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A review of the pseudoscorpion genus *Ideoblothrus* (Pseudoscorpiones, Syarinidae) from western and northern Australia

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(Accepted 15 January 2006)

Abstract

Five new pseudoscorpion species belonging to the genus *Ideoblothrus* are named and described from Western Australia and the Northern Territory: *I. pisolitus* from a single pisolitic mesa near Pannawonica, *I. nesotymbus* from limestone karst on Barrow Island, *I. westi* from limestone karst near the Fortescue River, *I. descartes* from a vine thicket on Descartes Island in the Kimberley, and *I. milikapiti* from rainforest on Melville Island. New specimens of *I. papillon* Harvey from Papillon Cave and *I. woodi* Harvey from Cave C-167, Western Australia are recorded. A further species is recognised but not named as adult specimens are not available: *Ideoblothrus* sp. 'Mesa A' occurs within a different pisolitic mesa than *I. pisolitus*.

Keywords: Pseudoscorpiones, Neobisioidea, *Ideoblothrus*, morphology, new species, short-range endemics, taxonomy

Introduction

The pseudoscorpion genus *Ideoblothrus* was first named by Balzan (1892) as a subgenus of *Ideobisium* Balzan, 1892, with a single included species, *Ideobisium (Ideoblothrus) similis* Balzan, 1892 from Petare, Miranda Province, Venezuela. The name *Ideoblothrus* languished as a synonym of *Ideobisium* until resurrected by Muchmore (1982) who revalidated the name, elevated it to generic level and provided a modern description of the genus and the type species. He also transferred many other species of *Ideobisium* to *Ideoblothrus* and demonstrated that the two genera, although sharing several similarities, could be reliably distinguished from each other based on a variety of morphological features. Muchmore (1982) also compared *Ideoblothrus* with *Pachychitra* Chamberlin, 1938, originally named for a cave-dwelling species from Yucatán, Mexico (Chamberlin 1938) with a further nine species named and described from across the Central America and the Caribbean region (Hoff 1945, 1964; Wagnenaar-Hummelinck 1948; Muchmore 1972, 1979). He concluded

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that *Ideoblothrus* and *Pachychitra* were synonymous. Harvey (1991a) transferred *Ideobisium ceylonicum* Beier, 1973 from Sri Lanka (Beier 1973) to *Ideoblothrus*, as it clearly matched the diagnosis and description provided by Muchmore (1982). New described species were subsequently named from Ivory Coast (Heurtault 1983), Brazil (Mahnert 1985a, 1985b), and Western Australia (Harvey 1991b).

Ideoblothrus species are known to occur in Africa, Asia, the Americas, and Australia (Muchmore 1982; Harvey 1991a), and there are currently 36 species named within the genus (Table I). The vast majority of species occur in tropical rainforest ecosystems within leaf litter or soil. Only five species have been found in subterranean environments, three from Mexico and two from Australia. Chamberlin (1938) described *Pachychitra maya* from a cave near Oxkutzcab, Yucatán, Mexico, and Muchmore (1972) named *P. grandis* from Cueva del Tío Ticho, Chiapas, Mexico and *P. similis* [later renamed as *Ideoblothrus vampirorum* Muchmore, 1982, because this species became a secondary homonym of *I. similis* (Balzan) when *Pachychitra* was synonymised with *Ideoblothrus*] from Cueva de los Vampiros, Tamaulipas, Mexico. Harvey (1991b) described *I. woodi* from an unnamed cave on Cape Range Peninsula, Western Australia and *I. papillon* from Papillon Cave, also on Cape Range Peninsula (Figures 1,2). These two species are also the only named Australian species of the genus.

Recent surveys of karst environments in Western Australia have recovered several new species of *Ideoblothrus*, including one from pisolite formations near Pannawonica, one from a borehole near the Fortescue River, and one from limestone karst on Barrow Island. In addition to naming and describing these species, we also describe the first epigeal species of the genus from Australia, taken from vine thicket habitats in northern Australia, one from the Kimberley region of Western Australia and another from Melville Island, Northern Territory. We are aware of other species in the tropical rainforests of eastern Queensland but refrain from naming this fauna until a detailed appraisal can be undertaken.

Material and methods

The material examined for this study is lodged in the Western Australian Museum, Perth (WAM). Terminology and mensuration mostly follows Chamberlin (1931), with the exception of the nomenclature of the pedipalps, legs, and with some small modifications to the terminology of the trichobothria (Harvey 1992). The following abbreviations are used in the illustrations for the carapaceal setal rows: *an*, anterior row; *oc*, ocular row; *me*, median row; *in*, intermediate row; *po*, posterior row. This system is slightly modified from that employed by Gabbutt (1965) and Gabbutt and Vachon (1965, 1967, 1968) for the Neobisiidae. The following abbreviations are used in the illustrations for the male genitalia, largely following Legg (1975): *ejca*, ejaculatory canal atrium; *gls*, glandular setae; *lgs*, lateral genital sac; *mgs*, median genital sac.

The specimens were studied using temporary slide mounts which were prepared by immersion of specimens in 25% lactic acid at room temperature, and mounting them on microscope slides with 10 or 12 mm coverslips supported by small sections of 0.25, 0.35, or 0.50 mm diameter nylon fishing line. After study the specimens were washed in distilled water and returned to 75% ethanol with the dissected portions placed in 12 × 3 mm glass genitalia microvials (BioQuip Products). All specimens were studied using an Olympus BH-2 compound microscope and illustrated with the aid of a drawing tube. Measurements were taken at the highest possible magnification using an ocular graticule. Photographs of whole animals were taken using a Micropublisher 5.0 digital camera mounted on a Leica

Table I. Named species of *Ideoblothrus* and their recorded distributions.

Region	Species	Distribution
Africa	<i>Ideoblothrus baloghi</i> (Mahnert, 1978)	Congo
	<i>Ideoblothrus godfreyi</i> (Ellingsen, 1912)	South Africa
	<i>Ideoblothrus holmi</i> (Beier, 1955)	Uganda, Zaire
	<i>Ideoblothrus leleupi</i> (Beier, 1959)	Zaire
	<i>Ideoblothrus lepesmei</i> (Vachon, 1941)	Guinea, Ivory Coast
	<i>Ideoblothrus muchmorei</i> Heurtault, 1983	Ivory Coast
	<i>Ideoblothrus occidentalis</i> (Beier, 1959)	Zaire
	<i>Ideoblothrus seychellesensis</i> (Chamberlin, 1930)	Seychelles
Australasia	<i>Ideoblothrus zicsii</i> (Mahnert, 1978)	Congo
	<i>Ideoblothrus bipectinatus</i> (Daday, 1897)	Indonesia (West Papua), Papua New Guinea
	<i>Ideoblothrus ceylonicus</i> (Beier, 1973)	Sri Lanka
	<i>Ideoblothrus descartes</i> sp. nov.	Australia (Western Australia)
	<i>Ideoblothrus nesotymbus</i> sp. nov.	Australia (Western Australia)
	<i>Ideoblothrus milikapiti</i> sp. nov.	Australia (Northern Territory)
	<i>Ideoblothrus palauensis</i> (Beier, 1957)	Palau
	<i>Ideoblothrus papillon</i> Harvey, 1991	Australia (Western Australia)
	<i>Ideoblothrus pisolitus</i> sp. nov.	Australia (Western Australia)
	<i>Ideoblothrus pugil</i> (Beier, 1964) [including <i>I. pugil robustus</i> (Beier, 1966)]	Solomon Islands
	<i>Ideoblothrus westi</i> sp. nov.	Australia (Western Australia)
	<i>Ideoblothrus woodi</i> Harvey, 1991	Australia (Western Australia)
	<i>Ideoblothrus carinatus</i> (Hoff, 1964)	Jamaica
	<i>Ideoblothrus curazavius</i> (Wagenaar-Hummelinck, 1948)	Netherlands Antilles (Curaçao)
	<i>Ideoblothrus floridensis</i> (Muchmore, 1979)	USA (Florida)
Meso-America	<i>Ideoblothrus grandis</i> (Muchmore, 1972)	Mexico
	<i>Ideoblothrus insularum</i> (Hoff, 1945)	Jamaica, Puerto Rico
	<i>Ideoblothrus maya</i> (Chamberlin, 1938)	Mexico
	<i>Ideoblothrus mexicanus</i> (Muchmore, 1972)	Mexico
	<i>Ideoblothrus pygmaeus</i> (Hoff, 1964)	Jamaica, Martinique
	<i>Ideoblothrus truncatus</i> (Hoff, 1964)	Jamaica
	<i>Ideoblothrus vampirorum</i> Muchmore, 1982	Mexico
	<i>Ideoblothrus similis</i> (Balzan, 1892)	Cayman Islands, Galapagos Islands, Mexico, Venezuela
Meso-America, South America	<i>Ideoblothrus amazonicus</i> (Mahnert, 1979)	Brazil (Amazonas)
South America	<i>Ideoblothrus brasiliensis</i> (Mahnert, 1979)	Brazil (Amazonas, Pará)
	<i>Ideoblothrus caecus</i> (Mahnert, 1979)	Brazil (Amazonas, Pará)
	<i>Ideoblothrus colombiae</i> Muchmore, 1982	Colombia
	<i>Ideoblothrus costaricensis</i> (Beier, 1931)	Costa Rica, Ecuador
	<i>Ideoblothrus fenestratus</i> (Beier, 1955)	Peru
	<i>Ideoblothrus kochalkai</i> Muchmore, 1982	Colombia
	<i>Ideoblothrus levipalpus</i> Mahnert, 1985	Brazil (Amazonas)
	<i>Ideoblothrus paraensis</i> Mahnert, 1985	Brazil (Pará)
	<i>Ideoblothrus tenuis</i> Mahnert, 1985	Brazil (Amazonas)

MZ16 microscope; multiple images were combined using Auto-Montage by Syncroscopy (version 4.01).

We have directly compared the five new species of *Ideoblothrus* with the published descriptions of all previously known members of the genus to ensure that they have not been previously named. In the diagnoses, however, we have limited our comparisons to the previously name Australasian species, utilising the following descriptions: Daday (1897),

Figures 1, 2. Known distributions of *Ideoblothrus* species in Western Australia and Northern Territory.

Morikawa (1963), and Beier (1965) for *I. bipectinatum* (Daday, 1897); Beier (1957) for *I. palauensis* (Beier, 1957); Beier (1964) for *I. pugil* (Beier, 1964); Beier (1966) for *I. pugil robustus* (Beier, 1966); Beier (1973) for *I. ceylonicus* (Beier, 1973); and Harvey (1991b) for *I. papillon* Harvey, 1991 and *I. woodi* Harvey, 1991.

Family SYARINIDAE Chamberlin
Subfamily IDEOBISIINAE Banks
Ideoblothrus Balzan

Ideobisium (*Ideoblothrus*) Balzan 1892, p 541.

Pachychitra Chamberlin 1938, p 111; Hoff 1945, p 1; Hoff 1964, p 7–8; Muchmore 1979, p 195 (synonymised by Muchmore 1982, p 207).

Ideoblothrus Balzan: Muchmore 1982, p 207; Harvey 1991a, p 421; Harvey 1991b, p 495.

Type species. Ideobisium (*Ideoblothrus*): *Ideobisium* (*Ideoblothrus*) *similis* Balzan, 1892, by subsequent designation of Muchmore (1982).

Pachychitra: *Pachychitra maya* Chamberlin, 1938, by original designation.

Diagnosis

Species of *Ideoblothrus* can be distinguished from the morphologically similar genus *Ideobisium* by the following features, following Muchmore (1982): eyes completely absent (two pairs of eyes present in *Ideobisium*); pleural membrane granulo-striate near cephalothorax, remainder longitudinally striate (Muchmore stated that *Ideoblothrus* has entirely smooth pleural membranes) (granulate anteriorly, becoming longitudinally granulo-striate or smoothly striate posteriorly in *Ideobisium*); trichobothria *ib*, *isb*, *esb*, and *eb* positioned in an oblique row near base of fixed finger (positioned near middle of hand and *isb* on external side of hand near base of fixed finger in *Ideobisium*); pedipalpal segments mostly smooth but with fine granules on flexor side of femur, patella, and chelal hand (entirely smooth in *Ideobisium*); suture between femur IV and patella IV not indented on dorsal margin (indented in *Ideobisium*); arolium as long as or slightly longer than claws (arolium shorter than claws in *Ideobisium*); internal genital setae of the male arranged in two triangular groups of three (two parallel longitudinal rows of three in *Ideobisium*); median genital sac of the male genital system of *Ideoblothrus* species composed of single sac (distinctly bipartite in *Ideobisium*).

Ideoblothrus is also very similar to *Microblothrus* Mahnert, 1985, known by *M. tridens* Mahnert, 1985 from Amazonian Brazil, which was distinguished from *Ideoblothrus* by the lack of trichobothria *isb* and *sb*.

Ideoblothrus can be distinguished from the other genera currently included in the Syarinidae as follows. *Syarinus* Chamberlin, 1930 and *Anyrsius* Harvey, 1998 (Syarininae) possess a much-reduced femur of legs III and IV, and the suture between the femur and patella is strongly oblique (femur not reduced in size, and suture slightly oblique to long axis in *Ideoblothrus*). Trichobothrium *ib* is located on the chelal fingers in *Ideoblothrus*, *Microblothrus*, but is situated on the dorsal margin of the chelal hand basal to the level of *eb* and *esb* in *Aglaochitra* Chamberlin, 1952, *Alocobisium* Beier, 1952, *Chitrella* Beier, 1932, *Chitrellina* Muchmore, 1996, *Hadoblothrus* Beier, 1952, *Microcreagrella* Beier, 1961, *Microcreagrina* Beier, 1961, *Pseudoblothrus* Beier, 1931, and *Nannobisium* Beier, 1931.

Description

The description presented by Muchmore (1982) requires no modification except for:

Pedipalp: robust, segments usually less than 3.0 times longer than broad, but more than 3.0 times longer than broad in troglobitic species.

Pleural membrane: finely, longitudinally striate, but occasionally granulo-striate within cephalothorax.

Male genitalia: median genital sac composed of single ovoid sac.

Remarks

Our observations on the male genital system of several different syarinids indicate that there is substantial variation in the morphology of the median genital sac. Species of *Ideoblothrus* bear a single ovoid median genital sac, which we have observed in several Australian species, *I. woodi* (Harvey 1991b, Figure 33), *I. papillon* (Harvey 1991b), *I. pisolitus*, *I. nesotymbus*, *I. milikapiti*, and *I. descartes*, as well as *I. sp.* from Colombia (WAM T65473). This morphology contrasts strongly with that found in species of *Ideobisium* which have a strongly bipartite median genital sac, confirmed in *I. puertoricense* Muchmore, 1982 from Puerto Rico (WAM T68624) and *I. sp.* from New Caledonia (WAM, not registered). The bipartite morphology also occurs in several other syarinids, including *Aglaochitra* Chamberlin, 1952, *Pseudoblothrus* Beier, 1931, and *Chitrella* Beier, 1932 (e.g. Chamberlin 1952; Vachon 1952, 1954, 1969; Mahnert 1980, 1990; Inzaghi 1983; M. S. Harvey, unpublished data).

Ideoblothrus papillon Harvey

Ideoblothrus papillon Harvey 1991b, p 498–500, Figures 34–41; Harvey *et al.* 1993, p 131, 134.

Material examined

Holotype: ♂, Australia: Western Australia: Papillon Cave, C-15, Cape Range peninsula, 22°12'48"S, 113°58'32"E, 25 June 1989, under stone in dark zone, M. S. Harvey (WAM 91/288). Paratype: Australia: Western Australia: 1♀, Papillon Cave, C-15, Cape Range peninsula, 22°12'48"S, 113°58'32"E, 16 July 1989, W. F. Humphreys (WAM 91/289).

Other material. Australia: Western Australia: 1♀, Papillon Cave, C-15, Cape Range peninsula, 22°12'48"S, 113°58'32"E, 11 August 1999, R. D. Brooks (WAM T70783); 1♀, Papillon Cave, C-15, Cape Range peninsula, 22°12'48"S, 113°58'32"E, 11 August 1999, W. F. Humphreys (WAM T70784).

Remarks

This species is known only from Papillon Cave, C-15, situated on Cape Range peninsula.

Ideoblothrus woodi Harvey

(Figures 5, 6)

Ideoblothrus woodi Harvey 1991b, p 497–498, Figures 27–33, 40–41; Harvey *et al.* 1993, p 131, 134.

Material examined

Holotype: ♂, Australia: Western Australia: Cave C-167, Cape Range peninsula, 22°09'09"S, 113°59'39"E, 20 June 1989, under stone in dark zone, M. S. Harvey

(WAM 91/286). Paratype: Australia: Western Australia: 1♀, collected with holotype (WAM 91/287).

Other material. Australia: Western Australia: one deutonymph, Cave C-167, Cape Range peninsula, 22°09'09"S, 113°59'39"E, 21 July 1991, R. D. Brooks (WAM T71323); one protonymph, Cave C-167, Cape Range peninsula, 22°09'09"S, 113°59'39"E, 30 July 1991, R. D. Brooks (WAM T23723).

Description

Deutonymph. Colour: generally pale, pedipalps pale yellow orange.

Chelicera: with five setae on hand, all setae acuminate; movable finger with one sub-distal seta; flagellum of five blades, distal blade broadened and finely denticulate; serrula exterior with ca 17 blades.

Pedipalp: trochanter 1.57, femur 2.77, patella 2.31, chela (with pedicel) 3.21, chela (without pedicel) 3.03, hand 1.49 times longer than broad, movable finger 1.11 times longer than hand. Fixed chelal finger with six trichobothria, movable chelal finger with two trichobothria (Figure 5): *esb*, *isb*, *sb*, and *st* absent; *eb* situated at base of fixed finger; *ib* situated on dorso-distal surface of hand; *ist* and *est* situated close together; *it* situated distally to *est* and *ist*; *et* situated sub-distally; *b* situated sub-basally; *t* situated sub-medially; *t* slightly shortened, lanceolate, and bent backward. Venom apparatus only present in fixed chelal finger. Chelal teeth: fixed finger with 22 slightly retrorse teeth, tooth row ending just distal to *it*; movable finger with 32 rounded teeth, tooth row extending midway between *t* and *b*.

Cephalothorax: carapace 1.11 times longer than broad; without eyes; with 20 setae, arranged 4: 4: 4: 4: 4.

Abdomen: pleural membrane granulo-striate near cephalothorax, remainder longitudinally striate, without setae. Tergites and sternites undivided.

Dimensions (mm) of deutonymph WAM T71323: body length 1.184. Carapace 0.354/0.320. Chelicera 0.192/0.090, movable finger 0.138. Pedipalps: trochanter 0.141/0.090, femur 0.282/0.102, patella 0.275/0.119, chela (with pedicel) 0.481/0.150, chela (without pedicel) 0.454, hand length 0.224, movable finger length 0.249.

Protonymph. Colour: generally pale, pedipalps very pale yellow.

Chelicera: with four setae on hand, all setae acuminate; movable finger without sub-distal seta; flagellum not visible in preparation; serrula exterior with ca 14 blades.

Pedipalp: trochanter 1.35, femur 2.45, patella 2.17, chela (with pedicel) 3.35, chela (without pedicel) 3.17, hand 1.53 times longer than broad, movable finger 1.13 times longer than hand. Fixed chelal finger with three trichobothria, movable chelal finger with one trichobothrium (Figure 6): *isb*, *esb*, *sb*, *st*, *est*, *ist*, *b*, and *it* absent; *eb* situated at base of fixed finger; *ib* situated on dorso-distal surface of hand; *et* situated sub-distally; *t* situated medially on movable finger; *t* bent backwards, but not lanceolate. Venom apparatus only present in fixed chelal finger. Chelal teeth: fixed finger with 12 slightly retrorse teeth, tooth row ending distally to *et*; movable finger with 22 rounded teeth, tooth row extending to *t*.

Cephalothorax: carapace 1.26 times longer than broad; without eyes; with 16 setae, arranged 4:4:4:2:2.

Abdomen: pleural membrane granulo-striate near cephalothorax, remainder longitudinally striate, without setae. Tergites and sternites undivided.

Dimensions (mm) of protonymph WAM T23723: body length 1.168. Carapace 0.299/0.237. Chelicera 0.147/0.075, movable finger 0.106. Pedipalps: trochanter 0.112/0.083, femur 0.189/0.077, patella 0.195/0.090, chela (with pedicel) 0.378/0.113, chela (without pedicel) 0.358, hand length 0.173, movable finger length 0.195.

Remarks

This species is known only from Cave C-167 situated on Cape Range peninsula. Due to a typographical error, Harvey (1991b) incorrectly reported that the width of the chela in the male of *I. woodi* is 0.21 mm; the correct width is 0.27 mm.

Very few protonymphs of the family Syarinidae have been described. The protonymphs of *Ideobisum caecum* Mahnert, 1979 (now *Ideoblothrus caecus*) from Brazil (Mahnert 1979) and *Anysrius chamberlini* Harvey, 1998 from Tasmania (Harvey 1998) were described and the trichobothrial pattern illustrated, but neither recorded or illustrated the morphology of trichobothrium *t*. Mahnert (1985b) illustrated the trichobothrial pattern of *Microblothrus tridens* Mahnert, 1985 from Brazil and showed that trichobothrium *t* is distinctly lanceolate. The protonymph of *I. woodi* has an acuminate trichobothrium *t*, quite unlike the morphology of the deutonymph and adults. Whether this pattern is more widespread throughout the family remains to be seen through the examination of more protonymphs.

Ideoblothrus pisolitus sp. nov.

(Figures 3, 8–21)

Material examined

Holotype: ♂, Australia: Western Australia: Mesa B, 38.1 km W of Pannawonica, site MEBRC0021 (T3-28), 21°39'36"S, 115°57'20"E, March to May 2005, litter trap, 30 m depth, M. Greenham, D. Kamien, and L. Mould (WAM T65783). Paratypes: Australia: Western Australia: 1♀, same data as holotype (WAM T68194); 2♂, same data as holotype (WAM T65786, T65787); all from Mesa B, 37.9 km W of Pannawonica: 1♀, site MEBRC0016 (T1-23), 21°39'49"S, 115°57'27"E, March to May 2005, litter trap, 10 m depth, M. Greenham, D. Kamien, and L. Mould (WAM T65785); one tritonymph, site MEBRC0015 (T4-29), 21°39'52"S, 115°57'27"E, March to May 2005, litter trap, 40 m depth, M. Greenham, D. Kamien, and L. Mould (WAM T65784).

Etymology

The specific epithet refers to the presence of this species within Mesa B, which is formed from pisolite.

Diagnosis

Ideoblothrus pisolitus differs from all other species of the genus by the noticeably more slender pedipalpal patella and chela, which are 2.22–2.26 (♂), 2.08–2.27 (♀) and chela (with pedicel) 3.36–3.47 (♂), 3.07 (♀) times longer than broad, respectively. In addition, *I. pisolitus* has only four setae in the intermediate row of the carapace, which are situated near the lateral margins of the carapace.

Figures 3, 4. (3) *Ideoblothrus pisolitus* sp. nov., paratype ♀ (WAM T65785). (4) *I. nesotymbus* sp. nov., paratype ♀ (WAM T75213).

Description

Adults. Colour: carapace and pedipalps reddish brown, abdomen and legs pale tan.

Chelicera (Figure 17): five setae on hand, all setae acuminate, *is*, *ls*, *sbs*, and *bs* long, *es* very short; movable finger with one sub-distal seta; fixed finger with ca eight teeth; movable finger with ca seven teeth; with two dorsal lyrifissures and one ventral lyrifissure; galea straight and extends past tip of finger but not extending to tip of galeal seta; flagellum (Figure 18) of five blades, distal blade broadened and finely denticulate; serrula exterior with 23–25 (♂), 25–27 (♀) blades.

Pedipalp (Figure 9): internal margins of trochanter, femur, patella, and chela sparsely granulate; setae on internal margins very long and acicular; trochanter without tubercles; trochanter 1.82–2.04 (♂), 1.79–1.99 (♀), femur 3.09–3.24 (♂), 2.95–3.07 (♀), patella 2.22–2.26 (♂), 2.08–2.27 (♀), chela (with pedicel) 3.36–3.47 (♂), 3.07 (♀), chela (without pedicel) 3.13–3.25 (♂), 2.86–2.90 (♀), hand 1.44–1.60 (♂), 1.59–1.61 (♀) times longer than broad; movable finger 1.04–1.16 (♂), 0.79–0.84 (♀) times longer than hand. Femur without tactile setae; without basal projection. Patella with two lyrifissures situated dorsally near pedicel. Fixed chelal finger with eight trichobothria, movable chelal finger with four trichobothria (Figure 10): *eb* and *esb* at base of finger, *isb* situated near *ib*; *est* situated near *ist*; *it* distal to *est*; *et* sub-distal; microsetae (chemosensory setae) absent on both fingers; trichobothria *b* of movable finger situated basally; *sb*, *st*, and *t* situated medially, close to each other; *t* slightly shortened, lanceolate, and bent backward. Venom apparatus present only in fixed chelal finger, venom duct very short, nodus ramosus inflated. Chelal teeth of both fingers (Figure 10) rounded; fixed finger with 40 (♂), 38 (♀) teeth; movable finger with

50 (♂), 52 (♀) teeth; accessory teeth absent. External and internal chelal condyles small and rounded.

Cephalothorax: carapace (Figure 8) 1.34–1.44 (♂), 1.35–1.36 (♀) times longer than broad; sub-rectangular; without any traces of eyes; epistome present; with 21 setae arranged 4: 4: 4: 4: 5; without furrows; with five pairs of small lyrifissures, first and second pairs placed near anterior margin, third pair placed sub-medially, fourth and fifth pairs placed near setae on posterior row. Manducatory process (Figure 14) with one long distal and one long sub-distal seta, without sub-oral seta; remainder of maxilla with eight setae. Chaetotaxy of coxae I–IV: 5–6: 5: 3–4: 6 (♂), 6: 5: 3–4: 6 (♀). Posterior section of coxae II slightly overlapping anterior section of coxae III (Figure 14).

Abdomen: pleural membrane granulo-striate near cephalothorax, remainder longitudinally striate (Figures 14–16), without setae. Tergites and sternites undivided. Tergal chaetotaxy: holotype ♂, 6: 7: 7: 9: 8: 8: 9: 9: 9: 7: 4: 2; paratype ♀ (WAM T68194), 6: 7: 8: 9: 9: 9: 9: 9: 9: 7: 7: 2; setae uniseriate and acuminate. Sternal chaetotaxy: holotype ♂, 9: (3) 10 [3+3] (2): (2) 8 (2): 10: 11: 11: 11: 10: 10: 4: 2; paratype ♀ (WAM T68194), 8: (3) 6 (3): (2) 8 (2): 11: 12: 11: 11: 11: 10: 4: 2; setae on sternite II of ♀ small; setae uniseriate and acuminate; without median glandular setae; anus not surrounded by sternite XI.

Genitalia: male genitalia with small rounded ejaculatory canal atrium; moderately sized lateral genital sacs and an undivided, enlarged median genital sac (Figure 19); male internal genital setae arranged in two triangular groups of three; pair of setae surrounding an antero-median notch of the posterior genital operculum; single, ovoid median genital sac. Female genitalia (Figure 21) with single, broad median cribriform plate, and one pair of slender lateral median cribriform plates.

Legs (Figures 12, 13): femora I and II longer than patellae I and II; femora I and II with one transverse lyrifissure situated sub-distally; femur + patella of leg IV 3.74 (♂), 3.88 (♀) times longer than broad; legs III and IV with articulation between femur and patella segments slightly oblique; tibiae III and IV with medial tactile seta; metatarsi III and IV with sub-basal tactile seta; diplotarsate, all legs with tarsus longer than metatarsus; subterminal tarsal setae distally serrate; arolia same length as claws, not divided; claws simple.

Dimensions (mm) of ♂ holotype WAM T65783 (with other males in parentheses where relevant): body length 2.25 (1.49–1.72). Pedipalps: trochanter 0.230/0.118 (0.211–0.233/0.114–0.116), femur 0.429/0.134 (0.408–0.424/0.131–0.132), patella 0.430/0.190 (0.392–0.398/0.177–0.179), chela (with pedicel) 0.739/0.220 (0.720–0.733/0.211–0.214), chela (without pedicel) 0.688 (0.670–0.685), hand length 0.352 (0.309–0.333), movable finger length 0.365 (0.349–0.357). Chelicera 0.243/0.100 (0.240–0.256/0.102–0.104), movable finger length 0.179 (0.177–0.192). Carapace 0.496/0.371 (0.467–0.494/0.333–0.342). Leg I: femur 0.170/0.079, patella 0.150/0.074, tibia 0.227/0.049, metatarsus 0.086/0.035, tarsus 0.154/0.031. Leg IV: femur + patella 0.389/0.104, tibia 0.321/0.058, metatarsus 0.096/0.045, tarsus 0.148/0.039.

Dimensions (mm) of ♀ paratype WAM T68194 (♀ paratype WAM T65785): body length 2.98 (2.45). Pedipalps: trochanter 0.321/0.179 (0.339/0.170), femur 0.567/0.192 (0.590/0.192), patella 0.611/0.269 (0.571/0.275), chela (with pedicel) 1.027/0.335 (1.059/0.345), chela (without pedicel) 0.957 (1.000), hand length 0.531 (0.554), movable finger length 0.446 (0.436). Chelicera 0.333/0.156 (0.340/0.150), movable finger length 0.260 (0.261). Carapace 0.670/0.493 (0.674/0.499). Leg I: femur 0.234/0.104, patella 0.191/0.094, tibia 0.318/0.064, metatarsus 0.110/0.043, tarsus 0.182/

0.033. Leg IV: femur + patella 0.540/0.139, tibia 0.447/0.081, metatarsus 0.118/0.054, tarsus 0.205/0.045.

Tritonymph. Morphology generally as in adults.

Colour: all sclerotised portions pale red-orange, rest of body pale yellow-brown.

Chelicera: with five setae on hand, all setae acuminate; movable finger one sub-distal seta; galea straight and extends past tip of finger but not extending to tip of galeal seta; flagellum of five blades, distal blade broadened and finely denticulate; serrula exterior with ca 22 blades.

Pedipalp: internal margins of femur, patella, and chela with light granulations, setae on internal margins very long and acicular; femur without tactile setae; trochanter 2.04, femur 3.06, patella 2.19, chela (with pedicel) 3.17, chela (without pedicel) 2.94, hand 1.58 times longer than broad, movable finger 0.91 times longer than hand. Fixed chelal finger with seven trichobothria, movable chelal finger with three trichobothria (Figure 11): *isb* and *sb* absent; *eb* and *esb* situated at base of fixed finger; *ib* situated on dorso-distal surface of hand; *ist* and *est* situated close together, *et* situated sub-distally; *b* situated sub-basally; *st* and *t* situated sub-distally, *t* lanceolate, slightly shortened, and bent backward. Venom apparatus only present in fixed chelal finger, venom duct very short, nodus ramosus inflated. Chelal teeth: fixed finger with ca 29 rounded teeth; movable finger with ca 38 rounded teeth.

Cephalothorax: carapace 1.38 times longer than broad; without eyes; epistome absent; with 23 setae, arranged 4: 4: 4: 4: 2: 5.

Abdomen: pleural membrane granulo-striate near cephalothorax, remainder longitudinally striate, without setae. Tergites and sternites undivided. Tergal chaetotaxy: 6: 7: 6: 8: 8: 8: 9: 9: 8: 7: 6: 2. Sternal chaetotaxy: 0: (2) 4 (2): (2) 7 (2): 9: 9: 9: 8: 7: 7: 4: 2.

Legs: femur I longer than patella I; metatarsi and tarsi not fused; arolium same length as claws, not divided.

Dimensions (mm) of tritonymph paratype WAM T65784: body length 1.750. Carapace 0.481/0.349. Pedipalps: trochanter 0.226/0.111, femur 0.398/0.130, patella 0.372/0.170, chela (with pedicel) 0.669/0.211, chela (without pedicel) 0.621, hand length 0.333, movable finger length 0.304.

Remarks

Ideoblothrus pisolitus has only been found within one iron-bearing pisolite mesa, approximately 173 ha in area, in the Pannawonica region of Western Australia. Three males, two females, and one tritonymph were collected from three boreholes using leaf-litter baited traps placed at depths of 10–40 m.

Ideoblothrus sp. "Mesa A" (Figure 7)

Material examined

Australia: Western Australia: one deutonymph, Mesa A, ca 45 km W of Pannawonica, borehole MEARC2856, 21°39'59"S, 115°53'03"E, 25 July to 8 September 2005, T. Williams and D. Kamien (WAM T66073).

Figures 5–7. *Ideoblothrus* spp., left chelae, lateral. (5) *I. woodi* Harvey, deutonymph from Cave C-167 (WAM T71323). (6) *I. woodi* Harvey, protonymph from Cave C-167 (WAM T23723). (7) *I.* sp. “Mesa A”, deutonymph from Mesa A, Western Australia (WAM T66073). Scale bars: 0.2 mm.

Description

Deutonymph. Colour: generally pale, pedipalps and chelicera very pale yellow orange.

Chelicera: with five setae on hand, all setae acuminate; movable finger one sub-distal seta; flagellum of five blades, distal blade broadened and finely denticulate; serrula exterior with ca 17 blades.

Pedipalp: trochanter 1.60, femur 2.93, patella 2.29, chela (with pedicel) 3.32, chela (without pedicel) 3.12, hand 1.58 times longer than broad, movable finger 1.03 times longer than hand. Fixed chelal finger with six trichobothria, movable chelal finger with two trichobothria (Figure 7): *isb*, *sb*, *esb*, and *st* absent; *eb* situated at base of fixed finger; *ib* situated on dorso-distal surface of hand; *ist* and *est* situated close together; *it* situated distally to *est* and *ist*; *et* situated sub-distally; *b* situated sub-basally; *st* situated sub-medially. Venom apparatus only present in fixed chelal finger. Chelal teeth: fixed finger with 18 rounded teeth, tooth row ending basally to *et*; movable finger with 27 rounded teeth, tooth row extending midway between *st* and *b*.

Cephalothorax: carapace 1.42 times longer than broad; without eyes; with 20 setae, arranged 4: 4: 4: 3: 5.

Abdomen: pleural membrane granulo-striate near cephalothorax, remainder longitudinally striate, without setae. Tergites and sternites undivided.

Dimensions (mm) of deutonymph WAM T66073: carapace 0.326/0.230. Chelicera 0.177/0.090, movable finger 0.125. Pedipalps: trochanter 0.150/0.094, femur 0.272/0.093,

patella 0.240/0.105, chela (with pedicel) 0.458/0.138, chela (without pedicel) 0.430, hand length 0.218, movable finger length 0.224.

Remarks

A single deutonymph was collected from Mesa A situated approximately 7.6 km from Mesa B, the only known location of *I. pisolitus*. Due to the lack of adult specimens we cannot be sure of its identity. However, it is possible that it represents a distinct taxon, making it consistent with patterns found in other troglobitic organisms present within these pisolithic formations. In particular, molecular studies have shown Mesa A and Mesa B to contain distinct species of the schizomid genus *Draculoides* (O. Berry, unpublished data).

Ideoblothrus nesotymbus sp. nov.

(Figures 4, 22–28)

Material examined

Holotype: ♂, Australia: Western Australia: Barrow Island, 5.8 km NW of Chevron Texaco Camp, borehole S2, 20°46'33"S, 115°26'53"E, 8 March to 20 April 2006, litter trap, 7 m depth, L. Mould and L. Beesley (WAM T75203). Paratypes: Australia: Western Australia: Barrow Island: 1♀, 5.8 km NW of Chevron Texaco Camp, borehole S2, 20°46'33"S, 115°26'53"E, 31 April to 18 July 2006, litter trap, 14 m depth, L. Mould and K. Edward (WAM T75213); 1♀, 4.3 km N of Chevron Texaco Camp, borehole B19, 20°47'23"S, 115°26'54"E, 28 February to 18 April 2005, litter trap, 6 m depth, G. Humphreys and L. Mould (WAM T66019); 1♀, Barrow Island, 7.1 km NW of Chevron Texaco Camp, borehole BMW4, 20°47'02"S, 115°23'39"E, 7 March 2006, litter trap, L. Mould and L. Beesley (WAM T71969).

Etymology

The specific epithet refers to the occurrence of this subterranean species on Barrow Island (*nesos*, Greek, island; and *tymbos*, Greek, tomb).

Diagnosis

Ideoblothrus nesotymbus is substantially larger than most other Australasian species [e.g. pedipalpal patella length 0.45–0.50 mm (♂), 0.53–0.56 mm (♀)], including *I. descartes*, *I. westi*, *I. milikapiti*, *I. pugil*, *I. ceylonicus*, *I. palauensis*, and *I. bipectinatus* which are all substantially smaller (e.g. pedipalpal patella length less than 0.33 mm). *Ideoblothrus nesotymbus* differs from *I. pisolitus* in the shape of the pedipalpal chela which is noticeably more slender in *I. pisolitus*. It differs from *I. pugil robustus* in being slightly larger [e.g. pedipalpal patella length 0.42 mm (♀)]. It differs from *I. woodi* by the length of the male galea, which is relatively long in *I. nesotymbus* and much reduced in *I. woodi*. It differs from *I. papillon* by the slightly less slender pedipalpal chela, which is 2.59 (♂), 2.69–2.92 (♀) times longer than broad in *I. nesotymbus* and 2.83 (♂), 3.00 (♀) times longer than broad in *I. papillon*.

Figures 8–13. *Ideoblothrus pisolitus* sp. nov., holotype ♂ unless otherwise stated. (8) Carapace. (9) Right pedipalp, dorsal. (10) Left chela, lateral. (11) Left chela, lateral, paratype tritonymph (WAM T65784). (12) Leg I. (13) Leg IV. Scale bars: 0.2 mm (8, 10–13); 0.5 mm (9).

Description

Adults. Colour: carapace and pedipalps reddish brown, chelicera and coxae orange, legs and abdomen pale tan.

Chelicera: five setae on hand, all setae acuminate, *is*, *ls*, *sbs*, and *bs* long, *es* very short; movable finger with one sub-distal seta; fixed finger with ca 7 (♂), 9–14 (♀) teeth; movable finger with ca 8 (♂), 7–8 (♀) teeth; with two dorsal lyrifissures and one ventral lyrifissure; galea of male straight, extending to tip of fixed finger; galea of female slightly curved, extending past tip of finger but not to tip of galeal seta; flagellum of five blades, distal blade broadened and finely denticulate; serrula exterior with 30 blades.

Figures 14–18. *Ideoblothrus pisolitus* sp. nov., holotype ♂. (14) Coxal region, ventral. (15) Detail of pleural membrane, near pedipalpal coxae. (16) Detail of pleural membrane, near sternite IV. (17) Left chelicera, dorsal. (18) Flagellum. Scale bars: 0.2 mm (14); 0.1 mm (15–18).

Pedipalp (Figure 23): mostly smooth, with only the internal margins of trochanter and femur sparsely granulate; setae on internal margins long and acicular; trochanter without tubercles; trochanter 1.64 (♂), 1.49–2.09 (♀), femur 2.89 (♂), 2.84–3.06 (♀), patella 2.00 (♂), 1.93–2.06 (♀), chela (with pedicel) 2.81 (♂), 2.83–3.11 (♀), chela (without pedicel) 2.59 (♂), 2.69–2.93 (♀), hand 1.38 (♂), 1.49–1.58 (♀) times longer than broad; movable finger 0.90 (♂), 0.78–0.91 (♀) times longer than hand. Femur without tactile setae; without basal projection. Patella with three lyrifissures, two situated dorsally near pedicel, and one situated distally. Fixed chelal finger with eight trichobothria, movable chelal finger with four trichobothria (Figure 24): *eb*, *esb*, *ib*, and *isb* forming an oblique row on baso-lateral margin of fixed finger; *est* situated near *ist*; *it* situated medially, distal to *est* and *ist*; *et* sub-distal; seven small lanceolate setae present on fixed chelal finger; microsetae (chemosensory setae) absent on both fingers; trichobothria *b* of movable finger situated basally; *sb*, *st*, and *t* situated medially, very close to each other; *t* slightly shortened, lanceolate, and bent backward. Venom apparatus present only in fixed chelal finger, venom duct very short, nodus ramosus inflated. Fixed finger with 43 (♂), 36–48 (♀) slightly retrorse teeth, tooth row terminating basally to *est* (Figure 25); movable finger with 50 (♂), 48–52 (♀) rounded

Figures 19–21. *Ideoblothrus pisolitus* sp. nov., holotype ♂ unless otherwise stated. (19) Male genitalia, ventral. (20) Male genital opercula, ventral. (21) Female genitalia, paratype ♀ (WAM T68194). Scale bars: 0.1 mm.

teeth, extending nearly to full length of finger (Figure 26); accessory teeth absent. External and internal chelal condyles small and rounded.

Cephalothorax: carapace (Figure 22) 1.21 (♂), 1.27–1.35 (♀) times longer than broad; sub-rectangular; without any traces of eyes; epistome small; with 25 (♂), 21–25 (♀) setae arranged 4: 4: 4: 6: 7 (♂), 4: 4: 4: 4–7: 5–6 (♀); without furrows; with five pairs of small lyrifissures, first and second pairs placed near anterior margin, third pair placed sub-medially, fourth and fifth pairs placed near setae on posterior row. Manducatory process with one long distal and one long sub-distal seta, without sub-oral seta (Figure 27); remainder of maxilla with eight setae. Chaetotaxy of coxae I–IV: 6: 5: 4: 5 (♂), 6: 6: 4: 6 (♀). Posterior section of coxae II slightly overlapping anterior section of coxae III (Figure 27).

Abdomen: pleural membrane granulo-striate near cephalothorax, remainder longitudinally striate, without setae. Tergites and sternites undivided. Tergal chaetotaxy: holotype ♂, 6: 6: 8: 9: 9: 9: 9: 9: 7: 4: 2; paratype ♀ (WAM T66019), 6: 6: 8: 8: 9: 8: 8: 8: 8: 7: 4: 2; setae uniseriate and acuminate. Sternal chaetotaxy: holotype ♂, 9: (?) 10 [4+3] (2): (?) 7 (3): 9: 9: 9: 9: 10: 9: 4: 2; paratype ♀ (WAM T66019), 9: (3) 8 (3): (2) 7 (2): 9: 11: 11: 11: 11: 9: 6: 2; setae on sternite II of ♀ small; setae uniseriate and acuminate; without median glandular setae; anus not surrounded by sternite XI.

Genitalia: male genitalia, identical to *I. pisolitus*, apart from internal genital setae arranged in a triangular group of three setae and a group of four setae: pair of setae on edge

Figures 22–28. *Ideoblothrus nesotymbus* sp. nov., holotype ♂ unless otherwise stated. (22) Carapace, paratype ♀ (WAM T66019). (23) Right pedipalp, dorsal. (24) Left chela, lateral. (25) Detail of left fixed chelal finger, lateral. (26) Detail of left movable chelal finger, lateral. (27) Coxal region, ventral, paratype ♀ (WAM T66019). (28) Female genitalia, paratype ♀ (WAM T75213). Scale bars: 0.2 mm (22, 24); 0.5 mm (23, 27); 0.1 mm (25, 26, 28).

of sternite III surrounding the antero-median notch of posterior genital operculum. Female genitalia with single, broad median cribriform plate, and one pair of small lateral median cribriform plates (Figure 28).

Legs: femora I and II longer than patellae I and II; femora I and II with one transverse lyrifissure situated sub-distally; femur + patella of leg IV 2.68 (♂), 2.98 (♀) times longer than broad; legs III and IV with articulation between femur and patella segments slightly oblique; tibiae III and IV with medial tactile seta; metatarsi III and IV with sub-basal tactile seta; diplotarsate, all legs with tarsus longer than metatarsus; subterminal tarsal setae distally serrate; arolia same length as claws, not divided; claws simple.

Dimensions (mm) of ♂ holotype WAM T75203: body length 1.35. Pedipalps: trochanter 0.263/0.160, femur 0.474/0.164, patella 0.448/0.224, chela (with pedicel) 0.805/0.287, chela (without pedicel) 0.744, hand length 0.397, movable finger length 0.358. Chelicera 0.278/0.133, movable finger length 0.221. Carapace 0.512/0.422. Leg I: femur 0.176/0.093, patella 0.175/0.088, tibia 0.213/0.058, metatarsus 0.079/0.037, tarsus 0.128/0.032. Leg IV: femur + patella 0.429/0.160, tibia 0.351/0.080, metatarsus 0.109/0.056, tarsus 0.180/0.056.

Dimensions (mm) of ♀ paratype WAM T66019 (with other females in parentheses where relevant): body length ca 1.79 (2.31). Pedipalps: trochanter 0.307/0.147 (0.281–0.346/0.189), femur 0.528/0.186 (0.563–0.627/0.192–0.205), patella 0.499/0.250 (0.525–0.557/0.255–0.288), chela (with pedicel) 0.923/0.326 (0.946–1.075/0.322–0.346), chela (without pedicel) 0.877 (0.894–1.011), hand length 0.486 (0.510–0.544), movable finger length 0.391 (0.395–0.493). Chelicera 0.318/0.147, movable finger length 0.247. Carapace ca 0.595/0.442 (0.593/0.458). Leg I: femur 0.211/0.106, patella 0.182/0.099, tibia 0.262/0.059, metatarsus 0.100/0.039, tarsus 0.181/0.032. Leg IV: femur + patella 0.477/0.160, tibia 0.384/0.081, metatarsus 0.111/0.056, tarsus 0.202/0.048.

Remarks

Ideoblothrus nesotymbus has only been found at three locations within limestone karst on Barrow Island. One male and three females were collected from boreholes using leaf-litter baited traps placed at depths of 5–46 m.

Ideoblothrus westi sp. nov. (Figures 29–35)

Material examined

Holotype: ♀, Australia: Western Australia: Fortescue River, borehole B7, in the alluvials, 21°03'17"S, 116°09'35"E, 29 March 2001, P. L. West (WAM T71319).

Etymology

This species is named for Paul West, collector of the holotype.

Diagnosis

Ideoblothrus westi is amongst the smallest species of the genus [e.g. pedipalpal patella 0.30 mm (♀)] and, amongst the Australasian species, is of similar size to *I. descartes* and *I.*

Figures 29–35. *Ideoblothrus westi* sp. nov., holotype ♀. (29) Carapace. (30) Right pedipalp, dorsal. (31) Left chela, lateral. (32) Left chelicera, dorsal. (33) Leg I. (34) Leg IV. (35) Coxal region, ventral. Scale bars: 0.2 mm (29–31, 35); 0.1 mm (32–34).

pugil (e.g. pedipalpal patella 0.30–0.32 mm). It is larger than *I. milikapiti*, *I. palauensis*, and *I. bipectinatus* (e.g. pedipalpal patella 0.20–0.22 mm). *Ideoblothrus westi* differs from similarly sized species of the genus by the shape of the pedipalpal chela, which is rather stout and the externo-basal margin of the chelal hand is distinctly angulate.

Description

Adult female. Colour: pedipalps reddish brown, legs pale yellow brown, rest of body pale yellow.

Chelicera (Figure 32): five setae on hand, all setae acuminate, *is* very long, *ls*, *sbs*, *bs*, and *es* short; movable finger with one sub-distal seta; fixed finger with ca eight teeth; movable finger with ca four teeth; with two dorsal lyrifissures and one ventral lyrifissure; galea long, slightly curved and extends to tip of galeal seta; flagellum of five blades, distal blade broadened and finely denticulate; serrula exterior with ca 15 blades.

Pedipalp (Figure 30): mostly smooth, with only the internal margins of patella and chela with sparse fine granulations; setae on internal margins very long and acicular; trochanter without tubercles; trochanter 1.80, femur 2.69, patella 2.00, chela (with pedicel) 2.60, chela (without pedicel) 2.50, hand 1.35 times longer than broad, movable finger 0.82 times longer than hand. Femur without tactile setae; without basal projection. Patella with one lyrifissure situated dorsally near pedicel. Fixed chelal finger with eight trichobothria, movable chelal finger with four trichobothria (Figure 31): *eb* and *esb* situated close together on lateral margin of hand, *isb* situated medially at base of finger, slightly basal to *ib*; *est* situated near *ist* and *it*; *et* sub-distal; single sensory pit between *sb* and *st*; microsetae (chemosensory setae) absent on both fingers; trichobothrium *b* of movable finger situated sub-basally; *sb*, *st*, and *t* situated medially, close to each other; *t* lanceolate, slightly shortened, and bent backward. Venom apparatus present only in fixed chelal finger, venom duct very short, nodus ramosus inflated. Chelal teeth of both fingers with flattened edges; fixed finger with 13 teeth, tooth row terminating slightly basal to *et*; movable finger with ca 27 teeth; accessory teeth absent. External and internal chelal condyles small and rounded.

Cephalothorax: carapace (Figure 29) 1.22 times longer than broad; sub-rectangular; without any traces of eyes; epistome very small; with 25 setae arranged 4: 4: 4: 6: 7; without furrows; with four pairs of small lyrifissures, first and second pairs placed near anterior margin, third pair placed sub-medially, and fourth pair placed near edge of posterior row. Manducatory process with one long distal and one long sub-distal seta, without sub-oral seta (Figure 35); remainder of maxilla with six setae. Chaetotaxy of coxae I–IV: 5: 4: 5: 5.

Abdomen: pleural membrane granulo-striate near cephalothorax, remainder longitudinally striate, without setae. Tergites and sternites undivided. Tergal chaetotaxy: 6: 9: 8: 8: 9: 9: 9: 9: 9: 7: 2; setae uniseriate and acuminate. Sternal chaetotaxy: 4: (1) 4 (1): (2) 6 (2): 9: 11: 11: 11: 9: 9: 4: 2; setae on sternite II of ♀ small; setae uniseriate and acuminate, without medial glandular setae; anus not surrounded by sternite XI.

Genitalia: female genitalia not visible in preparation.

Legs (Figures 33, 34): femora I and II longer than patellae I and II; femora I and II with one transverse lyrifissure situated sub-distally; femur + patella of leg IV 2.92 times longer than broad; legs III and IV with articulation between femur and patella segments slightly oblique; tibiae III and IV with one medial and one sub-distal tactile seta; metatarsi III and IV with sub-basal tactile seta; diplotarsate, all legs with tarsus longer than metatarsus; subterminal tarsal setae distally serrate; arolia slightly longer than claws, not divided; claws simple.

Dimensions (mm) of ♀ holotype WAM T71319: body length 1.883. Pedipalps: trochanter 0.167/0.093, femur 0.293/0.109, patella 0.300/0.150, chela (with pedicel) 0.492/0.189, chela (without pedicel) 0.472, hand length 0.255, movable finger length 0.208. Chelicera 0.177/0.086, movable finger length 0.137. Carapace 0.339/0.278. Leg I: femur 0.110/0.060, patella 0.096/0.058, tibia 0.130/0.040, metatarsus 0.054/0.027, tarsus

0.061/0.022. Leg IV: femur + patella 0.228/0.078, tibia 0.171/0.045, metatarsus 0.063/0.033, tarsus 0.075/0.031.

Remarks

Ideoblothrus westi is known from a single location situated in the Fortescue River in the Pilbara region of Western Australia (Figure 2).

Ideoblothrus descartes sp. nov.

(Figures 36–41)

Material examined

Holotype: ♂, Australia: Western Australia: Descartes Island, site DERT01, 14°09'50"S, 125°40'47"E, near freshwater seep, under rocks, 30 August 2002, M. S. Harvey and R. J. Teale (WAM T70785). Paratypes: Australia: Western Australia: 1♂, 2♀, same data as holotype (WAM T70787–T70789).

Etymology

The specific epithet is a noun in apposition taken from the type locality, Descartes Island. This island was originally named for the famed French philosopher, mathematician and scientist, René Descartes (1596–1650).

Diagnosis

Ideoblothrus descartes is a medium-sized species of the genus [e.g. pedipalpal patella 0.31–0.32 mm (♂), 0.30–0.31 (♀)], notably larger than *I. bipectinatus*, *I. palauensis*, and *I. milikapiti* (patella 0.20–0.22 mm), and smaller than *I. woodi*, *I. papillon*, *I. pisolitus*, *I. nesotymbus*, and *I. pugil robustus* (patella greater than 0.40 mm). It is approximately the same size as *I. pugil* [patella 0.33 mm (♂)], *I. ceylonicus* (patella 0.28–0.36 mm), and *I. westi* [patella 0.30 mm (♀)], differing from *I. pugil* by the longer chelal hand versus movable finger ratio (0.94–0.99 in *I. descartes* and 0.71 in *I. pugil*), from *I. ceylonicus* by the slightly stouter chela [chela (with pedicel) 2.61–2.68 (♂), 2.60–2.64 (♀) in *I. descartes* and 2.7–3.0 in *I. ceylonicus*] and from *I. westi* by the lack of a strongly angulate externo-basal margin of the chelal hand.

Description

Adults. Colour: pedipalps red orange, carapace, chelicera, and coxae yellow orange, rest of body pale yellow.

Chelicera: five setae on hand, all setae acuminate, *is*, *ls*, *sbs*, and *bs* long, *es* very short; movable finger with one sub-distal seta; fixed finger with ca 10 teeth; movable finger with six teeth; with two dorsal lyrifissures and one ventral lyrifissure; male galea short, only very slightly curved and not extending to tip of galeal seta; female galea long, curved and extends to tip of galeal seta; flagellum of five blades, distal blade broadened and finely denticulate; serrula exterior with 21–23 (♂), 22 (♀) blades.

Figures 36–41. *Ideoblothrus descartes* sp. nov., holotype ♂ unless otherwise stated. (36) Carapace. (37) Left pedipalp, dorsal. (38) Right chela, lateral. (39) Detail of fixed chelal finger, lateral. (40) Detail of movable chelal finger, lateral. (41) Coxal region, ventral, paratype ♂ (WAM T70787). Scale bars: 0.2 mm (36–38, 41); 0.1 mm (39, 40).

Pedipalp (Figure 37): internal margins of trochanter, femur, patella and chela with fine granulations; setae on internal margins long and acicular; trochanter without tubercles; trochanter 1.77–1.93 (♂), 1.85–1.91 (♀), femur 2.43–2.60 (♂), 2.54–2.58 (♀), patella 1.80–1.83 (♂), 1.78–1.89 (♀), chela (with pedicel) 2.61–2.68 (♂), 2.60–2.64 (♀), chela (without pedicel) 2.41–2.48 (♂), 2.46–2.50 (♀), hand 1.25–1.29 (♂), 1.26–1.28 (♀) times longer than broad; movable finger 0.94–0.99 (♂), 0.94–0.95 (♀) times longer than hand. Femur without tactile setae; without basal projection. Patella with four lyrifissures, two situated dorsally near pedicel, and two situated distally. Fixed chelal finger with eight trichobothria, movable chelal finger with four trichobothria (Figure 38): *eb*, *esb*, *isb*, and *ib* forming an oblique row on basolateral margin of fixed finger; *ist*, *est*, and *it* situated close together forming a triangle; *est* situated adjacent to *ist*; *et* sub-distal; six small lanceolate setae present on fixed chelal finger;

microsetae (chemosensory setae) absent on both fingers; trichobothrium *b* of movable finger situated sub-basally; *sb*, *st*, and *t* situated medially, close to each other; *t* lanceolate, slightly shortened, and bent backward. Venom apparatus present only in fixed chelal finger, venom duct very short, nodus ramosus inflated. Fixed finger with 23 (♂), 25 (♀) slightly retrorse teeth, only extending to level of *est* (Figure 40); movable finger with 32 (♂), 37 (♀) rounded teeth, extending nearly to full length of finger (Figure 41); accessory teeth absent. External and internal chelal condyles small and rounded.

Cephalothorax: carapace (Figure 36) 1.26–1.29 (♂), 1.29–1.32 (♀) times longer than broad; sub-rectangular; without any traces of eyes; epistome present; three specimens (including holotype ♂) with 24 setae arranged 4: 4: 6: 6, one specimen (paratype ♀) with 25 setae arranged 4: 4: 5: 6: 6; without furrows; with five pairs of small lyrifissures, first and second pairs placed near anterior margin, third pair placed sub-medially, fourth and fifth pairs placed near edge of posterior row. Manducatory process with one long distal and one long sub-distal seta, without sub-oral seta; remainder of maxilla with nine setae (Figure 41). Chaetotaxy of coxae I–IV: 6: 5: 4: 7 (♂), 6–7: 5: 5–6: 6–7 (♀).

Abdomen: pleural membrane granulo-striate near cephalothorax, remainder longitudinally striate, without setae. Tergites and sternites undivided. Tergal chaetotaxy: holotype ♂, 6: 7: 9: 9: 9: 9: 9: 9: 7: 6: 2; paratype ♀ (WAM T70789), 6: 8: 9: 9: 9: 9: 9: 9: 7: 7: 2; setae uniseriate and acuminate. Sternal chaetotaxy: holotype ♂, 7: (2) 10 [3+3] (2): (2) 7 (2): 11: 11: 11: 11: 11: 6: 2; paratype ♀ (WAM T70789), 6: (2) 7 (2): (2) 8 (2): 11: 12: 12: 11: 11: 11: 6: 2; setae on sternite II of ♀ small; setae uniseriate and acuminate, without medial glandular setae; anus not surrounded by sternite XI.

Genitalia: male genitalia, as far as can be discerned, identical to *I. pisolitus*; internal genital glandular setae arranged in two triangular groups of three; pair of setae on edge of sternite III surrounding the antero-median notch of the posterior genital operculum. Female genitalia with single, broad median cribriform plate, and one pair of slender lateral median cribriform plates.

Legs: femora I and II longer than patellae I and II; femora I and II with one transverse lyrifissure situated sub-distally; femur + patella of leg IV 2.64 (♂), 2.73 (♀) times longer than broad; legs III and IV with articulation between femur and patella segments slightly oblique; tibiae III and IV with medial tactile seta; metatarsi III and IV with sub-basal tactile seta; diplotarsate, all legs with tarsus longer than metatarsus; subterminal tarsal setae not distally serrate; arolia same length as claws, not divided; claws simple.

Dimensions (mm) of ♂ holotype WAM T70785 (with ♂ paratype WAM T70787 in parentheses, where applicable): body length 1.82 (1.34). Pedipalps: trochanter 0.188/0.106 (0.195/0.101), femur 0.321/0.089 (0.340/0.131), patella 0.311/0.170 (0.317/0.176), chela (with pedicel) 0.543/0.208 (0.573/0.214), chela (without pedicel) 0.502 (0.531), hand length 0.259 (0.275), movable finger length 0.256 (0.258). Chelicera 0.215/0.101, movable finger length 0.159. Carapace 0.397/0.314 (0.406/0.314). Leg I: femur 0.127/0.075, patella 0.104/0.068, tibia 0.148/0.044, metatarsus 0.058/0.032, tarsus 0.107/0.029. Leg IV: femur + patella 0.285/0.108, tibia 0.221/0.064, metatarsus 0.076/0.042, tarsus 0.118/0.038.

Dimensions (mm) of ♀ paratype WAM T70789 (with ♀ paratype WAM T70788 in parentheses, where applicable): body length 1.74 (0.173). Pedipalps: trochanter 0.195/0.102 (0.189/0.102), femur 0.330/0.130 (0.322/0.125), patella 0.302/0.170 (0.314/0.166), chela (with pedicel) 0.557/0.211 (0.554/0.213), chela (without pedicel) 0.518 (0.526), hand length 0.269 (0.269), movable finger length 0.256 (0.253). Chelicera 0.222/0.099, movable finger length 0.162. Carapace 0.422/0.321 (0.378/0.294). Leg I: femur 0.129/

0.068, patella 0.100/0.065, tibia 0.151/0.045, metatarsus 0.052/0.032, tarsus 0.096/0.028. Leg IV: femur + patella 0.284/0.104, tibia 0.222/0.062, metatarsus 0.069/0.042, tarsus 0.118/0.036.

Remarks

Ideoblothrus descartes was collected from under rocks at the base of a freshwater seep in Descartes Island, in the Kimberley region of Western Australia (Figure 1).

Ideoblothrus milikapiti sp. nov.

(Figures 42–45)

Material examined

Holotype: ♂, Australia: Northern Territory: Milikapiti, Melville Island, 11°25'S, 130°40'E, 21 December 1994, D. Hyder (WAM T70782). Paratype: Australia: Northern Territory: 1♂, same data as holotype (WAM T71390).

Etymology

The specific epithet is a noun in apposition taken from the type locality, Milikapiti on Melville Island.

Diagnosis

Ideoblothrus milikapiti is one of the smallest in the genus [e.g. pedipalpal patella length 0.20–0.21 mm (♂)] and is much smaller than most other Australasian species, including *I. pisolitus*, *I. nesotymbus*, *I. descartes*, *I. westi*, *I. papillon*, *I. woodi*, *I. ceylonicus*, *I. pugil*, and *I. pugil robustus* (all with pedipalpal patella greater than 0.30 mm). It is of similar size to *I. bipectinatus* from New Guinea [e.g. pedipalpal patella 0.21 mm (♂)], and *I. palauensis* from Palau [e.g. pedipalpal patella 0.22 mm (♂)]. It differs from *I. bipectinatus* by the shape of the pedipalpal chela (with pedicel) which is 2.84–2.94 (♂) times longer than broad, compared with 2.25 (♂) in *I. bipectinatus*. It differs from *I. palauensis* in the position of trichobothrium *ist* and *it* which are adjacent to each other in *I. palauensis* but *it* is slightly distal to *ist* in *I. milikapiti*.

Description

Adult male. Colour: pedipalps and chelicera red orange, carapace slightly orange, rest of body pale yellow.

Chelicera: five setae on hand, all setae acuminate, *is*, *ls*, *sbs*, and *bs* long, *es* very short; movable finger with one sub-distal seta; fixed finger with ca seven teeth; movable finger with ca six teeth; with two dorsal lyrifissures and one ventral lyrifissure; galea short, only very slightly curved and not extending to tip of galeal seta; flagellum of five blades, distal blade broadened and finely denticulate; serrula exterior with ca 17–18 blades.

Pedipalp (Figure 43): mostly smooth, with only the internal margins of femur, patella, and chela with fine granulations; setae on internal margins long and acicular; trochanter

Figures 42–45. *Ideoblothrus milikapiti* sp. nov., holotype ♂. (42) Carapace. (43) Right pedipalp, dorsal. (44) Left chela, lateral. (45) Coxal region, ventral. Scale bars: 0.1 mm (42, 44, 45); 0.2 mm (43).

without tubercles; trochanter 1.74–1.93, femur 2.46–2.48, patella 1.86–1.89, chela (with pedicel) 2.84–2.97, chela (without pedicel) 2.70–2.75, hand 1.35–1.38 times longer than broad, movable finger 1.03–1.04 times longer than hand. Femur without tactile setae; without basal projection. Patella with two lyrifissures situated dorsally near pedicel. Fixed chelal finger with eight trichobothria, movable chelal finger with four trichobothria (Figure 44): *eb*, *esb*, *isb*, and *ib* forming an arc on baso-lateral margin of hand; *isb* situated slightly distally to *ib*; *ist*, *est*, and *it* situated close together; *et* sub-distal; two small lanceolate setae present on fixed chelal finger, one situated near *esb* and another between *isb* and *est*;

microsetae (chemosensory setae) absent on both fingers; trichobothrium *b* of movable finger situated sub-basally; *sb*, *st*, and *t* situated medially, close to each other, *st* and *t* nearly touching and separated by less than one areolar diameter; *t* lanceolate, slightly shortened, and bent backward. Venom apparatus present only in fixed chelal finger, venom duct very short, nodus ramosus inflated. Chelal teeth of both fingers with flattened edges; fixed finger with 20–21 teeth; movable finger with ca 27–29 teeth; accessory teeth absent. External and internal chelal condyles small and rounded.

Cephalothorax: carapace (Figure 42) 1.13–1.28 times longer than broad; sub-rectangular; without any traces of eyes; epistome small; with 22 setae arranged 4: 4: 4: 4: 6; without furrows; with three pairs of small lyrifissures, first and second pairs placed near anterior margin, and third pair placed near edge of posterior row. Manducatory process with one long distal and one long sub-distal seta, without sub-oral seta; remainder of maxilla with seven setae (Figure 45). Chaetotaxy of coxae I–IV: 4–5: 4: 4: 6. Posterior section of coxae II slightly overlapping anterior section of coxae III (Figure 45).

Abdomen: pleural membrane granulo-striate near cephalothorax, remainder longitudinally striate, without setae. Tergites and sternites undivided. Tergal chaetotaxy: 6: 6–7: 7–8: 9: 9: 9: 9: 9: 7: 7: 2; setae uniseriate and acuminate. Sternal chaetotaxy: 6–8: (2) 10 [3+3] (2): (2) 7–8 (2): 10–11: 11: 11: 11: 11: 10–11: 4: 2; setae uniseriate and acuminate, without medial glandular setae; anus not surrounded by sternite XI.

Genitalia: male genitalia, as far as can be discerned, identical to *I. pisolitus*, apart from a smaller medial genital sac; pair of setae on edge of sternite III surrounding the antero-median notch of the posterior genital operculum; internal genital glandular setae arranged in two triangular groups of 3.

Legs: femora I and II longer than patellae I and II; femora I and II with one transverse lyrifissure situated sub-distally; femur + patella of leg IV 3.00 times longer than broad; legs III and IV with articulation between femur and patella segments slightly oblique; tibiae III and IV with one medial and one sub-distal tactile seta; metatarsi III and IV with medial tactile seta; diplotarsate, all legs with tarsus longer than metatarsus; subterminal tarsal setae not distally serrate; arolia slightly shorter than claws, not divided; claws simple.

Dimensions (mm) of ♂ holotype WAM T70782 (with ♂ paratype WAM T71390 in parentheses, where applicable): body length 1.04 (1.26). Pedipalps: trochanter 0.125/0.072 (0.129/0.067), femur 0.221/0.089 (0.221/0.090), patella 0.201/0.108 (0.212/0.112), chela (with pedicel) 0.371/0.125 (0.381/0.134), chela (without pedicel) 0.344 (0.362), hand length 0.172 (0.181), movable finger length 0.178 (0.187). Chelicera 0.155/0.077 (0.152/0.075), movable finger length 0.115 (0.112). Carapace 0.285/0.253 (0.285/0.222). Leg I: femur 0.088/0.051, patella 0.074/0.048, tibia 0.104/0.032, metatarsus 0.042/0.026, tarsus 0.071/0.021. Leg IV: femur + patella 0.186/0.062, tibia 0.141/0.042, metatarsus 0.053/0.030, tarsus 0.080/0.027.

Remarks

Ideoblothrus milkapiti is known from a single location on Melville Island in the Northern Territory (Figure 1).

Discussion

The description of five new species of *Ideoblothrus* from western and northern Australia brings the total number of species in this genus to 41, with seven Australian species. Further species

are known from Queensland, but have not been studied as part of this study, and they remain unnamed. *Ideoblothrus* is the largest genus of Syarinidae, and is also the third largest neobisioid genus, surpassed only by *Neobisium* with 216 species and *Roncus* with 115 species. It has the most widespread distribution of any neobisioid genus and is known from all tropical and sub-tropical regions of the world (Table I). It is difficult to postulate on historical scenarios that might have led to this cosmo-tropical distribution but the options include recent dispersal or a widespread Pangean distribution overlayed with vicariance.

Of the seven named Australian species, five occur within subterranean habitats, and all are from the semi-arid and arid zones of Western Australia. The only other subterranean species of *Ideoblothrus* occur in Mexico (Chamberlin 1938; Muchmore 1972), and all of these are no doubt the result of separate incursions into the subterranean milieu.

All of the Australian species of *Ideoblothrus* can be regarded as short-range endemic species as defined by Harvey (2002). All seven species have highly localised distributions and they occur in discontinuous habitats. *Ideoblothrus papillon* and *I. woodi* occur in caves on Cape Range Peninsula, *I. pisolitus* and *I. nesotymbus* (as well as *I. sp.* "Mesa A") occur in other subterranean cavities, and *I. descartes* and *I. milikapiti* occur in rainforest thickets. This pattern is very similar to the distribution of the other neobisioid family found throughout the region, the Hyidae (Harvey 1993, forthcoming). Epigean species of *Indohya* occur throughout the Kimberley rainforests, with troglobitic species occurring in the Cape Range Peninsula (*I. humphreysi* and *I. damocles*) and the Kimberley region (*I. napiensis* and *I. gollum*).

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