

## The Systematics of the Hyidae (Pseudoscorpionida : Neobisioidea)

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### Abstract

The Hyidae are redefined and three new synapomorphies are recognised which define the family: basi-dorsal mound on femora I and II; minute setae on female sternite II; and 2-3 stout setae on the pedipalpal femur. Three genera are included: *Hya* Chamberlin, with *H. minuta* (Tullgren) and *H. chamberlini*, sp. nov.; *Indohya* Beier, with *I. besucheti* Beier, *I. caecata* Beier, *I. panops*, sp. nov., *I. beieri*, sp. nov., *I. pusilla*, sp. nov. and *I. typhlops*, sp. nov.; and *Hyella*, gen. nov., with *H. humphreysi*, sp. nov. (type species), the first known cavernicolous species of the family. *Hya heterodonta* Chamberlin is considered a junior synonym of *Ideobisium minutum* Tullgren. The Hyidae are divided into two subfamilies, Hyinae for *Hya*, and Indohyinae, subfam. nov., for *Indohya* and *Hyella*. A new distribution record is given for *Tyrannochthonius krakatau* Harvey (Chthoniidae), based on part of the type series of *I. minutum*.

### Introduction

Of the seven known families of Neobisioidea, the smallest is the Hyidae with only four species (Harvey 1991a, 1991b). It was erected by Chamberlin (1930) for a monotypic genus from the Philippines, *Hya* Chamberlin. Beier (1932) treated the Hyinae as a subfamily of the Ideoroncidae, and transferred the Indonesian species *Ideobisium minutum* Tullgren to *Hya*. Chamberlin (1946) reinstated the Hyidae as a full family, and included a second genus, *Leucohya* Chamberlin from Mexico, in a separate subfamily, Leucohyinae. Additional genera from central America were later added to the Leucohyinae by various authors; these were all transferred to the Bochicidae (along with *Leucohya*) by Muchmore (1982).

Beier (1957, 1967) added two further monotypic genera, *Parahya* Beier and *Stenohya* Beier, to the family; these have been transferred to the Neobisiidae (Harvey 1991b). *Parahya* has since been transferred to its own family, Parahyidae (Harvey 1992). Finally, *Indohya* Beier was added to the Hyidae (Beier 1974) for two species from southern India: *I. besucheti* Beier and *I. caecata* Beier. The discovery of several undescribed species of Hyidae from Australia and Sri Lanka, including an unusual cavernicolous species, allows a re-examination of the taxa currently attributed to the family.

### Materials and Methods

Specimens are lodged in the following institutions.

ANIC	Australian National Insect Collection, Canberra
JCC	J. C. Chamberlin collection, Oregon
MHNG	Muséum d'Histoire Naturelle, Geneva
MJC	Mark Judson collection, Leeds
NHMW	Naturhistorisches Museum, Wien
SMF	Forschungsinstitut Senckenberg, Frankfurt am Main

SMNS	Staatliches Museum für Naturkunde, Stuttgart
WAM	Western Australian Museum, Perth
WBM	William B. Muchmore collection, Rochester, New York
ZMH	Zoologisches Institut und Zoologisches Museum, Hamburg

Specimens were mounted on microscope slides in Euparal, or cleared in lactic acid and temporarily examined in glycerol. A female of *Indohya panops* was dehydrated, mounted and gold-coated for examination in a JEOL JSM-35C Scanning Microscope. Terminology follows Chamberlin (1931), with the exception of pedipalp and leg segments (Harvey 1992). 'SP' and 'SL' refer to specimens preserved in spirit or mounted on slides, respectively. Supplementary collection data not available on the original labels (e.g. latitudes and longitudes) are presented in parentheses.

### Family HYIDAE Chamberlin

Hyidae Chamberlin, 1930: 41. — Harvey, 1991a: 314 (full synonymy); Harvey, 1992: 1408.

#### Diagnosis

Femora I and II with basi-dorsal mound surmounted by a small seta and slit sensilla. Anterior genital operculum of ♀ with extremely small setae. Pedipalpal femur with 2–3 stout setae on posterior-basal margin.

#### Description

Generally pale in colour; pedipalps and carapace sometimes slightly red-brown. Pleural membrane granulo-striate. Chelicera with 5–6 acuminate setae on hand and 1 acuminate, subdistal seta on movable finger; lamina exterior absent; serrula exterior distally free; velum absent; flagellum with 5–7 distally serrate blades; galea long and slender. Carapace sub-rectangular; with 12–16 setae; without furrows; without epistome; eyes present or absent. Pedipalpal femur with 2 tactile setae in basal half, and with 2–3 stout setae on posterior-basal margin; without basal projection. Fixed chelal finger and hand with 8 trichobothria; *eb*, *esb* and *isb* in diagonal row at base of fixed finger, with *ist* situated slightly distally; *ib* situated dorsally on hand; *et*, *est* and *it* grouped distally. Movable chelal finger with 4 trichobothria; *st* and *t* grouped together near distal end of finger; *t* not lanceolate. Trichobothrial bases not examined. Chelal fingers with marginal teeth either contiguous and homodentate (Indohyinae) or slightly spaced and heterodentate (Hyinae). Venom apparatus present in both chelal fingers (Hyinae) or only in movable chelal finger (Indohyinae); venom ducts moderately long, nodus ramosus terminating near *est* in fixed finger (when present), and proximal to *st* in movable finger. Tergites and sternites undivided, except for sternite IV which is partially divided in some species. Pedipalpal coxa with 2 apical setae; posterior maxillary lyrifissure present. Setae of anterior genital opercula of ♀ extremely small. Male genitalia not unusual. Female genitalia very simple, consisting of single enlarged median diverticulum; spermathecae absent. Spiracles simple, with spiracular helix; anterior pair of tracheae long, ramifying into tracheoles when above coxae IV; posterior pair of tracheae short, ramifying into tracheoles almost immediately; spiracular plates with setae. Legs: femora I and II much longer than patellae I and II; femora I and II with basi-dorsal mound surmounted by a small seta and slit sensilla; leg IV with articulation between femur and patella segments oblique; diplotarsate, all legs with tarsus longer than metatarsus; subterminal tarsal setae acuminate; metatarsus of leg IV with tactile seta; arolia shorter than claws, not divided; claws simple.

#### Monophyly and Relationships

Previous diagnoses of the Hyidae have always cited the presence of a venom apparatus in both chelal fingers. While this is true of *Hya*, the venom apparatus is clearly lacking from the fixed finger in species of *Indohya* and *Hyella*. In any event, taxa cannot be defined by the presence of a venom apparatus in both chelal fingers, as this is the plesiomorphic condition (Harvey 1988a, 1992). Therefore, other characters are necessary to firmly establish a relationship between the three genera here attributed to the Hyidae. Suggested relationships within the family are shown in a cladogram (Fig. 1) which is derived from the character states given in Table 1.

The Hyidae represent the sister-group to a clade which consists of Neobisiidae, Syarinidae, Parahyidae and Gymnobisiidae (Harvey 1992). All five families possess a small group of slit sensilla on femora I and II, which has been subsequently lost in some Syarinidae.

Character 1. *Femora I and II, mound*. Members of the three hyid genera are unique amongst pseudoscorpions in the possession of a small but distinct mound on the dorsal surface of femora I and II (e.g. Figs 11, 33, 63, 95). This mound is sub-basally situated, and surmounted by a small seta and slit sensilla. I have examined species of several other neobisioid families (Neobisiidae: *Neobisium* Chamberlin, *Roncocreagris* Mahnert, *Stenohya* Beier; Syarinidae: *Ideobisium* Balzan, *Ideoblothrus* Balzan, *Nannobisium* Beier, *Syarinus* Chamberlin; Parahyidae: *Parahya* Beier; Gymnobisiidae: *Mirobisium* Beier; Bochicidae: *Vachonium* Chamberlin, *Paravachonium* Beier; Ideoroncidae: *Albiorix* Chamberlin, *Dhanus* Chamberlin, *Ideoroncus* Balzan), and although some possess slit sensilla in this position,

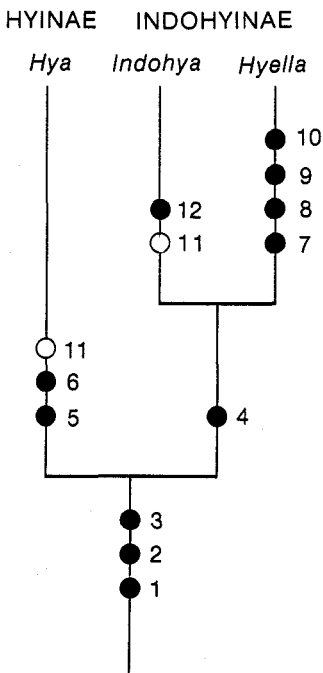


Fig. 1. Cladogram depicting suggested relationships within Hyidae. Autapomorphies (closed circles), homoplasies (open circles).

Table 1. Character matrix

0, plesiomorphy; 1, apomorphy; ?, not known

Character: plesiomorphic state; apomorphic state	<i>Hya</i>	<i>Indohya</i>	<i>Hyella</i>
1. Femora I and II, mound: absent; present	1	1	1
2. Female setae, sternite II: acuminate; minute	1	1	1
3. Pedipalpal femur, 2-3 stout setae: absent; present	1	1	1
4. Venom apparatus, fixed finger: present; absent	0	1	1
5. Curved setae near <i>ib</i> : absent; present	1	0	0
6. Chelal teeth, fixed finger: contiguous; well spaced	1	0	0
7. Carapace, setae: 14-16; 12	0	0	1
8. Size: small; large	0	0	1
9. Flagellum, number of blades: 5-6; 7	0	0	1
10. Trichobothrium <i>b</i> : not basal; basal	0	0	1
11. Chelal teeth, movable finger: present; small or absent	1	1	0
12. Male genitalia, dorsal apodeme: small; large, wing-like	0	1	?

none possess a distinct mound. It is clearly autapomorphic for the Hyidae. Dr W. B. Muchmore (personal communication) has kindly examined representatives of several American neobisoid families, and reports that the mound is absent.

Character 2. *Female setae, sternite II*. Similarly, the setae on the anterior genital operculum of female hyids are not acicular, but are extremely small and difficult to detect (e.g. Figs 15, 36, 61, 62, 98). Chamberlin (1946, figs 23–4) depicted long, acicular setae in *Hya heterodonta*, but close examination of *Hya* specimens (including types of *H. heterodonta*) reveals that the setae are very small. Presumably, Chamberlin assumed that the setae had been lost from the specimens at hand and drew acicular setae without realising their true nature. Other neobisoid species at hand lack these minute setae (I have examined females of most of the genera listed above).

Character 3. *Pedipalpal femur, 2–3 stout setae*. The row of stout setae on the posterior-basal margin of the pedipalpal femur appears to be autapomorphic for the family (e.g. Fig. 64). Most specimens possess three setae, but some specimens of *Hya chamberlini* and *Indohya besucheti* possess only two.

Character 4. *Venom apparatus, fixed chelal finger*. The presence of a venom apparatus in both chelal fingers is apomorphic for the suborder Iocheirata (Harvey 1992), and thus plesiomorphic when considering taxa within this clade. Subsequent losses of the venom apparatus from one or both chelal fingers have occurred in a variety of taxa, and the loss of the venom apparatus in the fixed finger of *Indohya* and *Hyella* (e.g. Figs 29, 92) is considered apomorphic.

Character 5. *Setae near ib*. Adults and tritonymphs of *Hya* spp. possess 1 (*H. chamberlini*) or 4–5 (*H. minuta*) curved setae anterior to *ib* (Figs 5, 20). This is unique for the genus (and subfamily), and is considered apomorphic. These setae are very occasionally lost in *H. chamberlini*.

Character 6. *Chelal teeth*. The chelal teeth of most pseudoscorpions are contiguous. Many different groups have independently acquired spaces between the teeth; these spaces are apomorphic. *Hya minuta* and *H. chamberlini* are the only hyids with widely spaced teeth (Figs 5, 20).

Character 7. *Carapace, setae*. *Hya* and *Indohya* spp. possess 14–16 carapacial setae (e.g. Figs 4, 30, 54), whereas *Hyella humphreysi* possesses only 12 (Fig. 94), which is considered apomorphic. *H. humphreysi* lacks the ocular setae and a pair of median setae. The lack of ocular setae also occurs in the Indian *Indohya* spp. (Figs 30, 40), which is clearly independent.

Character 8. *Size*. *Hya* and *Indohya* spp. attain a maximum pedipalpal femur length of 0.53 mm, whereas that of *H. humphreysi* is 1.50 mm. The large size of *H. humphreysi* is clearly related to its cavernicolous habits, and is considered apomorphic.

Character 9. *Flagellum, number of blades*. Most specimens of *Hya* and *Indohya* spp. possess 5–6 flagellar blades. Some specimens of *H. minuta* have 7 blades, and Dr W. B. Muchmore reports (in litt.) that he has observed one specimen with 7 blades in one flagellum and 8 in the other. The single known adult of *Hyella humphreysi* possesses 7 blades, which is considered apomorphic. The variation in *Hya* spp. may negate the value of this character.

Character 10. *Trichobothrium b*. *Trichobothrium b* is situated midway between *sb* and the proximal end of the movable finger in *Hya* and *Indohya* spp. (e.g. Figs 6, 29). It is situated much closer to the proximal end of the movable finger in *Hyella humphreysi* (Fig. 92).

Character 11. *Chelal teeth, movable finger*. *Hyella humphreysi* is the only hyid that retains a full complement of teeth on the movable chelal finger (Fig. 92), which appears to be the plesiomorphic state. *Hya* and *Indohya* spp. possess vestigial teeth or no teeth at all (e.g. Figs 6, 29); these reductions are considered apomorphic, and have occurred twice.

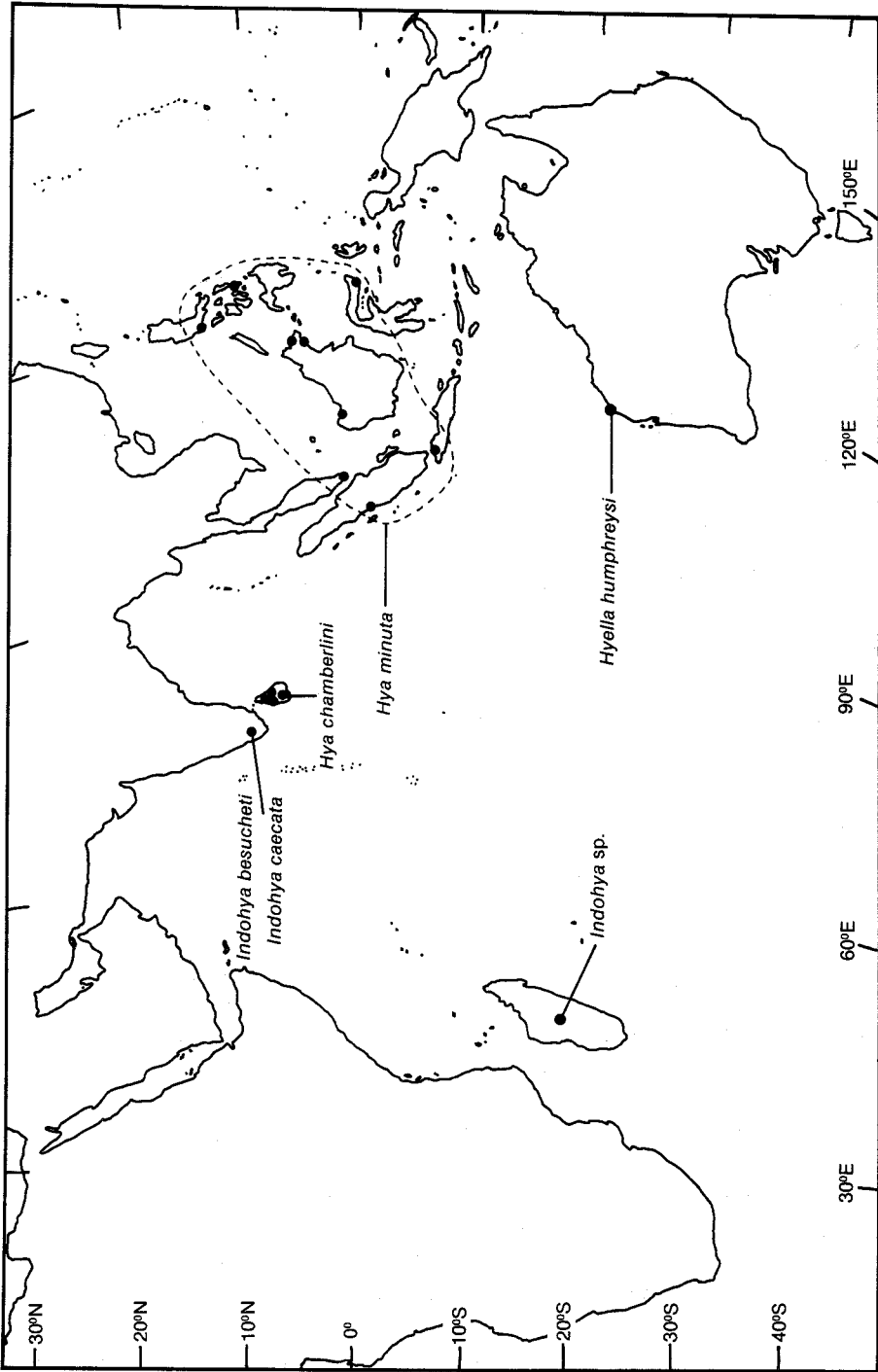


Fig. 2. The known distribution of *Hya* spp., some *Indohya* spp. and *Hyella* spp. The Madagascan locality is approximate.

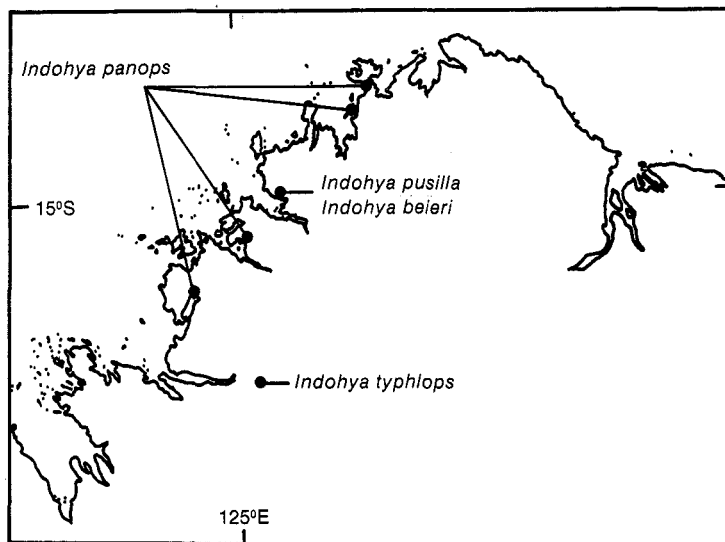


Fig. 3. The known distribution of some *Indohya* spp. in north-western Australia.

Character 12. *Male genitalia, dorsal apodeme*. The dorsal apodeme of *Indohya* spp. is quite large and wing-like (e.g. Fig. 58), whereas that of *Hya* spp. is quite small (Fig. 14). The former state is considered apomorphic. Males of *Hyella humphreysi* are needed to test the distribution of this character state, as it may be apomorphic for *Indohya* plus *Hyella*.

### Biogeography

The three known hyid genera are found on land masses bordering the Indian Ocean (Figs 2, 3). *Hya* extends from Sri Lanka through Malaysia (Malaya, Sabah, Sarawak) and Indonesia (Java, Sumatra, Sulawesi), as far north as the Philippines, but has not been found further east than northern Sulawesi. However, this may simply reflect lack of collections from areas such as the Moluccas, Timor and Irian Jaya.

*Indohya* is known from south-western India, Madagascar and north-western Australia, while its sister-group, *Hyella*, is known from caves in Cape Range, Western Australia. The distribution of the Indohyinae (*Indohya* and *Hyella*) has strong similarities with that of the Feaellidae (Harvey 1989), and a vicariant hypothesis is again postulated to explain the distribution of the Indohyinae. A dispersal hypothesis is rejected because of the lack of indohyines from non-continental land areas, and the apparent unsuitability of small, poorly sclerotised pseudoscorpions for prolonged trans-oceanic voyages.

Until the late Jurassic, Gondwana consisted of South America, Africa, Madagascar, India, New Zealand, Australia and Antarctica (Briggs 1987). By 150 million years ago, a rift separated South America and Africa from the remaining continental blocks, which remained united until the separation of India and Madagascar during the mid-Cretaceous. The presence of Indohyinae in India, Madagascar and Australia indicates that the genus had evolved prior to this division. Further species of Indohyinae are to be expected on those portions of Gondwana that were contiguous with Madagascar, India and north-western Australia during the late Jurassic and that have retained suitable habitats and climatic conditions since the Mesozoic. They may still occur in the Seychelles and southern or eastern Africa.

Other taxa that exhibit trans-Indian Ocean distribution patterns have been summarised by Main (1991). The extreme similarity between the Indian and Australian Indohyinae suggests that morphological divergence has been extremely weak in the past 140 million years, as noted by Cranston *et al.* (1987) for the midge *Archaeochlus* Brundin (Diptera: Chironomidae).

The presence of *Hya* in Sri Lanka and the Indonesian Archipelago may reflect the Gondwanan origin of the latter (Audley-Charles 1987).

#### Post-embryonic Development

Although protonymphs are not known for any hyid, the deutonymph, tritonymph and adult are known for *Hya minuta* and *Indohya panops*. The post-embryonic development of the chelal trichobothria (Figs 6–8, 48–50) conforms with that of other neobisoides (Mahner 1981). Extrapolation with other neobisoides produces the following formula (PN, protonymph; DN, deutonymph; TN, tritonymph; A, adult):

$$eb_{PN} esb_{TN} est_{DN} et_{PN} / ib_{DN} isb_A ist_{PN} it_{DN} / b_{DN} sb_A st_{TN} t_{PN}.$$

#### Key to Species of Hyidae

1. Fixed chelal finger heterodentate (Figs 6, 18); venom apparatus present in both chelal fingers (Figs 6, 18) ..... Hyinae ..... 2
- Fixed chelal finger homodentate (e.g. Figs 29, 92); venom apparatus present only in movable chelal finger (e.g. Figs 29, 92) ..... Indohyinae ..... 3
- 2(1). Chela (with pedicel) 0.605–0.80 (♂), 0.68–0.85 (♀) mm in length; 4–5 setae anterior to *ib* (Fig. 5) (Indonesia, Malaysia, Philippines, Singapore) ..... *Hya minuta* (Tullgren)
- Chela (with pedicel) 0.48–0.615 (♂), 0.56–0.67 (♀) mm in length; 1 seta anterior to *ib* (very occasionally absent) (Fig. 20) (Sri Lanka) ..... *Hya chamberlini*, sp. nov.
- 3(1). Movable chelal finger with more than 50 well-developed teeth (Fig. 92); carapace with 12 setae (Fig. 94); flagellum with 7 blades (Fig. 90); pedipalps large and attenuate (e.g. ♀ femur 1.50 mm in length, approximately 7.1 × longer than broad) (Australia) ..... *Hyella humphreysi*, sp. nov.
- Movable chelal finger without teeth or with several poorly developed teeth (e.g. Fig. 29); carapace with 14–16 setae (e.g. Figs 30, 54); flagellum with 5–6 blades (e.g. Figs 32, 53); pedipalps smaller and not extremely attenuate (e.g. ♂, ♀ femur 0.32–0.46 mm in length, approximately 3.5–4.3 × longer than broad) ..... *Indohya* ..... 4
- 4(3). Carapace with 14 setae, ocular setae absent (Figs 30, 40) ..... 5
- Carapace with 16 setae, ocular setae present (Figs 54, 70, 78, 84) ..... 6
- 5(4). Cheliceral hand with 5 setae (Fig. 31); fixed chelal finger with 20–21 very flat teeth (Fig. 29) (India) ..... *Indohya besucheti* Beier
- Cheliceral hand with 6 setae (Fig. 41); fixed chelal finger with 29 flat teeth (Fig. 39) (India) ..... *Indohya caecata* Beier
- 6(4). Eyes present (Figs 54, 70, 78) ..... 7
- Eyes absent (Fig. 84) (Australia) ..... *Indohya typhlops*, sp. nov.
- 7(6). With 4 eyes (Figs 54, 70) ..... 8
- With 2 eyes (Fig. 78) (Australia) ..... *Indohya beieri*, sp. nov.
- 8(5). Pedipalpal femur 0.41–0.425 mm in length; pedipalpal femur with granulations on basal half (Figs 51, 64) (Australia) ..... *Indohya panops*, sp. nov.
- Pedipalpal femur 0.32–0.33 mm in length; pedipalpal femur smooth (Fig. 66) (Australia) ..... *Indohya pusilla*, sp. nov.

#### Subfamily HYINAE Chamberlin

Hyinae Chamberlin. — Beier, 1932: 166.

#### Diagnosis

Fixed chelal finger heterodentate, and with teeth widely spaced. Venom apparatus present in both chelal fingers. With curved setae anterior to *ib* (very occasionally absent). Dorsal apodeme of male genitalia small.

#### Remarks

This subfamily is reinstated for the genus *Hya*.

Genus *Hya* Chamberlin

*Hya* Chamberlin, 1930: 41-2. —Harvey, 1991a: 314 (full synonymy).

Type species: *Hya heterodonta* Chamberlin, 1930 (junior synonym of *Ideobisium minutum* Tullgren, 1905), by original designation.

*Diagnosis*

As for subfamily.

*Remarks*

*Hya* is represented by two Asian species, which differ from all other hyids by the heterodentate teeth of the fixed chelal finger (Figs 6, 18).

*Included Species*

*Hya minuta* (Tullgren) and *H. chamberlini*, sp. nov.

*Hya minuta* (Tullgren)

(Figs 2, 4-17)

*Ideobisium minutum* Tullgren, 1905: 44-5, figs 4a-c.

*Hya heterodonta* Chamberlin, 1930: 42, figs 2kk, 3e. —Harvey, 1991a: 314 (in part) (full synonymy).  
Syn. nov.

*Hya minuta* (Tullgren). —Beier, 1932: 167, fig. 168; Harvey, 1991a: 314-5 (full synonymy); Harvey, 1992: figs 78-86.

Not *Hya minuta* (Tullgren). —Beier, 1973: 42; Beier, 1974: 1003; Murthy and Ananthakrishnan, 1977: 25; Harvey, 1991a: 314 (in part) (misidentifications, see *Hya chamberlini*, sp. nov.).

*Material Examined*

*Lectotype of Ideobisium minutum* (present designation). ♀, Depok [6°22'S., 106°45'E.], Java, Indonesia, detritus, March 1904, Kraepelin (ZMH; SP).

*Paralectotypes of Ideobisium minutum*. 1♂, 1♀, same data as lectotype (ZMH; SP); other paralectotypes, see Remarks.

*Holotype of Hya heterodonta*. ♂, Mt Makiling [=Mt Maquiling, 14°08'N., 121°12'E.], Luzon, Philippines, 1923-25, C. F. Baker (JCC, JC-550.04003; SL).

*Allotype of Hya heterodonta*. ♀, same data as holotype (JCC, JC-550.04002; SL).

*Other material examined*. **Indonesia:** *Java:* 4♂, 1♀, 1 tritonymph, [Batavia, now Jakarta, 6°08'S., 106°45'E.] (SMF, Roewer collection, 1953/35; SP); *Sulawesi:* 1♂, 1♀, Danau Moat via Kotamobagu, 0°44'N., 124°26'5"E., 1200 m, litter, 13.ix.1985, P. Greenslade (WAM; SP); 1♂, same data except 21.x.1985 (WAM; SL); 1♂, 3♀, Dumoga-Bone Natl Pk, 0°35'N., 123°52'E., 492 m, litter, 10.ix.1985, P. Greenslade (WAM; SP); 1♀, 30 km W. of Lolak, 0°54'N., 124°00'E., sea level, litter, 19.ix.1985, P. Greenslade (WAM; SL); *Sumatra:* 1♂, [Padang, 1°00'S., 100°21'E.] (SMF, Roewer collection, 1947/29; SP). **Malaysia:** *Sabah:* 1♂, 1 tritonymph, Lambin Natl Pk, S. of Miri, 50 m, *Dipterocarpus rectagulus* forest, 13.iv.1984, P. Strinati, C. Hug (MHNG; SP); 2♂, 2♀, 1 tritonymph, Sibuga Forest Reserve, nr Sandakan [5°52'N., 118°04'E.], rainforest berlesate, 9.vi.1968, R. W. Taylor (ANIC; SP); 1 tritonymph, 1 deutonymph, Lungmanis, 43 miles along Labuk Rd from Sandakan [5°52'N., 118°04'E.], rainforest berlesate, 13.vi.1968, R. W. Taylor (ANIC; SL); 1♂, Tawau [4°16'N., 117°54'E.], Quoin Hill, 750 ft, rainforest berlesate, 16-19.vi.1968, R. W. Taylor (ANIC; SP); *Sarawak:* 1♀, 1 tritonymph, Semengoh Forest Reserve, 11 miles SW. of Kuching [1°33'N., 110°20'E.], rainforest berlesate, 28-31.v.1968, R. W. Taylor (ANIC; SL); 3 tritonymphs, same data except 1-4.vi.1968 (ANIC; SP); 1♂, same data except 30.vi.1968 (ANIC; SL); 1 tritonymph, same data except 2-3.vii.1968 (ANIC; SP); 1♀, Mt Santubong, nr Kuching [5°52'N., 118°55'E.], rainforest berlesate, 5.vi.1968, R. W. Taylor (ANIC; SP). **Philippines:** *Leyte:* 3♂, 7♀, SW. Abuyong [10°44'N., 125°01'E.], 100-300 m, forest, 8.iii.1991, W. Schwaller *et al.* (SMNS; SP). **Singapore:** 2♂, 2♀, Bukit Timah Nature Reserve [c. 1°22'N., 103°48'E.], 15.xi.1966, Murthy (NHMW; SP); 1♀, same data except 20-21.i.[1986], J. A. Murphy (MJC; SP).

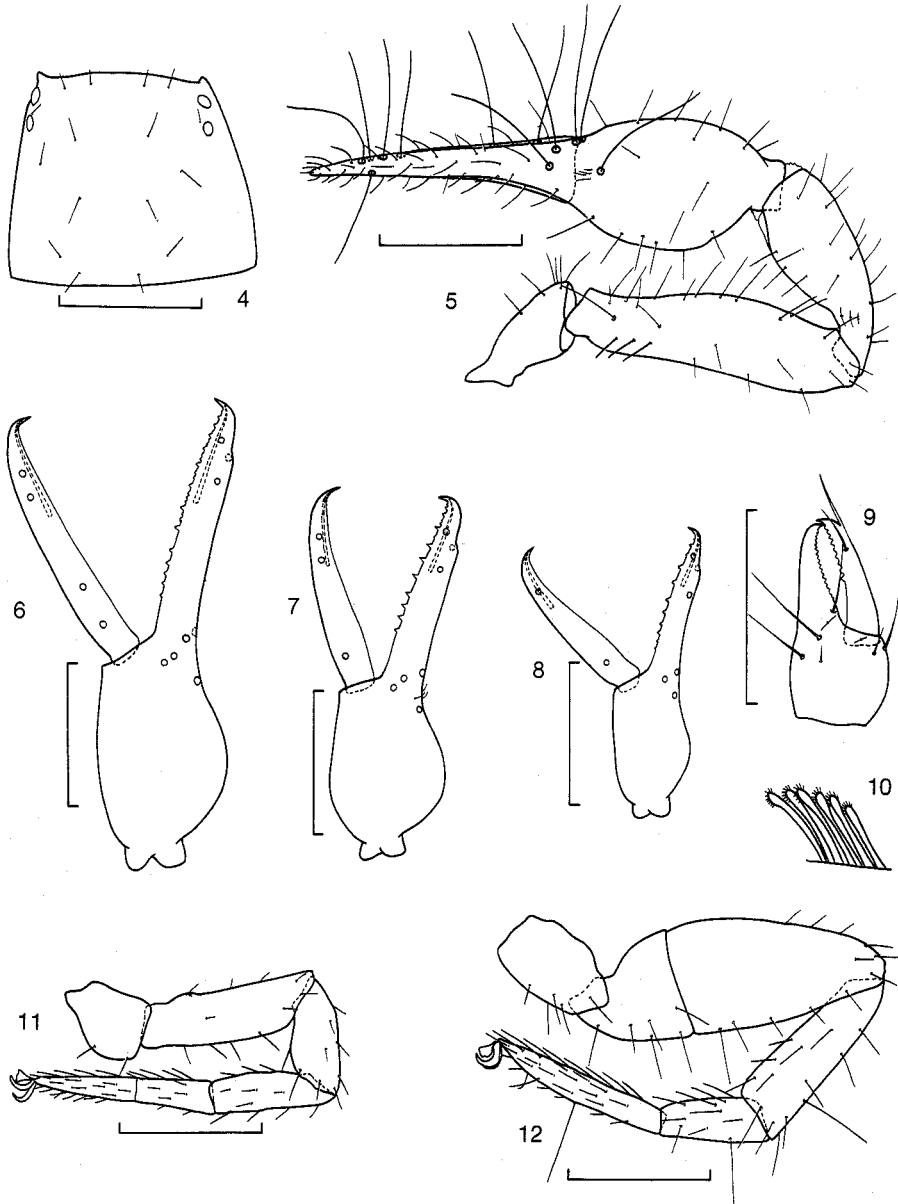


*Diagnosis*

Chela (with pedicel) 0·605–0·80 (♂), 0·68–0·85 (♀) mm in length. 4–5 setae anterior to *ib*.

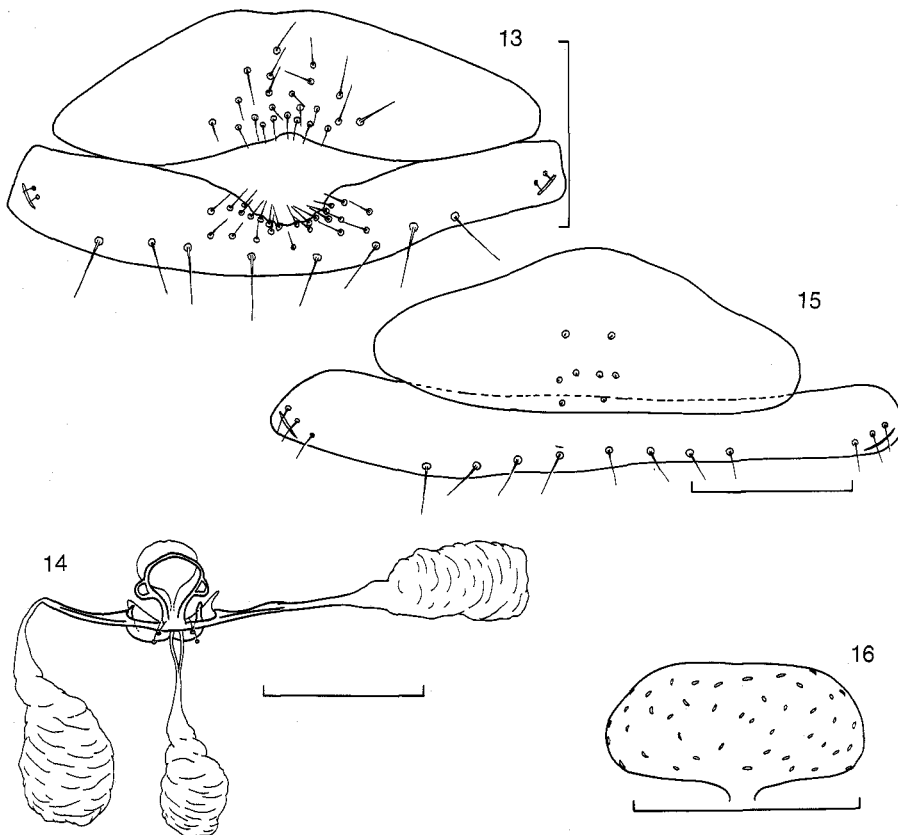
*Description**Adult*

Colour light yellow-brown. Setae straight and acicular. Pedipalp (Fig. 5): trochanter 2·20–2·50 (♂), 2·00–2·33 (♀), femur 3·75–4·42 (♂), 3·46–4·00 (♀), patella 2·67–2·85 (♂), 2·50–2·73 (♀), chela (with pedicel) 3·32–3·83 (♂), 3·12–3·38 (♀), chela (without



**Figs 4–12.** *Hya minuta* (Tullgren), from Semengoh, Sarawak, unless otherwise stated: 4, carapace, male; 5, right pedipalp, dorsal, male; 6, left chela, lateral, male; 7, left chela, lateral, tritonymph; 8, left chela, lateral, deutonymph, Sandakan, Sabah; 9, right chelicera, male; 10, flagellum, female; 11, left leg I, male; 12, left leg IV, male. Scale lines, 0·2 mm.

pedicel) 3·18–3·61 ( $\sigma$ ), 2·96–3·19 ( $\varphi$ ), hand 1·27–1·44 ( $\sigma$ ), 1·23–1·42 ( $\varphi$ ) $\times$  longer than broad, movable finger 1·47–1·50 ( $\sigma$ ), 1·29–1·58 ( $\varphi$ ) $\times$  longer than hand. Fixed chelal finger and hand with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 6). Venom apparatus present in both chelal fingers, terminating in nodus ramosus proximal to *est* in fixed finger, and proximal to *st* in movable finger. 4–5 small curved setae anterior to *ib*; femur with 2 sub-basal tactile setae, and 3 sub-basal posterior setae. Chelal teeth: fixed finger with 16–18 ( $\sigma$ ), 15–18 ( $\varphi$ ) widely spaced teeth, plus 9–10 ( $\sigma$ ), 7–12 ( $\varphi$ ) small intercalary teeth; movable finger without teeth or with several extremely low teeth. Chelicera (Fig. 9): with 6 setae on hand; movable finger with 1 seta; galea very slender; fixed finger with 17–18 ( $\sigma$ ), 14–20 ( $\varphi$ ) teeth; movable finger with 7–8 ( $\sigma$ ), 6–10 ( $\varphi$ ) teeth; flagellum with 6–7 distally serrate blades (Fig. 10). Carapace (Fig. 4) 0·88–0·89 ( $\sigma$ ), 0·97–1·06 ( $\varphi$ ) $\times$  longer than broad; with 4 corneate eyes; with 16 setae arranged 4: 4: 2: 2: 2: 2. Tergites and sternites undivided, except for sternite IV which is divided. Tergal chaetotaxy:  $\sigma$ , 4: 6: 6–8: 7–8: 8: 8–9: 8–10: 9: 6–8: 7–8: 4: 2;  $\varphi$ , 4: 6: 6–7: 8–9: 9: 8–9: 10: 8–9: 9: 8–9: 4–6: 2. Sternal chaetotaxy:  $\sigma$ , 17–23: (2–3)24–37[4](2–3): (3)8(3): 13–14: 13–15: 14–15: 12–15: 12–14: 12: 4–6: 2;  $\varphi$ , 6–8: (2–3)8(2–3): (2–3)8–10(2–3): 13–15: 13–15: 15–16: 13–15: 13–15: 13–14: 5: 2. Coxal chaetotaxy:  $\sigma$ ,  $\varphi$ , 5: 5: 5–6: 6. Genital opercula as in Figs 13, 15. Male genitalia as in Fig. 14. Female genitalia (Fig. 16) simple. Legs (Figs 11, 12): femur + patella IV 2·59–2·71 ( $\sigma$ ), 2·63 ( $\varphi$ ) $\times$  longer than broad.



**Figs 13–16.** *Hya minuta* (Tullgren), from Semengoh, Sarawak, unless otherwise stated: 13, male genital opercula; 14, male genitalia, ventral; 15, female genital opercula; 16, female genitalia, ventral. Scale lines, 0·1 mm.

*Dimensions* (mm). ♂ (♀). Body length 1.04–1.26 (1.01–1.38). Pedipalps: trochanter 0.20–0.24/0.08–0.11 (0.20–0.25/0.09–0.11), femur 0.41–0.53/0.10–0.12 (0.43–0.51/0.11–0.13), patella 0.28–0.37/0.10–0.13 (0.30–0.38/0.11–0.14), chela (with pedicel) 0.605–0.80/0.17–0.23 (0.68–0.81/0.21–0.25), chela (without pedicel) 0.585–0.77 (0.65–0.78), hand length 0.26–0.32 (0.26–0.34), movable finger length 0.39–0.47 (0.41–0.45). Chelicera 0.21–0.28/0.11–0.15 (0.24–0.29/0.12–0.16), movable finger length 0.13–0.17 (0.16–0.18). Carapace 0.31–0.39 (0.35–0.36/0.34–0.36). Anterior eye diameter 0.03–0.04 (0.04), posterior eye diameter 0.03 (0.03). Leg I: trochanter 0.11–0.13/0.08–0.09 (0.13/0.10), femur 0.22–0.25/0.07 (0.24–0.25/0.08), patella 0.14–0.16/0.06–0.07 (0.15–0.16/0.07), tibia 0.14–0.18/0.04–0.05 (0.17–0.18/0.05), metatarsus 0.09–0.10/0.04 (0.10–0.11/0.04), tarsus 0.13–0.18/0.03 (0.14–0.16/0.03). Leg IV: trochanter 0.14–0.15/0.09–0.12 (0.17/0.11–0.12), femur + patella 0.38–0.44/0.14–0.17 (0.42/0.16), tibia 0.24–0.28/0.07–0.08 (0.28–0.29/0.08), metatarsus 0.14–0.17/0.05–0.06 (0.15–0.16/0.05), tarsus 0.22–0.26/0.04 (0.24–0.25/0.04).

#### *Tritonymph*

Pedipalps: trochanter 2.25, femur 3.89–4.33, patella 2.60–2.67, chela (with pedicel) 3.38–3.75, chela (without pedicel) 3.19–3.50, hand 1.44 × longer than broad. Fixed chelal finger with 7 trichobothria, movable chelal finger with 3 trichobothria (Fig. 7); *isb* and *sb* absent. 3 small curved setae anterior to *ib*. Chelal teeth: fixed finger with 12–13 teeth, plus 3–9 intercalary teeth; movable finger without teeth. Chelicera with 6 setae on hand; 1 on movable finger; galea very slender. Carapace 0.91 × longer than broad; 4 eyes present. Sternite II without setae. Legs as in adult.

*Dimensions* (mm). Body length 1.05–1.10. Pedipalps: trochanter 0.18/0.08, femur 0.35–0.39/0.09, patella 0.24–0.26/0.09–0.10, chela (with pedicel) 0.54–0.60/0.16, chela (without pedicel) 0.51–0.56, hand length 0.23, movable finger length 0.31–0.34. Chelicera 0.21/0.10–0.11, movable finger length 0.13. Carapace 0.30/0.33.

#### *Deutonymph*

Pedipalps: trochanter 2.16, femur 4.50, patella 2.43, chela (with pedicel) 3.73, chela (without pedicel) 3.45, hand 1.45 × longer than broad. Fixed chelal finger with 6 trichobothria, movable chelal finger with 2 trichobothria (Fig. 8); *isb*, *esb*, *sb* and *st* absent. Without curved setae anterior to *ib*. Chelal teeth: fixed finger with 10 teeth, plus 3 intercalary teeth; movable finger with 0 teeth. Chelicera with 5 setae on hand; 1 on movable finger; galea very slender. Carapace 0.81 × longer than broad; 4 eyes present. Sternite II without setae. Legs as in adult.

*Dimensions* (mm). Body length 0.77. Pedipalps: trochanter 0.13/0.06, femur 0.27/0.06, patella 0.17/0.07, chela (with pedicel) 0.41/0.11, chela (without pedicel) 0.38, hand length 0.16, movable finger length 0.24. Chelicera 0.15/0.08, movable finger length 0.10. Carapace 0.21/0.26.

#### *Remarks*

The type material of *Ideobisium minutum* consists of three species. One vial contains three specimens (1♂, 2♀) from Depok consistent with Tullgren's (1905) description and figures. One of these females was figured by Beier (1932, fig. 168) and has been selected as the lectotype. Two other vials from Buitenzorg (now Bogor, 6°34'S., 106°45'E.) contain species of two different families. One contains a female of *Tyrannochthonius krakatau* Harvey (Chthoniidae); the other contains a female of *T. krakatau* and a juvenile atemnid. These specimens extend the known distribution of *T. krakatau* from the Krakatau Islands and Pelau Peucang, Java (Harvey 1988b), further east to Bogor. There appears to be no type material of *Hya heterodonta* in the United States National Museum, Washington D.C. (J. A. Coddington, personal communication), contrary to the statement by Chamberlin (1930).

The paired sacs of the female genitalia figured by Chamberlin (1946, fig. 23) appear to be artifacts.

The synonymy of *Ideobisium minutum* and *Hya heterodonta* is supported by comparison of all the material at hand. The differences between the two species cited by Beier (1932) and Chamberlin (1946) are either not evident or of so little importance that they are considered invalid.

*Hya minuta* is widespread throughout south-east Asia and is known from Borneo (Sabah and Sarawak), Java, Sulawesi, Sumatra, the Philippines and Singapore (Fig. 2). The records from Sri Lanka (Beier 1973, 1974) are treated under *H. chamberlini*.

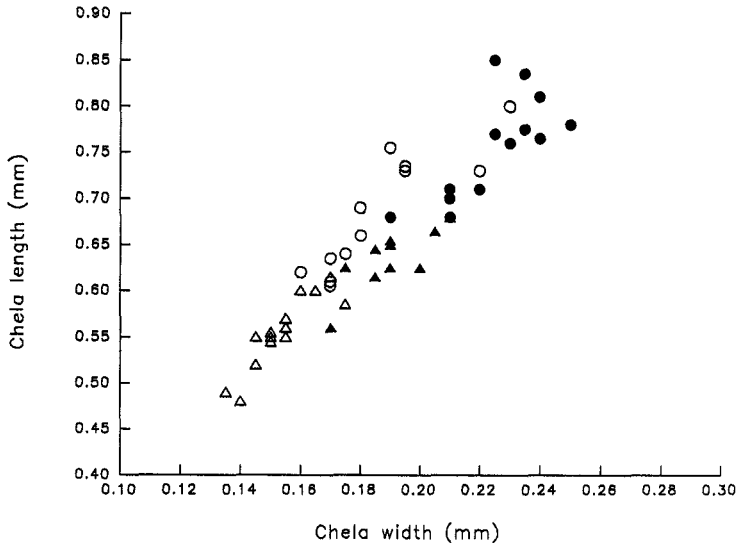


Fig. 17. *Hya* spp., graph of chela (with pedicel) length v. width. *Hya minuta* Chamberlin (circles), *H. chamberlini*, sp. nov. (triangles). Open symbols, males; closed symbols, females.

*Hya chamberlini*, sp. nov.

(Figs 2, 17–27)

*Hya minuta* (Tullgren).—Beier, 1973: 42; Beier, 1974: 1003; Murthy and Ananthakrishnan, 1977: 25; Harvey, 1991a: 314 (in part) (misidentifications).

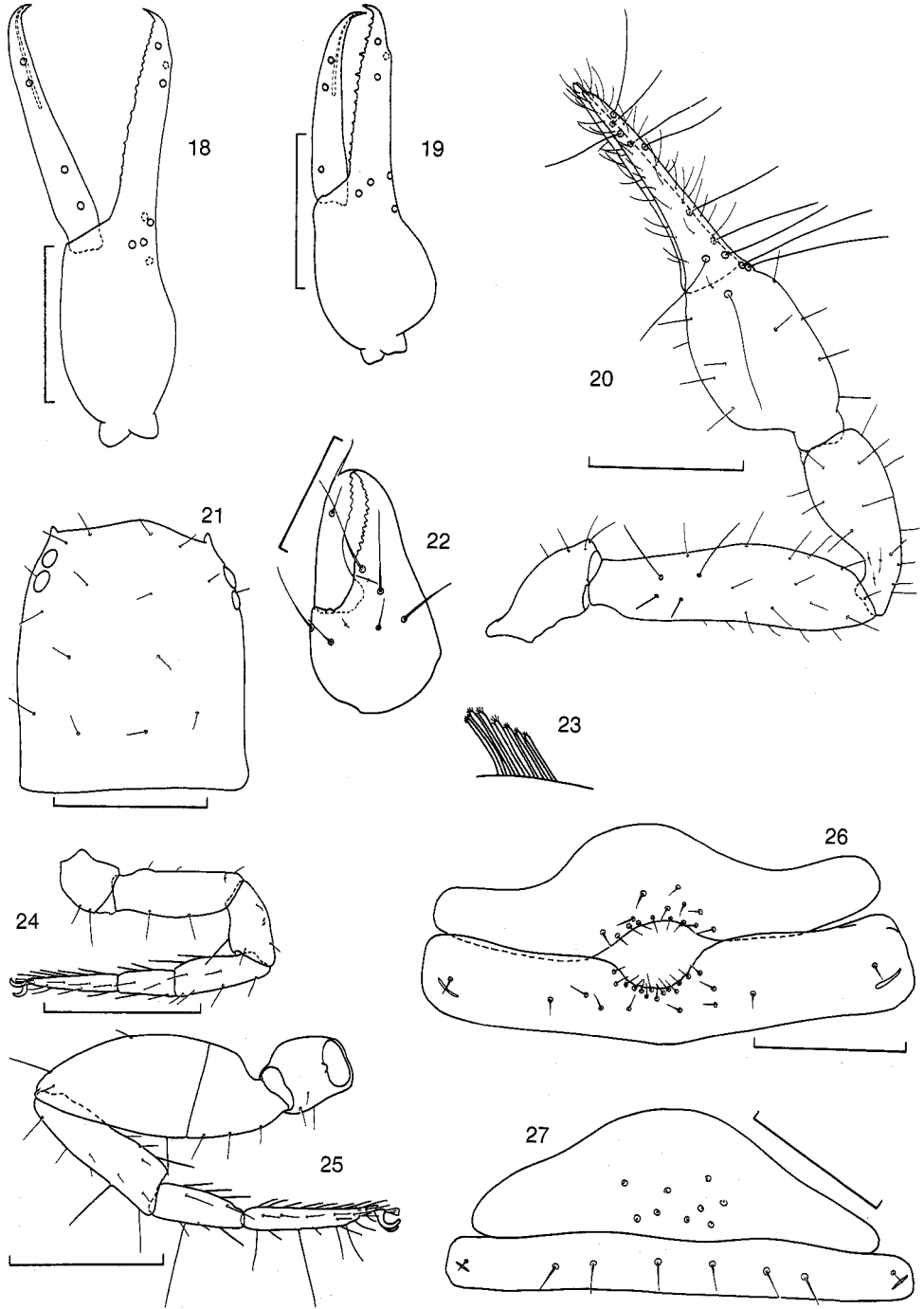
*Material Examined*

*Holotype*. ♂, Dambulla [7°51'N., 80°40'E.], Central Province, Sri Lanka, 17.i.1970, C. Besuchet, I. Löbl (MHNG; SP).

*Paratypes*. **Sri Lanka**: *Central Province*: 4♂, 1♀, same data as holotype (MHNG; SP); 1♂, 2♀, same data as holotype (NHMW; SP); 1♂, same data as holotype (WAM 91/1595; SP); 1♂, 1♀, Hasalaka nr Weragamtota [7°20'N., 80°59'E.], 11.ii.1970, C. Besuchet, I. Löbl (MHNG; SP); 1♂, Horton Plains, 11 miles SSE. of Nuwara-Eliya [c. 6°52'N., 80°52'E.], 15.ii.1970, C. Besuchet, I. Löbl (MHNG; SP); *Eastern Province*: 1♂, 1♀, Gal Oya [8°08'N., 80°50'E.], 14 miles E. of Bibile, 8.iii.1962, Brinck, Andersson, Cederholm (NHMW; SP); 1♂, Kantalei [8°22'N., 81°00'E.], 2.ii.1970, C. Besuchet, I. Löbl (MHNG; SP); *North Central Province*: 1♀, Ambagaswewa, 3.ii.1970, C. Besuchet, I. Löbl (MHNG; SP); 2♂, 2♀, Alut Oya [8°13'N., 80°52'E.], 3.ii.1970, C. Besuchet, I. Löbl (MHNG; SP); 1♀, Medawachchiya [8°30'N., 80°30'E.], 6.ii.1970, C. Besuchet, I. Löbl (MHNG; SP); 1♀, Mihintale [8°20'N., 80°30'E.], 7.ii.1970, C. Besuchet, I. Löbl (MHNG; SP); *Sabaragamuwa Province*: 1♀, Kegalla [7°15'N., 80°21'E.], 14.i.1970, C. Besuchet, I. Löbl (MHNG; SP); *Western Province*: 2♂, Alawala [c. 7°10'N., 80°07'E.], 26 miles NE. of Colombo, 6.iii.1962, Brinck, Andersson, Cederholm (NHMW; SP); 2 tritonymphs, Gampaha Botanical Gardens [7°06'N., 80°00'E.], 5.xii.1972, C. Besuchet, I. Löbl (MHNG; SP).

*Diagnosis*

Chela (with pedicel) 0·48–0·615 (♂), 0·56–0·67 (♀) mm in length. 1 seta anterior to *ib* (very occasionally absent).



**Figs 18–27.** *Hya chamberlini*, sp. nov, holotype male unless otherwise stated: 18, left chela, lateral; 19, left chela, lateral, paratype tritonymph from Gampaha; 20, right pedipalp, dorsal; 21, carapace; 22, left chelicera; 23, flagellum; 24, left leg I; 25, left leg IV; 26, male genital opercula; 27, female genital opercula. Scale lines, 0·2 mm (Figs 18–21, 24, 25), 0·1 mm (Figs 23, 26, 27).

*Description**Adult*

Colour light yellow-brown. Setae straight and acicular. Pedipalp (Fig. 20): trochanter 2.07–2.31 (♂), 2.19–2.38 (♀), femur 3.39–3.79 (♂), 3.50–3.81 (♀), patella 2.44–2.68 (♂), 2.53–2.67 (♀), chela (with pedicel) 3.34–3.75 (♂), 3.24–3.42 (♀), chela (without pedicel) 3.20–3.45 (♂), 3.08–3.24 (♀), hand 1.31–1.56 (♂), 1.29–1.42 (♀) × longer than broad, movable finger 1.31–1.46 (♂), 1.19–1.36 (♀) × longer than hand. Fixed chelal finger and hand with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 18). Venom apparatus present in both chelal fingers, terminating in nodus ramosus proximal to *est* in fixed finger, and proximal to *st* in movable finger. 1 small curved seta anterior to *ib* (very occasionally absent); femur with 2 sub-basal tactile setae, and 2–3 sub-basal posterior setae. Chelal teeth: fixed finger with 13 (♂), 14 (♀) widely spaced teeth, plus 6 (♂), 7 (♀) very small intercalary teeth; movable finger without teeth or with several extremely low teeth. Chelicera (Fig. 22): with 6 setae on hand; movable finger with 1 seta; galea very slender; fixed finger with 16–19 (♂), 14–16 (♀) teeth; movable finger with 6 (♂), 6–7 (♀) teeth; flagellum with 6 distally serrate blades (Fig. 23). Carapace (Fig. 21) 0.84–1.06 (♂), 0.86–1.12 (♀) × longer than broad; with 4 corneate eyes; with 16 setae arranged 4: 4: 2: 2: 2. Tergites and sternites undivided, except for sternite IV which is divided. Tergal chaetotaxy: ♂, 4: 6: 6–8: 6–8: 8–9: 8: 8: 8–9: 9: 7–9: 5–7: 2; ♀, 4: 6–8: 7–8: 8: 8–9: 8–9: 8–9: 9–10: 8–9: 7–9: 5–7: 2. Sternal chaetotaxy: ♂, 13–14: (2–3)21–25 [4](2–3): (2–3)6–12(2–3): 10–14: 11–13: 11–13: 11–13: 11–12: 9–11: 5–7: 2; ♀, 7–10: (2)6–8(2): (2)7–8(2): 11–12: 12–14: 13–15: 13–15: 11–13: 10–11: 7–8: 2. Coxal chaetotaxy: ♂, ♀, 5: 5: 4–5: 5–7. Genital opercula as in Figs 26, 27. Male and female genitalia virtually identical to *H. minuta*. Legs (Figs 24, 25): femur + patella IV 2.46 (♂), 2.56 (♀) × longer than broad.

*Dimensions* (mm). ♂ (♀). Body length 0.94–1.14 (1.22–1.53). Pedipalps: trochanter 0.155–0.19/0.075–0.085 (0.175–0.22/0.08–0.095), femur 0.305–0.395/0.09–0.11 (0.35–0.43/0.10–0.115), patella 0.22–0.28/0.085–0.11 (0.24–0.29/0.095–0.11), chela (with pedicel) 0.48–0.615/0.14–0.175 (0.56–0.68/0.17–0.21), chela (without pedicel) 0.46–0.58 (0.535–0.65), hand length 0.20–0.255 (0.22–0.28), movable finger length 0.275–0.345 (0.305–0.385). Chelicera 0.175–0.22/0.09–0.11 (0.21–0.255/0.105–0.125), movable finger length 0.115–0.15 (0.135–0.165). Carapace 0.285–0.345/0.27–0.36 (0.33–0.385/0.33–0.45). Anterior eye diameter 0.025–0.03 (0.025–0.03), posterior eye diameter 0.02–0.025 (0.025–0.03). Leg I: trochanter 0.09–0.095/0.07–0.08 (0.105/0.09), femur 0.135–0.185/0.055–0.065 (0.185/0.07), patella 0.10–0.13/0.05–0.055 (0.13/0.055), tibia 0.105–0.135/0.04–0.045 (0.135/0.045), metatarsus 0.06–0.085/0.035–0.04 (0.075/0.035), tarsus 0.10–0.14/0.025–0.03 (0.12/0.025). Leg IV: trochanter 0.135/0.09 (0.145/0.095), femur + patella 0.32/0.13 (0.345/0.135), tibia 0.21/0.065 (0.23/0.065), metatarsus 0.125/0.045 (0.125/0.05), tarsus 0.16–0.20/0.03 (0.17/0.03).

*Tritonymph*

Pedipalps: trochanter 2.21, femur 3.88, patella 2.44, chela (with pedicel) 3.25, chela (without pedicel) 3.14, hand 1.36 × longer than broad. Fixed chelal finger with 7 trichobothria, movable chelal finger with 3 trichobothria (Fig. 19); *isb* and *sb* absent. 1 small curved seta anterior to *ib*. Chelal teeth: fixed finger with 13 teeth, plus 6 very low intercalary teeth; movable finger without teeth. Chelicera with 6 setae on hand; 1 on movable finger; galea very slender. Carapace 1.10 × longer than broad; 4 eyes present. Sternite II without setae. Legs much as in adult.

*Dimensions* (mm). Body length 0.94. Pedipalps: trochanter 0.155/0.07, femur 0.31/0.08, patella 0.195/0.08, chela (with pedicel) 0.455/0.14, chela (without pedicel) 0.44, hand length 0.19, movable finger length 0.25. Chelicera 0.18/0.095, movable finger length 0.11. Carapace 0.28/0.255.

*Remarks*

The specimens from Sri Lanka identified as *Hya minuta* by Beier (1973, 1974) are generally smaller than those from south-east Asia (Fig. 17), and are here regarded as a separate species. Amongst these specimens, those from Alut Oya are the smallest, with a chela (with pedicel) length of 0.43–0.44 (♂), 0.56 (♀) mm.

*Etymology*

This species is named for the late Dr Joseph C. Chamberlin, who erected the genus *Hya* and the family Hyidae.

Subfamily **INDOHYINAE**, subfam. nov.

*Diagnosis*

Fixed chelal finger homodontate and with contiguous teeth. Venom apparatus present only in movable chelal finger. Without small curved setae anterior to *ib*.

*Remarks*

The lack of a venom apparatus in the fixed chelal finger is the sole apomorphy for the Indohyinae; this character state is found in two other neobisoid families: Bochicidae (*Vachonium* and *Paravachonium* only) and Gymnobisiidae. These families lack the apomorphies of the Hyidae, and the venom apparatus appears to have been lost independently in the Indohyinae.

Genus *Indohya* Beier

*Indohya* Beier, 1974: 1003.—Harvey, 1991a: 315 (full synonymy).

Type species: *Indohya besucheti* Beier, 1974, by original designation.

*Diagnosis*

Movable chelal finger with teeth markedly reduced. Carapace with 14–16 setae. Flagellum with 5–6 blades. Trichobothrium *b* equidistant between basal end of movable finger and *sb*. Dorsal apodeme of male genitalia large, wing-like.

*Remarks*

The specimen of *Indohya* sp. reported by Heurtault (1986) from Madagascar was examined by the author in 1989 during a visit to the Muséum National d'Histoire Naturelle, Paris (courtesy of Dr J. Heurtault). The species will be described by Dr Heurtault.

*Included Species*

*Indohya beieri*, sp. nov., *I. besucheti* Beier, *I. caecata* Beier, *I. panops*, sp. nov., *I. pusilla*, sp. nov. and *I. typhlops*, sp. nov.

*Indohya besucheti* Beier

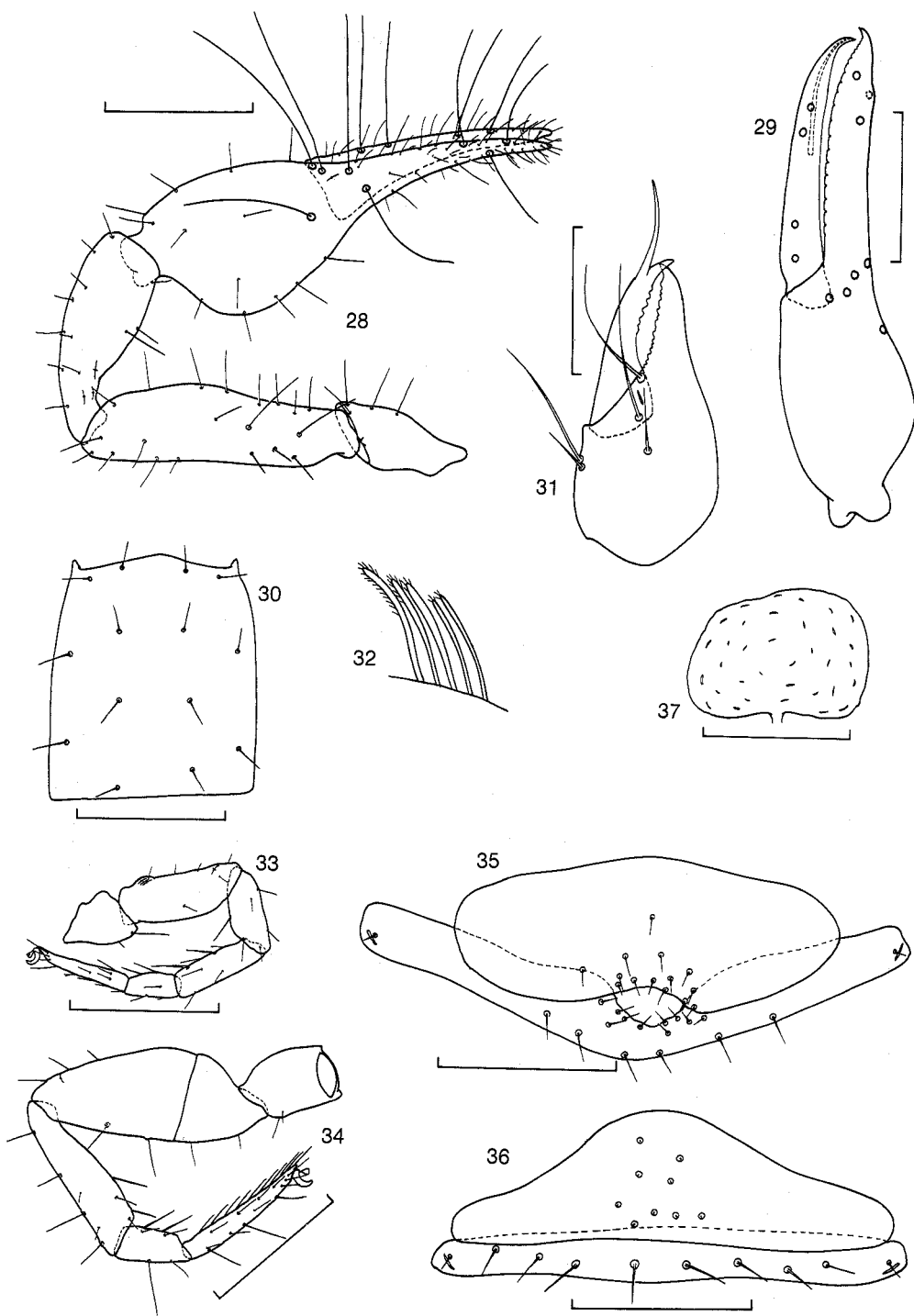
(Figs 2, 28–37)

*Indohya besucheti* Beier, 1974: 1003–4, fig. 3.—Harvey, 1991a: 315 (full synonymy).

*Material Examined*

*Holotype*. ♀, Suruli Falls, Varushanad Hills, Tamil Nadu (as Madras), India, forest litter, 550 m, 8.xi.1972, C. Besuchet, I. Löbl (MHNG; SP).

*Paratypes*. **India: Tamil Nadu:** 2♀, same data as holotype (MHNG; SP); 2♀, same data as holotype (NHMW; SP); **Kerala:** 1♂, Cardamom Hills between Pambanar and Peermade [c. 9°45'N., 77°00'E.], 950 m, forest litter, 9.xi.1972, C. Besuchet, I. Löbl (MHNG; SP).



**Figs 28–37.** *Indohya besucheti* Beier, holotype female unless otherwise stated: 28, left pedipalp, dorsal; 29, left chela, lateral, paratype male; 30, carapace; 31, left chelicera; 32, flagellum; 33, left leg I; 34, left leg IV; 35, male genital opercula, male paratype; 36, female genital opercula; 37, female genitalia, ventral. Scale lines, 0.2 mm (Figs 28–30, 33, 34), 0.1 mm (Figs 31, 35, 39), 0.05 mm (Fig. 37).



*Diagnosis*

Eyes absent. Cheliceral hand with 5 setae. Carapace with 14 setae. Pedipalpal femur 0.39 (♂), 0.36 (♀) mm in length. Fixed chelal finger with very flat 21 (♂), 20 (♀) teeth.

*Description**Adult*

Colour light yellow-brown. Setae long, straight and acicular. Pedipalp (Fig. 28): trochanter 2.35 (♂), 2.38–2.57 (♀), femur 3.71 (♂), 3.60–4.00 (♀), patella 2.48 (♂), 2.67–2.84 (♀), chela (with pedicel) 3.48 (♂), 3.06–3.14 (♀), chela (without pedicel) 3.30 (♂), 2.89–2.94 (♀), hand 1.58 (♂), 1.32–1.33 (♀) × longer than broad, movable finger 1.19 (♂), 1.20–1.21 (♀) × longer than hand. Fixed chelal finger and hand with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 29). Venom apparatus present only in movable chelal finger, terminating in nodus ramosus proximal to *st*. Femur with 2 sub-basal tactile setae, and 2–3 sub-basal posterior setae. Chelal teeth: fixed finger with 21 (♂), 20 (♀) very flat teeth; movable finger without teeth. Chelicera (Fig. 31): with 5 setae on hand; movable finger with 1 seta; galea very slender; fixed finger with 8–11 teeth; movable finger with 5–6 teeth; flagellum with 5 distally serrate blades (Fig. 32). Carapace (Fig. 30) 1.23 (♂), 1.11–1.18 (♀) × longer than broad; lateral margins slightly convex; without eyes or eye spots; with 14 setae arranged 4: 4: 2: 2: 2, ocular setae absent. Tergites and sternites undivided, except for sternite IV which is incompletely divided. Tergal chaetotaxy: ♂, 4: 6: 6: 7: 7: 8: 8: 8: 7: 7: 5: 2; ♀, 4: 4–6: 6: 6–7: 8: 8: 8: 8: 7–8: 7–8: 4–5: 2. Sternal chaetotaxy: ♂, 14: (1)16(1): (1)6[4](1): 8: 8: 8: 8: 10: 8: 6: 2; ♀, 5–9: (1)7–8(1): (1)6–8(1): 8–10: 9–10: 10–11: 10: 9–10: 9–10: 5–8: 2. Coxal chaetotaxy: ♂, 3: 4: 5: 6; ♀, 3–4: 3–4: 4–5: 5–6. Genital opercula as in Figs 35, 36. Male genitalia virtually identical to other *Indohya* spp. Female genitalia (Fig. 37) simple. Legs (Figs 33, 34): femur + patella IV 2.52 (♂), 2.58 (♀) × longer than broad.

*Dimensions* (mm). ♂ (♀). Body length 0.78 (0.93–1.08). Pedipalps: trochanter 0.20/0.085 (0.18–0.19/0.07–0.08), femur 0.39/0.105 (0.36/0.09–0.10), patella 0.285/0.115 (0.265–0.28/0.095–0.105), chela (with pedicel) 0.575/0.165 (0.55–0.59/0.0175–0.19), chela (without pedicel) 0.545 (0.515–0.55), hand length 0.26 (0.24–0.25), movable finger length 0.31 (0.29–0.30). Chelicera 0.19/0.10 (0.185–0.20/0.09–0.095), movable finger length 0.12 (0.115–0.12). Carapace 0.345/0.28 (0.30–0.31/0.255–0.28). Leg I: trochanter 0.095/0.075 (0.095/0.07), femur 0.175/0.065 (0.16/0.06), patella 0.125/0.05 (0.115/0.05), tibia 0.14/0.04 (0.135/0.04), metatarsus 0.085/0.035 (0.08/0.03), tarsus 0.14/0.03 (0.13/0.03). Leg IV: trochanter 0.13/0.095 (0.135/0.075), femur + patella 0.34/0.135 (0.31/0.12), tibia 0.245/0.065 (0.23/0.055), metatarsus 0.11/0.045 (0.145/0.045), tarsus 0.195/0.03 (0.175/0.03).

*Remarks*

*Indohya besucheti* appears to be most similar to *I. caecata* due to the presence of only 14 carapacial setae. They differ in a number of characters, including the number of cheliceral setae and the shape of the chelal teeth.

Although Beier (1974) stated that this species possesses two small eyes, I could detect no trace of eyes or eye spots on the type specimens. The male from Cardamom Hills is slightly larger than the females from the type locality, yet is still considered conspecific.

*Indohya caecata* Beier

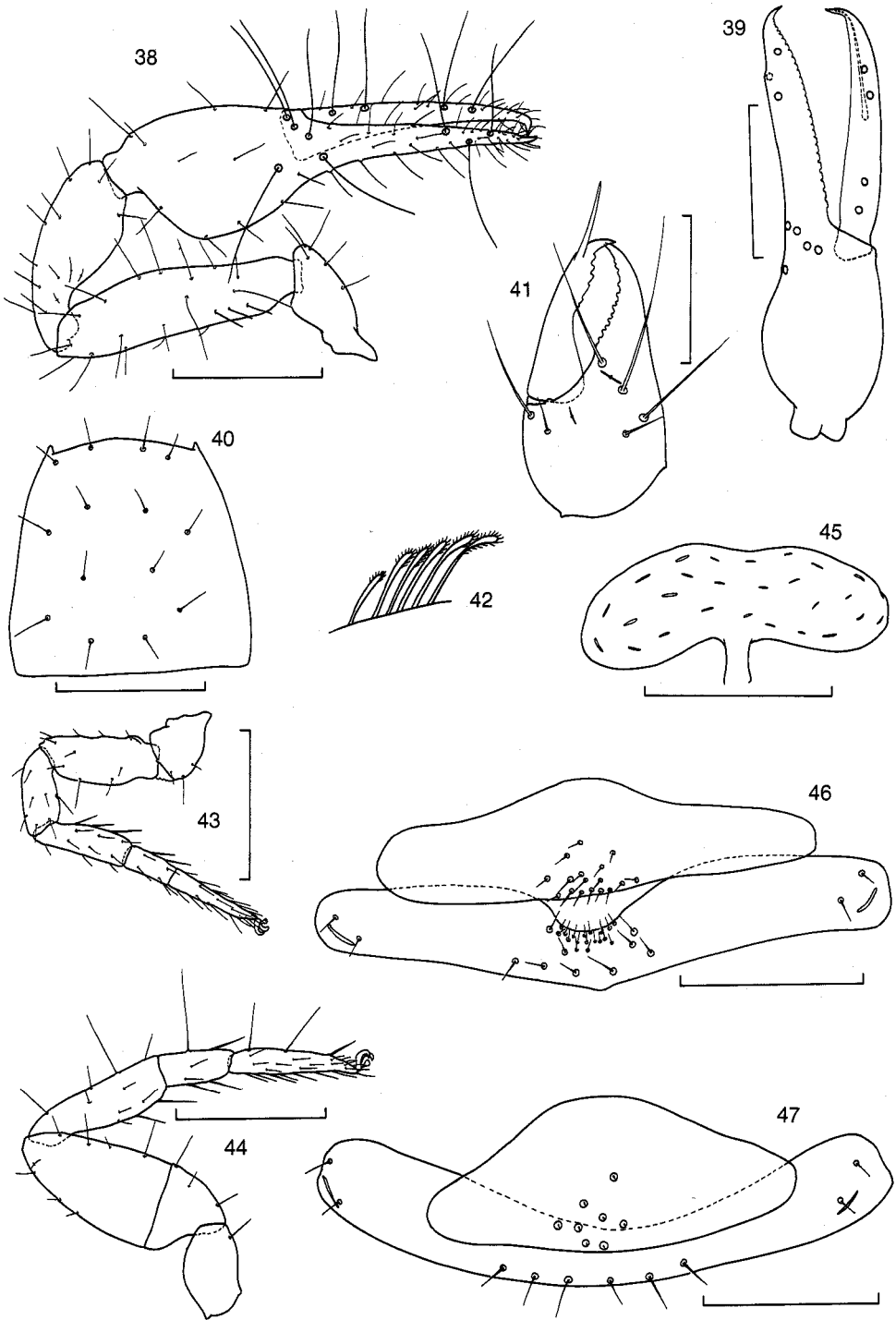
(Figs 2, 38–47)

*Indohya caecata* Beier, 1974: 1004–6, fig. 4. – Harvey, 1991a: 315 (full synonymy).

*Material Examined*

*Holotype*. ♂, Kaikatty, Nelliampathi Hills, Kerala, India, 900 m, forest litter, 30.xi.1972, C. Besuchet, I. Löbl (MHNG; SP).

*Paratypes*. **India: Kerala:** 5♂, 4♀, same data as holotype (MHNG; SP); 1♂, 1♀, same data as holotype (NHMW; SP).



**Figs 38–47.** *Indohya caecata* Beier, holotype male, unless otherwise stated: 38, left pedipalp, dorsal; 39, right chela, lateral; 40, carapace; 41, left chelicera; 42, flagellum; 43, left leg I; 44, left leg IV; 45, female genitalia, ventral, female paratype; 46, male genital opercula; 47, female genital opercula, female paratype. Scale lines, 0.2 mm (Figs 38–40, 43, 44), 0.1 mm (Figs 41, 46, 47), 0.05 mm (Fig. 45).

*Diagnosis*

Eyes absent. Cheliceral hand with 6 setae. Carapace with 14 setae. Pedipalpal femur 0.32–0.34 (♂), 0.37–0.38 (♀) mm in length. Fixed chelal finger with 29 flat teeth.

*Description**Adult*

Colour light yellow-brown. Setae long, straight and acicular. Pedipalp (Fig. 38): trochanter 2.19–2.47 (♂), 2.35–2.44 (♀), femur 3.53–3.94 (♂), 3.33–3.80 (♀), patella 2.37–2.63 (♂), 2.38–2.48 (♀), chela (with pedicel) 3.35–3.59 (♂), 3.13–3.38 (♀), chela (without pedicel) 3.19–3.38 (♂), 2.97–3.24 (♀), hand 1.35–1.47 (♂), 1.28–1.38 (♀) × longer than broad, movable finger 1.32–1.35 (♂), 1.19–1.31 (♀) × longer than hand. Fixed chelal finger and hand with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 39). Venom apparatus present only in movable chelal finger, terminating in nodus ramosus proximal to *st*. Femur with 2 sub-basal tactile setae, and 3 sub-basal posterior setae. Chelal teeth: fixed finger with 29 flat teeth; movable finger without teeth. Chelicera (Fig. 41): with 6 setae on hand; movable finger with 1 seta; galea very slender; fixed finger with 11–12 teeth; movable finger with 6–7 teeth; flagellum with 6 distally serrate blades (Fig. 42). Carapace (Fig. 40) 0.97–1.10 (♂), 0.84–0.91 (♀) × longer than broad; lateral margins slightly convex; without eyes or eyespots; with 14 setae arranged 4: 2: 2, ocular setae absent. Tergites and sternites undivided, except for sternite IV which is incompletely divided. Tergal chaetotaxy: ♂, 4: 6: 6–8: 6–8: 8: 8–9: 9: 8–9: 8–9: 7–9: 5–7: 2; ♀, 4: 6: 6–8: 7–8: 7–8: 8–10: 8–9: 9: 9: 7: 6: 2. Sternal chaetotaxy: ♂, 15–17: (2)19–21(2): (3)6[4](3): 9–10: 9–10: 10–12: 12–13: 11–12: 11–12: 7–8: 2; ♀, 8: (2)6(2): (2–3)6(2–3): 8–10: 11–12: 11–13: 12–13: 12–13: 10–12: 6–7: 2. Coxal chaetotaxy: ♂, 3–4: 4–5: 5: 5–6; ♀, 3–4: 4–5: 5: 5. Genital opercula as in Figs 46, 47. Male genitalia virtually identical to other *Indohya* spp. Female genitalia (Fig. 45) simple. Legs (Figs 43, 44): femur + patella IV 2.52 (♂), 1.83 (♀) × longer than broad.

*Dimensions* (mm). ♂ (♀). Body length 1.00–1.06 (0.90–1.18). Pedipalps: trochanter 0.175–0.185/0.075–0.08 (0.19–0.20/0.08–0.085), femur 0.32–0.355/0.09–0.095 (0.35–0.38/0.10–0.105), patella 0.225–0.25/0.095–0.10 (0.25–0.265/0.105–0.11), chela (with pedicel) 0.54–0.575/0.16–0.17 (0.61–0.63/0.185–0.20), chela (without pedicel) 0.51–0.545 (0.58–0.605), hand length 0.22–0.235 (0.25–0.27), movable finger length 0.29–0.31 (0.32–0.335). Chelicera 0.18–0.185/0.09–0.10 (0.205–0.22/0.10–0.115), movable finger length 0.11–0.12 (0.13–0.135). Carapace 0.29–0.33/0.29–0.32 (0.30–0.335/0.33–0.40). Leg I: trochanter 0.095/0.07 (0.10/0.06), femur 0.16/0.06 (0.135/0.06), patella 0.115/0.05 (0.125/0.045), tibia 0.125/0.04 (0.115/0.04), metatarsus 0.075/0.03 (0.065/0.03), tarsus 0.13/0.025 (0.115/0.03). Leg IV: trochanter 0.12/0.075 (0.115/0.085), femur + patella 0.29/0.115 (0.265/0.145), tibia 0.195/0.06 (0.21/0.06), metatarsus 0.095/0.04 (0.07/0.035), tarsus 0.17/0.03 (0.165/0.03).

*Remarks*

As discussed under *I. besucheti*, *I. caecata* appears to be most similar to that species. Beier (1974) reported 12 paratypes, but I could find only 11 in MHNG and NHMW.

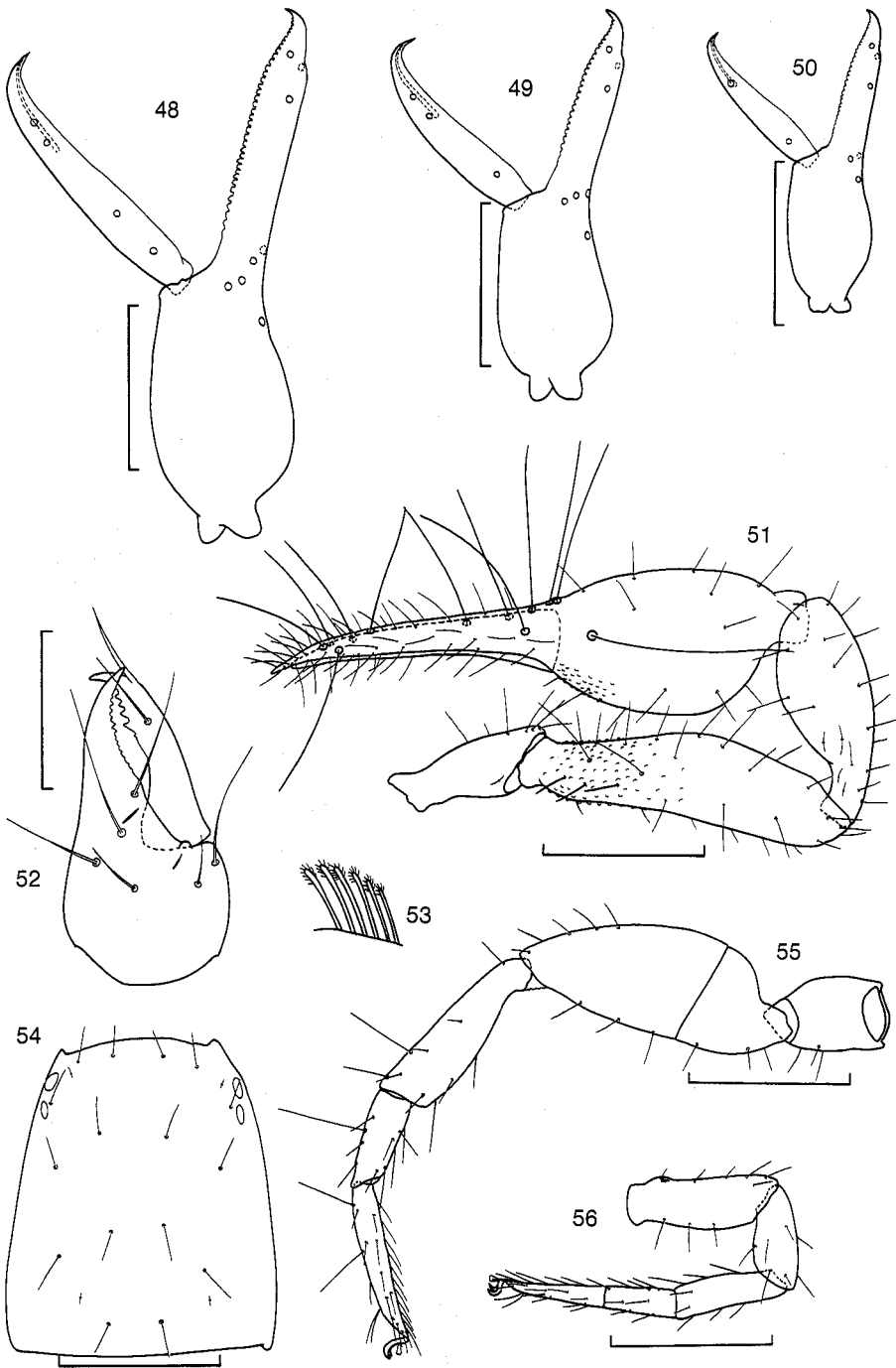
*Indohya panops*, sp. nov.

(Figs 3, 48–64)

*Material Examined*

*Holotype*. ♂, 13.5 km NE. of Crystal Head, SW. Osborne I. (CALM site 11/1), Western Australia, Australia, 14°23'S., 125°57'E., rainforest litter, 25–31.i.1989, CALM staff (WAM 91/1364; SL).

*Paratypes*. **Australia: Western Australia:** 13♂, 11♀, same data as holotype (WAM 91/1365–1388; SL, SP); 1♂, 1♀, same data as holotype (WBM; SP); 1♂, 1♀, same data as holotype (MHNG; SP); 2♂, 1 tritonymph, 1 deutonymph, same data except June 1988, J. D. Majer (WAM 91/1389–1392; SL); 2♀, 20.5 km NW. of Mt French, Glenelg R. (CALM site 23/4), 15°48'25"S., 124°44'15"E.,



**Figs 48-56.** *Indohya panops*, sp. nov., holotype male unless otherwise stated: 48, left chela, lateral; 49, left chela, lateral, paratype tritonymph; 50, left chela, lateral, paratype deutonymph; 51, right pedipalp, dorsal; 52, right chelicera; 53, flagellum; 54, carapace; 55, left leg IV; 56, left leg I, without trochanter. Scale lines, 0.2 mm (Figs 48-51), 0.1 mm (Figs 54-56).

rainforest litter, 25–31.i.1989, CALM staff (WAM 91/1393–1394; SP); 1 tritonymph, Mt Trafalgar (CALM site 14/3), 15°17'S., 125°04'E., rainforest litter, June 1988, J. D. Majer (WAM 91/1395; SP); 1 deutonymph, same data except 25–31.i.1989, CALM staff (WAM 91/1396; SP); 1♀, 10 km NW. of September Pt, nr Cape Bougainville (CALM site 6/2), 13°56'30"S., 126°08'E., rainforest litter, 25–31.i.1989, CALM staff (WAM 91/1397; SP).

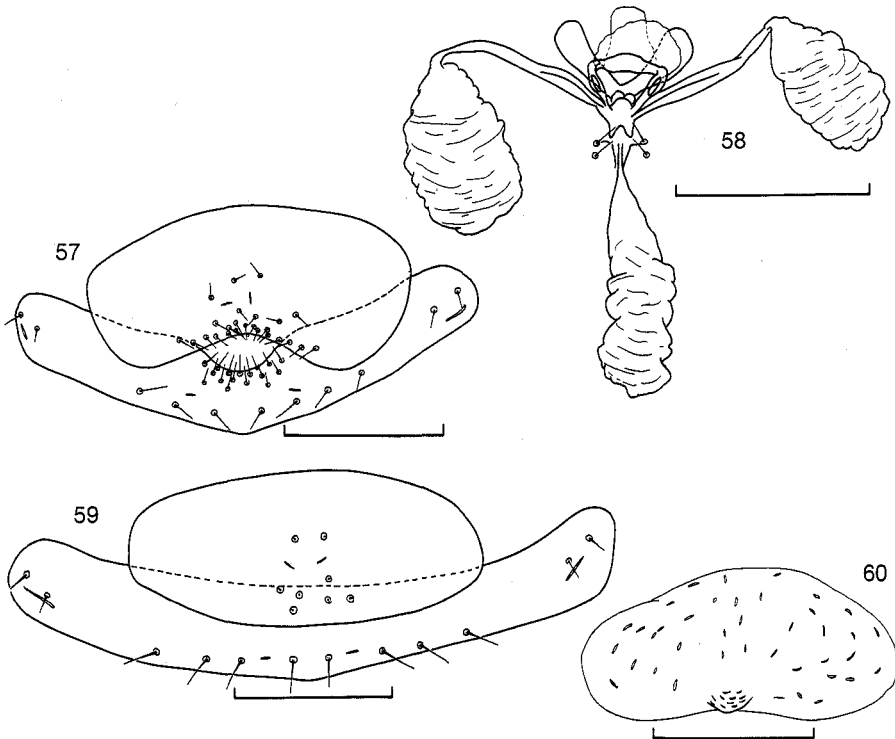
### Diagnosis

Four eyes. Cheliceral hand with 6 setae. Carapace with 16 setae. Pedipalpal femur 0.41–0.425 (♂, ♀) mm in length. Fixed chelal finger with 35–36 (♂), 36–38 (♀) teeth.

### Description

#### Adult

Colour light yellow-brown. Setae straight and acicular. Pedipalp (Fig. 51): trochanter 2.41–2.50 (♂), 2.35–2.53 (♀), femur 3.90–4.25 (♂), 3.95 (♀), patella 2.59–2.90 (♂), 2.61–2.77 (♀), chela (with pedicel) 3.63–3.82 (♂), 3.46–3.63 (♀), chela (without pedicel) 3.40–3.56 (♂), 0.63–0.65 (♀), hand 1.50–1.60 (♂), 0.27–0.285 (♀) × longer than broad, movable finger 1.09–1.22 (♂), 1.09–1.27 (♀) × longer than hand; femur sparsely granulate on basal portion. Fixed chelal finger and hand with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 48). Venom apparatus present only in movable chelal finger, terminating in nodus ramosus proximal to *st*. Femur with 2 sub-basal tactile setae, and 3 sub-basal posterior setae. Chelal teeth: fixed finger with 35–36 (♂), 36–38 (♀) teeth, mostly flat, but several basal teeth pointed; movable finger with several low teeth. Chelicera (Fig. 52): with 6 setae on hand; movable finger with 1 seta; galea very slender; fixed finger with 12–14 teeth; movable finger with 6–9 large teeth; flagellum with 6 distally serrate blades



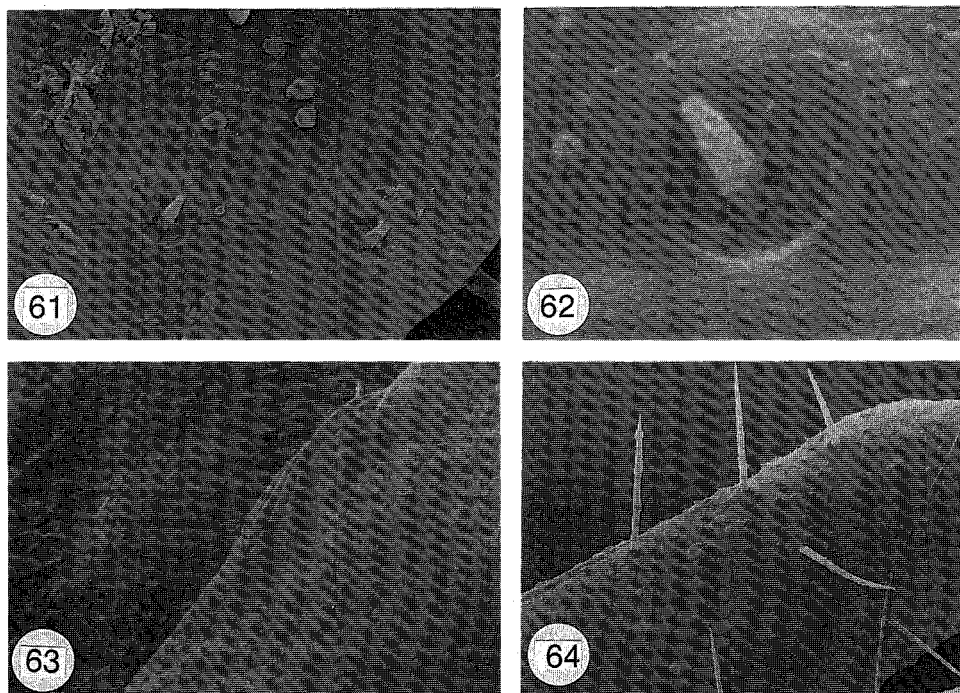
**Figs 57–60.** *Indohya panops*, sp. nov.: 57, genital opercula, holotype male; 58, genitalia, ventral, holotype male; 59, genital opercula, paratype female; 60, genitalia, ventral, paratype female. Scale lines, 0.1 mm (57–59), 0.05 mm (Fig. 60).

(Fig. 53). Carapace (Fig. 54) 1.03–1.09 ( $\sigma$ ), 0.95–0.99 ( $\varphi$ )  $\times$  longer than broad; lateral margins slightly convex; with 4 eyes; with 16 setae arranged 4: 4: 2: 4: 2, ocular setae present. Tergites and sternites undivided, except for sternite IV which is incompletely divided. Tergal chaetotaxy:  $\sigma$ , 4: 6: 6: 7–6: 7–8: 8: 8: 8: 6–7: 6: 4: 2;  $\varphi$ , 4: 6: 6: 7–8: 8: 8: 8: 8: 6: 4: 2. Sternal chaetotaxy:  $\sigma$ , 20–25: (2)18–24[4](2): (2)7–8(2): 11–12: 11–12: 12–13: 12: 10–11: 9–11: 7: 2;  $\varphi$ , 8: (2)8(2): (2–3)7(2–3): 12–13: 11–13: 13: 12–15: 12: 10–11: 5–7: 2. Coxal chaetotaxy:  $\sigma$ , 4: 4–5: 4–5: 6;  $\varphi$ , 4: 4–5: 4–5: 6. Genital opercula as in Figs 57, 59. Male genitalia as in Fig. 58. Female genitalia (Fig. 60) simple. Legs (Figs 55, 56): femur + patella IV 2.41–2.48 ( $\sigma$ ), 2.52–2.59 ( $\varphi$ )  $\times$  longer than broad.

*Dimensions* (mm).  $\sigma$  ( $\varphi$ ). Body length 1.04–1.28 (1.18–1.23). Pedipalps: trochanter 0.20–0.205/0.08–0.085 (0.20–0.215/0.085), femur 0.41–0.425/0.10–0.105 (0.415/0.105), patella 0.285–0.305/0.105–0.11 (0.30–0.305/0.11–0.115), chela (with pedicel) 0.635–0.67/0.17–0.18 (0.675–0.69/0.19–0.195), chela (without pedicel) 0.595–0.625 (0.63–0.65), hand length 0.27–0.28 (0.27–0.285), movable finger length 0.305–0.33 (0.31–0.345). Chelicera 0.195–0.20/0.10–0.105 (0.22/0.11), movable finger length 0.12 (0.13–0.135). Carapace 0.365–0.395/0.335–0.385 (0.37–0.39/0.385–0.405). Anterior eye diameter 0.02–0.025 (0.02), posterior eye diameter 0.015 (0.015–0.02). Leg I: trochanter 0.11/0.08 (0.09–0.10/0.08), femur 0.18–0.19/0.065 (0.185–0.20/0.06–0.07), patella 0.12–0.125/0.05–0.055 (0.125–0.13/0.05–0.055), tibia 0.145–0.15/0.04 (0.14–0.15/0.04–0.045), metatarsus 0.08–0.09/0.03 (0.085–0.10/0.03–0.035), tarsus 0.13–0.145/0.025–0.03 (0.13–0.145/0.03). Leg IV: trochanter 0.14–0.145/0.095 (0.08–0.095), femur + patella 0.35–0.36/0.145 (0.34–0.35/0.135), tibia 0.24–0.245/0.065–0.07 (0.24–0.245/0.06–0.065), metatarsus 0.13–0.135/0.045–0.05 (0.13–0.135/0.04–0.05), tarsus 0.20–0.205/0.03 (0.19–0.21/0.03).

#### *Tritonymph*

Pedipalps: trochanter 2.38, femur 3.88, patella 2.39, chela (with pedicel) 3.52, chela (without pedicel) 3.22, hand 1.56  $\times$  longer than broad. Fixed chelal finger with 7 tricho-



**Figs 61–64.** Scanning electron micrographs, *Indohya panops*, sp. nov., paratype female: 61, 62, setae on anterior genital opercula; 63, femur II showing mound; 64, pedipalpal femur showing setae.

bothria, movable chelal finger with 3 trichobothria (Fig. 49); *isb* and *sb* absent. Chelicera with 6 setae on hand; 1 on movable finger; galea very slender. Carapace  $1.33 \times$  longer than broad; 4 small eyes; with 16 setae arranged 4: 4: 2: 4: 2. Sternite II without setae. Legs as in adult.

*Dimensions* (mm). Body length 1.04. Pedipalps: trochanter 0.155/0.065, femur 0.31/0.08, patella 0.215/0.09, chela (with pedicel) 0.475/0.135, chela (without pedicel) 0.435, hand length 0.25, movable finger length 0.21. Chelicera 0.165/0.09, movable finger length 0.10. Carapace 0.30/0.225.

#### *Deutonymph*

Pedipalps: trochanter 2.36, femur 3.38, patella 2.29, chela (with pedicel) 3.43, chela (without pedicel) 3.19, hand  $1.90 \times$  longer than broad. Fixed chelal finger with 7 trichobothria, movable chelal finger with 3 trichobothria (Fig. 50); *isb* and *sb* absent. Chelicera with 5 setae on hand; 1 on movable finger; galea very slender. Carapace  $1.20 \times$  longer than broad; 4 small eyes; with 16 setae arranged 4: 4: 2: 4: 2. Sternite II without setae. Legs as in adult.

*Dimensions* (mm). Body length 0.80. Pedipalps: trochanter 0.13/0.055, femur 0.22/0.065, patella 0.16/0.07, chela (with pedicel) 0.36/0.105, chela (without pedicel) 0.335, hand length 0.20, movable finger length 0.15. Chelicera 0.13/0.07, movable finger length 0.07. Carapace 0.24/0.20.

#### *Remarks*

*Indohya panops* is significantly larger than the only other known *Indohya* species with four eyes, *I. pusilla*.

#### *Etymology*

The specific epithet refers to the presence of four eyes (*panops* Greek, all-seeing).

### *Indohya pusilla*, sp. nov.

(Figs 3, 65–73)

#### *Material Examined*

*Holotype*. ♂, 3.4 km SW. of Manning Ck, Prince Frederick Harbour (CALM site 8/4), Western Australia, Australia, 15°00'15"S., 125°21'E., rainforest litter, 25–31.i.1989, CALM staff (WAM 91/1398; SL).

*Paratype*. **Australia: Western Australia:** 1♀, same data as holotype (WAM 91/1399; SL).

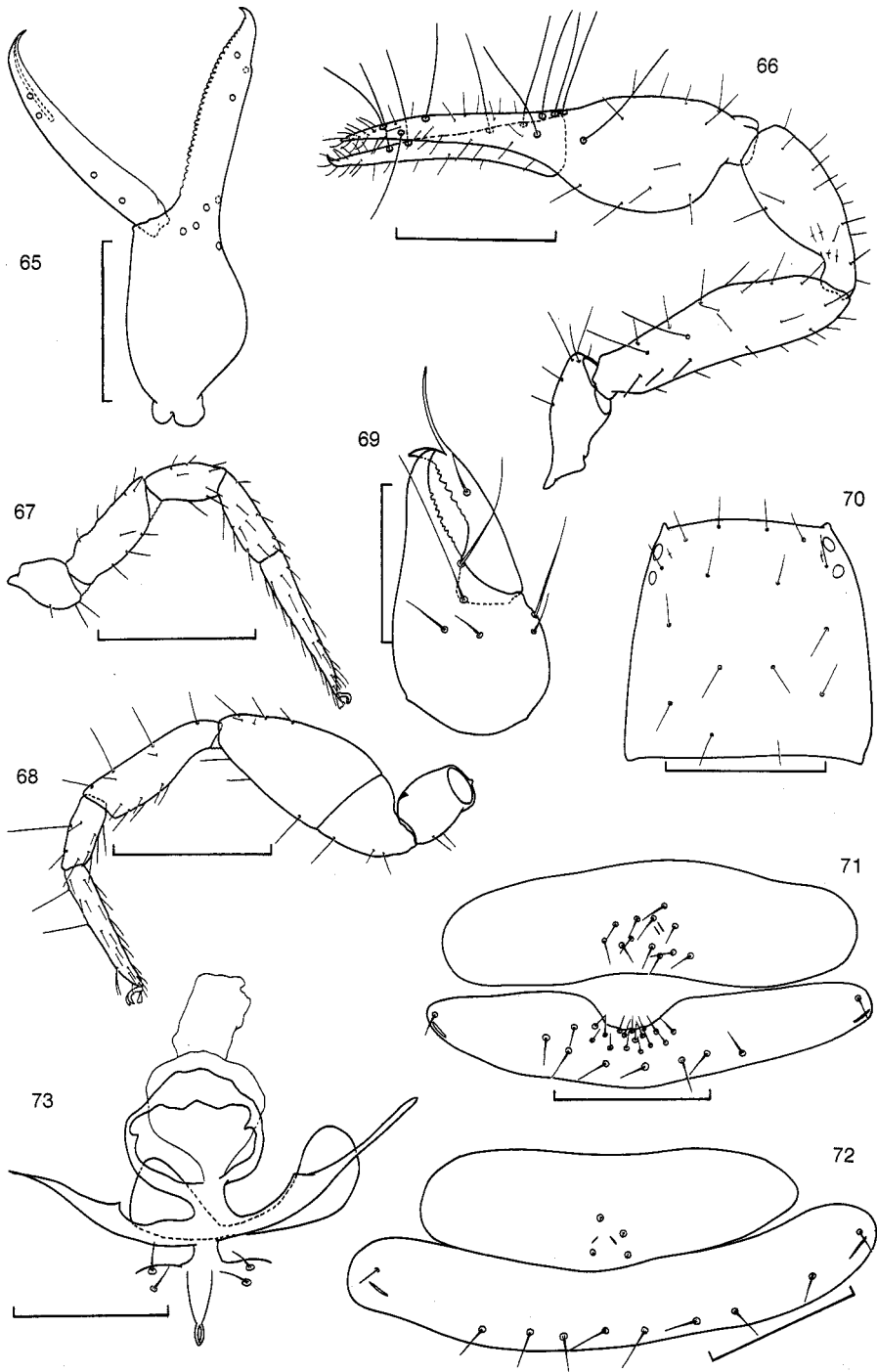
#### *Diagnosis*

Four eyes. Cheliceral hand with 6 setae. Carapace with 16 setae. Pedipalpal femur 0.32–0.34 mm in length. Fixed chelal finger with 36 teeth.

#### *Description*

##### *Adult*

Colour light yellow-brown. Setae straight and acicular. Pedipalp (Fig. 66): trochanter 2.43 (♂), 2.27 (♀), femur 3.56 (♂), 3.78 (♀), patella 2.56 (♂), 2.61 (♀), chela (with pedicel) 3.55 (♂), 3.15 (♀), chela (without pedicel) 3.31 (♂), 2.94 (♀), hand 1.38 (♂), 1.26 (♀)  $\times$  longer than broad, movable finger 1.48 (♂), 1.33 (♀)  $\times$  longer than hand. Fixed chelal finger and hand with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 65). Venom apparatus present only in movable chelal finger, terminating in nodus ramosus proximal to *st*. Femur with 2 sub-basal tactile setae, and 3 sub-basal posterior setae. Chelal teeth: fixed finger with 36 (♂) teeth, teeth 22, 23, 25, 26, 28–31 slightly acute, remainder blunt; movable finger without teeth. Chelicera (Fig. 69): with 6 setae on hand; movable finger with 1 seta; galea very slender; fixed finger with 9 (♂), 10 (♀) teeth; movable finger with 6 (♂), 8 (♀) teeth; flagellum with 5 blades. Carapace (Fig. 70) 1.00



**Figs 65-73.** *Indohya pusilla*, sp. nov., holotype male unless otherwise stated: 65, left chela, lateral; 66, right pedipalp, dorsal; 67, left leg I; 68, left leg IV; 69, left chelicera, paratype female; 70, carapace, paratype female; 71, genital opercula, male; 72, genital opercula, paratype female; 73, genitalia, ventral, male, slightly distorted. Scale lines, 0.2 mm (Figs 65-68, 70), 0.1 mm (Figs 69, 71, 72), 0.05 mm (Fig. 73).



(♀) × longer than broad; lateral margins slightly convex; with 4 eyes; with 16 setae arranged 4: 4: 2: 4: 2, ocular setae present. Tergites and sternites undivided, except for sternite IV which is incompletely divided. Tergal chaetotaxy: ♂, 4: 6: 6: 6: 7: 8: 8: 8: 8: 6: 4: 2; ♀, 4: 6: 6: 8: 8: 8: 8: 8: 6: 4: 2. Sternal chaetotaxy: ♂, 12: (1)25[4](1): (2)6(2): 9: 10: 11: 11: 9: 10: 5: 2; ♀, 4: (1)8(1): (2)6(2): 10: 11: 11: 11: 10: 9: 5: 2. Coxal chaetotaxy: ♂, ♀, 4: 4: 4-5: 6. Genital opercula as in Figs 71, 72. Male genitalia as in Fig. 73. Female genitalia simple. Legs (Figs 67, 68): femur + patella IV 2.59 (♂), 2.55 (♀) × longer than broad.

*Dimensions* (mm). ♂ (♀). Body length 0.98 (1.05). Pedipalps: trochanter 0.17/0.07 (0.17/0.075), femur 0.32/0.09 (0.34/0.09), patella 0.23/0.09 (0.235/0.09), chela (with pedicel) 0.515/0.145 (0.535/0.17), chela (without pedicel) 0.48 (0.50), hand length 0.20 (0.215), movable finger length 0.295 (0.285). Chelicera 0.165/0.08 (0.185/0.095), movable finger length 0.095 (0.11). Carapace 0.305/? (0.295/0.295). Anterior eye diameter 0.02 (0.02), posterior eye diameter 0.03 (0.02). Leg I: trochanter 0.08/0.065 (0.09/0.065), femur 0.15/0.05 (0.15/0.055), patella 0.105/0.045 (0.095/0.045), tibia 0.12/0.04 (0.12/0.04), metatarsus 0.075/0.03 (0.07/0.03), tarsus 0.12/0.025 (0.11/0.025). Leg IV: trochanter 0.105/0.075 (0.115/0.07), femur + patella 0.285/0.11 (0.28/0.11), tibia 0.195/0.055 (0.20/0.055), metatarsus 0.095/0.04 (0.095/0.04), tarsus 0.17/0.025 (0.165/0.03).

#### Remarks

This species has been collected at the same locality as *I. beieri* (Fig. 3).

#### Etymology

The specific epithet refers to the small size of this species (*pusilla* Latin, very little, small).

#### *Indohya beieri*, sp. nov.

(Figs 3, 74-80)

#### Material Examined

*Holotype*. ♀, 3.4 km SW. of Manning Ck, Prince Frederick Harbour (CALM site 8/4), Western Australia, Australia, 15°00'15"S., 125°21'E., rainforest litter, January 1989, CALM staff (WAM 91/1363; SL).

#### Diagnosis

Two eyes. Cheliceral hand with 6 setae. Carapace with 16 setae. Pedipalpal femur 0.365 mm in length. Fixed chelal finger with 34 teeth.

#### Description

##### *Adult female*

Colour light yellow-brown. Setae straight and acicular. Pedipalp (Fig. 75): trochanter 2.31, femur 3.65, patella 2.43, chela (with pedicel) 3.22, chela (without pedicel) 3.03, hand 1.35 × longer than broad, movable finger 1.22 × longer than hand. Fixed chelal finger and hand with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 74). Venom apparatus present only in movable chelal finger, terminating in nodus ramosus proximal to *st*. Femur with 2 sub-basal tactile setae, and 3 sub-basal posterior setae. Chelal teeth: fixed finger with 47 teeth, most blunt, except for 24, 27 and 28 which are acute; movable finger with several very low teeth, virtually obsolete. Chelicera (Fig. 79): with 6 setae on hand; movable finger with 1 seta; galea very slender; fixed finger with 10 teeth; movable finger with 8 teeth; flagellum not visible. Carapace (Fig. 78) 1.10 × longer than broad; lateral margins slightly convex; with 2 small eyes; with 16 setae arranged 4: 4: 2: 4: 2, ocular setae present. Tergites and sternites undivided. Tergal chaetotaxy: 4: 6: 7: 6: 7: 8: 8: 8: 9: 6: 4: 2. Sternal chaetotaxy: 7: (1)8(1): (2)6(2): 9: 10: 9: 10: 10: 11: 4: 2. Coxal chaetotaxy: 4: 5: 5: 6. Genital opercula as in Fig. 80. Genitalia simple. Legs (Figs 76, 77): femur + patella IV 2.77 × longer than broad.

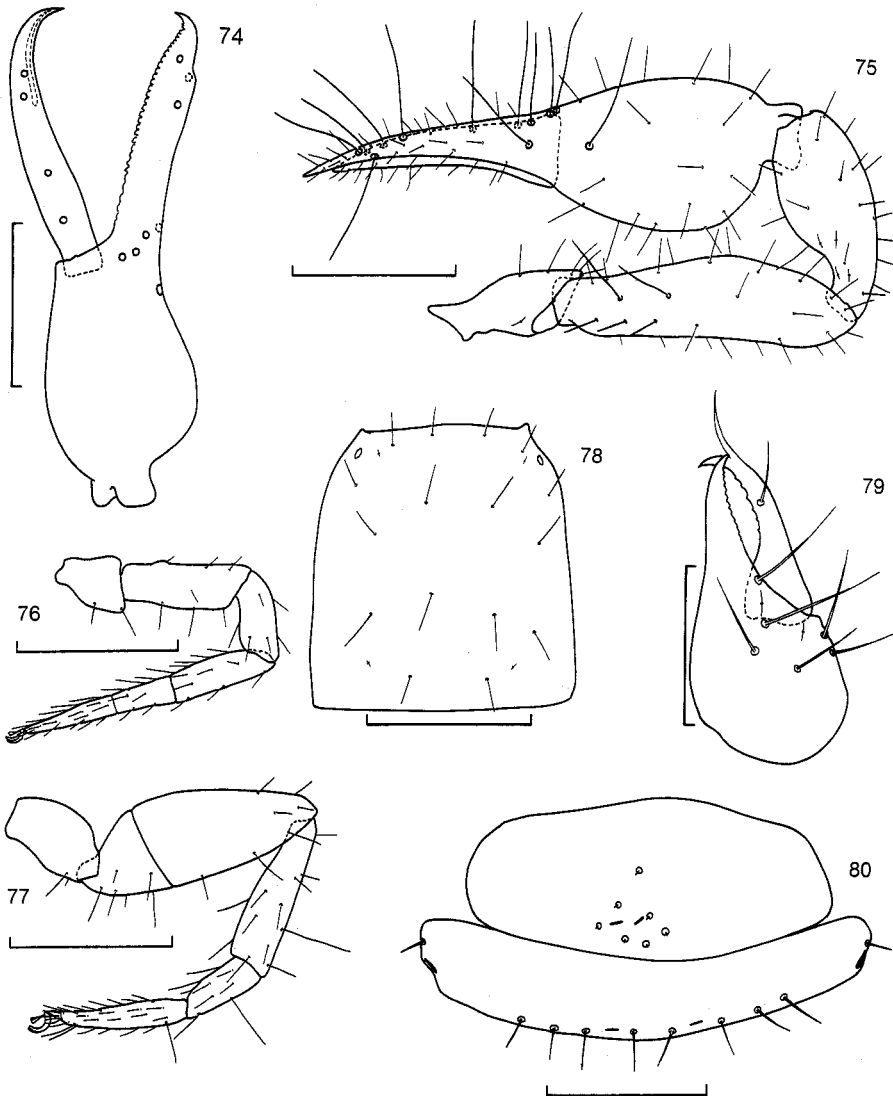
*Dimensions* (mm). Body length 1.05. Pedipalps: trochanter 0.185/0.08, femur 0.365/0.10, patella 0.255/0.105, chela (with pedicel) 0.595/0.185, chela (without pedicel) 0.56, hand length 0.25, movable finger length 0.305. Chelicera 0.19/0.09, movable finger length 0.115. Carapace 0.345/0.315. Eye diameter 0.01. Leg I: trochanter 0.08/0.07, femur 0.16/0.055, patella 0.11/0.05, tibia 0.13/0.035, metatarsus 0.075/0.03, tarsus 0.115/0.025. Leg IV: trochanter 0.125/0.075, femur+patella 0.305/0.11, tibia 0.21/0.09, metatarsus 0.10/0.04, tarsus 0.17/0.03.

#### Remarks

*Indohya beieri* is the only known hydrid with two eyes. This species is known from a single locality (Fig. 3), and was collected with *I. pusilla*.

#### Etymology

This species is named for the late Dr Max Beier, who described the genus *Indohya*.



**Figs 74-80.** *Indohya beieri*, sp. nov., holotype female: 74, left chela, lateral; 75, right pedipalp, dorsal; 76, left leg I; 77, left leg IV; 78, carapace; 79, right chelicera; 80, genital opercula. Scale lines, 0.2 mm (Figs 74-78), 0.1 mm (Figs 79, 80).

*Indohya typhlops*, sp. nov.

(Figs 3, 81–88)

*Material Examined*

*Holotype*. ♀, 25.3 km WSW. of Mt Blythe on Charnley R. (CALM site 25/2), Western Australia, Australia, 16°22'35"S., 125°12'35"E., rainforest litter, January 1989, CALM staff (WAM 91/1400; SL).

*Diagnosis*

Eyes absent. Cheliceral hand with 6 setae. Carapace with 16 setae. Pedipalpal femur 0.46 mm in length. Fixed chelal finger with 41 teeth.

*Description**Adult female*

Colour yellow-brown. Setae straight and acicular. Pedipalp (Fig. 82): trochanter 2.30, femur 3.92, patella 3.00, chela (with pedicel) 3.21, chela (without pedicel) 3.06, hand 1.33 × longer than broad, movable finger 1.28 × longer than hand. Fixed chelal finger and hand with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 81). Venom apparatus present only in movable chelal finger, terminating in nodus ramosus proximal to *st*. Femur with 2 sub-basal tactile setae, and 3 sub-basal posterior setae. Chelal teeth: fixed finger with 41 teeth, 23, 24, 26, 28, 29, 31, 33–35 acute, remainder blunt; movable finger with several very low teeth. Chelicera (Fig. 83): with 6 setae on hand; movable finger with 1 seta; galea very slender; fixed finger with 9 small teeth; movable finger with 7 small teeth; flagellum not visible. Carapace (Fig. 84) 1.04 × longer than broad; lateral margins slightly convex; without eyes or eyespots; with 16 setae arranged 4: 4: 2: 4: 2, ocular setae present. Tergites and sternites undivided. Tergal chaetotaxy: 4: 6: 6: 7: 7: 8: 8: 7: 6: 4: 5: 2. Sternal chaetotaxy: 9: (3)8(3): (3)8(3): 10: 9: 9: 9: 8: 9: 7: 2. Coxal chaetotaxy: 4: 4: 4: 5. Genital opercula as in Fig. 87. Genitalia (Fig. 88) simple. Legs (Figs 85, 86): femur + patella IV 2.79 × longer than broad.

*Dimensions* (mm). Body length 1.60. Pedipalps: trochanter 0.23/0.10, femur 0.47/0.12, patella 0.36/0.12, chela (with pedicel) 0.77/0.24, chela (without pedicel) 0.735, hand length 0.32, movable finger length 0.41. Chelicera 0.24/0.12, movable finger length 0.14. Carapace 0.405/0.39. Leg I: trochanter 0.12/0.13, femur 0.22/0.065, patella 0.14/0.055, tibia 0.16/0.045, metatarsus 0.09/0.04, tarsus 0.145/0.03. Leg IV: trochanter 0.16/0.095, femur + patella 0.39/0.14, tibia 0.29/0.065, metatarsus 0.135/0.05, tarsus 0.225/0.035.

*Remarks*

This blind species is the largest known *Indohya* species.

*Etymology*

The specific epithet refers to the lack of eyes (*typhlops* Greek, blind).

Genus *Hyella*, gen. nov.

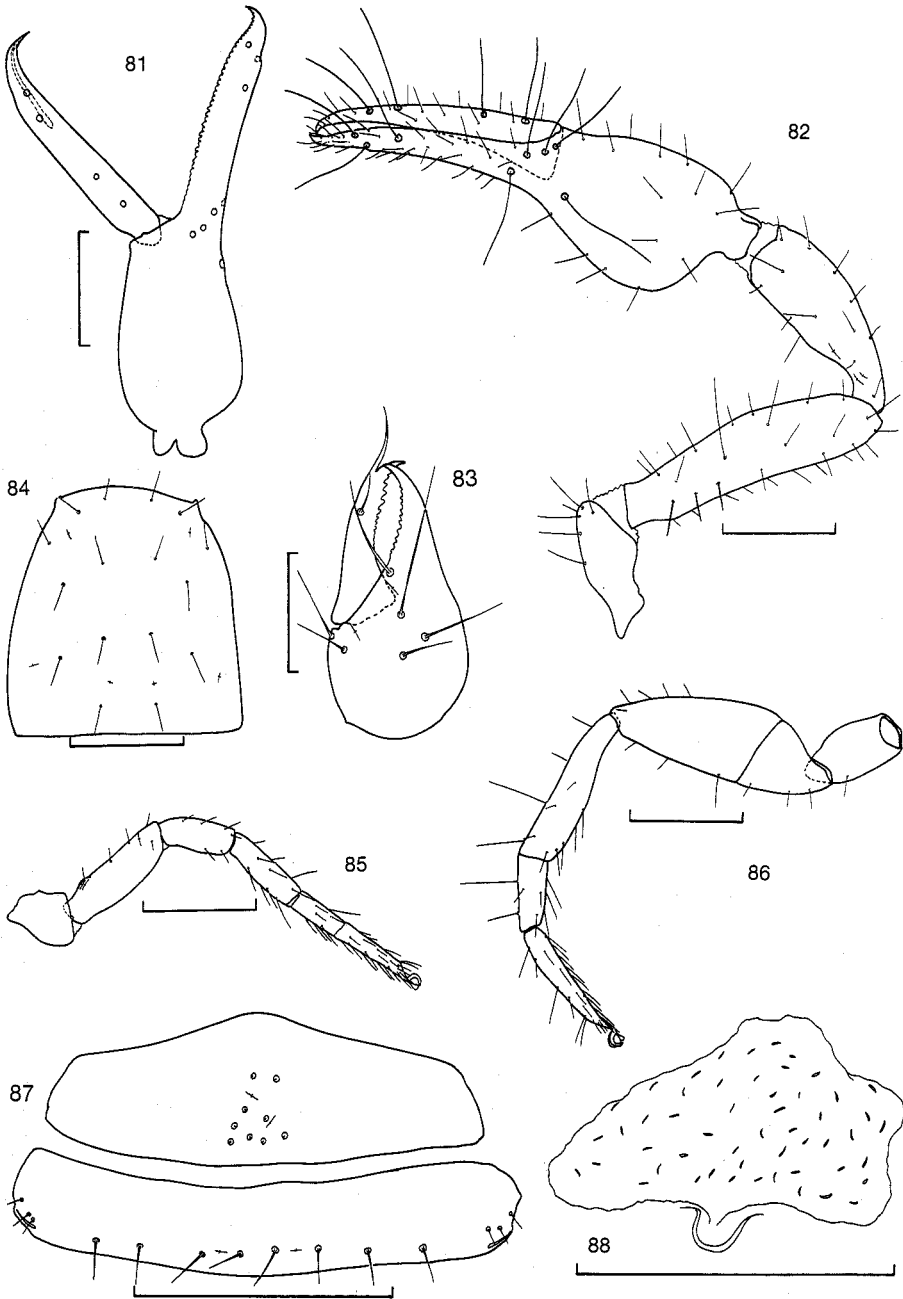
Type species: *Hyella humphreysi*, sp. nov.

*Diagnosis*

Movable chelal finger with more than 50 well-developed teeth. Carapace with 12 setae. Flagellum with 7 blades. Trichobothrium *b* much closer to basal end of movable finger than to *sb*.

*Remarks*

*Hyella* is currently represented by a single cavernicolous species from Cape Range, Western Australia.

*Included Species**Hyella humphreysi*, sp. nov.*Etymology*The generic name is based on *Hya*, and is feminine in gender.

**Figs 81-88.** *Indohya typhlops*, sp. nov., holotype female: 81, left chela, lateral; 82, right pedipalp, dorsal; 83, left chelicera; 84, carapace; 85, left leg I; 86, left leg IV; 87, genital opercula; 88, genitalia, ventral. Scale lines, 0.2 mm (Figs 81, 82, 84-86), 0.1 mm (Figs 83, 87, 88).

*Hyella humphreysi*, sp. nov.

(Figs 2, 89–99)

Gen. et sp. nov.—Harvey, 1991c: 500.

*Material Examined*

*Holotype*. ♀, Papillon Cave, C-15, Cape Range, Western Australia, Australia, 22°13'S., 113°59'E., under stone in dark zone, 28.vi.1989, M. S. Harvey, W. F. Humphreys (WAM 90/726; SL).

*Paratypes*. **Australia: Western Australia:** 1 tritonymph, Papillon Cave, C-15, Cape Range, 22°13'S., 113°59'E., 29.iii.1991, D. Brooks (WAM 91/1054; SP); 1 tritonymph, Trionomo Cave, C-103, Cape Range, 22°07'S., 113°59'E., 15.viii.1988, D. Brooks (WAM 90/727; SL).

*Diagnosis*

As for genus.

*Description**Adult female*

Colour light red-brown. Setae long, straight and acicular. Pedipalp (Fig. 91): trochanter 2.45, femur 7.14, patella 4.54, chela (with pedicel) 4.45, chela (without pedicel) 4.13, hand 1.60 × longer than broad, movable finger 1.55 × longer than hand; femur without basal projection. Fixed chelal finger and hand with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 92): *eb*, *esb* and *isb* in diagonal row at base of fixed finger, with *ist* situated slightly distally. Venom apparatus present only in movable chelal finger, terminating in nodus ramosus proximal to *st*. Femur with 2 sub-basal tactile setae, and 3 sub-basal posterior setae. Chelal teeth: fixed finger with 93 teeth, mostly blunt, but some proximal teeth slightly acute; movable finger with 57 blunt teeth. Chelicera (Fig. 89): with 6 setae on hand; movable finger with 1 seta; galea very slender; fixed finger with 11 teeth; movable finger with 10 teeth; flagellum with 7 distally serrate blades (Fig. 90). Carapace (Fig. 94) 1.35 × longer than broad; lateral margins slightly convex; without eyes or eyespots; with 12 setae arranged 4: 2: 2: 2: 2. Tergites and sternites undivided, except for sternite IV which is incompletely divided. Tergal chaetotaxy: 2: 2: 4: 6: 6: 6: 6: 6: 2: 2. Sternal chaetotaxy: 24: (4)11(4): (4)10(4): 10: 10: 10: 10: 10: 8: 6: 2. Coxal chaetotaxy: 3: 4: 5: 7. Genital opercula as in Fig. 98. Genitalia (Fig. 99) simple. Legs (Figs 95–97) extremely attenuate; femur + patella IV 4.73 × longer than broad.

*Dimensions* (mm). Body length 2.70. Pedipalps: trochanter 0.49/0.20, femur 1.50/0.21, patella 1.18/0.26, chela (with pedicel) 2.09/0.47, chela (without pedicel) 1.94, hand length 0.75, movable finger length 1.16. Chelicera 0.44/0.22, movable finger length 0.27. Carapace 0.81/0.60. Leg I: trochanter 0.27/0.17, femur 0.65/0.11, patella 0.40/0.09, tibia 0.48/0.06, metatarsus 0.29/0.06, tarsus 0.39/0.04. Leg IV: trochanter 0.39/0.17, femur 0.32/0.20, patella 0.82/0.22, femur + patella 1.04, tibia 0.76/0.11, metatarsus 0.37/0.09, tarsus 0.69/0.06.

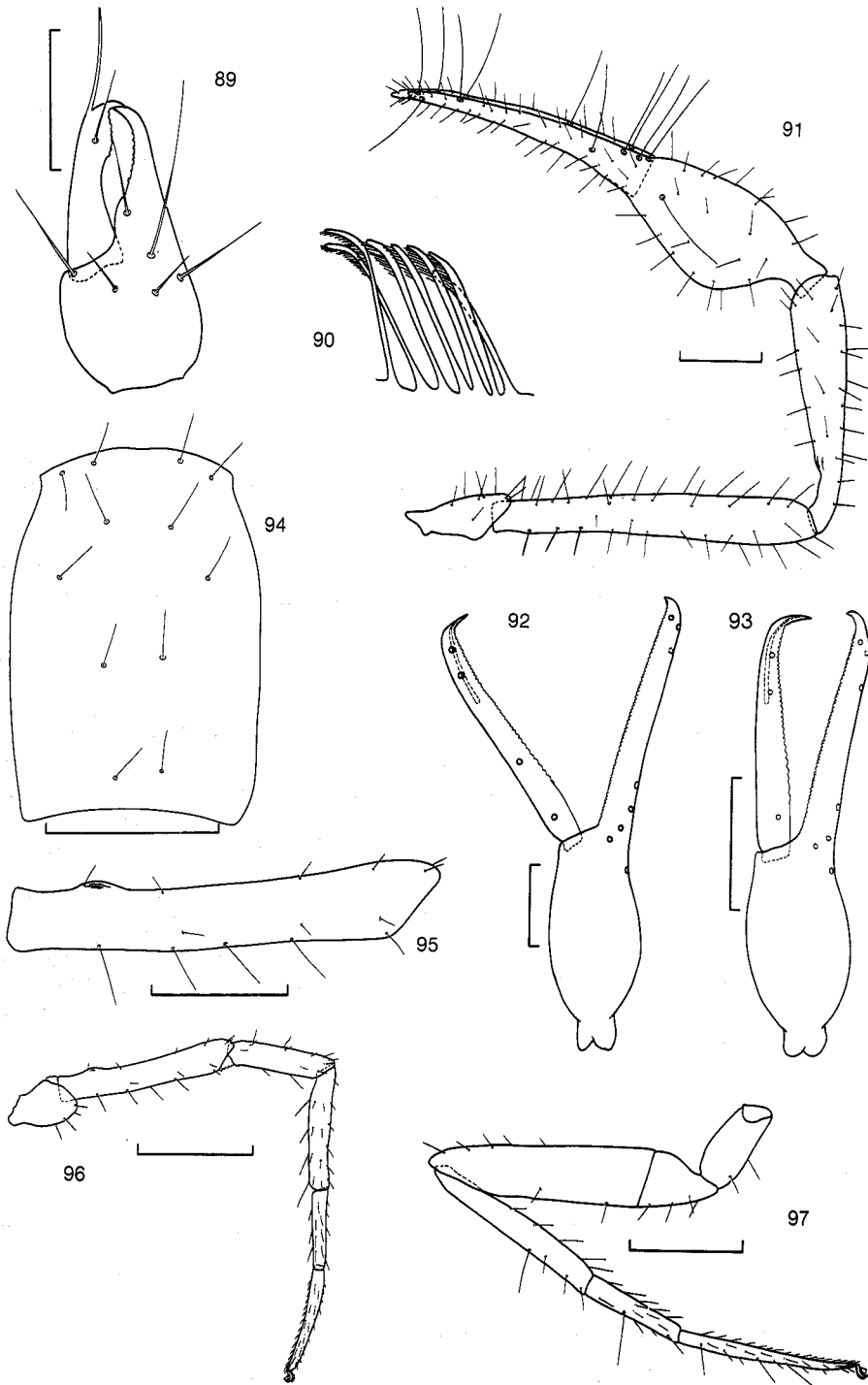
*Tritonymph*

Pedipalps: trochanter 2.40, femur 5.35, patella 3.58, chela (with pedicel) 4.03, chela (without pedicel) 3.74, hand 1.49 × longer than broad. Fixed chelal finger with 7 trichobothria, movable chelal finger with 3 trichobothria (Fig. 93); *isb* and *sb* absent. Chelicera with 6 setae on hand; 1 on movable finger; galea very slender; flagellum with 6 blades. Carapace 1.19 × longer than broad; eyes absent. Sternite II without setae. Legs as in adult.

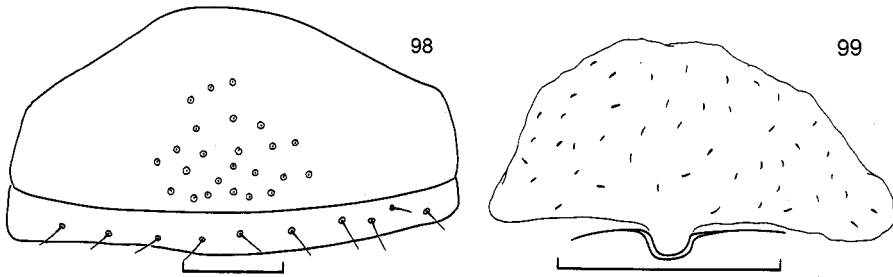
*Dimensions* (mm). Body length 2.10. Pedipalps: trochanter 0.36/0.15, femur 0.91/0.17, patella 0.68/0.19, chela (with pedicel) 1.41/0.35, chela (without pedicel) 1.31, hand length 0.52, movable finger length 0.76. Carapace 0.64/0.54.

*Remarks*

*Hyella humphreysi* has been taken from only two caves in Cape Range, Western Australia, despite repeated searches in the numerous caves of the region. The female was



**Figs 89-97.** *Hyella humphreysi*, sp. nov., holotype female unless otherwise stated: 89, left chelicera; 90, flagellum; 91, right pedipalp, dorsal; 92, left chela, lateral; 93, left chela, lateral, paratype tritonymph; 94, carapace; 95, left femur I; 96, left leg I; 97, left leg IV. Scale lines, 0.4 mm (Figs 91-94, 96, 97), 0.2 mm (Figs 89, 95).



**Figs 98–99.** *Hyella humphreysi*, sp. nov., holotype female: 98, genital opercula; 99, genitalia, ventral. Scale lines, 0·1 mm.

taken from under a stone in a dark section of the cave, and the tritonymph from Trionomo Cave was collected from a small bank of litter. The cave fauna of Cape Range has been treated by Humphreys (1990), Humphreys and Collis (1990), Humphreys *et al.* (1989), and the pseudoscorpion fauna by Harvey (1991c).

With an adult body length of 2·7 mm, *H. humphreysi* is by far the largest known hyid.

#### *Etymology*

This species is named for Bill Humphreys, who first attracted my attention to the fascinating cave fauna of Cape Range, and whose efforts resulted in the collection of the type series.

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Specimens were placed at my disposal by Dr A. N. Andersen (CSIRO, Darwin), Dr M. Grasshoff (SMF), Dr J. Gruber (NHMW), Dr R. B. Halliday and Mr T. E. Wier (ANIC), Dr W. F. Humphreys (WAM), Mr M. Judson (Leeds University), Dr V. Mahnert and Dr B. Hauser (MHNG), Dr B. Y. Main (University of Western Australia), Dr D. R. Malcolm (JCC), Dr W. B. Muchmore (University of Rochester), Dr G. Rack (ZMH) and Dr W. Schawaller (SMNS). Dr W. B. Muchmore graciously examined several American neobisoids at my request in the search for minute structures. Dr J. A. Coddington (USNM, Washington) searched in vain for type material in his institution. Dr W. F. Humphreys and his enthusiastic field team collected the first known specimen of *Hyella humphreysi*, and a grant from the W. H. Butler fund enabled the collection of an adult. The Kimberley material was collected on trips organised by the Department of Conservation and Land Management. Julianne Waldoock provided the scanning micrographs.

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