proscapus bordered at either side by the lateral wing-like extensions of the median part of the scapus. Abdomen of female with dark dorsal pattern, which is obscure in the male sex. Abdomen of *retezaticus* totally grey without any pattern.

Remarks: In spite of its large size the genus is very homogenous especially as to the structure of the secondary genital organs. Thus the main bulk of it is here placed in the *tenuis*-group. The other group is the *alacris*-group which differs from the former by having the epigyne with strongly developed lateral teeth (VAN HELSDINGEN 1965: 30). So far, this group includes only *alacris.*

4.6. Genus *Oryphantes* HULL, 1932 gen. rev. (Fig. 15: A-B):

Oryphantes HULL, 1932. – Trans. North. Natural Union, 1(2): 109.

Type-species: *Linyphia angulata* O. PICKARD-CAMBRIDGE, 1881.

Species included: *O. angulatus* (O. PICKARD-CAMBRIDGE, 1881), *O. bipilis* (KULCZYNSKI, 1885), *O. cognatus* (TANASEVITCH, 1992), *O. geminus* (TANASEVITCH, 1982). All **n. comb.** ex *Lepthyphantes.*

Diagnosis: Males of this genus are recognized by having a large, outwards projecting embolic thumb, bifid embolus proper, and totally reduced carina (Fig. 15: A-B). Females distinguishable by the presence of the elongated outgrowths of the lateral walls of the epigyne, directed under the proscapus.

Description: Small to medium-sized linyphiids: total length 2,00-2,70. Legs without dark bands. Chaetotaxy: Fe I: 0-1-0-0, Fe II-IV: 0-0-0-0; Ti I: 2-1-1-0, II: 2-0-1-0, III-IV: 2-0-0-0; Mt I-IV: 1-0-0-0. TmI – 0,20-0,27; no trichobothrium on metatarsus IV. Male palp: Patella with a conical or cylindrical outgrowth bearing a special spine. Paracymbium with a tooth

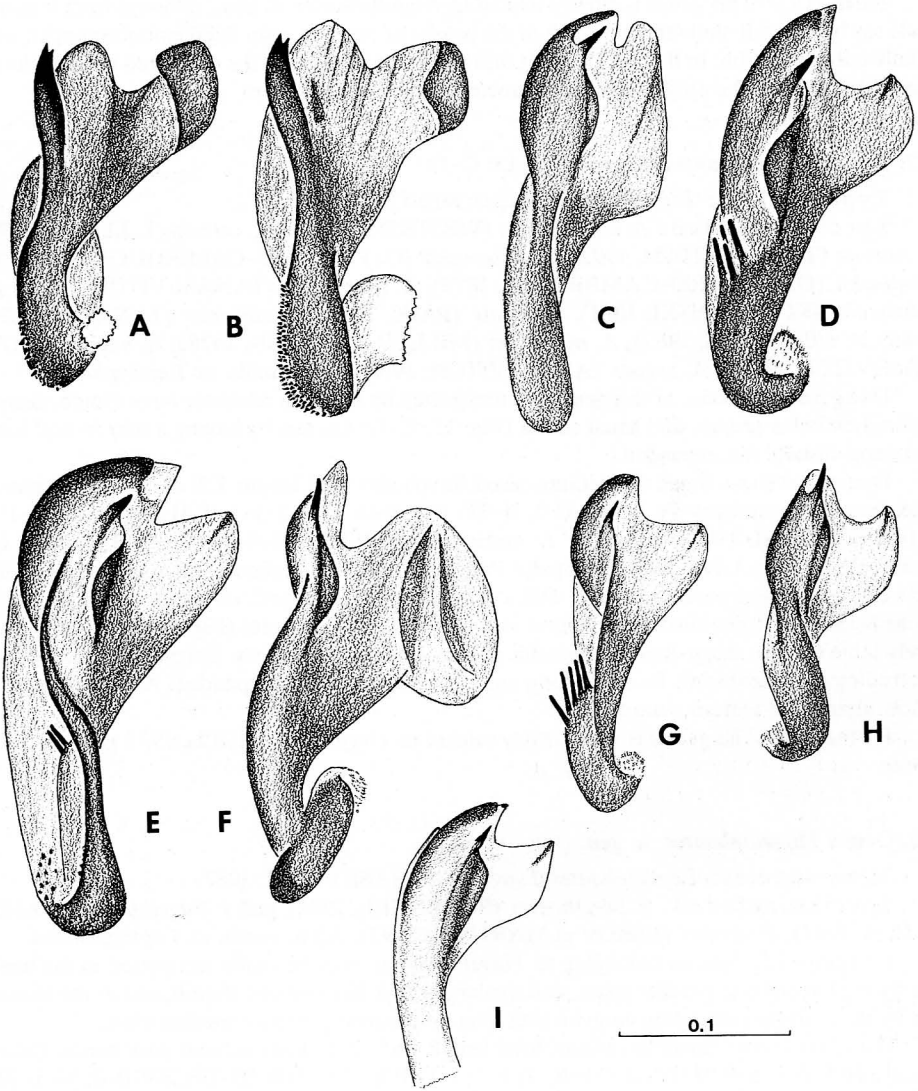

Fig. 15: Embolus of *Oryphantes* spp.
A: *O. geminus* (TANASEVITCH). – B: *O. angulatus* (O. PICKARD-CAMBRIDGE). – C: *O. angulipalpis* (WESTRING). – D: *O. dybowskii* (O. PICKARD-CAMBRIDGE). – E: *O. maritimus* (TANASEVITCH). – F: *O. ussuricus* (TANASEVITCH). – G: *O. sibiricus* (TANASEVITCH). – H: *O. karpinskii* (O. PICKARD-CAMBRIDGE). – I: *O. cerinus* (L. KOCH).

on its apical part. Embolus (Fig. 15: A-B) large, with outwards projecting embolic thumb. Embolus proper bifid. Carina totally reduced. Epigyne with a slightly protruding epigyneal area. Lateral walls of the epigyneal cavity with elongated outgrowths, directed under the proscapus. Abdomen grey to black, abdominal pattern absent.

Remarks: This genus is closely related to *Anguliphantes* **n. gen.,** differing from it in the male sex by the well-defined outgrowth of the patella of the male palp, bifid embolus proper, and totally reduced carina. In the female sex it differs by the presence of the elongated outgrowths of the lateral walls of the epigyneal cavity, directed under the proscapus.

4.7. Genus *Anguliphantes* n. gen. (Fig. 15: C-I):

Type-species: *Linyphia angulipalpis* WESTRING, 1851.

Species included: *A. angulipalpis* (WESTRING, 1851), *A. cerinus* (L. KOCH, 1879), *A. curvus* (TANASEVITCH, 1992), *A. dybowskii* (O. PICKARD-CAMBRIDGE, 1873), *A. karpinskii* (O. PICKARD-CAMBRIDGE, 1873), *A. maritimus* (TANASEVITCH, 1988), *A. monticola* (KULCZYNSKI, 1881), *A. nasus* (PAIK, 1965), *A. sibiricus* (TANASEVITCH, 1986), *A. silli* (WEISS, 1987), *A. tripartitus* (MILLER & SVATON, 1978), *A. ussuricus* (TANASEVITCH, 1988), *A. zygius* TANASEVITCH, 1993. All **n. comb.** ex *Lepthyphantes.*

Diagnosis: Males of this genus are recognized by having a relatively large thumb, sharp-pointed embolus proper, and small carina (Fig. 15: C-I); females by having a narrow and long proscape, distally not expanded.

Description: Small to medium-sized linyphiids: total length 1,17-2,50. Legs without dark bands. Chaetotaxy: Fe I: 0-1-0-0, II-IV: 0-1-0-0; Ti I: 2-1-1-0, II: 2-0-1-0, III-IV: 2-0-0-0; Mt I-III: 1-0-0-0 (except *L. maritimus*: Mt I-IV: 1-0-0-0). TmI – 0,14-0,22; no trichobothria on metatarsus IV. Male palp: Patella without well-defined outgrowth, ending with a special spine. Paracymbium usually with a ridge in middle part and/or one or two small teeth. Lamella characteristica curved medially at an angle of ca. 90°. Embolus (Fig. 15: C-I) with a relatively large thumb, sharp-pointed embolus proper, and a small carina. Epigyne with a strongly protruding epigyneal area. Proscape long and narrow, distally not expanded. Abdomen grey to black, abdominal pattern absent.

Remarks: The genus is very closely related to *Oryphantes* HULL, 1932 **gen. rev.,** see above.

4.8. Genus *Flagelliphantes* n. gen. (Fig. 16: A):

Type-species: *Lepthyphantes flagellifer* TANASEVITCH, 1987.

Species included: *F. bergstroemi* (SCHENKEL, 1931), and *F. flagellifer* (TANASEVITCH, 1987), *F. sterneri* (ESKOV et MARUSIK, 1993). All **n. comb.** ex *Lepthyphantes.*

Diagnosis: Species belonging to *Flagelliphantes* may be easily recognized in the male sex by the flagelliform patellar spine, and the large hood-like embolic thumb, and in the female sex by the strongly protruding epigyne with long and narrow posterior median plate.

Description: Small linyphiids: total length 1.65-2.10. Legs without dark bands. Chaetotaxy: Fe I: 0-1-0-0, II-IV: 0-0-0-0; Ti I: 2-1-1-0, II: 2-0-1-0, III-IV: 2-0-0-0; Mt I-III: 1-0-0-0. TmI – 0,15-0,21; no trichobothria on metatarsus IV. Male palp: Patella with a flagelliform spine. Cymbium without basal outgrowths. Embolus (Fig. 16: A, B) rather small with large hood-like thumb. Epigyne relatively narrow, strongly protruding. Proscape long, S-shaped, more or less rigid. Posterior median plate hypertrophied, long and narrow with parallel sides. Abdomen grey to black, abdominal pattern absent.

Remarks: Judging from the shape of embolus this genus seems to be related to *Anguliphantes* **n. gen.** and *Oryphantes* HULL, 1932 **gen. rev.**

4.9. Genus *Decipiphantes* n. gen. (Fig. 16: D):

Type-species: *Linyphia decipiens* L. KOCH, 1879.

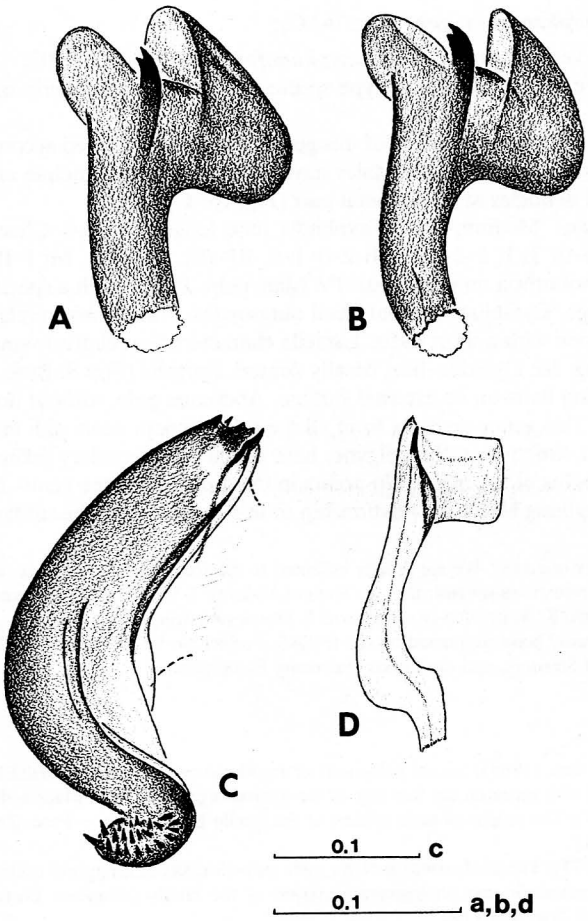

Fig. 16: Embolus. – A: *Flagelliphantes bergstroemi* (SCHENKEL). – B: *F. flagellifer* (TANASEVITCH). – C: *Formiphantes lephthyphantiformis* (STRAND). – D: *Decipiphantes decipiens* (L. KOCH).

Species included: *D. decipiens* (L. KOCH, 1879) **n. comb.** ex *Lepthyphantes.*

Diagnosis: Species belonging *Decipiphantes* may be easily recognized in the male sex by rectangular thumb and the long and narrow proximal part of the embolus (Fig. 16: D) and in the female sex by the presence of a lateral outgrowth of the proscapus, and long posteriorly protruding lateral walls of the epigyneal cavity, covering the distal part of the proscape.

Description: Small linyphiids: total length 1.70-2.10. Legs without dark bands. Chaetotaxy: Fe I: 0-1-0-0, II-IV: 0-0-0-0; Ti I: 2-1-1-0, II: 2-0-1-0, III-IV: 2-0-0-0; MT I-III: 1-0-0-0. Tm I: 0.21-0.25; no trichobothria on metatarsus IV. Male palp: Patella anteriodorsally with a cylindrical or conical outgrowth, bearing a special spine. Cymbium with basal outgrowth. Paracymbium simple. Embolus (Fig. 16: D) with a long and narrow proximal part. Lamella characteristica long and complex. Epigyne: Lateral walls long, posteriorly protruding, covering the distal part of the proscape. Proscape with lateral outgrowths. Abdomen grey to black, abdominal pattern absent.

4.10. Genus *Formiphantes* n. gen. (Fig. 16: C):

Type-species: *Taranucnus lephthyphantiformis* STRAND, 1907.

Species included: Only the type species *F. lephthyphantiformis* **n. comb.** ex *Lepthyphantes.*

Diagnosis: The only member of this genus is easily recognized according to the secondary proscape in the female epigyne. Males have the embolus in principle of the sickle-shaped type bearing small denticles at its proximal part (Fig. 16: C).

Description: Medium-sized linyphiids: total length 2.0-2.4. Chaetotaxy: Fe I: 0-1-0-0, II-IV: 0-0-0-0; Ti I: 2-1-1-0, II: 2-0-1-0, III-IV: 2-0-0-0; Mt I-III: 1-0-0-0. Tm I: 0.17-0.19, no trichobothria on metatarsus IV. Male palp: Patella with a special spine. Tibia with a mediodorsal bulge. Cymbium without basal outgrowths. Paracymbium relatively large, toothless. Embolic division with a short radix. Lamella characteristica relatively small, strongly sclerotized. Embolus (Fig. 16: C) sickle-like, basally dented. Epigyne (Figs 8: B; 9: A): with a secondary proscape bearing hairs on its external surface. Abdomen pale, without dorsal pattern.

Remarks: This genus deviates from all the other genera dealt with in this paper by having a curious extra structure in the epigyne, here called the secondary proscape. Although the sickle-shaped embolus of the male palp points in the direction of the genus *Lepthyphantes* it is too early to say anything about the relationship of this genus within the subfamily Micronetinae.

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