

**A RECLASSIFICATION OF THE SPECIES OF
LINYPHIA LATREILLE BASED ON THE FUNCTIONING
OF THE GENITALIA (ARANEIDA, LINYPHIIDAE)**

Part II. *Microlinyphia* Gerhardt and *Frontinellina* Van Helsdingen

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With 74 text-figures and 1 table

INTRODUCTION

In this second part of my series of papers on the genus *Linyphia* sensu Bonnet (1957) two genera are dealt with which have been removed from *Linyphia* Latreille on morphological and ethological grounds. The functioning of the genitalia of one example of either genus have been described and discussed in the first part (Van Helsdingen, 1969).

Though the results were not as striking as in the case of *Neriene* versus *Linyphia*, the study of the functional aspects of the genitalia have added much to the understanding of the correlations between the shapes of the different parts of the male and female secondary sexual organs. *Neriene* was separated from *Linyphia* largely on the basis of the differences in the functioning of the genitalia, as revealed in fixed genital complexes, supported, of course, by purely morphological characters. *Microlinyphia* was created by Gerhardt (1928) on ethological grounds, and the existence of this separate genus is confirmed indeed by the results obtained in the field of functioning. *Frontinellina* was created by me (Van Helsdingen, 1969) for the reception of two species with strongly deviating genital organs.

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An explanation of the abbreviations used in the text and comments on the technical procedures were given in part I under the heading "Method". For convenience' sake the abbreviations of the elements of male palp and female epigyne are listed alphabetically below.

male palp	epigyne
e = embolus	fd = fertilization duct
em = embolic membrane	rs = receptaculum seminis
ea = embolic apophysis	s = scape
l = lamella	st = spiral tube
ma = median apophysis	tp = turning-point
r = radix	
t = tegulum	
ta = terminal apophysis	
tap = terminal appendage	

Microlinyphia Gerhardt

Microlinyphia Gerhardt, 1928, Zeitschr. Morph. Ökol. Tiere, 10: 632. Type-species, by original designation: *Linyphia pusilla* Sundevall.

Pusillia Chamberlain & Ivie, 1943, Bull. Univ. Utah, 33(10): 23. Type-species, by original designation: *Linyphia mandibulata* Emerton.

Bonnetiella Di Caporiacco, 1949, Comment. Pont. Acad. Scient., 13: 358. Type-species, by original designation: *Bonnetiella singularis* Di Caporiacco. [new synonymy].

Remarks. — Chamberlin & Ivie (1943), when erecting the new genus *Pusillia*, probably had not noticed Gerhardt's earlier conclusion on the subject. This is well understandable, because Gerhardt published his new genus for the first time rather concealed in one of his voluminous papers on courtship in spiders. Gerhardt based *Microlinyphia* mainly on differences in the number of spermdrops needed by a male to fill its palps, observed in *Linyphia clathrata* [= *Nerienne clathrata* (Sundevall)] and *L. emphana* [= *Nerienne emphana* (Walckenaer)] on the one hand, and in *Microlinyphia pusilla* (Sundevall) on the other. *Pusillia* was erected on purely morphological grounds. On account of the functional aspects of the genitalia I fully endorse the necessity for the use of a separate genus for *pusilla* and related species.

Bonnetiella was erected for the reception of a single female specimen, which Di Caporiacco described in the same paper as *B. singularis*. The specimen is in a very bad condition, though the vulva is still recognizable, and this may explain why Di Caporiacco did not recognize the species, and also why he included the genus in a different subfamily (Micronetinae).

The names *Microlinyphia* and *Pusillia* have not been accepted by all recent authors. In most papers one finds *pusilla*, for instance, still listed as a true *Linyphia*, while American authors have used either *Pusillia* or *Linyphia*. In the opinion of Merrett (1963: 456) there is little justification for using a separate genus for *pusilla* and related species. Wiehle (1956: 324) dealt with *Microlinyphia* as a subgenus or species-group, including *pusilla*, *impigra*, and *frutetorum*. In this paper I have used the genus *Frontinellina* for the species mentioned last, while I have united a number of Palaearctic, Ethiopian, and Nearctic species in *Microlinyphia*.

Infrageneric affinities. — With the exception of *M. delesserti*, and in a sense *M. impigra*, the genus is remarkably homogeneous. The differences in the genitalia often are small. Moreover, the variability of the species as regards the genital organs is much larger than that observed in *Nerienne*, *Linyphia*, and *Frontinellina*. Notably the length of the male embolus and the number of coils of the spiral tube in the vulva are far from constant. It is, therefore, understandable that Hackman (1954: 11) considered the possibility of a polytypic Holarctic species in the case of *pusilla* and *mandibulata*. However, a comparison of the North American species with the Old World representatives of the genus points to a discontinuity between *mandibulata* and *dana* on the one hand, and *pusilla* (from Eurasia and Western North America) and *sterilis* on the other. Differences between these two groups are certainly not of a mere quantitative nature (cf. Hackman, 1954: 11). *M. pusilla* and *sterilis* rather might form a polytypic species, the differences between these two species being very slight. The differences all

lie in the genital organs and appear to be constant, and on these grounds they are considered to be of specific value.

Description. — Medium sized animals (3-6 mm). Cephalothorax of male comparatively long and narrow, less elongate in females. Cephalothorax of males with the extension of the chitinous integument ventrally on border of head and thorax proportionally longer, triangular and pointing in mesal direction between chelicerae and gnathocoxae (extensions of either side connected mesally in *delesserti*). PME on black tubercles, and separated from each other by 1.5-2.5 times their own diameter, usually farther apart than from PLE. Lateral eyes contiguous. AME small and close together. Chelicerae of males long and parallel, slanting backwards towards gnathocoxae at an angle of approximately 45° , chelicerae of females normal. Males with a strongly developed protrusion on posterior surface of chelicerae, in females less conspicuous. Stridulating file composed of broken ridges or absent. Four or five teeth in both rows.

Legs long and slender, notably in males, length of tibia I 10 diams. or more. At least femur I bearing spines. Tibiae with dorsal, lateral, and ventral spines. Metatarsi always with spines. Tm I 0.13-0.24. Metatarsus IV without trichobothrium. Leg I longest, leg II longer than or as long as leg IV. Abdomen cylindrical in male, more oblong in female, posterior surface perpendicular to dorsal surface, postero-dorsal tubercle not or barely discernible.

Male palp. — Tibia always with a dorsal spine, sometimes with an additional mesal or lateral spine, rarely (*delesserti*) with more lateral spines. Paracymbium small, simple and inconspicuous, distal arm narrow. Tegular complex evenly rounded, without lobes or incisions, median apophysis arising from antero-mesal surface. Median apophysis with straight proximal part, distal part membranous with sharply pointed or finger-like tip; proximal part widened at base, but without depression there (cf. *Neriene*). Radix small, completely attached by membrane to dorsal side of lamella; proximal tip barely knob-shaped (cf. *Linyphia*). Embolus long and thread-like (but short in *delesserti*), forming a large and conspicuous loop at the unexpanded palp; element attached to distal tip of radix, chitinous outer margin strongly curved at base, membranous velum on inner curve narrowing quickly towards tip; an embolic apophysis nearly always present (except in *delesserti*), as a small corkscrew-shaped appendage not far from base of embolus at inner bend. Embolic membrane spatulate, arising from membranous connection of radix, base of embolus, and dorsal side of lamella, element tapering to a point, usually with a longitudinal fold. Terminal apophysis a

very small and inconspicuous chitinous strip or semi-spherical element, with short hairs or villi, lying in the angle between lamella proper and lateral projection; sometimes absent. Lamella flat, mesal margin usually curved to ventral side, forming a narrow upturned brim; lateral projection long and slender, concave on lateral surface, directed forwards; protrusions usually present on dorsal surface near proximal tip, and near mesal margin on half length; proximal tip rounded.

Epigyne. — Small and inconspicuous, consisting of a narrow triangular incision of anterior wall of epigastric furrow, provided with a small rounded scape, entrances lying in incision; or entrances situated at either side of small scape or mesal lobe; scape or lobe depressed in the middle, or with small pit. Epigyne barely more chitinous than surrounding surface. Spiral tube leading from entrance towards turning-point in regular coils around central axis, formed by the fertilization duct, column of spiral coils narrowing gradually towards tip. Wall of tube thin, membranous, becoming thicker and more chitinous near turning-point, transition usually rather sudden. Direction of spiral becoming reversed at turning-point, a thick-walled duct leading from there to globular receptaculum. Fertilization duct running backwards from receptaculum to dorsal side of dorsal wall of complex, slightly twisted in axis of column, and forming a loop around tube near entrance.

Key to the species

1. Femur I usually with more than one d-spine and two l'-spines. Interstice between third and fourth dorsal teeth of chelicerae wider than between other teeth. Male palp (fig. 57): cymbium not more than 1.3 times as long as tibia; embolus (fig. 63, *e*) short and curved, without embolic apophysis. Epigyne (fig. 55, 59): posterior border excised mesally; scape with small knob-shaped tip, constricted below knob; ducts between entrances and turning-points very short, receptacula close to posterior margin (fig. 60, 61). — Central Africa . . . *delesserti* Di Caporiacco, p. 62
- Femur I usually with one d-spine and two l'-spines, though additional spines may be present. Dorsal cheliceral teeth equidistant. Male palp: cymbium at least 1.7 times as long as tibia; embolus long and thread-like, an embolic apophysis present near base. Epigyne: scape broad or tongue-shaped, never knob-shaped; vulva always with spirally coiled tubes with several coils 2
2. Male palp: distal part of median apophysis (fig. 8, *ma*) with curved bluntly pointed tip. Epigyne (fig. 1): posterior margin triangularly or semi-circularly incised in the middle, incision closed on posterior side by a small rounded scape, which curves in ventral direction; entrances of spiral tubes in sides of incisions 3
- Male palp: distal part of median apophysis (fig. 51, *ma*) with sharp tip. Epigyne (fig. 44, 49): posterior margin rather straight, without median incision; scape much shorter than wide, or a median protrusion present between the two entrances of the spiral tubes 8
3. Abdomen uniformly dark dorsally, or with a lighter area in the middle. Abdomen of male very long and slender, more than three times as long as high. Legs long

- and slender. Anterior femora of male with large and conspicuous warts, which are slightly larger than cheliceral warts. Tm I 0.13-0.15. Male palp: tip of distal part of median apophysis (fig. 22, *ma*) hook-shaped, long in comparison with proximal part; length of embolus 0.7-0.8 mm. Vulva (fig. 27): 3.5 coils of spiral tube. — Madagascar *simoni* spec. nov. p. 30
- Pattern of abdomen otherwise. Abdomen of male less elongate. Anterior femora never with conspicuous warts. Tm I 0.16-0.24. Male palp: distal part of median apophysis not much longer than proximal part; embolus longer. Vulva: 4 or more coils of spiral tube 4
4. Cephalothorax with black median stripe. Abdomen with characteristic pattern, consisting of black dorso-lateral bands and a black median stripe followed by four black chevrons on posterior half. Male palp (fig. 14, 17): length of embolus about 1.2 mm. Vulva (fig. 15, 19); 4.5-5 coils of spiral tube. — Madeira and Canary Islands *johnsoni* Blackwall and *inexplicabilis* Denis, p. 24, 29
- Cephalothorax with or without black median stripe. Pattern of abdomen otherwise. Male palp: embolus longer. Vulva: at least 6 coils of spiral tube 5
5. Abdomen with a median row of black markings, which may fuse lengthwise, and with black lateral areas in darker specimens. Male palp: tibia with a dorsal spine near incision of distal margin, and with an additional lateral spine, embolus shorter than 2.5 mm; mesal margin of lamella evenly curved from proximal to distal tip. Vulva (fig. 5, 9): 6-8 coils of spiral tube; loops of fertilization ducts around entrances of spiral tubes not touching mesally, but well separated 6
- Basic pattern of abdomen consisting of two dorsal rows of black spots, which often fuse lengthwise or across. Male palp: tibia with a dorsal spine near incision of distal margin, but without lateral spine; a mesal spine often present; embolus 2.5 mm or longer; mesal margin of lamella slightly angular on half length, straight in front and behind angle. Vulva (fig. 30, 38); 8 or more coils of spiral tube; loops of fertilization ducts nearly touching mesally 7
6. Male palp (fig. 2): embolic apophysis (fig. 3, *ea*) corkscrew-shaped, pigmented. Vulva (fig. 5): 6.5-7.5 coils of spiral tube; entrances of spiral tubes situated anteriorly in sides of triangular incision. — Palearctic region and Western North America *pusilla* Sundevall, p. 9
- Male palp (fig. 11): embolic apophysis (fig. 13, *ea*) narrow and membranous, not pigmented. Vulva (fig. 9): 7-8 coils of spiral tube; entrances of spiral tubes situated rather posteriorly in sides of triangular incision. — Africa south of Sahara *sterilis* Pavesi, p. 17
7. Cephalothorax brown, often very dark, without grey median stripe. Cephalothorax of male conspicuously elongate, with long cephalic part. Abdomen of male with a pair of white transverse dorsal spots on anterior half. Chelicerae of male very long, ratio length to length of cephalothorax 0.6-0.8. Legs comparatively short, femur I 0.95-1.15 times length cephalothorax in males, 1.1-1.35 times in females. Spines short; length of d''-spine on tibia I less than 1.5 diams. in males; absolute length of d''-spine on tibia I less than 0.33 mm in females. — North America *mandibulata* Emerton, p. 35
- Cephalothorax light brown, usually with a grey median stripe, which may be very obscure. Cephalothorax of male not conspicuously elongate. Abdomen of male never with white transverse dorsal spots, but with white latero-dorsal bands. Chelicerae of male not extremely long, ratio length to length of cephalothorax 0.5-0.6. Legs very long, femur I 1.4-1.8 times length cephalothorax in males, 1.2-1.5 times in females. Spines long, length of d''-spine on tibia I 2.5 diams. or more in males; absolute length of d''-spine on tibia I more than 0.33 mm in females. — West coast of North America *dana* Chamberlin & Ivie, p. 45
8. Cephalothorax with a grey median stripe, bifurcate anteriorly, sometimes only

faintly visible. Abdomen of female white with few black markings; abdomen of male brown suffused with black, with a pair of white transverse dorsal spots on anterior half. Length of tibia I of male 12-14 diams. Epigyne (fig. 44): entrances of spiral tubes separated by a median protrusion, which is lightly depressed ventrally. — Eurasia west of Ob River, North America

- Cephalothorax without a grey or black median stripe. Abdomen of female with black-brown dorso-lateral bands, and with a short dark dorsal median stripe on anterior half. Abdomen of male without white transverse dorsal spots. Length of tibia I of male 21 diams. Epigyne (fig. 49): scape wider than long, lying below entrances of spiral tubes. — East African mountains
impigra Pickard-Cambridge, p. 50
aethiopica Tullgren, p. 57

***Microlinyphia pusilla* (Sundevall)**

(fig. 1-8)

Linyphia pusilla Sundevall, 1829, Kongl. Svenska Vet.-Acad. Handling., 1829: 215 (p.p.; variety β only, Sweden). — L. Koch, 1879, Kongl. Svenska Vet.-Akad. Handling., 16(5): 9 (Siberia). — O. Pickard-Cambridge, 1885, Scient. Res. Sec. Yarkand Miss., Aran.: 43 (China, Sinkiang). — Strand, 1903, Bergens Mus. Aarb., 1903(10): 8 (var. *quadripunctata* with white ventral spots, Siberia). — Simon, 1929, Arachn. France, 6(3): 638, 744, fig. 985-986 (key, France). — Lockett & Millidge, 1953, British Spid., 2: 400, fig. 237D, 239A, 241C (British Isles). — Wiehle, 1956, Tierw. Deutschl., 44: 331, fig. 545-551 (key, Germany). — Yaginuma, 1957, Acta Arachn., 14: 54 (Japan, Hokkaido); 1960, Spid. Japan Colour: 42 (not depicted).

Microlinyphia pusilla; Gerhardt, 1928, Zeitschr. Morph. Ökol. Tiere, 10: 632 (courtship and pairing, creation of new genus).

Pusillia pusilla; Chamberlin & Ivie, 1943, Bull. Univ. Utah, 33(10): 26 (not in U.S.A.; transferred to new genus).

Linyphia fuliginea Blackwall, 1833, London & Edinburgh Phil. Mag. Journ. Sci., (3)3: 349 (description δ , England). — Thorell, 1870, Rem. syn. Europ. spid.: 50 (= *L. pusilla* Sundevall).

Linyphia pratensis Wider, 1834, Mus. Senckenb., 1: 251, pl. 17 fig. 8 (description φ , Germany). — Thorell, 1870, Rem. syn. Europ. spid.: 50 (= *L. pusilla* Sundevall).

Linyphia pascuensis Walckenaer, 1841, Hist. nat. Ins., Aptères, 2: 251 (description φ , Pyrenees). — Thorell, 1870, Rem. syn. Europ. spid.: 49 (? = *L. hortensis* Sundevall). — Simon, 1884, Arachn. France, 5(2): 241 (= *L. pusilla* Sundevall).

Linyphia carnica Di Caporiacco, 1922, Mem. Soc. ent. Ital., 1: 81, text-fig. (description φ , Italy); 1927, Mem. Soc. ent. Ital., 5: 100 (Italy). [new synonymy].

Linyphia baltistana Di Caporiacco, 1935, Mem. Soc. ent. Ital., 13: 158, pl. 3 fig. 10a-c (description φ δ , Karakoram). [new synonymy].

Linyphia hortensis; Denis, 1943, Bull. Mus. R. Hist. nat. Belgique, 19(12): 18 (p.p.; Belgium).

Pusillia bonita Chamberlin & Ivie, 1943, Bull. Univ. Utah, 33(10): 26, fig. 41-42 (diagnosis φ δ , U.S.A., Wyoming and Idaho); 1947, Bull. Univ. Utah, 37(10): 61 (Alaska). — Kurata, 1949, Canad. Ent., 81: 128 (Canada). — Levi & Levi, 1951, Zoologica, New York, 36; 222 (Montana, Wyoming). [new synonymy].

Microlinyphia bonita; Lowrie & Gertsch, 1955, Amer. Mus. Novit., 1736: 5 (Wyoming).

Theridion signatum Hahn, 1834, Die Arachniden, 2: 40, pl. 54 fig. 155 (description φ δ , Germany).

Theridion ampullaceum Walckenaer, 1841, Hist. nat. Ins., Aptères, 2: 336 (nomen

novum for *T. signatum* Hahn). — Thorell, 1870, Rem. syn. Europ. spid.: 51 (= *L. pusilla* Sundevall).

For complete list of references up to 1939 see Bonnet (1957: 2524).

Types. — ♀ lectotype and 8 ♀ paralectotypes of *Linyphia pratensis* Wider, by present designation, from Germany, Odenwald (SMF). ♀ lectotype of *Linyphia carnica* Di Caporiacco, by present designation, from Italy, Sauris (MZF); 7 paralectotypes (juveniles) from several localities in Italy, Carnia (MZF). ♂ lectotype of *Linyphia baltistana* Di Caporiacco, by present designation, from Kashmir, Shiriting (MSNM); 4 paralectotypes (juveniles) from several localities at Kashmir (MSNM); 1 ♀ paralectotype from Kashmir, Alchori (MZF). ♂ holotype and ♀ "allotype" of *Pusillia bonita* Chamberlin & Ivie, by original designation, from U.S.A., Wyoming (UUC; not examined); 3 ♀ paratypes from same locality (UUC; examined).

Remarks. — The original description by Sundevall (1829) is scanty. Only his variety β is recognizable, and subsequent authors have always based their conception of the present species on this variety, the main form being unidentifiable.

The species has been described by many authors under different names, certainly due to the lack of communication in the early days of arachnology, but equally in consequence of the variability of the species. Many of the older synonyms were recognized by Thorell (1870), a few more recent names are added in this paper after examination of the original material concerned.

The true position of *Linyphia pascuensis* Walckenaer remains doubtful. Thorell (1870: 49) was inclined to believe that Walckenaer must have had *L. hortensis* before him, though he could not understand the remark about the spineless legs. Simon (1884: 241; 1929: 745) thought to recognize *pusilla* from the description. There is something to be said for either opinion. The size mentioned by Walckenaer (4.7 mm) is rather large for *pusilla*, though still possible. The chestnut-brown coloration of cephalothorax and abdomen, and the abdominal pattern, rather agree with *hortensis*, and so does the remark about the chelicerae, which are said to be not elongate. On the other hand Walckenaer stated the species to be very common in the Pyrenees, notably in meadows and grass-land, and this forms strong evidence in favour of *pusilla*. The latter species has frequently been recorded from the Pyrenees, while open country certainly is not the typical habitat of *L. hortensis*. The absence of hairs and spines on the legs does not fit in with any *Linyphia* species. All things considered I prefer, though with some reserve, to list the species under *pusilla*, as was done by Simon and Bonnet (1957).

Microlinyphia pusilla is very variable as to the abdominal pattern, depending on the extent of the white bands or spots. Specimens with four white ventral spots in two pairs (see description of ♀) have been described as a distinct colour-variety *quadripunctata* by Strand (1903).

Simon's figure of the epigyne of *L. pusilla* (1929: fig. 987) certainly is in better accordance with *M. impigra*. His description of the epigyne of *pusilla* seems to include either species; the description of the epigyne of *impigra* is correct.

Linyphia pusilla has been recorded from North America by Keyserling (1886: 55) and subsequent authors. All records of the species from that region, as far as could be traced, either relate to *Microlinyphia mandibulata* (Emerton) or to *M. dana* (Chamberlin & Ivie). Chamberlin & Ivie (1943: 23-26) pointed out that the European *pusilla* did not occur in the Nearctic region, that *mandibulata* and their new species *dana* were clearly distinct species, and that a third species occurred in the western part of North America, which was not unlike *pusilla*. I have found this third species, *bonita*, to be conspecific with *pusilla*. Thus *M. pusilla* after all occurs in the nearctic region, but it should be emphasized here again that the species is restricted to the western part of the continent. Most, if not all, earlier records of *pusilla* from North America were used for *mandibulata* or *dana*, which seem to be much more common, and which occur from East to West Coast and only west of the Rocky Mountains, respectively. Some of the earlier records may well have been correct, but it is impossible to infer this from a mere name and locality in a faunal list. A re-examination of all material involved would be necessary to put this straight.

Bonnet (1957: 2526) listed one more synonym in his catalogue. *Linyphia globosa* Wider, however, is presently known as *Poeciloneta globosa*. Wider's species was recognized by Strand (1916: 16), after examination of the type-specimen, as a senior synonym of *Poeciloneta variegata* (Blackwall). Nevertheless Simon (1929: 745, note) considered it to be a colour-variety of *pusilla*. Bonnet appears to have followed the decision of Simon.

Male. — Measurements in mm. Total length 2.8-4.0; cephalothorax, length 1.4-2.0, width 0.85-1.2; abdomen, length 1.5-2.05, width 0.55-1.0, height 0.5-1.0; chelicerae, length 0.85-1.30, width 0.28-0.40.

Cephalothorax. — Long and narrow, width 0.5-0.6 of length, width of head 0.6 of width of thorax. Colour brown to dark brown. Posterior margin slightly excised, sides constricted at border of head and thorax. Integument on border of head and thorax bent to ventral side and in mesal direction between chelicerae and gnathocoxae. Seen from side, dorsal line rising evenly

from posterior margin to foveal region, less steeply from fovea to eye-region; clypeus straight. Thorax nearly bare, very short hairs on striae and along margins only; clypeus, eye-region and anterior part of head short-haired.

Eyes. — Eye-region as wide as head. Anterior row straight, posterior row recurved. PME on black tubercles, which are large, and which sometimes touch mesally. AME on a common black spot, which may fuse with the black tubercles of the PME. Diameter of PME 0.07-0.09 mm, laterals of same size, diameter of AME 0.7 of diameter of PME. PME separated from each other by 1.8-2.1 diams., from PLE by 1.4-1.8 diams., and from AME by 1.6 diams. of PME. AME separated by about their own diameter. Height of clypeus 0.10-0.11 of length cephalothorax.

Chelicerae. — Brown or dark brown, as cephalothorax. Rather long and narrow, but not divergent, with nearly parallel sides, slanting backwards towards sternum. Length 0.58-0.65 of length cephalothorax. Slightly swollen latero-frontally at base, but not forming a basal tubercle. Faint broken ridges on basal half of lateral surface. Dorsal, ventral, and apical half of lateral surface with short hairs on warts. Posterior surface with a conspicuous protrusion proximally on basal half, bearing many warts with short hairs. Dorsal row with five teeth; basal three small, equidistant but rather widely spaced; apical pair very small and close together. Ventral row with five very small equidistant teeth; basal tooth opposite to second or third dorsal tooth.

Gnathocoxae. — Brown, with black suffusion at base and apex; lateral sides parallel; two times as long as wide. Labium black-brown, with raised anterior margin. Sternum brown, with black suffusion; width 0.8 of length, produced between coxae IV.

Legs. — Uniformly light yellow-brown, with blackish streaks on basal halves of femora in dark specimens. Legs long and narrow; length of femur I 1.0-1.2 times length cephalothorax; length tibia I 14-18 diams. of segment. Measurements (of specimen from The Netherlands, Apeldoorn) in mm:

	I	II	III	IV	palp
Fe	1.80	1.55	1.10	1.65	0.62
Pa	0.40	0.40	0.30	0.35	0.19
Ti	1.80	1.45	0.85	1.35	0.25
Mt	1.90	1.55	1.00	1.50	—
Ta	1.00	0.80	0.50	0.70	0.60

Chaetotaxy. — Fe I dl'; II-IV d. Pa I-IV d''d', basal spine short and weak.

Ti I-II $v'_b v''_b d'' (v'v'')$ l' d' v' l'' [l'_a l''_a v'_a v''_a]

III-IV d'' v' l' d' [l'_a l''_a v'_a v''_a]

Mt I-II dl' l''v v_a; III-IV dl'v v_a

Length of d'' -spine on tibia I 0.06-0.11 mm, diameter of segment at base of d'' -spine 0.10-0.13 mm; on tibia IV 0.07-0.09 mm and 0.09-0.11 mm, respectively. Tm I 0.19-0.23. Position of d'' -spine on tibia I 0.23-0.28.

Abdomen. — Cylindriform, long and narrow. A pair of white transverse dorsal spots on one-fourth of length always present. Remainder of dorsal surface variable, grey-brown in light specimens, black in dark specimens. In light specimens a dorsal pattern reminding that of female often faintly visible.

Palp (fig. 2, 4). — All segments yellow-brown, suffused with grey, cymbium heavily suffused with grey. Femur nearly straight. Patella with short dorsal spine near distal margin. Tibia longer than patella, widening distally; dorsal spine as long as segment or slightly shorter, situated near superficial incision of distal margin; a second slightly shorter spine on lateral surface near distal margin. Cymbium 2.2-2.4 times as long as tibia, without spines. Paracymbium with short and narrow distal arm; proximal arm shortly haired. Tegulum rounded apically, barely protruding laterally. Median apophysis (fig. 8, *ma*) with flat finger-shaped tip on distal part. Embolus (fig. 3, *e*) long and thread-like, 1.7-2.0 mm long. Embolic apophysis (fig. 3, *ea*) corkscrew-shaped with one turn, last turn blade-like. Terminal apophysis (fig. 3, *ta*) a narrow and twisted membraneous appendage, short and difficult to see. Lamella (fig. 3, 7, *l*) longer than cymbium, proximal tip reaching backwards to middle of tibia, distal tip tapering to a point; mesal margin evenly curved, with narrow raised brim on ventral side; lateral free projection long, grooved on outside. Embolic membrane (fig. 3, *em*) broad, tapering to a point.

Female. — Measurements in mm. Total length 3.0-4.8; cephalothorax, length 1.3-1.8, width 0.9-1.25; abdomen, length 1.85-3.0, width 1.3-2.3, height 1.3-2.2; chelicerae, length 0.62-0.91, width 0.26-0.41.

Cephalothorax. — Less elongate than in male, width 0.7 of length. Posterior margin broadly excised. Eye-region and clypeus shortly haired. Sizes and spacing of eyes as in male. Black tubercles of PME often fused with black spot on which AME are situated. Height of clypeus 0.10-0.13 of length of cephalothorax.

Chelicerae. — Colour as cephalothorax, with a black streak on dorsal surface from base mesally towards apex laterally. Not elongate and not slanting backwards as in male. Protrusion on ventral surface less conspicuous. Lateral surfaces slightly bulging on basal halves, straight on apical halves. Dorsal row with four to five teeth, apical tooth close to fourth, others equidistant; basal and fourth teeth of equal size, second and third

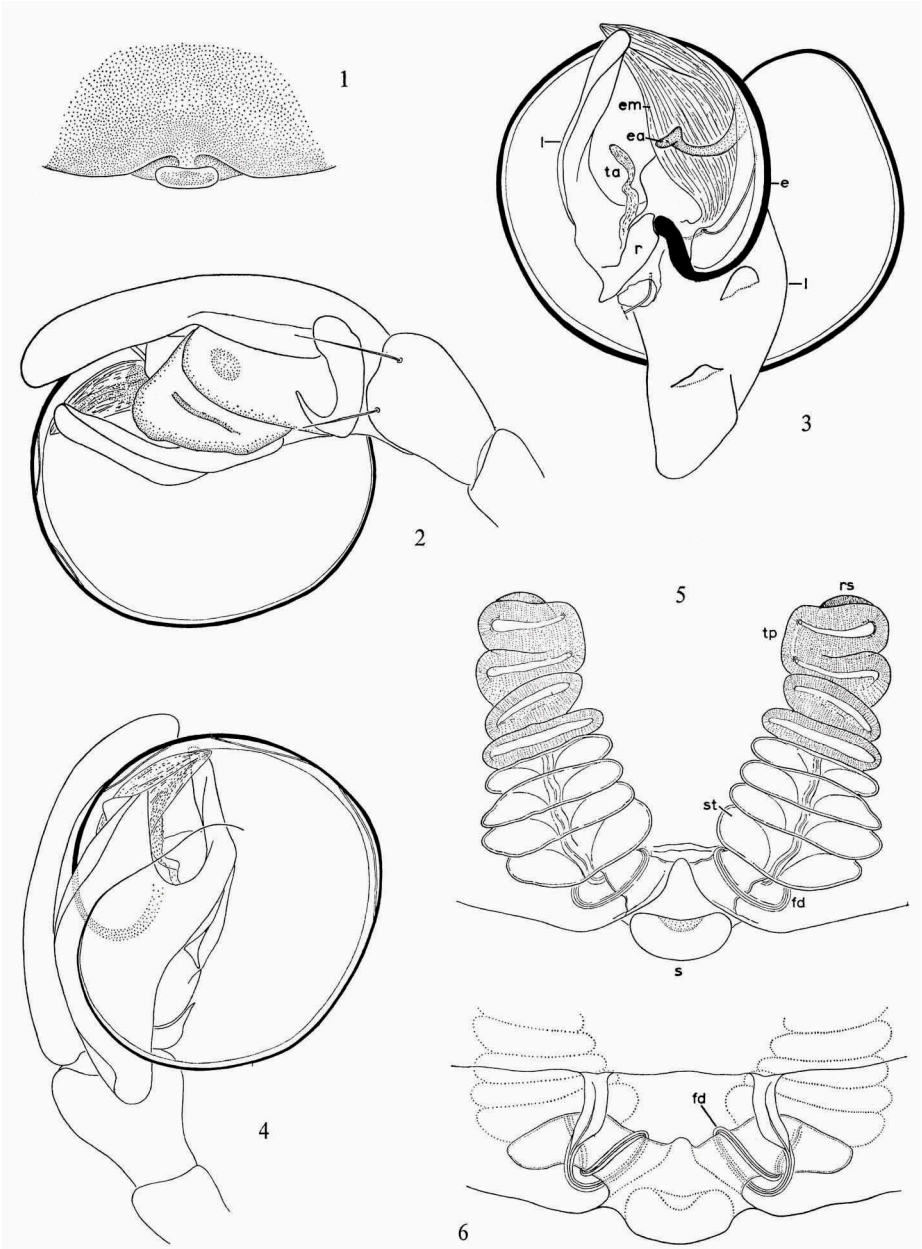


Fig. 1-6. *Microlinyphia pusilla*. 1, epigyne; 2, male palp, lateral aspect; 3, embolic section, with radix (*r*), embolus (*e*), embolic apophysis (*ea*), embolic membrane (*em*), lamella (*l*) and terminal apophysis (*ta*), dorsal aspect; 4, male palp, ventral aspect; 5, vulva, ventral aspect; 6, vulva, dorsal aspect of posterior part. 1, 3, $\times 95$; 2, 4, $\times 67$; 5, 6, $\times 177$.

teeth two times as large. Ventral row with four to six smaller teeth, equidistantly spaced, basal tooth opposite to third dorsal tooth.

Legs. — Yellow-brown to orange-brown, femora with blackish streaks in dark specimens. Length of femur I 1.1-1.3 times length cephalothorax; length tibia I 10-13 diams. of segment. Measurements (of specimen from The Netherlands, Apeldoorn) in mm:

	I	II	III	IV
Fe	1.80	1.50	1.15	1.55
Pa	0.40	0.35	0.30	0.35
Ti	1.65	1.35	0.80	1.20
Mt	1.65	1.35	0.90	1.45
Ta	1.00	0.80	0.55	0.70

Chaetotaxy. — As in male. Length of d'' -spine on tibia I 0.15-0.20 mm, diameter of segment at base of d'' -spine 0.13-0.18 mm; on tibia IV 0.20-0.25 mm and 0.11-0.15 mm, respectively. Tm I 0.17-0.27. Position of d'' -spine on tibia I 0.21-0.25.

Abdomen. — Short and high, with moderately curved dorsal surface, posteriorly rather abruptly passing into straight perpendicular posterior surface. Abdominal pattern very variable, but all specimens have the ventral halves of lateral and posterior surfaces and the whole ventral surface blackish brown or black; a few light or white spots around spinnerets and a quadrangle of ventral spots may occur, the anterior pair behind epigastric furrow and opposite to the opercula, posterior pair nearer to spinnerets than to epigastric furrow and closer to each other than anterior pair. Dorsal surface with a black median stripe, flanked by white bands, which reach the black upper half of the posterior surface. Lateral surface with a white band from anterior side to posterior surface, narrowly connected with other side there; remainder of lateral surface black. In dark specimens dorsal white bands broken up into a row of four transverse spots at either side; lateral white band also broken up into four spots, second spot largest, fourth spot narrow and horizontal, reaching posterior surface but not connected with spot on other side; black median stripe connected with other black areas of abdomen by black strands between the white spots, whole abdomen thus becoming black with white spots. In light specimens dorsal stripe broken up into a row of four black spots, second one largest, diamond-shaped, the others small, round or squarish; white dorsal bands broad and fused on posterior part of lateral surface with broad white lateral bands, which are separated on anterior half by a narrow black streak; upper half of posterior surface black. Opercula, epigyne, and spinnerets equally black.

Epigyne (fig. 1). — Small and inconspicuous, consisting of a small

rounded scape, which lies in a triangular incision of the anterior margin of the epigastric furrow.

Vulva (fig. 5, 6). — Entrances of spiral tubes in lateral walls of triangular incision, lying as far to the front as possible, the brims of the two entrances touching mesally (cf. *sterilis*). Spiral tubes (fig. 5, *st*) with between 6.5 and 7.5 coils, the anteriormost pair sclerotized and thick-walled, the others membranous; tubes between turning-points (fig. 5, *tp*) and receptacula (fig. 5, *rs*) short, thick-walled. Receptacula small. Fertilization duct (fig. 5, *fd*) running through axis of coils, making a complete loop around spiral tube near entrance, then curving to dorsal side of complex. Scape (fig. 5, *s*) small, short and rounded, curved in ventral direction, a small median pit present near its tip; scape closing triangular incision at posterior side.

Distribution and habitat. — Palaearctic region including North Africa, and the western part of North America. Records from Asia are scarce (Kashmir, Sinkiang); in Japan not south of Hokkaido. In North America the species (*bonita*!) has been recorded from the following states and regions: Alaska, Mackenzie, Idaho, Wyoming. I also have seen specimens from Washington and Colorado. Wyoming and Colorado are the easternmost records from the North American continent as far as could be traced now.

Records from Europe are numerous, and one certainly may call *Microlinyphia pusilla* a common species. It is not restricted to marshy areas or other relatively humid localities, though it may often be very dominant there. It likewise occurs in drier habitats, e.g. on heather in sandy areas, but always in open country, not inside woods. The mating period falls in May; the courtship and pairing has been described by Gerhardt (1928: 632). In North America, too, the webs of this species have been observed on vegetation in meadows (Levi & Levi, 1951: 222; additional records in present paper).

Material examined.

Netherlands. — 1 ♀, Gelderland, Hoog-Soeren, heath, 27.v.1958, P. J. van Helsdingen (ML). 1 ♀, Kootwijk, Gerritsfles, wet heath, 3.ix.1959, P. J. van Helsdingen (ML). 1 ♀, Tondense heide near Hall, 15 km SE. of Apeldoorn, 5.viii.1960, P. J. van Helsdingen (ML). 1 ♀, Kootwijkerveen, 10 km W. of Apeldoorn, marshy heath, 8.v.1961, P. J. van Helsdingen (ML); 1 ♀, do., 5.vi.1961 (ML); 1 ♀, do., 9.xi.1961 (ML); 1 ♀, do., 21.vii.1962 (ML). 1 ♂, Staverden, wet heath, 11.viii.1962, P. J. van Helsdingen (ML); 13 ♀ 12 ♂, do., 26.iv.1968 as subadults, last moult before 15.v.1968 (ML). — 1 ♀, Limburg, Gerendal near Schin op Geul, 29.v.1963, P. J. van Helsdingen (ML).

Belgium. — 1 ♀, Brabant, Limelette, 7.vi.1962, J. Kekenbosch (ISNB). 1 ♀, Hofstade, 9.vii.1944, J. Verschuren (ISNB). — 4 ♀ 1 ♂, Limburg, As-en-Campine, on heather,

26.iii.1957, J. Kekenbosch (ISNB); 3 ♀ 1 ♂, do., 3.v.1962 (ISNB). — 4 ♀ 1 ♂, Namur, Winenne, 22.vii.1950, H. Synave (ISNB). — 1 ♀, Liège, Hockai, 16.vi.1938, A. Collart (ISNB); 1 ♀, do., 24.vi.1938 (*L. hortensis*; Denis, 1943; ISNB). 1 ♂, Hertogenwald, 30.v.1937, A. Collart (ISNB). — 1 ♀, Luxembourg, Mirwart, Bois Smuid, 6.vii.1943, R. Tollet (ISNB). 1 ♀, La Roche, vii.1959, G. Hoevenaghel (ISNB).

Germany. — 9 ♀, Hessen, Odenwald, leg. Wider (♀ lectotype and 8 ♀ paralectotypes, by present designation, of *Linyphia pratensis* Wider; SMF). 4 ♀ 2 ♂, Offenbach a. Main, 2.iv.1949, A. Zilch (SMF). — 1 ♀ 3 ♂, Bayern, Muggendorf (MNP). — 3 ♀ 1 ♂, Sachsen-Anhalt, Ballenstedt, viii.1924, C. F. Roewer (SMF).

France. — 1 ♀, Yonne, Champigny-sur-Yonne, 5.viii.1956, D. Lamore (MCZ). — 14 ♀, Puy de Dôme, Voisrières near Lac Chambon, 900 m, meadow, 9-14.vii.1967, P. J. van Helsdingen (ML).

Portugal. — 2 ♀, Beira Litoral, Mira, vii.1929, R. Lopes (MB).

Italy. — 1 ♀, Venezia, Sauris, 1500 m, 15.ix.1921, L. Di Caporiacco (♀ lectotype of *Linyphia carnica* Di Caporiacco; MZF); 7 juvenile specimens, from same and nearby localities (paralectotypes; MZF). 2 ♀, Forni Avoltri, 1200 m, 2.viii.1924 (*Linyphia carnica*; Di Caporiacco, 1927; MECB). — 1 ♀, Perugia, Monte del Lago Trasimeno, vi.1967, S. Ruffo (MV).

Greece. — 4 ♀, Stereá Ellás, Athens (MNP). — 1 ♂, Thraki, 10 km S. of Souflion, 27.vi.1959 (ML). — 1 ♀, Crete, Khania, vi.1926, C. F. Roewer (SMF).

Tunisia. — 1 ♀, Carthage (MNP).

Kashmir. — 1 ♀ 1 ♂, Shiriting, 2500 m, wet meadow, 19.iv.1929, Italian Karakoram Expedition (♂ lectotype and ♀ paralectotype of *Linyphia baltistana* Di Caporiacco; MSNM). 4 juvenile specimens, Shigar, Dusso, Askole, and Parkutta (paralectotypes of *L. baltistana*; MSNM). 1 ♀, Alchori, 2300 m, 26.iv.1929 (paralectotype of *L. baltistana*; MZF).

China, Sinkiang. — 2 ♀, Yarkand, 21-27.v.1874, and between Yarkand and Bursi, 28.v-17.vi.1874, Second Yarkand Mission (O. Pickard-Cambridge, 1885; HDO).

Japan. — 1 ♀, probably from Japan, leg. Hilgendorf (between type-specimens of *Linyphia albolimbata* Karsch; ZMB).

U.S.A. — 2 ♀, "Wisconsin, Colorado" (*L. pusilla*; Keyserling, 1886 (p.p.); MNP). — 4 ♀, Colorado, Electra Lake (108W 37N), 2560 m, 28.vi-1.vii.1919 (AMNH). 2 ♀, Chaffee Co., Cottonwood Lake, Sawatch Mountains, meadow, 3000 m, 5-6.vii.1961, H. & L. Levi (MCZ). 1 ♂, Longs Peak, Canadian Zône (105W 40N), vii.1919, Cockerell (MCZ). — 3 ♀, Wyoming, Yellowstone Lake, Bridge Bay, 9.vii.1935, W. Ivie (paratypes of *Pusilla bonita* Chamberlin & Ivie; UUC). — 4 ♀ 2 ♂, Washington, Stevens Co., Cedar Lake (117W 49N), v.1962, W. Ivie (ML).

***Microlinyphia sterilis* (Pavesi) comb. nov.**

(fig. 9-13)

Linyphia sterilis Pavesi, 1883a, Rendic. R. Ist. Lombardo, (2)16(9): 3 (preliminary note); 1883b, Ann. Mus. civ. Stor. nat. Genova, 20: 31, 98 (description ♀, Ethiopia). — Strand, 1908, Rev. suisse Zool., 16: 339 (Ethiopia). — Di Caporiacco, 1947, Ann. Hist.-nat. Mus. Nat. Hungarici, 40: 147 (Tanganyika); 1949, Comment. Pont. Acad. Scient., 13: 352, fig. 19a-d (Kenya).

Linyphia suspiciosa Pavesi, 1883a, Rendic. R. Ist. Lombardo, (2)16(9): 3 (preliminary note); 1883b, Ann. Mus. civ. Stor. nat. Genova, 20: 30, 98 (description ♀, Ethiopia). [new synonymy].

Linyphia interpolis O. Pickard-Cambridge, 1904, Ann. S. African Mus., 3: 161, pl. 12 fig. 3 (description ♀ ♂, South Africa). [new synonymy].

Linyphia aethiopica; Tullgren, 1910, Wissensch. Ergebn. schwed. zool. Exped. Kili-mandjaro, 3(20): 145 (p.p., 4 ♀ only, other specimens are *M. aethiopica*). — Di Caporiacco, 1949, Comment. Pont. Acad. Scient., 13: 353, fig. 20 (Kenya).

Linyphia africanibia Strand, 1913, Wissensch. Ergebn. deutsch. Zentr.-Afrika-Exped., 4(2): 352 (description ♀, Ruanda). — Di Caporiacco, 1949, Comment. Pont. Acad. Scient., 13: 354 (pullus, Kenya). [new synonymy].

Bonnetiella singularis Di Caporiacco, 1949, Comment. Pont. Acad. Scient., 13: 359 (description ♀, Kenya). [new synonymy].

Linyphia bonneti; Di Caporiacco, 1949, Comment. Pont. Acad. Scient., 13: 354 (p.p.; one adult ♀ from Kenya only, others belong to *N. kibonotensis*).

Types. — ♀ lectotype and ♀ paralectotype of *Linyphia sterilis*, by present designation, from Ethiopia (MG). ♀ holotype of *Linyphia suspiciosa* from Ethiopia (MG). ♂ lectotype and ♀ paralectotype of *Linyphia interpolis*, by present designation, from South Africa, Clanwilliam District (HDO). ♀ holotype of *Linyphia africanibia* from Ruanda (ZMB). ♀ holotype of *Bonnetiella singularis* from Kenya (LZAB).

Remarks. — The species is very variable in coloration. Thus it is not surprising that Pavesi described the species under two different names, viz., *L. suspiciosa* and *L. sterilis*, in one and the same paper. The former name has never been used again after Pavesi's time, and I prefer, therefore, to use the latter for the present species. Moreover, the lectotype of *L. sterilis* is in a much better condition than the holotype of *suspiciosa*, most legs of which are missing.

Microlinyphia aethiopica certainly is a different species, as is clear from Tullgren's description and figures. However, some of the specimens, which are explicitly mentioned in the original description of *aethiopica*, and which consequently belong to the type-series, do not belong to that species, but to *M. sterilis*. All remaining specimens agree very well with the description and figures of *aethiopica*, and the lectotype was selected from those specimens.

Linyphia interpolis O. Pickard-Cambridge, *Linyphia africanibia* Strand, *Bonnetiella singularis* Di Caporiacco, and Di Caporiacco's record of *L. aethiopica* from Kenya, are all listed here after a re-examination of the material concerned. The type-series of *Linyphia bonneti* Di Caporiacco contains one adult female specimen of the present species; the lectotype was selected from the remainder of the series, all subadult specimens of *Nerienne kibonotensis* (Tullgren).

Microlinyphia sterilis is not unlike *pusilla*; the differences between the two species are small but constant. As in *pusilla*, there is a considerable variation in the extent and intensity of the black pigmentation of the outer layer of the abdomen, and also in the grey or black suffusion on the legs.

Specimens from one locality usually are comparable as to these characters, but I have never examined large numbers from one locality.

Male. — Measurements in mm. Total length 3.3-4.5; cephalothorax, length 1.7-1.95, width 1.0-1.05; abdomen, length 1.8-2.5, width 0.9-1.0, height 0.9-1.0; chelicerae, length 1.05-1.15, width 0.35-0.38.

Cephalothorax. — Brown to dark brown, suffused with black and with narrow blackish margins. Posterior margin cut off straight. Thorax long and narrow, sides lightly rounded and curved to front, slightly constricted at border of head and thorax, with triangular extensions of integument on border of head and thorax curved in ventral and mesal direction. Width 0.55-0.6 of length, width of head 0.6 of width of thorax. From side, dorsal line straight, barely rising from posterior margin to eye-region; clypeus straight. Very short hairs along margins and on striae, short hairs on clypeus, at eye-region, and on head.

Eyes. — Eye-region barely narrower than head. Anterior row straight, posterior row slightly recurved. PME on black tubercles, which are separated mesally, area surrounding AME blackish, lateral eyes on a common black tubercle. Diameter of PME 0.07-0.09 mm, laterals of same size, AME slightly smaller. PME separated from each other by 1.8-2.3 diams., from PLE by 1.0-1.5 diams., and from AME by 1.3-1.5 diams. of PME. AME separated by about their own diameter. Height of clypeus 0.12-0.17 of length of cephalothorax.

Chelicerae. — Colour as cephalothorax. Comparatively long and narrow, barely divergent. Shortly haired, hairs on papillae. Basal tubercle very small, only visible in meso-frontal view. Lateral surface with faint broken ridges. Posterior surface with protrusion with warts, as in *pusilla*. Dorsal row with four teeth, rather widely and equidistantly spaced, small, apical tooth very small. Ventral row with three to four teeth, basal tooth opposite to second tooth of dorsal row.

Gnathocoxae. — Brown, suffused with black, apices lighter; lateral sides converging on basal halves, diverging again towards apices, which are truncated obliquely. Labium blackish brown, anterior margin raised and lighter. Sternum blackish brown; width 0.7 of length, narrowly produced between coxae IV.

Legs. — Light brown, suffused with black in dark specimens on coxae, on pro- and retro-lateral streaks on femora, and on the remainder of legs IV; the other legs with faint suffusion on patellae and with faint apical rings on tibiae. Legs rather long and thin; length of femur I 1.1-1.3 times length cephalothorax; length of tibia I 15-19 diams. of segment. Measurements

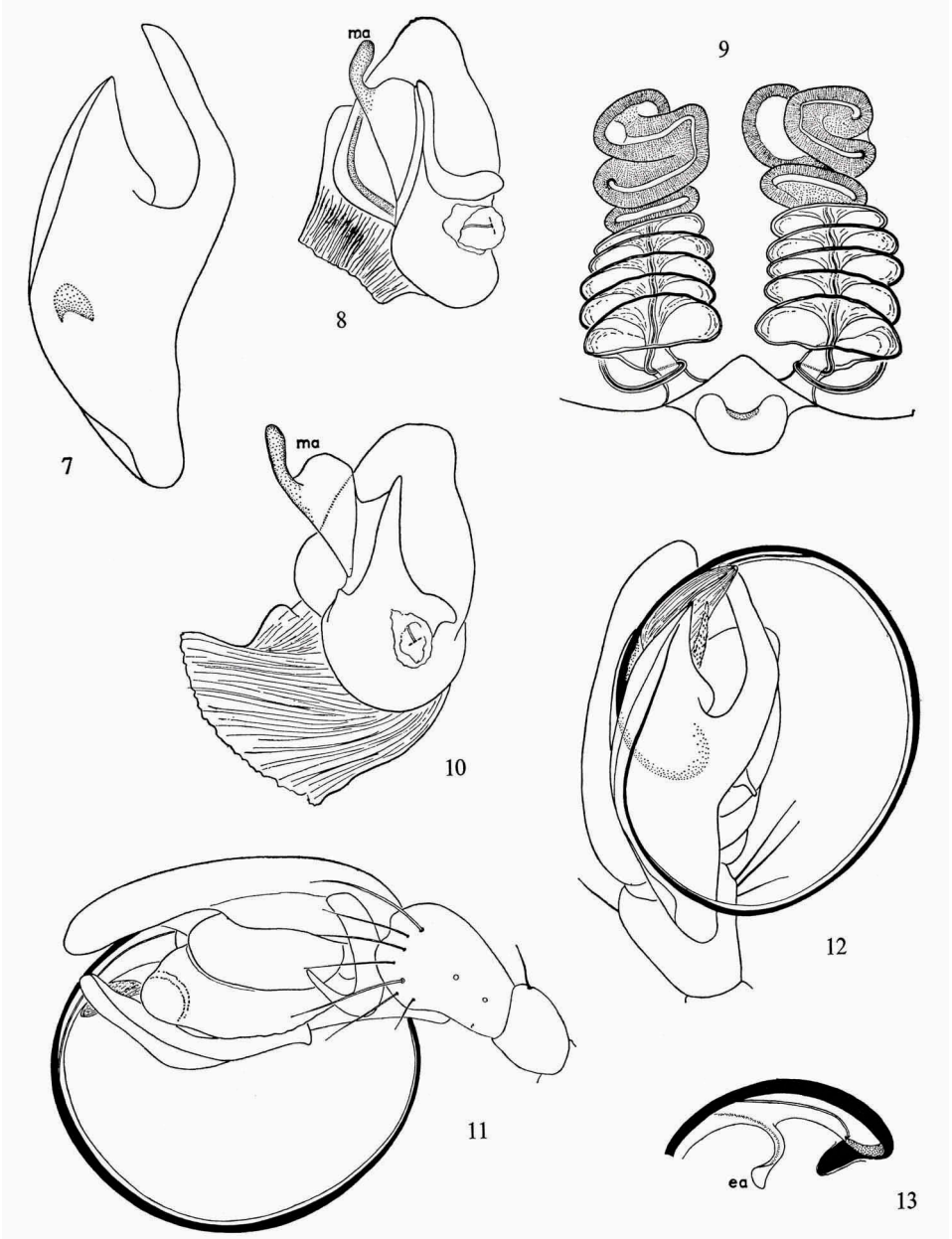


Fig. 7-8. *Microlinyphia pusilla*. 7, lamella, ventral aspect; 8, tegular complex with median apophysis (*ma*), mesal aspect. Fig. 9-13. *M. sterilis*. 9, vulva, ventral aspect; 10, tegular complex with median apophysis (*ma*), mesal aspect; 11, male palp, lateral aspect; 12, do., ventral aspect; 13, base of embolus with embolic apophysis (*ea*). 7, 8, 10, 13, $\times 95$; 9, $\times 177$; 11, 12, $\times 67$.

(of specimen from South Africa, Clanwilliam Division, Ramskop) in mm :

	I	II	III	IV	palp
Fe	2.10	1.90	1.40	2.05	0.66
Pa	0.40	0.40	0.35	0.35	0.17
Ti	2.15	1.80	1.10	1.70	0.26
Mt	2.40	2.00	1.35	2.05	—
Ta	1.25	0.95	0.65	0.85	0.57

Chaetotaxy. — Fe I dl'; II dl'; III-IV d. Pa I-IV d''d', basal spine weaker and shorter than apical one.

Ti I-II v''_b d'' (v'v'') l' d' l' [l'_al''_av'_av''_a]
 III-IV d'' v' l' d' [l'_al''_av'_av''_a]

Mt I-II dl'l'v; III-IV dl'v

Length of d''-spine on tibia I 0.09-0.12 mm, diameter of segment at base of d''-spine 0.11-0.12 mm; on tibia IV 0.17-0.19 mm and 0.10-0.11 mm, respectively. Tm I 0.19-0.23. Position of d''-spine on tibia I 0.22-0.26.

Abdomen. — Cylindriform, dorsal surface often caved in in the middle and ending perpendicularly above spinnerets; posterior surface about straight. A pair of white transverse spots always present on one-fourth of length, narrowly separated mesally. A series of small white lateral spots sometimes present, but more often lacking. Dorsal surface uniformly black, or with faint black chevrons on dark grey background. Remainder of abdomen black. Opercula black-brown.

Palp (fig. 11, 12). — All segments suffused with black. Femur lightly curved, ventral side concave. Patella with a short dorsal spine near apical margin. Tibia 1.5 times as long as patella, cymbium 2.2 times as long as tibia. Tibia much wider at apex than at base, as seen from above, and with a dorsal apical spine as long as segment; latero-ventrally with few long hairs. Cymbium without spines. Distal arm of paracymbium short and narrow. Tegulum with rounded protrusion on latero-apical margin pointing in anterior direction. Median apophysis (fig. 10, *ma*) well-developed with strongly chitinous distal part and rounded apical margin; dorsal tip nearly straight, flat with rounded apex. All elements of embolic division resembling those of *pusilla*, with the exception of the embolic apophysis (fig. 13, *ea*), which in the present species is simply curved and barely twisted, not pigmented, and rather narrow. Embolus very long and thin, measuring 2.0-2.35 mm. Radix very small and lying against base of lateral arm of lamella, which is of the usual shape. Embolic membrane attached to mesal arm of lamella.

Female. — Measurements in mm. Total length 3.4-4.5; cephalothorax, length 1.35-1.8, width 0.8-1.25; abdomen, length 1.9-3.2, width 1.2-2.1, height 1.2-2.4; chelicerae, length 0.72-0.87, width 0.32-0.40.

Cephalothorax. — Light brown to dark brown, with light or heavy suffusion, and with narrow grey or dark grey lateral margins; striae visible. Posterior margin superficially excised; width 0.6-0.7 of length, width of head 0.6 of width of thorax. Shortly haired as in male. Eye-region as wide as head. Anterior row slightly recurved; posterior row clearly recurved. Sizes and spacing not differing from male. Height of clypeus 0.11-0.16 of length of cephalothorax.

Chelicerae. — Colour as cephalothorax, black or grey suffusion restricted to lateral surface and dorsal streak from base mesally to apex laterally. Without basal tubercle. Very faint broken ridges on lateral surface. Tubercle on posterior surface less protruding than in male. Dorsal row with five cheliceral teeth, sometimes only four; teeth equidistant, fifth, if present, close to fourth, second tooth largest, basal tooth and apicals smaller, diminishing in size towards apex. Ventral row with five teeth, exceptionally four or six teeth present; all teeth small and equidistantly placed; basal tooth opposite to second tooth of dorsal row.

Legs. — Light yellow-brown to brown, with grey or black suffusion as in male. Length of femur I 1.1-1.3 times length cephalothorax; length of tibia I 12-15 diams. of segment. Measurements (of lectotype of *Linyphia sterilis*) in mm:

	I	II	III	IV
Fe	1.70	1.50	1.10	1.60
Pa	0.40	0.40	0.30	0.35
Ti	1.60	1.30	0.85	1.25
Mt	1.65	1.40	0.95	1.45
Ta	1.05	0.80	0.55	0.70

Chaetotaxy. — Not differing from male. Length of d''-spine on tibia I 0.15-0.25 mm, diameter of segment at base of d''-spine 0.11-0.16 mm; on tibia IV 0.18-0.27 mm and 0.10-0.14 mm, respectively. Tm I 0.21-0.24. Position of d''-spine on tibia I 0.22-0.25.

Abdomen. — Oval in outline when seen from above, rather rectangular in lateral view, with nearly parallel dorsal and ventral surfaces, and straight perpendicular posterior surface; transition of dorsal into posterior surface usually with a small postero-dorsal tubercle. Abdomen beige-coloured with pattern of black suffusion and white blotches, pattern variable in extent and intensity. A mesal row of five black spots or markings always present on dorsal side, last spot forming the dark dorsal surface of the postero-dorsal tubercle; basal spot oblong, on anterior and dorsal surfaces, narrowly

connected with black lateral areas; second spot round or diamond-shaped, on second quarter of abdomen; following two spots usually broad, forming chevrons. In light specimens all spots small and isolated, posterior ones not forming chevrons, all spots usually light chocolate-brown. In dark specimens spots and chevrons black-brown, and all spots and chevrons connected with each other and with the lateral black areas; even the second diamond-shaped spot chevron-like. Light dorsal areas, between mesal row of spots and chevrons and lateral black areas, beige-coloured with white blotches, often fused into white spots, light areas small and broken up into small oval spots in darker specimens. Lateral surface uniformly black-brown or chocolate-brown on ventral half; dorsal half with a row of five white spots, first spot oblong and horizontal, second and third oval and vertical, fourth spot small and circular, fifth small and situated on posterior surface. Spots large in light specimens, narrowly separated by black or contiguous, spots small in dark specimens, widely separated by black streaks, connecting dark ventral half with black dorso-lateral area. Posterior surface black. Ventral surface, including spinnerets and genital area, uniformly black. Opercula dark brown.

Epigyne. — Very small, with short round scape behind small mesal triangular excision of anterior border of epigastric furrow.

Vulva (fig. 9). — Spirally coiled tubes between entrances and turning-points with seven to eight coils, five or six of which are membranous, the last two sclerotized and with thicker walls. Entrances well-separated from each other, lying rather far posteriorly in triangular excision of the posterior margin (cf. *pusilla*). Receptacula globular, connected with turning-points by half a coil of sclerotized tube; fertilization ducts lying centrally in axis of columns of spiral tubes, curving around tubes near entrances, then curving to dorsal side of dorsal wall of vulva. Scape short and rounded, curved to ventral side, with small mesal pit on ventral surface.

Distribution and habitat. — As far as known at present the species occurs in East and South Africa from Ethiopia in the north, then southwards in Kenya, Tanganyika, Uganda, Ruanda, Congo, and Nyassa (all east of 25°E), to South Africa, where it is found in Transvaal, Natal, and in Clanwilliam on the west coast of Cape of Good Hope.

Most females were collected from February to May and from November to December, males in August and December. All records are from at least 1000 m, the highest record is from the Kilimandjaro at 3000 m. Data about habitat are but rarely mentioned. The specimen from the Kilimandjaro comes from rainforest, other available data read "from leaf-litter" and "on shrubs in shadow".

Material examined.

Ethiopia. — 2 ♀, Mahal Unoz, iv.1877, Let Marefia (16 km. N. of Ankober), xii.1878, O. Antinori (lectotype and paralectotype of *Linyphia sterilis* Pavesi; MG). 1 ♀, Let Marefia, ii.1879. O. Antinori (holotype of *Linyphia suspiciosa* Pavesi; MG). 1 ♂, Addis Ababa, P. Goderis (MT).

Kenya. — 1 ♀ 2 ♂, Elmenteita, xii.1945, A. Toschi & Meneghetti (*Linyphia aethiopica*; Di Caporiacco, 1949; LZAB). 10 ♀ 5 ♂, Nairobi, 1944, A. Toschi & Meneghetti (*Linyphia aethiopica*; Di Caporiacco, 1949; 2 ♀ 1 ♂ MZF, 8 ♀ 4 ♂ LZAB); 6 ♀ 3 juvs., do. (*Linyphia sterilis*; Di Caporiacco, 1949; 2 ♀ 2 juvs. MZF, 4 ♀ 1 juv. LZAB). 1 ♀, Nairobi, iv.1945, A. Toschi & Meneghetti (holotype of *Bonnetiella singularis* Di Caporiacco; LZAB). 1 ♀, Mau, xii.1945 (paralectotype of *Linyphia bonneti* Di Caporiacco; LZAB). 1 ♀, Molo, 2450 m, 14.xii.1964, A. Holm (ZIU); 4 ♀ 1 ♂, do., 2250 m, 15.xii.1964, A. Holm (1 ♀ ML, others ZIU).

Uganda. — 5 ♀ 2 ♂, Entebbe, viii.1959, P. L. G. Benoit (5 ♀ 1 ♂ MT, 1 ♂ ML). 1 ♀, Entebbe, 1200 m, Botanical Garden, in leaf-litter, 26.ii.1938, A. Holm (ZIU); 2 ♀ 1 ♂, do., on shrubs in shadow, 26.ii.1938, A. Holm (2 ♀ ZIU, 1 ♂ ML).

Ruanda. — 1 ♀, Lake Karago (between Lake Kivu and Ruhengeri), xi.1907, Deutsch. Zentr.-Afr. Exped. 1907-1908 (holotype of *Linyphia africanibia* Strand; ZMB). 1 ♀, Kisenyi, 1460 m, 9.viii.1953, A. Bertrand (MT).

Congo-Kinshasa. — 3 ♀, Orientale, Distr. Ituri, Mongbwalu, camp Mundu, xi.1939, J. Lepersonne (ML). — Kivu, environments of Butembo, ix-x.1965, M. J. Celis (MT). 1 ♀, Kivu, Butembo, valley of Musora, v.1967, P. Lejeune (MT). 1 ♀, Kivu, Rutshuru, iii.1937, J. Ghesquiere (MT). — 4 ♀, Katanga, Distr. Lualaba, Terr. Jadotville, Kando, iii.1930, G. F. de Witte (MT).

Tanganyika. — 1 ♀, Kilimandjaro, Kiboscho, 3000 m, rainforest, Swedish Kilimandjaro Exped. (*Linyphia aethiopica*; Tullgren, 1910 (p.p.); MS). 2 ♀, Meru, Ngare na Nyuki (river), xi.1906 (*Linyphia aethiopica*; Tullgren, 1910 (p.p.); MS); 1 ♀, Meru, plain west of mountain, xii.1906 (*Linyphia aethiopica*; Tullgren, 1910 (p.p.); MS). 1 ♀, Arusha, x-xi.1905, K. Kittenberger (*Linyphia sterilis*; Di Caporiacco, 1947 (p.p.); MZF). 1 ♀, Mt. Oldeani, forest, 2300 m, 10.vi.1957, P. Basilewski & N. Leleup (MT). 1 ♀, Bundukl, Uluguru Mts., moy Mgeta, 1300 m, 30.iv-2.v.1957, P. Basilewski & N. Leleup (MT).

Nyasaland. — 1 ♀, Karonga, Cap. Casati (IZP).

South Africa. — 1 ♂, Transvaal, Mariepskop, viii.1960, N. Leleup (MT). — 1 ♀, Natal, Pietermaritzburg, Woolds View, iii.1951, R. F. & A. Lawrence (NM). — 1 ♀ 1 ♂, Cape of Good Hope, Clanwilliam Division, Ramskop, D. Klaver (♂ lectotype and ♀ paralectotype of *Linyphia interpolis* O. Pickard-Cambridge; HDO); 1 ♀ 1 ♂, do., C. L. Leipoldt (HDO).

Microlinyphia johnsoni (Blackwall) comb. nov.

(fig. 14-18, 20)

Linyphia johnsoni Blackwall, 1859, Ann. Mag. Nat. Hist., (3)4: 261 (description ♀, Madeira). — Kulczyński, 1899, Rozpr. Akad. Um. wydz. mat. przyr., 36: 65, pl. 7 fig. 59, 61-62, 65-66 (description ♀ ♂, Madeira and Porto Santo). — Schenkel, 1938, Ark. Zool., 30A(7): 23 (Madeira). — Denis, 1962, An. Faculd. Cienc. Porto, 44: 80 (Madeira).

Types. — The original material of the species has not been recovered in the collections of Oxford or London.

Remarks. — It is not unlikely that *Microlinyphia inexplicabilis* Denis

should be listed here as a synonym. For a motivation of this presumption the reader is referred to the remarks on that species.

Male. — Measurements in mm. Total length 3.8; cephalothorax, length 1.65, width 1.1; abdomen, length 2.3, width 0.8, height 0.9; chelicerae, length 0.90, width 0.30.

Cephalothorax. — Light yellow-brown, with a median black line and two blackish submarginal bands. Median band from posterior margin to close behind PME, darkest close behind fovea, diffuse behind and in front; sub-lateral bands as broad as median band, diffuse. Posterior margin excised mesally, sides evenly rounded to front, barely constricted at border of head and thorax. Triangular extensions of integument on border of head and thorax curved in ventral and mesal direction, as in *pusilla*. Width 0.65 of length, width of head 0.6 of length cephalothorax. From side, dorsal line nearly straight between posterior margin and eye-region; clypeus straight. Very short hairs along margins and striae, eye-region with longer hairs and some spinehairs, clypeus shortly haired.

Eyes. — Eye-region as wide as head. Both rows approximately straight. PME on large black tubercles, which are narrowly separated mesally. AME on a common black spot. Diameter of PME 0.10 mm; laterals smaller, barely larger than AME, which measure 0.06 mm. PME separated from each other by 2.0 diams., from PLE by 1.1. diams., and from AME by 1.6 diams. AME separated by their own diameter. Height of clypeus 0.13 of length of cephalothorax.

Chelicerae. — Light yellow-brown. Lateral and mesal sides straight, truncated obliquely on apical half. Posterior surface with elevation on basal half. Basal tubercle not present. Stridulating file not visible. Dorsal row with four cheliceral teeth, basal tooth small, second and third teeth two times as large, apical tooth very small. Ventral row with five smaller teeth, second tooth largest, apical pair very small and close together, others equidistant; basal tooth opposite to third tooth of dorsal row.

Gnathocoxae. — Yellow-brown, lightly suffused with black; lateral margins slightly emarginate, not diverging. Labium brown, suffused with black; anterior margin raised. Sternum light brown, suffused with black at margins and on produced part between coxae IV; width 0.8 of length.

Legs. — Light yellow-brown, with narrow black rings at apices of femora, tibiae and metatarsi, patellae lightly suffused with black; anterior tibiae lightly suffused with black in the middle. Femur I 1.9 times as long as cephalothorax, length of tibia I 24 diams. of segment. Measurements (of Schenkel's specimen from Madeira) in mm:

	I	II	III	IV	palp
Fe	3.15	2.80	1.90	2.85	0.55
Pa	0.50	0.48	0.38	0.40	0.18
Ti	3.30	2.75	1.50	2.20	0.28
Mt	3.70	3.10	1.80	2.70	—
Ta	1.75	1.40	0.85	1.15	0.50

Chaetotaxy. — Fe I d'l'; II-IV d. Pa I-IV d''d', basal spine short and weak.

Ti I-II v''_b d'' (v'v'') l' v' l'' d' [l'_al''_av'_av''_a]
 III-IV d'' v' l' d' [l'_al''_av'_av''_a]
 Mt I-II d l' l''; III-IV d l' v'_av''_a

Length of d''-spine on tibia I 0.31 mm, diameter of segment at base of d''-spine 0.14 mm; on tibia IV 0.37 mm and 0.11 mm, respectively. Tm I 0.16. Position of d''-spine on tibia I 0.24.

Abdomen. — Cylindriform. Light with blackish pattern. Dorsal surface beige-coloured with few small white blotches; a narrow black median stripe present on anterior three-fifths, followed by three black chevrons on posterior part. Latero-dorsally a narrow black line, connected anteriorly with the median stripe and posteriorly with the last chevron. Posterior surface black. Lateral surface beige-coloured with white blotches. Ventral surface black, spinnerets and genital area included.

Palp (fig. 14, 17). — All segments light yellow-brown. Tibia one and a half times as long as patella. Tibia with a latero-dorsal spine, which is slightly longer than the segment, and with a shorter lateral spine, both near distal margin. Cymbium without spines, 1.8 times as long as tibia. Distal arm of paracymbium short and tapering to a point. Distal part of median apophysis (fig. 16, *ma*) not much longer than proximal part; tip of distal part with a lightly curved finger-like projection. Embolus long and thread-like, measuring 1.2 mm in the single available male, with a slender and pointed corkscrew-shaped embolic apophysis (fig. 18) near base. Terminal apophysis (fig. 20, *ta*) small and twisted, with minute hairs or villi at blunt tip. Lamella (fig. 20, *l*) of usual shape, proximal tip rounded, distal tip broadly pointed and reaching only as far as the middle of the lateral projection, which is slightly curved. Embolic membrane (fig. 20, *em*) with rounded tip.

Female. — Measurements in mm. Total length 4.5-4.6; cephalothorax, length 1.8-2.0, width 1.3-1.4; abdomen, length 2.6-2.9, width 1.5-1.7, height 1.3-1.7; chelicerae, length 0.95-1.05, width 0.40-0.45.

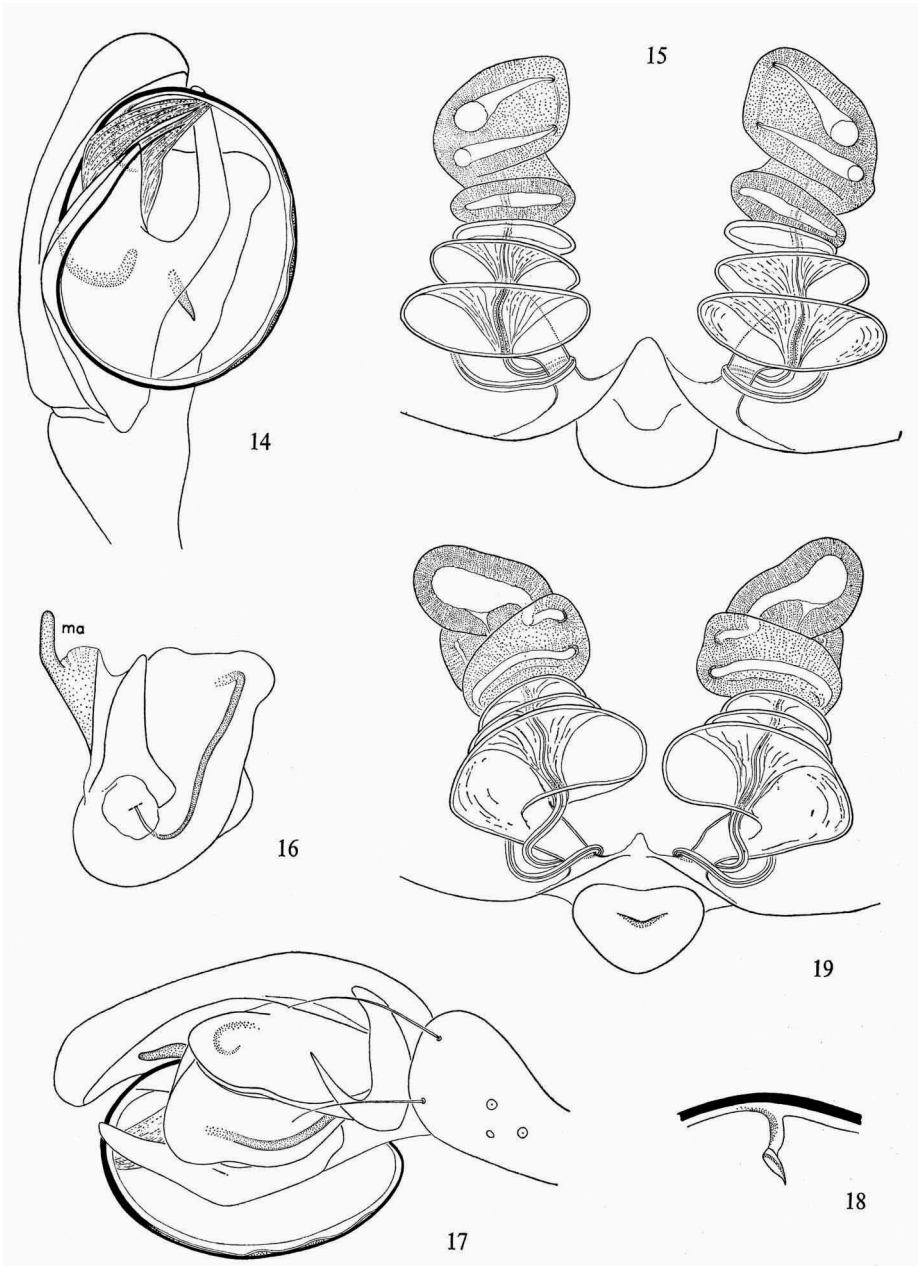


Fig. 14-18. *Microlinyphia johnsoni*. 14, male palp, ventral aspect; 15, vulva, ventral aspect; 16, tegular complex with median apophysis (*ma*), mesal aspect; 17, male palp, lateral aspect; 18, embolic apophysis. Fig. 19. *M. inexplicabilis*, vulva, ventral aspect. 14, 17, $\times 95$; 15, 19, $\times 213$; 16, 18, $\times 100$.

Cephalothorax. — Colour as in male, with blackish median and sublateral bands. Width 0.7-0.75 of length, width of head 0.65 of width of thorax. Hairs at eye-region and on clypeus shorter. PME on black tubercles as in male. Diameter of PME 0.11-0.12 mm, diameter of AME 0.65 of PME, laterals barely larger. Interstices as wide as in male. Height of clypeus 0.12-0.15 of length cephalothorax.

Chelicerae. — Colour as cephalothorax. Basal tubercle absent. Faint broken ridges visible on basal half of lateral surface. Posterior surface with a slight elevation only. Dorsal row with five cheliceral teeth, basal tooth small, second and third teeth twice as large, then diminishing in size towards small apical tooth; all teeth equidistant. Ventral row with four to five small teeth, basal tooth as large as basal dorsal tooth, others smaller, all equidistant; basal tooth opposite to third dorsal tooth.

Legs. — Yellow-brown, annulated as in male. Length of femur I 1.4-1.5 times cephalothorax, length of tibia I 13-14 diams. of segment. Measurements in mm (of one of Schenkel's specimens from Madeira):

	I	II	III	IV
Fe	2.75	2.45	1.75	2.40
Pa	0.60	0.55	0.45	0.50
Ti	2.75	2.25	1.35	1.95
Mt	2.70	2.35	1.55	2.25
Ta	1.50	1.15	0.75	1.05

Chaetotaxy. — Not differing from male, length of d''-spine on tibia I 0.36-0.37 mm, diameter of segment at base of d''-spine 0.21 mm; on tibia IV 0.40-0.45 mm and 0.15-0.16 mm, respectively. Tm I 0.18. Position of d''-spine on tibia I 0.25-0.27.

Abdomen. — Oblong with moderately curved dorsal surface and perpendicular posterior surface, without postero-dorsal tubercle. Dorsal surface beige-coloured, with white blotches forming a white streak at either side of black median band on anterior half, this band as narrow as mesal band on cephalothorax; posterior half with four small black V-shaped markings, their arms pointing backwards. A narrow black latero-dorsal band from base of abdomen to last chevron, at ventral side bordered by an equally narrow white band, which remains separated from other side posteriorly by the black posterior surface; remainder of lateral surface and opercula beige-coloured, contrasting strongly with the dark grey or blackish ventral surface. Spinnerets beige-coloured.

Epigyne. — Small and inconspicuous, resembling that of *pusilla*. Position of receptacula discernible as small brown areas.

Vulva (fig. 15). — Columns of spiral tube parallel. Entrances of spiral

tubes situated laterally in triangular excision. Five coils of spiral tube between entrances and turning-points, last coil thick-walled, others membranous. Fertilization duct in axis of column, ending with one loop around tube near entrance, then curving to dorsal side. Scape small and rounded, with mesal pit on ventral side.

Distribution. — Madeira and Porto Santo.

Material examined.

Madeira and Porto Santo. — 1 ♀, Madeira, 1957, Mission Vandel (Denis, 1962; CD). 2 ♀ 1 ♂, Madeira and Rabaçal, vii-viii.1935, O. Lundblad (Schenkel, 1938; NMB).

Microlinyphia inexplicabilis (Denis) comb. nov.

(fig. 19)

Linyphia inexplicabilis Denis, 1941, Ann. Soc. ent. France, 110: 113, fig. 3-4 (description ♀, Teneriffe).

Type. — ♀ holotype from Canary Islands, Teneriffe (BM).

Remarks. — This species very well may be synonymous with *M. johnsoni* (Blackwall) from Madeira. The abdomen of the holotype is in a very bad condition, rather dark and shrunken, the pattern only faintly recognizable in consequence. Judging from the original description and figure, the specimen was already in this condition when Denis described it. His wrong interpretation of the epigyne is probably due to the integument around the epigyne and the epigyne itself being wrinkled. It is impossible to see to what extent the dark colour of the abdomen was caused by desiccation, which it apparently had to endure once, but probably it was of much darker coloration than *johnsoni*. The only other specimen available from the Canary Islands, a female specimen from Palma, has the characteristic pattern of *johnsoni*, with a black median streak on the anterior half of the abdomen, followed by four black V-shaped markings. The black latero-dorsal band, however, is broader and sinuate, and the black ventral surface contrasts less strikingly with the lateral surface, the latter being brown and not beige-coloured. The vulvae of the two specimens differ from the vulva of *johnsoni* only in the number of coils of the spiral tubes, viz., five in *johnsoni* (fig. 15) from Madeira, four and a half in *inexplicabilis* (fig. 19) from Teneriffe and Palma. This character, however, appears to be variable in other species (cf. *pusilla*), and therefore seems to have little diagnostic value.

I have not found any other differential characters beside those mentioned above. There are differences in size, but again this seems to be of little significance, as *inexplicabilis* from Teneriffe is smaller, but the specimen

from Palma is larger than the specimens of *johnsoni* from Madeira. The measurements of the specimens are (specimen from Palma in brackets): length 3.05(5.0) mm; cephalothorax, length 1.5(1.7) mm, width 1.1.(1.25) mm; length of femur I 2.15(2.6) mm.

Probably *inexplicabilis* resembles *johnsoni* sufficiently to consider the two conspecific. However, in view of the differences observed I should like to examine more material, and males in the first place, before feeling justified to list *inexplicabilis* as a synonym of *johnsoni*. Consequently I have dealt with them as separate species here.

Distribution. — Canary Islands.

Material examined.

Canary Islands. — 1♀, Teneriffe, Taraconte, 17.iv.1913, A. S. Hirst (holotype of *Linyphia inexplicabilis* Denis; BM). — 1♀, Palma (MNP).

***Microlinyphia simoni* spec. nov.**

(fig. 21-27)

Types. — ♂ holotype, 2♂ paratypes, 6♀ paratypes, from Madagascar, Diego-Suarez (MNP, 1♂ 1♀ paratypes ML).

A tube with the above mentioned specimens was found in the collection at Paris. It dates back to the days of Simon, who probably is responsible for the small pencil-written label in the tube, which reads: "*Linyphia polita* E.S., Diego-Suarez". Apparently he has never published this new species from Madagascar. I take the liberty to replace the name proposed by Simon by a derivative of his own name, as a late homage to this great French Arachnologist.

Male. — Measurements in mm. Total length 3.0-3.4; cephalothorax, length 1.15-1.3, width 0.75-0.9; abdomen, length 1.75-2.05, width 0.55-0.75, height 0.5-0.6; chelicerae, length 0.62-0.75, width 0.25-0.26.

Cephalothorax. — Light brown to dark brown, lightly suffused with black on striae and at margins. Posterior margin cut off straight, sides evenly rounded and only slightly constricted at border of head and thorax. Triangular ventral extensions at border of head and thorax small. Width 0.65-0.7 of length, width of head 0.5 of width of thorax. From side, dorsal line straight from posterior margin to eye-region, clypeus straight. Very short hairs along striae and margins, eye-region and clypeus with short hairs.

Eyes. — Eye-region occupying whole width of head. Both rows straight or slightly recurved. PME on large black tubercles, which are touching or narrowly separated mesally, and which are fused with the black spot on

which the AME are situated. Diameter of PME 0.07-0.08 mm, diameter of AME and lateral eyes 0.06-0.07 mm. PME separated from each other by 1.6-1.8 diams., from PLE by 1.0 diam., and from AME by 1.3 diams. of PME. AME separated by 0.6 of their own diameter. Height of clypeus 0.13-0.15 of length of cephalothorax.

Chelicerae. — Brown with black suffusion, as cephalothorax. Lateral surface slightly bulging on basal half, apical half straight. Mesal side straight on apical part, slightly bulging on basal part. Chelicerae as a whole slightly diverging. Posterior surface with a large elevation on basal half, bearing warts. Dorsal surface with short hairs on small warts. Basal tubercle small but distinct. Lateral surface with irregular ridges on basal three-fourths. Cheliceral teeth numbering four in dorsal row; basal three equidistant, increasing in size from small basal tooth to third tooth, which is two times as large as basal tooth; apical tooth as small as basal tooth, situated near base of fang, separated from third tooth by a distance as wide as space occupied by the basal three teeth. Ventral row with four small teeth, basal tooth opposite to third tooth of dorsal row, apical tooth opposite to apical dorsal tooth; second tooth rather close to basal tooth, others more widely spaced.

Gnathocoxae. — Brown, lightly suffused with black; lateral margins emarginate, diverging apically, truncated perpendicularly in front. Labium brown with black suffusion, anterior margin lighter; nearly as long as wide. Sternum brown with very light suffusion; width 0.9 of length, slightly produced between coxae IV.

Legs. — Uniformly light yellow-brown. Legs long and slender; length of femur I 1.6-1.9 times length cephalothorax; length of tibia I 22-25 diams. of segment. Femora I and II with short hairs, situated each at the base of a sharp tooth-like wart; warts slightly larger and more distinct than warts on chelicerae. Measurements (of holotype) in mm:

	I	II	III	IV	palp
Fe	2.25	2.00	1.20	1.85	0.44
Pa	0.30	0.30	0.25	0.27	0.12
Ti	2.15	1.80	1.00	1.60	0.19
Mt	2.45	2.05	1.10	1.90	—
Ta	1.10	0.85	0.55	0.75	0.35

Chaetotaxy. — Fe I d l'l''; II d'l''; III d; IV dd. Pa I-IV d''d', basal spine weak.

Ti	I	v'' _b d'' (v'v'')	l'l'' d'	[l' _a l'' _a v' _a v'' _a]
	II	v'' _b d'' (v'v'')	l'' d'	[l' _a l'' _a v' _a v'' _a]
	III-IV	d''	d'	[l' _a l'' _a v' _a v'' _a]

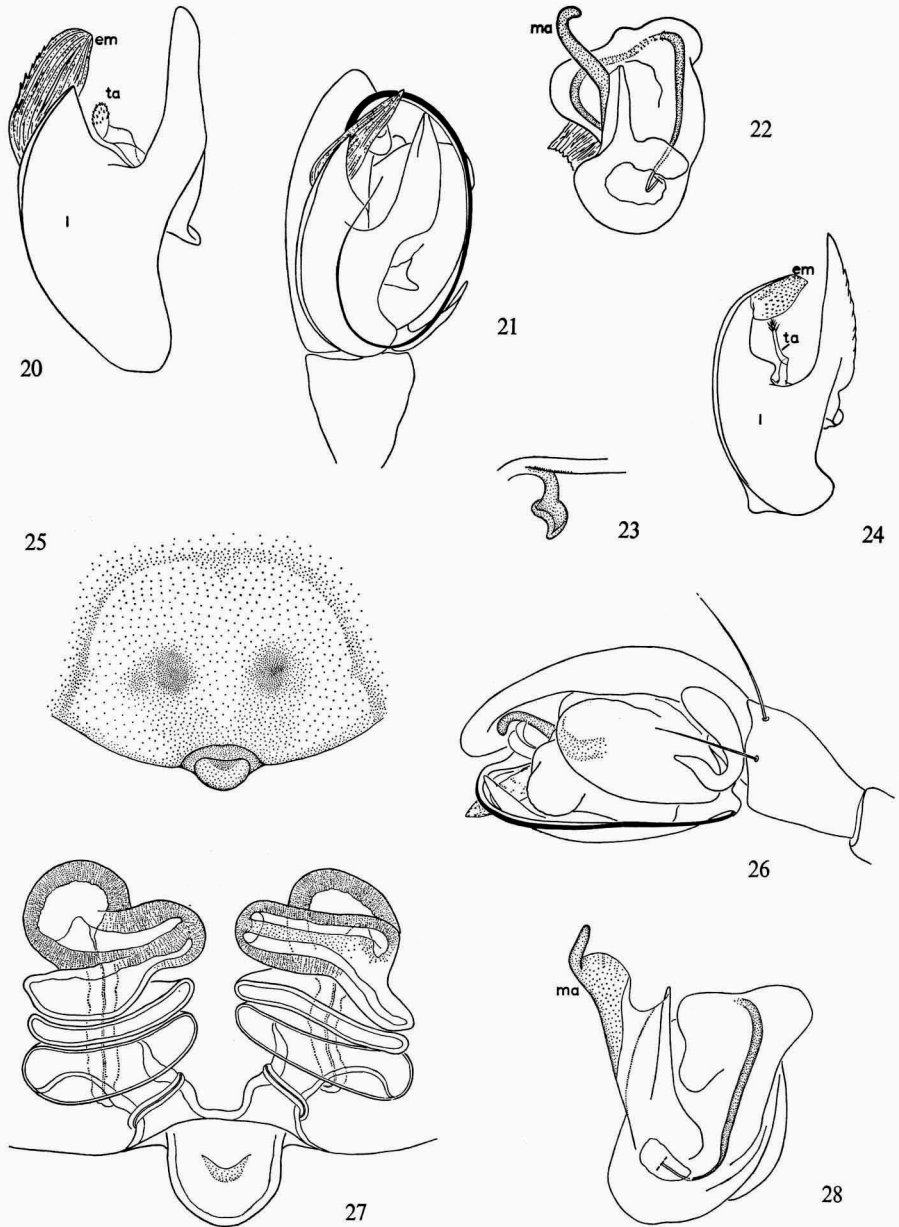


Fig. 20. *Microlinyphia johnsoni*, ventral aspect of lamella (*l*), with embolic membrane (*em*) and terminal apophysis (*ta*). Fig. 21-27. *M. simoni*. 21, male palp, ventral aspect; 22, tegular complex with median apophysis (*ma*), mesal aspect; 23, embolic apophysis; 24, ventral aspect of lamella (*l*), with embolic membrane (*em*) and terminal apophysis (*ta*); 25, epigyne; 26, male palp, lateral aspect; 27, vulva, ventral aspect. Fig. 28. *M. mandibulata*, tegular complex with median apophysis (*ma*), mesal aspect. 20-26, $\times 100$; 27, $\times 213$; 28, $\times 80$.

Metatarsi at least with a dorsal spine, no other spines could be found. Diameter of tibia I 0.09 mm, of tibia IV 0.08 mm. All spines broken off in available material. Tm I 0.13. Position of d''-spine on tibia I 0.21-0.23.

Abdomen. — Long and narrow, cylindrical. Light brown with black suffusion, which forms a black spot at posterior end of dorsal surface. A lateral row of four white spots along whole length; second spot, on half length, and fourth spot, next to black postero-dorsal spot, conspicuous; first and third spots small. The type-series contains one dark specimen, which has the abdomen heavily suffused with black with relatively small lateral spots. Ventral surface coloured as dorsal surface.

Palp (fig. 21, 26). — Segments light yellow-brown, cymbium lightly suffused with black. Patella short, with a short dorsal spine. Tibia one and a half times as long as patella, with a dorsal and a lateral spine near apical margin, both as long as segment. Cymbium slightly less than two times as long as tibia, without spines. Paracymbium inconspicuous, distal arm half as long as proximal arm and curved in anterior direction. Tegulum with rather well-developed antero-lateral lobe. Median apophysis (fig. 22, *ma*) with short proximal part, and with much longer and more slender, bluntly tipped distal part. Embolus long and thread-like, measuring 0.75-0.8 mm, at the unexpanded palp less conspicuous than in *pusilla*. Embolic apophysis (fig. 23) corkscrew-shaped, pigmented, with proportionally large last turn. Lamella (fig. 24, *l*) with bluntly rounded proximal tip; antero-lateral tip pointed and longer than mesal tip and membrane (fig. 24, *em*) together. Terminal apophysis (fig. 24, *ta*) small, thread-like and twisted, with shortly haired tip.

Female. — Measurements in mm. Total length 3.4-4.0; cephalothorax, length 1.1-1.35, width 0.8-1.0; abdomen, length 2.3-3.1, width 1.15-1.8, height 1.1-1.7; chelicerae, length 0.50-0.67, width 0.25-0.30.

Cephalothorax. — Brown, lightly suffused, in dark specimens heavily suffused with black. Posterior margin broadly but superficially excised. Width 0.65-0.75 of length, width of head 0.6 of width of thorax. From side, dorsal line rising from posterior margin to fovea, nearly level between fovea and eye-region; clypeus straight. Eye-region very shortly haired. PME slightly larger than in male (0.08-0.09 mm), and eyes slightly closer together. Height of clypeus 0.12-0.13 of length of cephalothorax.

Chelicerae. — Colour as cephalothorax. In dark specimens with heavy black suffusion on an oblique dorsal streak from mesally at base towards laterally at apex, and on lateral and ventral surfaces. Posterior surface with a very slight elevation on basal half. Very faint stridulating ridges visible

on basal two-thirds of lateral surface. Dorsal row with five cheliceral teeth, arranged equidistantly; second and third teeth of equal size, twice as large as basal and fourth teeth, apical tooth very small. Ventral row with four to five small teeth, basal tooth opposite to third dorsal tooth, all small and equidistant.

Legs. — Light yellow-brown, patellae slightly darker. Length of femur I 1.4-1.5 times length cephalothorax. Length tibia I 14-16 diams. of segment. Measurements (of paratype) in mm:

	I	II	III	IV
Fe	1.70	1.50	1.05	1.60
Pa	0.35	0.35	0.30	0.30
Ti	1.70	1.40	0.85	1.25
Mt	1.85	1.55	1.00	1.55
Ta	1.00	0.80	0.55	0.70

Chaetotaxy. — Fe I dl'l'; II-IV d. Pa I-IV d''d', basal spine weak.

Ti I d'' (v'v'') l' v' l'' d' [l'a l'' a v' a v'' a]
 II d'' l' d' [l'a l'' a v' a v'' a]
 III-IV d'' l' v' d' [l'a l'' a v' a v'' a]

Mt I-II dl'l'v; III-IV dl'vva.

Diameter of tibia I at base of d''-spine (broken off) 0.11-0.12 mm, diameter of tibia IV 0.09-0.10 mm. Tm I 0.15. Position of d''-spine on tibia I 0.25-0.27.

Abdomen. — Oblong in dorsal view. Dorsal surface evenly curved from base to postero-dorsal tubercle, which forms the transition to the posterior surface. With the exception of a row of four white lateral spots, whole abdomen light brown to brown, lightly to heavily suffused with black, mesal area of dorsal surface usually lighter; in dark specimens this light mesal area not present. Postero-dorsal tubercle blackish. Ventral surface uniformly grey-brown. First and third lateral spots small, second spot larger, situated on half length, fourth spot small but clear white, adjoining the black postero-dorsal tubercle.

Epigyne (fig. 25). — Small and inconspicuous. Posterior margin narrowly and superficially excised, the excision nearly completely occupied by a small rounded scape, which is curved in ventral direction.

Vulva (fig. 27). — Two parallel columns of spiral tube. Entrances narrowly separated mesally. Between three and three and a half coils of spiral tube from entrances to turning-points, which are all membraneous, the last half turn excepted. Fertilization duct running through axis of column and ending with one complete turn around posterior part of spiral

tube before curving to dorsal side of vulva. Receptacula rather large. Scape small, with a semi-covered depression. Width of excision 0.10-0.12 mm, width of scape 0.065-0.075 mm.

Distribution. — Madagascar.

Material examined.

Madagascar. — 6♀ 3♂, Diego-Suarez (MNP, 1♀ 1♂ paratypes ML).

***Microlinyphia mandibulata* (Emerton)**

Linyphia mandibulata was described by Emerton (1882: 64) from the eastern part of the United States. The dark colour of the species and the considerable length of the male chelicerae were explicitly mentioned and depicted.

Keyserling (1886: 55) recorded the species from the eastern side of the continent (New York) and from the West Coast (Washington State), and considered it to be conspecific with the European *Linyphia pusilla* Sundevall. However, the lengthy descriptions of male and female, adequately furnished with measurements of body and legs, certainly were based on specimens of *M. dana*. The colour and pattern of the cephalothorax, and the length of the legs in particular, are unmistakable. As to the figures, both male and female depicted also represent specimens of *dana*. *Microlinyphia dana* (Chamberlin & Ivie) is a West American species, and thus Keyserling's description and figures were probably based on the specimens from Washington only, and not on the specimens mentioned from New York. As *mandibulata* is listed as a synonym of *pusilla*, but in fact refers to *dana*, we must conclude that Keyserling has recognized generic rather than specific characters.

Several authors have endorsed the view of Keyserling, considering all North American *pusilla*-like specimens to be conspecific with the European *pusilla* (Simon, 1894: 693; 1929: 744; Comstock, 1913: 398; Berland, 1932: 379; Blauvelt, 1936: 130). Hackman (1954: 5) regarded *mandibulata* as a probable subspecies of *pusilla*. Others have always maintained the existence of two species in the Nearctic region, viz., *mandibulata* in the East and *pusilla* in the West (Banks, 1893: 129; 1900: 481; Emerton, 1920: 317), or believed the two species to occur together in the northern regions (Marx, 1890: 528; 1892: 156; Banks, 1910: 33). What second species they had in mind often is difficult to determine. In the case of Emerton (1920) *dana* (among others?) was involved, as could be determined after a re-examination of a series from California, Berkeley, which

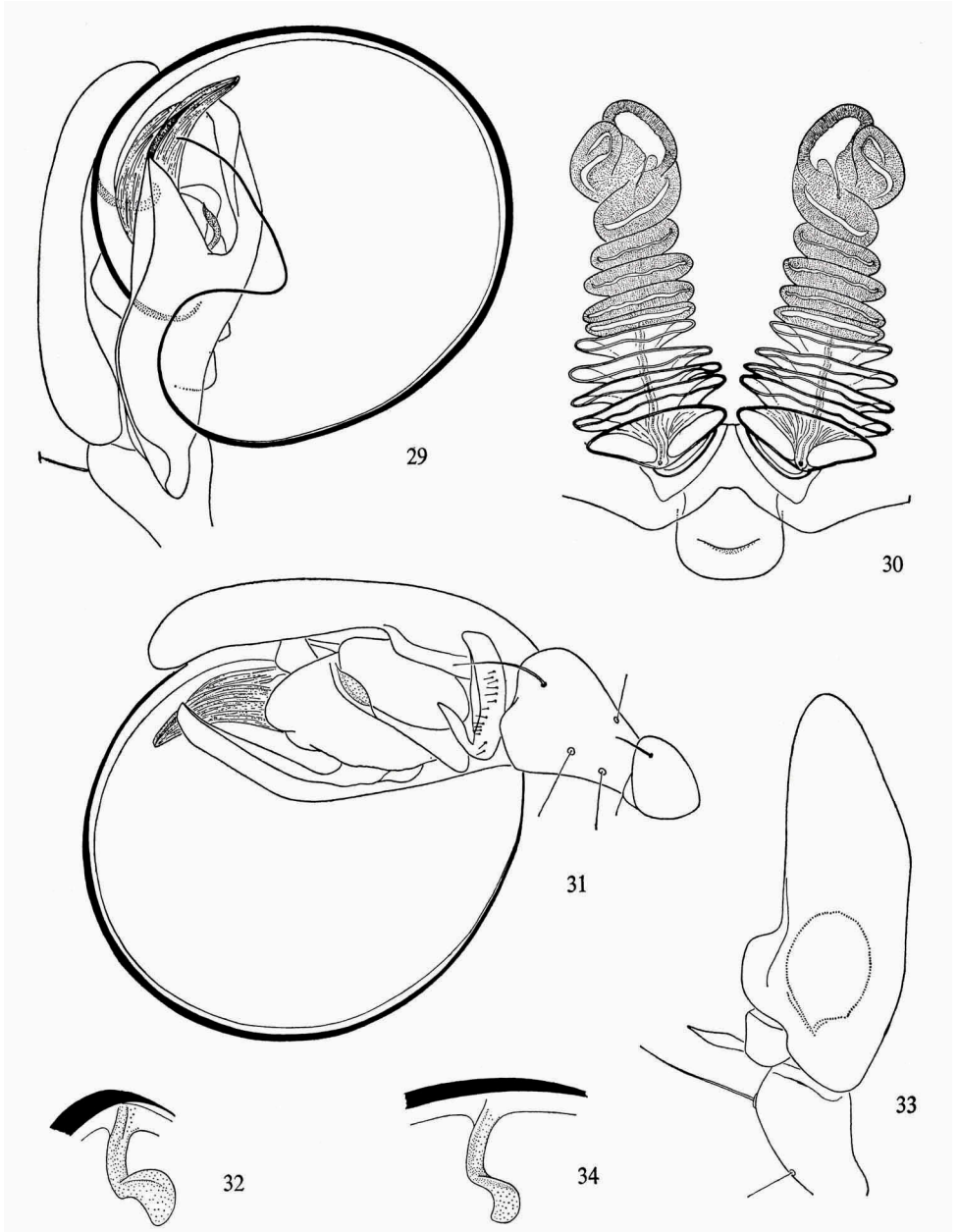


Fig. 29-33. *Microlinyphia mandibulata*. 29, male palp, ventral aspect; 30, vulva, ventral aspect; 31, male palp, lateral aspect; 32, embolic apophysis; 33, cymbium of male palp, dorsal aspect. Fig. 34. *M. dana*, embolic apophysis. 29, 31, 33, $\times 67$; 30, $\times 150$; 32, 34, $\times 100$.

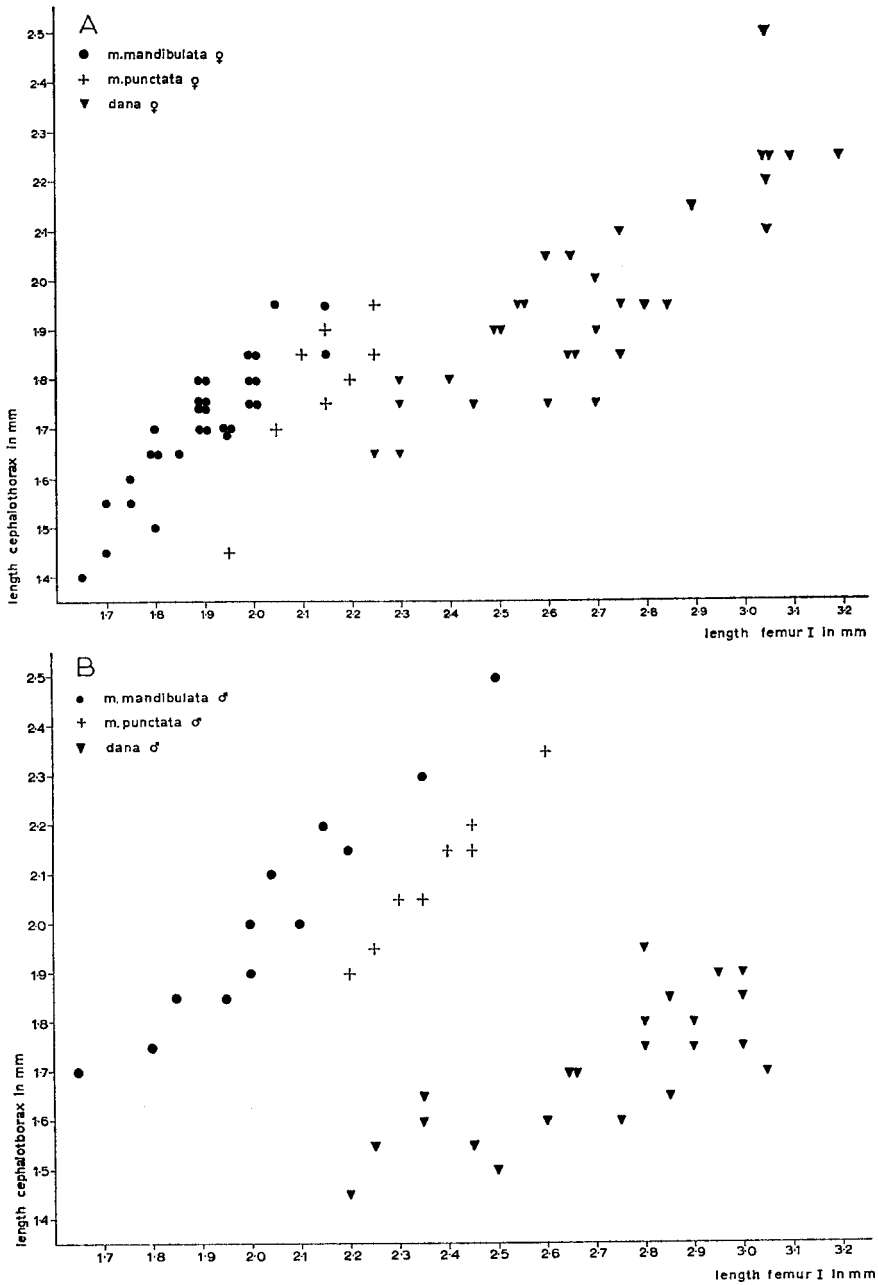


Fig. 35. Diagram, showing correlations between length of femur I and length of cephalothorax in females (A) and males (B) of *Microlinyphia dana* and the subspecies of *M. mandibulata*.

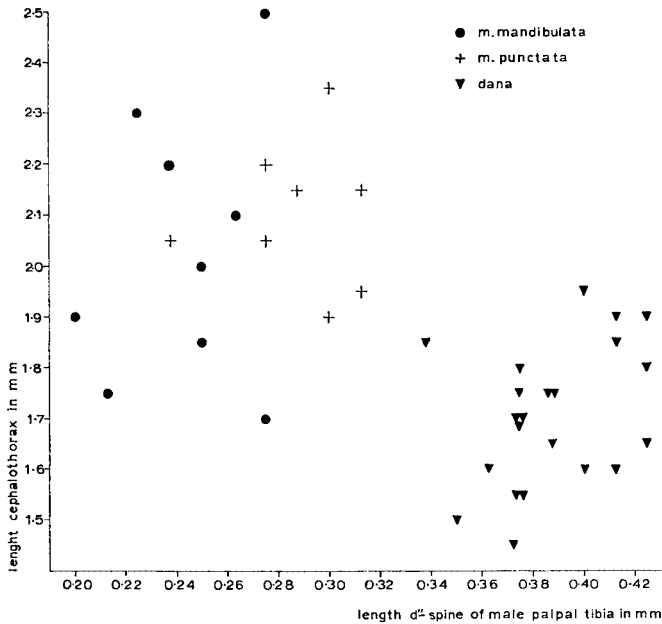


Fig. 36. Diagram, showing correlations between length of male palpal tibial spine and length of cephalothorax in *Microlinyphia dana* and the subspecies of *M. mandibulata*.

had been identified with and published as *pusilla* by Emerton (1920: 318). Chamberlin & Ivie (1943: 24) were first in recognizing the existence of three different species in North America, two of which have western distributions (*bonita* and *dana*), while the third species occurs in the northern parts of the continent from East to West Coast (*mandibulata*).

As indicated above, Blauvelt (1936), in her very useful paper on *Linyphia* and some related genera, has united all nearctic specimens of the present genus *Microlinyphia* into one species, which she thought to be conspecific with the European *pusilla*. Her long list of examined material mentions specimens from East to West Coast. Unlike Keyserling, Blauvelt has not given measurements of legs, while the main point of her description lies in the genitalia. Her descriptions of coloration and legs positively contain elements of *mandibulata* and *dana*, and possibly of *bonita*. Description and figures of the male palp mention and show the long tibial spine, which is characteristic for *dana*. As to the female, the description and figures of the epigyne and vulva again point to *dana* rather than to *mandibulata*, but it is impossible, and in fact purposeless, to identify the species depicted on these characters alone. As a consequence, we can not use her long list of examined

material for distributional purposes of the American species, though we may infer from the data that the genus *Microlinyphia* is not found south of 35°N.

Two subspecies have been described beside the nominate form by Chamberlin & Ivie (1943: 24). I have seen only three female specimens of *mandibulata provoana* which is said to have the males slightly lighter coloured than the nominate form; the females would be indistinguishable. The females examined by me exactly correspond with the nominate form; males were not available. The second subspecies, *mandibulata punctata*, bears white spots on the ventral side of the abdomen, and is lighter as a whole. I have found slight metrical differences (fig. 35, 36) between specimens of *punctata* and *mandibulata*, and I shall treat these two as subspecies here. They seem to be separated geographically by the Continental Divide, though this barrier is not very strict.

***Microlinyphia mandibulata mandibulata* (Emerton)**

(fig. 28-33, 35-37)

Linyphia mandibulata Emerton, 1882, Trans. Connecticut Acad. Arts Sci., 6: 64, pl. 19 fig. 2 (description ♀ ♂, eastern U.S.A.). — Banks, 1893, Journ. New York Ent. Soc., 1: 129 (key to eastern North American species).

Pusillia mandibulata; Chamberlin & Ivie, 1943, Bull. Univ. Utah, 33(10): 24 (transferred to new genus). — Levi & Field, 1954, Amer. Midland Natural., 51: 446 (*Pusilla* [!] *mandibulata*, Wisconsin). — Hackman, 1954, Acta Zool. Fennica, 79: 5, 10, 51, fig. 120 (New Foundland; ? = subspecies of *P. pusilla* Sundevall).

Microlinyphia mandibulata; Holm, 1960, Zool. Bidr. Uppsala, 33: 128 (Alaska).

Pusillia mandibulata provoana Chamberlin & Ivie, 1943, Bull. Univ. Utah, 33(10): 24 (diagnosis, Utah).

Linyphia pusilla; Blauvelt, 1936, Festschr. Strand, 2: 130, pl. 16 fig. 75-79 (p.p.; description and figures also refer to *M. dana*).

For complete list of references up to 1939, see Bonnet (1957: 2524, under *Linyphia pusilla* Sundevall).

Types. — ♂ lectotype of *Linyphia mandibulata* Emerton, by present designation, from Albany, New York; 18♀ and 1♂ paralectotypes from the same locality (MCZ). The lectotype was selected from the original series from one of the localities mentioned in the original description. Holotype ♂ and ♀ "allotype" of *Pusillia mandibulata provoana* Chamberlin & Ivie from Utah (AMNH; not examined); 2♀ paratypes from same locality (UUC; examined).

Remarks. — *Linyphia variabilis* Banks, considered to be synonymous with *L. pusilla* [probably = *Microlinyphia mandibulata* (Emerton)] by Blauvelt

(1936: 95), was treated as a valid senior synonym of *Neriene maculata* Emerton in an earlier paper (Van Helsdingen, 1969).

Male. — Measurements in mm. Total length 3.3-4.6; cephalothorax, length 1.7-2.5, width 0.95-1.25; abdomen, length 1.7-2.3, width 0.9-1.1, height 0.75-1.1; chelicerae, length 1.06-1.70, width 0.29-0.37.

Cephalothorax. — Brown to dark brown with narrow grey margins all around, clypeus included. Posterior margin straight or very lightly excised; sides evenly rounded towards border of head and thorax, head conspicuously prolonged with parallel sides; triangular extensions on border of head and thorax curved in mesal direction, bluntly rounded, not reaching extension of other side. Width 0.50-0.55 of length, width of head 0.7 of width of thorax. From side, dorsal line straight from posterior margin to eye-region; clypeus straight. Eye-region, clypeus and striae shortly haired.

Eyes. — Eye-region slightly narrower than head, width 0.6 of width of thorax. Both rows slightly recurved. PME on black tubercles, lateral eyes with black bases, AME on a common black spot. Diameter of PME 0.08-0.11 mm, laterals of same size; diameter of AME 0.6-0.7 of diam. of PME and separated from each other by that distance. PME separated from each other by 2.0-2.5 diams., from PLE by 1.1-1.3 diams., and from AME by 1.3-1.6 diams. of PME. Height of clypeus 0.13-0.16 of length of cephalothorax.

Chelicerae. — Colour as cephalothorax. Long and narrow but barely divergent, conspicuously slanting backwards. Length 0.62-0.79 of length of cephalothorax. Basal tubercle small but salient on dorso-lateral corner. Hairs on small papillae. Lateral surfaces slightly convex on basal three-fourths, slightly diverging on apical fourth. Ventral surface with conspicuous large protuberance on second fourth, produced mesally, beset with hairs on warts. Lateral surface with broken ridges on basal two-thirds. Dorsal row with four teeth on thickened meso-apical part; basal and apical teeth of same size, second and third teeth twice as large, all equidistant. Ventral row with four teeth; basal tooth of same size as basal dorsal tooth, and opposite to third dorsal tooth; other teeth smaller and at some distance of basal tooth, all close together.

Gnathocoxae. — Brown, suffused with grey; lateral margins slightly concave, apices truncated obliquely. Labium black-brown, semi-circular; anterior margin slightly lighter. Sternum dark brown suffused with grey; width 0.85 of length, narrowly produced between coxae IV.

Legs. — Light brown to orange-brown without annulations, but femora often with grey-brown longitudinal streaks. Legs slender; femur I slightly

shorter or as long as cephalothorax (0.95-1.1), length of tibia I 14-15 diams. of segment. Measurements in mm (of specimen from New Jersey):

	I	II	III	IV	palp
Fe	2.05	1.85	1.40	1.95	0.81
Pa	0.45	0.45	0.35	0.40	0.19
Ti	2.10	1.70	1.10	1.65	0.31
Mt	2.20	1.85	1.30	1.90	—
Ta	1.30	1.05	0.65	0.90	0.79

Chaetotaxy. — Fe I 1-2d, 2 l'; II 0-1d, 1 l'; III-IV d. Pa I-IV d''d', basal spine small and weak.

Ti I ($v'_b v''_b$) d'' ($v'v''$) l' ($v'v''$) l'' d' [$l'_a l''_a v'_a v''_a$]
 II v''_b d'' ($v'v''$) l' v' d' [$l'_a l''_a v'_a v''_a$]
 III-IV d'' l' v' d' [$l'_a l''_a v'_a v''_a$]

Mt I-II dl'l'' v v_a ; III-IV dl'l'' v v_a

Length of d''-spine on tibia I 0.10-0.13 mm, diameter of segment at base of d''-spine 0.11-0.16 mm; on tibia IV 0.10-0.11 mm and 0.10-0.11 mm, respectively. Tm I 0.18-0.22. Position of d''-spine on tibia I 0.21-0.25.

Abdomen. — Cylindriform. Blackish with faint iridescence. Two white transverse dorsal spots on one-fourth of length, barely separated mesally. Remnants of a white lateral band and white spots around spinnerets faintly visible below black pigment. Ventral side uniformly black.

Palp (fig. 29, 31). — Colour as legs, but more heavily suffused with grey, cymbium black-brown. Femur slightly curved with concave ventral side. Patella short, dorsal side evenly curved with a short dorsal spine, which measures 0.6 of length of segment. Tibia one and a half times as long as patella, but only 0.4 of length of cymbium; distally broader and higher than at base; distal margin with small incision dorso-laterally, dorsal spine situated near incision; spine shorter or as long as segment. Cymbium (fig. 33) long and narrow, spineless. Paracymbium small; distal arm narrow, thin and membranous; proximal arm comparatively strong with some short hairs. Tegulum with anterior tip broadly rounded, protruding slightly in lateral direction. Median apophysis (fig. 28, *ma*) with tip of distal part finger-like. Embolus long and thread-like, length 2.8-3.3 mm; embolic apophysis (fig. 32) well-developed, chitinous and pigmented, last and only turn a semi-circular blade. Lamella (fig. 37, *l*) of usual shape, comparatively narrow; lateral free projection long; internal apex shorter, tapering to a point. Embolic membrane (fig. 37, *em*) tapering to a blunt tip. Terminal apophysis (fig. 37, *ta*) a very small and narrow membranous lappet, lying in angle between lateral projection and anterior part of main body of lamella.

Female. — Measurements in mm. Total length 3.3-4.6; cephalothorax, length 1.4-1.95, width 0.9-1.3; abdomen, length 1.9-2.9, width 1.4-2.1, height 1.15-2.15; chelicerae, length 0.69-1.00, width 0.27-0.42.

Cephalothorax. — Colour not differing from male. Less conspicuously long, width 0.6-0.7 of length, width of head 0.55 of width of thorax. Dorsal line, when seen from side, with a short level stretch near fovea. Clypeus and eye-region very shortly haired. Sizes and spacing of eyes and height of clypeus not differing from male. Chelicerae not as elongate as in male. Stridulating file present. Protrusion on ventral surface small. Cheliceral teeth as in male, but slightly closer together.

Legs. — Length of femur I 1.1-1.2 times length cephalothorax; length of tibia I 11-13 diams. of segment. Measurements in mm (of specimen from New Jersey):

	I	II	III	IV
Fe	2.00	1.80	1.35	1.95
Pa	0.50	0.45	0.40	0.40
Ti	1.95	1.60	1.05	1.60
Mt	1.95	1.65	1.15	1.75
Ta	1.20	1.00	0.65	0.90

Chaetotaxy. — Fe I dI'; II-IV d. Patellae, tibiae, and metatarsi as in male, a v'_b -spine usually present on tibiae I and II. Spines much longer. Length of d'' -spine on tibia I 0.21-0.29 mm, diameter of segment at base of d'' -spine 0.12-0.17 mm; on tibia IV 0.22-0.31 mm and 0.11-0.16 mm, respectively. Tm I 0.18-0.25. Position of d'' -spine on tibia I 0.20-0.24.

Abdomen. — Dorsal surface only slightly curved, nearly parallel with ventral surface; posterior surface perpendicular, transition of dorsal into posterior surface distinct but without postero-dorsal tubercle. Dorsal pattern variable, composed of black markings on a light brown background; posterior part blackish brown with two light chevrons; anterior half with two pairs of black-brown spots. In dark specimens the anterior spots fused, forming a quadrangular black spot, which even can be fused laterally with black dorso-lateral areas; a light cross-band behind this anterior dorsal area and the posterior dark markings always present. In light specimens the anterior dark spots completely lacking. All possible intermediate forms between the two extremes mentioned occurring, but the anterior spots showing a tendency to fuse across the mesal line before fusing lengthwise. Anteriormost pair of dark spots preceded by a pair of white transverse spots. Lateral surface with white band, sometimes broken up into four spots; white band flanked at dorsal side by black band, which is very narrow or even lacking in light specimens. Ventral half of lateral surface black-brown, ventral surface

uniformly grey or black-brown, somewhat lighter than lateral surface. Spinnerets black-brown; opercula brown with black suffusion. Whole abdomen lightly iridescent, most conspicuous on black parts.

Epigyne. — Not noticeably different from *M. pusilla*. Triangular incision of the anterior margin of the epigastric furrow blunt, the sides enclosing an obtuse angle which is completely occupied by the small rounded scape. Coils of spiral tubes faintly visible through grey-brown integument.

Vulva (fig. 30). — Two columns of spirally coiled tubes nearly parallel. Entrances of tubes anteriorly in lateral walls of triangular incision. Spiral tubes with nine to eleven coils between entrances and turning-points, posterior five coils membranous, others with thicker walls, increasingly so in anterior direction. Fertilization ducts running through axes of columns from receptacula in posterior direction, making one turn round entrances of spiral tubes before ending on dorsal side of vulva.

Distribution and habitat. — *Microlinyphia m. mandibulata* occurs in Eastern North America, and has not been recorded south of 32°N. It is common in the eastern parts, and seems to occur sporadically on the west side of the Continental Divide; it is replaced there by the subspecific form *punctata*.

The species has been collected in nearly every month of the year. The mating period falls in May and the species builds a horizontal web close to the ground (Emerton, 1882: 64). Hackman (1954: 51) mentioned moist meadows as a habitat.

Material examined.

U.S.A., New Hampshire. — 5 ♀ 2 ♂, Mt. Washington, vi.1877, J. H. Emerton (*Linyphia mandibulata*; Emerton, 1882; paralectotypes; MCZ).

U.S.A., New York. — 18 ♀ 2 ♂, Albany, J. H. Emerton (♂ lectotype and paralectotypes of *Linyphia mandibulata* Emerton; MCZ). 4 ♀, New York (MNP).

U.S.A., New Jersey. — 24 ♀ 2 ♂, Lambertville, v-vi.1951-1953, W. Ivie (ML).

U.S.A., Michigan. — 4 ♀, Marquette Co., 28.vi.1932 (MCZ). — 2 ♀, Grand Traverse Co., 30.v.1950 (MCZ). — 2 ♀, Wexford Co., 3.v.1947 (MCZ); 1 ♂, do., 11.vi.1949 (MCZ). 1 ♂, Missaukee Co., 29.v.1939 (MCZ). — 1 ♂, Clare Co., 27.v.1950 (MCZ). — 1 ♀, Gladwin Co., Weiner Lake, 21.vii.1938 (MCZ); 1 ♀, do., 18.v.1940 (MCZ). — 1 ♀ 1 ♂, Newaygo Co., 29.vii.1944 (MCZ). — 1 ♀, Isabella Co., 13.v.1945 (MCZ). — 1 ♀ 1 ♂, Midland Co., summer 1944 (MCZ); 2 ♂, do., 4.v.1948 (MCZ). — 3 ♀ 1 ♂, Bay Co., 2.vi.1940 (MCZ). — 1 ♂, Muskegon Co., 16.viii.1945 (MCZ). — 1 ♀, Saginaw Co., 1.vi.1940 (MCZ). — 1 ♀, Genesee Co., 3.vi.1950 (MCZ). — 10 ♀ 1 ♂, Eaton Co., Pine Isles near Olivet, 15.ix.1933 (MCZ). 1 ♀, Charlotte, 27.vii.1938 (MCZ). — 2 ♀, Livingstone Co., George Reserve Univ. Michigan, 28-30.v.1944 (MCZ). — 1 ♀, Calhoun Co., Albion, 9.vii.1928 (MCZ); 1 ♀, do., 17.v.1933, Chickering (MCZ); 1 ♀, do., 6.vi.1933 (MCZ); 1 ♀, do., 23.xii.1933, Chickering (MCZ); 7 ♀, do., 25.v.1935 (MCZ); 1 ♂, do., 24.v.1936 (MCZ); 2 ♀ 1 ♂, do., vi.1938 (MCZ). 2 ♀ 1 ♂, Winnipeg Lake, 5.vii.1933 (MCZ). 1 ♀, Burlington, 31.v.1936 (MCZ). 2 ♀, Ott Preserve, 12.vi.1946 (MCZ); 1 ♀,

do., 29.xi.1946 (MCZ). — 1 ♀, Jackson Co., Swains Lake, Concord, 24.vi.1933 (MCZ). 1 ♀, Wolf Lake, 10.vii.1933 (MCZ). 1 ♀, 14 mi. E. of Jackson, 29.v.1949 (MCZ). — 4 ♀, Washtenaw Co., Ypsilanti, 29.vi.1935 (MCZ). 1 ♀, Waterloo Rec. Area, 12.vi.1949 (MCZ).

U.S.A., Georgia. — 1 ♀, "Georgia" (*Linyphia pusilla*; Keyserling, 1886 (p.p.); MNP).

U.S.A., Wisconsin. — 1 ♀ 1 ♂, "Wisconsin, Colorado" (MNP).

U.S.A., Utah. — 2 ♀, Utah Lake at mouth of Provo River, 25.vi.1941, W. Ivie (paratypes of *Pusillia mandibulata provoana* Chamberlin & Ivie; UUC).

U.S.A., Washington. — 6 ♀ 1 ♂, Cedar Lake, near Leadpoint (117W 49N), v.1962, W. Ivie (AMNH).

Microlinyphia mandibulata punctata (Chamberlin & Ivie) comb. nov.

(fig. 35, 36)

Pusillia mandibulata punctata Chamberlin & Ivie, 1943, Bull. Univ. Utah, 33(10): 24 (diagnosis ♀, western U.S.A.)

Types. — ♂ holotype and ♀ paratypes, by original designation, from Utah (UUC; not examined).

Remarks. — This subspecies was described from the western United States as a form with white ventral spots on the abdomen. I have seen a number of specimens, which apparently belong to this subspecies. There are five white or light spots on the ventral side of the abdomen, viz., one behind the opercula on either side, and three in front of the spinnerets. The spots are caused by a local deficiency of black pigmentation in the outer layer of the integument, and they may bear some white blotches. The whole animal is lighter than the nominate subspecies from the eastern part of the continent. There are no significant differences in the size of the specimens of the two forms, nor in the length of the cephalothorax, but the legs are slightly longer in *punctata*, both absolutely and proportionally (fig. 35). The spines on the legs are slightly longer, the tibial spine of the male palp is also longer (fig. 36). Differences in the genitalia have not been found. The general appearance of the males corresponds with the nominate form, e.g., the long chelicerae, the conspicuous elongate cephalothorax, and the pair of white transversal spots on the dorsal side of the abdomen are equally present in *mandibulata* and *punctata*.

The records of *punctata* by Chamberlin & Ivie (1943: 24) and the new material examined by me all originate from west of the Rocky Mountains, and apparently *punctata* does not cross the Continental Divide. I have seen specimens of the nominate form from the west side of the Continental Divide (Cedar Lake, Washington), which are as dark as in the East. However, *punctata* seems to be the commoner of the two in the West.

The subspecies *punctata* is not unlike *M. dana*, which occurs exclusively

along the Pacific Coast. Both are rather light, though *punctata* is still darker than *dana*. The differences between *dana* and the nominate form of *mandibulata* are clear-cut and convincing when presented diagrammatically. Coloration not considered, the most obvious differences lie in the length of the legs, in the length of the spines on legs and male palp, and in the length of the chelicerae. When plotting the length of femur I against the length of the cephalothorax (fig. 35), the presence of two different taxa is obvious. The symbols representing *punctata* clearly lie outside the range of *mandibulata* proper, while they have an intermediate position between *mandibulata* and *dana*. The same holds true for the length of the tibial spines on legs and male palp (fig. 36). Still I do not hesitate to consider *punctata* as a subspecies of *mandibulata*, as the differences mentioned between these two forms are relatively small, while other characters do not differ at all, e.g., the shape and length of the male chelicerae, the white transverse spots on the male abdomen, and the shape of the cephalothorax of the male. Theoretically it is possible that *punctata* is a hybrid form between *mandibulata* and *dana*, a problem which requires a profound experimental investigation and has to be left out of consideration here.

Distribution. — Nearctic region on the west side of the Continental Divide, from British Columbia to California.

Material examined.

Canada, British Columbia. — 1 ♂, Vancouver Island, 20-30.vi.1951, R. Guppy (AMNH).

U.S.A., Oregon. — 3 ♀ 1 ♂, Charleston Coos Co., 3.ix.1947, I. Newell (AMNH). 1 ♀, Grants Pass, 2.vii.1952, W. J. Gertsch (AMNH).

U.S.A., Arizona. — 2 ♀ 1 ♂, South-western Research Station (109W 32N), iii.1963, V. Roth (AMNH).

U.S.A., California. — 1 ♂, "Wisconsin, Colorado" (*Linyphia pusilla*; Keyserling, 1866 (p.p.); MNP). 1 ♂, Berkeley, vi.1905, J. H. Emerton (MCZ). 1 ♀ 1 ♂, Sisson [= Mt. Shasta], 1.vii.1905, J. H. Emerton (MCZ). 2 ♂, Solano Co., i.1956, K. W. Haller (AMNH). 1 ♀, Laguna Beach Lake, 6.vii.1934, W. Ivie & Rasmussen (*Pusillia mandibulata punctata*; Chamberlin & Ivie, 1943; UUC).

Microlinyphia dana (Chamberlin & Ivie) comb. nov.

(fig. 34-36, 38-41)

Pusilla dana Chamberlin & Ivie, 1943, Bull. Univ. Utah, 33(10) : 25 (description ♀ ♂, California, Washington, Oregon); 1947, Bull. Univ. Utah, 37(10) : 61 (Alaska).

Linyphia pusilla; Keyserling, 1886, Spinnen Amerikas, 2(2) : 55, pl. 12 fig. 163 (description ♀ ♂, Washington State). — Emerton, 1920, Trans. R. Canad. Inst., 12 : 317 (at least p.p.; Canada). — Blauvelt, 1936, Festschr. Strand, 2 : 130, pl. 16 fig. 75-79 (p.p.; genitalia).

Types. — ♂ holotype, several ♀ and ♂ paratypes, from California (UUC; not examined).

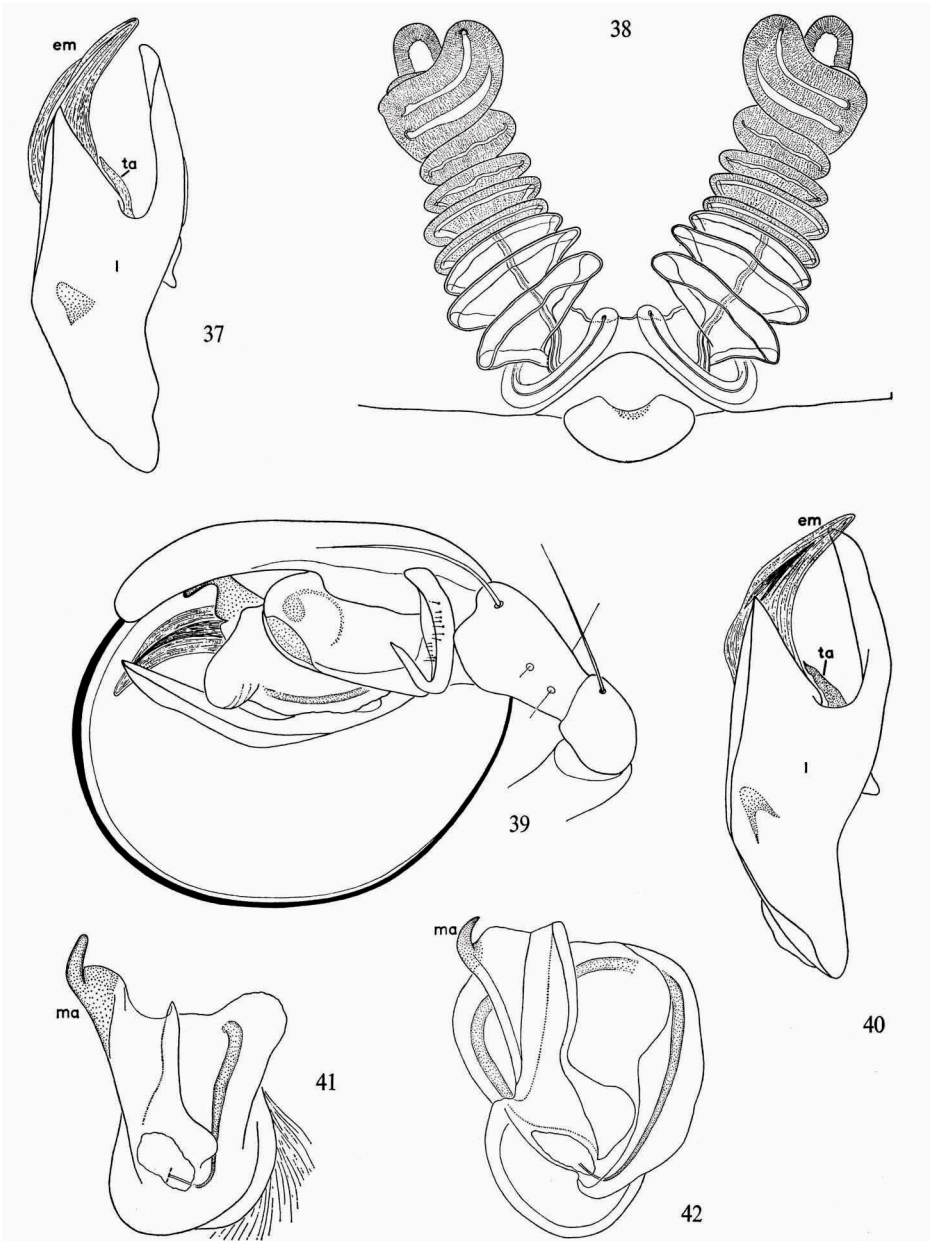


Fig. 37. *Microlinyphia mandibulata*, lamella (*l*), with embolic membrane (*em*) and terminal apophysis (*ta*), ventral aspect. Fig. 38-41. *M. dana*. 38, vulva, ventral aspect; 39, male palp, lateral aspect; 40, lamella (*l*), with embolic membrane (*em*) and terminal apophysis (*ta*), ventral aspect; 41, tegular complex with median apophysis (*ma*), mesal aspect. Fig. 42. *M. impigra*, tegular complex with median apophysis (*ma*), mesal aspect. 37, $\times 67$; 38, $\times 167$; 39, $\times 73$; 40, 41, $\times 80$; 42, $\times 95$.

Remarks. — Through kindness of Dr. W. P. McCafferty I had the opportunity to examine a series of the non-typical material, mentioned by Chamberlin & Ivie with the original description.

The species was named by Chamberlin & Ivie in 1943, but the earliest description dates from 1886, when Keyserling described specimens of *Linyphia pusilla* from Washington (for argumentation see under *M. mandibulata*). Apparently the description and figures of Keyserling were not recognized by Chamberlin & Ivie as an earlier description of their new species, as Keyserling is referred to under *Pusillia mandibulata* [= *M. mandibulata*]. Some of the earlier records of *mandibulata* or *pusilla* may also relate to *dana*. For differences with *M. mandibulata* see remarks on that species, and fig. 35-36.

Male. — Measurements in mm. Total length 3.1-4.3; cephalothorax, length 1.45-1.95, width 0.95-1.15; abdomen, length 1.6-2.15, width 0.9-1.4, height 0.95-1.4; chelicerae, length 0.81-1.07, width 0.26-0.35.

Cephalothorax. — Light brown, usually with a grey median stripe from foveal region to posterior part of head, not reaching PME, diffuse or obscurely bifurcate anteriorly. Lateral margins often with a broad faintly grey band, which may be restricted to posterior part. Posterior margin barely excised, sides evenly rounded and only lightly constricted at border of head and thorax, with small triangular extensions ventrally; head not conspicuously elongate (cf. *mandibulata*). Width 0.6-0.65 of length, width of head 0.55 of width of thorax. From side, dorsal line nearly straight, rising evenly from posterior margin to eye-region; clypeus straight. Eye-region and clypeus shortly haired, a few spine hairs present behind PLE and between eyes.

Eyes. — Eye-region occupying whole width of head. Anterior row straight, posterior row slightly recurved. PME on black tubercles, AME on a common black spot, bases of lateral eyes black. Diameter of PME 0.09-0.10 mm, laterals slightly smaller, diameter of AME 0.6-0.7 diam. of PME. PME separated from each other by 1.7-2.0 diams., from PLE by 0.9-1.4 diams., from AME by 1.5-1.7 diams. of PME. AME separated by their own diameter. Height of clypeus 0.12-0.15 of length of cephalothorax.

Chelicerae. — Brown, darker than cephalothorax. Length 0.47-0.59 of length cephalothorax (cf. *mandibulata*). Lateral surfaces barely bulging on basal three-fourths, slightly diverging at apices. Basal tubercle barely visible. Dorsal, lateral and posterior surfaces with hairs on papillae. Posterior surface with a light protrusion on second fourth, with small hairs on warts (cf. *mandibulata*). Dorsal row with four equidistant cheliceral teeth; second

tooth largest and twice as large as basal tooth, third tooth slightly smaller than second one, apical tooth small. Ventral row with five small teeth, all about equidistant; basal tooth opposite to gap between second and third teeth of dorsal row and as small as dorsal apical tooth; others slightly smaller.

Gnathocoxae. — Brown, lightly suffused with grey, apices white with grey suffusion; lateral margins slightly concave, apices truncated obliquely. Labium black-brown, anterior raised margin lighter. Sternum black-brown; width 0.8 of length, narrowly produced between coxae IV.

Legs. — Uniformly light yellow-brown to light brown. Legs very long and slender; length of femur I 1.4-1.8 times length cephalothorax; length of tibia I 20-25 diams. of segment. Measurements in mm (of specimen from California):

	I	II	III	IV	palp
Fe	2.75	2.55	1.70	2.35	0.72
Pa	0.55	0.50	0.40	0.45	0.19
Ti	3.05	2.55	1.40	2.05	0.29
Mt	3.30	2.75	1.65	2.45	—
Ta	1.70	1.45	0.80	1.10	0.69

Chaetotaxy. — Fe I d l'l''; II d l''; III-IV d. Pa I-IV d''d', basal spine short.

Ti I-II v''_b d'' (v'v'') l' v' l'' d' [l'_al''_av'_av''_a]
 III-IV d'' l' v' d' [l'_al''_av'_av''_a]

Mt I-II d l' l'' v; III-IV d l' v v_a

The v'-spine near the l''-spine on tibia II often lacking. Length of d''-spine on tibia I 0.35-0.41 mm, diameter of segment at base of d''-spine 0.11-0.15 mm; on tibia IV 0.46-0.52 mm and 0.11-0.14 mm, respectively. Tm I 0.16-0.20. Position of d''-spine on tibia I 0.20-0.24.

Abdomen. — Cylindriform. Dorsal surface light beige-coloured with white blotches, which form a pair of clear white bands laterally; white transverse dorsal spots never present (cf. *mandibulata*); three pairs of distinctly separated grey-brown spots on anterior half, and three chevrons on posterior half; spots may be fused lengthwise on anterior half. Dorsal half of lateral surface beige-coloured with white blotches and with a narrow blackish longitudinal streak on anterior half and at posterior tip of abdomen, streak rather dorso-lateral in position. Ventral half of lateral surface and ventral surface uniformly grey-brown, spinnerets and opercula included. Posterior surface light.

Palp (fig. 39). — All segments coloured as legs, cymbium only slightly

darker. Femur spineless, slightly curved with concave ventral side. Patella short, dorsal side slightly curved, dorsal spine nearly two times as long as segment. Tibia one and a half times as long as patella and 0.4 of length of cymbium; dorsal spine long, measuring 1.2-1.5 times length of segment, situated just dorsally of incision of distal margin. Cymbium without spines. Paracymbium with short and narrow distal arm; some short hairs on proximal arm. Tegulum with rounded protrusion antero-laterally, projecting stronger than in *mandibulata*. Median apophysis (fig. 41, *ma*) with finger-like blunt tip at distal part. Embolus long and thread-like, measuring 2.5-3.3 mm; embolic apophysis (fig. 34) pigmented, with blade-like tip which is slightly narrower than in *mandibulata*. Lamella (fig. 40, *l*) of usual shape, rather long and narrow; internal apex pointed. Embolic membrane (fig. 40, *em*) tapering to a sharp point. Terminal apophysis (fig. 40, *ta*) a small and narrow membraneous twisted element, barely visible between lamella and lateral projection of lamella.

Female. — Measurements in mm. Total length 3.8-5.8; cephalothorax, length 1.65-2.5, width 1.15-1.65; abdomen, length 2.2-3.7, width 1.5-2.45, height 1.55-2.6; chelicerae, length 0.82-1.15, width 0.34-0.49.

Cephalothorax. — Colour and pattern as in male. Excision of posterior margin deeper, width 0.65-0.7 of length. Hairs on head very short, no spinehairs present. Both rows of eyes straight. Diameter of PME 0.10-0.11 mm, laterals of same size, diameter of AME 0.7 of PME. Distance between PME mutually 1.5-1.8 diams., from PLE by 1.5-1.8 diams., and from AME by 1.1-1.3 diams. of PME. Height of clypeus as in male. Chelicerae proportionally shorter than in male. Stridulating ridges faintly visible. Third tooth of dorsal row as large as second, ventral row with four small teeth.

Legs. — Less slender than in male. Length of femur I 1.2-1.5 times length cephalothorax, length of tibia I 12-15 diams. of segment. Measurements in mm (of specimen from California):

	I	II	III	IV
Fe	2.65	2.40	1.70	2.25
Pa	0.60	0.55	0.45	0.50
Ti	2.65	2.25	1.35	1.90
Mt	2.70	2.35	1.55	2.25
Ta	1.40	1.20	0.80	1.00

Chaetotaxy. — The v' -spine near the l'' -spine not always present on tibia II, a v'' -spine sometimes present near l''' -spine on tibia I. Spines much longer than in male. Length of d'' -spine on tibia I 0.34-0.44 mm, diameter of segment at base of d'' -spine 0.17-0.25 mm; on tibia IV 0.35-0.49 mm

and 0.15-0.19 mm, respectively. Tm I 0.17-0.24. Position of d''-spine on tibia I 0.21-0.24.

Abdomen. — Dorsal surface moderately curved; transition of dorsal into posterior surface without postero-dorsal tubercle. Colour and pattern not differing from male.

Epigyne. — Barely different from *pusilla* or *mandibulata*, sides of triangular incision perpendicular to each other.

Vulva (fig. 38). — Entrances of spiral tubes situated anteriorly in sides of triangular incision. Columns of spiral tubes diverging in anterior direction. Each column with eight to ten coils, posterior three to four coils membranous, wall of anterior coils gradually becoming thicker towards turning-points. Receptacula small. Fertilization ducts in axes of columns, ending with a complete loop around entrances of spiral tubes.

Distribution and habitat. — The species is restricted to the Pacific Coast of the Nearctic region from Alaska in the north to California in the south. It has been collected in February and March, and from May till October. The habitat is not known.

Material examined.

Canada, British Columbia. — 2♀ 2♂, Vancouver Island, Wellington, 15-30.ix.1951, R. Guppy (AMNH).

U.S.A., Alaska. — 11♀ 5♂, Mitkof Island, 8 mi. N. of Ideal Cove, 3.ix.1951, B. Malkin (AMNH).

U.S.A., Washington. — 14♀ 1♂, Seattle, vii.1905, J. H. Emerton (MCZ). 13♀ 1♂, "Wisconsin, Colorado" (MNP; this series might very well constitute the material on which Keyserling (1886: 55) based his description of *Linyphia pusilla* from Washington, which was said to be in the possession of Simon; the material then would originate from Washington, and not from "Wisconsin, Colorado", where *dana* does not occur).

U.S.A., California. — 8♀ 3♂, Berkeley, vi.1905, J. H. Emerton (*Linyphia pusilla*; Emerton, 1920?; MCZ). 4♀ 6♂, Pebble Beach, Carmel, 11.x.1956, A. M. Nadler (ML). 4♀ 4♂, Pacific Grove, 15.viii.1931, W. Ivie (Chamberlin & Ivie, 1943; UUC). 1♂, Marin Co., Inverness, 19.x.1946, E. S. Ross (CAS). 2♀ 1♂, San Francisco, Lake Merced, 22.x.1936 (CAS). 1♀, San Francisco, Golden Gate Park, 23.ii.1935 (CAS); 2♀ 1♂ 2 juveniles, do., 10.iii.1935 (CAS).

Microlinyphia impigra (O. Pickard-Cambridge)

(fig. 42-48)

Linyphia impigra O. Pickard-Cambridge, 1871, Trans. Linn. Soc. London, 27: 422, pl. 55 fig. 18a-c (description ♂, England). — Simon, 1929, Arachn. France, 6(3): 638, 745, fig. 988 (key, France). — Locket & Millidge, 1953, British Spid., 2: 401, fig. 237H, 239D, 240F (England and Ireland). — Wiehle, 1956, Tierw. Deutschl., 44: 327, fig. 540-544 (key, Germany). — Locket, 1964, Ann. Mag. Nat. Hist., (13)7: 276 (designation of lectotype). — Lehtinen, 1964, Ann. Zool. Fennici, 1: 305 (South Finland). — Holm, 1968, Zool. Bidr. Uppsala, 37(2): 198 (Sweden).

Linyphia circumcincta O. Pickard-Cambridge, 1871, Trans. Linn. Soc. London., 27: 423 (description ♀, England); 1881, Spid. Dorset, 2: 578 (= *L. impigra*).

Linyphia maeklini Thorell, 1875a, Hor. Soc. Ent. Rossicae, 11: 60 (diagnosis ♂, Russia); 1875b, Kongl. Svenska Vet.-Akad. Handling., 13(5): 16 (description ♀ ♂, Russia). [new synonymy].

Linyphia culta O. Pickard-Cambridge, 1893, Proc. Dorset Nat. Hist. Antiquar. Fld. Cl. 14: 152, fig. 8 (description ♀, Ireland).

Lepthyphantes cultus; Carpenter, 1898, Proc. R. Irish Acad., 5: 183 (Ireland). — Jackson, 1916, Ann. Mag. Nat. Hist., (8)17: 164 (examination of type, = *L. impigra*).

Linyphia cayuga Emerton, 1914, Journ. New York Ent. Soc., 22: 264, pl. 8 fig. 7 (description ♀ ♂, U.S.A., New York). — Crosby & Bishop, 1928, Mem. Cornell Univ. Agric. Exper. Stat., 101: 1048 (U.S.A., New York). — Blauvelt, 1936, Festschr. Strand, 2: 127, pl. 10 fig. 70-74 (description ♀ ♂, U.S.A., New York). — Wiehle, 1956, Tierw. Deutschl., 44: 331 (= *L. impigra*).

Pusillia cayuga; Chamberlin & Ivie, 1943, Bull. Univ. Utah, 33(10): 26 (transferred to new genus); 1947, Bull. Univ. Utah, 37(10): 61 (U.S.A., Alaska).

Microlinyphia impigra; Van Helsdingen, 1969, Zool. Verh., 105: 19, 288, fig. 402-408 (functioning of genitalia; transferred to new genus).

Linyphia pusilla; Simon, 1929, Arachn. France, 6(3): fig. 987 (figure of epigyne of *impigra*!).

For a complete list of references up to 1939, see Bonnet (1957: 2507).

Types. — ♂ neotype of *Linyphia impigra*, from England, Bloxworth, designated by Locket (1964) (HDO). ♀ lectotype and 3 paralectotypes (1 ♂ 2 ♀) of *Linyphia maeklini*, by present designation, from the U.S.S.R., Ukraina, Dnepropetrovsk (MS). ♂ lectotype and ♀ paralectotype of *Linyphia cayuga*, by present designation, from U.S.A., New York, Ithaca, Cayuga Lake (MCZ).

Remarks. — The two sexes were described by Pickard-Cambridge (1871: 422, 423) under different names. Apparently he collected males and females together at the same locality, but was deceived by the considerable differences in colour of the abdomina of adult males and females. A few years later when collecting subadult specimens, which do not yet show sexual dimorphism, he was able to correct this error himself.

There is no difference between North American specimens of *cayuga* and the European *impigra*, as was already stated by Wiehle (1956: 331). I have seen the type-specimens of *L. cayuga*, and I agree with Wiehle's opinion. *Linyphia maeklini* Thorell is added as a synonym for the first time here. It is the easternmost and only Asiatic record of the species.

I have not recovered the original material of *Linyphia culta*. The ♀ holotype was examined by Jackson (1916: 164), and found to belong to *L. impigra*.

In my opinion, Simon's figure (1929: fig. 987) of the epigyne of *pusilla* in reality depicts *impigra*; the description of the epigyne of *impigra* is correct.

Male. — Measurements in mm. Total length 3.0-4.5; cephalothorax, length 1.45-2.2, width 0.95-1.35; abdomen, length 1.75-2.4, width 0.9-1.3, height 0.9-1.3; chelicerae, length 0.87-1.40, width 0.28-0.45.

Cephalothorax. — Yellow-brown to orange-brown, with grey median and sublateral bands; median band faint from posterior margin to fovea, diffuse and bifurcate on head, not quite reaching PME; submarginal bands diffuse from posterior margin to lateral constriction at border of head and thorax. Comparatively long and narrow, width 0.6-0.65 of length, width of head 0.55 of width of thorax. Posterior margin strongly excised, sides evenly rounded in anterior direction, smoothly passing into parallel sides of head; integument at border of head and thorax bent rather far in ventral and mesal direction between chelicerae and gnathocoxae. From side, dorsal line barely convex from posterior margin to eye-region; clypeus straight, sloping to front. Margins and striae with very short hairs, eye-region and clypeus with long hairs, directed forwards; head with three rows of short hairs behind PME and PLE.

Eyes. — Width of eye-region 0.5 of width of thorax. Both rows slightly recurved. Black tubercles of PME separated mesally, AME on a common black spot. Bases of lateral eyes black. Diameter of PME 0.07-0.08 mm, laterals of same size, diameter of AME about 0.7 of PME. PME separated from each other by 2.2-2.5 diams., from PLE by 1.7-1.9 diams., and from AME by 1.7-2.0 diams. of PME. AME separated by their own diameter. Height of clypeus 0.11-0.12 of length of cephalothorax.

Chelicerae. — Dark brown, suffused with black. Long and narrow, but only moderately diverging at apices; lateral sides moderately bulging on basal half, mesal sides evenly curved from base to apex. Posterior surface with large and conspicuous protrusion on mesal side of basal half, with small hairs on large warts. Dorsal surface and apical halves of ventral and lateral surfaces with short hairs, again on warts. Broken ridges on basal two-thirds of lateral surface conspicuous. Basal tubercle on latero-dorsal corner conspicuous, rather projecting. Dorsal row with four cheliceral teeth, equidistant, basal pair largest but rather small, apicals very small. Ventral row with four small teeth, equidistant and all of same size, smaller than basal pair but larger than apical pair of dorsal row, basal tooth opposite to third tooth of dorsal row.

Gnathocoxae. — Brown, lightly suffused with black, apices lighter; lateral margins straight and parallel, apices truncated perpendicularly. Labium wider than long, black-brown, anterior raised margin lighter. Sternum brown with blackish margins; width 0.8 of length, narrowly produced between coxae IV.

Legs. — Yellow-brown to light brown, often with an orange tinge. Length of femur I 0.9-1.0 times length cephalothorax; length of tibia I 12-14 diams. of segment. Measurements (of specimen from The Netherlands, Nieuwkoop) in mm:

	I	II	III	IV	palp
Fe	2.10	1.95	1.40	1.95	0.69
Pa	0.55	0.55	0.45	0.45	0.22
Ti	2.05	1.70	1.10	1.55	0.31
Mt	2.15	1.80	1.25	1.80	—
Ta	1.25	1.05	0.70	0.95	0.61

Chaetotaxy. — Fe I-II 1d, 2-3 l'; III d, 0-1 l'; IV d. Pa I-IV d''d'', basal spine weak.

Ti I-II v''_b d'' (v'v'') l'l'' d' [l'a'l''_av'a v''_a], l''-spine sometimes absent on II

III-IV d'' v' l' d' [l'a'l''_av'a v''_a]

Mt I-II d l'l''_a; III-IV d l' v v_a

Length of d''-spine on tibia I 0.19-0.25 mm, diameter of segment at base of d''-spine 0.10-0.16 mm, or tibia IV 0.25-0.30 mm and 0.10-0.14 mm, respectively. Tm I 0.18-0.21. Position of d''-spine on tibia I 0.22-0.25.

Abdomen. — Cylindriform with perpendicular posterior surface. Beige-coloured, evenly suffused with grey, usually without pattern, but some specimens have a dark median stripe on the anterior half and two or three pairs of dark spots posteriorly. Ventral surface always blackish. Two white transverse spots dorsally on one-fourth of length, and usually one pair of small white spots on posterior surface well above spinnerets; very small white spots may be present around spinnerets. Opercula and genital region light brown with grey suffusion.

Palp (fig. 43, 48). — Of same colour as legs, apical half of tibia and whole cymbium heavily suffused with black. Patella short, dorsal spine as long as segment. Tibia one and a half times as long as patella, and, when seen from side, as long as high at apex; anterior margin lightly incised dorso-laterally; one spine near incision and one lateral spine present, both as long as segment. Cymbium two times as long as tibia, often with a dorsal spine. Paracymbium U-shaped, distal arm half as long as proximal arm, tapering to a point. Proximal part of median apophysis (fig. 42, *ma*) as long as distal part, the latter with a lightly curved sharp tip. Embolus (fig. 45, 46, *e*) long, less conspicuous at the unexpanded palp than in *pusilla*; length 1.3-1.5 mm; embolic apophysis (fig. 45, 46, *ea*) comparatively heavy, cork-screw-shaped with two turns, tapering to a point. Terminal apophysis

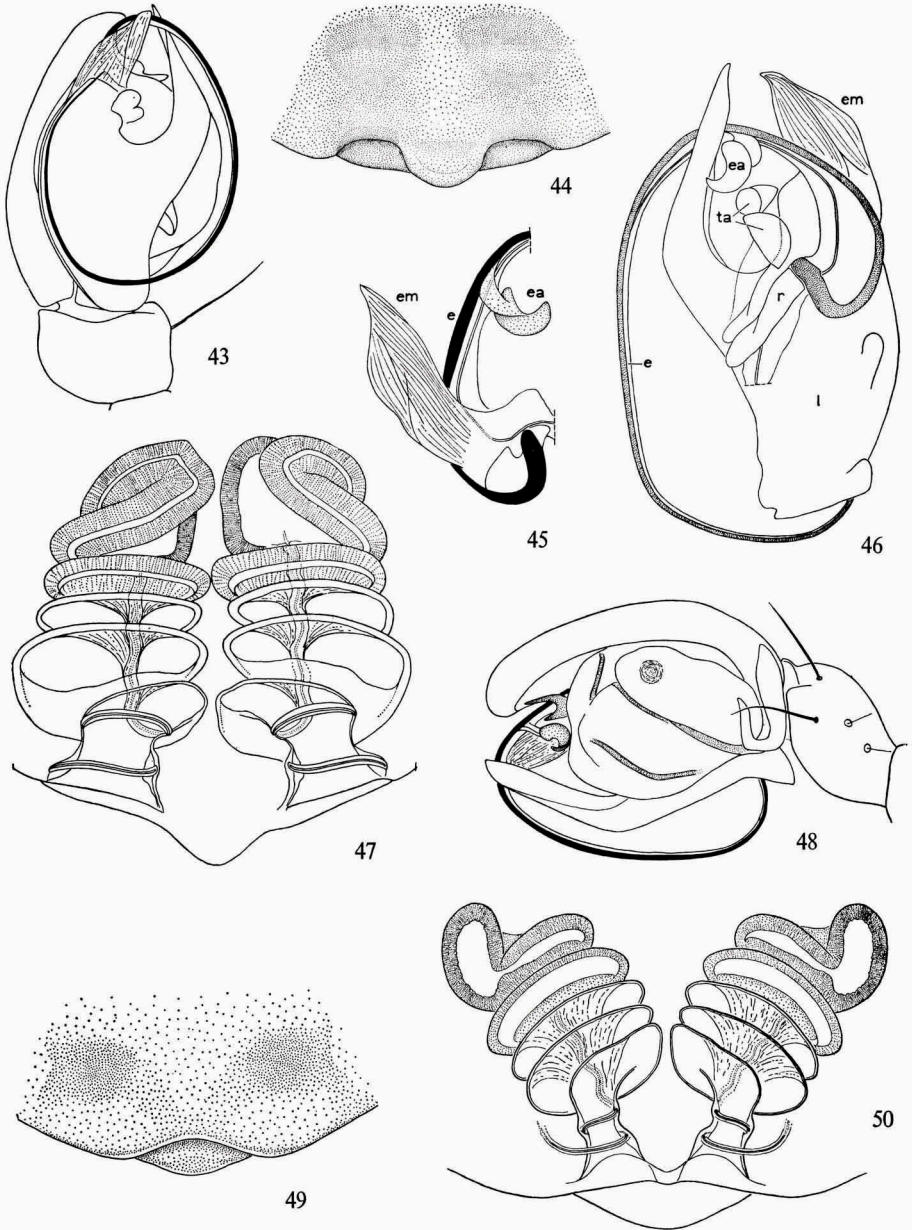


Fig. 43-48. *Microlinyphia impigra*. 43, male palp, ventral aspect; 44, epigyne; 45, base of embolus (*e*), with embolic apophysis (*ea*) and embolic membrane (*em*); 46, embolic section, with radix (*r*), embolus (*e*), embolic apophysis (*ea*), embolic membrane (*em*), terminal apophysis (*ta*), and lamella (*l*), dorsal aspect; 47, vulva, ventral aspect; 48, male palp, lateral aspect. Fig. 49-50. *M. aethiopica*. 49, epigyne; 50, vulva, ventral aspect. 43, 48, $\times 67$; 44-46, $\times 95$; 47, 50, $\times 177$; 49, $\times 100$.

(fig. 46, *ta*) very small, distal globular part with few hairs. Lamella (fig. 46, *l*) large, proximal tip truncate, mesal margin evenly curved towards rounded antero-mesal tip; lateral free projection long and narrow, bent inwards again on distal half, grooved on outside, protruding in front of antero-mesal tip of element, and reaching as far as sharp tip of embolic membrane (fig. 45, 46, *em*).

Female. — Measurements in mm. Total length 2.9-4.6; cephalothorax, length 1.45-1.8, width 1.0-1.4; abdomen, length 1.6-3.1, width 1.1-1.2, height 1.1-1.35; chelicerae, length 0.75-0.95, width 0.30-0.37.

Cephalothorax. — Light yellow-brown to light brown, head often darker; grey median stripe as in male. Margins suffused with grey or with some dark brown spots, most conspicuous at border of head and thorax. Median and lateral bands darker in Nearctic specimens, median band not or very faintly bifurcate. Width 0.7-0.8 of length, width of head 0.5-0.6 of width of thorax. Seen from side, dorsal line rising steeply from posterior margin to fovea, nearly horizontal on head. Hairs shorter than in male. Sizes of eyes as in male. PME separated from each other by 2.2-2.5 diams., from PLE by 1.5-1.8 diams., and from AME by 1.4 diams. of PME. Height of clypeus 0.08-0.10 of length of cephalothorax.

Chelicerae. — Yellow-brown or light brown. Not elongate as in male. Basal tubercle absent, protrusion on posterior surface less developed than in male. Four cheliceral teeth in dorsal row, equidistant, second and third teeth large, basal tooth half as large, apical tooth very small. Ventral row with three to five teeth, small and equidistant, basal tooth opposite to third dorsal tooth.

Legs. — Colour as in male, slightly longer. Length femur I 1.2-1.3 times length cephalothorax, length tibia I 11-12 diams. of segment. Measurements in mm (of specimen from The Netherlands, Nieuwkoop):

	I	II	III	IV
Fe	1.85	1.70	1.30	1.70
Pa	0.45	0.40	0.35	0.40
Ti	1.80	1.50	1.00	1.35
Mt	1.90	1.65	1.15	1.65
Ta	1.15	1.00	0.65	0.85

Chaetotaxy. — Fe I 1-2 d, 2-3 l'; II dl'; III-IV d. Patellae, tibiae, and metatarsi as in male, but tibiae I and II with an additional v'-spine near the l''-spine. Length of d''-spine on tibia I 0.26-0.30 mm, diameter of segment at base of d''-spine 0.15-0.19 mm; on tibia IV 0.30-0.34 mm and 0.14-0.16 mm, respectively. Tm I 0.20-0.23. Position of d''-spine on tibia I 0.20-0.25.

Abdomen. — Dorsal surface evenly curved, transition into steep posterior

surface distinct. Dorsal surface white with the exception of a narrow light brown mesal stripe from base to three-fourths of length. A white lateral band running around whole abdomen, bordered by a slightly less white region at dorsal margin. Ventral half of lateral surface and ventral surface light brown to black-brown with some white blotches ventrally, two pairs of which are bright and conspicuous, viz., one pair behind the epigastric furrow opposite to opercula, and one pair near the spinnerets; sometimes a white longitudinal streak present between these spots at either side. Posterior surface black-brown on lower half with some white spots near spinnerets. Opercula and spinnerets brown with grey suffusion.

Epigyne (fig. 44). — Small and inconspicuous, the two entrances separated by an obtuse triangular mesal part, which has the ventral surface lightly depressed. Entrances small.

Vulva (fig. 47). — Spiral tubes with about four coils to turning-points, the basal pair membranous, the apical pair chitinous. Fertilization ducts axially in columns of spiral tube, ending with a complete loop around entrances. Receptacula large. Width of epigyne in posterior view 0.29-0.32 mm, width of mesal part one-fourth of total width.

Geographical variation. — Apart from the minor differences in the pattern of the cephalothorax, as indicated above, specimens from Europe and America are remarkably alike.

Distribution and habitat. — Western and Central Europe and North America. In Europe it has been recorded from the British Isles, Sweden, Southern Finland (Lehtinen, 1964), Denmark, The Netherlands, Germany, the northern part of France, the Balkans, and the U.S.S.R. as far Tobolsk (68°E). In North America it has been found in Alaska and the State of New York.

It probably will be found in other countries also, when looked for in the right habitat. The species is locally abundant at marshy places, where it occurs between low plants, frequently in tussocks of sedge. The mating period falls in April and early May.

Material examined.

Netherlands. — 1 ♀ 1 ♂, Zuid-Holland, Nieuwkoopse Plassen, in tussocks of sedge, 20.vii.1959, P. J. van Helsdingen (ML); 1 ♀, do., 24.vii.1959 (ML); 1 ♀ 4 ♂, do., 19.iv.1961 (ML); 1 ♀, do., 29.iv.1961 (ML); 3 ♀, do., 14.viii.1962 (ML); 7 ♀ 10 ♂, do., 26.v.1963 (ML); 8 ♀, do., wet meadow, 26.iv.1968 (ML). 1 ♀ 2 ♂, Hoogmade, marshy area, 15.iv.1961, P. J. van Helsdingen (ML); 1 ♀, do., 5.v.1962 (ML); 9 ♀ 4 ♂, do., collected in subadult stage on 24.iii.1966, last moult before 31.iii.1968 (ML). 1 ♀ 4 ♂, Brielse Maas, between plants on bank, 5.iv.1959, P. J. van Helsdingen (ML). — 1 ♂, Limburg, Heerlen, 30.v.1963, P. J. van Helsdingen (ML).

British Isles. — 1 ♀ 1 ♂, Dorset, Bloxworth, 1863, O. Pickard-Cambridge (♂ neotype of *Linyphia impigra*; Locket, 1964; HDO).

U.S.S.R. — 3 ♀ 1 ♂ (palp only), Ukraina, Dnepropetrovsk (Jekaterinoslaw), A. von Nordmann (♀ lectotype and paralectotypes of *Linyphia maeklini* Thorell; MS).

Canada, Ontario. — 1 ♂, Toronto (AMNH). 2 ♀, Toronto, Grenadier Pond, 7.viii.1946, W. Ivie (ML).

U.S.A., New York. — 1 ♀ 1 ♂, Ithaca, 22.v.1911, J. H. Emerton (♂ lectotype and paralectotypes of *Linyphia cayuga* Emerton; MCZ).

Microlinyphia aethiopica (Tullgren) comb. nov.

(fig. 49-54)

Linyphia aethiopica Tullgren, 1910, Wissensch. Ergebn. schwed. zool. Exped. Kili-mandjaro, 3(20): 145, pl. 3 fig. 65a-c (p.p.; description ♀ ♂, Tanganyika).

Types. — ♀ lectotype and one ♀ paralectotype, by present designation, from Tanganyika, Meru (MS); four more paralectotypes, from Meru and the Kilimandjaro, do not agree with the description and figures, and appear to belong to *Microlinyphia sterilis*. Three more syntypes, including the only male, were not recovered and probably are lost.

Di Caporiacco's (1949: 353) record of the species was based on ten female and five male specimens from Kenya, which all were found to belong to *Microlinyphia sterilis* (Pavesi), and not to the present species.

Male. — Measurements in mm. Total length 3.55; cephalothorax, length 1.4, width 0.8; abdomen, length 2.05, width 0.7, height 0.8; chelicerae, length 0.70, width 0.27.

Cephalothorax. — Brown, heavily suffused with black. Posterior margin superficially excised, sides evenly rounded, barely constricted at border of head and thorax, and without triangular extensions of integument ventrally. Width 0.55 of length, width of head 0.65 of width of thorax. From side, dorsal line nearly straight from posterior margin to eye-region; clypeus straight. Eye-region and clypeus with short hairs, striae with very short hairs.

Eyes. — Eye-region as wide as head. Both rows nearly straight. PME on black tubercles, AME on a common black spot. Lateral eyes contiguous, with black base. Diameter of PME 0.09 mm, diameter of AME 0.08 mm, laterals as large as AME. PME separated from each other by 1.9 diams., from PLE by 1.1 diams., and from AME by 1.3 diams. of PME. AME separated by their own diameter. Height of clypeus 0.14 of length of cephalothorax.

Chelicerae. — Brown, heavily suffused with black, apices lighter. Lateral

surface moderately bulging on basal half, slightly diverging apically; mesal surface evenly curved to base of fang. Posterior surface with strong protrusion on second fourth, with short hairs on warts. Stridulating ridges not visible. Basal tubercle barely visible. Dorsal row with four teeth, second tooth largest, basal and third teeth half as large, apical tooth very small. Ventral row with four teeth, all very small and equidistant, basal tooth opposite to third tooth of dorsal row.

Gnathocoxae. — Brown, suffused with black, apices lighter; lateral margins converging to front. Labium black-brown, anterior margin narrowly raised and slightly lighter. Sternum black-brown; width 0.8 of length, narrowly produced between coxae IV.

Legs. — Uniformly light yellow-brown. Length of femur I 1.4 times cephalothorax, length of tibia I 21 diams. of segment. Measurements (of specimen from Kenya, Elgon) in mm:

	I	II	III	IV	palp
Fe	1.95	1.80	1.25	1.75	0.47
Pa	0.35	0.35	0.25	0.30	0.13
Ti	1.85	1.65	1.00	1.45	0.19
Mt	2.15	1.85	1.25	1.75	—
Ta	1.15	0.95	0.60	0.80	0.41

Chaetotaxy. — Fe I d l'; II-IV d. Pa I-IV d''d', basal spine half as long as apical one.

Ti I d'' l' l'' d' [l'a l'' a v' a v'' a]

II d'' l'' d' [l'a l'' a v' a v'' a]

III d'' d' [l'a l'' a v' a v'' a]

IV d'' l' d' [l'a l'' a v' a v'' a]

Mt I d l'; II and IV d; III d v v_a

Length of d''-spine on tibia I 0.16 mm, diameter of tibia I at base of d''-spine 0.09 mm; on tibia IV 0.29 mm and 0.08 mm, respectively. Tm I 0.19. Position of d''-spine on tibia I 0.22.

Abdomen. — Long and narrow, cylindrical. Pattern as in female but less distinct. Dorsal surface with a narrow black median stripe to half length, connected with black latero-dorsal bands anteriorly, tapering to a point behind; remainder of dorsal surface light brown with few small white blotches. Lateral surface with a light brown band with white blotches and spots, reaching posterior surface but separated there from band at other side by black area. Ventral surface blackish brown.

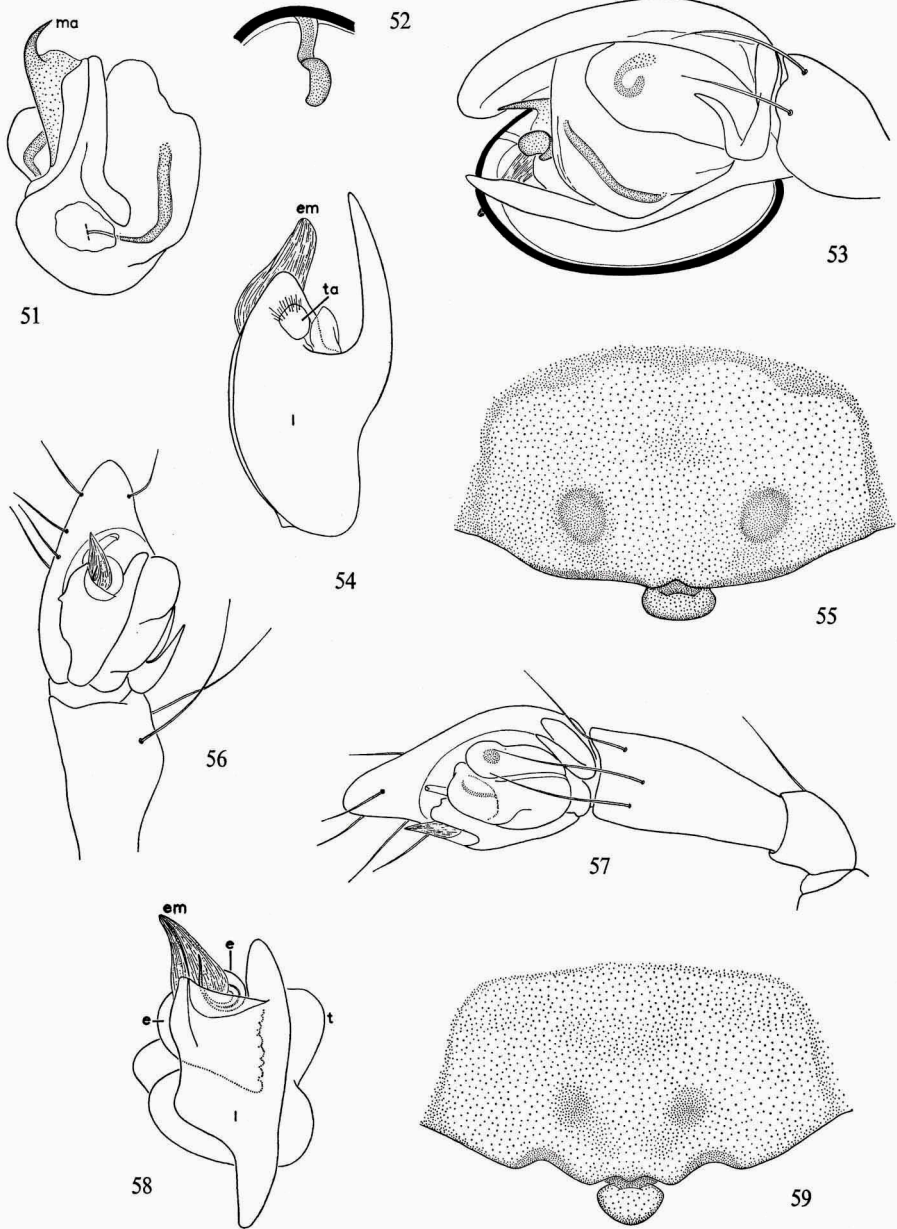


Fig. 51-54. *Microlinyphia aethiopica*. 51, tegular complex with median apophysis (*ma*), mesal aspect; 52, embolic apophysis; 53, male palp, lateral aspect; 54, lamella (*l*), with embolic membrane (*em*) and terminal apophysis (*ta*), ventral aspect. Fig. 55-59. *M. delesserti*. 55, epigyne; 56, male palp, ventral aspect; 57, do., lateral aspect; 58, ventral aspect of male palpal elements, showing lamella (*l*), embolus (*e*), embolic membrane (*em*), and tegulum (*t*); 59, epigyne of aberrant form. 51, 52, 54, $\times 100$; 53, 55, 59, $\times 95$; 56, 57, $\times 67$; 58, $\times 123$.

Palp (fig. 53). — All segments light yellow-brown, cymbium lightly suffused with black. Patella with a short dorsal spine. Tibia slightly longer than patella, anterior margin with a small excision latero-dorsally; two spines near anterior margin, both as long as segment, one near excision, one more lateral in position. Cymbium without spines, slightly more than two times as long as tibia. Paracymbium with pale and narrow distal arm tapering to a point, and curved in dorsal and anterior direction. Distal part of median apophysis (fig. 51, *ma*) with curved sharp tip. Embolus long and thread-like, 1.1 mm long, forming a loop at the unexpanded palp, but less conspicuous than in *pusilla* and *sterilis*. Embolic apophysis (fig. 52) corkscrew-shaped as usual, pigmented, apical part slightly heavier than basal stem. Lamella (fig. 54, *l*) relatively short and broad with rounded proximal tip, bluntly pointed antero-mesal tip, and rather straight free lateral projection. Terminal apophysis (fig. 54, *ta*) consisting of two parts, apical part globular with few short hairs.

Female. — Measurements in mm. Total length 3.8-4.2; cephalothorax, length 1.5-1.7, width 0.95-1.1; abdomen, length 2.3-2.6, width 1.15-1.5, height 1.05-1.4; chelicerae, length 0.75-0.82, width 0.31-0.35.

Cephalothorax. — Brown to dark brown, suffused with black, notably at margins and on posterior part of head; foveal region comparatively light. Posterior margin broadly and deeply excised, lateral constriction more distinct than in male. Width 0.6-0.7 of length, width of head 0.6 of width of thorax. Shortly haired, as male.

Eyes. — PME 0.10-0.11 mm, AME and lateral eyes smaller, their diameter measuring 0.07-0.08 mm. PME separated from each other by 1.8-2.2 diams., from PLE by 0.9-1.0 diam., and from AME 1.5 diams. of PME. AME separated by their own diameter. Height of clypeus 0.13-0.15 of length of cephalothorax.

Chelicerae. — Dark brown as cephalothorax, suffused with black. Posterior surface with low elevation. Basal tubercle not present. Very fine parallel ridges faintly visible on basal two-thirds of lateral surface. Dorsal row with four to five teeth, equidistant, basal and fourth teeth of same size, middle pair twice as large; apical tooth, if present, very small. Ventral row with four to five teeth, basal tooth as large as basal dorsal tooth and opposite to third dorsal tooth, gradually diminishing in size towards very small apical tooth, all equidistant.

Legs. — Uniformly light yellow-brown. Length of femur I 1.2-1.3 times length cephalothorax. Length of tibia I 13-14 diams. of segment. Measurements (of specimen from Kenya, Elgon) in mm:

	I	II	III	IV
Fe	1.90	1.75	1.30	1.80
Pa	0.40	0.40	0.35	0.35
Ti	1.75	1.50	1.00	1.40
Mt	1.95	1.75	1.20	1.70
Ta	1.05	0.90	0.60	0.75

Chaetotaxy. — Fe I d l'l'; II-III d; IV -. Pa I-IV d''d', basal spine weak and small.

Ti	I	v'' _b	d''	(v'v'')	l'	v'	l''	d'	[l'a ^{l''} _a v'a ^{v''} _a]
	II	v'' _b	d''	(v'v'')	v'	l''	d'	[l'a ^{l''} _a v'a ^{v''} _a]	
	III		d''		v'		d'	[l'a ^{l''} _a v'a ^{v''} _a]	
	IV		d''		l'	v'	d'	[l'a ^{l''} _a v'a ^{v''} _a]	

Mt I-II d l'l'' v v_a; III-IV d l' v v_a

Length of d''-spine on tibia I 0.26-0.36 mm, diameter of segment at base of d''-spine 0.12-0.15 mm; on tibia IV 0.34-0.36 mm and 0.11-0.13 mm, respectively. Tm I 0.21-0.23. Position of d''-spine on tibia I 0.29-0.31.

Abdomen. — Long and narrow, oblong in dorsal view; posterior surface oblique, transition of dorsal into posterior surface distinct but without postero-dorsal tubercle. Dorsal surface beige-coloured or light brown, sometimes with white blotches, surrounded by black-brown latero-dorsal bands, which fuse anteriorly and posteriorly; a narrow black-brown median line reaching half length of abdomen, tapering to a point there, connected with latero-dorsal bands anteriorly. Black chevrons sometimes visible on posterior half. Lateral surface black-brown with horizontal row of four white spots, second spot on half length, circular, the others oblong and horizontal, posterior spot reaching posterior surface. Ventral surface, including epigyne, opercula and spinnerets, uniformly black-brown.

Epigyne (fig. 49). — Small and inconspicuous. Posterior margin slightly concave mesally. A comparatively broad but short scape visible behind concave part. In posterior view two small and well separated entrances discernible.

Vulva (fig. 50). — Columns of spirally coiled tube diverging in anterior direction. Spiral tubes with three and a half coils between entrances and turning-points, last coil with thick and sclerotic wall, first coils membranous. Fertilization duct running backwards from receptaculum through axis of column, making one and a half loop around spiral tube near entrance before curving to dorsal side of vulva. Entrances narrowly separated mesally, lying ventrally of broad but short scape.

Distribution and habitat. — On mountains in Kenya and Tanganyika. All available specimens were collected in January and February.

Material examined.

Kenya. — 1 ♀ 1 ♂, S. side of Mt. Elgon, Kimilili River, 2400 m, 30.i.1965, Å. Holm (ZIU). 1 ♀, Cherangani Hills, Kipsait, 2940 m, 8.i.1965, Å. Holm (ZIU).

Tanganyika. — 2 ♀, Meru, rainforest, i.1907, Swedish Kilimandjaro Exped. (♀ lectotype and paralectotype of *Linyphia aethiopica* Tullgren; MS). 1 ♀, Kilimandjaro, upper border of forest, 2950 m, 16.ii.1956, P. Basilewski & N. Leleup (MT).

Microlinyphia delesserti (Di Caporiacco) comb. nov.

(fig. 55-64)

Linyphia delesserti Di Caporiacco, 1949, Comment. Pont. Acad. Scient., 13: 353 (new name for *L. sterilis* sensu De Lessert).

Linyphia sterilis; De Lessert, 1915, Rev. suisse Zool., 23: 10, pl. 1 fig. 6, 12, 18 (description ♀ ♂, Tanganyika).

Types. — ♀ lectotype, by present designation, from Tanganyika, Bukoba; 7 ♀ and 1 ♂ paralectotypes from same locality (MVG).

Remarks. — De Lessert (1915) mentioned some specimens of *Linyphia sterilis* Pavesi from Tanganyika, which he thought to agree sufficiently with Pavesi's description to assign them to that species. Di Caporiacco (1949), comparing the description of Pavesi with the figures and description of De Lessert and with new material from Central Africa, came to the conclusion that De Lessert's interpretation of *sterilis* was wrong, and that he obviously had described and depicted a different species. Di Caporiacco then proposed the new name *delesserti*.

M. delesserti deviates considerably from the other species of the genus. The male palp is small, and it lacks the long looped embolus. The embolus itself has no embolic apophysis. The epigyne is of slightly different shape, and the vulva, in either of the forms mentioned here, has but short tubes leading to the turning-points. The short ducts agree with the short embolus. The general structure of the genitalia, however, suggests a close affinity with the other species of *Microlinyphia*, though they certainly are comparatively simple. Some characteristic features of the male habitus, e.g., the comparatively long cephalothorax with ventral extensions on border of head and thorax, and the long backwards slanted chelicerae with the conspicuous posterior protrusion, support this view.

Male. — Measurements in mm. Total length 4.3-5.7; cephalothorax, length 1.8-2.15, width 1.1-1.25; abdomen, length 2.4-3.2, width 0.9-1.1, height 0.8-1.1; chelicerae, length 0.95-1.15, width 0.35-0.45.

Cephalothorax. — Brown, increasingly suffused with black towards margins, and with a narrow black border. Posterior margin cut off straight, not

excised; sides evenly curved, constriction at border of head and thorax slight. Ventral extensions of integument at border of head and thorax connected by a narrow strip of chitinous integument between chelicerae and gnathocoxae. Rather long and narrow, width 0.6 of length, width of head 0.6 of width of thorax. From side, dorsal line straight between posterior margin and eye-region; clypeus straight. Eye-region and clypeus shortly haired, striae and margins with very short hairs.

Eyes. — Eye-region occupying whole width of head. Both rows straight. PME on large black tubercles, which remain separated mesally. AME on a common black spot. Diameter of PME 0.12-0.14 mm, AME and lateral eyes smaller, measuring about 0.7 of diameter of PME. PME separated from each other by 1.6-1.8 diams., from PLE by 0.7-0.9 diams., and from AME by 1.1 diams. of PME. AME separated by their own diameter. Height of clypeus 0.11-0.13 of length cephalothorax.

Chelicerae. — Brown as cephalothorax, suffused with black on lateral surface, and on a dorsal streak from mesally at base to laterally at apex. Chelicerae as a whole barely diverging, lateral sides straight, posterior surface with prominent elevation on basal half. Mesal side slightly concave proximally of straight apical slant. Basal tubercle absent. Lateral surface bare on basal two-thirds, but without stridulating file, apical third and dorsal surface with short hairs on warts. Dorsal row with usually five, rarely six teeth with a large gap between third and fourth teeth, others equidistant. Basal tooth small, second and third twice as large, apical pair slightly smaller again. Ventral row with five small teeth, of same size as basal dorsal tooth, all equidistant, basal tooth opposite to third dorsal tooth or slightly more distally.

Gnathocoxae. — Brown, suffused with black; lateral margins straight, slightly converging to front, apices rounded. Labium black-brown, anterior raised margin lighter. Sternum brown, heavily suffused with black; width 0.75 of length, narrowly produced between coxae IV.

Legs. — Yellow-brown, lightly suffused with black; femora sometimes whitish yellow at apices, tibiae at bases and apices. Length of femur I 1.3 times length cephalothorax. Length of tibia I 15-17 diams. of segment. Measurements (of paralectotype) in mm :

	I	II	III	IV	palp
Fe	2.75	2.55	1.90	2.75	0.65
Pa	0.50	0.50	0.40	0.50	0.20
Ti	2.50	2.25	1.50	2.20	0.38
Mt	2.85	2.60	1.85	2.65	—
Ta	—	1.30	0.85	—	0.44

Chaetotaxy. — Fe I 2d, 3-4 l'; II 1d, 2-3 l'; III d, 2 l'; IV d l'. Pa I-IV d'' d', basal spine weak and short.

Ti I-II v''_b d'' (v'v'') l' v' l' d' [l'_al''_av'_av''_a]
 III-IV d'' l' v' d' [l'_al''_av'_av''_a]

Mt I-II d l' v; III-IV d l' v v_a

Length of d''-spine on tibia I 0.15-0.20 mm, diameter of segment at base of d''-spine 0.13-0.16 mm; on tibia IV 0.24 mm and 0.12-0.14 mm, respectively. Tm I 0.12. Position of d''-spine on tibia I 0.14-0.16.

Abdomen. — Long and slender, cylindrical. Dorsal surface with a few large light cream-coloured and ill-defined mesal spots on anterior two-thirds, which may bear some white blotches. Lateral surface with a row of three small light horizontal spots. Ventral surface with a narrow light transverse area behind epigastric furrow, and with a light area halfway between epigastric furrow and spinnerets. Remainder of abdomen blackish. Opercula, genital area and spinnerets light brown, suffused with black.

Palp (fig. 56, 57). — Femur and patella light yellow-brown, tibia and cymbium heavily suffused with black or completely black. Patella short, with apical spine near distal margin as long as segment. Tibia two times as long as patella and only slightly shorter than cymbium, slightly widening distally, and with a slight ventral elevation on distal half; dorsal apical spine short, ventral and ventro-lateral spines, of which five may be present, much longer than dorsal spine and nearly as long as segment. Cymbium with dorsal spine, and with some spines along mesal and apical margins, all spines short and stout. Paracymbium V-shaped, distal arm slightly shorter than proximal arm, tapering to a point. Median apophysis (fig. 62, *ma*) short and broad; proximal part of usual form; distal part with curved appendage projecting from base of proximal part, appendage thus not reaching as far as tip of proximal part. Embolus (fig. 58, 63, *e*) much shorter than in other species of the genus; attached by broad base to radix (fig. 63, *r*) and lamella, gradually narrowing towards thread-like tip and strongly curved; embolic apophysis absent. Lamella (fig. 58, 63, *l*) narrow at proximal tip, broad in the middle, ending distally with blunt lateral projection and nearly straight anterior margin at mesal side. Embolic membrane (fig. 58, 63, *em*) attached to antero-mesal corner of element, mesal margin without ventral raised brim as in other species of the genus; membrane protruding in front of lateral tip of lamella, broad at base, tapering to a point.

Female. — Measurements in mm. Total length 3.0-4.5; cephalothorax, length 1.45-1.75, width 0.9-1.2; abdomen, length 1.7-2.9, width 1.2-1.6, height 1.0-1.5; chelicerae, length 0.70-0.82, width 0.30-0.35.

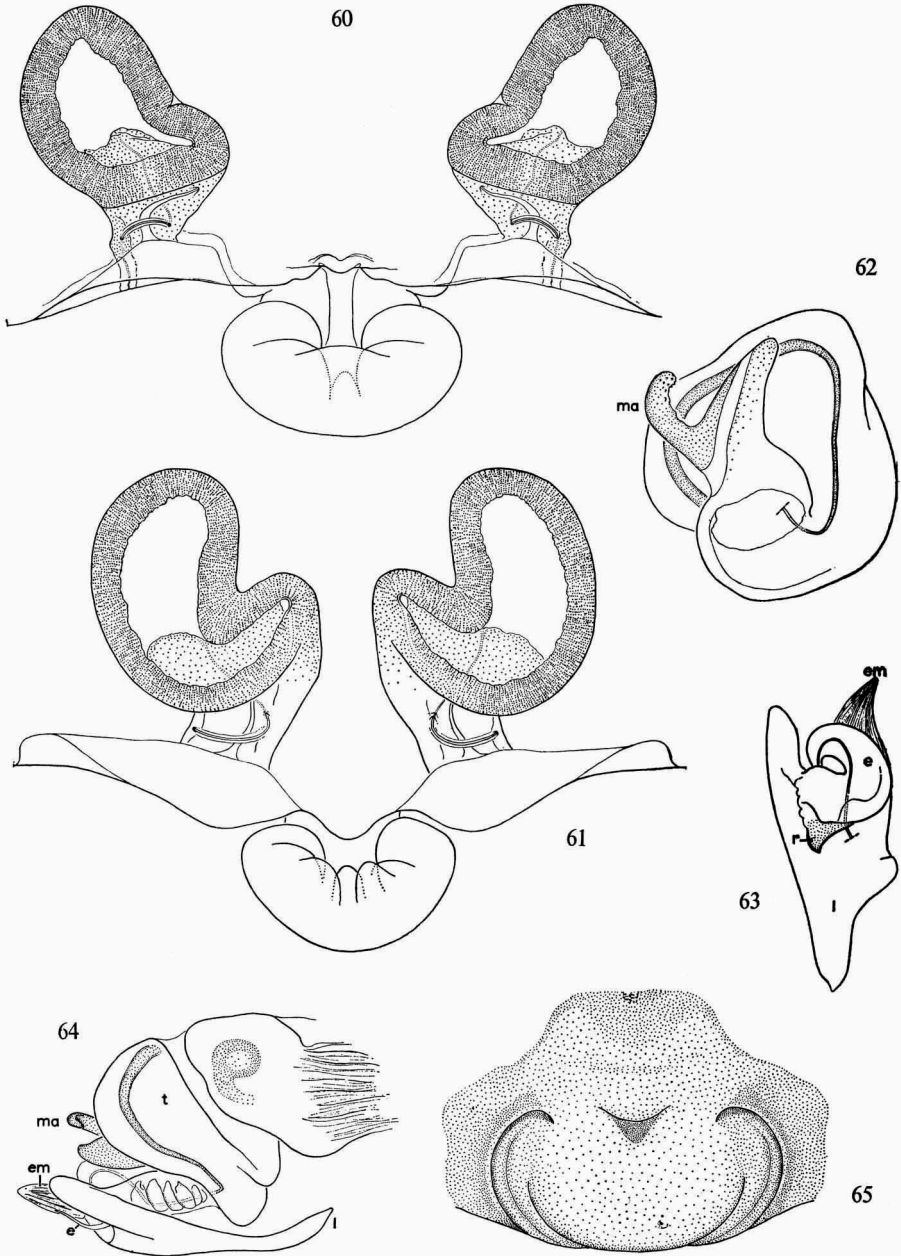


Fig. 60-64. *Microlinyphia delesserti*. 60, vulva, ventral aspect; 61, vulva of aberrant form, ventral aspect; 62, tegular complex with median apophysis (*ma*), mesal aspect; 63, embolic section, with radix (*r*), embolus (*e*), embolic membrane (*em*), and lamella (*l*), dorsal aspect; 64, elements of male palp, lateral aspect, showing tegulum (*t*), median apophysis (*ma*), lamella (*l*), embolus (*e*), and embolic membrane (*em*). Fig. 65. *Frontinellina frutetorum*, epigyne. 60, 61, $\times 308$; 62, $\times 162$; 63, 64, $\times 123$; 65, $\times 95$.

Cephalothorax. — Yellow-brown to brown, suffused with black as in male. Posterior margin very lightly excised. Seen from side, dorsal line and clypeus straight. Hairs on head slightly shorter than in male. Both rows of eyes slightly recurved. Diameter of PME 0.11-0.13 mm, lateral eyes slightly smaller, diameter of AME 0.6 of diam. of PME. PME separated from each other by 1.7-2.0 diams., from PLE by 0.7-0.8 diam., and from AME by 1.3 diams. of PME. Height of clypeus 0.11-0.13 of length cephalothorax, as in male.

Chelicerae. — Colour as cephalothorax, with black suffusion as in male. Elevation on posterior surface slight. Stridulating file not visible. Dorsal row of cheliceral teeth numbering four to five, basal tooth small, second and third teeth twice as large, fourth as large as basal tooth, fifth, if present, very small; interstice of third and fourth teeth two times as large as other interstices. Ventral row with five to six small teeth, fifth close to fourth, others equidistant.

Legs. — Light yellow-brown, lightly suffused with black; tibiae darker in the middle than at apices and bases. Length of femur I 1.2-1.3 times length cephalothorax. Length of tibia I 12-14 diams. of segment. Measurements (of lectotype) in mm:

	I	II	III	IV
Fe	2.10	1.90	1.50	2.05
Pa	0.45	0.45	0.38	0.40
Ti	1.95	1.70	1.20	1.70
Mt	2.10	1.90	1.40	1.95
Ta	1.25	1.10	0.75	0.95

Chaetotaxy. — Fe I d, 1-4 l'; II d, 1-2 l'; III-IV d. Pa I-IV d'' d', basal spine short and weak. Spines on tibiae and metatarsi as in male. Length of d''-spine on tibia I 0.19-0.22 mm, diameter of segment at base of d''-spine 0.14-0.15 mm; on tibia IV 0.15-0.25 mm and 0.12-0.13 mm, respectively. Tm I 0.13-0.15. Position of d''-spine on tibia I 0.23-0.26.

Abdomen. — Oblong in dorsal view; seen from side, dorsal surface only slightly curved and nearly parallel with ventral surface; posterior surface perpendicular or with a postero-dorsal tubercle. Dorsal surface with beige-coloured central area, about as wide as abdomen and reaching from base to black postero-dorsal tubercle; two or three pairs of grey or black spots on posterior two-thirds, usually connected with each other by black suffusion and forming longitudinal streaks, always lighter than black lateral markings. Lateral surface with a row of four light spots, which usually bear some white blotches; anterior spot connected with light ventral area behind epigastric furrow; second and third spot rather squarish, second spot

may be connected and third spot nearly always connected with light dorsal area; posterior spot small, laterally on posterior surface. Remainder of lateral surface black. Ventral surface, opercula included, beige-coloured, suffused with black, lighter than lateral black areas; a narrow light area present behind the epigastric furrow, posterior half also lighter, but spinnerets bordered by black. Posterior surface black. Spinnerets and epigyne light brown, suffused with black.

Epigyne (fig. 55). — Mesal knob-like scape protruding behind posterior margin of slightly swollen genital area, separating the two small openings, which are visible in posterior view. Receptacula visible as two widely separated brown spots, not far in front of posterior margin.

Vulva (fig. 60). — Entrances of short ducts on either side of knob-like scape separated by one and a half times width of scape. Tubes curving inwards directly behind entrances towards turning-points, which lie meso-dorsally. Receptacula large. Fertilization ducts equally short, making half a loop around entrances of tubes before curving in dorsal direction. Turning-points separated mesally by a distance, which is nearly as wide as scape. Posterior margin nearly straight, only slightly excised near the two entrances and mesally. Scape deeply excavated mesally. Maximum width of vulva 0.25-0.28 mm.

Aberrant specimen from East Congo (fig. 59, 61). — I have seen one female specimen from Kivu (Uvira, Mulenge, 1950 m, 4.ix.1951, N. Leleup), which differs from the other specimens in the following respects.

The cephalothorax yellow-brown with blackish posterior and lateral margins as far as the PME, broader than in the specimens from Tanganyika and Uganda. Eye-region heavily suffused with black. The chelicerae, on the contrary, light brown without the dark streaks described above. Colour of legs as in other specimens, femur I 1.4 times as long as cephalothorax. Spines arranged as usual, but slightly longer; length of d''-spine on tibia I 0.31 mm.

Shape of the abdomen slightly different. When seen from side, dorsal line declining from highest point on one-third of length towards small postero-dorsal tubercle, which lies close above the spinnerets. Dorsal spots on posterior half connected lengthwise and across. Lateral white spots smaller, middle pair fused, posterior pair very small. Ventral surface uniformly grey, without the lighter area behind the epigastric furrow, but as a whole lighter than lateral surface. Posterior margin of epigyne (fig. 59) more sinuate and more protruding in posterior direction. Entrances of tubes (fig. 61) separated by the width of the scape. The two columns of tube,

receptacula, and turning-points, much closer together, the distance between the turning-points only as wide as a quarter of the width of the scape. The greatest width of the vulva measures 0.22 mm.

Distribution. — Uganda, Tanganyika, East Congo-Kinshasa.

Material examined.

Tanganyika. — 8 ♀ 1 ♂, Karagwe, Bukoba, 1908, J. Carl (*L. sterilis*; De Lessert, 1915; ♀ lectotype and paralectotypes of *Linyphia delesserti* Di Caporiacco; MVG).

Uganda. — 2 ♀ 1 ♂, Entebbe, on shrubs in shadow, 1200 m, 26.ii.1938, Å. Holm (ZIU); 2 ♀ 3 ♂ 1 juvenile, do., Botanical Garden, sifted from leaf-litter below cacao-tree (1 ♀ 1 ♂ ML, others ZIU).

Congo-Kinshasa. — 1 ♀, Kivu, Uvira, Mulenge, 1950 m, 4.ix.1951, N. Leleup (aberrant ♀; MT).

Frontinellina Van Helsdingen

Frontinellina Van Helsdingen, 1969, Zool. Verh., 105: 284. Type-species: *Linyphia frutetorum* C. L. Koch, 1834, Faun. Ins. Germaniae init., 127: pl. 19-20.

The type-species of this genus has remained within *Linyphia* ever since its description. It was tentatively placed in the *Microlinyphia* group by Wiehle (1956: 324) because of the long embolus, but the other characters failed to contribute to the homogeneity of the group. Detailed analysis of the genital organs and other parts showed *frutetorum* to be different from the *Microlinyphia* species in a number of important characters. For that reason I proposed (1969) a new genus, to which now a second species, *Frontinellina locketi* from Natal, can be assigned. A third species is included provisionally.

Frontinellina frutetorum (C. L. Koch), and in a less degree *F. locketi*, show a marked resemblance to some species of the Nearctic genus *Frontinella*. The two genera have many characters in common, e.g. the spineless femora, the fine stridulating-files, and the abdominal pattern. The resemblance of the webs of *Frontinella pyramitela* (Walckenaer) and *Frontinellina frutetorum* is very striking too. The webs of these two species are saucer-shaped, while a second sheet lies at some distance below it. The spider hangs below the upper web. Photographs of the web of *Frontinella pyramitela* have been given by Emerton (1902: fig. 322) and Comstock (1913: fig. 400), and so much do they agree with the web of *Frontinellina frutetorum* that they might have been taken from this species. The structure of the web is distinctly different from those of *Neriene*, *Linyphia*, or *Microlinyphia*.

The genitalia are different, very complex in *frutetorum*, very simple in *pyramitela*. The males of *Frontinella laeta* (O. Pickard-Cambridge), the type-species of *Frontinella*, and of *F. pyramitela* (Walckenaer) have the dorsal spine of the palpal patella modified into a heavy and conspicuously

bent spine (*laeta*) or into a short conical spine (*pyramitela*). However, they are of similar basic structure, and might represent the extremes of a series of species which may be hidden among the many Linyphiids from Central America described in *Linyphia* or *Frontinella*. As long as these hypothetical species are unknown the discontinuity between Old and New World species remains considerable. From the above remarks it may be clear that I consider the genus closely related to *Frontinella*.

Description. — Animals of medium size (3-6 mm). PME not on black tubercles, slightly closer to each other than to PLE. Lateral eyes contiguous. AME smaller and close together. Chelicerae of male not elongate and not slanting backwards (cf. *Microlinyphia*), as short and broad as in female. Both rows with 3-5 teeth. Posterior surface with low protrusion on proximal half (cf. *Microlinyphia*).

Legs long and slender, notably in male; ratio length to width of tibia I 10 or more. Femora never with spines; tibiae with dorsal, ventral, and lateral spines, but only dorsal spines present in the small specimen of *loketi*. Metatarsi with or without spines. Tm I 0.19-0.26. Metatarsus IV without trichobothrium. Leg II about as long as leg IV, leg I slightly longer. Abdomen rather squarish in lateral view.

Male palp. — Tibia with one dorsal spine, normal hairs rather long, additional spines or spinehairs never present. Cymbium with narrow tip. Paracymbium about as high as long, without distinct arms. Tegular complex comparatively small. Median apophysis of tegular complex a small rounded lobe on mesal surface. Radix long, with rounded proximal tip and slender distal end, the latter slightly hook-shaped. Rest of elements implanted on a central bladder-like structure. Embolus very long, ribbon-shaped, coiled in long turns along palp, and visible from all sides. Lamella a long and flat element, with a conspicuously sickle-shaped free distal part. Two membraneous twisted terminal appendages, possibly the homologues of embolic membrane and terminal apophysis.

Epigyne. — A flat or bulging mesal area with narrow slit-like entrances. Scape not present; small semi-covered depression medially. Vulva with two columns of membraneous tube between entrances and turning-points. Thick-walled duct between turning-point and receptaculum short, but very long in *loketi*, coiled in reversed direction. Fertilization duct running axially through column of spirally coiled tube, curving along ventral side of slit-like entrance, and ending on dorsal side of vulva.

Distribution and habitat. — Europe, Mediterranean region, and South Africa. Web of very characteristic shape, consisting of a saucer-shaped

upper web, below which the spider hangs, and a parallel lower sheet. The webs are built on trees, shrubs, and plants in open country, not in woods. (Observations based on *frutetorum* only).

Key to the species (*dearmata* not included)

1. Larger than 3.5 mm. At least tibia I with a 1' and a 1''-spine. Abdomen of female with a median dorsal band, bordered by white latero-dorsal areas. Male palp (fig. 69, 72): lamella (*l*) large and sickle-shaped, distal tip of radix (*r*) hook-shaped. Epigyne (fig. 65): a semi-spherical smooth protuberance; vulva (fig. 66) with about 5 coils of membraneous tube between entrances and turning-points. — Europe and Mediterranean region *frutetorum* C. L. Koch, p. 70
- Smaller than 3.0 mm. Tibiae with dorsal spines only, the apical one hair-like and difficult to see. Abdomen of female black, with four pairs of light spots on posterior half. Epigyne (fig. 74): not bulging; vulva (fig. 73) with a very large number of coils of membraneous tube; 6 coils of chitinous tube in reversed direction between turning-points and receptacula, coiled around the latter. Male unknown. — South Africa *loketi* spec. nov., p. 77

Frontinellina frutetorum (C. L. Koch)

(fig. 65-72)

Linyphia frutetorum C. L. Koch, 1834, Faun. Ins. Germaniae init., 127; pl. 19-20 (description of ♀ ♂, Germany). — Kulczyński, 1894, Math. naturw. Ber. Ungarn, 12: 330 (var. *punctiventris*, Hungary). — Simon, 1929, Arachn. France, 6(3): 630, 744, fig. 959-961 (key); nominate form and var. *occidentalis*, France). — Giltay, 1932, Bull. Mus. R. Hist. nat. Belgique, 8(22): 24, fig. 17 (var. *niger*, Greece). — Wiehle, 1956, Tierw. Deutschl., 44: 324, fig. 534-539 (key, Germany). — Lehtinen, 1964, Ann. Zool. Fennici, 1: 305 (Southern Finland).

Frontinellina frutetorum; Van Helsdingen, 1969, Zool. Verh., 105: 286 (transferred to new genus).

Linyphia quadrata Wider, 1834, Mus. Senckenb., 1: 244, pl. 17 fig. 3 (Germany). — Walckenaer, 1841, Hist. nat. Ins., Aptères, 2: 249 (= *Linyphia frutetorum* C. L. Koch). — Strand, 1916, Arch. Naturg., 81 A (9): 7 (re-examination of type-material).

Linyphia fastuosa Lucas, 1846, Explor. scient. Algérie, Zool., 1: 255 (description ♀, Algeria); do., 4: pl. 16 fig. 1 (habitus). — Simon, 1884, Arachn. France, 5(2): 239 (= *Linyphia frutetorum* C. L. Koch).

For a complete list of references up to 1939, see Bonnet (1957: 2502).

Types. — ♀ lectotype and 8 paralectotypes of *Linyphia quadrata* Wider, by present designation, from Germany, Odenwald (SMF).

Remarks. — Three different varieties have been described, which in my opinion do not have any subspecific value. They may be looked upon as a demonstration of the considerable variability in coloration of the species. Kulczyński's variety *punctiventris* (1894: 330) has white ventral spots on the abdomen, and would be smaller than the nominate form. I have examined a large series of *punctiventris* from Kulczynski's collection at the Hungarian Natural History Museum, but the specimens do not differ in size from the nominate form, while only one female had a pair of clear white ventral spots

on the abdomen. White spots of this kind are frequently found in *frutetorum*. The variety *occidentalis* of Simon (1929: 630) was described from a few light specimens from France, which have the dark dorsal band of the abdomen adorned with small white blotches. These small white spots usually are present in small numbers. In Simon's specimens the dorsal band is very light in consequence, but the outline is still distinctly recognizable. The variety *niger* of Giltay (1932: 24) was based on a single male from Greece, which is heavily suffused with black on all parts, a condition not rare among males of this species. As the three colour varieties mentioned are not restricted to definite areas or regions, but are known from the whole range of the species, they are thought to have no taxonomic value.

Male. — Measurements in mm. Total length 3.5-5.0; cephalothorax 1.8-2.4, width 1.2-1.55; abdomen, length 1.9-2.7, width 1.2-1.5, height 1.1-1.5; chelicerae, length 0.85-1.1, width 0.35-0.50.

Cephalothorax. — Orange-brown, faintly suffused with black, and with narrow grey lateral margins. Posterior margin barely excised, nearly straight, sides evenly rounded, with a very slight constriction at border of head and thorax. Width 0.6-0.7 of length, width of head 0.6 of width of thorax. Seen from side, rising evenly from posterior margin to fovea, rising very slightly from fovea to eye-region, reaching highest point just behind PME; clypeus straight. Striae with very short hairs; head with longer hairs on rows behind PLE and PME, at eye-region, and on upper half of clypeus; some spine-hairs behind PLE.

Eyes. — Eye-region narrower than head, only 0.45 of width of thorax. Both rows very lightly recurved. PME with narrow black rings. Diameter of PME 0.08-0.10 mm, laterals of about same size, AME slightly smaller. PME separated from each other by 1.0-1.1 diam., from PLE by 1.1-1.3 diams., and from AME by 1.4-1.5 diams. of PME. AME separated by slightly less than their own diameter. Height of clypeus 0.17-0.18 of length of cephalothorax.

Chelicerae. — Brown, suffused with black, apices blackish. Mesal sides close together for three-fourths of length before curving outwards; lateral sides slightly bulging on basal two-thirds, slightly diverging on apical third. Basal tubercle present on latero-dorsal surface, small but rather prominent. Stridulating file present on basal two-thirds of lateral surface, consisting of fine parallel ridges. Dorsal row with three to five cheliceral teeth; basal pair at end of straight mesal side, second tooth twice as large as basal one; third tooth, and others if present, small and wart-like in a curved row to base of fang, third tooth often fused with second one at base. Ventral row

with three to four equidistant teeth, gradually diminishing in size from basal tooth, which is as large as basal dorsal tooth, towards very small apical tooth; basal tooth opposite to third tooth of dorsal row.

Gnathocoxae. — Orange-brown, suffused with black, apices lighter; lateral sides nearly parallel. Labium blackish brown, anterior margin raised; slightly broader than long. Sternum orange-brown, heavily suffused with black; width 0.85 of length, narrowly produced between coxae IV.

Legs. — Coxae orange-brown. Femora orange-brown at bases, fading into yellow-brown with greenish tinge. Other segments light brown, tips of tarsi blackish-brown, without annulations. Legs rather slender; length of femur I about 1.1-1.3 times length cephalothorax; length of tibia I 15-16 diams. of segment. Measurements (of specimen from Italy, Lago di Ledro) in mm:

	I	II	III	IV	palp
Fe	2.65	2.40	1.75	2.60	0.87
Pa	0.60	0.55	0.50	0.55	0.23
Ti	2.75	2.25	1.30	2.05	0.26
Mt	3.00	2.45	1.65	2.65	—
Ta	1.45	1.20	0.75	1.05	0.87

Chaetotaxy. — Femora spineless. Pa I-IV $d''d'$, basal spine weaker than apical one.

Ti I $d'' v'' l' l'' d'$ [$l'_a l''_a v'_a v''_a$]

II $d'' v'' l' l'' d'$ [$l'_a l''_a v'_a v''_a$]

III-IV $d'' v'' l' l'' d'$ [$l'_a l''_a v'_a v''_a$]

Mt I-II spineless; III-IV $d l' v v_a$

Length of d'' -spine on tibia I 0.25-0.27 mm, diameter of segment at base of d'' -spine 0.15-0.17 mm; on tibia IV 0.29-0.31 mm and 0.12-0.16 mm, respectively. Apical spines on tibiae often hair-like. Tm I 0.19-0.23. Position of d'' -spine on tibia I 0.18-0.22.

Abdomen. — Cylindriform, rounded posteriorly and protruding above spinnerets. Dorsal surface beige-coloured with faint and irregular blackish pattern, resembling pattern of female, and with small white blotches faintly visible below black suffusion. In lighter specimens dorsal surface completely beige-coloured. Border of posterior and dorsal surfaces with white cross-band, usually uninterrupted, curving in ventral direction at sides. Posterior surface black, a few white blotches often present above spinnerets. Ventral surface black, with brown opercula and black spinnerets. A pair of light spots or white blotches often present behind epigastric furrow opposite to opercula.

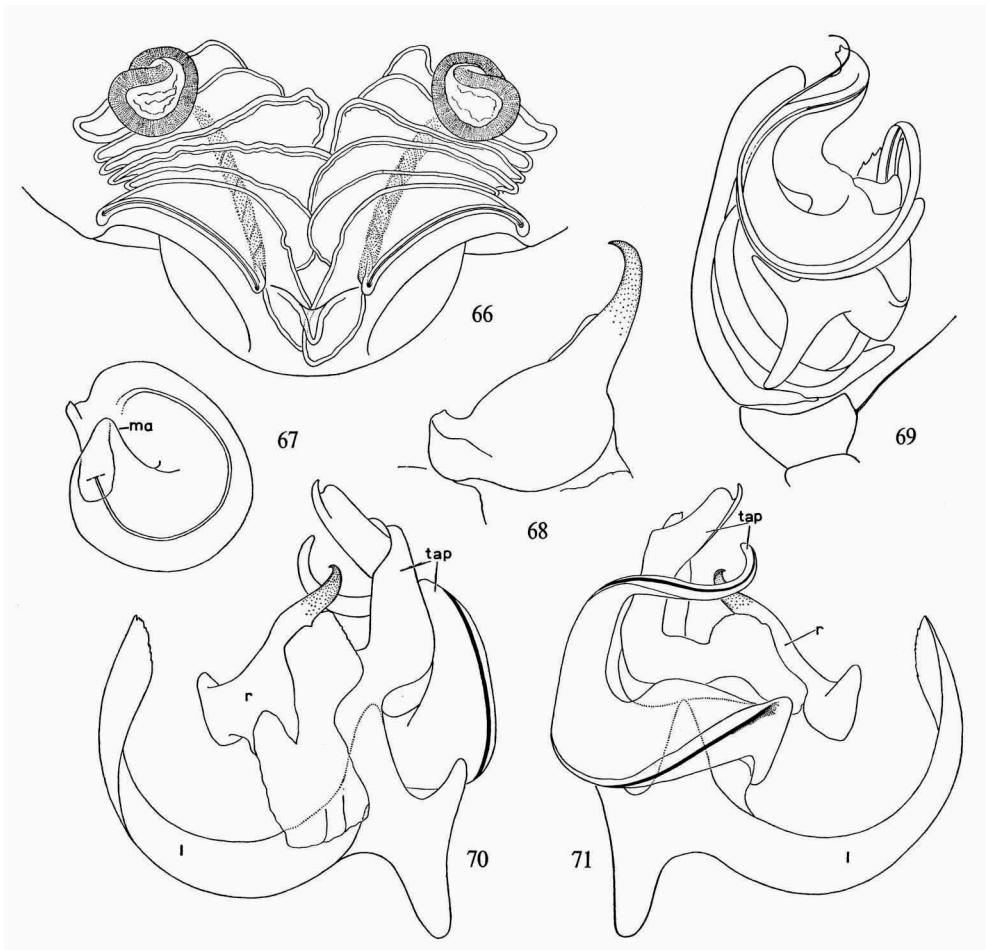


Fig. 66-71. *Frontinellina frutetorum*. 66, vulva, ventral aspect; 67, tegular complex with median apophysis (*ma*), mesal aspect; 68, radix, latero-dorsal aspect; 69, male palp, ventral aspect; 70, embolic section of male palp, with radix (*r*), lamella (*l*), and terminal appendages (*tap*), dorsal aspect; 71, do., ventral aspect. 66, $\times 123$; 67, 69, $\times 49$; 68, $\times 95$; 70, 71, $\times 67$.

Palp (fig. 69, 72). — Segments orange-brown, cymbium nearly black. Femur slightly fusiform, spineless. Patella short, with dorsal apical spine one and a half times as long as segment. Tibia higher than long as seen from side with dorsal spine as long as height of segment. Tibia and cymbium with long hairs. Cymbium tapering to a narrow distal tip. Paracymbium a large and broad sclerite, with nearly parallel dorsal and ventral margins; distal margin emarginate, forming a dorsal and a ventral rounded tip; dorsal half with long hairs. Tegulum (fig. 67) disk-shaped, with short blunt median

apophysis (*ma*) laterally on distal surface, at the base of which the spermiduct leaves the tegulum and goes directly to the embolus; a small blunt tooth, pointing in same direction as median apophysis, situated at dorsal margin of distal surface. Radix (fig. 68, 70, 71, *r*) broadly connected with median apophysis by membrane, proximal and ventral tip bluntly rounded, curving in dorsal and apical direction distally, tapering to a narrow curved tip. Embolus very long, lying in long coils and bends around tegulum and other elements, visible at the unexpanded palp (fig. 69, 72) from all sides, element ribbon-like at base and gradually becoming thread-like towards tip, attached by short rod-like base to central terminal bladder. Lamella (fig. 70, 71, *l*) large, with three short arms and one long curved arm; proximal arm with rounded tip, situated basally at mesal side of the unexpanded palp; two short arms at mesal side, one free, the other attached by means of the central terminal bladder to radix, embolus, and terminal appendages; the long and free curved arm visible as a semi-circular element in lateral view, curving in dorsal and apical direction, its distal part folded, forming a sheath through which the embolus passes with one of its coils; tip of latter arm serrate. Two terminal appendages (fig. 70, 71, *tap*) present, a lateral and a mesal one, both membraneous with swollen bases, implanted on the central terminal bladder, twisted parallel with each other in the unexpanded palp, tips folded together and concealing tip of embolus; lateral appendage with broad squarish base, marked by a black seam from base to tip; mesal appendage broadly connected with radix at base, slightly shorter than lateral appendage, tip folded and forming a sheath.

Female. — Measurements in mm. Total length 3.6-5.6; cephalothorax, length 1.5-1.9, width 1.05-1.35; abdomen, length 2.1-3.8, width 1.4-2.5, height 1.5-3.0; chelicerae, length 0.77-0.98, width 0.35-0.44.

Cephalothorax. — Yellow-brown to brown, with light orange tinge only (cf. male), and with narrow grey lateral margins. Posterior margin moderately excised, shape otherwise as in male. Hairs shorter, but some spine-hairs present behind PLE. PME slightly nearer to each other, separated by 0.7-0.9 of their own diameter.

Chelicerae. — Colour as cephalothorax, blackish at tips. Basal tubercle absent, stridulating file with fine parallel ridges. Five equidistant teeth dorsally, basal tooth small, second tooth twice as large, then gradually diminishing in size towards very small apical tooth. Five teeth in ventral row, apical pair very small and close together, others more widely spaced and as large as basal dorsal tooth. Basal tooth opposite to third tooth of dorsal row.

Legs. — Coxae orange-brown, other segments light brown or yellow-brown, femora often with a greenish tinge, tarsi darkened. Length of femur I 1.2-1.3 times length cephalothorax, length of tibia I 10-11 diams. of segment. Measurements in mm (of specimen from Italy, Lago di Ledro):

	I	II	III	IV
Fe	2.15	1.85	1.35	1.95
Pa	0.50	0.50	0.45	0.45
Ti	2.10	1.60	0.95	1.45
Mt	2.00	1.70	1.10	1.85
Ta	1.25	0.95	0.65	0.85

Chaetotaxy. — Tibiae with spines as in males, metatarsi III and IV with fewer spines. Length of d''-spine on tibia I 0.34-0.38 mm, diameter of segment at base of d''-spine 0.19-0.21 mm; on tibia IV 0.44-0.46 mm and 0.16-0.20 mm, respectively. Tm I 0.18-0.23. Position of d''-spine on tibia I 0.18-0.20.

Abdomen. — Rather high and broad, with straight posterior surface, and with parallel dorsal and ventral surfaces. Median dorsal band about half as wide as abdomen, narrow anteriorly, margins sinuate, truncated posteriorly at transition of dorsal into posterior surface, posterior corners drawn out in lateral direction; band beige-coloured with white blotches in varying density, black suffusion present on anterior and posterior parts and along margins. Posterior surface black, separated from dorsal band by narrow white transverse band; a short white transverse bar present close to spinnerets. Dorso-lateral bands white. Lateral surface white, with a black streak from above operculum to half length of abdomen, posterior half with faint grey vertical streaks. Ventral surface black, often with a pair of light or white spots behind the epigastric furrow opposite to opercula. Opercula brown, spinnerets blackish.

Epigyne (fig. 65). — Protruding ventrally and in posterior direction as a rounded projection, with a pair of curved slit-like entrances which curve in mesal direction posteriorly. Surface smooth, light brown or cream-coloured between slits. There is a small semi-covered depression mesally between ventral tips of slit-like entrances.

Vulva (fig. 66). — About four and a half coils of membranous spiral tube between slit-like entrances and turning-points, which lie laterally or ventrally of receptacula. First coils orientated obliquely, mesal side of coils reaching into tip of mesal projection. Receptacula large and globular. Fertilization ducts running backwards through axis, slightly twisted, posteriorly curving along lateral side of entrances to dorsal wall.

Distribution and habitat. — A European and Mediterranean species, which reaches as far north as Belgium, Germany, South Russia, and, surprisingly enough, Southern Finland (Lehtinen, 1964: 305). Not recorded from the British Isles. Bonnet (1957: 2503) has erroneously listed the species to occur also in Denmark. The paper of Deichman (1920: 257), to which he refers, says exactly the opposite. The record of Six (1958: 295) from the Netherlands has never been confirmed. The species is known to occur in North Africa and Asia Minor. The records from China (Schenkel, 1937: 79) were found to be wrong; the specimens have been re-examined, and they appear to belong to the *peltata*-group of *Neriene*, probably to *N. angulifera* (Schenkel) (Van Helsdingen, 1969: 259).

The species builds very characteristic horizontal saucer-shaped webs in the branches of trees and shrubs, and on plants. The webs are large, from one to two decimetres in diameter, with upturned margins, and with long "guy-ropes" to a central point above the web and to surrounding branches or plants. A second, but much looser, web hangs below and parallel to the upper web at a distance of one or two centimetres, and the spider hangs in the usual inverted position below the upper web. This type of web, which is distinctly different from the webs of *Neriene*, *Linyphia*, and *Microlinyphia* species, shows an amazing resemblance to the web of the Nearctic *Frontinella pyramitela* (Walckenaer) (*communis* Hentz), as depicted by Emerton (1902: fig. 322) and Comstock (1913: fig. 400).

Frontinellina frutetorum is an early maturing species. Through kindness of Mr. J. C. Ledoux I received a series from the south of France (Juvignac) collected on April the 16th, when the specimens were on the point of moulting for the last time or had just moulted. The observations on the pairing (Van Helsdingen, 1969: 21) were made on these specimens. A male from the 9th of April from Portugal (Douro Litoral) is the earliest specimen I have seen. Adult specimens can be found through the rest of the year.

Material examined.

Germany. — 9♀, Hessen, Odenwald, leg. Wider (lectotype and paralectotype of *Linyphia quadrata* Wider; SMF). — 1♀, Bayern, Muggendorf (MNP).

France. — 10♀, Drôme, Bourdeaux, along river Rubion, on low shrubs, 7-17.vii.1968, P. J. van Helsdingen (ML). — 8♀ 11♂, Hérault, Juvignac, 16.iv.1967, J. C. Ledoux (ML). — 3♀, Gironde, Forêt d'Arcachon (*Linyphia frutetorum occidentalis* Simon; MNP).

Corsica. — 4♀ 4♂, Corsica (MNP). 1♀, Calacuccia, 1000-1500 m, 7.ix.1953, H. Kahman (SMF).

Portugal. — 1♂, Minho, Serra do Gerez, v.1909, A. F. de Seabra (MB). — 1♂, Douro Litoral, Afurada near Gaia, 9.iv.1942, R. Lopes (MB). — 1♀, Aigarve, Vila

Real de Santo Antonio, vi.1930, A. Bacelar (MB). — 4 ♀, Estremadura, Amadora, vi.1941 (MB).

Spain. — 2 ♀, Extremadura, Guadalupe, 600-800 m, 3-24.v.1958, G. Fagel (ISNB). — 1 ♀, Lerida, Seo de Urgel, Sierra del Cadi, 700-900 m, in leaf-litter, 21.v.1962, G. Fagel (ISNB).

Algeria. — 2 ♀ 1 ♂, Djebel Edough (MNP).

Italy. — 1 ♀ 1 ♂, Trentino, Lago di Ledro near Riva, 650 m, 17.v.1959, P. J. van Helsdingen (ML). 1 ♂, Lago di Tenna N. of Riva, 570 m, 17.v.1959, P. J. van Helsdingen (ML). 3 ♀, Drena N. of Riva, 400 m, 25.v.1959, P. J. van Helsdingen (ML). — 1 ♀, Verona, Quinzano, iv.1967, leg. Osella (MV). — 9 ♀, Parma, Bazzano, 500 m, under hedge, 23.viii.1950, leg. Pasquali (MECB). 1 ♀, Parma, 60 m, 13.v.1950, A. Valle (MECB). — 2 ♀, Umbria, Monte del Lago Trasimeno, 14.vi.1967, S. Ruffo (MV); 1 ♀, do., vi.1967, S. Ruffo (MV). — 3 ♂, Campania, Ravello near Amalfi, Monti Lattari, 330 m, wood of chestnut and oak, 29.v.-3.vi.1962, H. W. Levi (MCZ); 1 ♂, do., grass on east slope, 2.vi.1962, H. W. Levi (MCZ). 3 ♀, Matese, Sassinoro, 12.vi.1962, S. Ruffo (MV). — 1 ♀, Calabria, La Sila, Ampollino, 22.vi.1960, S. Ruffo (MV). — 1 ♀, Sicilia, Nebrodi, Femminamorta 15.vi.1961, S. Ruffo (MV).

Hungary. — 32 ♀ 8 ♂, Tokaj and other localities (*Linyphia frutetorum punctiventris* Kulczyński; HM).

Yugoslavia. — 1 ♂, Istria, N. slope of Mt. Učka, 1100 m, 23.vi.1962, H. & L. Levi (MCZ). 2 ♀, Rovinj, 20.viii.1956, R. Braum (SMF). 3 ♀ 1 ♂, Rovinj, in shrubs, 2.vi.1962 (ML). 3 ♀ 1 ♂, Limski Fjord S. of Rovinj, 3.vi.1962 (ML). 1 ♀, Ročko polje, forest, 23.v.1968, C. L. Deeleman (ML). — 1 ♀, Croatia, Gračac, 6.viii.1964, C. L. Deeleman (ML). 1 ♀, Plitvice, 20-22.vi.1962, H. & L. Levi (MCZ). — 8 ♀ 2 ♂, Dalmatia, Mlini near Dubrovnik, wet meadow, 30.v.1962 (ML). 1 ♀, Lokrum Island, 25.v.1962 (ML). — 2 ♀, Servia, Pirot, Vlasi, 5.viii.1967, C. L. Deeleman (ML).

Greece. — 1 ♂, Peloponnesus, at junction of Divri and Doana River (?), 3.v.1930, M. A. d'Orchymont (*Linyphia frutetorum niger* Giltay; ISNB). — 5 ♀ 6 ♂, Corfu (HDO). — 4 ♀, Kreta, Kanea and environments, vi.1926, C. F. Roewer (SMF).

Turkey. — 1 ♀, Balukli near Bursa (Brussa, Prusa), F. Werner (Kulczyński, 1903; NMW). 2 ♂, 30 km E. of Samsun, 17.viii.1958, G. P. Lampel (HDO).

Syria. — 1 ♂, Syria (MNP).

Lebanon. — 1 ♂, Qartaba, 1200-1400 m, v.1964, G. Fagel (ISNB).

Frontinellina dearmata (Kulczyński) comb. nov.

Linyphia dearmata Kulczyński, 1899, Rozpr. Akad. Um. wydz. mat. przyr., 36: 386, pl. 7 fig. 63-64, 69-70 (description ♀, Madeira). — Denis, 1962, An. Faculd. Cienc. Porto, 44: 80 (citation of record of Kulczyński, 1899).

Of this species only the description and figures are available at the moment. I have not succeeded in locating the original material (3 ♀) of Kulczyński. On the ground of the description it seems very likely that it is synonymous with, or closely related to, *Frontinellina frutetorum* (C. L. Koch), and I have therefore tentatively transferred the species to *Frontinellina*. *Frontinellina frutetorum* has never been recorded from Madeira, but it is known to occur in North Africa and the Iberian Peninsula.

The figure of the epigyne (pl. 7 fig. 63) is reasonably well in accordance with this view, and the description of the epigyne also supports it, the size mentioned (0.40 mm) agreeing very well with that of *F. frutetorum*. The

size of the specimen (5.5 mm), the length of the cephalothorax (1.8 mm), and of the abdomen (3.4 mm), all are in favour of the synonymy hinted at here, and so are the chaetotaxy (femora spineless, anterior tibiae with I' and I''-spine), and the spacing of the eyes.

However, the coloration seems to differ to such a degree, that a mere placing into the synonymy of *F. frutetorum* is impossible. The cephalothorax is said and shown (pl. 7 fig. 64) to have broad dark submarginal bands, while in *frutetorum* there are narrow grey lateral margins only. In *dearmata* the abdomen seems to be light, and the characteristic pattern of *frutetorum* cannot be recognized from the description; the ventral surface is dark, as in *frutetorum*, with few white spots. *F. frutetorum* can be very light too, e.g., the variety *occidentalis* Simon, but there are no dark submarginal bands on the cephalothorax in this variety, nor in the nominate form. We must await a new investigation of Madeira, before we can tell more about the true status of *dearmata*.

Frontinellina locketi spec. nov.

(fig. 73, 74)

Type. — ♀ holotype from South Africa, Natal, Pietermaritzburg, Town Bush, v.1951, R. F. Lawrence (NM).

It is a pleasure to dedicate this new species to Mr. G. H. Locket, who once awakened my interest in spiders and has kept it alive ever since.

The species is smaller than *frutetorum*, the epigyne less swollen. The vulva appears to be much more complicated. The male is yet unknown, but I expect it to have a proportionally very long embolus.

Female. — Measurements in mm. Total length 2.9; cephalothorax, length 1.15, width 0.75; abdomen, length 1.8, width 1.1, height 1.0; chelicerae, length 0.55, width 0.26.

Cephalothorax. — Dark brown, with black striae and margins. Posterior margin barely excised, sides slightly curved, moderately constricted at border of head and thorax. Width 0.65 of length, width of head 0.75 of width of thorax. From side, dorsal line rising evenly from behind to highest point behind eye-region; clypeus straight. Head, eye-region and clypeus with short hairs.

Eyes. — Eye-region slightly narrower than width of head. Anterior row straight, posterior row recurved. PME with narrow black rings. Diameter of PME 0.08 mm, laterals of same size, diameter of AME 0.06 mm. PME separated from each other by 0.95 diam., from PLE by 1.55 diams., and from

AME by 0.9 diam. of PME. AME separated by 0.6 of their own diameter. Height of clypeus 0.13 of length of cephalothorax.

Chelicerae. — Dark brown as cephalothorax, suffused with black on basal three-fourths. Basal tubercle absent. Stridulating file present, consisting of fine parallel ridges on basal three-fourths. Dorsal row with four teeth, equidistant; basal and third teeth of same size, second tooth twice as large, apical tooth very small. Ventral row with three equidistant teeth; basal tooth largest, as large as basal dorsal tooth, others smaller; basal tooth opposite to apical dorsal tooth.

Gnathocoxae. — Brown, heavily suffused with black at bases, apices lighter; lateral margins slightly converging towards front. Labium blackish brown, anterior raised margin light brown. Sternum black-brown, produced between coxae IV; width 0.8 of length.

Legs. — Yellow-brown with blackish streaks and annulations. Coxae suffused with black. Femora with blackish pro- and retro-lateral streaks, and with narrow irregular apical rings, which are interrupted dorsally. Patellae blackish. Tibiae with broad faint median rings, and with narrow apical rings. Metatarsi darkened at bases and apices. The black markings are more conspicuous on the posterior pairs of legs. Femur I as long as cephalothorax. Tibia I slightly shorter; length of tibia I 10 diams. of segment. Measurements (of holotype) in mm:

	I	II	III	IV
Fe	1.20	1.05	0.75	1.15
Pa	0.35	0.30	0.25	0.30
Ti	1.05	0.90	0.45	0.85
Mt	1.05	0.90	0.55	0.95
Ta	0.70	0.55	0.40	0.55

Chaetotaxy. — Femora spineless. Pa I-IV d'' d' , both weak and hair-like. Tibiae with a well-developed d'' -spine, and with a hair-like d' -spine, without ventral or lateral spines. Metatarsi and tarsi spineless.

Length of d'' -spine on tibia I 0.16 mm, diameter of segment at base of d'' -spine 0.10 mm; on tibia IV 0.15 mm and 0.09 mm, respectively. Tm I 0.26. Position of d'' -spine on tibia I 0.20.

Abdomen. — Rather high with parallel dorsal and ventral surfaces; dorsal surface protruding above spinnerets. Posterior surface perpendicular and straight.

Abdomen mainly black, with small light areas with white blotches. Dorsal surface with three pairs of light transverse areas, first pair on half length of abdomen and only narrowly separated mesally; second and third pairs separated more widely, and situated more dorso-laterally; a fourth pair of

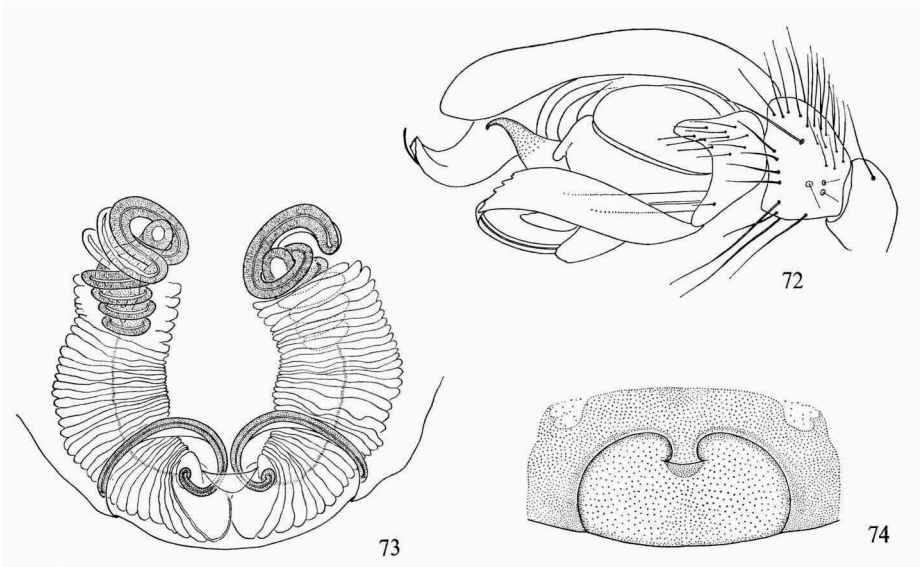


Fig. 72. *Frontinellina frutetorum*, male palp, lateral aspect. Fig. 73-74. *F. locketi*. 73, vulva, ventral aspect; 74, epigyne. 72, $\times 49$; 73, $\times 123$; 74, $\times 95$.

light comma-shaped spots lies on the upper half of the posterior surface. Few small light spots present ventro-laterally close to the spinnerets. Ventral surface uniformly black. Opercula and spinnerets black-brown.

Epigyne (fig. 74). — Much less protruding than in *frutetorum*. The two entrances slit-like, converging in front and curved in mesal direction there, ending just in front of mesal semi-covered depression. Area between entrances brown, smooth.

Vulva (fig. 73). — A very large number of membrane coils between entrances and turning-points; six coils of thick-walled and chitinous tube between turning-point and base of receptaculum, coiled around pear-shaped receptaculum in reversed sense. Fertilization duct running backwards through axis of coils, then curving around outside of entrance to dorsal side of epigyne.

Distribution. — South Africa, Natal.

DISCUSSION

It is not be wondered at that the recognition of the species, which are now brought together in *Microlinyphia*, has troubled so many systematists. Two major phenomena have conspired against the arachnologists who had to deal with specimens of this genus. In the first place there is the amazing variability of most species — of the abdominal pattern in particular —,

seemingly pointing to the existence of many different taxonomic entities. The abdominal pattern of *M. pusilla*, for instance, varies between a light abdomen with a median dorsal row of blackish spots in light specimens and a blackish abdomen with paired light dorsal spots in the darker specimens. As regards the European fauna this difficulty had been largely mastered, as witness the many synonyms already recognized in the course of time. The only name — still in relation to the European fauna — that has to be added to the long list of synonyms of *M. pusilla* is *Linyphia carnica* Di Caporiacco from the Karnische Alpen. But the common representative of the genus in Africa, *M. sterilis* (Pavesi), appears to have been described under five different names, and one of them in a different genus at that. The species moreover had been confounded with some of the other African species of the genus. As to the Nearctic region, the *pusilla*-like specimens have been assigned in turn to *pusilla* or to separate species, but here the following phenomenon certainly has played a part too.

It is the absence of easily detected characters at the epigyne and male palp which has obscured the relationships within the genus in the second place. The external epigyne is very small and inconspicuous in most species and barely is of any help for the recognition of the species. Differences can be found in the internal structures, the vulvae, where the number of coils of the spiral tubes and the degree of chitinization of these coils give reliable characters. Together with the basic pattern of the abdomen — e.g. the median dorsal row of dark spots in *pusilla* and *sterilis* versus the paired spots in *mandibulata* and *dana* — the internal structures were found to be very useful for the delimitation of the species. The male palps of the different species, too, resemble each other very closely. The positions and length of the tibial spines, the shape of the embolic apophysis, and the length of the embolus, were found to offer reliable characters, though not all of them are easily obtained.

Largely trusting on the characters mentioned, some insight was gained into the distributions of the species (table 1), and into the affinities within the genus. The Eurasian *M. pusilla* and the East and South African *M. sterilis* are much alike, while the differences observed are constant. One gets the impression that they are of relatively recent (?) common origin and have not much differentiated since they became isolated. The surrounding islands, as far as they have yielded any members of the genus yet, have their own species: *simoni* on Madagascar, *johnsoni* on Madeira, and *inexplicabilis* on the Canary Islands. The characters observed suggest a close relationship between the *pusilla-sterilis* complex and the three insular species from the Atlantic Islands and Madagascar. From East Africa two more *Microlinyphia*

TABLE I

Synopsis of the distributions of the species of *Microlinyphia*

	Nearctic		Palaeartic		Ethiopian
	West	East	Europe	Asia	
<i>pusilla</i>	+		+	+	
<i>sterilis</i>					+
<i>johnsoni</i>			(Madeira)		
<i>inexplicabilis</i>			(Canary Isl.)		
<i>simoni</i>					(Madagascar)
<i>mandibulata mandibulata</i>		+			
<i>mandibulata punctata</i>	+				
<i>dana</i>	+				
<i>impigra</i>	+	+	+		
<i>aethiopica</i>					+
<i>delesserti</i>					+

species are known, viz., *delesserti* and *aethiopica*, the former of which strongly deviates from the general type, while the latter seems to be restricted to the higher altitudes of the East African mountains. *M. aethiopica* probably is the vicarious species in the Ethiopian region of the Holarctic *impigra*, and thus it does not seem likely that *aethiopica* and *simoni* had a direct common ancestor. The Atlantic islands may have been colonized from North-West Africa where *pusilla* might occur (it has been recorded from the Iberian Peninsula and Tunisia). The contacts between East Africa and the Palaeartic region probably have run through Lesser Asia and Arabia. Madagascar must have been colonized from East Africa because of its geographic position. These suggestions concerning the colonization of the islands around Africa do not necessarily postulate the existence of land connections in the past, because there always is the possibility of aerial migration in spiders.

The Eurasian *pusilla*, it now appears, occurs on the west side of North America, and not in the east as has often been asserted in the past. The distribution of *M. pusilla*, like that of *M. impigra*, thus can be called holarctic. Apparently *pusilla* crossed the Bering Strait and reached North America from the west. It is not impossible that the *mandibulata-dana* group came to the New World on an earlier occasion, or that the *pusilla* and the *mandibulata-dana* groups had a common holarctic ancestor. The *mandibulata-dana* ancestor then differentiated into two species at either side of the North-South mountainous barrier, *dana* on the west side and *mandibulata* in the east. The settling in more recent times of what in the meantime had become *pusilla* in Eurasia apparently met with species too different to merge in. The species now seems able to maintain itself alongside its Nearctic congeners.

Of course the above remarks about the evolution of the zoogeographical

pattern are but suggestions, starting from the supposition that the centre of distribution was situated in the Old World. In general the pattern is comparable with that of the *clathrata* group of *Neriene*. However, the distributional areas of the species are far from completely known. There is the usual gap in our knowledge of the West Siberian (does *impigra* not occur there?) and South-Eastern Asiatic faunas. The North-Western part of the Nearctic region is worth special attention, as may have become clear from the above remarks. It can be of great help when the areas of the species in that region can be delimited more accurately, especially the way they extend into Alaska and North-West Canada.

Concerning *Frontinellina* not much has to be added to what has been said in the remarks on the genus (p. 69). The New World genus *Frontinella* is suggested to represent a vicarious genus.

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Synonyms are given in *italics*

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