

## New species in the opilionid genus *Stylocellus* from Malaysia, Indonesia and the Philippines (Opiliones, Cyphophthalmi, Stylocellidae)

William A. Shear

Department of Biology,  
Hampden-Sydney College,  
Hampden-Sydney,  
Virginia 23943, USA

### Summary

Eleven new species of *Stylocellus* are described. Three of these species, *S. dumoga*, *S. hillyardi* and *S. tambusisi*, are from Sulawesi. Six, *S. collinsi*, *S. mulu*, *S. kinabalu*, *S. leakeyi*, *S. sabah* and *S. gryllospecus*, are from Borneo. The last named is the second described species of the genus showing troglitic adaptations. *Stylocellus pangrango* is from Java, and *S. tarumpitao* from the Philippines, extending the range of the genus to that archipelago. Study of the new species has allowed some clarifications of the genital anatomy within the genus. A small eyeless, female specimen, which may represent a second species of the enigmatic genus *Miopsalis* Thorell, is reported from Sarawak.

### Introduction

#### Review of previous literature

Despite their obvious phylogenetic importance, the cyphophthalmid opilionids of the genus *Stylocellus* have received little attention from arachnologists. This is in part due to their provenance in tropical Southeast Asia and the Indomalaysian Archipelago, an area not well explored for arachnids, many parts of which are now difficult of access to Western European and American biologists. However, three of the major natural history museums of the world, the British Museum (Natural History), the American Museum of Natural History, and the California Academy of Sciences, had in their collections unidentified material of *Stylocellus*. Beginning in 1986, I obtained and studied these specimens, but other projects delayed the presentation of my results until now. As far as can be determined, all of these specimens represented new species, and they are named and described below.

In addition to adding to our knowledge of the geographical range of *Stylocellus* (the record for the Philippines is new for that archipelago), the new species include the second known with troglitic adaptations, provide clarification of the anatomy of the penis, and force some modifications in my earlier (Shear, 1980) rediagnosis of the family.

The history of study of *Stylocellus* is not lengthy, though the animals have been known to science since Westwood described the first species, *Stylocellus sumatranus*, in 1874. Subsequently, Thorell (1883, 1891) added more species, a thorough review was published (with more species) by Hansen & Sørensen in 1904, and Roewer (1942) added two more new species. Thirty-seven years later, I described yet one more new form (Shear, 1979), and in my reclassification of the suborder Cyphophthalmi (Shear, 1980) confirmed the suspected status of the family Stylocellidae as the sister group of the Afro-South American families Ogoveidae and Neogoveidae.

By 1991, with the addition by Rambla (1991) of a third species from Borneo, the distribution of the genus and family included the Malay Peninsula (2 species), Sumatra (3 species), Java (2 species), Borneo (3 species) and Sulawesi (1 species). Here I add three more from Sulawesi, six more from Borneo, one more from Java, and one from the Philippines. Martens (1980) mentioned specimens from “the Khasi and Garo Hills in Meghalaya south of the Brahmaputra” in Assam, India, near the border with Bangladesh. At the time of writing, these specimens have not been described or named. Given this distribution, it was not surprising to encounter a new species from the Philippines, and it seems safe to predict that species of *Stylocellus* will eventually turn up from Vietnam, Thailand, Cambodia, and perhaps extreme southern China. The distribution of the genus along the archipelagos to the east may be more interesting and more difficult to predict, but it is possible *Stylocellus* has reached Irian Jaya (western New Guinea).

#### A note on the eyes

An optical function for the “eyes” of the related order Ricinulei has been questioned recently on structural grounds (Platnick & Shadab, 1976). Scanning Electron Microscope studies of the pale areas sometimes called “ocelli” (though there is no evidence that they fit the strict definition of ocelli) revealed that the surfaces are poorly differentiated from adjoining cuticle and bear a dense coat of microtrichia. As a result, Platnick & Shadab (1976) argued that these laterally placed patches could not function as lenses. The structure of the overlying cuticle does not preclude simple photoreception.

No comparable information is available for *Stylocellus*. However, the domed cuticle of stylocellid eyes appears almost completely transparent, and a reflective tapetum can easily be seen. They are probably light-sensitive organs. Tapeta are characteristic of arachnid lateral eyes (including the so-called “posterior medians” of some spiders, which are derived from laterals) but not of median eyes. The eyes of all other opilionids are median eyes, derived from the ancestral median ocelli; a tapetum is lacking, and their rhabdoms face the lens (Martens, 1978: 23). The presence of a tapetum suggests that the laterally placed stylocellid eyes are not derived from median ocelli which migrated to the edges of the carapace, though such migration is known in some other opilionids.

Thus there is some evidence that the eyes of stylocellids are indeed eyes, and are probably lateral eyes, the medians, present in all other major opilionid groups, having been lost.

The presence of lateral eyes in *Stylocellus* was thought to represent a unique plesiomorphy amongst Opiliones, and was tacitly used to oppose the genus to all other cyphophthalmids, as primitive. My cladistic analysis (Shear, 1980), however, showed that Stylocellidae is not the sister group of all other families, but only of Neogoveidae + Ogoveidae. Juberthie (1988) has recently mentioned (*passim*) a new species of Pettalidae with eyes. Regardless of their derivation, the presence of eyes in *Stylocellus* and Juberthie’s new species is probably plesiomorphic among cyphophthalmids, but apomorphic

for the cyphophthalmids amongst Opiliones. The loss of median eyes in cyphophthalmids and the loss of lateral eyes in all other opilionids are both apomorphic compared with the ancestral arachnid complement of median ocelli and multi-lensed lateral eyes.

#### *Remarks on taxonomic characters*

1. *Sulci*: The bodies of cyphophthalmids exhibit a remarkable degree of fusion, approaching that shown by oribatid mites. Abdominal segments, however, can usually be discerned. In the older literature, the divisions between the cephalothorax and abdomen, between abdominal segments, and often along a mid-dorsal line, have been referred to as "sulci", but in fact no grooves or folds are present. At high magnification, these lines are seen to be only very shallow depressions with clear strips of cuticle, where in some species the usual pebbled sculpture of the surface does not appear. This condition has been clearly illustrated in SEM pictures published by Juberthie (1988: fig. 14). Smooth-cuticled species show these lines as areas where the canals leading to tiny surface microsetae do not occur. Clearly the "sulci" result from the heavy sclerotisation of intersegmental membranes. They mark the positions of segmental divisions and a mid-dorsal division of the thoracic and abdominal tergites, and the extent of these lines appears to be of some systematic value. For the sake of consistency, I continue to use the terms "sulcus" and "sulci" in the descriptions presented here.

2. *Cuticular microsculpture*: The cuticular microsculpture of the cyphophthalmids is highly varied, sometimes bizarre, and has been the subject of recent study using the Scanning Electron Microscope (e.g., Rambla, 1991, on *Stylocellus*; Juberthie, 1988; Rambla & Fontarnau, 1984; Juberthie & Massoud, 1976; Legg, 1990). The species described below are about evenly divided between those with a smooth dorsum and those in which the dorsum is evenly covered with small tubercles, an ornamentation described herein as "pebbling" ("nipples" of Rambla, 1991). Among the smooth species most appear to have a dull, matt finish, though one or two are shiny. This may be a feature influenced by conditions of preservation. In the species with pebbled terga, the legs also share this ornamentation, while among the smooth species, there are a few with some pebbling on the distal leg segments; this never occurs on the femora and may be limited to the distal parts of the posterior tarsi. Hansen & Sørensen (1904) and Roewer (1923) set great store on the distribution of pebbled ornamentation on the second cheliceral segment. This does appear to be of some use but is the same in a number of species and absent in most smooth ones. Interestingly, regardless of the presence or absence of pebbling on other parts of the body, some microsculpture of this type always occurs on the palpal trochanter.

3. *Meristic characters*: Size appears to be a good character, especially in syntopic pairs of species, which tend to differ in size so that a mixed collection can usually be detected without having to carry out measurements. The L/W ratios of the legs are also useful as an index of leg robustness; these differ among species that are nearly the same size. The proportions of the palpal articles also seem useful, including the relative lengths of the articles.

In 1980, I thought that all *Stylocellus* shared a common type of chelicera, also found in ogoveids and neogoveids, with the second segment elongate, attenuate distally, and with small fingers bearing relatively large, irregular teeth (e.g., Figs. 41, 42). However, robust chelicerae with numerous regular teeth on large fingers (Figs. 2, 3) are found in some of the new species described below, as well as some intermediates (Figs. 31, 32, 80, 81). Of use in separating species of *Stylocellus*, this discovery also may force a reconsideration of my 1980 cladogram.

Except that males have somewhat longer fourth tarsi, the measurements of females are virtually the same as associated males, so even though both sexes were available for some of the new species, the females are not described separately. The great significance of the penis in characterising species, however, suggests that isolated females should not be described. A few specimens of this type are discussed briefly at the end of this paper.

4. *Penis*: The penis of a stylocellid (*Stylocellus beccari*) was first illustrated by Hansen & Sørensen (1904), but evidently not again until 1979 (Shear, 1979). The drawing Hansen & Sørensen presented is entirely accurate, though the details surrounding the gonopore are covered by the dorsal setae. In contrast, some of the details of my 1979 drawing are not accurate. In 1980, I characterised the stylocellid penis as follows:

"Membranous trilobed structure dorsal to the gonopore; ventral plate of normal size and shape, with long apical setae and ventral setae in a transverse row; dorsal setae with bases fused, three groups (two lateral, one median) vaguely indicated (Shear, 1980: 21)."

The study of a wider range of *Stylocellus* species now makes it necessary to modify and add to this description.

The ventral plate in *Stylocellus* (e.g., Fig. 7) is poorly sclerotised and somewhat membranous. The cuticle of the ventral plate has a microsculpture of scattered, small, acute denticles of uniform size and shape (Fig. 104). In most species examined there are three ventral setae, and they may be nearly at the apical margin of the plate, or some distance removed from it. In a few species, there are as many as five of these setae, and their arrangement may make it difficult to distinguish the ventral setae from the apical setae. The apical (marginal) setae vary in number from four to 10. The denticulate microsculpture of the ventral plate sometimes becomes more concentrated around the bases of the setae (Figs. 17, 18, 105), which themselves do not seem to be set in sockets, but spring directly from the ventral plate cuticle. In some cases this microsculpture, in a modified form, extends some distance up the setae (Figs. 47, 105). Also interesting are a few species in which there is a definite tendency for pairs of the apical setae to fuse at their bases and then divide again further along their length, producing the appearance of a single seta with two equal branches (Figs. 15, 17, 18). The dorsal setae are not accurately depicted in my 1979 drawing of *S. sedgwicki*, nor are they correctly described in the 1980 account just quoted. As shown in the Hansen & Sørensen (1904) illustration, the setae are actually in left and right lateral groups (Fig. 66), not two lateral groups and a median group. The bases of these unusually flattened setae are coalesced in the two groups, and at the base of each of the plates so formed a strong muscle

attaches, indicating that they are movable as a unit. In the species illustrated here, there are from five to eight on each side. Within the left and right groups, a subdivision occurs, with from three to six of the lateralmost setae fused for a greater part of their length than the three to five in the mesal group; the lateral subgroup setae are sometimes strongly toothed distally (Fig. 96).

The structures surrounding the gonopore were not observed by Hansen & Sørensen (1904), who did not dissect the penis further. To get a clear view of these structures, I removed the dorsal setae from one side, and the special imaging properties of Nomarski contrast allowed me to see a great deal of detail. The gonopore is dorsally covered by a smooth flap (*lacinius dorsalis*, *ld*, Fig. 9; Latin terms are introduced here for compact reference) with an evenly curved, marginate apex; the length and width of this flap varies from species to species. On either side of the pore are side lobes (*lobuli laterales*) densely set, in most cases, with acute fimbriae (*ll*, Fig. 9). Lateral to these lobes in a few species are structures resembling the sense organs on the female ovipositor, or a single seta (*s*, Fig. 9). At the ventral bases of the side lobes are bilaterally paired finger-like structures (*digiti*) of varying length and with a different ornamentation than the lobes themselves (*d*, Fig. 9). Ventral to the pore is a broad, median ventral lobe (*lobus medialis*) with very characteristic microsculpture resembling small, curved fingers (*lm*, Fig. 9).

Variation in some of these structures is difficult to describe, but the illustrations show what can be found.

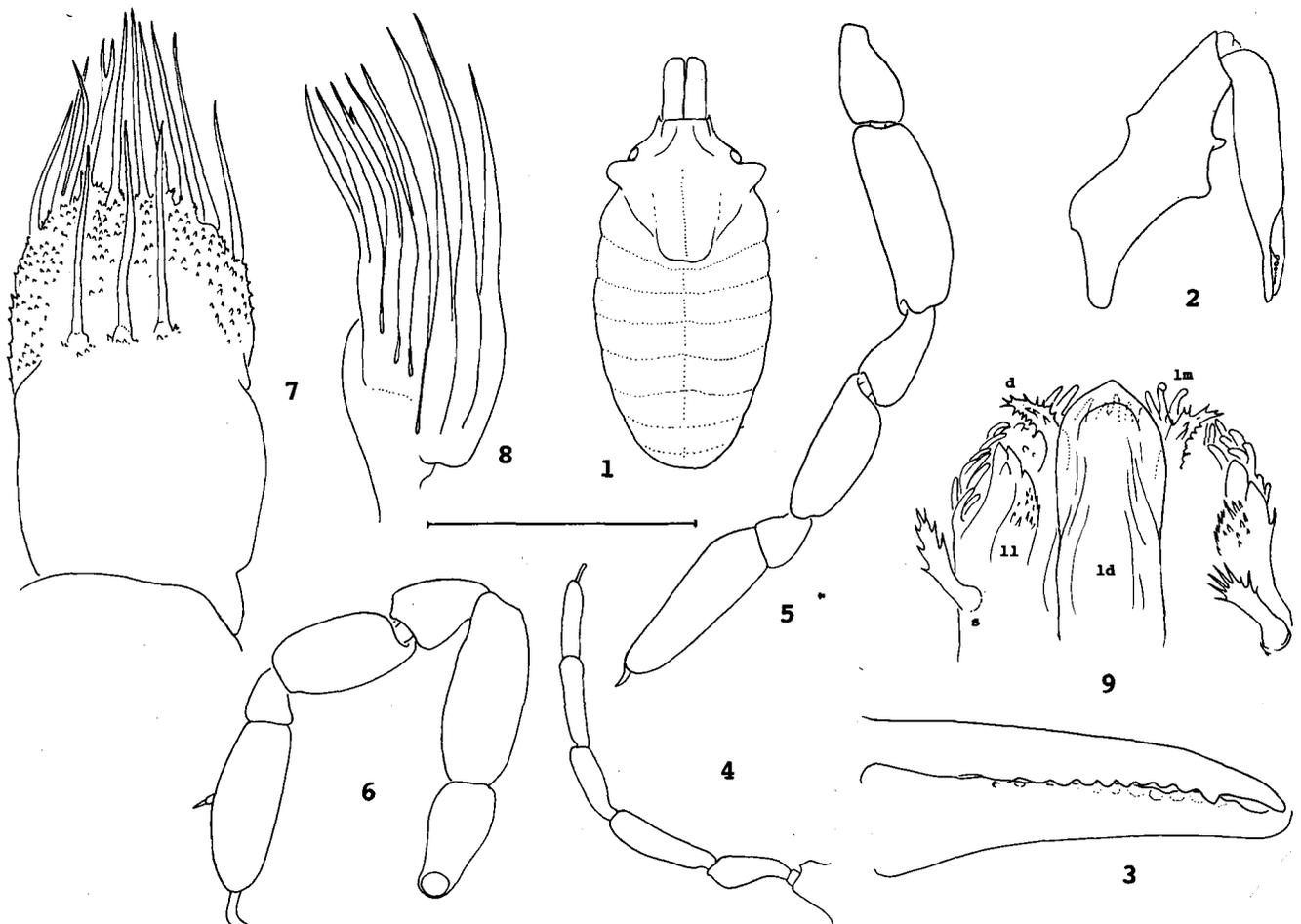
Probably the key apomorphy in the penis of the stylocellids is the basally fused, unsocketed setae of the dorsal complex, which seem to have been turned into a kind of movable hand with immobile fingers. The differences in the penes of the several species strongly suggest that penis anatomy plays a role in reproductive isolation (Eberhard, 1985).

Thus, as in other cyphophthalmids, the penis is a complex organ rich in characters for species identification, and must be illustrated in detail.

5. *Other characters*: The shape and position of the adenostyle, the form of the ventral cephalothoracic complex, and some other traditionally used characters are much less useful in *Stylocellus* because there appears to be little variation.

#### Methods

Specimens were examined under a dissecting microscope at 40 × to 80 × for details of the cephalothorax and abdomen. The right chelicera, pedipalp, and first and fourth legs were dissected off and temporarily mounted on microscope slides for measurement and drawing at 40 ×, 100 ×, and 200 ×. Care was taken to make the measurements in the same way on each specimen; the lines



Figs. 1–9: *Stylocellus dumoga*, n. sp., male. 1 Dorsum; 2 Chelicera; 3 Cheliceral teeth; 4 Palpus; 5 First leg; 6 Fourth leg; 7 Penis, ventral view; 8 Left dorsal seta group of penis, dorsal view; 9 Gonopore complex of penis, dorsal view. Abbreviations: d = digiti, ld = lacinius dorsalis, ll = lobuli laterales, lm = lobus medialis, s = seta. Scale line = 3.2 mm (Fig. 1), 1.5 mm (Figs. 2, 4–6), 0.30 mm (Figs. 3, 7, 8), 0.15 mm (Fig. 9).

along which these were done are shown on the drawings of *S. leakeyi* (Figs. 80–84). All measurements in the species descriptions are in mm. The lengths and widths of legs and palpi are expressed in the order: trochanter (palpi only), femur, patella, tibia, metatarsus (legs only), tarsus; lengths are given first and separated from widths by a stroke, and the L/W ratio follows in parentheses. The L/W ratios of the palpal femora and the first and fourth leg femora and tibiae seem most useful for separating species and are shown in the descriptions in bold-face.

The penes of males were dissected out through an incision between the first and second abdominal sterna. The cuticle of these animals is unusually thick, though somewhat leathery, and there are no intersegmental membranes separating sterna, so inevitably some damage was done during this dissection. The penes were also mounted temporarily on slides and examined and drawn at 200× and 400× under a compound microscope equipped with Nomarski Differential Interference Contrast. Penial setation patterns can be expressed as a formula, with the total numbers of setae in each group as follows: ventral, apical, right/left dorsal. In the descriptions, 3, 6, 7/7 means 3 ventral, 6 apical and 14 dorsal setae, the latter in right and left groups of seven each. All drawings, including those of the bodies, appendages and genitalia, were made using a drawing tube.

## Systematics

Family STYLOCELLIDAE Hansen & Sørensen, 1904, emend. Shear, 1980

Genus *Stylocellus* Westwood, 1874

*Stylocellus dumoga*, new species (Figs. 1–9)

*Types*: Holotype male (BMNH) from Gunung Poniki, elevation 900 m, Dumoga Bone National Park, Utara, Sulawesi, November 1985, coll. Paul Hillyard; two female paratypes (BMNH), same data.

*Etymology*: The species name is a noun in apposition, after the type locality.

*Diagnosis*: Of the known forms from Sulawesi, close to *S. modestus* Hansen & Sørensen, but differing in its smaller size and different proportions; the syntopic species *S. hillyardi* (described below) is much larger, at 5.46 mm body length; *S. tambusisi* (also described below) is smaller, at 3.19 mm body length. Each of the three new species also has a distinctive penis; the genitalia of *S. modestus* have not been described in detail.

*Male*: Total length 4.08, width across ozophores 1.81, greatest width 2.08, L/W = 1.96. Dorsum (Fig. 1) finely granulate. Eyes nearly touching bases of ozophores; ozophores relatively short, nearly conical; opening small, with plug. Cephalothoracic transverse sulcus pronounced. Transverse abdominal sulci distinct, mid-dorsal abdominal sulcus present on segments 1–5. Ventral thoracic complex typical. First cheliceral segment (Fig. 2) 1.6 long, 0.43 wide, with large ventral tooth. Second cheliceral segment 1.34 long, 0.24 wide, slender, evenly tapered, nearly straight, pebbled ornamentation on basal fifth; fixed finger 0.47 long, 35% length of second segment. Cheliceral teeth small, uniform (Fig. 3). Palpal seg-

ments (Fig. 4) 0.43, 0.61/0.16 (**3.81**), 0.43, 0.47/0.09 (5.22), 0.42. Legs with heavily pebbled ornamentation. Leg I (Fig. 5) segments 1.01/0.35 (**2.88**), 0.61/0.28 (2.18), 0.73/0.30 (**2.43**), 0.35/0.24 (1.45), 1.00/0.30 (3.30). Leg IV (Fig. 6) segments 1.01/0.40 (**2.52**), 0.52/0.36 (1.45), 0.66/0.38 (**1.74**), 0.38/0.24 (1.60), 0.90/0.33 (2.74). Adenostyle base 54% of tarsal length from tarsal base.

Penis in ventral view (Fig. 7) with three ventral setae far removed from distal margin; 10 apical setae with some tendency to basal fusion and with setal bases ornamented. Dorsal setae (Fig. 8) eight on each side, mesal group of three, lateral group of five progressively more fused in lateral direction, most lateral two setae fused for nearly one-third their length. Setal formula 3, 10, 8/8. Lacinius dorsalis (*ld*) strongly marginate, apex slightly acute. Lobuli laterales (*ll*) with few acute fimbriae, lobed distally; digiti curved, with numerous acute teeth; unusual sense organs (*s*) near lateral bases of lobuli. Lobus medialis (*lm*) with long, curved fingers (Fig. 9).

*Female*: Similar to male except for usual sexual differences.

*Distribution*: Known only from the type locality, where it was taken syntopically with the following species. Gunung (Mount) Poniki (1817 m) is at about 0°40'N, 124°S at about the point where the Minahassa Peninsula, the great northern arm of Sulawesi, curves gradually to the north.

*Stylocellus hillyardi*, new species (Figs. 10–19)

*Types*: Holotype male (BMNH) from Gunung Poniki, elevation 900 m, Dumoga Bone National Park, Utara, Sulawesi, November 1985, coll. Paul Hillyard.

*Etymology*: I am pleased to name this species for Paul Hillyard, the collector, and curator of arachnids at the British Museum (Natural History) who kindly loaned much of the material reported on here.

*Diagnosis*: Larger than the preceding species and with a distinctly different body form (L/W = 2.32, as opposed to 1.96 in *dumoga*). *Stylocellus tambusisi*, also from Sulawesi, is smaller than both of these (3.19 mm long) and rounder in appearance (L/W = 1.7). The legs of *hillyardi* are also proportionally longer and thinner; see ratios in descriptions.

*Male*: Total length 5.46, width across ozophores 1.96, greatest width 2.35, L/W = 2.32. Dorsum (Fig. 10) lacking visible microsculpture, with dull, matt finish. Eyes nearly touching bases of ozophores, but located slightly above midline of ozophore bases; ozophores relatively short, nearly conical; opening small, with plug. Cephalothoracic transverse sulcus pronounced. Transverse abdominal sulci distinct, mid-dorsal abdominal sulcus present on segments 3–7. Ventral thoracic complex typical. First cheliceral segment (Fig. 11) 2.12 long, 0.56 wide, with large ventral tooth. Second cheliceral segment 1.77 long, 0.33 wide, relatively robust, evenly tapered, nearly straight, fixed finger 0.49 long, 28% length of second segment. Cheliceral teeth small, uniform. Palpal segments (Fig. 12) 0.61, 0.90/0.23 (**3.93**), 0.59, 0.70/0.12 (5.80), 0.57. Legs smooth, except for small amount of pebbled ornamentation at tips of tarsi above claws. Leg I (Fig. 13) segments 1.60/0.47 (**3.40**), 0.80/0.41 (1.95), 1.08/0.38

(2.84), 0.47/0.33 (1.42), 1.53/0.38 (4.03). Leg IV (Fig. 14) segments 1.74/0.43 (4.04), 0.90/0.47 (1.92), 1.13/0.42 (2.69), 0.50/0.35 (1.44), 1.48/0.40 (3.70). Adenostyle base 41% of tarsal length from tarsal base.

Penis in ventral view (Fig. 15) with three ventral setae far removed from distal margin and bases close together; 10 apical setae with strong tendency to basal fusion (third and fourth seta on each side from lateral margin basally fused; Figs. 17, 18) and with setal bases ornamented. Dorsal setae (Fig. 16) 10 on each side, mesal group of four, lateral group of six progressively more fused in lateral direction. Setal formula 3, 10, 10/10. Lacinius dorsalis weakly marginate, apex evenly rounded. Lobuli laterales with numerous acute fimbriae, digiti curved, with blunt, curved teeth. Lobus medialis with long, curved fingers which partially obscure digiti (Fig. 19).

*Notes:* Known only from the type locality, where it was taken syntopically with the preceding species, which see for detailed information.

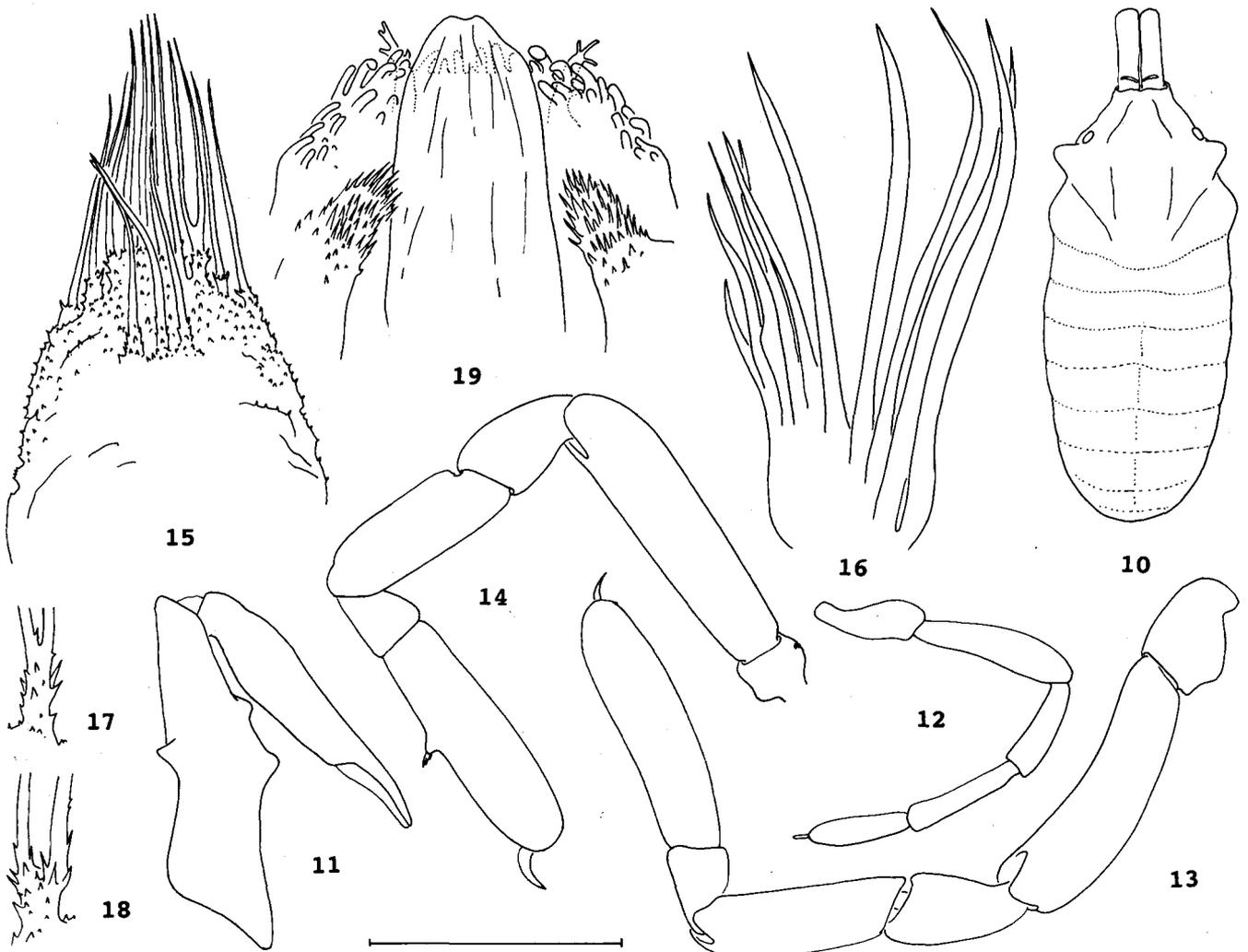
*Stylocellus tambusisi*, new species (Figs. 20–29)

*Types:* Holotype male (BMNH) from Tambusisi Damar, Tambusisi Mtn., Sulawesi, 10 March 1980; no collector's name on label.

*Etymology:* The species name, a noun in apposition, refers to the type locality.

*Diagnosis:* In addition to the characters given under the diagnoses of the preceding two species, *tambusisi* differs in the very unusual penis, in which hypertrophied lobuli laterales with very long fimbriae almost entirely obscure all other gonopore structures, and in which the lateral dorsal setae are not basally fused (Figs. 28, 29).

*Male:* Total length 3.19, width across ozophores 1.58, greatest width 1.88, L/W = 1.70. Dorsum (Fig. 20) entirely and heavily tuberculate, irregular streaks of black pigment visible beneath cuticle, densest anteriorly. Eyes nearly touching bases of ozophores, but located slightly below midline of ozophore bases; ozophores short, truncate-conical; opening large, with plug. Cephalothoracic transverse sulcus indistinct. Transverse abdominal sulci nearly obsolete, mid-dorsal abdominal sulcus absent. Ventral thoracic complex typical. First cheliceral segment (Fig. 21) 1.46 long, 0.40 wide, with large ventral tooth. Second cheliceral segment 1.17 long, 0.21 wide, robust, scarcely tapered, nearly straight, pebbled ornamentation on basal sixth; fixed finger 0.30 long, 26% length of second segment. Cheliceral teeth (Fig. 22) small,



Figs. 10–19: *Stylocellus hillyardi*, n. sp., male. 10 Dorsum; 11 Chelicera; 12 Palpus; 13 First leg; 14 Fourth leg; 15 Penis, ventral view; 16 Left dorsal setal group, dorsal view; 17, 18 Examples of basally fused apical setae; 19 Gonopore complex of penis, dorsal view. Scale line = 3.2 mm (Fig. 10), 1.5 mm (Figs. 11–14), 0.30 mm (Figs. 15, 16), 0.15 mm (Figs. 17–19).

uniform. Palpal segments (Fig. 23) 0.43, 0.49/0.14 (3.48), 0.38, 0.40/0.10 (4.00), 0.34. Legs heavily and entirely pebbled. Leg I (Fig. 24) segments 0.92/0.29 (3.17), 0.50/0.26 (2.00), 0.66/0.23 (2.87), 0.31/0.22 (1.42), 0.80/0.26 (3.08). Leg IV (Fig. 25) segments 0.87/0.24 (3.62), 0.52/0.30 (1.74), 0.61/0.28 (2.17), 0.30/0.19 (1.56), 0.81/0.26 (3.14). Adenostyle (Fig. 26) base 62% of tarsal length from tarsal base.

Penis in ventral view (Fig. 27) with three ventral setae removed from distal margin, bases separated by about twice their diameter; 10 short apical setae without tendency to basal fusion, setal bases weakly ornamented. Dorsal setae (Fig. 28) 7 on each side, no accentuated fusion of lateral setae evident. Setal formula 3, 10, 7/7. Lacinius dorsalis weakly marginate, apex evenly rounded. Lobuli laterales greatly enlarged, with numerous very long, acute fimbriae (Fig. 29).

**Distribution:** The data given under "Types" is from a handwritten, pencilled label; in addition, a typeset label in the vial says: SULAWESI TENGAH, nr. Morowali, Ranu R. area, 20.i.-20.iv.1980. On the back of this latter label are two other partial labels for two other Sulawesi localities. As the handwritten label was probably put in the vial at the time of collection, I suspect that it gives more correct information. However, the two places referred to are not far apart. The Tambusisi Mountains are at about 1°38'S, 121°23'E, and Morowali is just to the south-east on the north shore of the Gulf of Tolo.

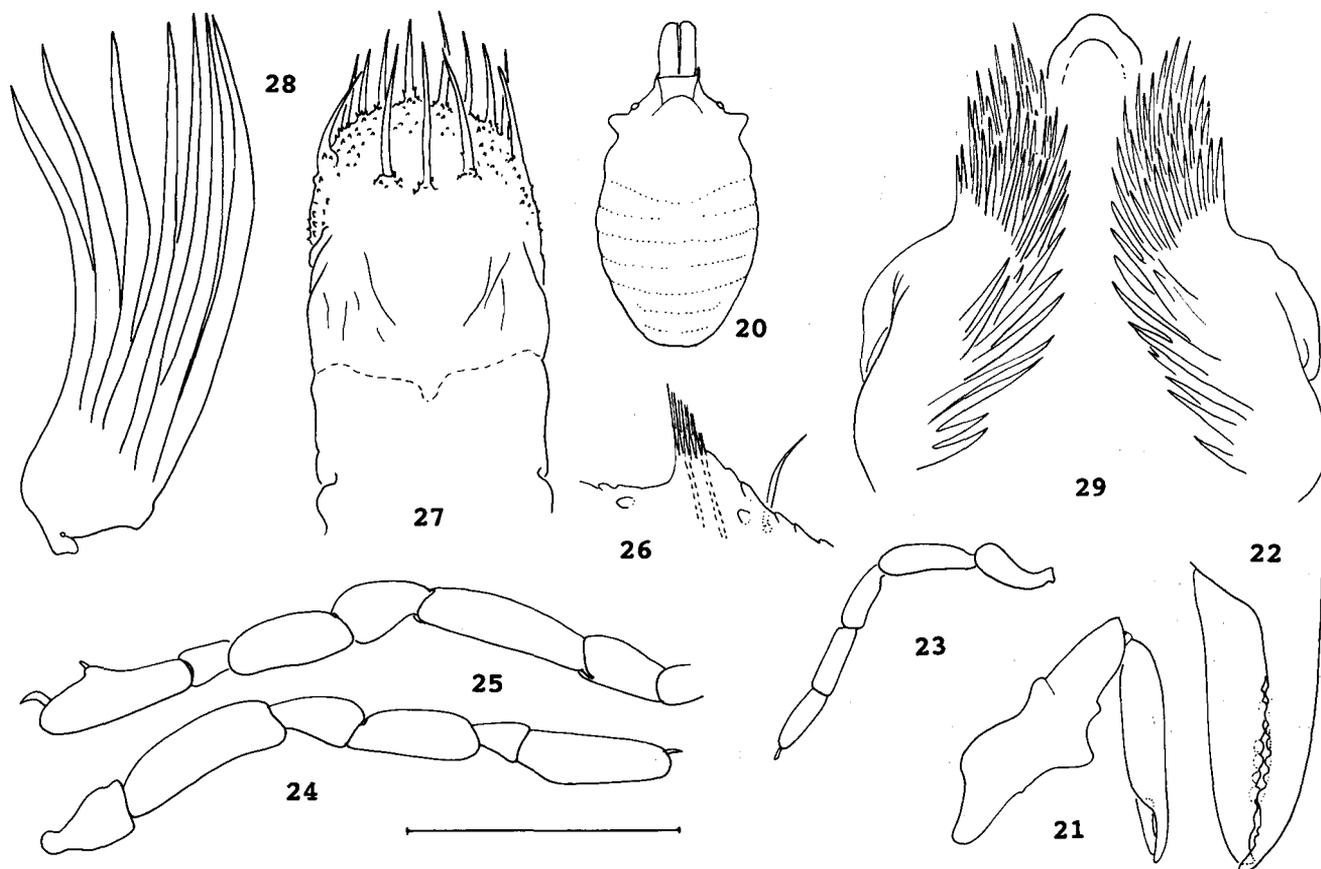
***Stylocellus gryllospecus*, new species (Figs. 30–39)**

**Types:** Holotype male (BMNH) from Cricket Cave, near Deer Cave, Mulu National Park, Sarawak, 8 May 1978, coll. Fred Wanless. Paratype male and three paratype females (BMNH), same data.

**Etymology:** The species name is a latinised version of the name of the type locality.

**Diagnosis:** A distinctive, large species with exceptionally long, thin legs (Figs. 34,35) suggestive of troglitic adaptation. The subdivided lobuli laterales of the penis, with the distal sublobes ending in three or four acute processes, are unique (Fig. 39; see also Notes, below). *Stylocellus silhavyi* Rambla, 1991 is very closely related, but one-sixth larger, at about 7.3 mm long.

**Male:** Total length 6.19, width across ozophores 2.42, greatest width 3.08, L/W = 2.01. Dorsum (Fig. 30) lacking visible microsculpture, with dull, matt finish. Eyes separated from bases of ozophores by about one diameter, located slightly above midline of ozophore bases; ozophores relatively short, nearly cylindrical; opening large, with plug. Cephalothoracic transverse sulcus moderately pronounced. Transverse abdominal sulci indistinct, mid-dorsal abdominal sulcus absent. Ventral thoracic complex typical. First cheliceral segment (Fig. 31) 2.87 long, 0.57 wide, without ventral tooth. Second cheliceral segment 2.68 long, 0.35 wide, relatively robust, untapered, slightly curved, basal two-thirds with pebbled ornamentation, fixed finger 0.73 long, 27% length of



Figs. 20–29: *Stylocellus tambusisi*, n. sp., male. 20 Dorsum; 21 Chelicera; 22 Cheliceral teeth; 23 Palpus; 24 First leg; 25 Fourth leg; 26 Adenostyle; 27 Penis, ventral view; 28 Left dorsal setal group, dorsal view; 29 Gonopore complex of penis, dorsal view. Scale line = 3.2 mm (Fig. 20), 1.5 mm (Figs. 21, 23–25), 0.30 mm (Figs. 22, 26–28), 0.15 mm (Fig. 29).

second segment. Cheliceral teeth (Fig. 32) small, uniform. Palpal segments (Fig. 33) 0.83, 1.57/0.19 (8.24), 0.87, 1.17/0.12 (9.71), 0.90. Legs covered with pebbled ornamentation. Leg I (Fig. 34) segments 2.60/0.43 (6.07), 1.13/0.43 (2.63), 1.91/0.35 (5.47), 0.75/0.30 (2.49), 2.17/0.40 (4.03). Leg IV (Fig. 35) segments 2.90/0.38 (7.64), 1.17/0.45 (2.60), 1.90/0.40 (4.74), 0.87/0.29 (3.00), 2.40/0.40 (6.00). Adenostyle base 41% of tarsal length from tarsal base.

Penis in ventral view (Fig. 36) with three ventral setae removed from distal margin, bases separated by twice their diameter; eight apical setae with no tendency to basal fusion, setal bases not ornamented. Dorsal setae (Fig. 37) eight (nine; Fig. 38) on each side, mesal group of five, lateral group of three (four) progressively more fused in lateral direction. Setal formula 3, 8, 8/9. Lacinius dorsalis strongly marginate, apex slightly pointed. Lobuli laterales divided into two sub-lobes each, basal with numerous acute fimbriae, distal with three or four long apical processes; digiti curved, with blunt, curved teeth. Lobus medialis with few, short fingers (Fig. 39).

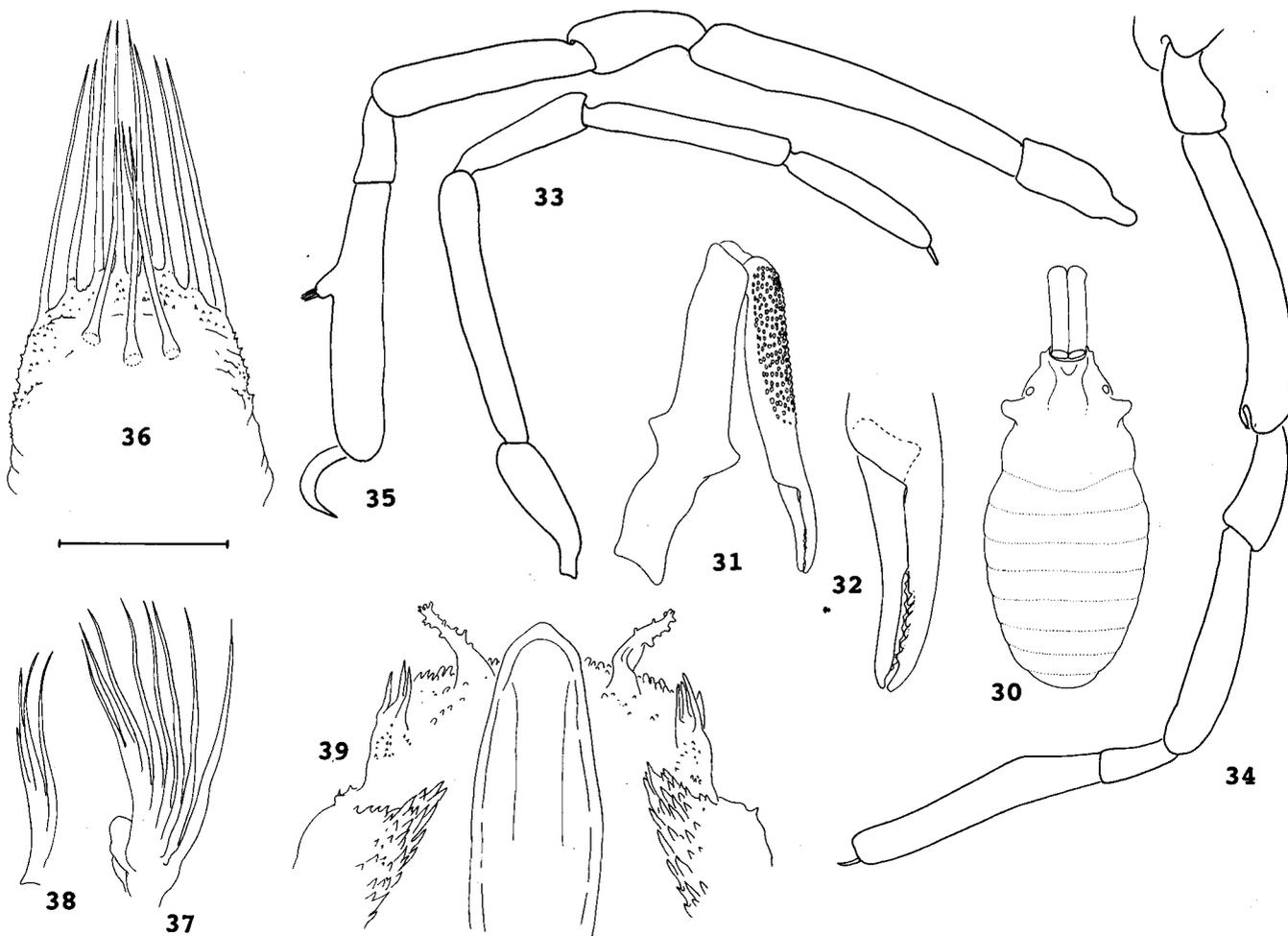
*Female*: Similar in all nonsexual characters to male.

*Distribution*: Known only from the type locality, a limestone cave. Mulu National Park centres on Gunung (Mount) Mulu (2173 m), near the Brunei border, at 4°02'N, 114°15'E. The cavernous limestone hills of the park are between Gunung Mulu and the Brunei border,

and extend in a SW-NE direction for more than 20 km (Collins, 1980). The exact location of Cricket Cave is not known to me.

*Notes*: While well pigmented, the extraordinarily long, thin appendages of this large species, more than twice as long compared to their width as those of similar forms, suggest troglobitic adaptation.

Rambla (1991) has described *Stylocellus silhavyi* from another cave, Cobweb Cave, in Mulu National Park. I have been unable to learn anything about the geographical relationships of these caves. Rambla's material was collected in 1980 or 1981 by Philip Chapman. *Stylocellus silhavyi* appears to be a larger species (7.33 mm long) than *S. gryllospecus*; femur I is 42% the length of the body in *gryllospecus*, 51% in *silhavyi*. Unfortunately, Rambla (1991) does not give segment widths for the legs of *silhavyi*, but it is probably safe to assume that they are at least as attenuate as in *gryllospecus*, and that *silhavyi* also shows this troglobitic adaptation. The penes of the two species are very similar, the only obvious difference being that the middle seta of the ventral group of three in *silhavyi* is much more basal than the other two, while in *gryllospecus*, it is at the same level. Rambla (1991) does not illustrate the gonopore structures. The differences in size and proportion, however, suggest that two species are involved.



Figs. 30–39: *Stylocellus gryllospecus*, n. sp., male. 30 Dorsum; 31 Chelicera; 32 Cheliceral teeth; 33 Palpus; 34 First leg; 35 Fourth leg; 36 Penis, ventral view; 37 Left dorsal setal group, dorsal view; 38 Right dorsal setal group, lateral subgroup, ventral view; 39 Gonopore complex of penis, dorsal view. Scale line = 3.2 mm (Fig. 30), 1.5 mm (Figs. 31, 33–35), 0.30 mm (Figs. 32, 36–38), 0.15 mm (Fig. 39).

*Stylocellus collinsi*, new species (Figs. 40–49)

*Types*: Holotype male, five paratype males, paratype female (BMNH) from Gunung Mulu National Park, 4th Division, Baram District, Sarawak, East Malaysia, 27 February 1978, coll. N. M. Collins. Male and two female paratypes (BMNH) from "Site C", Gunung Mulu National Park, 2 April 1978, coll. N. M. Collins.

*Etymology*: The species is named for the collector, N. M. Collins.

*Diagnosis*: This species and the following, both from Sarawak, are evidently related and are similar in general appearance. *Stylocellus collinsi* differs from *mulu* in its larger size, having significantly shorter, thicker legs, and in details of the penis.

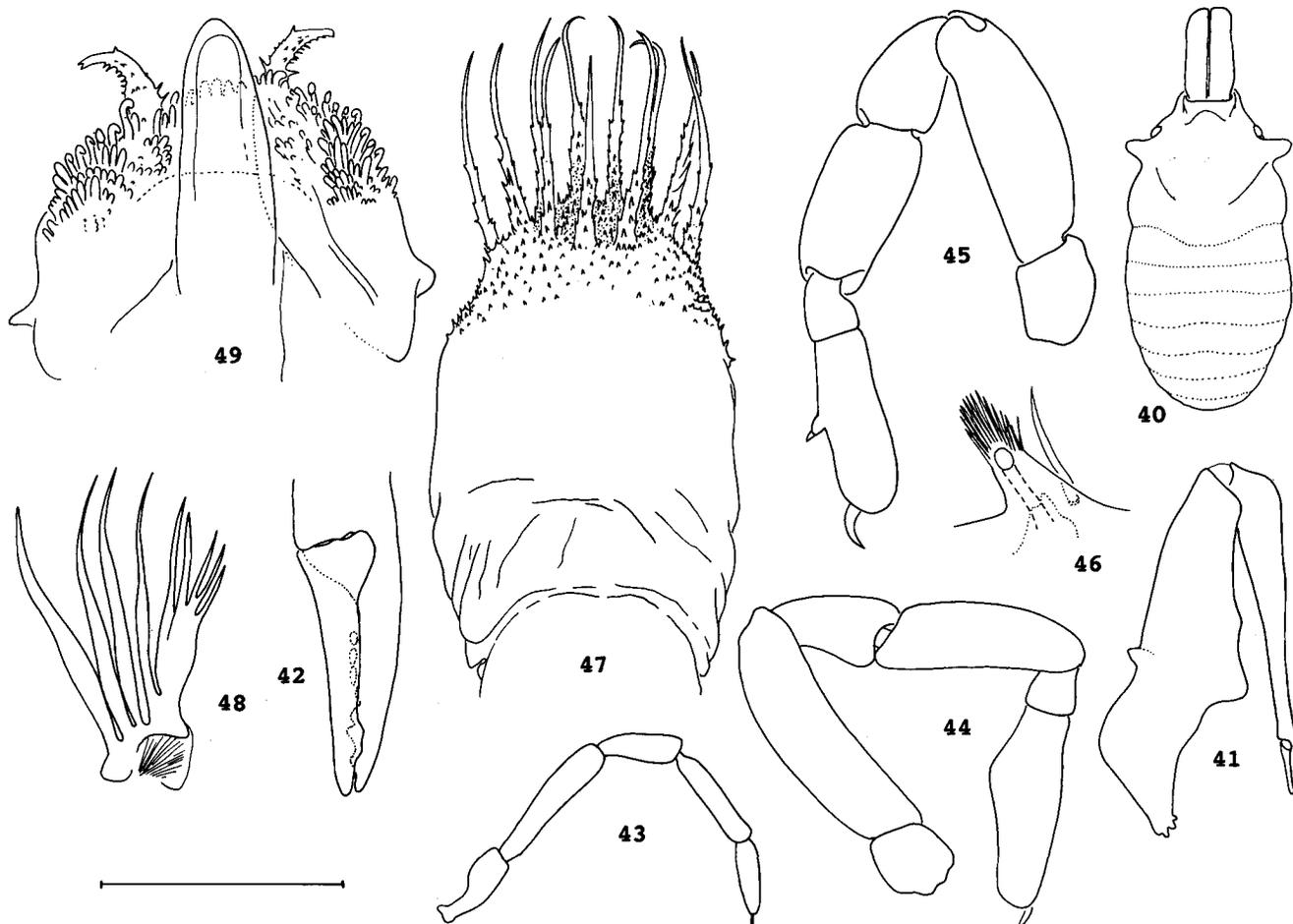
*Male*: Total length 4.46, width across ozophores 2.19, greatest width 2.19, L/W = 2.04. Dorsum (Fig. 40) lacking visible microsculpture, with dull, matt finish. Eyes separated from bases of ozophores by about one diameter, but located slightly above midline of ozophore bases; ozophores relatively long, subcylindrical; opening small, with plug. Cephalothoracic transverse sulcus pronounced. Transverse abdominal sulci distinct, mid-dorsal abdominal sulcus absent. Ventral thoracic complex typical. First cheliceral segment (Fig. 41) 2.24 long, 0.63 wide, with small ventral tooth; second cheliceral segment without basal ornamentation, 1.95 long, 0.26 wide, narrow, sharply tapered, slightly expanded at fingers, nearly

straight, fixed finger 0.31 long, 16% length of second segment. Cheliceral teeth relatively large, irregular (Fig. 42). Palpal segments (Fig. 43) 0.52, 0.85/0.16 (5.33), 0.52, 0.66/0.12 (5.50), 0.43. Legs smooth. Leg I (Fig. 44) segments 1.53/0.43 (3.56), 0.82/0.43 (1.90), 1.13/0.40 (2.83), 0.41/0.28 (1.49), 1.22/0.43 (2.83). Leg IV (Fig. 45) segments 1.51/0.52 (2.91), 0.82/0.50 (1.63), 0.99/0.50 (1.77), 0.42/0.31 (1.35), 1.13/0.37 (3.06). Adenostyle (Fig. 46) base 49% of tarsal length from tarsal base.

Penis in ventral view (Fig. 47) with three ventral setae close to distal margin and bases close together; eight apical setae with no evident tendency to basal fusion, basal ornamentation of both apical and ventral setae extending more than half length of each seta. Dorsal setae (Fig. 48) nine on each side, mesal group of four, lateral group of five with lateralmost four setae strongly fused for more than two-thirds length. Setal formula 3, 8, 9/9. Lacinius dorsalis strongly marginate, apex evenly rounded. Lobuli laterales nearly obsolete; digiti curved, with acute teeth. Lobus medialis with long, curved fingers which partially obscure digiti (Fig. 49).

*Distribution*: Known only from the type localities; see the preceding species for detailed location of Mulu National Park. Collins (1980) has described a number of his collection sites in the Mulu National Park. "Site C" is at 220 m elevation, on a 25–35° slope in mixed dipterocarp forest.

*Notes*: The "Site C" male differs from the holotype in a number of meristic characters. It is 3.62 long and 2.00



Figs. 40–49: *Stylocellus collinsi*, n. sp., male. 40 Dorsum; 41 Chelicera; 42 Cheliceral teeth; 43 Palpus; 44 First leg; 45 Fourth leg; 46 Adenostyle; 47 Penis, ventral view; 48 Right dorsal setal group, dorsal view; 49 Gonopore complex of penis, dorsal view. Scale line = 3.2 mm (Fig. 40), 1.5 mm (Figs. 41, 43–45), 0.30 mm (Figs. 42, 46–48), 0.15 mm (Fig. 49).

wide (both across the ozophores and at the widest point),  $L/W = 1.81$ . The appendages differ in their measurements and ratios in a chaotic way, with some segments more stout and others more slender than the holotype. They are considered to belong to the same species because despite these differences, the penes are identical in size and shape; camera lucida drawings of the two can be exactly superimposed. It has been repeatedly shown that complex male genitalia may be virtually invariable within species even amongst individuals differing greatly in body size (Eberhard, 1985). There is, however, one difference in the penes. In the holotype there is an additional, very small, dorsal seta at the lateral side of the series.

*Stylocellus mulu*, new species (Figs. 50–59)

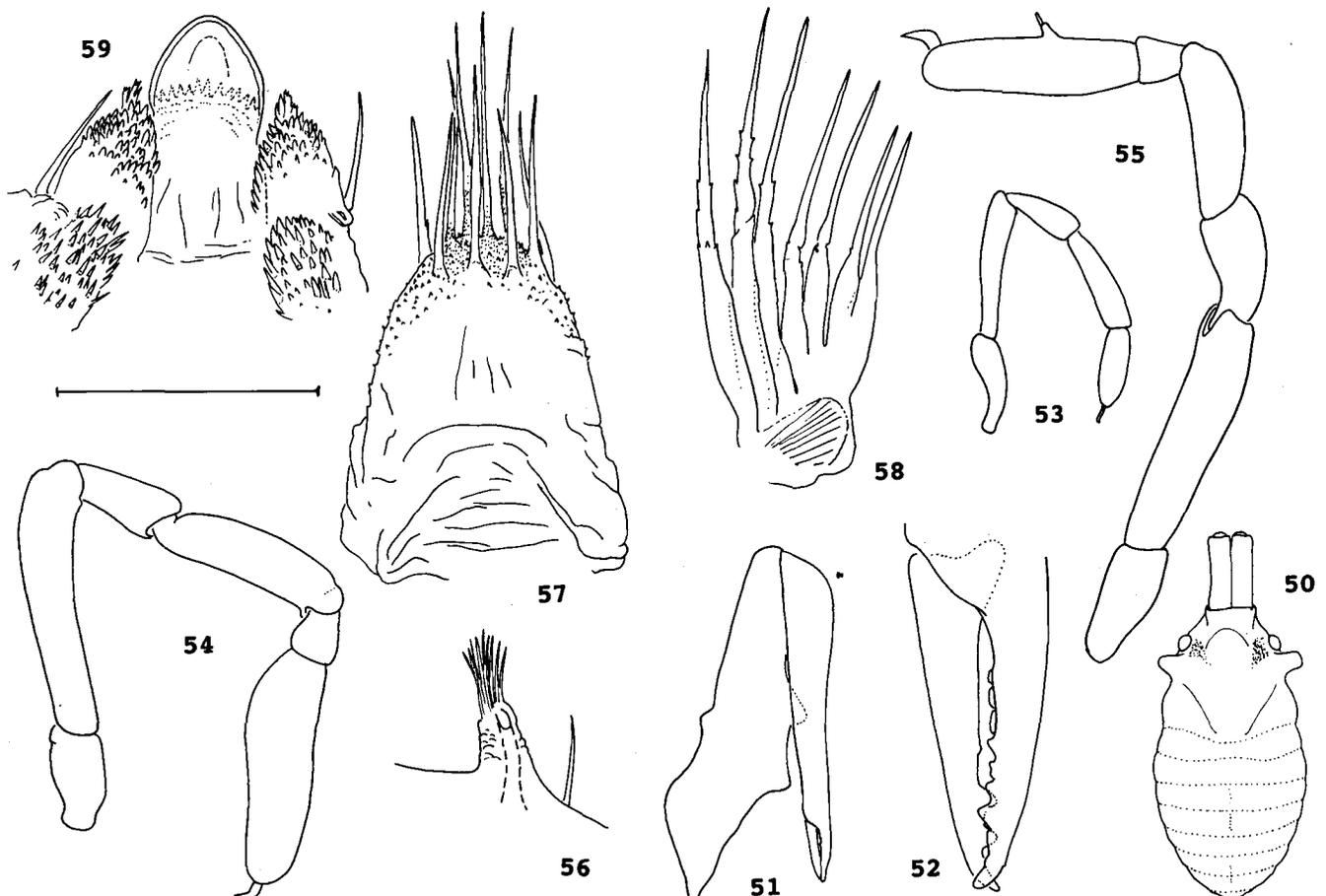
*Types*: Holotype male, four paratype females (BMNH) from Gunung Mulu National Park, 4th Division, Baram District, Sarawak, East Malaysia, elevation 1650 m, May–June 1978, coll. P. Hammond *et al.* in a litter sample. Male and female paratypes (BMNH) from lower montane forest soil cores at “Zonation Site H” in Gunung Mulu National Park, 1650 m elevation, coll. N. M. Collins, no date. Obviously, these may represent collections from the same place and time.

*Etymology*: The species is named for the Gunung Mulu National Park.

*Diagnosis*: This species and the preceding, both from Gunung Mulu National Park, Sarawak, are evidently

related and are similar in general appearance. *Stylocellus mulu* differs from *collinsi* in its smaller size, having significantly longer, thinner legs, and in details of the penis.

*Male*: Total length 3.62, width across ozophores 1.85, greatest width 1.82,  $L/W = 2.0$ . Dorsum (Fig. 50) lacking visible microsculpture, with shining finish. Eyes separated from bases of ozophores by less than one diameter, white, large, prominent, located slightly above midline of ozophore bases; ozophores relatively long, subcylindrical; opening small, with plug. Cephalothoracic transverse sulcus pronounced. Transverse abdominal sulci distinct, mid-dorsal abdominal sulcus absent. Ventral thoracic complex typical. First cheliceral segment (Fig. 51) 2.02 long, 0.52 wide, with very large ventral tooth; second cheliceral segment entirely unornamented, 1.81 long, 0.26 wide, narrow, sharply tapered, slightly expanded at fingers, nearly straight, fixed finger 0.31 long, 17% length of second segment. Cheliceral teeth (Fig. 52) relatively large, irregular, movable finger with two large distal teeth, others obsolete. Palpal segments (Fig. 53) 0.57, 0.82/0.16 (5.11), 0.45, 0.61/0.12 (5.07), 0.43. Legs smooth, shining. Leg I (Fig. 54) segments 1.55/0.28 (5.53), 0.64/0.29 (2.21), 1.04/0.30 (3.48), 0.34/0.26 (1.34), 1.30/0.42 (2.90). Leg IV (Fig. 55) segments 1.43/0.33 (4.32), 0.71/0.35 (2.04), 0.94/0.33 (2.85), 0.33/0.24 (1.38), 1.25/0.31 (4.04). Adenostyle (Fig. 56) base 45% of tarsal length from tarsal base.



Figs. 50–59: *Stylocellus mulu*, n. sp., male. 50 Dorsum; 51 Chelicera; 52 Cheliceral teeth; 53 Palpus; 54 First leg; 55 Fourth leg; 56 Adenostyle; 57 Penis, ventral view; 58 Right dorsal setal group, dorsal view; 59 Gonopore complex of penis, dorsal view. Scale line = 3.2 mm (Fig. 50), 1.5 mm (Figs. 51, 53–55), 0.30 mm (Figs. 52, 56–58), 0.15 mm (Fig. 59).

Penis in ventral view (Fig. 57) with three ventral setae close to distal margin and bases close together; six apical setae with no evident tendency to basal fusion, slight basal ornamentation of both apical and ventral setae extending no more than one-third length of each seta. Dorsal setae toothed (Fig. 58), seven on each side, mesal group of three, lateral group of four with lateralmost two setae strongly fused for more than half their length. Setal formula 3, 6, 7/7. Lacinius dorsalis weakly marginate, apex slightly acute. Lobuli laterales evidently subdivided, proximal sublobe with long fimbriae, distal sublobe with shorter, stouter fimbriae, seta near base of distal sublobe on each side; digiti much reduced, scarcely detectable. Lobus medialis with short, nearly triangular fingers (Fig. 59).

**Distribution:** As noted under the heading "Types" the two vials in which the material of this species was found may represent collections made at the same locality, since the elevation figures are the same. "Site H" at 1650 m elevation is described by Collins (1980) as being on a 30° slope, with waterlogged soil. The plant cover was mossy, with *Racemobambos* and stunted trees.

***Stylocellus pangrango*, new species (Figs. 60–68)**

**Types:** Holotype male (AMNH) from Java, Gunung Pangrango, 2000 m elevation, August 1921, no collector's name.

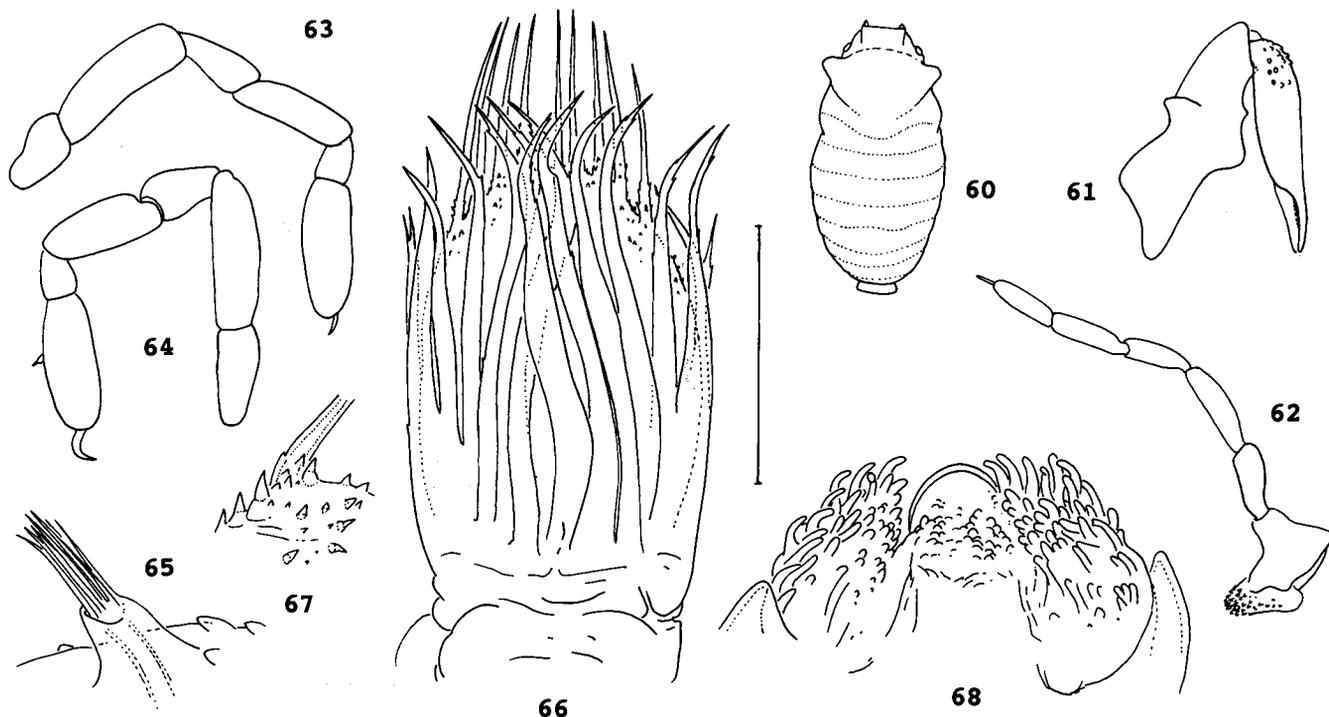
**Etymology:** The species is named for the type locality.

**Diagnosis:** Two other species have been described from Java. *Stylocellus javanus* Thorell is a large species, 5.5 mm long; the present species is only 3.2 mm long. The legs of *pangrango* are significantly longer with respect to the body length than in *sulcatus* Hansen & Sørensen; leg I is slightly longer than the body in *pangrango*, but only 80% of the

body length in *sulcatus*, which is also somewhat larger at 3.75 mm long, and has a prominent dorsal longitudinal sulcus.

**Male:** Total length 3.20, width across ozophores 1.46, greatest width 1.62, L/W = 1.98. Dorsum (Fig. 60) densely covered with small, pebbled microsculpture. Eyes separated from bases of ozophores by about one diameter, but located slightly above midline of ozophore bases; ozophores relatively short, subconical; opening small, with plug. Cephalothoracic transverse sulcus pronounced. Transverse abdominal sulci distinct, mid-dorsal abdominal sulcus absent. Ventral thoracic complex typical. First cheliceral segment (Fig. 61) 1.39 long, 0.42 wide, with small ventral tooth; second cheliceral segment 1.22 long, 0.24 wide, robust, slightly curved, fixed finger 0.31 long, 25% length of second segment. Cheliceral teeth small, regular, about 10 on each finger. Palpal segments (Fig. 62) 0.43, 0.54/0.14 (3.86), 0.38, 0.45/0.14 (3.21), 0.38. Legs densely pebbled. Leg I (Fig. 63) segments 0.87/0.26 (3.86), 0.49/0.23 (2.13), 0.70/0.21 (3.33), 0.23/0.19 (1.21), 0.78/0.26 (3.00). Leg IV (Fig. 64) segments 0.87/0.28 (3.11), 0.47/0.27 (1.74), 0.52/0.28 (1.65), 0.31/0.19 (1.65), 0.75/0.26 (2.88). Adenostyle (Fig. 65) base 41% of tarsal length from tarsal base.

Penis with three ventral setae removed from distal margin, bases separated by about three times their diameters; nine apical setae with no evident tendency to basal fusion, slightly ornamented at bases. Dorsal setae (Fig. 66) eight on each side, mesal group of four, lateral group of four with lateralmost three setae strongly fused for more than half their length. Setal formula 3, 9, 8/8. Lacinius dorsalis marginate, apex evenly rounded. Lobuli laterales nearly obsolete; digiti not observed. Lobus medialis with very long, curved fingers (Fig. 68).



Figs. 60–68: *Stylocellus pangrango*, n. sp., male. 60 Dorsum; 61 Chelicera; 62 Palpus; 63 First leg; 64 Fourth leg; 65 Adenostyle; 66 Penis, dorsal view; 67 Base of an apical seta; 68 Gonopore complex of penis, dorsal view. Scale line = 3.2 mm (Fig. 60), 1.5 mm (Figs. 61–64), 0.30 mm (Figs. 65, 66), 0.15 mm (Figs. 67, 68).

**Distribution:** Known only from the type locality. Gunung (Mount) Pangrango (3019 m) is at 6°48'S, 106°32'E, north-east of Sukabumi, in the western quarter of Java.

**Notes:** Accompanying the holotype are three immature specimens, the two larger probably two moults from maturity, and the smaller at least three.

***Stylocellus kinabalu*, new species** (Figs. 69–78)

**Types:** Holotype male (AMNH) from Malaysia, Borneo, Sabah, Kinabalu National Park, 1500 m elevation, 26 June 1979, coll. M. Perranck.

**Etymology:** The species is named for the type locality.

**Diagnosis:** Two species have been described previously from Borneo. *Stylocellus lionotus* Pocock and *S. pococki* Hansen & Sørensen are both large species, about 6 mm long; the present species is only 2.8 mm long. Two additional Borneo species are described below; *leakeyi* is 4.2 mm long and *sabah* is 4.8 mm long.

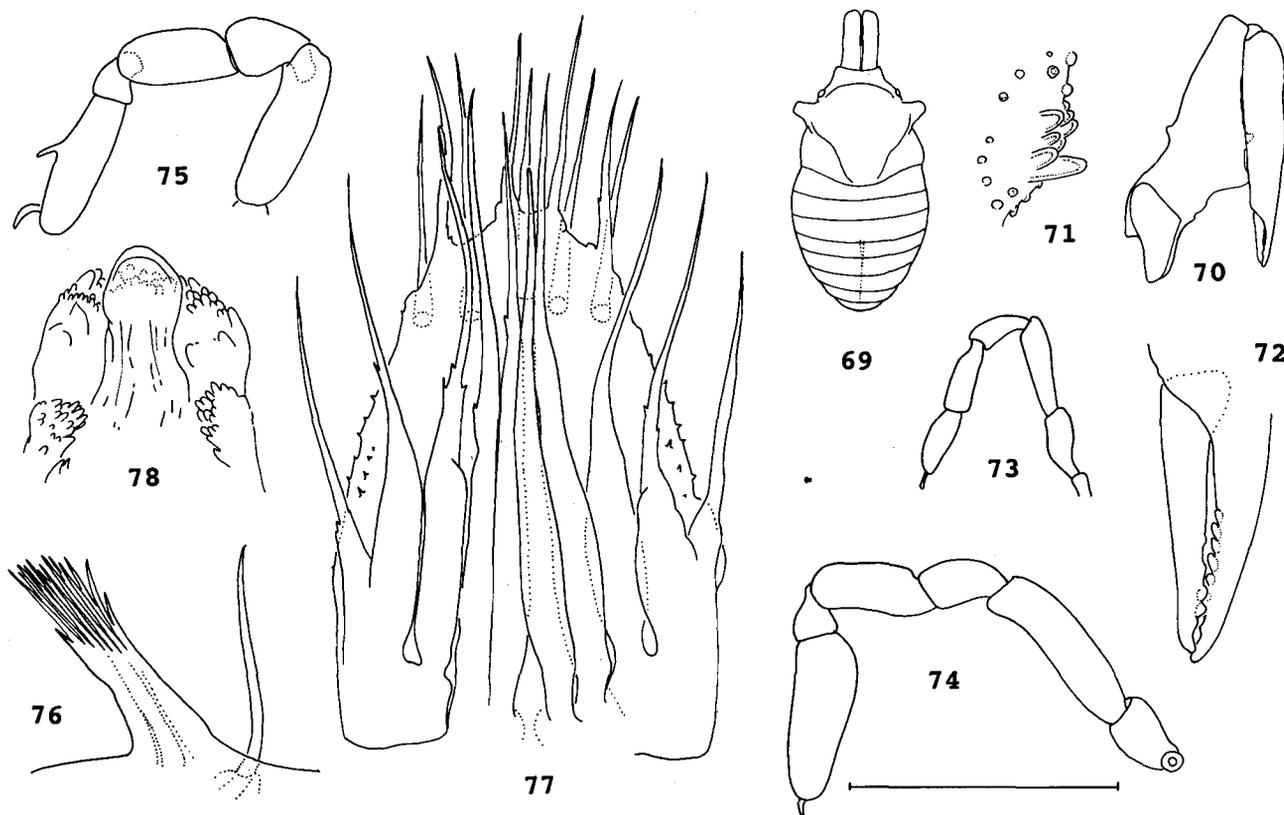
**Male:** Total length 2.80, width across ozophores 1.54, greatest width 1.62, L/W = 1.73. Dorsum (Fig. 69) without microsculpture, with dull matt finish. Eyes adjacent to bases of ozophores, located about at midline of ozophore bases; ozophores relatively short, subconical, projecting slightly forward; opening small, with plug. Cephalothoracic transverse sulcus pronounced. Transverse abdominal sulci distinct, mid-dorsal abdominal sulcus vaguely indicated on posterior few abdominal segments. Ventral thoracic complex typical. First cheliceral segment (Fig. 70) 1.46 long, 0.47 wide, with ventral tooth (Fig. 71) consisting of several small robust knobs; second cheliceral

segment 1.23 long, 0.23 wide, robust, straight, fixed finger 0.24 long, 19% length of second segment. Cheliceral teeth of fixed finger with basal series of 5 small teeth, two or three large distal teeth, movable finger with large distal teeth only (Fig. 72). Palpal segments (Fig. 73) 0.37, 0.52/0.12 (4.35), 0.28, 0.38/0.12 (3.19), 0.34. Legs smooth. Leg I (Fig. 74) segments 0.90/0.24 (3.75), 0.47/0.24 (1.96), 0.57/0.26 (2.20), 0.26/0.23 (1.13), 0.87/0.35 (2.48). Leg IV (Fig. 75) segments 0.89/0.26 (3.41), 0.52/0.30 (1.74), 0.59/0.28 (2.11), 0.31/0.21 (1.49), 0.77/0.26 (2.94). Adenostyle (Fig. 76) base 47% of tarsal length from tarsal base.

Penis in dorsal view (Fig. 77) with five ventral setae removed from distal margin, middle seta a little more distal than others, bases separated by about their diameters; four short apical setae with no evident tendency to basal fusion, bases not ornamented. Dorsal setae (Fig. 77) five on each side, mesal group of two, lateral group of three with lateralmost two setae fused for slightly more of their length than these two with mesal member of group. Setal formula 5, 4, 5/5. Lacinius dorsalis slightly marginate, apex evenly rounded. Lobuli laterales small, unusually proximal in position; digiti not observed. Lobus medialis with some fingers significantly larger than others (Fig. 78).

**Distribution:** Known only from the type locality. Kinabalu National Park centres on Mt. Kinabalu (4101 m), north-east of Kota Kinabalu, the capital of Sabah.

**Notes:** Accompanying the holotype is a single immature specimen in the penultimate instar.



Figs. 69–78: *Stylocellus kinabalu*, n. sp., male. 69 Dorsum; 70 Chelicera; 71 Ventral knob of first cheliceral article; 72 Cheliceral teeth; 73 Palpus; 74 First leg; 75 Fourth leg; 76 Adenostyle; 77 Penis dorsal view; 78 Gonopore complex of penis, dorsal view. Scale line = 3.2 mm (Fig. 69), 1.5 mm (Figs. 70, 73–75), 0.30 mm (Figs. 71, 72, 76, 77), 0.15 mm (Fig. 78).

***Stylocellus leakeyi*, new species** (Figs. 79–87)

*Types*: Holotype male (BMNH) from Malaysia, Borneo, Sabah, Gunung Silum, 440 m elevation, 1983, coll. R. Leakey; male paratype (BMNH), same locality, soil sample to 25 cm depth, 880 m elevation, no date, coll. R. Leakey.

*Etymology*: The species is named for the collector.

*Diagnosis*: The present species is 4.2 mm long, as opposed to 2.8 for *kinabalu*, 4.8 for *sabah* and about 6 for *lionotus* and *pococki*. The accompanying illustrations (Figs. 77, 85, 94) also show the significant differences between the penes in the three Sabah species described here.

*Male*: Total length 4.20, width across ozophores 2.0, greatest width 2.08, L/W = 2.0. Dorsum (Fig. 79) unornamented, with smooth matt finish. Eyes unusually small, separated from bases of ozophores by about one diameter, located about at midline of ozophore bases; ozophores relatively long, subcylindrical; opening small, with plug. Cephalothoracic transverse sulcus pronounced. Transverse abdominal sulci distinct, mid-dorsal abdominal sulcus absent. Ventral thoracic complex typical. First cheliceral segment (Fig. 80) 1.84 long, 0.52 wide, lacking ventral tooth; second cheliceral segment with dense, small pebbling, 1.53 long, 0.28 wide, slender, slightly curved, fixed finger 0.36 long, 18% length of second segment. Cheliceral teeth (Fig. 81) small, regular, about 8 on fixed finger, three distal on movable finger. Palpal segments (Fig. 82) 0.52, 0.71/0.17 (4.18), 0.38, 0.50/0.14 (3.57), 0.43. Legs with ornament of small pebbles, mostly dorsodistal on segments distal to femora. Leg I (Fig. 83) segments 1.22/0.49 (2.5), 0.70/0.42 (1.67), 0.90/0.35 (2.57), 0.30/0.21

(1.43), 1.13/0.40 (2.83). Leg IV (Fig. 84) segments 1.30/0.38 (3.43), 0.73/0.41 (1.78), 0.83/0.42 (2.0), 0.34/0.31 (1.12), 1.08/0.38 (2.84). Adenostyle base 48% of tarsal length from tarsal base.

Penis in ventral view (Fig. 85) with three ventral setae close to distal margin, bases nearly touching; eight apical setae with no evident tendency to basal fusion, slightly ornamented at bases. Dorsal setae (Fig. 86) five on each side, mesal group of three, lateral group of two. Setal formula 3, 8, 5/5. Lacinius dorsalis marginate, quite narrow. Lobuli laterales large, with dense, acute fimbriae; digiti long. Lobus medialis with very long, curved fingers (Fig. 87).

*Distribution*: Known only from the type locality.

*Notes*: Accompanying the paratypes from the soil sample are two immature specimens, one penultimate (female?) and one very early instar.

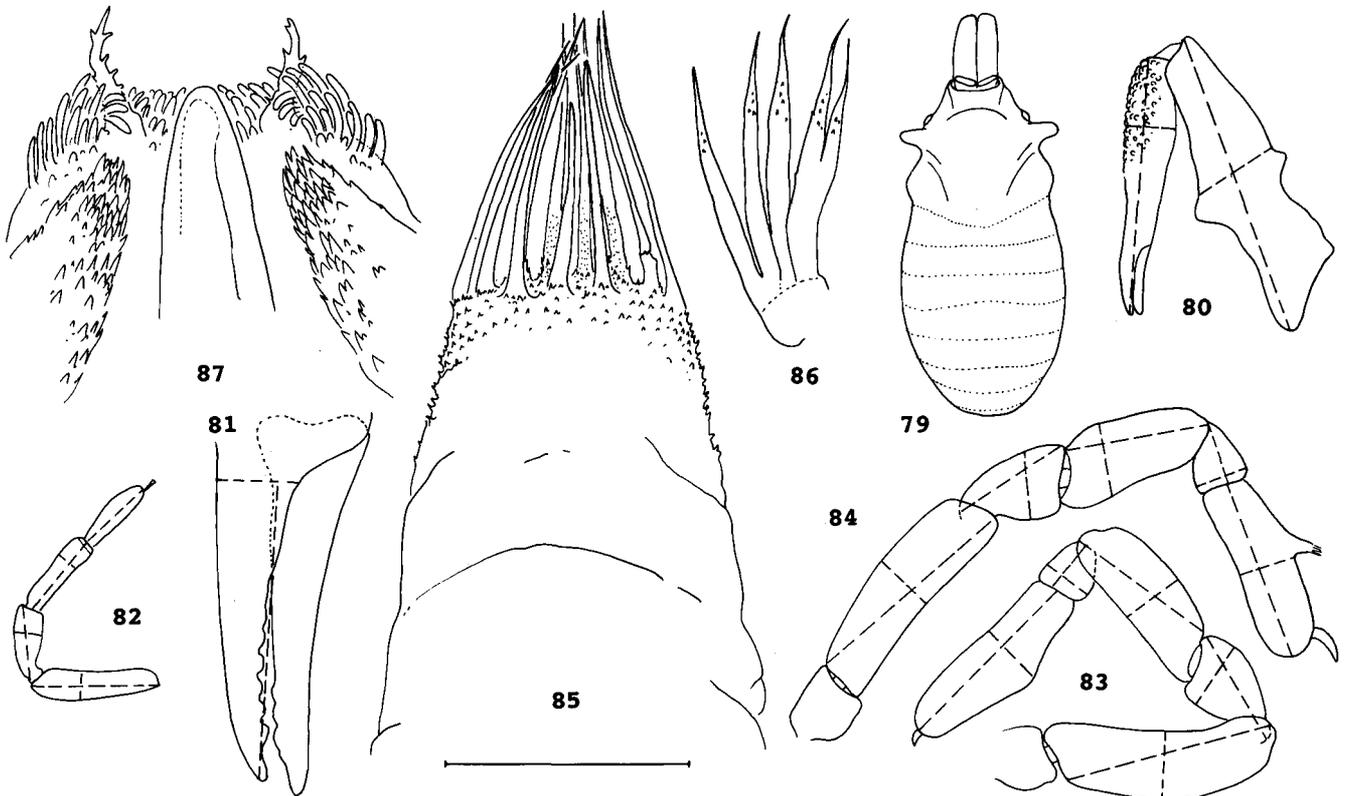
***Stylocellus sabah*, new species** (Figs. 88–97)

*Types*: Holotype male, paratype male (BMNH) from Malaysia, Borneo, Sabah, Gunung Sabah, 440 m elevation, from litter, 1983, coll. R. Leakey.

*Etymology*: The species is named for the Malaysian province of Sabah.

*Diagnosis*: This species is syntopic with *leakeyi*, but is larger, lacks pebbled ornamentation on the legs and chelicerae, has larger eyes, and has proportionally longer first legs (femur I about 40% of body length as opposed to about 30% for *leakeyi*).

*Male*: Total length 4.67, width across ozophores 2.50, greatest width 2.80, L/W = 1.67. Dorsum (Fig. 88) smooth with dull matt finish. Eyes adjacent to bases of ozophores,



Figs. 79–87: *Stylocellus leakeyi*, n. sp., male. Broken lines on Figs. 80–84 show how measurements of appendages were taken. **79** Dorsum; **80** Chelicera; **81** Cheliceral teeth; **82** Palpus; **83** First leg; **84** Fourth leg; **85** Penis, ventral view; **86** Right dorsal setal group, dorsal view; **87** Gonopore complex of penis, dorsal view. Scale line = 3.2 mm (Fig. 79), 1.5 mm (Figs. 80, 82–84), 0.30 mm (Figs. 81, 85, 86), 0.15 mm (Fig. 87).

but located slightly above midline of ozophore bases; ozophores relatively long, subcylindrical; opening small, with plug. Cephalothoracic transverse sulcus pronounced. Transverse abdominal sulci distinct, mid-dorsal abdominal sulcus absent. Ventral thoracic complex typical. First cheliceral segment (Fig. 89) 2.34 long, 0.70 wide, with small ventral tooth; second cheliceral segment 1.91 long, 0.31 wide, slender, tapering, straight, fixed finger 0.38 long, 20% length of second segment. Cheliceral teeth (Fig. 90) reduced, two strong distal teeth on fixed finger, two low bumps distal on movable finger. Palpal segments (Fig. 91) 0.59, 0.96/0.17 (5.65), 0.56, 0.71/0.14 (5.07), 0.52. Legs smooth. Leg I (Fig. 92) segments 2.00/0.47 (4.25), 1.00/0.45 (2.20), 1.57/0.43 (3.64), 0.45/0.34 (1.32), 1.74/0.50 (3.48). Leg IV (Fig. 93) segments 1.69/0.57 (2.96), 1.04/0.57 (1.83), 1.56/0.59 (2.64), 0.52/0.40 (1.30), 1.47/0.43 (3.41). Adenostyle unusually robust, base 59% of tarsal length from tarsal base.

Penis in ventral view (Fig. 94) with five ventral setae distributed in an arc, bases separated by more than three times their diameters; four apical setae with no evident tendency to basal fusion, not ornamented. Dorsal setae (Fig. 95) six on each side, mesal group of three (with many teeth, Fig. 96), lateral group of three with lateralmost two

setae more strongly fused. Setal formula 5, 4, 6/6. Lacinius dorsalis strongly marginate, broad, apex evenly rounded. Lobuli laterales with small, acute laciniae; digiti small. Lobus medialis with long, curved fingers (Fig. 97).

*Distribution:* Known only from the type locality.

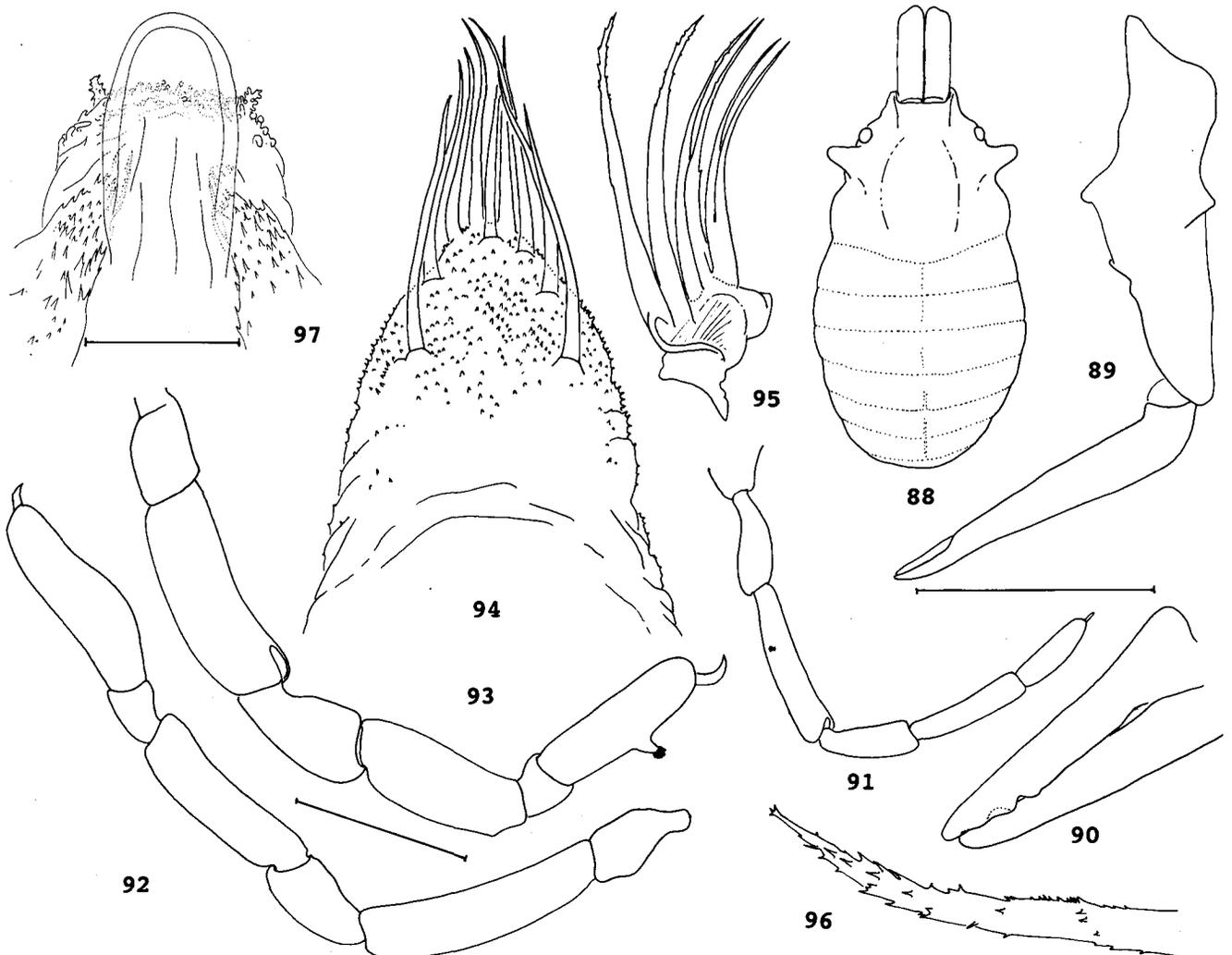
*Stylocellus tarumpitao*, new species (Figs. 98–109)

*Types:* Holotype male (AMNH) from Philippine Islands, Palawan, Ransang, S. Tarumpitao Point, 100 m elevation, 5 January 1980, coll. M. Quate.

*Etymology:* The species is named for the type locality.

*Diagnosis:* No other *Stylocellus* species are presently known from the Philippine Islands.

*Male:* Total length 5.62, width across ozophores 2.38, greatest width 2.85, L/W = 1.97. Dorsum (Fig. 98) smooth with dull matt finish. Eyes much reduced, same colour as dorsum, adjacent to bases of ozophores, but located above midline of ozophore bases; ozophores relatively long, subcylindrical, extending straight laterally; opening small, with plug. Cephalothoracic transverse sulcus pronounced. Transverse abdominal sulci distinct, mid-dorsal abdominal sulcus faintly indicated on posterior abdominal segments. Ventral thoracic complex typical. First cheliceral segment (Fig. 99) 2.47 long, 0.61 wide,



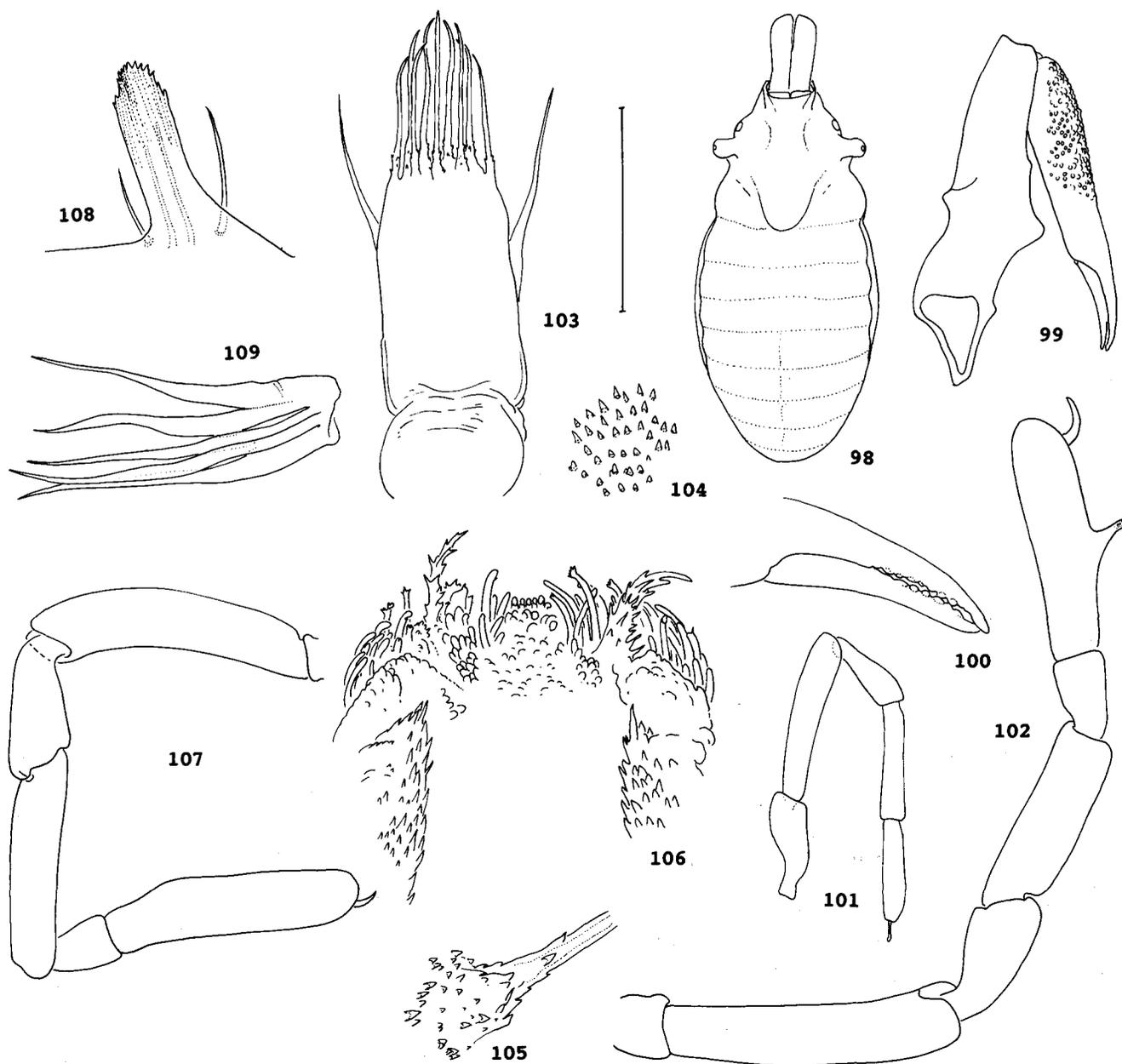
Figs. 88–97: *Stylocellus sabah*, n. sp., male. 88 Dorsum; 89 Chelicera; 90 Cheliceral teeth; 91 Palpus; 92 First leg; 93 Fourth leg; 94 Penis, ventral view; 95 Left dorsal setal group, ventral view; 96 Most medial seta of left dorsal setal group; 97 Gonopore complex of penis, dorsal view. Scale lines = 3.2 mm (Fig. 88), 1.5 mm (Figs. 89, 91–93), 0.30 mm (Figs. 90, 94, 95), 0.15 mm (Figs. 96, 97).

with small ventral tooth; second cheliceral segment with pebbled ornamentation for about half its length, 2.10 long, 0.37 wide, relatively robust, straight, fixed finger 0.57 long, 27% length of second segment. Cheliceral teeth (Fig. 100) small, uniform, about 10 on fixed finger. Palpal segments (Fig. 101) 0.70, 1.23/0.23 (5.37), 0.66, 0.82/0.16 (5.11), 0.73. Legs smooth, except for some pebbled ornamentation on metatarsi and tarsi, more prominent on posterior legs. Leg I (Fig. 102) segments 2.00/0.42 (4.76), 1.00/0.42 (2.40), 1.56/0.36 (4.35), 0.52/0.35 (1.49), 1.77/0.42 (4.22). Leg IV (Fig. 107) segments 2.12/0.42 (5.05), 1.00/0.47 (2.15), 1.30/0.44 (2.96), 0.61/0.37 (1.65), 1.74/0.44 (3.95). Adenostyle (Fig. 108) robust, base 47% of tarsal length from tarsal base.

Penis in ventral view (Figs. 103, 104) with three ventral setae close to margin, bases separated by about one diameter; six apical setae with no evident tendency to

basal fusion, bases ornamented (Fig. 105). Dorsal setae (Fig. 109) five on each side, mesal group of three, lateral group of two more strongly fused. Setal formula 3, 6, 5/5. Lacinius dorsalis marginate, broad, apex evenly rounded. Lobuli laterales with acute laciniae; digiti large, with many branches. Lobus medialis with long, curved fingers, many with apical teeth (Fig. 106).

*Distribution:* Known only from the type locality. Ransang (8°57'N, 117°33'E) is a small town at the southern end of the island of Palawan, south-west of the larger city of Malabuñgan; Tarumpitao Point is nearby (9°03'N, 117°38'E) and is (or was) the site of an airfield. The southern tip of Palawan is separated from Sabah, Borneo, by the narrow Balabac Strait, dotted with scattered islands large and small. Thus the close relationship of this species to several known from Sabah is not unexpected. Gressitt (1956) excluded Palawan from his



Figs. 98-109: *Stylocellus tarumpitao*, n. sp., male. **98** Dorsum; **99** Chelicera; **100** Cheliceral teeth; **101** Palpus; **102** Fourth leg; **103** Penis, ventral view; **104** Microsculpture of ventral side of ventral plate of penis; **105** Base of apical seta of penis; **106** Gonopore complex of penis, dorsal view; **107** First leg; **108** Adenostyle; **109** Right dorsal setal group, dorsal view. Scale line = 3.2 mm (Fig. 98), 1.5 mm (Figs. 99, 101, 102, 107), 0.60 mm (Figs. 100, 103, 109), 0.30 mm (Fig. 108), 0.15 mm (Figs. 104-106).

Philippine region, placing it instead, with Borneo, in the Malayan region. Schuh & Stonedahl (1986) presented an area cladogram based on mirid bug distributions which grouped Palawan with Borneo, rather than with the northern Philippines.

#### Unnamed specimens

From lower montane forest in Mulu National Park, Sarawak, at an elevation of 1140 m, M. Collins collected a small mature female cyphophthalmid on 8 February 1978. This female is only 1.9 mm long, and while agreeing with *Stylocellus* in most characters, has no eyes; undoubtedly it represents a fourth species from Mulu, but I have chosen not to name it in the absence of males. A second, larger female, probably of *S. collinsi*, was in the same vial.

This specimen may shed light on the somewhat mysterious name *Miopsalis pulicaria* Thorell (1891). Thorell described this species on a single specimen, probably a juvenile or female, from Penang Island, Malaysia. In the Latin description, he clearly states in four different places that the specimen lacked *oculorum sessilium* in advance of the "stalked eyes [ozophores]". In most other characters mentioned, the specimen agrees well with *Stylocellus*. However, the first tibiae are described as twice as long as wide, a situation not known from any *Stylocellus* species, in which the first tibiae are at least 2.5 times longer than wide. It would seem that the specimen was not a male, since Thorell notes that it differs from *Stylocellus* in having no modifications of the fourth tarsus. I suspect the specimen was a mature female, since in juvenile cyphophthalmids the spiracles are set off on separate sclerites on the right and left sides, derived from the divided first sternite; in mature animals these sclerites fuse without a trace to the enlarged second sternite which separates them. Thorell would have been unlikely to have missed such a distinction. No additional specimens have been found.

The small Mulu female, like *Miopsalis pulicaria*, has quite short, stout legs and is eyeless. Given distribution patterns of cyphophthalmids in tropical Asia and its maturity at such small size, it could not be *M. pulicaria*, but suggests that the generic name *Miopsalis* may be valid and include at least two species. These questions can only be answered if males are found.

The Californian Academy of Sciences collection contains a single female *Stylocellus* from Gua Anak Takun, a limestone cave in Templer Park, 7.5 km north of Kuala Lumpur, Malaysia, collected 13 June 1962, by E. S. Ross and D. Cavagnaro. This female is 4.5 mm long, and the legs, while slender, are not outside the normal range of surface-dwelling species. The male of *S. sedgwicki* Shear (Penang Island) is slightly smaller but of similar pro-

portions; without males from Gua Anak Takun it cannot be determined if the female is this species or another.

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