

## A new ischnurid scorpion from the Northern Territory, Australia

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**Abstract** – A new species of ischnurid scorpion is described. *Liocheles longimanus* has been collected in Oenpelli Caves and in Kakadu National Park, Northern Territory. The scorpion, found near the mouth of the cave and under a log in Kakadu, appears normally pigmented and has apparently normal eyes. The new species is compared with other *Liocheles* from Australia; a striking difference from these is the much elongated pedipalps.

### INTRODUCTION

Scorpions are well known to inhabit caves and some show marked adaptations to this habitat. The earliest record of a cave scorpion is that of *Belisarius xambeui*, described from Conat and the valley of Queillan, eastern Pyrenees, by Simon (1879), who recorded it from under stones, making no mention of caves. This species occurs within and outside caves (Auber 1959), particularly in the interstices between blocks of limestone beneath a covering of leaves and moss. Though Simon stated that *Belisarius* lacks eyes, Vachon (1944) found that two pairs of reduced lateral eyes are in fact present. The genus *Typhlochactas* was described by Mitchell (1968) from eyeless troglobitic, i.e. obligate cave dwelling, species from caves in Mexico. Other species of *Typhlochactas* have since been described both from caves (Mitchell 1972) and from forest litter (Mitchell and Peck 1977, Sissom 1988). *Vaejovis gracilis*, probably a true troglobite with reduced eyes and slender appendages, was described from Mexico by Gertsch and Soleglad (1972). Francke (1977, 1978) described troglobitic diplocentrid scorpions, also from Mexico. Of these *Diplocentrus anophthalmus* is eyeless and pale, *D. mitchelli* has markedly reduced eyes and minimal pigmentation and *D. cueva* has apparently normal lateral eyes, reduced median eyes and slightly reduced pigmentation. Francke (1982) also described the deepest living cave scorpion yet recorded, *Alacran tartarus*, from up to 812m from the cave entrance.

South America has yielded two species of the buthid genus *Tityus* from caves in Venezuela (Gonzalez-Sponga 1974). Lourenço (1981) described *T. demangei* from in and outside Los Tayos caves in Ecuador, and also a chactid, *Troglotayosicus vachoni*, which he regarded as truly troglobitic, from the same caves. The latter species lacks median eyes, but two pairs of lateral eyes are present. Lourenço and Francke (1985) review knowledge of cave scorpions up to that time, listing thirteen species

with absent or reduced eyes, indications of the troglobitic habit. Eleven of these are from Mexico, with one each from Ecuador and Sarawak; the latter, *Chaerilus chapmani* (Vachon and Lourenço 1985) is the only non-American species.

Exploration of the Australian cave fauna has included work on spiders by Main (1969, 1976), Gray (1973a,b) and Main and Gray (1985). Humphreys (1991) and colleagues have studied the fauna of caves in north-western Australia, to which he has led expeditions. These have yielded 54 species of arachnids and 10 of myriapods, including 16 fully troglobitic species, discussed and compared with those from three other Australian karst systems by Harvey *et al.* (1993). These lists include no scorpions.

During a visit to caves at Oenpelli in the Northern Territory, Dr Alice Wells and Ms Jenni Webber found two scorpions, apparently the first from Australian caves, which they sent to the author for examination. One, of the genus *Lychas*, will be described in a separate paper. The other, the subject of the present paper, belongs to the genus *Liocheles*. A second specimen of the latter has since been collected by G. Wallis from under decaying bark in Kakadu National Park.

### MATERIAL AND METHODS

Terminology follows Hjelle (1990). Both specimens, preserved in 70% ethanol, are now in the collection of the Northern Territory Museum of Arts and Sciences, Darwin (NTM).

Measurements and drawings were made with a dissecting microscope with a drawing attachment. The right hemispermatophore of the holotype was removed through a slit in the pleural membrane and drawn in two positions, (Fig 13). One, following Koch (1977), is from the ventral aspect with anterior to the bottom of the page. The second is of the hemispermatophore rotated 90 to the right.

## SYSTEMATICS

## Family Ischnuridae

## Subfamily Ischnurinae Pocock

Genus *Liocheles* Sundevall*Liocheles longimanus* sp. nov.

## Material Examined

*Holotype*

♂, Oenpelli Cave, Northern Territory, Australia, 12°32.5'S, 133°03.5'E, 21–22 July 1992, Alice Wells and Jenni Webber (NTM). This specimen, the first to be recorded, has a damaged carapace, but contained hemispermaphores.

*Paratype*

**Australia: Northern Territory:** 1♂, Kakadu National Park, 13°15.80'S, 139°39.0'E, under decaying bark in monsoon vine forest, 20 February 1994, G. Wallis (NTM). This specimen is intact, but contained no hemispermaphores.

## Diagnosis

Whole scorpion much flattened. Pedipalps elongate, length of hand and fixed finger >4.8 x hand width. Single accessory trichobothrium half way

between Eb group and Est on posterior surface of hand. Metasomal segments and vesicle without keels. Carapace and tergites grey brown, shagreened, without pits. Legs, vesicle of telson and ventral surface of mesosoma pale brown, pedipalps pale brown with much darker brown borders, granules and fingers. Median eyes small, on low ocular eminence. Three pairs of lateral eyes.

## Description (Male)

*General.* Flattened body, legs and pedipalps, pedipalps very long, stout. Metasoma short, thin. Aculeus short, strongly curved. Discrete strong setae on body, metasoma, pedipalps and legs. (Fig.1).

*Carapace.* Flat, shagreened, grey brown, with ill-defined reticulated pattern. Ocular eminence low; median eyes small, one lens diameter apart. Frontal notch pronounced, central portion horizontal. Three lateral eyes, size, ranked largest first, 2,1,3, on lateral border of frontal lobe. Supraciliary ridges low, smooth. Median longitudinal furrow shallow. Triangular depression divided. Lateral groove well defined, shallow. No keels on carapace. Lateral and posterior borders smooth, without granules or teeth.

*Tergites.* Matt shagreened surface, colour as carapace but without pattern. Without keels.

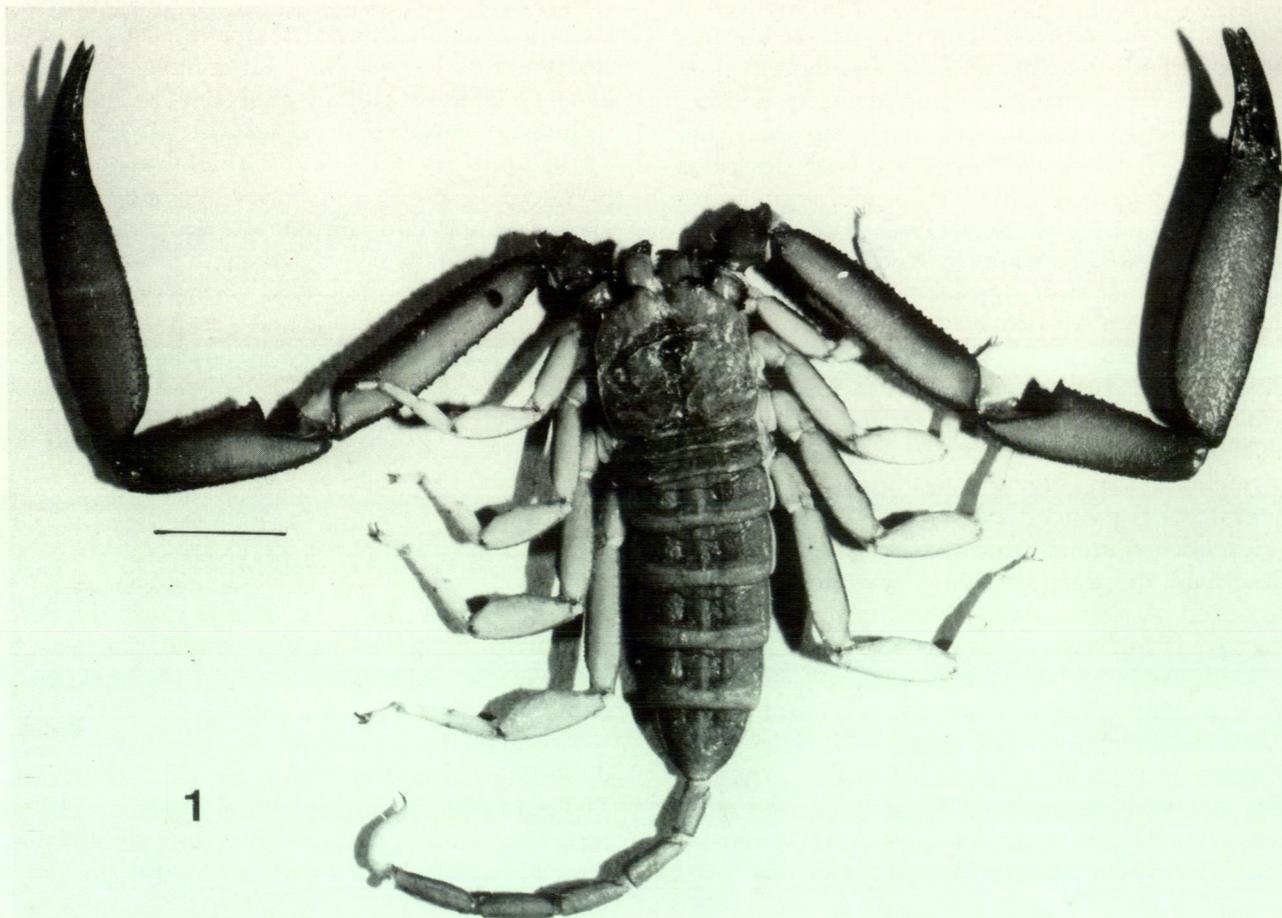
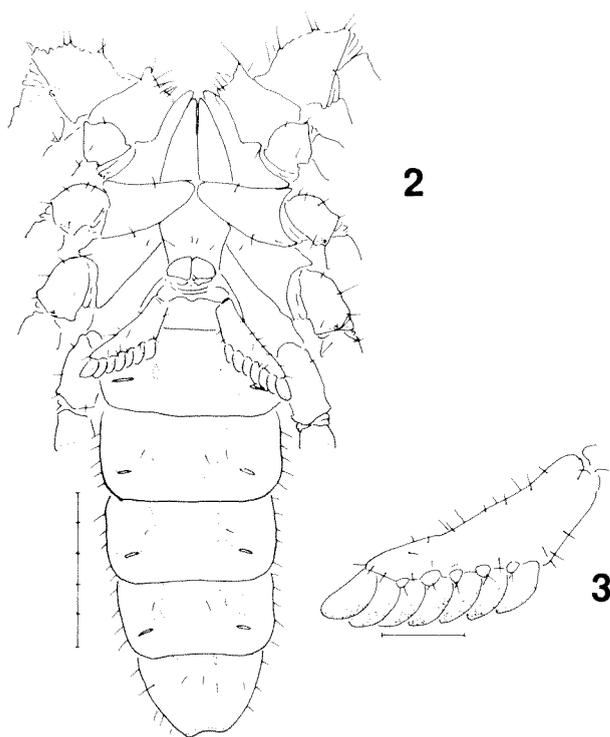


Figure 1 *Liocheles longimanus* sp. nov.: photograph of preserved adult male (holotype) Scale bar, 5 mm.



Figures 2-3 *Liocheles longimanus* sp. nov.: 2, ventral view, showing coxae and trochanters of pedipalps and legs, sternum, genital plate, pectines and stigmata; 3, right pectine, showing seven teeth and five fulcra. Scale bar, 5 mm (Fig. 2), 1 mm (Fig. 3).

Lateral corners rounded. Pretergite 1 and 2 almost straight, 3-7 wavy, smooth with fine pores.

*Sternum.* (Fig. 2). Pentagonal, smooth, shiny, pale straw colour. Genital operculum divided, genital papillae present. Pectine basal plate with bilateral low rounded prominences on anterior border. Smooth, shiny.

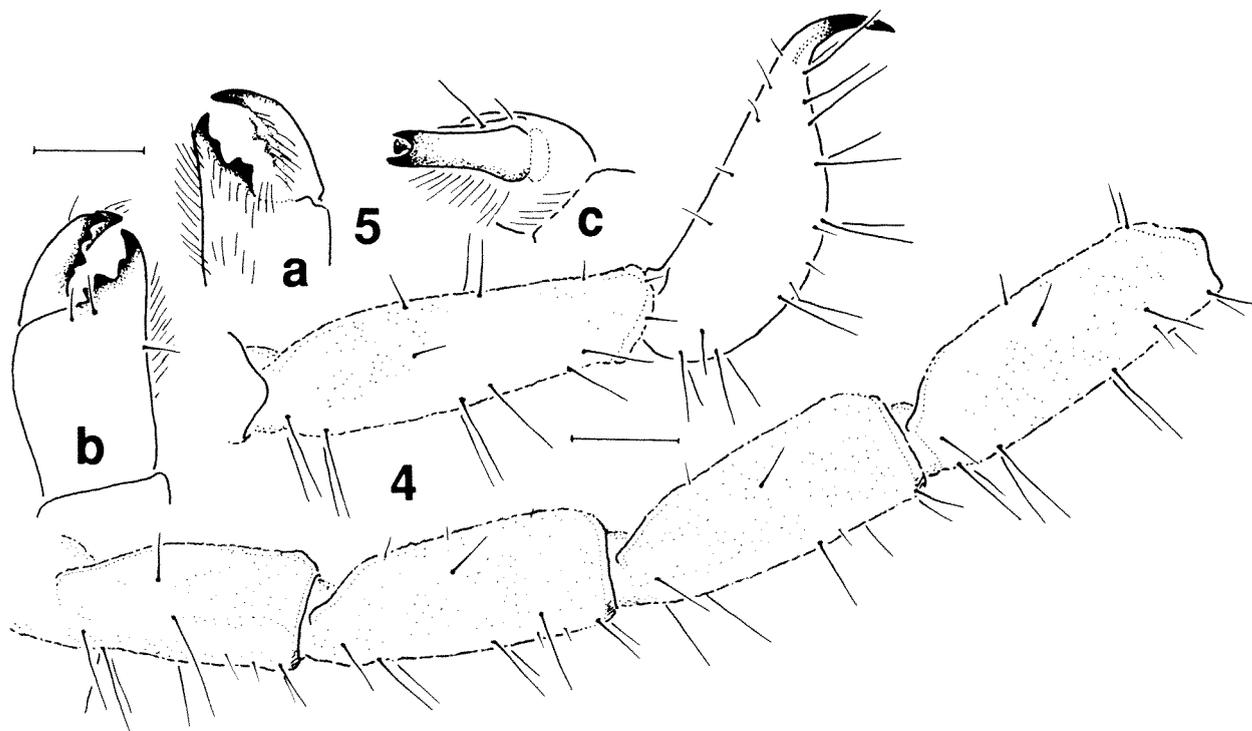
*Pectines.* (Fig. 3). Small, smooth, shiny. Few setae. Teeth squat. Five fulcra. Tooth count, 7,7 in both specimens.

*Sternites:* 1-4 smooth, shiny. Posterolateral corners rounded. Posterior borders 1 and 2 straight, 3 and 4 slightly concave. Stigmata only slightly oblique. Sternite 5 smooth, without keels.

*Metasoma* (Fig. 4). short. I-V without keels, finely granular, more granulation on IV and V. Setae long, stout. Vesicle smooth, shiny, without keels or granules. Slightly pigmented. Setae long and stout. Aculeus short, strongly curved, dark and well sclerotised.

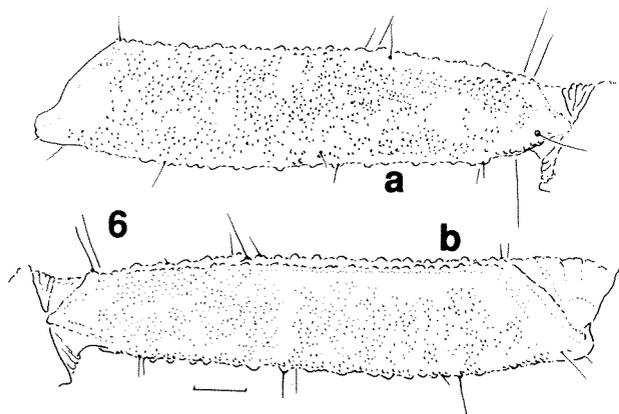
*Chelicerae* (Fig. 5). Smooth, shiny, fine pigmented pattern on hand. Teeth without secondary serrations. Fixed finger with two-cusped basal tooth, higher than median tooth, no ventral tooth. Movable finger with sub-basal tooth larger than basal or median teeth. Distal tooth pair meshing with distal tooth of fixed finger.

*Pedipalp.* Coxa smooth, pale ventrally, strongly sclerotised. Few low denticles and stout setae at anterior projection extending round anterior rim. Dorsal surface smooth proximally, shagreened distally. Strong rounded denticles along dorsolateral and ventrolateral borders, darkly

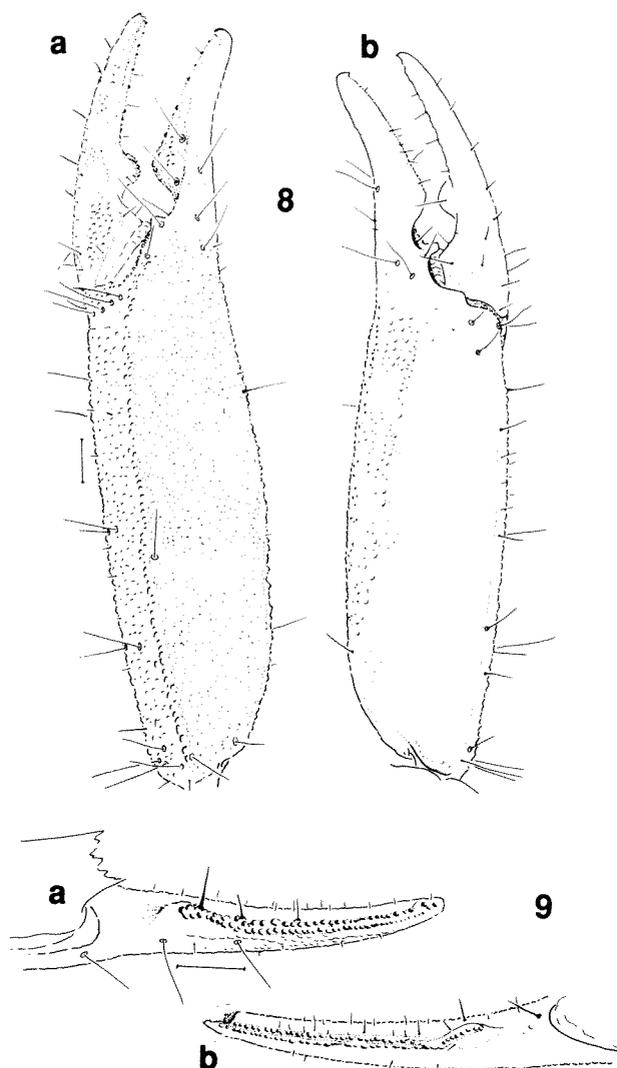


Figures 4-5 *Liocheles longimanus* sp. nov.: 4, metasoma, lateral; 5, chelicera: a, dorsal; b, ventral; c, end on, movable finger meshing with fixed finger. Scale bars, 1 mm.

sclerotised. Dark sclerotic line on anteromedial face, emerging from beneath carapace towards base of trochanter. Few setae. Trochanter, dorsal surface shagreened, with granules, especially along distal border. Smooth to shagreened ventrally with low granules. Yellow brown, with dark sclerotised edges. Low stout teeth along anteromedial border. Few stout setae. Tuberculate ridges with stout setae, darkish brown, mainly due to sclerotisation. Femur (Fig. 6): long, flat; yellow-brown with dark borders. Dorsal surface shagreened, low granules. Anterodorsal border black with stout granules. Few stout setae. Posterior border with stout irregular teeth. Distal rim smooth, with no teeth or granules. Ventral, smoother than dorsal, fine shagreen with shiny low granules. Anteroventral border with irregular row of distinct black granules, lower than those on anterodorsal border. Anterior surface brown, shagreened with fine granules. One large granule with seta on surface between borders. Bordered dorsally and ventrally by parallel anterodorsal and anteroventral lines of granules. Patella (Fig. 7): Stout, with marked



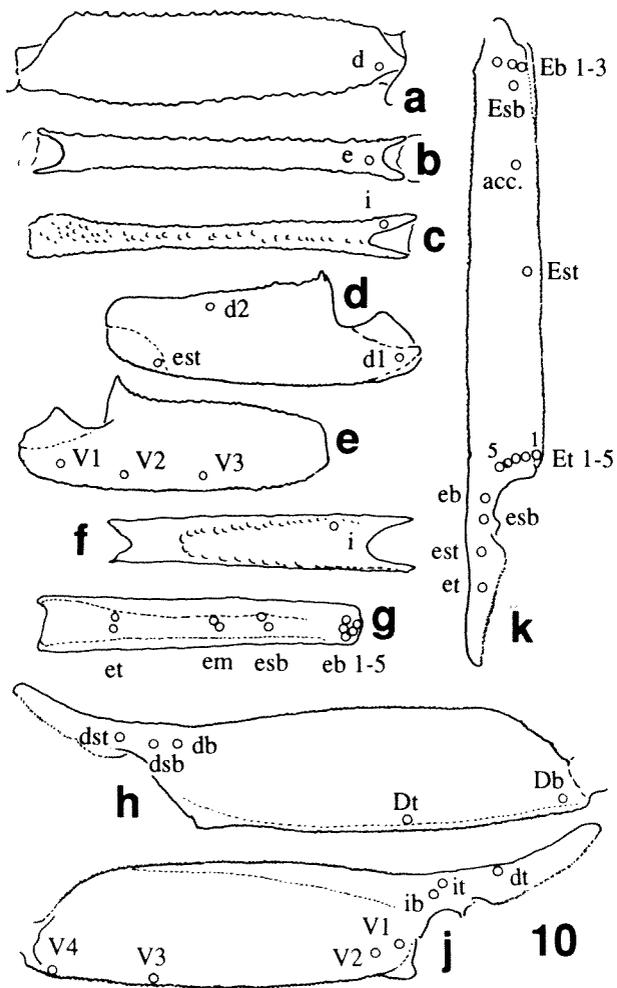
Figures 6-7 *Liocheles longimanus* sp. nov.: 7, left femur: a, dorsal; b, ventral; 7, left patella: a, dorsal; b, ventral. Scale bars, 1 mm.



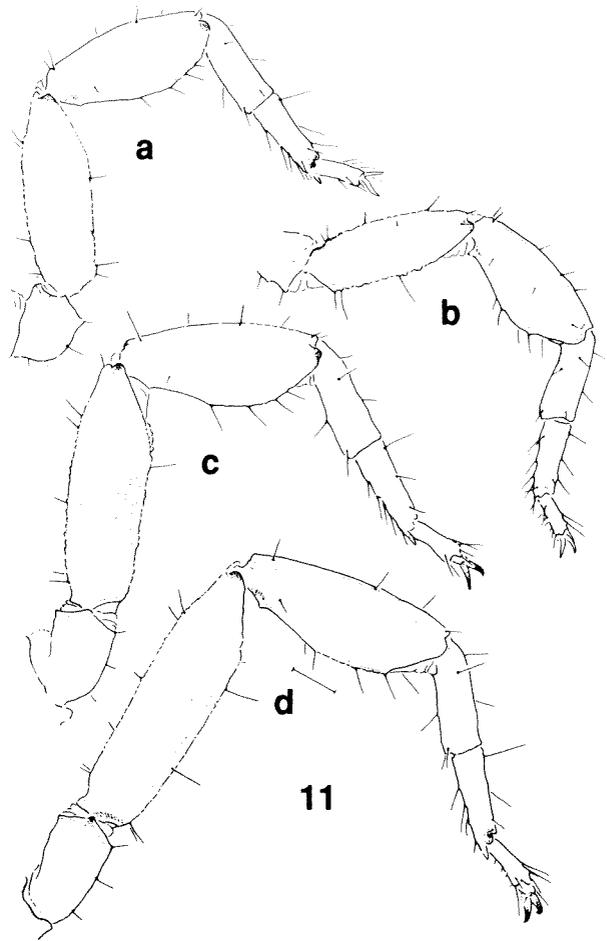
Figures 8-9 *Liocheles longimanus* sp. nov.: 8, left hand: a, dorso-lateral; b, ventro-medial; 9, fingers, showing dentition: a, fixed; b, movable. Scale bars, 1 mm.

proximal anterior projection ending in a tooth flanked by two setae. Dorsal surface shagreened with small granules. Brown, merging to black at edges. Proximal joint surface smooth. anterodorsal border with 3-4 distally directed teeth at proximal end beside 'trident', more distally becoming granules and fading to smooth border at distal end. Posterodorsal border of prominent irregular granules. External surface granular, brown. Posteroventral border of irregular granules. Ventral surface smooth, low granules. Distal crest of low dark granules. Proximal border curved, not granular. Hand (Fig. 8): Brown with external surface and keels almost black. Dorsal and ventral surfaces evenly covered with small granules; surface between these matt. Dorsal and ventral surfaces parallel, posterior surface almost perpendicular to these. Line of fixed finger projected proximally as keel of small but distinct granules. Posterodorsal and posteroventral keels

similar. Basal articular pedicle distinct. Ventral surface shiny, with fewer granules than dorsal. Irregular row of fine granules from base of moveable finger obliquely to base of hand; not true keel, as no angulation of surface. Fingers shiny, rugose with fine granules. Slightly curved. Fixed finger with prominent basal notch. Slight terminal hook, uniform internal and external rows of low even granules, which fade out at basal lobe. Scattered fine hairs along tooth rows and on finger. (Fig. 9). Fixed finger; Five strong hairs along inner edge of teeth, with smaller more numerous hairs between. One large hair in basal notch, one right at base, close to joint. Movable finger. Seven strong hairs along inner edge of teeth, including one medial to basal lobe and one in notch. Two or three smaller hairs between large ones, along external keel ventrally. Two indistinct rows of subequal granules. External surface granular with few fine hairs. Tip of moveable finger slightly hooked. Trichobothria: Pattern C (following Sissom (1990)



**Figure 10** *Liocheles longimanus* sp. nov.: positions of trichobothria. a, femur dorsal; b, femur posterior; c, femur anterior; d, patella, dorsal; e, patella ventral; f, patella anterior; g, patella posterior; h, hand dorsal; j, hand ventral; k, hand posterior.



**Figure 11** *Liocheles longimanus* sp. nov.: legs, dorsal. a, I; b, II; c, III; d, IV. Scale bar, 1 mm.

based on Vachon (1974)). Positions of the trichobothria are shown in Fig. 10. Numbers: Femur, 3. Patella, 18. Hand and fixed finger, 27. Total 48.

**Legs** (Fig. 11). Pale brown, shagreened, matt, with fine granules darker than background. Coxae. I and II with apophyses, overlapping, II nearly as long as I. Apophysis II more darkly sclerotised than I. Coxae II, III, IV border sternum. All leg joints shiny ventrally. Trochanters, all pale. Femora wide, flattened, irregular coarse denticles along posterior edge, II and III > I > IV. Dark denticulate anterodorsal and anteroventral keels, with irregular denticles III > I > II > IV. Patellae wide, with few fine denticles along anterior border, not true keels. Dorsal and ventral surfaces smoothly curved. Tibiae smooth ventrally, no denticles. All legs with few but stout setae. Tarsi. (Fig. 12). smooth ventrally, anterior spine at distal end of all tarsomeres I. Ungues equal, shiny, dark. Tarsomere II with dorsal midline projection bearing stout hair and sclerotised apotele. Tarsomeres II with two rows of setae ventrally, no tarsal spines.

**Hemispermaphore** (Fig. 13). The proportions of the hemispermaphore differ from those of *L.*

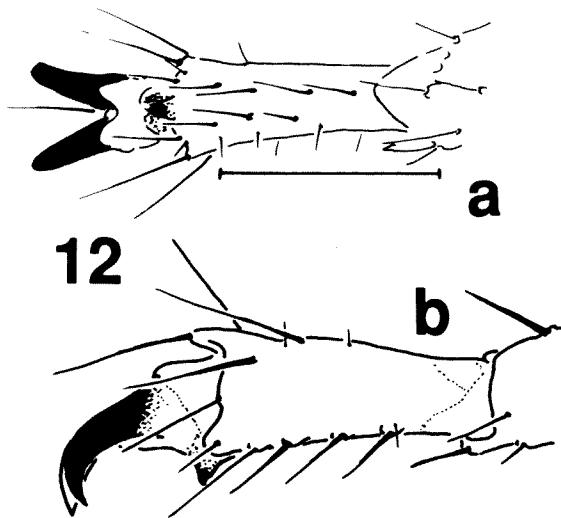


Figure 12 *Liacheles longimanus* sp. nov.: tarsomere 2, leg IV. a, ventral; b, external. Scale bar, 1 mm.

*australasiae*, *L. waigiensis* and *L. karschii*, figured by Koch (1977), e.g. the distal lamina in the present species is longer than those in Koch's drawings.

Measurements

	Holotype	Paratype
Total L	36.9	38.0
Midline carapace L	5.5	7.0
Metasoma I, L	2.2	2.7
W	1.2	1.4
H	1.1	1.2
II, L	2.8	3.2
W	1.0	1.0
H	1.1	1.3
III, L	2.9	3.2
W	0.9	1.1
H	1.2	1.2
IV, L	3.1	3.7
W	0.9	1.0
H	1.1	1.1
V, L	3.5	4.0
W	0.9	1.0
H	1.1	1.1
Telson, L	3.3	4.0
Vesicle, L	3.6	3.0
W	1.1	1.2
H	1.2	1.3
Aculeus, L	0.8	1.0
Pedipalp Femur, L	10.7	13.6
W	2.4	3.0
H	1.1	1.5
Patella, L	8.5	11.2
W	3.1	4.1
H	1.4	2.0
Hand, L	16.0	21.0
W	3.3	4.2
H	1.6	2.1
Moveable F, L	4.7	5.5
Pectine count	7,7	7,7

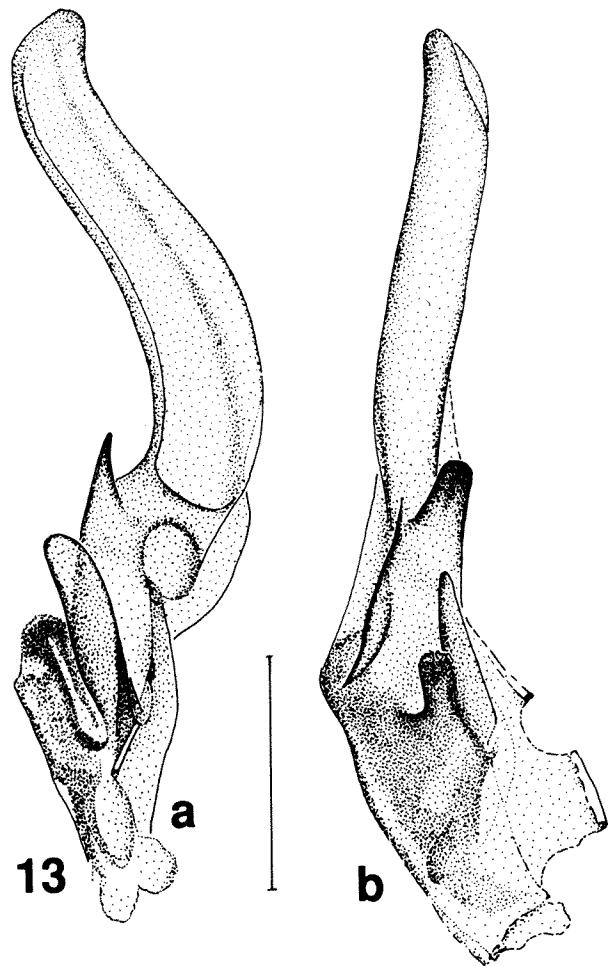


Figure 13 *Liacheles longimanus* sp. nov.: right hemispermatophore. Anterior downwards. a, ventral view; b, rotated 90° to the right. Scale bar, 1 mm.

Discussion and Comparisons

Scorpions of the genus *Liacheles* are morphologically adapted to a greater or lesser degree for living in crevices, being more or less flattened and having stout pedipalps which form an armoured shield when the scorpion backs into a crack. There is sexual dimorphism, the male having relatively longer and stouter pedipalps than the female. The present species shows the adaptation to crevices to a marked degree; though spanning 78 mm, nowhere is the holotype deeper than 1.6 mm.

Graham Brown (personal communication), who has visited the Oenpelli Caves, states that the scorpions may be seen deep in cracks between the layers of weathered sandstone in which the caves are formed, but that they are extremely difficult to retrieve. He further states that the cave at Oenpelli is a tunnel extending for ca.140m through a ridge, and that in the depths of it is a chamber leading to a chimney, to which light does not penetrate and where the temperature and humidity probably fluctuate little. Nearer the entrance, where the

**Table 1** Proportions, patella L/W and hand L/W of Australian species of *Liocheles*

Species	<i>L. waigiensis</i>		<i>L. australasiae</i>		<i>L. karschii</i>		<i>L. longimanus</i>		
	♂	♀	♂	♀	♂	♀	♂	♀	
n	8	10	0	23	4	5	2	0	
Pat.L/W,	Mean	2.10	1.99	–	1.68	1.89	1.85	2.75	–
	Range	1.72–2.70	1.82–2.26	–	1.56–1.78	1.78–2.0	1.67–2.10	2.73–2.77	–
	SD	0.28	0.13	–	0.05	0.09	0.16	0.03	–
Hand L/W,	Mean	4.15	3.72	–	3.08	3.75	3.42	4.92	–
	Range	3.23–4.74	3.08–4.13	–	2.72–3.50	3.58–4.10	2.85–3.88	4.85–5.0	–
	SD	0.53	0.31	–	0.18	0.24	0.43	0.11	–

scorpion was found, some light does penetrate and conditions are less constant, though still humid.

This information, the animals colouration and the presence of apparently well formed eyes suggested that *L. longimanus* is not an obligate cave-dweller, and this is confirmed by the finding of the second specimen under a log.

The present species shows considerable differences from the three *Liocheles* species listed by Koch (1977) as occurring in Australia. The most obvious is the great length of the pedipalps, reflected in the proportions of length to width of the femur, patella and hand. Comparisons are given in Table 1. The hand bears an accessory trichobothrium midway between the Eb group and Est on the posterior surface. Est is single in this species, as it is in *L. australasiae*, but the latter has Dt considerably proximal to Est, whereas they are at almost the same level in the other three species. Fig. 14. The metasomal segments also show differences, bearing neither granules nor keels in the present species. *L. australasiae* has granular metasomal segments and granular keels with terminal denticles. *L. waigiensis* has rugose and granulate intercarinal surfaces with granulate to denticulate, though poorly defined, dorsal and

posterior keels. *L. karschii* has least denticulation, there being minute denticles on the intercarinal surfaces dorsally, particularly on the proximal segments, and only traces of keels. *L. karschii* has 10–12 pectinal teeth in the male, however, compared with 6–11 for *L. waigiensis*, 8–9 for *L. australasiae* and seven in both the present specimens.

The exaggerated length of the pedipalps may well turn out to be less marked in the female, in accordance with the sexual dimorphism shown by other species of *Liocheles*. It is also probable that the internal projection on the patella will be less marked, and the fingers without the prominent basal lobes.

Koch (1977) lists a further species of *Liocheles* from outside Australia, *L. nigripes* (Pocock 1897). This species, from India, was described by Pocock (1900) as being shiny pitchy brown with dark legs, having denticles on the metasomal segments like *L. australasiae* and with the dorsal surface of the femur smooth with punctures. Pocock's description was not illustrated, but these differences serve to separate that species from *L. longimanus* now described.

#### Distribution

Known only from the two localities listed.

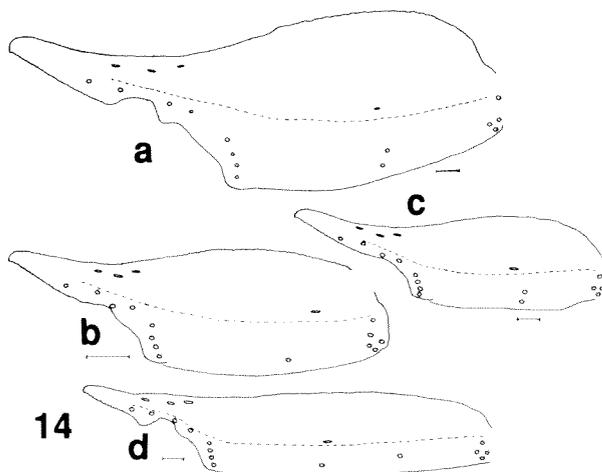
#### Etymology

The specific name reflects the notably elongated pedipalps.

#### ACKNOWLEDGEMENTS

It is a pleasure to join in celebrating the important contributions to Australian arachnology made over the years by Barbara York Main.

I wish to thank Alice Wells, Jenni Webber and Graham Brown for the opportunity to examine and describe the new scorpions from Oenpelli and Kakadu, Dr M.S. Harvey for loan of specimens from the Western Australian Museum for comparison and Dr W.D. Sissom for his invaluable comments on the manuscript.



**Figure 14** Dorsolateral views of hands to show differences in trichobothrial patterns: a, *Liocheles karschii*; b, *L. australasiae*; c, *L. waigiensis*; d, *L. longimanus*. Scale bars, 1 mm.

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