

Spiders of the Oriental-Australian region. I. Lycosidae: Venoniinae and Zoicinae

PEKKA T. LEHTINEN & HEIKKI HIPPA

Lehtinen, P. T. & Hippa, H. 1979: Spiders of the Oriental-Australian region I. Lycosidae: Venoniinae and Zoicinae. — Ann. Zool. Fennici 16: 1—22.

Web-spinning for catching prey is a plesiomorphic character in Lycosidae. Hippasinae auct., defined according to long spinnerets and correlated web-spinning habits, is polyphyletic.

Small web-spinning Lycosids and their vagrant relatives from the Oriental-Australian region are revised.

Venoniinae (including *Anomalosa*, *Venonia*, *Zantheres*, and *Satta*) and Zoicinae (*Lysania* and *Zoica*) are established as new subfamilies of Lycosidae.

Satta gen. n. and *Kwintippia* subgen. n. of *Zoica* are described. *Flanona* Simon, 1898 = *Zoica* (*Zoica*) Simon, 1896. *Vagellia* Simon, 1899 is not a synonym of *Zoica*. *Anomalomma* Simon, 1890 is insufficiently described and therefore a dubious genus, but probably a synonym of *Lysania* Thorell, 1890. The taxonomic position of various *Anomalomma* spp. and other misplaced species is discussed.

New taxa: *Venonia kokoda* (♂♀), *V. milla* (♂♀), *V. vilkkii* (♀), *Zoica* (*Kwintippia*) *wauensis* (♂♀), *Z. (K.) bolubolu* (♀), and *Satta cannibalorum* (♂) from New Guinea, *Z. (K.) falcata* (♂♀) from New Guinea and Borneo, *Lysania sabahensis* (♀) from Borneo, and *Z. (Z.) bambusicola* (♀) from Thailand. Adult ♂♀ of *Venonia cinctipes* (Simon, 1898) comb. n., are described for the first time, as well as unknown sexes of *Zantheres gracillimus* Thorell, 1887 (♀), *Lysania pygmaea* Thorell, 1890 (♂), *Zoica parvula* (Thorell, 1895) (♂) and *Z. puellula* (Simon, 1898) (♂), comb. n. Additional new combinations are *Venonia muju* (Chrysanthus, 1967) and *V. micans* (Simon, 1898).

Pekka T. Lehtinen and Heikki Hippa, Department of Biology, University of Turku, SF-20500 Turku 50, Finland.

1. Introduction

This is the first of a series of papers dealing with the spiders of the Oriental-Australian region. The material was recently collected during five expeditions made by the Zoological Museum of Turku University. All material is preserved in that museum, unless otherwise mentioned.

Lycosids are generally regarded as typical vagrant spiders, and the few known genera of web-spinning Lycosids have always been grouped together. This group was originally called Hippaseae by Simon (1898b), and Petrunkevitch (1928) created the subfamily Hippasinae for all Lycosids with long spinnerets correlated with known or supposed web-spinning habits. Later on, species with a web for catching prey were consistently referred to Hippasinae.

Roewer (1960) did so for most of the small species discussed in this paper as well as for *Aulonia albimana* and various African species. Recently, Job (1968) also listed *Aulonia* in Hippasinae, and Brady (1962, 1972), although he did not fully agree with previous opinions, did not remove American web-spinning Lycosids, including *Sosippus*, from Hippasinae.

During our field work in the Far East we observed that many tropical Lycosids spin a web for catching prey, and that the different types of Lycosids differ greatly in the type of web spun. In contrast to Holarctic and Neotropical Lycosids, many tropical species in the Old World are small or even minute; they occupy a wide range of habitats, including the dark floor of rain forests and even subterranean microhabitats. The European Lycosids, although rich in species and dominant in many

Table 1. Comparison of Lycosid subfamilies.

	Venoniinae	Zoicinae	Hippasinae	Lycosinae
Size	small (-medium) 3–6.5 mm	minute-small 1.5–4 mm	medium-large 6–24 mm	medium-very large 5–30 mm
Carapace cephalic area	narrow ± high	flat, ± indistinctly limited (or normal)	protruding, but laterally sloping	usually high, seldom narrow
colour pattern	absent	absent	obscure bands	1–3 distinct light longitudinal bands
post. ocular trapezium	trapezoidal	wide trapezoidal	wide trapezoidal	usually ± quadrangular
size of anterior eyes	small	variable, usually small	rather large	very variable
Cheliceral armature Abdomen	2–3 + (2–)3–5	2–3 + 2–4	2 + 2–3	2–3 + 2–3
basic colour pattern	insignificant with white spots	absent or striking white markings	basic pattern of Amaurobioidea	basic pattern of Amaurobioidea
special features	pale posterodorsal spot (spots)	male scutum, female with small lateral scuta	white transverse seg- mental bands or pairs of spots	usually none
modified hairs (when present)	glistening hairs (ultrastructure variable)	white feathery hairs	distally club-shaped hairs, white feathery hairs	glistening serrate hairs, ventral abdo- minal spicules, etc.
Leg spinulation dorsal femoral	1 row + apical pair	1 row	3 rows	1 or 3 rows
ventral tib. & metat.	2–3 + 2–3 pairs	2–3 + 1–3 pairs	3 + 3 pairs	2–10 + 2–10 pairs
dorsal tib. & metat.	variable	I–II: absent	I–IV: numerous	variable, but numerous
Male palp origin of embolus	mesial	distal	mesial	mesial with basal coil
shape of embolus	simple curved spine	very variable	simple curved spine	variable, but often simple curved spine
shape of conductor	large apical, usually with specialized apex	variable	simple curved, often resembling embolus	variable
truncus	simple, weakly sclerotized	rather simple, with lateral boss	simple, but well sclerotized	very complicated, with apophyses
median apophysis	articulated membra- nous (-absent)	absent	bipartite or distinctly bilobate	well sclerotized, thick
functional conductor	conductor	variable (also truncal apophysis?)	conductor	truncal apophysis or conductor
modifications of cymbium and basal palpal segment	usual in cymbium, also in femur and tibia	tibia sometimes thickened	cymbium with lateral lobe	rare in cymbium, tibia, or femur
Epigyne	entire plate with central depression	central hairy plate	posteriorly protruding hairy extension	median inverted T-shaped plate with anterior pockets
Web	sheet web	sheet web or none	funnel web or reduced funnel bottom (? or none)	funnel web or reduced funnel bottom, usually none
Cocoon	white, globular, with seam	white, globular	white or coloured, globular	white or coloured, globular or lens-shaped
Distribution	Oriental-Australian	Oriental-Australian	Oriental-Ethiopian (- Australian)	worldwide

open habitats, seem to represent only a few, exceptionally successful lines of lycosid evolution (Pardosini, Lycosini, and some deviating forms). Because of the entirely vagrant habits of the Pardosini, the whole Lycosidae has been erroneously classified as vagrant, although many well-known Lycosids (*Lycosa*, *Trochosa*, *Geolycosa*) are

more or less sedentary and use the reduced funnel bottom of a funnel type web as a permanent retreat. The classical definition of Lycosidae must also be corrected in other important respects. Although most Lycosids are three-clawed and without scopulae, "*Lycosa*" *orimus* Chamberlin 1924 and several related Neotropi-

cal species have only two tarsal claws and strong scopulae on the tarsi, metatarsi and tibiae.

The American *Sosippus* is a typical member of Lycosinae on account of both male and female genital organs. Its Neotropical relative *Porrina* deviates from all other Lycosids in having the anterior lateral eyes raised on tubercles. Their well-developed funnel web is similar to that of *Hippasa* and related true Hippasine genera, but also to various Agelenids. Thus the funnel web is simply a plesiomorphic character for a wide group of families of Amaurobiomorpha. The African web-spinning Lycosids also represent several unrelated groups, but a detailed discussion concerning the relationships of various genera of Hippasinae auct. is outside the scope of this paper.

Lehtinen (1978:262) first noticed that there is no gap at all between traditional Lycosinae and Pardosinae, and in this paper this largest group of Lycosidae is referred to simply as Lycosinae. However, this does not imply that Lycosinae and Pardosinae auct. can simply be lumped together. On the contrary, a number of deviating genera must be transferred elsewhere, and Hippasinae must probably be expanded to include some more or less vagrant groups.

The classification of Lycosidae was discussed extensively by Roewer (1959, 1960) and Guy (1966), but all their supraspecific categories are based on simple meristic characters, including the number of cheliceral teeth, relative size and pattern of eyes, etc., and most of them are purely artificial. Both these authors totally neglected the characters afforded by the genital organs at supraspecific levels.

The nomenclature of the different parts of the Lycosid genital organs has not yet been established, and their homologies with corresponding structures in other families of Amaurobiomorpha (sensu Lehtinen 1978) have not been finally clarified.

Kronstedt (1975:226—227) reviewed the terminology of Lycosid genital organs, but the structures discussed by him and various earlier authors cited by him do not quite correspond to the genital structures of Lycosids treated in this paper. This is especially true of the epigyne, for which the traditional alternative names apply only to an epigyne of Lycosine type.

No attempt will be made to establish the homologies of Lycosid genital organs in this context. We have simply chosen some available

terms for the structures to be discussed (see Figs. 22—23). We are aware that "conductor" is not a very suitable name for the outer part of the Lycosid embolic division, because it is not always a functional conductor, and that "median apophysis" was originally used in Araneoida for a part that can hardly be compared with any part of the Amaurobiomorph palpus. Concerning Kronstedt's "terminal apophysis" we prefer the term "truncus" for three reasons. Firstly "terminal apophysis" has been used for topographically widely different parts of the bulbus in other spider groups. Secondly this sclerite always originates more or less basally between the subtegulum and tegulum, where it remains totally concealed between the bulbus and alveolus in the unexpanded palpus. Thirdly the position of the truncus is not terminal in Venoniinae, and even less so in Zoicinae, although in Lycosidae the complicated distal part of the truncus is largely terminal.

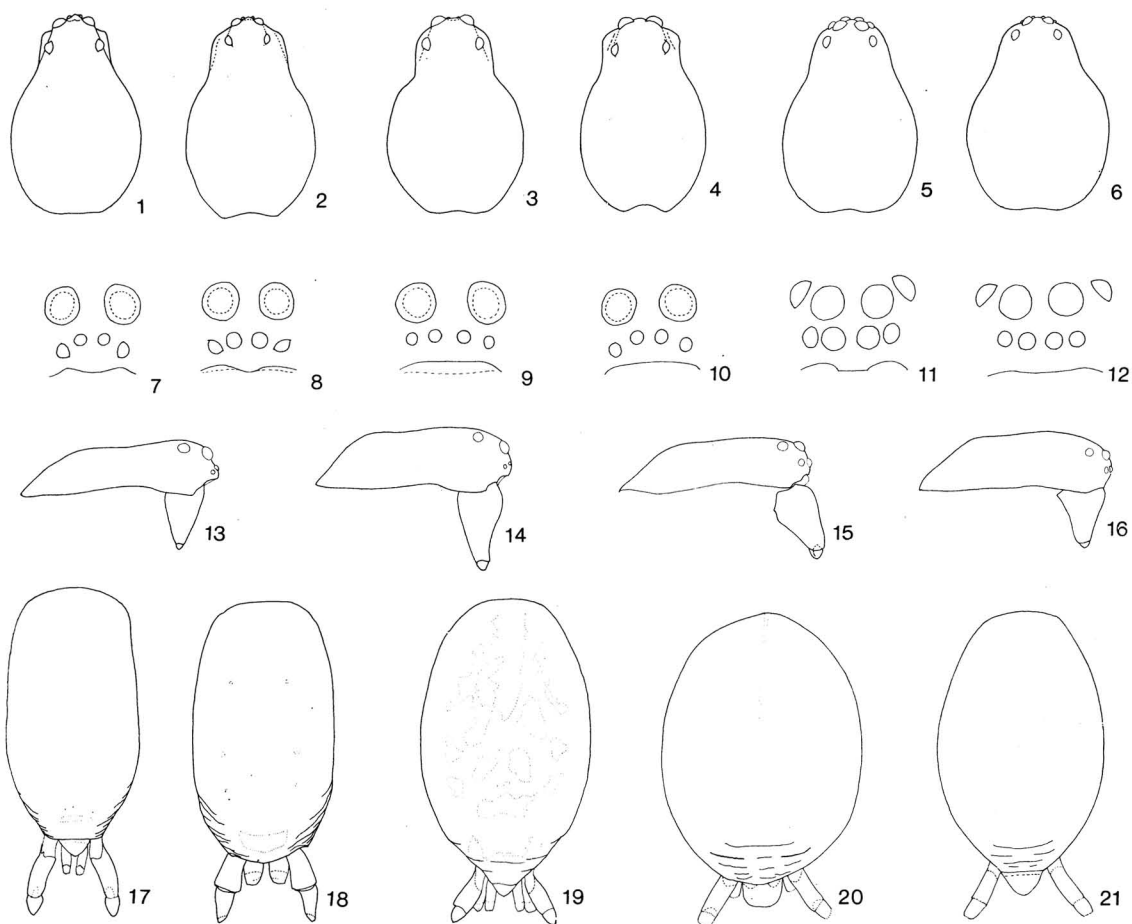
In the Oriental area and around the Torres Strait a common and widespread type of Lycosidae is small and slender, without longitudinal colour pattern on the carapace, and without the typical basic abdominal pattern of Pardosini and Lycosini. They are revised here in accordance with the principles of modern taxonomy. All the holotypes mentioned have been examined unless otherwise stated.

2. Descriptions¹

Venoniinae subfam. n.

Small to medium (3—6.5 mm) web-spinning Lycosids. Carapace unicolorous, cephalic area high and narrow, clypeus more or less protruding centrally. Abdomen rather narrow, with variable but often insignificant pattern.

¹ The following abbreviations will be used in this section: ALE = anterior lateral eyes, AME = anterior median eyes, PLE = posterior lateral eyes, PME = posterior median eyes, ALS = anterior lateral spinnerets, PLS = posterior lateral spinnerets, BMNH = British Museum, Natural History, London, MCSN = Museo Civico di Storia Naturale „Giacomo Doria", Genoa, MNHN = Museum National d'Histoire Naturelle, Paris, MZT = Zoological Museum, Department of Biology, University of Turku, Turku, NHR = Naturhistoriska Riksmuseet, Stockholm, RNHL = Rijksmuseum van Natuurlijke Historie, Leiden, SMF = Senckenberg-Museum, Frankfurt-am-Main, ZMH = Zoologisches Museum der Universität Hamburg, Hamburg, ZSI = Zoological Survey of India, Calcutta, PTL = Pekka T. Lehtinen (collector).



Figs. 1–21. Carapace of male in dorsal view (Figs. 1–6), anterior and median eyes of male in anterior view (Figs. 7–10), eyes of male in anterior view (Figs. 11–12), carapace of male in lateral view (Figs. 13–16) and abdomen of male in dorsal view (Figs. 17–21). — 1, 7, 13 and 18: *Venonia coruscans* Thorell (Borneo). — 2, 8 and 17: *Anomalosa kochi* (Simon) (lectotype). — 3, 9, 14 and 19: *Satta cannibalorum* sp. n. (holotype). — 4 and 10: *Lysania pygmaea* Thorell (Pinang.) — 5, 11, 15 and 20: *Zoica parvula* (Thorell) (Central Thailand). — 6, 12, 16 and 21: *Z. falcata* sp. n. (New Guinea). — Orig.

Glistening hairs or strikingly white hairs of variable ultrastructure often present. Male palpus with simple truncus; median apophysis more or less membranous or lacking. Cymbium, palpal tibia, or femur may be modified. Epigyne usually with central depression. Egg cocoon white, more or less globular, but with central seam.

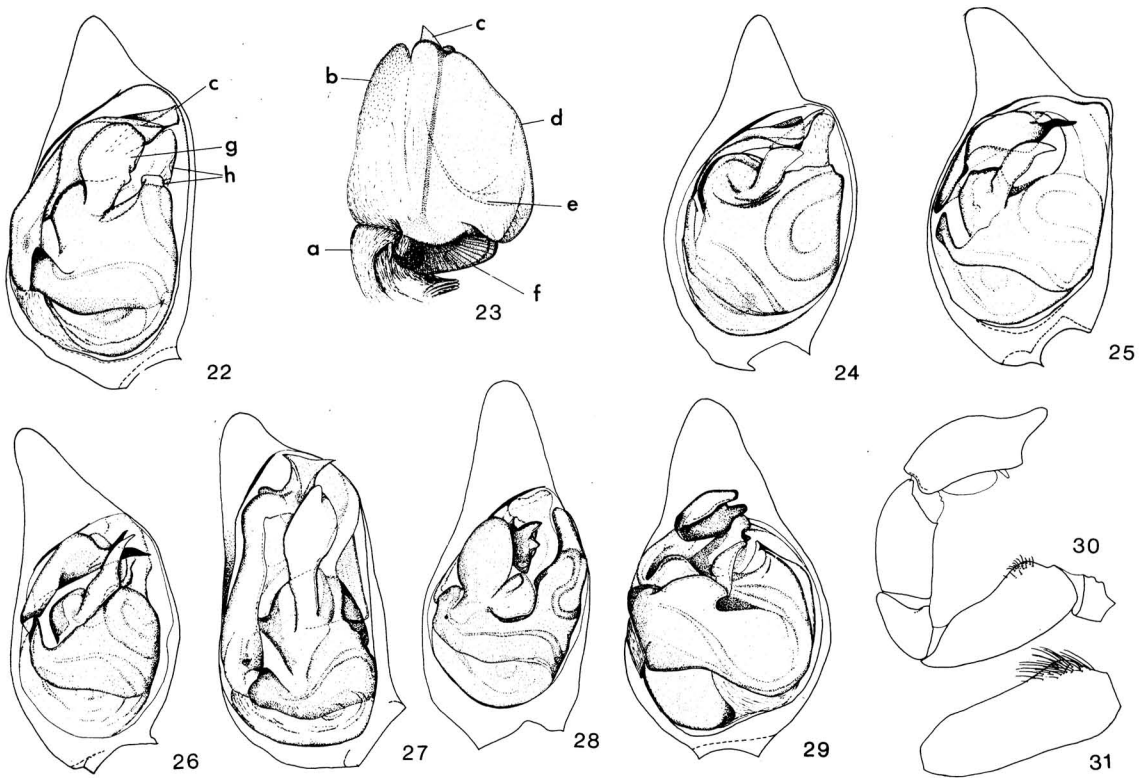
For differential diagnosis, see Table 1.

The spinnerets of all known Venoniinae are rather long and slender, the posterior pair with long conical distal segments. This combination is more or less correlated with the web-spinning habits. Considerable variation may be caused

by artefacts influencing the telescopic structure of the segmented spinnerets.

The sexual dimorphism in Venoniinae is reflected in the relative length and colour pattern of the legs, as well as in minor differences in the shape of the carapace and abdomen, but it is not usually striking.

The male genital organs have an S-shaped ejaculatory duct, the mesial margin of the tegulum drawn to a lobe directly connected with the bipartite embolic division. The embolic division is divided into an inner embolus proper, a simple curved spine, and an outer distal conductor, which is obviously a functional



Figs. 22–31. Male palp: tarsus in ventral view (Figs. 22, 24–29), bulbus in dorsal view (Fig. 23), in retrolateral view (Fig. 30) and retrolateral view of femur (Fig. 31). — 22 and 23: *Venonia milla* sp. n. (paratype). — 24: *V. coruscans* Thorell (Borneo). — 25 and 30: *V. cinctipes* (Simon) (New Guinea). — 26 and 31: *V. muju* (Chrysanthus) (New Guinea). — 27: *V. kokoda* sp. n. (holotype). — 28: *Anomalosa kochi* (Simon) (lectotype). — 29: *Satta cannibalorum* sp. n. (holotype). Abbreviations: a = haematodocha, b = truncus, c = conductor, d = tegulum, e = embolus, f = subtegulum, g = median apophysis, h = tegular apophysis. — Orig.

conductor. The truncus is simple — in its simplest form virtually only a haematodocha with weakly sclerotized margins, and without distinct apophyses. For the exceptional palpal structure of *Zantheres*, see p. 11.

The female epigyne usually has a central depression flanked by variously shaped copulatory pockets. The posterior epigynal area is continuous, not divided into lateral and median plates. *Zantheres* has an epigynal scape.

Typical species of Venoniinae are easily recognizable in the field by their small, slender appearance, simple sheet web and glistening abdominal hairs. However, there are no true key characters.

The web of *Venonia* (details not known for other genera) is similar to the web of the sympatric and ecologically similar *Lysania* (Zoicinae). The web of the sympatric *Hippasa holmerae*

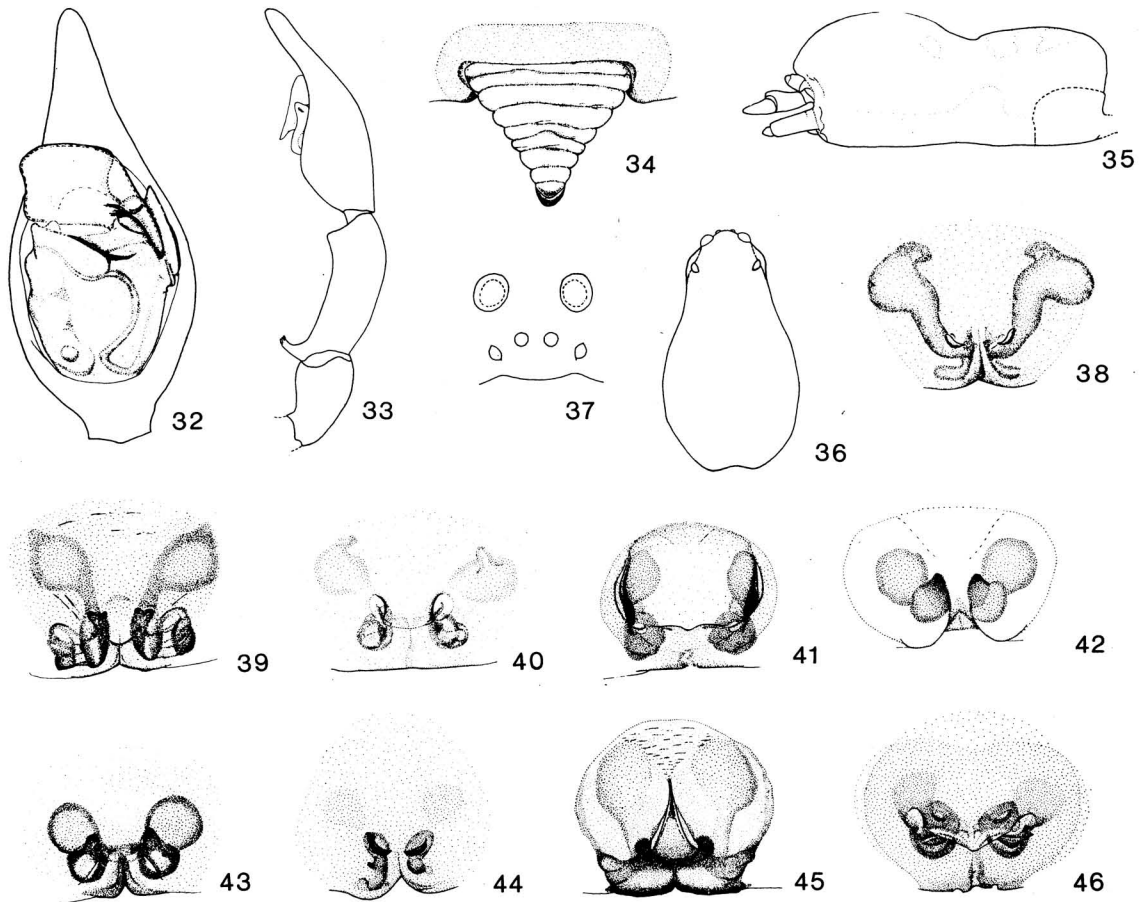
Thorell, 1895 may also include a very weakly defined retreat.

A long, narrow, practically unicolorous carapace with narrow head and protruding ocular area has been a parallel development in *Venonia*, *Zantheres*, and the European *Aulonia albimana*, whose position is uncertain.

Glistening hairs occur in all species of *Venonia* and *Zantheres*, but also in an undescribed genus of Lycosinae in the Far East. In the different genera these hairs differ in ultrastructure (Figs. 65–67), suggesting parallel evolution rather than synapomorphy.

In both Venoniinae and Hippasinae the male palpus has a simple truncus. This is certainly a plesiomorphic character in Lycosidae. The truncus itself is present only in this family.

The lack of a median plate and associated anterior pockets in the epigyne is probably



Figs. 32–37. *Zantheres gracillimus* Thorell (holotype male and paratype female). — 32: palpal tarsus of male in ventral view. — 33: palpal patella, tibia and tarsus of male in prolateral view. — 34: female epigyne in ventral view, after a freehand drawing. — 35: abdomen of male in lateral view. — 36: carapace of male in dorsal view. — 37: anterior and median eyes in anterior view. — Orig.

Figs. 38–46. Epigyne in ventral view. — 38: *Venonia coruscans* Thorell (Borneo). — 39: *V. milla* sp. n. (paratype). — 40: *V. micans* (Simon) (lectotype). — 41: *V. vilkkii* sp. n. (paratype). — 42: *V. cinctipes* (Simon) (New Guinea). — 43: *V. muju* (Chrysanthus) (New Guinea). — 44: *V. micarioides* (L. Koch) (lectotype). — 45: *V. kokoda* sp. n. (paratype). — 46: *Anomalosa kochi* (Simon) (paratype). — Orig.

primary in all Venoniinae, but this character is also shared by primitive Hippasinae, including *Hippasa*. In some derivatives of Lycosinae these structures may be secondarily reduced or strongly modified. But in many respects the epigyne of Venoniinae differs greatly from that of Hippasinae. The monophyly of Venoniinae as delimited here is not indisputable, but we prefer to list *Satta* and *Zantheres* as probable deviating Venoniinae rather than to suggest new higher taxa for them. Clearly they do not belong to Lycosinae, Hippasinae or Zoicinae.

Another difficulty is the placing of *Aulonia*, which in external features is strikingly similar to Venoniinae. This spider has repeatedly been compared with species of Venoniinae. The epigyne of *Aulonia* in fact has distinct anterior pockets, but the epigynal plate is not typically Lycosine. The truncal apophyses are very strong and act as a functional conductor, the “conductor” itself being small. Hence it may have had a common origin with Lycosinae, but it may represent a separate phyletic line in which the web-spinning habits have been preserved.

Anomalosa Roewer, 1960

Anomalosa Roewer, 1960, Explor. Parc. Nat. Upemba 55:177.

Type-species *Anomalomma kochi* Simon, 1898, by original designation.

Medium-sized Lycosids (larger than other Venoniinae) with insignificant abdominal pattern and without glistening hairs. Male palpus with a few modifications, but tegulum drawn out into a large latero-apical lobe including a coil of the ejaculatory duct. Median apophysis two-lobed, membranous. Epigynal plate simple, with small paired orifice. For differential diagnosis, see Table 2.

Roewer (1960) based his description solely on the structure of the eyes and chelicerae. He also included *Anomalomma harishi* Dyal, 1935 in *Anomalosa*. This indicates that genital organs were not used at all in defining the genus.

Anomalosa is a rather close, structurally mainly plesiomorphic relative of *Venonia*. It has no striking characters apart from the genital organs, and therefore other species may have been misplaced.

Anomalosa kochi (Simon, 1898)

Anomalomma kochi Simon, 1898, Ann. Soc. Entomol. Belg. 42:23.

Lectotype ♂ and alloparatype ♀ selected here from syntype material (including 4 additional ♀♀), from Cooktown, Queensland, Australia, in MNHN (Paris).

Males can be separated from most medium-sized Australian Lycosids by the bilobate membranous median apophysis and the mesial angle of a typically Venoniine tegulum. The female epigyne is a simple sclerotized

plate with a pair of copulatory orifices, a simple type that is very difficult to separate from the epigyne of some undescribed species of Lycosids with entirely different palpal structure.

Male: carapace 2.9 × 1.9 mm, index 1.55; abdomen 2.4 mm; tibia I 1.8 mm, tibial index 0.61.

Carapace (Fig. 2) pale brown with faint darker radiating striae; eyes of anterior ocular area surrounded by black. Eye pattern: Figs. 2, 8. Chelicerae pale brown; palpus pale yellowish brown; maxillae and labium apically pale yellowish brown, basally darker brown. Legs pale yellowish brown with slight paler annulations similar to female. Abdomen (Fig. 17) dorsally and laterally greyish brown with faint pale hairy patches and faint small paler posterodorsal spot, ventrally pale yellowish brown. Spinnerets greyish brown, the anterior pair darkest. Palpus: Fig. 28.

Female: carapace 2.2–3.0 × 1.5–2.0 mm, index 1.18–1.56; abdomen 2.3–3.5 mm; tibia I 1.5–1.8 mm, tibial index 0.59–0.64. As male, except carapace, chelicerae and sternum deeper orange brown; legs darker, II–IV with rather distinct subbasal and submedian paler annulation on femora and tibiae, annulation patterns increasing in intensity from legs II to IV; no pale posterodorsal spot on abdomen. Epigyne: Fig. 46; in one specimen the posterolateral receptacula extend further posteriorly.

Simon's (1898a, 1898b) original placing of *A. kochi* in *Anomalomma* can be explained by the very wide and obscure delimitation of this genus which, besides typical *Venonia* spp., included *Lysania* and also African Hippasinae. We have not yet revised those medium-sized and large Oriental-Australian Lycosidae for which no interpretable figures of genitalia are available. Therefore other species of *Anomalosa*

Table 2. Genera of Venoniinae.

	<i>Anomalosa</i>	<i>Venonia</i>	<i>Zantheres</i>	<i>Satta</i>
Total size	6–6.5 mm	3–5 mm	3.5–4 mm	3.5 mm
Cheliceral armature	3 + 3	3 + 2–4	2–4 + 3–4	3 + 2
Distance of PME	Ø of PM	Ø of PM	1.5 Ø of PM	Ø of PM
Abdominal colour pattern	simple Lycosid type	pairs of white spots	pairs of white spots	simple Lycosid type
Glistening hairs	absent	always present, feathery	always present, simple	absent
Ventral tibial & metatarsal spines	2–3 + 3 pairs	2–3 + 2–3 pairs	I: 1 + 2, II–IV: 2 + 2 pairs	3 + 3 pairs
Sexual dimorphism	insignificant	leg coloration, length of legs, shape of carapace	shape of abdomen, length of legs	female unknown
Male palp conductor	distally lobed	distally ± pointed	large, distally pointed	complicated with 2 folds
median apophysis	bipartite	falciform	absent	falciform
mesial tegular part	narrow lobe	narrow lobe	wide, rounded	wide, rounded
cymbial modifications	absent	present	absent	absent
tibial modifications	none	tibia swollen or none	basal barbed hook	none
femoral modifications	none	sometimes present	absent (femur very long)	none
Epigyne	simple plate with lateral foveae	simple plate with central depression	wrinkled scape with posterior pit	female unknown
Distribution	Queensland	Malaya-Philippines-Queensland	Burma	New Guinea

may have been described already. Our extensive Lycosid material from these areas does not include any close relatives of *Anomalosa* except *Venonia*.

Venonia Thorell, 1894

Venonia Thorell, 1894, Bull. Soc. Entomol. Ital. 26:12. Type species by original designation and monotypy *V. coruscans* Thorell, 1894.

Small, narrow Lycosids with small sheet web, easily recognized by a white posterodorsal spot on abdomen and by glistening hairs. Male palpus often with cymbial modifications; median apophysis membranous, but distinctly articulated with tegulum. Epigyne usually with a central depression.

For differential diagnosis, see Table 2.

Carapace and chelicerae \pm unicolorous dark or blackish, with different tones in different populations; radiating darker striae indistinct; ocular area blackish; sternum, maxillae, labium, and coxae paler than carapace. Legs in male sometimes almost unicolorous pale yellow to greenish grey in old, well-sclerotized specimens; some specimens (presumably just after the last moult) with annulation pattern more or less similar to that of females. Female legs with femora I \pm unicolorous dark, femora II—IV and tibiae dark, with 3 paler annuli on femora, tibiae with paler submedian annulus, and distal segments usually unicolorous pale, except sometimes metatarsi with indistinct dark apical rings. Abdomen without typical Lycosid pattern, but scattered white spots often also present besides the striking posterodorsal spot; ventrally paler, with distinct dark longitudinal stripes. Spinnerets dark.

Leg spinulation inconstant, including ventral spines of tibiae and metatarsi, which may include irregularly placed unpaired spines in addition to the normal 2—3 pairs; dorsal femoral spines in one row, but some specimens have an additional pair of small lateral spines apically; patellae, tibiae and metatarsi with longer dorsal spines and a few irregular lateral spines; tarsi spineless.

Tarsi with two short, central rows of trichobothria; metatarsi with 2 basal and 1 subdistal rows; tibiae with complicated patterns of trichobothria; all rows consist of trichobothria of distally increasing length, the longest being more than four times the diameter of the corresponding segment.

Sexual dimorphism usually \pm distinct, affecting relative length of legs, shape of carapace, intensity of white abdominal pattern and glistening hairs, in addition to patterns of leg coloration mentioned above.

The six small species are very similar, without marked differences in the structure of the genital organs. *V. kokoda* has somewhat deviating genitalia and in other respects is also the most different species. We do not create a monotypic subgenus for this species, at least not until more information is available. There are probably many still undescribed species of these small spiders.

Venonia coruscans Thorell, 1894

Venonia coruscans Thorell, 1894, Bull. Soc. Entomol. Ital. 26: 33. ♂ only.

V. coruscans, Workman & Workman, 1897: 96, Table 96. ♂ ♀.

Holotype ♂ from Singapore, type preservation unknown.

Additional material, all from Malaysia: Johor, Kota Tinggi District, Jalan Lombong, Biological Field Station, 4 ♀ 6 juv. from litter and sparse vegetation of rain forest, 31.X.—4.XI. 1976, PTL. — Johor, Kota Tinggi, 1 ♀ on small sheet web in old field with grass, 3. XI. 1976, PTL. — Borneo (Sabah), Kota Kinabalu District, Kota Kinabalu, 1 ♂ 6 ♀ 5 juv. on small sheet webs in high grass at forest edge, 5.XI. 1976, PTL. — 1 ♂ 6 ♀ 5 juv. — Borneo (Sabah), Tuaran district, Kelawat, 1 ♀ from roadside jungle slope at 2600 m, 6.XI. 1976, PTL.

In the three first-mentioned places this species was collected with local *Lysania* sp. from similar webs.

Not separable in the field from other species of *Venonia*, but not known to occur sympatrically with any of them. Male with an exceptionally thick loop in the ejaculatory duct and a wide extension of the mesial tegular margin round the median apophysis. Female best characterized by shape of receptacula.

Male: Carapace 1.6 × 1.0 mm, index 1.58; abdomen 1.4 mm; tibia I 1.3 mm, tibial index 0.79.

Carapace (Figs. 12, 13) and other sclerotized parts with greenish grey tone; cheliceral margin with 3+3 teeth. Abdominal pattern consisting of a few indistinct pale spots; white posterodorsal spot rather large, broader than long. Legs annulated in the single adult specimen available, greenish. Palpus: Fig. 24.

Female: carapace 1.4—1.7 × 1.0—1.2 mm, index 1.42—1.48; abdomen 1.7—1.9 mm; tibia I 1.7—1.9 mm, tibial index 0.65—0.75.

As male, but sclerotized parts usually darker, and legs more distinctly annulated; white posterodorsal spot varying from elongate oval to rounded rectangular. Sclerotization of epigyne (Fig. 38) variable.

Venonia micans (Simon, 1898) comb. n.

Anomalomma micans Simon, 1898, Ann. Soc. Entomol. Belg. 42:24.

Lectotype ♀ selected from syntype series of 2 ♀♀ (one damaged) from the Philippines, Luzon, Montalvan, in MNHN (Paris).

Separated from *V. coruscans* by different shape of spermathecae, and from all other species of *Venonia* by presence of lateral branch of spermathecae. Male unknown.

Female: carapace 1.6 × 1.1 mm, index 1.46; abdomen 1.5—1.6 mm; tibia I 1.0—1.1 mm, tibial index 0.66—0.68.

In these specimens dark radiating striae of carapace distinct and legs II—IV quite distinctly annulated. See also the short description by SIMON (1898a). Epigyne: Fig. 40.

Venonia milla sp. n.

Holotype ♂, alloparatype ♀, and 1 ♂ 5 ♀ 10 juv. paratypes from Papua New Guinea, Milne Bay District,

Kiriwina (Trobriand) I., Losuia, on small sheet webs in dense herb vegetation in sparse palm forest close to seashore 24. II. 1974 (PTL), in MZT (Turku).

Additional material from Kiriwina I.: Gumilababa, in grass of forest margin, 25 II. 1974: 1 ♂ 1 juv. Gumilababa — Wabutuma, in litter of forest rich in coral soil, 26.II.1974 1 ♂ 3 ♀ 9 juv. (both PTL).

Separated from other small species of *Venonia* by flattened apex of conductor in male, and by shape of spermathecae in female.

Male: carapace 1.6—1.7 × 1.1—1.2, index 1.38—1.44; abdomen 1.6—1.7 mm; tibia I 1.4—1.6, tibial index 0.83—0.94.

Coloration and cheliceral armature as in *V. coruscans*, including the greenish grey tone. Legs in practically unicolorous specimens deep yellowish brown, in more distinctly annulated specimens greenish grey with paler annulations. Abdomen dorsally with 3—4 pairs of faint irregular paler spots, white posterodorsal spot subrectangular, small to moderate in size. Palpus: Figs. 22—23. Femur without modifications.

Female: carapace 1.6—1.8. × 1.2—1.3, index 1.38—1.44; abdomen 1.7—2.2 mm; tibia I 1.0—1.5 mm, tibial index 0.61—0.83.

On average darker than male. Legs II—IV distinctly annulated; dorsal abdominal pattern variable, but posterodorsal spot always distinct. Epigyne: Fig. 39.

Venonia micarioides (L. Koch, 1877)

Aulonia micarioides L. Koch, 1877, Arachn. Austral. I: 961 (♂♀ described). T. 83, Fig. 6—6a, T. 84 Fig. 1—1a.

Artoria micarioides, Simon, 1887, Ann. Soc. Entomol. Fr., (Ser. 6) 7: Bull., p. CLXXXVI.

Venonia micarioides, Simon, 1898, Hist. Nat. Araign. 2(2): 344.

Lectotype selected by Rack (1961: 13; listed as holotype) from a series of syntypes (including juv. ♂ from Bowen, Queensland): ♀ from Australia, Queensland, Port Mackay, in ZMH (Hamburg). Original adult ♂ presumably lost, its conspecificity probable.

Female separated from *V. kokoda* by lack of median septum, from all other species of *Venonia* by much larger size. According to original description (not very good in regard to genital organs), male could be separated from *V. kokoda* by simple tip of conductor and basally modified femora of palp., and from other species with modified palpal femora by large size.

Female: carapace 2.0 × 1.3 mm, index 1.42; abdomen 2.2 mm; tibia I 1.3 mm, tibial index 0.63.

Cheliceral armature 3 + 3; AME equal to ALE, 1/2 Ø apart; PME distinctly larger than PLE, slightly less than Ø apart; cephalic area slightly lighter than the blackish brown thoracic area, except ocular area, which is blackish. Abdomen dorsally ± unicolorous, glistening hairs throughout; light posterodorsal spot subquadrangular, rather small; abdomen ventrally and laterally with distinct whitish stripes. Legs distinctly annulated (but most legs missing). Epigyne: Fig. 44.

Shape of spermathecae very difficult to see in the only adult specimen, whose hair covering is badly worn. The conspecificity of juvenile paratypes from Bowen is by no means certain, but as no other large species of *Venonia* is known from Queensland, it is quite probable. The same is true of the originally described adult male.

Venonia vilkkii sp. n.

Anomalomma cinctipes, Chrysanthus 1967, Nova Guinea, Zool. 37: 425, Fig. 85: ♀ from Queensland, in SMF (Frankfurt/Main), det. Roewer, non *A. cinctipes* Simon, 1898.

Holotype ♀ from Papua New Guinea, Milne Bay District, D'Entrecasteux Is., Goodenough I., Bolu Bolu, at base of high grass 28.II.1974 PTL, in MZT (Turku).

Additional material: Papua New Guinea, Central District, Haima, 1 ♀, 1 juv. grassy forest edge 12.II.—22.III. 1974 (pitfall traps) (PTL).

Separated from *V. muju* and *V. cinctipes* by much wider central depression of the epigyne, from *V. milla* and related Oriental species by lack of spermathecal branch. Male unknown.

Female: carapace 1.2—1.3 × 0.7—0.8 mm, index 1.5—1.7; abdomen 1.3—1.6 mm; tibia I 0.8—1.0 mm, tibial index 0.7—0.8.

Coloration and cheliceral armature as in *V. coruscans*; Leg annulation in specimens studied more distinct ventrally than dorsally. Abdomen dorsally with small pale patches, pale posterodorsal spot moderately large, subquadrangular. Epigyne: Fig. 41.

For *Anomalomma cinctipes*, Chrysanthus, 1967, see discussion under *Venonia cinctipes*.

Venonia cinctipes (Simon, 1898) comb. n.

Anomalomma cinctipes Simon, 1898, Ann. Soc. Entomol. Belg. 42: 24. Holotype subadult ♀ from Cooktown, Queensland, Australia, in MNHN (Paris), non *A. cinctipes*, Chrysanthus, 1967, Nova Guinea, Zool. 37: 425, Fig. 85.

Additional material, all from Papua New Guinea: Milne Bay District, D'Entrecasteux Is., Goodenough I., Bolu Bolu at base of high grass (together with *V. vilkkii*) 1.III.1974, 2 ♀ 1 juv. (PTL); adjacent herb meadow 28.II.1974 1 ♂ (alloparatype) (PTL). — Central district, Sapphire, 1 ♂ extremely dry grassy slope in cultivated area 13.II.—22.III.1974 (pitfall traps) (PTL).

Male palpal femur with distinct basal boss, its hairs short and outstanding, not oblique as in *V. muju*; apex of conductor simple, pointed. Female epigyne close to *V. muju*, but lateral lobes protruding and spermathecae farther from each other.

Male: carapace 1.3—1.5 × 0.9 mm, index 1.45—1.64; abdomen 1.3 mm; tibia I 1.0 mm, tibial index 0.70—0.78.

Female: carapace 1.4—1.5 × 0.9—1.1 mm, index 1.41—1.49; abdomen 1.5—1.6 mm; tibia I 0.9—1.0 mm, tibial index 0.66—0.67.

Both sexes more or less similar to *V. muju*. For genital organs, see Fig. 42.

The holotype and only specimen of *Anomalomma cinctipes*, as originally described by Simon (1898 a), is a subadult female with partial sclerotization of some epigynal features as in many other subadult Lycosidae.

Venonia vilkkii from Queensland was identified by Roewer as *Anomalomma cinctipes*, but this identification was published after Roewer's

death, and probably without direct consultation, by Chrysanthus (1967).

After careful comparison of the subadult holotype with all available material of *Venonia* we conclude that the species figured here as *Venonia cinctipes* is probably conspecific with the holotype. The problem can never be solved even with additional material, because *V. cinctipes* and *V. vilkkii* are sympatric and were collected in the same habitat in Bolu Bolu. Practically all the characters mentioned here are variable in all small species of *Venonia*, and thus we can only speak of average characters and greater probabilities. The lost male specimen of *Venonia micarioides* from Bowen, Queensland, might also be the male of *V. cinctipes*, and according to the original description it certainly belonged to the same species group, because Koch (1877) mentions the modified palpal femora. However, there are no nomenclatural problems, because Rack (1961) selected the female as the lectotype of *V. micarioides*.

V. vilkkii has a narrower carapace, especially in the cephalic area, and the clypeal boss is less distinct. The AME are also relatively smaller. The leg annulations are in the same position in all species, but dorsally less distinct in our specimens of *V. vilkkii*. The white postero-dorsal spot is smaller.

The fourth species around the coastal area of the Torres Strait, *V. milla*, has a different epigyne, and in fact represents a different species group. The eye pattern of *V. milla* is also on average closer to *V. vilkkii* than to *V. cinctipes*.

Subadult specimens of *V. cinctipes* and *V. muju* cannot be separated, but according to present knowledge *V. muju* is found only in the central mountainous area of New Guinea and the northern but not southern coastal area; thus *V. cinctipes* and *V. muju* are vicariant.

Venonia muju (Chrysanthus, 1967), comb. n.

Anomalomma muju Chrysanthus, 1967, Nova Guinea, Zool. 37:425, Figs. 82—84.

Holotype ♀, allotype ♂, and 2 paratype ♂♂ from Indonesia, Irian Barat (New Guinea), Mindiptana (Br. Monulf 1958/59 and 1965), in RNHL (Leiden), examined in 1974, additional information supplied later by Dr. Peter van Helsdingen.

Additional material, all from Papua New Guinea, Morobe District: Yalu, 4 km south of Lae, in dense roadside thicket 18.III.1974, 2 ♀ (PTL). — Wau, kunaigrass slope below Wau Ecology Institute 13.III.1974 1♀ 1 juv. (PTL); 8.III. — 2.IV. 1974 by pitfall traps, 2 ♂ (PTL & J. Linsley Gressitt); coffee plantation

7.III.1974, 1 juv. (PTL) and 8.III.1974 2 ♀ (PTL & H. Hippa); in litter of *Piper* bush 6.III.1974, 1♂ 1♀ (PTL).

Male separated from *V. cinctipes* by double apex of conductor and long, oblique hairs of the femoral palpal boss. Female differing from *V. cinctipes* as well as other *Venonia* spp. in closely spaced spermathecae.

Male: Carapace 1.7—1.9 × 1.1—1.2 mm, index 1.58—1.60; abdomen 1.6—1.7 mm; tibia I 1.3—1.4 mm, tibial index 0.81—0.83.

Coloration as *V. cinctipes*; annulation variable in our material. Cheliceral armature 3 + 2—4. Pale postero-dorsal spot rather small, subcircular. Spinnerets darker than abdomen dorsally. Palpus: Figs. 26 & 31.

Female: Carapace 1.4—1.5 × 0.9—1.0 mm, index 1.47—1.56; abdomen 1.5—1.7 mm, tibia I 1.0—1.2 mm, tibial index 0.69—0.76.

Carapace dark greenish grey to olive brown; legs distinctly annulated, as in *Venonia* in general; spinnerets not darker than abdomen. Epigyne: Fig. 43.

Venonia kokoda sp. n.

Holotype ♂ from Papua New Guinea, Central District, Girinumu (Owers Corner), in litter of dark, dense tree fern stand on slope 13.II.1974 (PTL), in MZT (Turku); 2 juv. paratypes with the same data. Allotype ♀ also from Girinumu, base of moist rock wall facing north, 13.II.1974 (PTL).

The largest species of *Venonia*. Legs of male totally unicolorous yellowish brown; legs of female with dark annulations wider than in other *Venonia* spp. Male palp with axe-shaped tip of conductor, female epigyne with well-developed median septum.

Male: carapace 1.9 × 1.5 mm, index 1.25; abdomen 1.9 mm; tibia I 1.7 mm, tibial index 0.89.

Female: carapace 1.8 × 1.3 mm, index 1.37; abdomen 2.5 mm; tibia I 1.3 mm, tibial index 0.72.

Cheliceral armature 4 + 3—4. Carapace unicolorous dark brown; ocular area with some long bristles; clypeal boss distinct, dorsally visible in front of AME; ALE slightly bigger than AME, PME distinctly bigger than PLE; PME separated by slightly more than their radius only. Abdominal pattern with insignificant transverse bands (adult female dorsally worn); pale postero-dorsal spot very distinct in juvenile specimens, but hardly visible in male; male abdomen dorsally slightly sclerotized, but without distinctly limited scutum; PLS much longer than ALS, distal segment long and conical, only slightly shorter than basal segment.

Legs in male uniform yellowish brown. Microscopy with excellent light conditions reveals very faint traces of dark pigment at the site of the wide female annulations. Female femora I unicolorous blackish brown; leg spinulation variable and more or less irregular; tibiae and metatarsi ventrally with 2—3 + (2—)3 pairs of spines.

Male palp (Fig. 27) with the tibia strongly thickened; femora without modifications. Lateral tegular apophysis totally sclerotized, exceptionally long. Epigyne: Fig. 45, posterior margin protruding.

Relationships of the known species of Venonia. Cladograms cannot be constructed, as the males of *V. micans* and *V. vilkkii* are unknown and the

male of *V. micarioides* is lost. *V. kokoda* will probably be placed in a separate subgenus when more information is available; the epigynal septum is unique, but the strongly flattened apex of the conductor in the male is also different from the more or less simple apex in the other members of the genus.

V. muju, *V. cinctipes*, *V. vilkkii* and probably also *V. micarioides* have rounded seminal receptacula, and lack the lateral tapering lobe characteristic of *V. coruscans*, *V. micans*, and *V. milla*. The receptacula of *V. micarioides* could not be studied in detail without destroying the lectotype. L. Koch's (1877) description of the male leaves no doubt of the close relationship with *V. muju*, although the *V. micarioides* female is larger.

The four members of the *V. muju* group are also united by the structure of the male palpal organs, and the unknown male of *V. vilkkii* will probably also prove to have modified palpal femora. The palpal structures of *V. coruscans* and *V. milla* are not very similar, but in both species the palpal femora are unmodified. A flattening of the apex of the conductor has probably occurred independently in *V. milla* and *V. kokoda*.

The *V. coruscans* group has a wide distribution from Malaya and the Philippines to the islands of the Solomon Sea, while the *V. muju* group is known only from New Guinea and Queensland.

Zantheres Thorell, 1887

Zantheres Thorell, 1887, Ann. Mus. Civ. Genova (Ser. 2^a) 5:317. Type-species *Z. gracillimus* Thorell, 1887, by original designation and monotypy.

Carapace and abdomen exceptionally narrow; abdomen centrally constricted, especially in the male, obviously due to ant mimicry. Whole body bearing broad glistening hairs with smooth margins. Male palpal segments long; tibia with basal apophysis bearing ctenidia. Female epigyne with wrinkled scape, its distal pit most probably accommodating the male tibial ctenidia during copulation.

Zantheres gracillimus Thorell, 1887

Zantheres gracillimus Thorell, 1887, Ann. Mus. Civ. Genova (Ser. 2^a) 5: 318. Holotype ♂ from Northern Burma, Bhamo in ZMH (Hamburg). Alloparatype ♀ and an additional paratype ♀ (labelled *v. nigricans*) also from Bhamo in MCSN (Genoa). The ♀ has never been described, but the material was identified and labelled by Thorell himself.

Both sexes exceptionally long-legged and narrow.

For genital characters, see generic diagnosis. Habits unknown.

Male: carapace 1.6 × 1.0 mm, index 1.56; abdomen 2.0 mm; tibia I 1.8 mm, tibial index 1.11. Female not measured, but slightly larger, and legs relatively a little shorter. Figs. 35—37.

Thorell (1887; 318—321) gave a detailed description of the male, and the most important characters are listed in Table 2. The coloration of the holotype has faded more or less totally, and the females are also much faded, although the pattern of paired anterior and unpaired posterior spots formed by glistening hairs is visible in one female. Palpus: Figs. 32, 33.

The females resemble the male, except in the following respects. Abdomen quite narrow, but not distinctly constricted; chelicerae long and narrow as in male, but each margin of cheliceral groove armed with four teeth, the most medial tooth on the anterior margin being bifid in at least one female; legs light brown as in male, except that femora are basally and ventrally dark; sternum with light central stripe.

Female epigyne (Fig. 34) with a characteristic wrinkled scape, but differing somewhat in length and shape in the specimens examined.

In spite of differences in the cheliceral armature of the single male specimen, there is no doubt about its conspecificity with the undescribed female specimens. The specimen labelled *v. nigricans* was not more different in coloration, and there is no reason to believe that the known specimens of *Zantheres* represent more than one species.

Thorell (1887) originally compared *Zantheres* with *Aulonia*, but Simon (1898b) placed it among *genera invisa*. Roewer (1954) placed it in Lycosinae, but later transferred it, with *Aulonia*, to Hippasinae (Roewer 1960).

In *Zantheres* the locking mechanism of the male and female genital organs is unique among Lycosidae. Parallel locking mechanisms, including various parts of the male palpus and epigynal scape or adjacent sclerotized structures, are widespread in spiders, and have certainly developed independently in several phyletic lines.

In the male bulbus, the median apophysis is entirely reduced, as in many Zoicinae, but the reduction is not synapomorphy, as the distal parts of the bulbus, including the conductor, embolus, and truncus, are closer to those of Venoniinae. However, the shape of the tegulum is very different, and although *Zantheres* may be a derivative of *Venonia*, it is not closely related. The spermathecae of the type material of females could not be examined, but the vulva is rather simple in all Venoniinae and Zoicinae (as well as many Lycosinae and Hippasinae), and so

probably could not be used for the exact placing of *Zantheres*.

The relatively long spinnerets indicate that *Zantheres* has a web, too.

The pattern of glistening hairs is similar in *Venonia* and *Zantheres*, but the ultrastructure (Figs. 65—66) is different. On the other hand, the ultrastructure of the normal abdominal hairs is very different in Hippasinae (Fig. 72), and this confirms our opinion that *Zantheres* is not related to Hippasinae. Table 1 shows that in Hippasinae the male and female genital organs, eye pattern, dorsal colour pattern, leg spine pattern, etc. are of an entirely different type.

"*Venonia*" *himalayensis* Gravely, 1925

Venonia himalayensis Gravely, 1925, Rec. Indian Museum 26: 608, Fig. 4 L. Holotype from Rungneet Tea Estate 1500—1600 m, Darjeeling District, India (sex not indicated), in ZSI (Calcutta), not available. Both sexes mentioned.

Tikader & Malhotra (in press) present figures of the male palp, epigyne, and carapace of this species, but it is not possible to place this species according to these. It is only certain that it is neither *Venonia* nor *Zantheres*. Glistening hairs are mentioned in the original description (Gravely 1925), and as the epigyne is not Lycosine, this species could either represent an undescribed Venonine genus or be related to *Lysania*.

Satta gen. n.

Type-species *Satta cannibalorum* sp. n.

Small Lycosids without carapace pattern or abdominal scutum; legs annulated. Anterior eye row slightly procurved. Male palpus with an articulated but membranous median apophysis; conductor complicated; embolus originating mesially close to tegular angle. Embolus a simple curved spine lying along distal groove of the tegulum. Truncus with sclerotized but simple lateral apophysis. Female unknown.

Satta cannibalorum sp. n.

Holotype ♂ from Papua New Guinea, Eastern Highland District, Kigupa, kunaigrass meadow close to the aboriginal village, 17.III.1974 (PTL), in MZT (Turku).

Male palpus with a large cavity between tegular margin and conductor.

Male: carapace 1.7 × 1.2 mm, index 1.42; abdomen 1.7 mm; tibia I 1.3 mm, tibial index 0.75.

Carapace and eyes; Figs. 3, 9, 14. White hairs on the ocular area. Chelicerae with three teeth on anterior margin of cheliceral groove and 2 widely spaced teeth on posterior margin. Coloration: carapace, dark greyish brown; sternum greyish brown; chelicerae, labium, and maxillae light brown. Labium as long as wide, distally obtuse. Abdomen with lancet-shaped anteromedian

stripe consisting of light hairs only. Tegumental pattern with a few light transverse bands on caudal half of abdomen. White hairs scattered along dorsum of abdomen, forming paired spot posteriorly close to spinnerets.

All legs more or less distinctly annulated; femora with narrow light central band, tibiae with wider central band, metatarsi with only dark base and tip, and tarsi light. Leg spinulation as in most heavily spinulated Lycosidae; femora with long dorsal spines; tibiae and metatarsi with irregular lateral and dorsal spines, 3 + 3 pairs of ventral spines, and very complicated pattern of trichobothria, the longest being more than six times the diameter of the corresponding segments; metatarsus I with 2 long trichobothria in positions 0.4 and 0.7. Tarsi with 2 rows of central trichobothria, as in other Venoniinae. Spinnerets normal, ALS and PLS cylindrical, distal segment of both pairs short conical.

Male palp: Fig. 29.

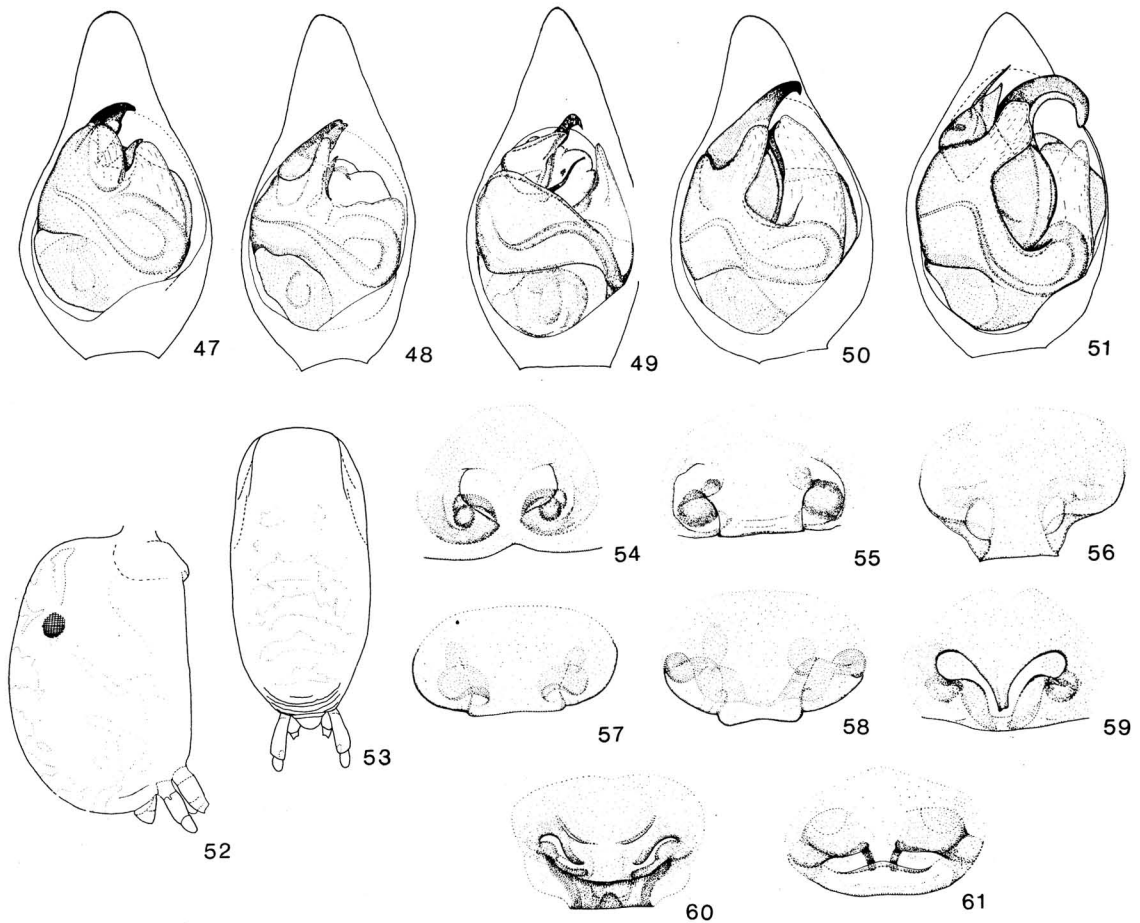
Perhaps vagrant. In the absence of females the placing remains uncertain. Clearly, the species cannot be placed in Lycosinae or Hippasinae. The median apophysis resembles that of typical Venoniinae, whereas this structure is lacking in all known representatives of Zoicinae. Therefore *Satta* is tentatively listed here in Venoniinae.

Zoicinae subfam. n.

Minute to small (1.5—3 mm) Lycosids, web-spinning or vagrant. Carapace more or less unicolorous; cephalic area flattened and gently sloping both laterally and anteriorly or almost normal. Abdominal pattern variable or lacking; male abdomen with ± distinct scutum. Point of attachment of one pair of dorsoventral muscles clearly visible, sometimes covered in female by small pair of lateral scuta. Male palpus with no articulated median apophysis; origin of embolus more or less apical. Truncus more sclerotized than in Venoniinae, but less so than in most Lycosiinae; lateral truncal apophysis simple. Epigyne with central hairy plate. Egg cocoon white, globular, without central seam.

For differential diagnosis, see Table 1.

Lehtinen (1967: 276) suggested that *Zoica* might represent a subfamily of its own. As only a female of *Zoica parvula* was then known, and no field information was available, this group was tentatively placed in Zoridae, because the shape of the carapace and the exceptional eye pattern are quite atypical of Lycosidae. Careful comparison of all Oriental-Australian types of



Figs. 47–53: Palpal tarsus of male in ventral view (Figs. 47–51), female abdomen in lateral view (Fig. 52) and male abdomen in dorsal view (Fig. 53). — 47: *Zoica parvula* (Thorell) (Central Thailand). — 48: *Z. puellula* (Simon) (Ceylon). — 49: *Lysania pygmaea* Thorell (Pinang). — 50: *Zoica wauensis* sp. n. (paratype). — 51: *Z. falcata* sp. n. (paratype). — 52–53: *Lysania pygmaea* Thorell (Pinang). — Orig.

Figs. 54–61. Female epigyne in ventral view. — 54: *Lysania pygmaea* Thorell (Pinang). — 55: *L. sabahensis* sp. n. (holotype). — 56: *Zoica parvula* (Thorell) (Central Thailand). — 57: *Zoica puellula* (Simon) (Ceylon), — 58: *Z. bambusicola* sp. n. (holotype). — 59: *Z. falcata* sp. n. (New Guinea). — 60: *Z. wauensis* sp. n. (paratype). — 61: *Z. bolubolu* sp. n. (holotype). — Orig.

Lycosidae shows that *Lysania* and *Zoica* are related, as they have several synapomorphies that are not known in other Lycosid groups. These include the sclerotization patterns of the abdomen in both sexes, the lack of a median apophysis (cf. *Zantheres*, p. 11), the origin of the embolus and its type, and the basic structure of the epigyne. In the striking colour patterns and the shape of the carapace these two genera differ greatly. Additional genera, when described, may change the definition of this group.

The placing of Zoicinae remains uncertain. *Lysania* is probably a more primitive type than *Zoica*, having a web, an unmodified carapace, and a simple embolus, but even so, its affinities remain obscure. It may be more closely related to Venoniinae than to Lycosinae, but a common origin with Hippasinae is highly unlikely.

Lysania Thorell, 1890

Lysania Thorell, 1890, Ann. Mus. Civ. Genova (Ser. 2^a) 10:48. Type-species *L. pygmaea* Thorell, 1890, by original designation and monotypy.

Carapace unicolorous dark, except for light posterior stripe behind fovea. Abdomen with white lateral bands; male with large dorsal scutum, female with small lateral scuta around muscle insertions. Legs with strikingly white annulations in male, annulated in female. Male palp without median apophysis, tegulum mesially widely rounded, embolus a simple curved spine. Epigyne with central hairy plate. Web small, horizontal, sheetlike; egg cocoon white, globular.

Lysania pygmaea Thorell, 1890

Lysania pygmaea Thorell, 1890, Ann. Mus. Civ. Genova (Ser. 2^a) 10:49.

Holotype ♀ from Pulau Pinang, Malaysia, leg. L. Fea, in MCSN (Genoa). The specimen examined is in poor condition, having been dried up, but comparison of the epigyne with fresh topotypical material confirms the identification.

Additional material, all from Malaysia: Pulau Pinang, Telok Kumbar, from small horizontal sheet webs in roadside grass bordering a rubber plantation, 13.XI.1976, 2♂ 11♀ 11 juv. (including ♂ alloparatype) (PTL). — Pulau Pinang, Batu Ferringgi, shore meadow 29.XI.1976, 2 ♀ 1 juv. (PTL). — Johor, Kota Tinggi District, Jalan Lombong, 10 km north of Kota Tinggi, roadside grass 4—24.XI.1976 (pitfall traps), 5 ♂ 1 juv. (PTL & Sulaiman bin Mat.); in litter of steep forest slope 4—24. XI. 1976 (pitfall traps), 2♂ 2 juv. (PTL & Sulaiman bin Mat.); soil under fern thicket on brookside 30.X.1976, 1♀ 2 juv. (PTL). — Johor, Kota Tinggi District, Jalan Lombong, Biological Field Station, in litter of rain forest 31.X.—4.XI.1976. 1 juv. (PTL). — Johor, Kota Tinggi, old field with grass in town 3.XI.1976, 2♂ 7♀ 3 juv. (PTL). — Selangor, Kuala Lumpur, Lembah Pantai, in jungle litter 12.XI.1976, 2♀ 1 juv. (PTL).

The male is easily recognizable in the field by the strikingly white anterior metatarsi and patellae, long legs, and scutate abdomen. The female is readily separated from other Lycosid genera by the white anterolateral stripes on the abdomen, and from *Lysania sabahensis* by the posteriorly tapering epigynal plate.

Male: carapace 1.4—1.65 × 0.85—1.1 mm, index 1.51—1.64; abdomen 0.8—0.9 mm; tibia I 1.1—1.45 mm, tibial index 0.77—0.87.

Carapace (Figs. 4,10) dark brownish grey, narrow light stripe between fovea and caudal margin. Chelicerae, sternum, maxillae, and labium brownish grey. Ocular area blackish.

Abdomen narrow oval, dorsally dark grey and wholly covered by scutum, which is more distinctly limited anteriorly than posteriorly. Scutum covered with erect, anteriorly curved black hairs; anterior margin fringed with white hairs, but much less distinctly than in female. Abdomen ventrally light greyish brown.

Legs very long, even in comparison to females of this species. Legs I and IV much longer than II and III. Femora and tibiae I—III dark grey, centrally narrowly and indistinctly annulated with light greyish brown. Femora IV light brown, as usually also tibiae IV, but in some specimens the latter dark grey with annulations. Metatarsi and tarsi I—II light yellow in preserved material; metatarsi and also patellae brightly white in living specimens, owing to white hairs. Metatarsi III—IV light yellowish brown with apical dark ring in both fresh and preserved material; tarsi III—IV light yellow.

Tibiae and metatarsi I with no dorsal or lateral spines; ventral spines short, 3 + 2 pairs. Tarsi and metatarsi I covered throughout with short, erect hairs. Tarsi with 2 rows of central trichobothria; metatarsi and tibiae with complicated pattern of trichobothria, the longest ones less than three times the diameter of the corresponding segment.

Palp in Fig. 52. Cymbium entirely covered with exceptionally long hairs; basal segments unmodified. Embolus a simple, outwardly curved spine. Lateral tegular apophysis totally membranous; truncal margin sclerotized, but without distinct apophysis.

Female: carapace 1.3—1.4 × 0.9 mm, index 1.46—1.52; abdomen 1.5—1.9 mm; tibia I 0.9—1.1 mm, tibial index 0.78—0.79.

Carapace as in male; other parts of cephalothorax lighter yellowish brown. Abdomen blackish brown, dorsally with posterior light transverse bars and scattered white hairs. Anterior margin fringed laterally with distinct stripe of white hairs. Lateral scuta in place of muscle insertions not inconspicuous and well sclerotized. Ventral surface light greyish brown, light area extending laterally to 2—3 oblique bands, also covered with brightly white hairs.

Femora I—IV dark brownish grey, narrowly annulated centrally with light grey; tibiae brownish yellow, centrally with very faint annulations; metatarsi and tarsi unicolorous light orange brown. Palpal femora and patellae dark grey; tibiae and tarsi yellowish brown. Legs with normal Lycosid spinulation pattern, including lateral and dorsal spines on all tibiae and metatarsi. White markings on legs totally lacking in living females.

Epigyne: Fig. 54. Lateral furrows on high, light-coloured protuberances; central plate hairy throughout.

Lysania sabahensis sp. n.

Holotype ♀ with 3 ♀ and 2 juv. paratypes from Malaysian Borneo, Sabah, Kota Kinabalu District, Kota Kinabalu, on small sheet webs in high grass at forest edge 5.XI.1976 (PTL), in MZT (Turku).

Not separable from *L. pygmaea* in the field, but smaller and epigyne with posteriorly much wider, ± parallel central plate. Male unknown.

Female: carapace 1.2—1.35 × 0.8—0.9 mm, index 1.43—1.52; abdomen 1.1—1.5 mm; tibia I 0.7—0.8 mm, tibial index 0.58—0.60.

Anterior eye row distinctly procurved, AME slightly larger than ALE, anterior eyes separated by less than their diameter. PME larger than PLE, separated by less than their diameter.

Coloration of cephalothorax as in *L. pygmaea*. Abdomen with similar pattern as *L. pygmaea*, but white markings even more distinct. Lateral scuta smaller than in *L. pygmaea*, lacking in juvenile specimens in both species. Abdomen ventrally very pale brownish yellow.

Leg coloration as in *L. pygmaea*, but light annulation often wider. Tibiae and metatarsi ventrally with 2—3 + 2—3 pairs of spines. Dorsal femoral spines in one row, long and rather strong.

Epigyne: Fig. 55.

Thorell (1890: 48—49) compared his *Lysania pygmaea* with *Anomalomma* Simon, 1890, and supposed that these two genera might even be synonymous, but he stressed the size difference

between *L. pygmaea* and *A. lycosinum*. As *L. sabahensis* is even smaller, it cannot be conspecific with *A. lycosinum*.

Simon (1898a, 1898b), with hesitation, synonymized *Lysania* with *Anomalomma*, mainly because of the exceptional cheliceral armature, but his definition of *Anomalomma* in these papers was based mainly on species now included in *Venonia* and *Anomalosa*, although he still listed *A. lycosinum* as the type-species. Possibly van Hasselt's (1890) material was no longer available to Simon, and now, at least, it has been lost. The original description of *A. lycosinum* disagrees in most respects with all species subsequently included in *Anomalomma* by Simon.

In addition to *Lysania*, several other Lycosid genera of about the same size and with similar tegumental pattern fit the description of *Anomalomma lycosinum*, and many of them seem to be vagrant. The original description of *A. lycosinum* described the spinnerets as short. The status of *A. lycosinum* can only be settled after a thorough study of the Lycosid fauna of Tjibodas, Java.

Both species of *Lysania* are probably common and dominant spiders in open grassy habitats in Southern Asia, being typical vicariant species. Both were also collected together with *Venonia coruscans*.

Zoica Simon, 1898

Zoica Simon, 1898, Hist. Nat. Araign. 2(2): 248, *nomen novum* for *Zobia* Thorell, 1895. Type species by monotypy and original designation for *Zobia*: *Zobia parvula* Thorell, 1895.

Zobia Thorell, 1895: Descr. Catal. Spid. Burma; 53, junior homonym of *Zobia* Saalmüller, 1890.

Flanona Simon, 1898, Hist. Nat. Araign. 2(2): 359, *synon. n.* Type-species by original designation and monotypy *F. puellula* Simon, 1898.

(*Vagellia* Simon, 1899, Ann. Soc. Ent. Belg. 43: 101, type-species *V. helveola* Simon, 1899, from Sumatra, was erroneously synonymized with *Zoica* by Lehtinen (1967: 274); it is here excluded from Lycosidae).

The smallest known Lycosid species (1.5–2 mm), with no pattern on carapace, abdomen, or legs, but the males have a dorsal scutum. Cephalic area smoothly sloping both laterally and anteriorly, not abruptly raised as in most Lycosid groups. Anterior eye row recurved or almost straight; posterior median eyes very close to each other, never more than half their diameter apart. Male palpus without an articulated median apophysis, but tegular margin drawn out into a membranous lobe in most species. Embolus a thin curved spine arising distally between curved truncal apex and tegulum, then curving outwards. Apical part of embolus and shape of conductor very variable. Epigyne of different species groups differing greatly, but never of Lycosine type. All species vagrant. Egg-cocoon white and globular.

Thorell (1895: 54) compared his *Zobia* with *Lysania* and *Anomalomma*, and placed the genus between Agelenidae and Lycosidae, although for practical reasons he listed it under his Agelenoidea. *Zoica* was later generally listed in Agelenidae, until Lehtinen (1967: 276) placed it as an atypical group of Zoridae. This was done mainly on account of characters of *Vagellia helveola* (see above). A further comparison of fresh material of *Zoica parvula* with the type material of *Vagellia helveola* and *Zoica parvula* revealed that the generic synonymization was erroneous, and that true *Zoica* must be regarded as an exceptional Lycosid group. *Flanona* was originally listed in Lycosidae, and later placed in Lycosinae by Roewer (1954, 1960).

Zoica is provisionally delimited here very widely, mainly because of fairly uniform non-genital characters, as well as of traditionally very wide generic standards in many groups of Lycosidae, especially Pardosini and Hippasini. Only two well-defined subgenera, *Zoica* s. str. and *Kwintippia* subgen. n., are created here, but they could as well be treated as genera. *Flanona* is a synonym of *Zoica* s. str.

Zoica is most closely related to *Lysania*, although all species of *Zoica* are vagrant and both known species of *Lysania* are web-spinning. Although these two genera are also quite different in coloration, the fundamental structure of all parts of the male palpi as well as of the epigynes and vulvae is the same. They are also the only Lycosids with abdominal scuta.

Zoica (Zoica) Simon, 1898

Type species, see above.

Zoica (Z.) parvula (Thorell, 1895)

Zoica parvula (Thorell, 1895), Descr. Catal. Spid. Burma; 54.

Table 3. Comparison of the subgenera of *Zoica*.

	<i>Zoica</i> s. str.	<i>Kwintippia</i>
Shape of carapace	narrow, anter. parallel	wide, anteriorly tapering
Relative size of AME	variable, but may be large	minute
Position of long trichob. on metatarsi	0.6–0.7	0.7–0.8
Palpal cymbium	rather narrow	wide and thick
Embolus proper	short, curved spine	complicated
Tip of conductor	two-lobed	long, undivided
Epigynal pockets	absent	present

Lectotype ♀ designated here as the only specimen of syntype ♀♀ from Burma, Tharrawaddy, preserved in BMNH (London). A female from the syntype series in NHR (Stockholm) figured by Lehtinen (1967: Figs. 401—402).

Additional material: Sri Lanka, Kandy District, Peradeniya Botanical Garden, on lawn 30.I.1969, 1 ♂ 1 ♀ (PTL). — Sri Lanka, Colombo District, Negombo, Bolawalana, on mud and wet grass round a small pond 4.XI.1972, 7 ♀ (PTL & Ilkka Oksala). — Thailand, Chiangmai Province, Chiangmai, old field with grass within the town, 16.XI.1976, 6 ♀ 1 juv. (PTL). — Thailand, Phitsanulok Province, Phitsanulok, moist meadow with dense grass and herb vegetation 17.XI.1976, 1 ♀ (PTL). — Thailand, Phetchabun Province, Phetchabun, on lawn 28.X. — 20.XI.1976 (pitfall traps), 4 ♂ 1 ♀, including alloparatype ♂ (Jouko Ruohomäki & PTL); old field with grass 24.X. — 20.XI.1976 (pitfall traps), 2 ♂ (Jouko Ruohomäki & PTL). — Thailand, Phetchabun Province, Lom Sak, churchyard 27.X. — 18.XI.1976 (pitfall traps), 1 ♂ (Eero Huitula & PTL); meadow bordering paddy field 27.X. — 18.XI.1976 (pitfall traps), 1 ♂ (Eero Huitula & PTL); in litter of tree savanna 24.X. — 18.XI.1976 (pitfall traps), 1 juv. (Eero Huitula & PTL). — Malaysia, Johor, Kota Tinggi, old field with grass in town 3.XI.1976, 1 ♀ (PTL).

The smallest known Lycosid species. Separated from other known SE Asian species, *Z. puellula* and *Z. bambusicola*, by larger AME. Male with membranous lobe of tegulum insignificant, and female with epigyne protruding posteriorly. Separated from known New Guinean and Indonesian species of *Zoica* (= *Kwintippia*) by narrower carapace, larger anterior eyes, and greatly differing genital organs.

Male: carapace 0.75—0.8 × 0.5 mm, index 1.40—1.45; abdomen 0.8—0.9 mm; tibia I 0.45—0.55 mm, tibial index 0.59—0.66.

Female: carapace 0.8—0.9 × 0.55—0.65 mm, index 1.35—1.47; abdomen 0.9—1.0 mm; tibia I 0.45—0.5 mm, tibial index 0.52—0.59.

Cephalothorax, abdomen, and legs unicolorous yellowish brown to blackish brown; abdomen ventrally much lighter in dark specimens. Female without any traces of scutum, but muscular insertions clearly visible and fairly large. Male dorsum with variously developed hairy scutum. Figs. 5, 11, 15, 20.

Male palpus: Fig. 47. Epigyne: Fig. 56.

Zoica (*Z.*) *puellula* (Simon, 1898) comb. n.

Flanona puellula Simon, 1898, Hist. Nat. Araign. 2(2): 359. Holotype ♀ from Sri Lanka, Galle, together with alloparatype ♂ and several other paratypes as mentioned also by ROEWER (1960: 839), but never described, in MNHN (Paris).

Additional material from Sri Lanka (Ceylon): Ratnapura District, Belihul Oya, in grass and jungle litter 17.I.1969, 1 ♀ (PTL); 7.II.1969, 2 ♂ 2 ♀ 5 juv. (PTL). — Ratnapura District, Opanake, in litter of jungle 16.I. — 6.II.1969 (pitfall traps), 1 juv. (PTL & Michael Saaristo). — Moneragala District, Diyaluma Falls, in litter of dense jungle bush 18.I.1969, 2 ♀ 6 juv. (PTL). — Moneragala District, Gumbukana, in teak litter 19.XI.1972, 1 ♀ (PTL).

Not separable in the field from the possibly sympatric *Z. parvula*. PME much closer to each other than in *Z. parvula* (1/5—1/4 of their diameter). Male conductor with double straight tip; epigyne without caudal projection.

Male: carapace 0.9 × 0.6—0.65 mm, index 1.37—1.44; abdomen 0.9—1.0 mm; tibia I 0.45—0.5 mm, tibial index 0.55—0.56.

Female: carapace 0.9—0.95 × 0.6—0.7 mm, index 1.38—1.47; abdomen 1.0—1.1 mm; tibia I 0.5 mm, tibial index 0.55—0.56.

Cheliceral armature 3 + 2. Labium much wider than long, truncate. Sternum posteriorly widely truncate. Anterior median eyes small, as in all known species of *Zoica* except the generotype. Leg spinulation: femora with 2 dorsal spines; tibiae and metatarsi with 2 + 2—3 pairs of ventral spines and an apical ring of spines, and 1—2 basal to central dorsal spines. Colulus an unpaired knob with a few setae, as in all species of *Zoica*. Tarsal trichobothria 2—3 + 2—3 submedian.

Anterior spinnerets much thicker than posterior ones; distal segment of posterior spinnerets short conical. Coloration as in *Z. parvula*, but darkness of dorsal surface variable.

Male palp: Fig. 48. Epigyne: Fig. 57.

Zoica (*Z.*) *bambusicola* sp. n.

Holotype ♀ with 3 juv. paratypes from Thailand, Phetchabun Province, Nam Nao National Park, in litter of dense bamboo thicket 19.XI.1976, (PTL), in MZT (Turku).

Separated from the sympatric *Z. parvula* by the much smaller AME and by the shape of the epigynal plate. Probably also differs ecologically.

Female: carapace 1.05 × 0.75 mm, index 1.35; abdomen 1.0 mm; tibia I 0.55 mm, tibial index 0.55.

Other characters as in *Z. parvula*. Epigyne: Fig. 58.

Zoica (*Kwintippia*) subgen. n.

Type-species *Zoica* (*Kwintippia*) *falcata* sp. n.

Diagnosis and description: Table 4.

Zoica (*Kwintippia*) *falcata* sp. n.

Holotype ♂, alloparatype ♀ and 5 additional paratype ♀♀ Malaysian Borneo (Sabah), Kota Kinabalu District, Kota Kinabalu, in dense grass on old meadow with grass in central town area 5.XI.1976, PTL, in MZT; 5 paratype ♀♀ from grassy forest edge 5.XI.1976 (PTL).

Additional material, all from Papua New Guinea: Central District, Brown River valley, Goragatabu Creek, shady jungle 12.II.—22.III.1974 (pitfall traps), 1 ♂ (PTL & H. Hippa). — Central District, Haima, dry sandy slope bordering gravel pit 12.II. — 22.III.1974 (pitfall traps), 1 ♂ (PTL). — Central District, Girinumu (Owers Corner), litter of moist and shady slope with tree ferns 13.II.1974, 1 ♂ (PTL). — Eastern Highland District, Kigupa, kunaigrass meadow in aboriginal village 17.III.1974, 1 ♀ (PTL). — Morobe District, Yalu, 4 km south of Lae, in roadside thicket 18.III.1974, 1 ♀ (PTL). — Milne Bay District, D'Entrecasteux

Is., Goodenough I., Bolu Bolu, short herb meadow 28.II.1974, 1 ♀ (PTL).

The male is easily separated from other New Guinean species by the large, centrally spindle-shaped but distally falciform embolus, and the female by the closely spaced central pockets of the epigyne.

Male: carapace $0.9 \times 0.6-0.7$ mm, index 1.33—1.44; abdomen 0.8—0.9 mm; tibia I 0.5 mm, tibial index 0.56—0.57.

Female: carapace $0.9-0.95 \times 0.65-0.7$ mm; abdomen 0.8—0.9 mm; tibia I 0.5 mm, tibial index 0.52—0.54.

Coloration uniform brownish yellow; male with abdominal scutum. Carapace and eyes: Figs. 6, 12, 16. Male and female genital organs: Fig. 51, 59. Male conductor similar in shape to that of *Z. wauensis*, but concealed along alveolar margin, not visible ventrally.

Zoica (Kwintippia) sp.

Material from Indonesia, Sumatera Utara: Simalungun, Gunung Simarpatuk, Bangun Dolok, 1 juv. in pine forest at 1400 m 23.IX.1978. — Deli Serdang, Dulok Merawan, 1 subad. ♂ under ferns in rubber plantation 22.IX.1978, both PTL.

These juvenile specimens cannot be separated from *Z. (K.) falcata*, but probably they belong to an undescribed species. No material of *Zoica* was collected in western Sumatra.

Zoica (Kwintippia) wauensis sp. n.

Holotype ♂, alloparatype ♀, and additional paratypes (2♂ 27♀ 9 juv.) from Papua New Guinea, Morobe District, Wau, in litter of coffee plantation 7. III.1974 (PTL), in MZT (Turku).

Additional material, all from Papua New Guinea, Morobe District: Wau, coffee plantation 8.III. — 2.IV.1974 (pitfall traps), 1 ♂ 1 ♀ 1 juv. (PTL & J. Linsley Gressitt); litter of *Piper* bush around Wau Ecology Institute 6—8.III.1974, 9 ♀ 12 juv. (PTL & H. Hippa): kunaigrass slope 13.III.1974, 1 ♂ 2 ♀ (PTL) and 8.III. — 2.IV.1974 (pitfall traps), 1 ♂ (PTL & J. Linsley Gressitt). — Yalu, 4 km south of Lae, forest litter 15.III.74, 1 ♀ (PTL). Markham River Valley, west of Yalu, in stone bed 15.III.1974, 1 ♀ (PTL).

Separated from other New Guinean species of *Zoica (Kwintippia)* only by structure of genital organs. Embolus centrally enlarged, but apex short and simple; conductor without basal projections, ventrally clearly visible. Epigyne strongly bulging, epigynal pockets narrow, lateral.

Male: carapace $0.9-0.95 \times 0.65-0.7$ mm, index 1.38—1.44; abdomen, 0.9—1.1 mm; tibia I 0.5—0.55 mm, tibial index 0.50—0.57.

Female: carapace $0.9-1.1 \times 0.6-0.75$ mm, index 1.32—1.46; abdomen 0.9—0.3 mm; tibia I 0.45—0.6 mm, tibial index 0.51—0.55.

Male and female genital organs: Figs. 50, 60. The male scutum is somewhat variable in size and distinctness.

Zoica (Kwintippia) bolubolu sp. n.

Holotype ♀ and 3 additional paratype ♀♀ from Papua New Guinea, Milne Bay district, D'Entrecasteux Is., Goodenough I., Bolu Bolu, at the base of dense grass and moist bush 1.III.1974 (PTL), in MZT (Turku).

Separated from other New Guinean species by rounded posterior plate of epigyne, covered anteriorly by two blunt teeth above epigynal pockets. Male unknown.

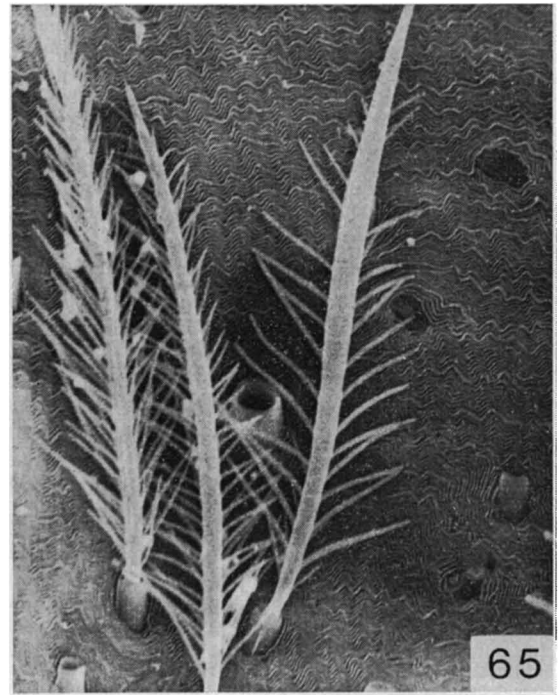
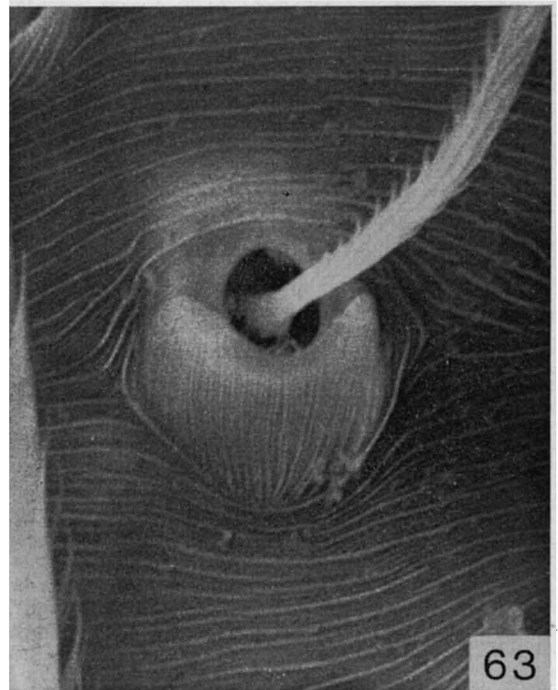
Female: carapace $0.85-0.9 \times 0.65-0.7$, index 1.30—1.32; abdomen 0.8—1.0 mm; tibia I 0.5 mm, tibial index 0.55—0.60.

3. Ultrastructure

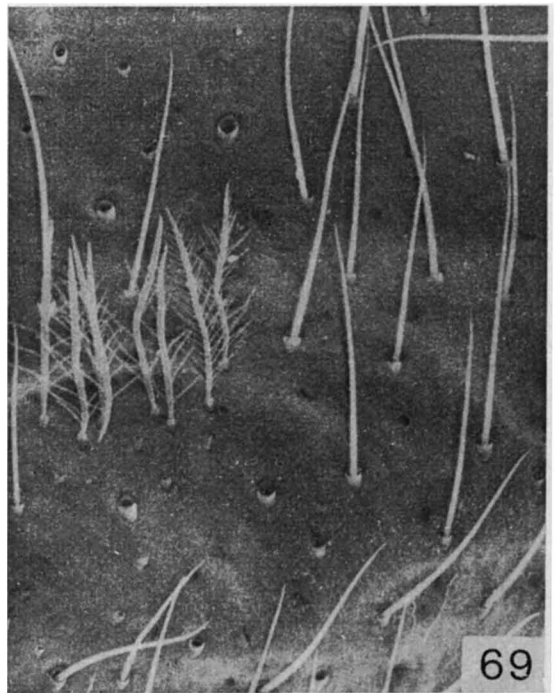
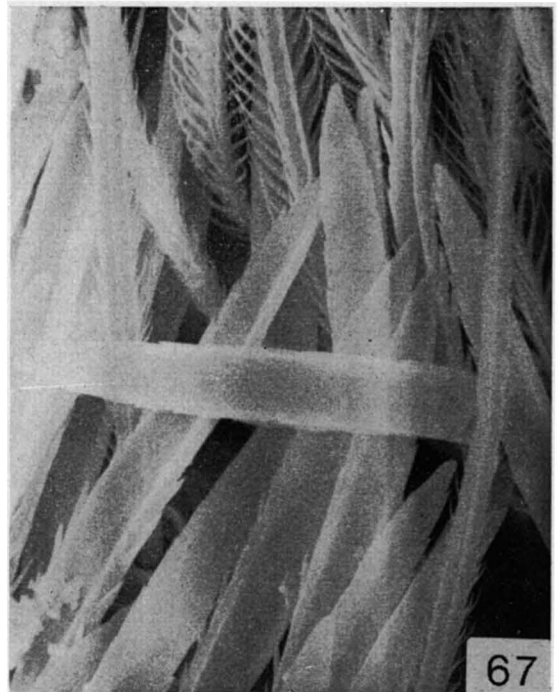
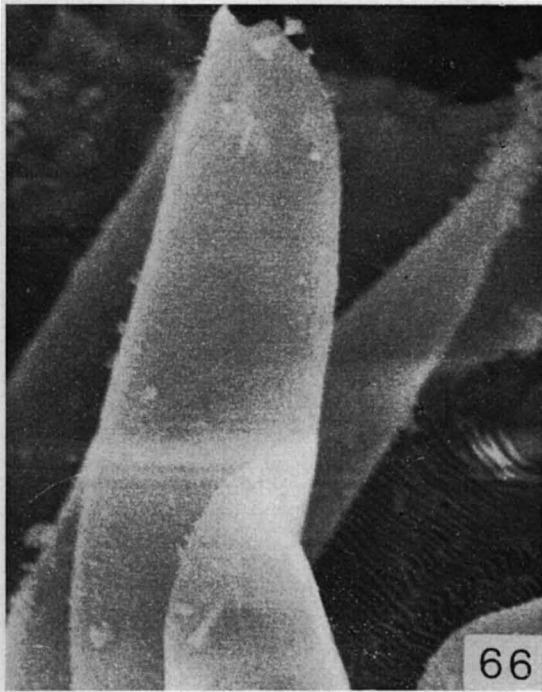
The ultrastructure of various Lycosid groups is still imperfectly known, but some preliminary results are worth mentioning here.

The trichobothrial base is very similar in *Venonia* (Fig. 62) and *Lysania* (Fig. 63), but seems to be similar in all Lycosinae and Hippasinae studied so far, including the Lycosine tribe Evippini, in which the ultrastructure of the hairs is in other respects exceptional (see Fig. 73). Although the base of the trichobothrium is very useful in comparisons of superfamilies and in many cases also of families (cf. Lehtinen 1975a, 1975b), it is not modified ultrastructurally in Lycosidae.

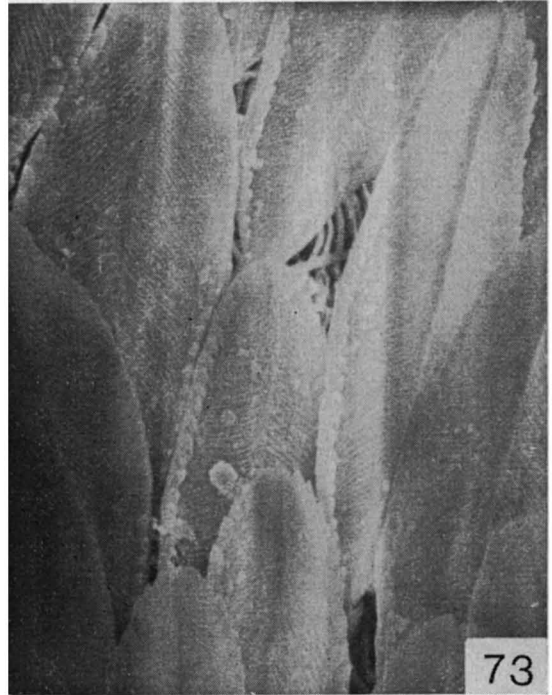
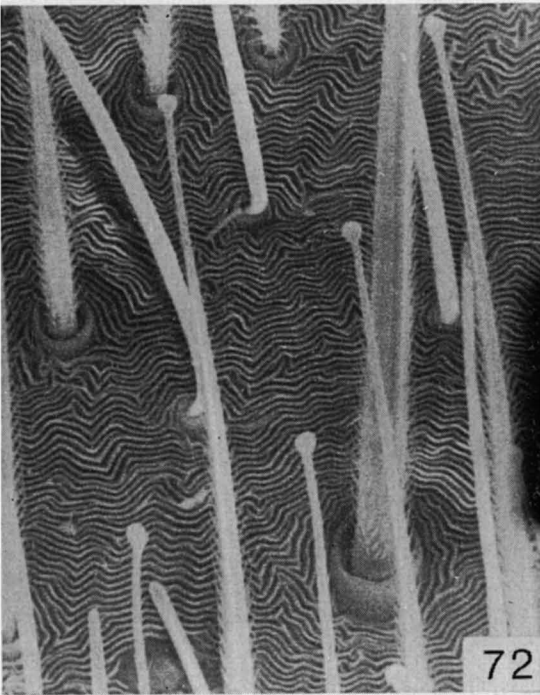
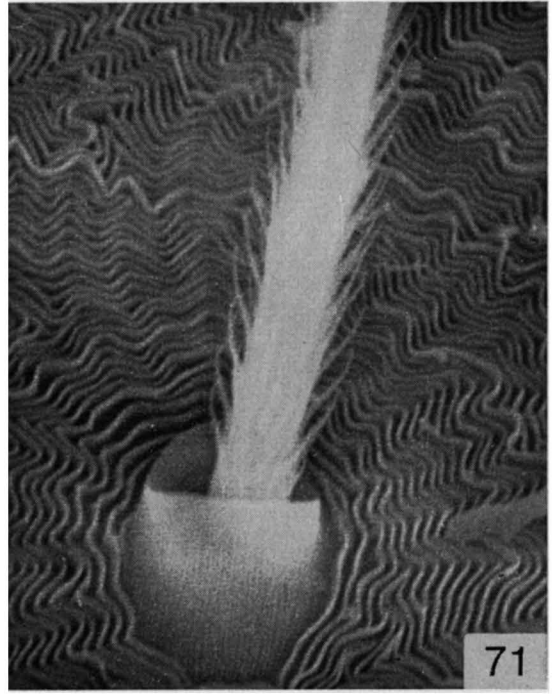
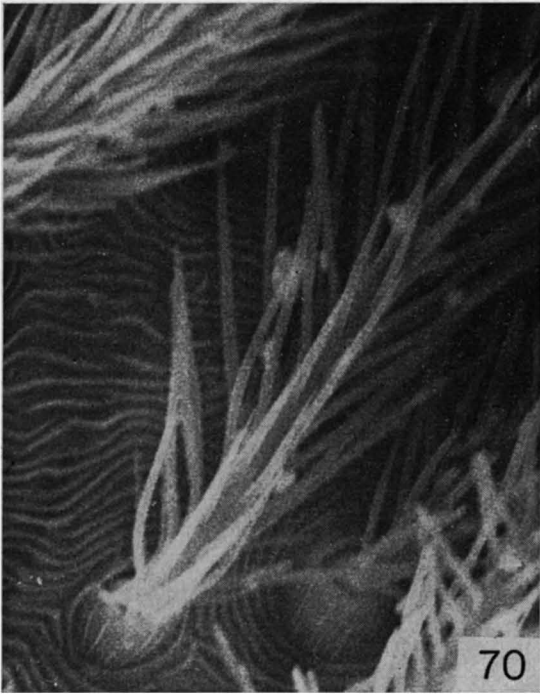
Most Lycosid groups studied, and especially the great majority of the worldwide Lycosinae, have only unmodified hairs of the plumose type (Fig. 71) on both legs and abdomen. The glistening hairs of the three Lycosid groups studied so far differ greatly in ultrastructure (see Figs. 65—67). Glistening hairs occur in many other families of diurnal spiders, too, including Corinnidae and Salticidae, and it seems that such hairs have developed in several lines of evolution and even within individual families. Feathery hairs, which can easily be observed under the light microscope, seem invariably to be present in Venoniinae (Figs. 68—70) and Hippasinae, but probably never in Lycosinae. Multidimensionally branched feathery hairs of the white posterodorsal abdominal spot of *Venonia* represent a type of hair that is quite rare within the whole Amaurobioidea (Lehtinen, unpublished data), although such hairs are common in Corinnidae, Zodariidae, Homalonychidae, etc. The abdominal hairs of all Hippasinae studied have a globular



Figs. 62–65. Ultrastructure of Lycosidae. — 62: *Venonia milla*, tarsal trichobothrium, 2650x. — 63: *Lysania pygmaea*, metatarsal trichobothrium, 2650x. — 64: *V. milla*, tarsal organ, 2650x. — 65: *V. milla*, glistening abdominal hairs, 885x.



Figs. 66–69. Ultrastructure of Lycosidae. — 66: *Zanthoxylum gracillimus*, glistening abdominal hairs, 1770x. — 67: *Lycosinae* sp. (undescibed sp. from Thailand), glistening abdominal hairs, 885x. — 68: *Lysania pygmaea*, abdominal hairs, 885x. — 69: *Venonia milla*, abdominal hairs, 450x.



Figs. 70–73. Ultrastructure of Lycosidae. — 70: *Venonia milla*, white hair from posterodorsal spot, 2650x. — 71: *V. milla*, normal abdominal hair, 2650x. — 72: *Hippasa holmerae*, normal abdominal hairs, 885x. — 73: *Evippa* sp., modified leg hairs, 700x.

apex, not present in Venoniinae or Zoicinae, but similar hairs have been described in Lycosinae (Rovner *et al.* 1973).

The skin of all Lycosids is furrowed, as in all groups of Lycosoidea and Amaurobioidea as well as in most related superfamilies of Amaurobiomorpha, and the tarsal organ is subdistal and semiglobular (Fig. 64).

The structure of the various types of hairs seems to be a useful taxonomic character at least in Venoniinae and Hippasinae, but the presence of parallel adaptations within Lycosidae means that a thorough analysis of all ultrastructural characters must be carried out in all Lycosid groups before any combinations of ultrastructural features can be used as a diagnostic character for any Lycosid group.

4. Misplaced species

Lycosa gilberta Hogg, 1905 was listed as *Venonia gilberta* by Roewer (1954: 307), but later he transferred it to *Hogna* (Roewer 1960). This huge species is a typical representative of the tribe Lycosini in Lycosinae, but probably not a *Hogna*.

Anomalomma harishi Dyal, 1935 was included in *Anomalosa* by Roewer (1960) on account of the relative size of the eyes. This species is probably synonymous with some known Indian representative of Lycosinae. The description by Dyal (1935) includes some odd features, e.g. the presence of apical ventral spines on the tarsi, but his figure of the epigyne shows that it is a typical Lycosine species.

No African species of *Anomalomma* belong to Venoniinae, although it is impossible to place all of them without careful examination of material of both sexes. *A. coccineoplumosa* Simon, 1898 (♀ examined) and *A. albiventris* Simon, 1898 were transferred by Simon (1910) to his *Chaleposa*, and Roewer (1960) transferred *A. schreineri* Purcell 1903 and *A. bisinuata* Purcell 1903 to *Chaleposa*, but described a relative of the former species as *Anomalomma rhodesianum*. These species may all belong to an African group distinct from all the subfamilies mentioned here, while *Chaleposa unicolor* Roewer, 1960 probably belongs to Hippasinae.

Aulonia macrops Simon, 1898 (♀ from Brazil, examined) is certainly not congeneric with *A. albimana*, but a typical representative of Lycosinae. *Aulonia luteonigra*

Mello-Leitão, 1945 from Argentina, has a strongly modified palpal femur in the male, and this small species with long spinnerets probably has a web. It is not an *Aulonia*, but its taxonomic position can be decided only after analysis of the type material, (cf. also Job 1968).

Acknowledgements. The field work and visits to various museums were made possible by travel grants from the National Science Council, the Herman Rosenberg Foundation of the University of Helsinki, the Turku University Foundation (Turun Yliopistosäätiö), the Finnish Academy of Sciences and Letters, the Finnish Scientific Society, the Oskar Öflund Foundation, and the Chancellors of the Universities of Helsinki and Turku.

The field work would not have been possible without the generous help of a number of colleagues and friends, not all of whom can be named here. We are especially grateful to Dr. J. Linsley Gressitt (Wau, Papua New Guinea), Mr. Juhani Vilkki and Mr. Arvi Nieminen (Korobosea, Papua New Guinea), Mr. Antti Satta (Lae, Papua New Guinea), Dr. Imanuel Vigeland and Mr. Sulaiman bin Mat. (Kota Tinggi, Malaysia), Prof. Dr. José Furtado (Kuala Lumpur, Malaysia), Mr. Jouko Ruohomäki (Phetchabun, Thailand), Mr. Eero Huitula (Lom Sak, Thailand), Mr. Raoul Laine (Chiangmai, Thailand), Mr. Aarno Salmenkivi (Phitsanulok, Thailand), Prof. Dr. P. H. D. H. da Silva (Colombo, Sri Lanka), Mr. Vidiyagoda Gunasekara (Mount Lavinia, Sri Lanka), and Mr. Dunegoda Wilmot (Negombo, Sri Lanka).

Prof. Max Vachon and Dr. Michel Hubert, Muséum National d'Histoire Naturelle, Paris, Dr. L. Capocaccia and Prof. Dr. Enrico Tortonese, Museo Civico Di Storia Naturale "Giacomo Doria", Genoa, Dr. Gisela Rack, Zoologisches Museum der Universität Hamburg, Hamburg, Dr. L. van der Hammen and Dr. Peter van Helsing, Rijksmuseum van Natuurlijke Historie, Leiden, Mr. Fred Wanless and Mr. Paul Hillyard, British Museum, Natural History, London, kindly placed the material of these museums at our disposal. Dr. B. K. Tikader, Poona, India, kindly placed unpublished drawings of Indian Lycosids at our disposal. We wish to express our sincere gratitude to all these institutions and individuals for fruitful cooperation and help.

We are also grateful for Dr. Michael Saaristo and Mr. Ilkka Oksala, M.Sc., who collected part of the material as members of the Turku University expeditions to Sri Lanka. Many of the above-mentioned persons in Thailand, Papua New Guinea and Malaysia have also actively collected material for this study, as stated in detail in the text.

References

- Brady, A. 1962: The spider genus *Sosippus* in North America, Mexico, and Central America (Araneae, Lycosidae). — *Psyche* 69: 129—164.
- 1972: Geographic variation and speciation in the *Sosippus floridanus* species group (Araneae: Lycosidae). — *Psyche* 79:27—48.
- Chrysanthus, F. 1967: Spiders from South New Guinea VIII. — *Nova Guinea, Zool.* 37:401—426.
- Dyal, S. 1935: Fauna of Lahore 4: Spiders of Lahore. — *Bull. Dept. Zool. Panjab Univ.* 1: 119—252, Pl. XI—XVII.
- Gravely, F. H. 1925: Some Indian spiders of the family Lycosidae. — *Rec. Indian Mus.* 26:587—613.
- Guy, Y. 1966: Contribution a l'étude des araignées de

- la famille des Lycosidae et de la sous-famille des Lycosinae avec étude spéciale des espèces du Maroc. — *Trav. Inst. Scient. Cherifien (Zool.)* 33:1—174.
- van Hasselt, A. W. M. 1890: *Araneae ex Archipelago Malayano*. — In Weber, M.: *Zoologische Ergebnisse einer Reise in Niederländisch Ost-Indien* 2: 193—210. Leiden.
- Hogg, H. R. 1905: On some South Australian spiders of the family Lycosidae. — *Proc. Zool. Soc. London* 1905: 569—590.
- Job, W. 1968: Das Röhrengewebe von *Aulonia albimana* (Walckenaer) (Araneida: Lycosidae) und seine systematische Bedeutung. — *Zool. Anz.* 180: 403—409.
- Koch, L. 1877: *Die Arachniden Australiens*: 889—968. — Nürnberg.
- Kronstedt, T. 1975: Studies on species of Holarctic *Pardosa* groups (Araneae, Lycosidae). I. Redescription of *Pardosa albomaculata* Emerton and description of two new species from North America, with comments on some taxonomic characters. — *Zool. Scripta* 4:217—228.
- Lehtinen, P. T. 1967: Classification of the Cribellate spiders and some allied families, with notes on the evolution of the suborder Araneomorpha. — *Ann. Zool. Fennici* 4:199—468.
- »— 1975a: Notes on the phylogenetic classification of Araneae. — *Proc. 6th Int. Arachnol. Congr.* 1974:26—29, 4 Pl.
- »— 1975b: The ultrastructure of some sensory organs of spiders. — *Scandem-75*: p 9.
- »— 1978: Definition and limitation of supraspecific taxa in spiders. — *Symp. Zool. Soc. London* 42:255—276.
- Mello-Leitão, C. F. de 1945: Arañas de misiones, Corrientes y entre Rios. — *Rev. Mus. La Plata (N.S.)*, Zool. 4: 213—302.
- Petrunkévitch, A. 1928: *Systema Araneorum*. — *Trans. Connecticut Acad. Arts Sci.* 29:1—270.
- Purcell, W. F. 1903: New South African spiders of the families Migidae, Ctenizidae, Barychelidae, Dipluridae, and Lycosidae. — *Ann. S. Afr. Mus.* 3:69—142.
- Rack, G. 1961: Die entomologischen Sammlungen des Zoologischen Staatsinstituts und Zoologischen Museums Hamburg II. Chelicerata II: Araneae. — *Mitt. Hamburg. Zool. Mus. Inst.* 59:1—60.
- Roewer, C. F. 1954: *Katalog der Araneae* II. — 1751 pp. Brussels.
- »— 1959: *Araneae Lycosaeformia* II. (Lycosidae). — *Explor. Parc National Upemba* 55: 1—518. Brussels.
- »— 1960: *Araneae Lycosaeformia* II: (Lycosidae) (Fortsetzung und Schluss). — *Explor. Parc National Upemba* 55:519—1040. Brussels.
- Rovner, J., Higashi G. A. & Foelix, R. F. 1973: Maternal behavior in wolf spiders: The role of abdominal hairs. — *Science* 182:1153—1155.
- Simon, E. 1887: (without title). — *Ann. Soc. Entomol. Fr. (Ser. 6)* 7: Bull. CLXXXVI.
- »— 1898a: Descriptions d'Arachnides nouveaux des familles des Agelenidae, Pisauridae, Lycosidae et Oxyopidae. — *Ann. Soc. Entomol. Belg.* 42: 5—34.
- »— 1898b: *Histoire Naturelle des Araignées* 2:2, 193—380. Paris.
- »— 1899: Contribution a la faune de Sumatra. Arachnides recueillis par M. J. L. Weyers, à Sumatra. — *Ann. Soc. Entomol. Belg.* 42: 5—34.
- »— 1910: Arachnoidea. Araneae (II). In L. Schultze: *Zoologische und antropologische Ergebnisse einer Forschungsreise im westlichen und zentralen Südafrika*. — *Denkschr. Med.-naturwiss. Ges. Jena* 16:175—218.
- Thorell, T. 1887: *Viaggio di L. Fea in Birmania e regioni vicine*. II. Primo saggio ragni Birmani. — *Ann. Mus. Civico Storia Nat. Genova (Ser. 2^a)* 5:5—417.
- »— 1890: Aracnidi di Nias e di Sumatra raccolti nel 1886 dal Sig. E. Modigliani. — *Ann. Mus. Civico Storia Nat. Genova (Ser. 2^a)* 10:5—106.
- »— 1894: *Decas Araneorum in ins. Singapore a Cel. Th. Workman inventarum*. — *Bull. Soc. Entomol. Ital.* 26: 321—355.
- »— 1895: *Descriptive catalogue of the spiders of Burma*. — 406 pp. British Museum, London.
- Tikader, B. K. & Malhotra, M. S. *Fauna of India: Spiders, Araneae*. Vol. II. Family Lycosidae (wolf spiders). — *Zool. Surv. India* (in press).
- Workman, T. & Workman, M. E. 1897: *Malaysian spiders* 11—13:81—104. — Belfast.

Received 25. XI. 1977

Printed 25. V. 1979