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COMPARATIVE NOTES ON THE SPECIES OF THE HOLARCTIC GENUS STEMONYPHANTES MENGE (ARANEIDA, LINYPHIIDAE)

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With 40 text-figures

INTRODUCTION

The very small genus *Stemonyphantes* up to our present knowledge is restricted to the temperate regions of Europe, Asia and North America. It was created by Menge (1866) for the European species *Aranea trilineata* Linnaeus, 1767, which, among others, appeared to be a junior synonym of *Aranea lineata* Linnaeus, 1758. The species was recorded also from North America (Emerton, 1876, 1882; Keyserling, 1886; and others). For nearly seventy years the nearctic population was thought to be conspecific with the palaearctic population. Keyserling (1886) even supposed the species to have been imported by ship from Europe and to have spread from there. A detailed description of *S. lineatus*, furnished with excellent figures of the genitalia of the species, was given by Blauvelt (1936) still without any indication of differences between European and North American specimens, although she states to have seen them from both regions. Gertsch (1951) was first in drawing attention to differences between the two populations; he created the new name *Stemonyphantes blauveltae* for the nearctic population.

In Europe a new variety *S. bucculentus* [= *lineatus*] *pictus* was described by Schenkel (1930) from the Riesengebirge on the Polish-Czechoslovakian frontier. Schenkel only possessed a female specimen, which differed from the nominate form mainly in the colour of the cephalothorax and abdomen. More specimens, including a male, were recorded by Buchar (1967) from the Böhmerwald in Czechoslovakia near the German frontier. Buchar examined the genitalia of these specimens and decided to raise Schenkel's variety to specific rank. He redescribed the species and listed the main differences with *S. lineatus*.

In the course of an investigation into the old names of L. Koch I came across the species *Linyphia conspersa*, described from Siberia in 1879. Description and figures of the species are sufficiently clear as to recognize it to belong to *Stemonyphantes*. Re-examination of the original material revealed its true status, a clearly distinct species *Stemonyphantes conspersus*, moreover a senior synonym of *Stemonyphantes lineatus pictus* Schenkel, the type of which it could be compared with.

As far as habitus and general characters of the three species are concerned there exist adequate descriptions, to which the reader is referred. The complicated and interesting genitalia, however, have not received the attention they deserve. Only in the case of *S. blauveltae* they have been described by Blauvelt (1936), while Merrett (1963) has given a schematic representation of the palpal elements of *S. lineatus*. In the present paper I have tried to give some additional characters of the three species and to compare the homologous structures of the genitalia. This has made it possible to reconsider the generic characters in current use and to add others which appeared to be of generic value.

Special attention has been paid here to the chaetotaxy of the legs and the morphology of the copulatory organs. As regards the latter the nomenclature of Merrett (1963) has been followed. In the description of the palps the terms dorsal, ventral, lateral and mesal have been used to indicate positions of elements and their orientation. The terms should be understood to have been applied to the palp when stretched out in front of the animal, while the cymbium lies dorsally.

As to the chaetotaxy I have used the system of abbreviations as developed in Acarology. The spines on the legs appear to be arranged in the following five rows (with used abbreviations in brackets): proventral (v′), retroventral (v″), pro-lateral (l′), retro-lateral (l″) and dorsal (d); the dorsal spines on the tibiae do not stand exactly in a median dorsal row, but slightly retro-dorsal and pointing in that direction (d″) or slightly pro-dorsal (d′). Pairs of spines are enclosed in round brackets, whorls of spines in square brackets. The indices a and b are used for apical and basal. Weak spines, which may be hair-like but still distinct from the normal hairs, are noted in italics.

Descriptions

Stemonyphantes Menge

Stemonyphantes Menge, 1866, Preussische Spinnen, 1:138. Type-species by monotypy: *Aranea trilineata* Linnaeus [= *Aranea lineata* Linnaeus].

Medium-sized animals (4-7 mm). Cephalothorax with black lateral margins and black median band. Cephalothorax of male with straight posterior margin and strongly curved sides, not constricted at border of cephalic and thoracic parts; ratio width to length 0.8. In females the posterior margin slightly excised and the sides constricted at border of head and thorax, sides of head parallel; ratio width to length 0.7-0.8.

Eyes in two nearly straight rows; lateral eyes of two rows touching, but not flattened against each other; PME in plane of cephalon, with narrow black rings or triangles, not on tubercles. All eyes subequal, ALE slightly larger, AME slightly smaller than PME. Eyes rather closely situated, distances between eyes not more than one diameter.

Chelicerae short and broad, with rather bulging dorsal surface. Three cheliceral teeth in dorsal row, two in ventral row. Middle tooth of dorsal row always largest. Basal tubercle never present. Stridulating file sometimes present in males, never in females. Protrusion on basal half of ventral surface low.

Gnathocoxae short with parallel sides, ratio length to width about 1.5. Labium rebordered. Seam between labium and sternum clearly recognizable. Sternum narrowly prolonged between coxae IV.

Legs annulated, notably posterior legs. Coxae with median and apical rings; femora with basal, median and subapical rings; patellae with apical, and tibiae with median and subapical rings. All femora with a dorsal spine on about half length, femur I with an additional l′-spine. Two rows of long ventral spinehairs from base to apex on all femora. Tibiae with long ventral spines (2 diams. long) in pairs in addition to dorsal and lateral spines. Metatarsi with at least one pair of long ventral spines. Position of d″-spine or spinehair on tibiae 0.2-0.3. Metatarsi of males fusiform, longer than tibiae; metatarsi of females not enlarged. All metatarsi with a trichobothrium; Tm I 0.25-0.35, usually about 0.30.

Abdomen with many white blotches on all sides, dorsal surface with a black pattern of varying extent.

Male palp. Proximal segments cylindriform. Ratio length of femur to length of cephalothorax 0.55-0.60. Patella with dorsal spine longer than segment. Tibia with long ventral spines, and with a ventral hook-shaped apophysis distally; one meso-dorsal apical spine, as long as segment.

Paracymbium large and flat, with a short ventral hook. Cymbium with a retro-lateral protrusion proximally. Tegulum with strongly chitinized distal apophyses, viz., one broad lobe and one heavy tooth-like projection ventrally; there is a conspicuous semi-covered cavity meso-ventrally just proximally of the apophyses. Median apophysis small, proximally on dorsal side of tegulum.

Embolic division consisting of a long flattened element, which lies parallel to the axis of the palp, and a long and thin ribbon-shaped embolus, which arises from the narrowed proximal end of the plate. Embolic division attached in the middle of the dorsal surface to the median apophysis by means of the membraneous envelope of the spermduct. Distal part of plate with three apical projections, viz., a large and slightly curved one on the dorsal surface near the mesal margin, a large pyramidal meso-apical projection with hollowed out distal surface, and a slender rod close to the pyramidal projection.

Epigyne and vulva. Epigyne small, consisting of a chitinous mesal plate, which is wider than long, and the sides of which converge in anterior direction; posterior surface with small depressions or excavated. Mesal plate bordered by a narrow groove on either side. Vulva with two spirally coiled grooves or ducts, which open into thick-walled receptacula. Fertilization-ducts running backwards rather straight, curving to dorsal side of vulva posteriorly.

Distribution and habitat. Holarctic region, not known from South East Asia and Japan. *S. lineatus* and *blauveltae* are recorded from between plants and at the base of trees near the ground. *S. conspersus* was found on the lower branches of trees up to 2 meters above the ground.

Key to the species [1]

1. Median black stripe on cephalothorax reaching PME but not forked on cephalic part. Cephalothorax of male inflated at either side of fovea. Apical tooth of dorsal row of cheliceral teeth at least half as long as strong middle tooth. Chelicerae of male with stridulating file on apical half of lateral surface (fig. 4, 24). Metatarsi not annulated. Legs relatively short and thick, ratio length to diameter of tibia I less than 9. Dorsal spines on anterior tibiae much weaker than ventral spines, hair-like. Leg IV longer than leg I. Embolic division of male palp longer than cymbium, reaching backwards to middle of tibia (fig. 2). Vulva with two heavily sclerotized columns with spirally coiled duct or groove (fig. 13). Posterior surface of epigyne straight, not excavated 2

— Median black stripe on cephalothorax forked on cephalic part, lateral arms ending behind PLE. Cephalothorax of male barely inflated on thoracic part. Apical tooth

1) East Siberian specimen left out of consideration (see under *S. blauveltae*).

of dorsal row of cheliceral teeth small, not half as long as middle tooth, very small in males. Chelicerae of male without stridulating files. Metatarsi with a median and subapical blackish ring. Legs relatively long and slender, ratio length to diameter of tibia I larger than 10. Dorsal spines on anterior tibiae not hair-like. Legs I and II longer than leg IV. Embolic division of male palp shorter than cymbium, not reaching middle of tibia (fig. 37). Posterior surface of epigyne excavated mesally. Vulva with the grooves between entrances and receptacula not obviously spirally coiled; secondary receptaculum present (fig. 31) . . . . *conspersus* (L. Koch)

2. Chelicerae of male (fig. 4) with conspicuous stridulating files on apical half. Ratio length of cephalothorax to length of femur I less than 1.0. Metatarsus I of male (fig. 9, 11) with 6-10 long l″-spines, or with shorter l″-spinehairs (fig. 10). Length of cymbium of male palp 1.3-1.4 mm, length of embolus 1.9-2.1 mm. Vulva with 5-6 coils of groove between entrances and receptacula (fig. 13) *lineatus* (Linnaeus)

— Stridulating files on male chelicerae faintly visible (fig. 24). Ratio length of cephalothorax to length of femur I 1.0-1.2. Metatarsus I of male without conspicuous l″-spines or spinehairs. Length of cymbium of male palp 0.9-1.1 mm, length of embolus 1.1-1.3 mm. Vulva with 3 coils of groove between entrances and receptacula (fig. 28) . . . . *blauveltae* Gertsch

Stemonyphantes lineatus (Linnaeus)

(fig. 1-16)

Aranea lineata Linnaeus, 1758, Systema Naturae, (ed. 10) 1: 620 (diagnosis).

Aranea trilineata Linnaeus, 1767, Systema Naturae, (ed. 12) 1 (2): 1031 (unexplained change of name; diagnosis).

Stemonyphantes trilineatus; Menge, 1866, Preussische Spinnen, 1: 139, pl. 26 fig. 58.

Stemonyphantes lineatus; Simon, 1929, Arachnides de France, 6 (3): 623, fig. 933, 934. Locket & Millidge, 1953, British Spiders, 2: 376, fig. 224 F-H. Wiehle, 1956, Tierw. Deutschlands, 44: 279, fig. 460-467.

For complete list of references up to 1939 see Bonnet (1958: 4150).

Males and females 4-6 mm.

Thoracic part of cephalothorax of male conspicuously swollen on either side of fovea, higher than cephalic part in lateral view. Median black stripe narrowed in front and reaching PME. Chelicerae short and broad, with three large teeth in dorsal row, basal tooth slightly smaller than middle tooth, apical tooth slightly smaller again than basal tooth but still more than half as long as middle tooth; ventral row with two teeth about the size of the dorsal apical tooth. Chelicerae of male (fig. 4) with clearly visible stridulating grooves on apical half of lateral surface, grooves rather widely spaced. Femur of male palp (fig. 15) with warts on mesal surface opposite to stridulating file. Stridulating file absent in females. Blackish margins of sternum usually contrasting strongly with light yellow central area.

Annulation of legs well visible, strongest on hind legs. Metatarsi without rings. Metatarsi of male fusiform in dorsal view (fig. 11) and curved with concave dorsal side, flattened dorso-ventrally, with retrolateral spines (fig. 9) (see below). Legs short and stout. Length of femur I 0.8-1.0 times length cephalothorax. Ratio length to diameter (at base of d″-spinehair) of tibia I 6-7. Leg IV longer than legs I and II.

Chaetotaxy (weak spines in italics):

Fe I dl′; II-IV d.
Pa I-II $d_b d_a$; III-IV $\mathrm{d_b d_a}$; basal spines half as long as apicals.

Female:

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

Male:

Ti I-II as female, but sometimes with 10-12 l″-spinehairs in two irregular rows along whole length.
Ti III-IV as female.
Mt I variable; a pair of (v′v″)-spines, l′-spine, and a whorl of apical spines $[\mathrm{l'_a l''_a v'_a v''_a}]$ always present; a number of hairs on the retro-lateral side have become spine-like; in some specimens the spines are short (fig. 10), and then the ventral spines on the anterior metatarsi are short too (about 1 diam.) and the anterior tibiae lack the l″-spinehairs; specimens with long l″-spines on the metatarsi I have the v-spines on the anterior metatarsi long (about 2 diams.) and have many l″-spinehairs on the anterior tibiae (fig. 9). The character appears to be variable between the two extremes.
Mt II as I, but less spinose, 4-8 l″-spines at most.
Mt III-IV as female.
Length of d″-spinehair on tibia I 1 diam. or more, on tibia IV the d″-spine measures about 2 diams. of segment. Length of ventral spines of middle two pairs on anterior tibiae 2 diams. or more; length of ventral spines on metatarsi 1-2 diams.

Male palp (fig. 2, 7). Femur long and cylindriform, without spines; mesal surface near base with a number of clearly visible warts (fig. 15). Patella more than twice as long as high, slightly fusiform; dorsal spine near distal margin 1.4 times as long as segment. Tibia (fig. 6) slightly shorter than patella, meso-dorsal spine as long as segment, and with two long spines and some spinehairs meso-ventrally and ventrally; apical margin indented retro-laterally just above base of ventral apophysis, which curves in distal direction. Cymbium (fig. 3) with slender tip and conspicuous blunt protrusion retro-laterally above distal end of base of paracymbium, protrusion pointing in lateral direction; the lateral margin of the cymbium bears a sclerotized salient corner proximally, which for the larger part is covered by the base

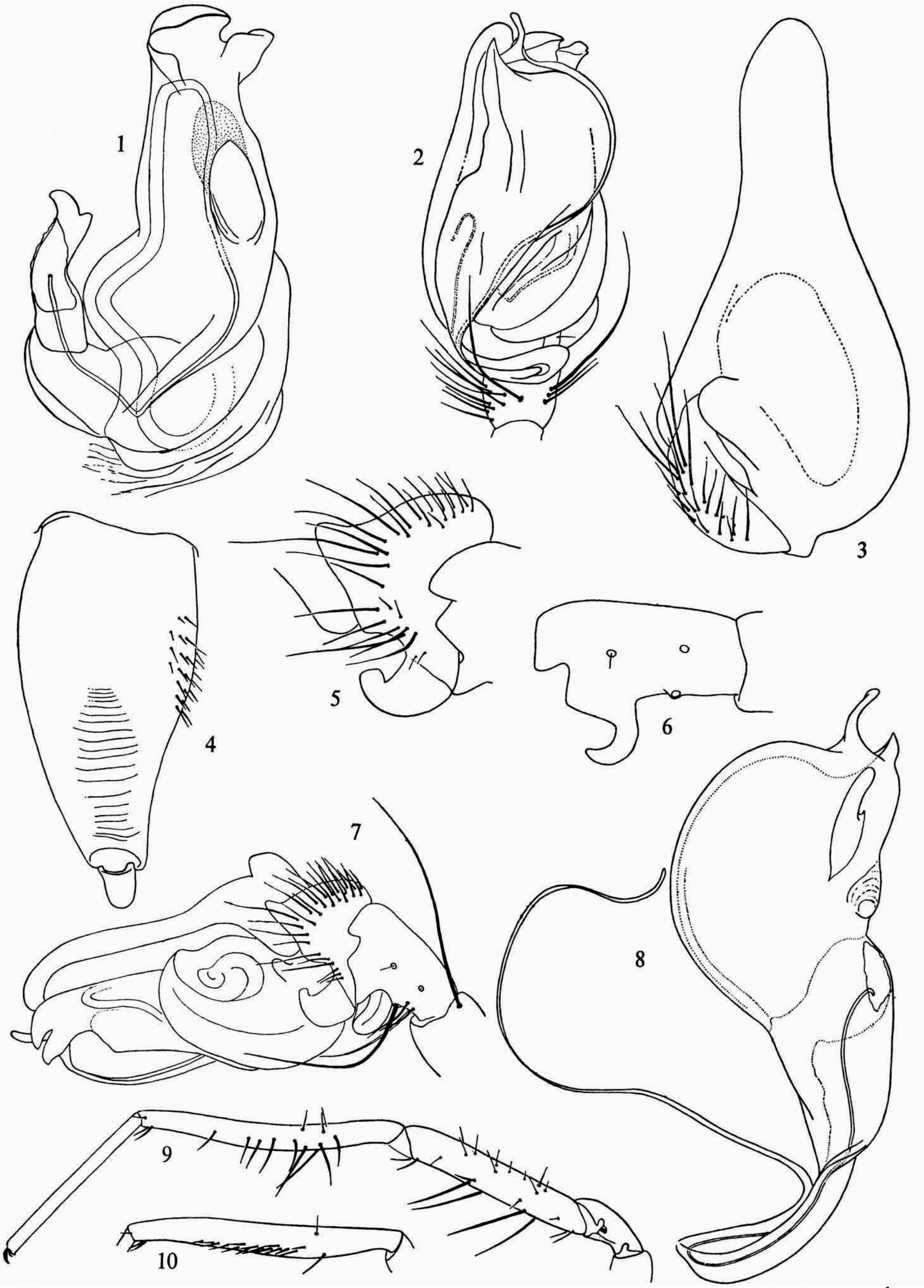

Fig. 1-10. *Stemonyphantes lineatus* (L.). 1, tegulum and median apophysis, mesal aspect; 2, male palp, ventral aspect; 3, cymbium, dorsal aspect; 4, male chelicera, lateral aspect; 5, paracymbium, lateral aspect; 6, tibia of male palp, lateral aspect; 7, male palp, lateral aspect; 8, embolic division, dorsal aspect; 9, distal segments of leg I, male, retro-lateral aspect; 10, tibia of leg I, male, other specimen, retro-lateral aspect. 1, 3-6, 8, × 50; 2, 7, × 33; 9, 10, × 17.

of the paracymbium; a very slight hump lies distally of the retro-lateral protrusion towards the chitinous margin. Paracymbium (fig. 5) large and flat, broad and slightly swollen at base with straight dorsal margin, tapering in ventral direction and ending with a short truncated hook; many short and long hairs along dorsal and distal margins.

Subtegulum large, occupying proximal half of retro-lateral aspect of palp. Tegulum (fig. 1, 12) long, the two heavily sclerotized apical apophyses reaching as far as tip of cymbium; median apical apophysis a broad lobe, which is curled mesad at the apical margin; ventro-apical apophysis of tegulum a heavy tooth, situated on the ventral margin close to the apical lobe; a short and nearly triangular ridge runs on the mesal surface diagonally towards the dorsal margin and ends close to the apical lobe, lobe and ridge enclosing a deep furrow, which at the ventral side of the tegulum is bordered by the apical lobe and the ventro-apical apophysis; mesal surface with a deep semi-covered depression well proximally of the apical apophyses and close to the ventral margin, the opening proximally.

Median apophysis (fig. 1, 12) situated proximally on dorsal side of tegulum; base rather flat with convex lateral surface, distal half rod-shaped, lightly curved ventrad and again dorsad at slender tip, carinate on lateral surface; mesal surface of base and middle portion of rod membraneous, transition of base to rod chitinous on all sides; spermduct leaving element on mesal side in the middle of rod; the median apophysis on first view looks like a continuation of the ventral and proximal margin of the tegulum, but it is clearly hinged to it by means of a membraneous connection.

Embolic division (fig. 8, 12) long and flat, with long tape-like embolus attached proximally. Apical half keeled at meso-ventral side, of roughly semi-circular outline in dorsal view, lateral margin strongly curved, mesal margin nearly straight; dorsal surface with a large and flat hook-like process near mesal margin, curved in apical direction; a bluntly rounded excrescence arises on the mesal margin proximally of hook-like process; the apex of the element bears a long and slender, slightly curved and bluntly tipped rod, and a heavy pyramidal process, which forms the end of the meso-ventral keel; this latter process is excavated on the distal surface, the furrow-like excavation constituting the end of a long narrow groove, which runs on the ventral surface along the curved lateral margin of the apical part of the embolic division, which has the lateral margin narrowly turned down to the ventral side; the long embolus lies inside this groove in the unexpanded palp; mesal surface of apical part, between keel and mesal margin, lightly excavated longitudinally.

Apical part separated from proximal narrower half by a less strongly chitinized middle region, where the spermduct enters the embolic division on the dorsal side near the mesal margin. Proximal part tapering in proximal direction, making a turn of ninety degrees to the lateral side and turning over on half length, the ventral surface becoming the dorsal side; the curved part thickly band-shaped and folded forwards at tip along the lateral side of the embolic division, and continuing as a clearly recognizable embolus; the proximal part is sclerotized along the mesal margin and most of the dorsal and lateral surfaces. The lateral margin is membraneous like the middle region. In palps treated with caustic potash, the proximal part of the embolic division becomes slightly stretched, which explains the differences in outline of the element in fig. 2 and 8.

Embolus (fig. 8) narrowing quickly at base and becoming a narrow ribbon-shaped or lace-like thread, which follows the lateral groove on the ventral surface of the apical part of the embolic division in the unexpanded palp.

Measurements of palp (in mm). Length cymbium 1.32-1.40, tegulum 1.10-1.20, embolic division at the unexpanded palp 1.42-1.50, embolus 1.9-2.1.

Epigyne and vulva (fig. 13, 14, 16). Mesal part of posterior margin chitinized, lightly depressed mesally near posterior margin; much wider than long in ventral view, bordered by an inward-curving groove on either side. Posterior surface perpendicular to ventral surface, with a small pit on either side. Vulva with two columns with a spirally coiled groove each, surrounded by a thick wall. Groove coiled clockwise from entrance to receptaculum in right column, counter-clockwise in left one, as is characteristic of the Linyphiidae. Number of coils approximately five, groove ending in the apical receptaculum. Receptacula with many lobes on inner surface. Fertilization-duct apparently running backwards through axis of column, where a light lumen can be detected, but the true limits of the duct are not easily distinguished from the equally light axial parts of the spiral groove. Duct curving to dorsal side of vulva well before the posterior margin of the vulva, ending as an open gutter towards the mesal plane. Thickness of walls of columns and the degree of divergence of the columns variable, but usually running more or less parallel. Width of middle part of epigyne 0.18-0.22 mm. In the only two available specimens from Siberia the shape of the middle part resembles *S. blauveltae*, while the width measures 0.26-0.27 mm; the internal structures of the vulvae, however, show five coils of spiral groove in either column.

Distribution and habitat. The species has been recorded from nearly all countries of Europe, including the British Isles, Scandinavia, Finland, Russia, the Balkans, Italy and the Iberian Peninsula. There are few records from Siberia (Kulczynski, 1885, 1916; Ermolajev, 1934; Sytchevskaja, 1935), which have to be reconsidered in the light of the occurrence of *S. blauveltae* in East Asia, as stated in this paper.

The species is common and can be found under leaves on the ground and between plants near the ground. It becomes adult from September onwards and one can collect adult specimens still in winter and spring.

The material used for the morphological data in the present paper originate from two localities, viz., the sand-dunes and saltmarshes of Voorne and of the former Nature Reserve "De Beer", both in the Netherlands, the latter of which is now sacrificed to the never ending urge for expansion of the industrial activities in a small country. It was commonly found there in tussocks of marram and other grasses.

Two female specimens from "Siberia" (Instytut Zoologiczny, Warszawa) undoubtedly belong to *lineatus*; however, as mentioned above, the width of the middle part of the epigyne is larger (0.26-0.27 mm), resembling in shape too the epigyne of *blauveltae*.

Stemonyphantes blauveltae Gertsch

(fig. 19-29)

Stemonyphantes blauveltae Gertsch, 1951, Amer. Mus. Nov., 1514: 1, fig. 4-5 (diagnosis, differences with *S. lineatus*; U.S.A.).

Linyphia bucculenta; Emerton, 1876, Psyche, 1 (21): 129 (common to Europe and North America).

Stemonyphantes bucculentus; Emerton, 1882, Trans. Connecticut Acad. Arts Scienc., 6 (1): 64, pl. 20 fig. 1 (*S. trilineata* in fig.). Blauvelt, 1936, Festschr. Strand, 2: 159, pl. 17 fig. 119-126 (p.p.).

Linyphia lineata; Keyserling, 1886, Spinnen Amerikas, Therid., 2 (2): 64, pl. 13 fig. 167 (descr. ♀, ♂).

Stemonyphantes lineatus; Kaston, 1948, Bull. State Geol. Nat. Hist. Surv., Connecticut, 70: 118, pl. 13 fig. 249-253 (fig. after Emerton, 1882).

For complete list of references up to 1939 see Bonnet (1958: 4150, sub *lineatus*).

Types. ♂ holotype, by original designation, from U.S.A., New York, Onondaga Co., Apulia Hill. Many ♂ and ♀ paratypes from same locality, and from Montana and Utah (American Museum of Natural History, New York, not examined).

Although Blauvelt (1936) examined material from North America and Europe, as indicated in her list of examined material, the descriptions of the genitalia and the illustrations are clearly based on nearctic specimens.

Females of same size as *lineatus*; males are smaller, largest size measured 4.5 mm, cephalothorax 2.1 mm.

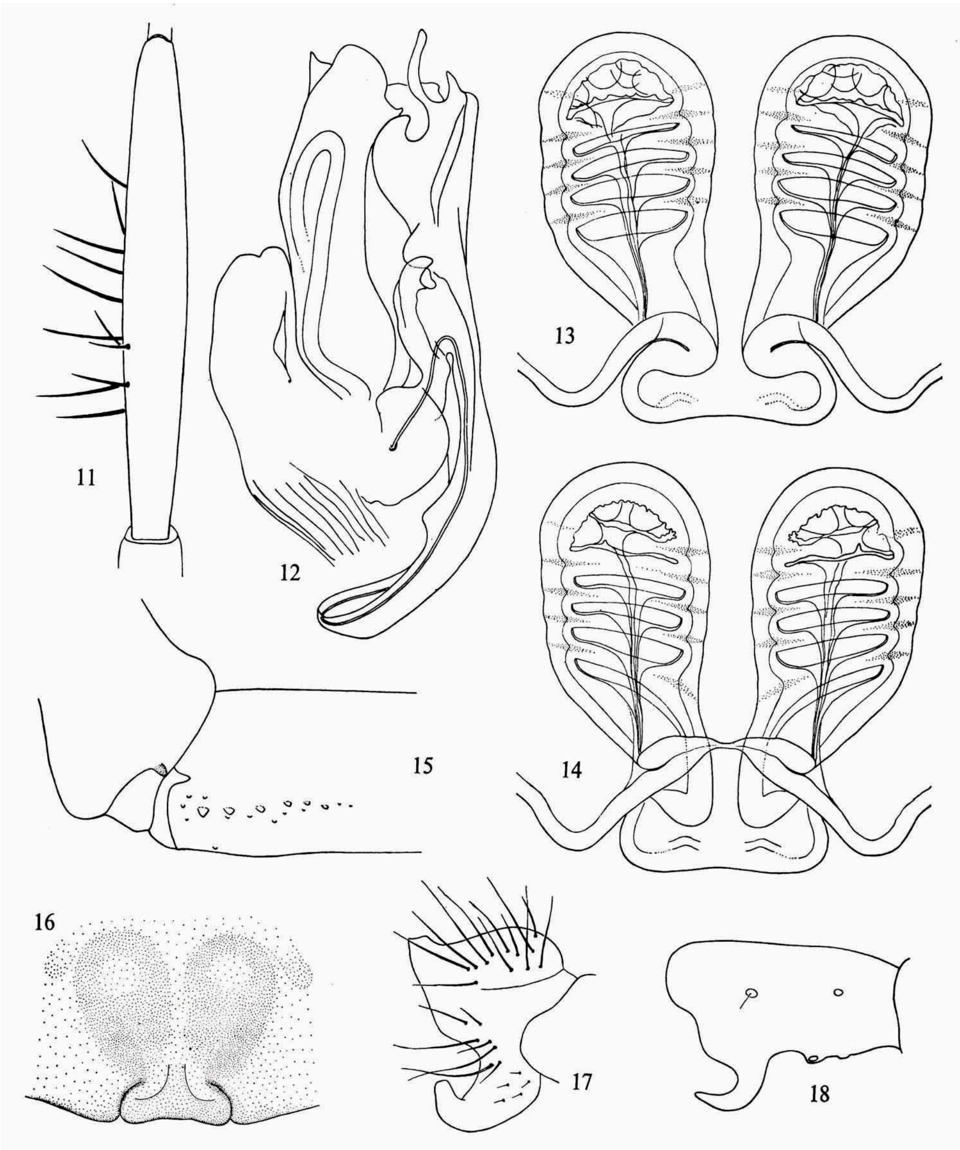

Fig. 11-16. *Stemonyphantes lineatus* (L.). 11, tibia of left leg I, male, dorsal aspect; 12, tegulum, median apophysis and embolic division, meso-dorsal aspect; 13, vulva, ventral aspect; 14, vulva, dorsal aspect; 15, base of femur of male palp, dorso-mesal aspect; 16, epigyne. Fig. 17-18. *S. blauveltae* Gertsch. 17, paracymbium, lateral aspect; 18, tibia of male palp, lateral aspect. 11, × 30; 12, × 50; 13, 14, × 133; 15, × 100; 16-18, × 67.

Gertsch (1951) pointed out the differences in the spacing of the eyes between *lineatus* and *blauveltae*. In *lineatus* the PLE should be removed further from the PME than in *blauveltae*. In my opinion all posterior eyes rather are more widely spaced in *lineatus*, but the differences are very small and not very reliable with every specimen, though probably correct when used statistically.

Cephalothorax of male swollen as in *lineatus*. The chelicerae of the male (fig. 24) have stridulating ridges, but they are much less obvious. Chelicerae of female lacking stridulating files. Legs annulated as in *lineatus*. Metatarsi of male fusiform and curved with concave dorsal side, but less spinose than in *lineatus*, orange-brown. Legs stout but slightly longer proportionally than in *lineatus*. Length of femur I 1.0-1.2 times length cephalothorax. Length of tibia I 7-8 diams. of segment. Leg IV longer than leg I.

Chaetotaxy (weak spines and spinehairs in italics):

Fe I dl'; II-IV d.

Pa I-II $d_b d_a$; III-IV $\mathrm{d_b d_a}$; basal spines half as long as apicals.

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

Ti III-IV v' d''l' v' l''d' $[\mathrm{l'_a l''_a v'_a v''_a}]$

Mt I-II (v'v'') *l'l''* $[\mathrm{l'_a l''_a v'_a v''_a}]$

Mt III-IV (v'v'') l'l'' (v'v'') $[\mathrm{l'_a l''_a v'_a v''_a}]$

Anterior tibiae and metatarsi of male (in North American specimens) without additional l''-spinehairs or l''-spines.

Length of d''-spinehair on tibia I about 1 diam., d''-spine on tibia IV 2 diams. or more. Length of strong v-spines on tibia and metatarsus I 2 diams. or more.

Male palp (fig. 21, 26). General appearance of *lineatus*, but differing in the following respects.

The warts on the mesal side at the base of the femur (fig. 20) are very small and much less easily detected. The apical margin of the tibia (fig. 18) is not indented on the retro-lateral side but only slightly excised. Tip of cybium (fig. 19) less slender in dorsal view. Shape of paracymbium (fig. 17) as in *lineatus*. The distal half of the tegulum (fig. 22, 25) is more compact; the apical margin of the median apical apophysis is only slightly curved mesad; the furrow between this margin and the meso-dorsal ridge on the one end and the ventro-apical apophysis on the other end is consequently less conspicuous; the meso-dorsal ridge is less triangular and lower.

In the embolic division (fig. 23, 25) the differences are equally small. The lateral margin of the apical part is curved less strongly, the proximal part is narrower and curved less in lateral direction. Apical and dorsal apophyses are slightly smaller. The embolus is shorter (1.2-1.3 mm).

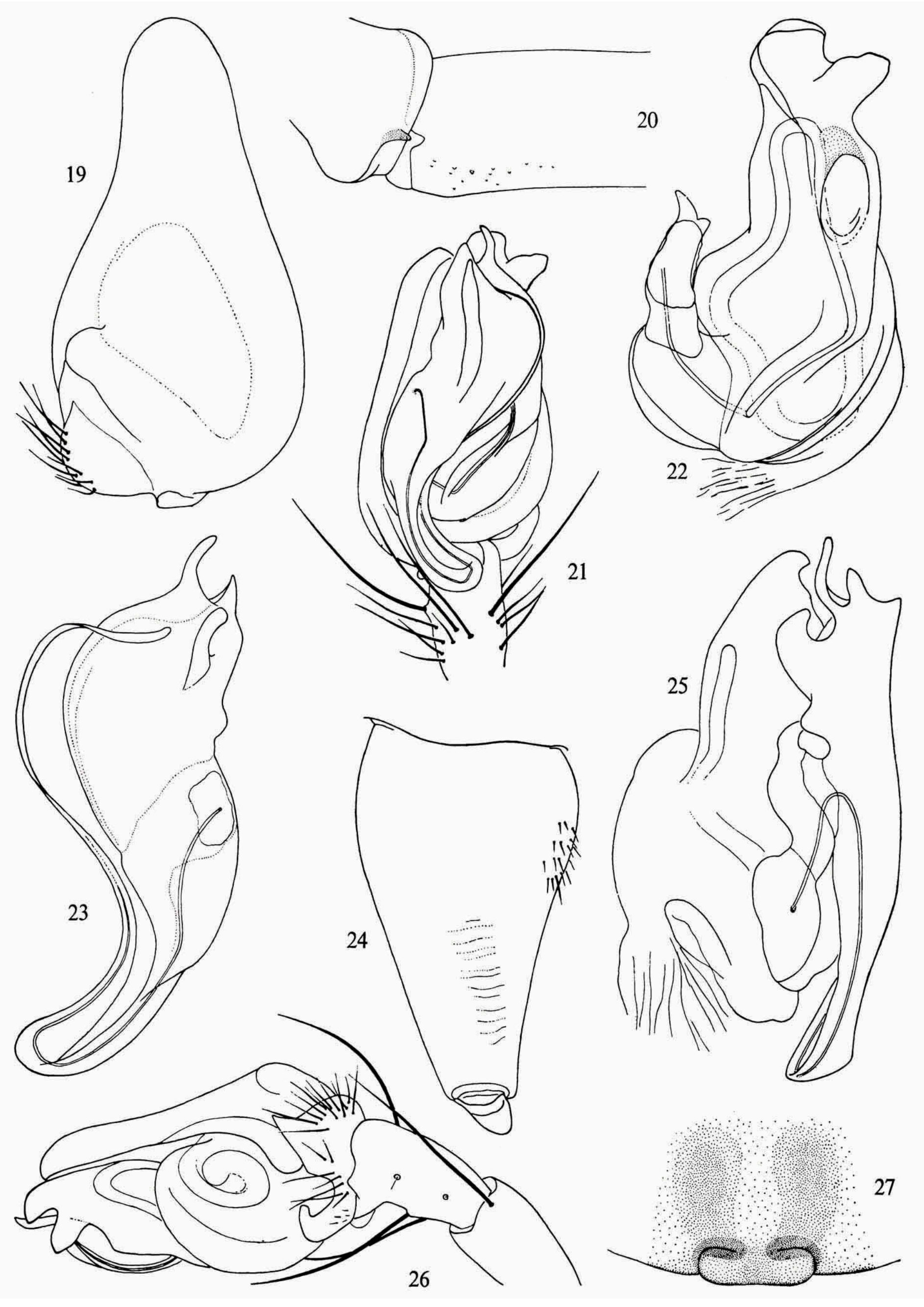

Fig. 19-27. *Stemonyphantes blauveltae* Gertsch. 19, cymbium, dorsal aspect; 20, base of femur of male palp, dorso-mesal aspect; 21, male palp, ventral aspect; 22, tegulum and median apophysis, mesal aspect; 23, embolic division, dorsal aspect; 24, male chelicera, lateral aspect; 25, tegulum, median apophysis and embolic division, meso-dorsal aspect; 26, male palp, lateral aspect; 27, epigyne. 19, 22-25, 27, × 67; 20, × 100; 21, 26, × 45.

Beside the morphological differences mentioned here, there are significant differences in size of the elements. The absolute sizes of the elements of the palp are smaller in *blauveltae,* as can be inferred from the figures and the used enlargement factors. The ratios of length of *blauveltae* to length of *lineatus* for cymbium, tegulum, median apophysis and embolic division, are 0.7-0.8; for the embolus proper, measured from the proximal fold to the tip, this ratio is even lower, slightly less than 0.6.

Calculated proportionally to the size of the examined animals (length cephalothorax), the ratios mentioned above are 0.8-0.9 for cymbium, tegulum, median apophysis and embolic division, and 0.7 for the embolus. This means that the shorter embolus of *blauveltae* is not merely due to the smaller size of the specimens, and consequently it constitutes a reliable specific character.

Measurements of palp (in mm). Length cymbium 0.92-1.05, tegulum 0.80-0.89, embolic division at the unexpanded palp 1.02-1.12, embolus 1.15-1.30.

Epigyne and vulva (fig. 27-29). Differing from *lineatus* in the number of spiral coils of the groove, of which three are present in *blauveltae,* and in the slightly broader and shorter middle part of the epigyne (0.22-0.26 mm).

Distribution and habitat. Recorded from many states of North America and Canada, but not south of 36° N. Apparently also occurring in East Asia (see below). Available data about habitat all point to the same situations as where *lineatus* occurs, viz., between plants and always near the ground. Adult specimens have been collected during most of the year (Blauvelt, 1936), but apparently more frequent in spring and autumn.

The present observations on *S. blauveltae* were made on North American specimens from many localities out of the collections of the American Museum of Natural History, New York, of the Museum of Comparative Zoology, Cambridge, Massachusetts, and from the Muséum national d'Histoire naturelle, Paris.

I have seen one male specimen from Ussuriysk (80 km N of Vladivostok) in East Siberia (Instytut Zoologiczny, Warszawa), the characters of which cut right through the differential characters listed here for *lineatus* and *blauveltae.* It is of small size (4.0 mm), with rather well developed stridulating files and with many lateral spines on the metatarsi I, thus resembling a small specimen of *lineatus.* The measurements of the palp on the other hand are very close to *blauveltae,* viz., length of cymbium 1.04 mm, embolic division 1.19 mm, and length embolus 1.4 mm. On account of the size of the palp and the shape of the different elements I have identified the specimen with *S. blauveltae.*

Stemonyphantes conspersus (L. Koch) comb. nov.

(fig. 30-40)

Linyphia conspersa L. Koch, 1879, Kongl. Svenska Vet.-Akad. Handl., 16(5):9, pl. 1 fig. 1 (descr. ♀, ♂; Jenissej, Siberia).

Stemonyphantes bucculentus var. *pictus* Schenkel, 1930, Entom. Meddel., 17:229 (descr. ♀; Riesengebirge). [new synonymy].

Stemonyphantes pictus; Buchar, 1967, Věst. Čs. spol. zool. (Acta soc. zool. Bohemoslovacae), 31(2):116, fig. 1-3 (redescr. ♀, descr. ♂; Böhmerwald, Czechoslovakia).

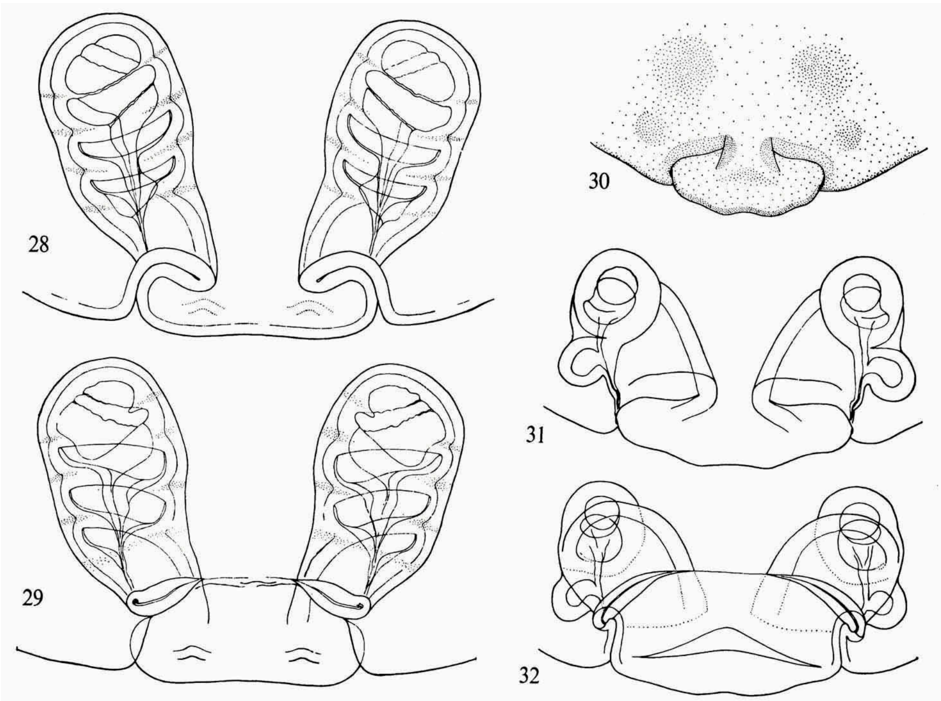

Fig. 28-29. *Stemonyphantes blauveltae* Gertsch. 28, vulva, ventral aspect; 29, vulva, dorsal aspect. Fig. 30-32. *S. conspersus* (L. Koch). 30, epigyne; 31, vulva, ventral aspect; 32, vulva, dorsal aspect. 28, 29, × 133; 30, × 67; 31, 32, × 89.

Types. ♂ lectotype of *Linyphia conspersa* L. Koch, by present designation, from Tunguska on Jenissej River, Siberia; 2 ♂ paralectotypes from same locality, 1 ♀ paralectotype from Nizhne-Imbatskoye, and 1 ♀ paralectotype from Surgutikha, all on Jenissej River, Siberia; whole type-series at the Naturhistoriska Riksmuseet, Stockholm. Holotype ♀ of *Stemonyphantes bucculentus* var. *pictus* Schenkel from Petzer, Riesengebirge (Universitetets Zoologiske Museum, København).

Males 5.1-5.7 mm, females 5.5-7 mm.

Median black stripe of cephalothorax forming a shield-shaped black spot on posterior part of cephalon, straight side forward; stripe diffused in front of spot, but two faint lateral streaks reach the PLE, forming an irregular black spot behind the eyes. Cephalothorax of male with deep-lying fovea, but thoracic part not swollen as in *lineatus* and *blauveltae*.

Chelicerae without stridulating files in either sex. Dorsal row of cheliceral teeth with three teeth; middle tooth large, basal tooth half as long, apical tooth smallest and not half as long as middle tooth in females, very small in males. Ventral row with two teeth of same size as basal dorsal tooth. Sternum becoming gradually lighter towards center, but lighter parts never sharply marked off against darker parts.

Legs annulated, metatarsi included, which have median and subapical rings. Metatarsus of male very lightly swollen on basal half, and slightly more sclerotized in the middle. Legs long and slender. Length of femur I 1.0-1.2 times length cephalothorax in females, 1.5-1.6 times in males (1.35 according to Buchar). Ratio length to diameter (at base of d″-spine) of tibia I 10 in females, 15 in males. Leg IV shorter or as long as leg I in females, clearly shorter than legs I and II in males.

Chaetotaxy:

Fe I dl′; II-IV d.

Pa I-IV $d_b d_a$, basal spine short.

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

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

Mt I-IV $(v'_b v''_b)$ $(v'v'')$ $l'l''$ $(v'v'')$ $[l'_a l''_a v'_a v''_a]$

Anterior metatarsi of male without a row of l″-spines, but with long ventral spinehairs along whole length; basal v-spines also in the shape of spinehairs.

Length of d″-spine on tibia I about 2 diams., on tibia IV 2.0-2.5 diams. in females, 2.5-3.0 diams. in males. Length of middle pairs of v-spines on anterior tibiae more than 2 diams., on anterior metatarsi 3 diams. or more.

Abdomen with a blackish dorsal pattern, reminding of the leaf-shaped dorsal band of *Linyphia montana* (Clerck).

Male palp (fig. 37, 40). Femur cylindriform, without spines; base of femur with very small warts on mesal surface, warts even smaller than in *blauveltae*. Patella two and a half times as long as high; dorsal spine situated near distal margin, 1.4 times as long as segment. Tibia (fig. 38) as long as patella, with mesal spine near distal margin as long as segment, and with two slightly longer ventral spines; meso-ventral surface with long spinehairs; ventro-apical apophysis directed forwards. Cymbium (fig. 33) not narrowed distally; protrusion on retro-lateral side of dorsal surface rather blunt and

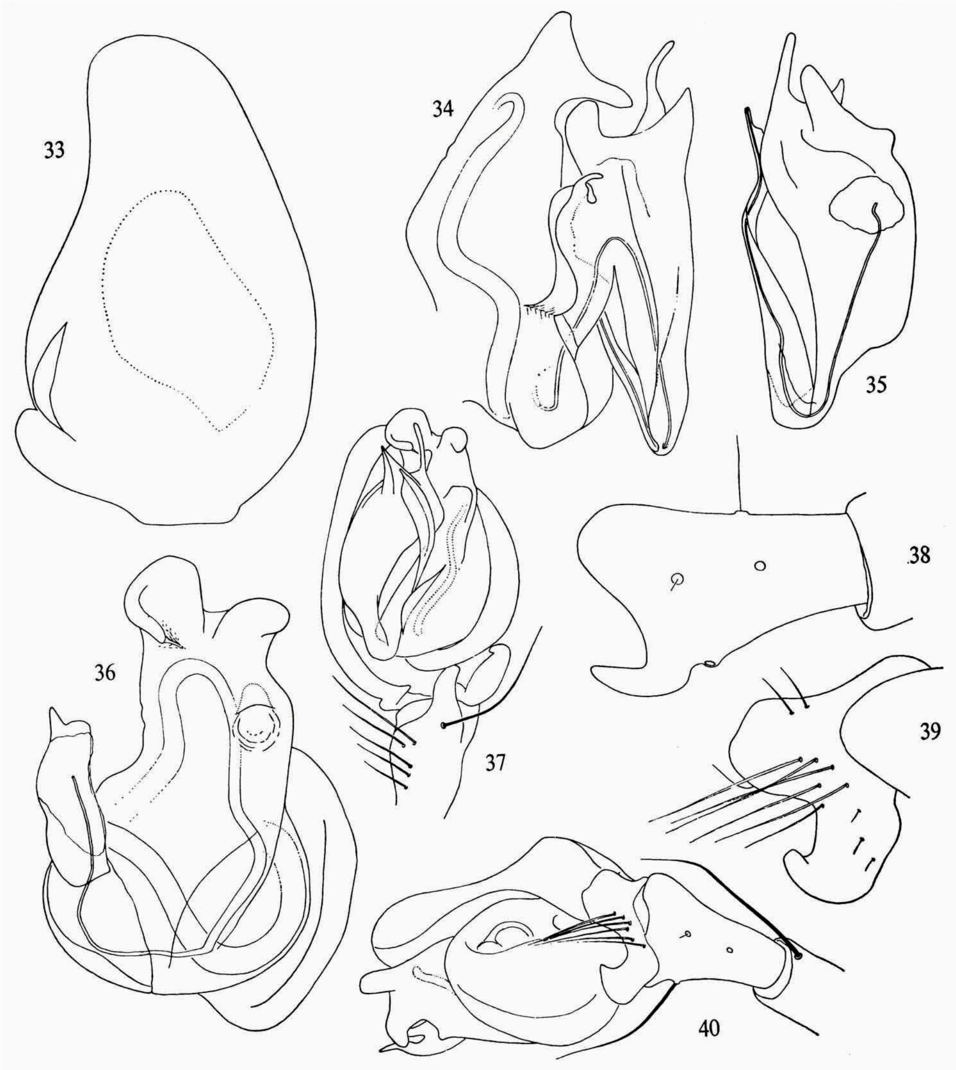

Fig. 33-40. *Stemonyphantes conspersus* (L. Koch). 33, cymbium, dorsal aspect; 34, tegulum, median apophysis and embolic division, meso-dorsal aspect; 35, embolic division, dorsal aspect; 36, tegulum and median apophysis, mesal aspect; 37, male palp, ventral aspect; 38, tibia of male palp, lateral aspect; 39, paracymbium, lateral aspect; 40, male palp, lateral aspect. 33-36, 38, 39, × 77; 37, 40, × 45.

broad, not accompanied by a hump distally of protrusion and chitinous lateral margin as in *blauveltae* and *lineatus*; salient corner on proximal part of lateral margin les developed. Paracymbium (fig. 39) as in *lineatus,* but ventral hook slightly broader proportionally; long forwardly directed hairs on middle part.

Subtegulum large, occupying proximal two-thirds of retro-lateral side of palp. Tegulum (fig. 34, 36) comparatively short and broad, shorter than cymbium but reaching tip of cymbium in the unexpanded palp, and bearing the usual two apical apophyses and mesal ridge; ventro-apical apophysis as broad as median apical one, the latter with sharp apical margin not curled mesad as in *lineatus*, curving backwards on dorsal side and passing without interruption into the ridge on the dorsal side of the mesal surface; ridge short but drawn out into a long slender tooth (fig. 34); ventro-apical apophysis more slender than in *lineatus*; semi-covered depression small but distinct. Median apophysis as in other species.

Embolic division (fig. 34, 35) slightly shorter than tegulum, three times as long as wide; dorsal surface rather flat with large subapical projection near mesal margin, projection bluntly rounded in lateral view; there is a small excrescence on the mesal margin at the base of the projection; lateral margin slightly sinuous, curving outwards on apical half, margin slightly raised, ending with a long and slender apophysis; ventral surface keeled, keel ending apically in a large sharp tooth, which is flattened on the distal surface, not excavated as in *lineatus*; a short groove on the ventral surface runs obliquely from lateral margin to base of tooth mentioned. Proximal end of embolic division narrowing rather suddenly, not bended or turned over as in *lineatus*, but folded forwards to the lateral side and continuing as broad ribbon-shaped embolus. Embolus tapering gradually towards tip but remaining flat and comparatively broad to just proximally of tip, suddenly narrowing there to short tooth. Middle part, where the spermduct enters the embolic division, membraneous, apical apophysis heavily sclerotized, lateral side of distal part and proximal part moderately sclerotized; proximal half of embolus heavily sclerotized on dorsal side.

Epigyne and vulva (fig. 30-32). Middle part of epigyne broad, roughly T-shaped; lateral margins curved inwards, then in anterior direction; posterior surface broadly excavated mesally. Vulva broader than long, groove making half a coil to the dorsal side, continuing with two coils, as a spiral groove on the inside wall of the receptaculum, which is curved ventrad. Fertilization-duct running backwards from lateral side of receptaculum and curving to dorsal side of vulva, provided with a small "secondary receptaculum" which lies postero-laterally from receptaculum. Width of middle part 0.30-0.35 mm.

Distribution and habitat. The species has now been recorded from Western Czechoslovakia (Böhmerwald and Riesengebirge) and from the Jennisej River in Siberia. Data concerning the habitat of the species were only mentioned by Buchar (1967), who collected his specimens on the lower branches of spruce-firs (0.5-2 m above the ground) on the border of a peat-moor. His specimens date from April and September. Schenkel's specimen from the Riesengebirge is labelled 17 July, 1929; this collecting date was not mentioned in the original description. The females of Koch's original material have been collected in September; the males are not dated.

Material examined.

Czechoslovakia: 1 ♀, Petzer near Trautenau, Riesengebirge, 17 July, 1929, E. Nielsen (holotype of *Stemonyphantes bucculentus pictus* Schenkel, 1930; Universitetets Zoologiske Museum, København).

Siberia: 3 ♂, Tunguska (62N 90E), on Jenissej River, 1875-1876, Nordenskiöld and Stuxberg (lectotype and paralectotypes of *Linyphia conspersa* L. Koch, 1879); 1 ♀, Nizhne-Imbatskoye (64N 88E), on Jenissej River, 16 September, 1875, Nordenskiöld and Stuxberg (paralectotype *L. conspersa*); 1♀, Surgutikha (64N 87E), on Jenissej River, 18 September, 1875, Nordenskiöld and Stuxberg (paralectotype *L. conspersa*; whole type series in Naturhistoriska Riksmuseet, Stockholm).

Discussion

According to Merrett (1963) *Stemonyphantes lineatus* is so aberrant in palp structure, that the parts cannot be homologized accurately with the elements in other species as far as the embolic division is concerned. Indeed it deviates considerably from his schematic representation of a generalized palp. However, the distribution of chitinized and membraneous parts on the embolic division may still hint to the limits of the original elements.

The strongly chitinized distal part (fig. 8) has a distinct proximal limit, which runs transversely across the embolic division just proximally of the strongly curved lateral margin and distally of the connecting membranes with the median apophysis. The central part, where the spermduct enters the element, is membraneous, the proximal part is chitinous again on the mesal side. The embolus is strongly chitinized from the proximal fold onwards. Consequently one might consider the proximal half to be derived from the radix, with the spermduct running along one side or through it to the embolus. The distal half then might be the remnant of a lamella or terminal apophysis. And the trend being the reduction or the absence of a terminal apophysis in species where the vulva of the female has no atrium, it is more probable we have before us a modified lamella.

When considering the differences and similarities between the three species dealt with in the present paper, one has to admit the striking resemblance between *lineatus* and *blauveltae* on the one hand, and the comparatively larger discontinuity between these two species and *S. conspersus* on the other. Comparing the European specimens of *lineatus* with the North American specimens of *blauveltae*, and leaving the single Siberian male of *blauveltae* out of consideration, the main differences between the two species lie in the genitalia, the relative length of the legs, the distinctness of the stridulating files, and the occurrence of l″-spines on the metatarsi I. Males of *blauveltae* moreover are smaller on the average. For the rest the two species are remarkably alike and have many characters in common, viz., the hair-like dorsal spines on the anterior tibiae, the coloration of cephalothorax and abdomen, the legs IV being longer than the front legs, and many others.

Examination of the Siberian male specimen reveals that we will get a different picture when we shall be able to study material from East Asia in the future. Two of the "specific" characters of *lineatus*, viz., the l″-spines on the male metatarsi I, and the well developed stridulating files on the male chelicerae, occur in the only available male of *blauveltae* from that region. The shape of the palpal elements is convincingly in accordance with *blauveltae*, but the sizes are slightly larger, though still close to the upper limits of the range found in North American material. It is most unfortunate that it will be very difficult to obtain more material from East Asia.

On the other hand we have the third species, *conspersus*, which is larger on the average, has a different pattern on cephalothorax and abdomen, has the legs longer and much more slender proportionally and legs IV as long as or shorter than I, while all spines are strong and never hair-like.

In my opinion, comparison of the genital organs shows comparable similarities between *lineatus* and *blauveltae*, *conspersus* again being more different. While the epigynes of *lineatus* and *blauveltae* have two small pits on the otherwise flat posterior surface, *conspersus* shows a distinct mesal excavation; the spiral groove is very short in *conspersus* and leads to receptacula, which are rather ventral in position; I have not found a homologue of the "secondary receptacula" of *conspersus* in the other species. The spiral grooves are much longer in *lineatus* and *blauveltae* and form conspicuous thick-walled columns of spiral coils towards the receptacula, while the two species seem to differ only in the number of coils. The male palp of *conspersus* is proportionally much smaller than in the other species, e.g. the ratio length of cymbium to length of cephalothorax is about 0.35 (*lineatus* 0.55-0.6, *blauveltae* 0.45-0.5), the ratio length of embolus to length of cephalothorax is 0.22 (*lineatus* 0.8-0.85, *blauveltae* 0.55-0.6). All elements of the palp of *conspersus* are not only smaller but also of a more simple structure, with less strongly developed apophyses than the homologous elements of the other species of the genus. The same applies to the epigyne, which is clearly less strongly developed than in *lineatus* and *blauveltae,* be it primitive or reduced, but unmistakably shows the same underlying generic plan.

The major difference between *lineatus* and *blauveltae* (again excluding the Siberian specimen from our observations) lies in the length of the embolus, which is longest in *lineatus* (ratio *blauveltae* to *lineatus* 0.6); there are many small differences in outline of the other elements, and all elements are relatively smaller in *blauveltae,* though less striking than the embolus. Judging from these differences in size between European and North American specimens it seems justified indeed to regard them as distinct species, despite their great resemblance. A proper functioning of the genitalia necessitates an attachment of the male palp to the epigyne, and I think it most unlikely that the small palp of *blauveltae* would get a foothold on the epigyne of *lineatus,* or vice versa. The sizes are too different, notably the length of the embolus. More material from East Asia should give us a clue as to the reality of this isolation.

This brings us to the functional aspects of the genitalia. The only thing we can say with some degree of certainty is that the ribbon-shaped embolus is brought into the spiral groove of the vulva during copulation, and indeed the measured length of the emboli corresponds well with the calculable length of the spiral grooves in the three species. This means that the proximal tip of the embolic division at the moment of maximum expansion of the palp lies near the entrance of the functioning half of the epigyne (left half when the left palp is used). However, as the tip of the embolus lies in the excavation on the distal surface of the meso-apical pyramidal tooth of the embolic division, it probably is this tooth which guides the small tip of the embolus to the correct slit-like entrance of the vulva. Thus we must infer, that at one moment during the expanding movements of the palp the distal end of the embolic division is near the entrance of the functioning half of the vulva, while the proximal end takes this position at the moment of maximum expansion of the palp.

The other apical apophyses may have functions in the first situation, e.g. fastening the embolic division in the appropriate position, enabling the embolus to enter the vulva, but it is equally likely that their functioning is restricted to the later phase of maximum expansion. In the same way one can speculate about the apical modifications of the tegulum, the "bezel" of Blauvelt, and the rôle played by the median apophysis.

The obvious method to solve these questions is of course to observe the pairing of one of the species, and if possible to fix the copulatory organs in functional contact. My attempts to do so with *S. lineatus* have failed so far. Males brought into the web of females remained inactive and the females kept to their retreats, which this species builds at one side of the web. May the present paper stimulate the interest of other arachnologists in this common spider with its strangely modified palp.

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References

Blauvelt, H. H., 1936. The comparative morphology of the secondary sexual organs of Linyphia and some related genera, including a revision of the group. Festschr. Strand, 2: 81-171, pl. 6-23.

Bonnet, P., 1958. Bibliographia Araneorum, 2(4): 3027-4230. Toulouse.

Buchar, J., 1967. Eine wenig bekannte Baldachinspinne Stemonyphantes pictus Schenkel, 1930. Věst. Čs. spol. zool. (Acta soc. zool. Bohemoslovacae), 31(2): 116-120, fig. 1-3.

Emerton, J. H., 1876. Spiders common to New England and Europe. Psyche, 1(21): 129-131.

——, 1882. New England spiders of the family Therididae. Trans. Connecticut Acad. Arts Scienc., 6(1): 1-86, pl. 1-24.

Ermolajev, W., 1934. Materialien zur Spinnenfauna West-Sibiriens. III. Die Spinnen der Stadt Tomsk. Folia Zool. Hydrobiol., 7(1): 130-148.

Gertsch, W. J., 1951. New American Linyphiid spiders. Amer. Mus. Nov., 1514: 1-11, fig. 1-16.

Kaston, B. J., 1948. Spiders of Connecticut. Bull. State Geol. Nat. Hist. Surv., Connecticut, 70: 1-874, pl. 1-144.

Keyserling, E., 1886. Die Spinnen Amerikas. Theridiidae, 2(2): 1-295, pl. 11-21. Nürnberg.

Koch, L., 1879. Arachniden aus Siberien und Novaja Semlja. Kongl. Svenska Vet.-Akad. Handling., 16(5): 1-136, pl. 1-7.

Kulczynski, W., 1885. Araneae in Camtschadalia a Dre B. Dybowski collectae. Pam. Akad. umiej. Krakow, 11: 1-60, pl. 9-11.

——, 1916. Araneae Siberiae occidentalis arcticae. Mém. Acad. Imp. Sci., (7)28(11): 1-44, pl. 1-2.

Linnaeus, C., 1758. Systema Naturae, (ed. 10) 1:1-823. Holmiae.

——, 1767. Systema Naturae, (ed. 12) 1 (2): 533-1327. Holmiae.

LOCKET, G. H. & A. F. MILLIDGE, 1953. British spiders, 2: 1-449, fig. 1-254. London.

MENGE, A., 1866. Preussische Spinnen. 1. Schrift. naturf. Ges. Danzig. N.F., 1 (3/4): 1-152, pl. 1-28.

MERRETT, P., 1963. The palpus of male spiders of the family Linyphiidae. Proc. Zool. Soc. London, 140 (3): 347-467, fig. 1-127.

SCHENKEL, E., 1930. Spinnen vom Petzer, Riesengebirge, und Mayrhof, Tirol, gesammelt van E. Nielsen. Entom. Meddel., 17: 228-231.

SIMON, E., 1929. Les Arachnides de France, 6 (3): 533-772, fig. 813-1112. Paris.

SYTSCHEWSKAJA, W. J., 1935. Etude sur les Araignées de la Kamtchatka. Folia Zool. Hydrobiol., 8 (1): 80-103, fig. 1-18, pl. 5.

WIEHLE, H., 1956. Spinnentiere oder Arachnoidea (Araneae). 28. Familie. Linyphiidae-Baldachinspinnen. Die Tierwelt Deutschlands, 44: 1-337, fig. 1-551.