



Three new species of the pseudoscorpion genus *Synsphyronus* (Pseudoscorpiones: Garypidae) from semi-arid Western Australia

Mark S. Harvey^{1,2}

¹ Collections & Research, Western Australian Museum, 49 Kew Street, Welshpool DC, Western Australia 6106, Australia.

² Adjunct: School of Biological Sciences, University of Western Australia, Crawley, Western Australia 6009, Australia.

*Corresponding author: mark.harvey@museum.wa.gov.au

Mark Harvey  <https://orcid.org/0000-0003-1482-0109>.



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Abstract

The pseudoscorpion genus *Synsphyronus* is widely distributed in the Australasian region, with 37 species described from Australia, two from New Zealand and one from New Caledonia. This paper describes three new species from semi-arid regions of Western Australia, *Synsphyronus alisonae*, sp. nov., *Synsphyronus spatiosus*, sp. nov. and *Synsphyronus tenuis*, sp. nov., which all inhabit saxicolous habitats.

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<http://zoobank.org/References/59f43353-f0fa-4e41-9ee1-a4677551239d>

Introduction

The pseudoscorpion genus *Synsphyronus* Chamberlin, 1930 is endemic to Australasia where there are currently 40 named species (Cullen & Harvey 2021; Harvey 1987, 2011, 2012, 2020; Harvey et al. 2015), making it the largest genus of the subfamily Synsphyroninae which was recently reestablished and defined by Harvey et al. (2020). The majority of species have been described from Australia, including Tasmania, but two are recorded from New Zealand (Harvey 1987) and one from New Caledonia (Harvey 2020). Many additional unnamed species are also known from Australia, especially in arid and semi-arid ecosystems (Harvey, unpublished data). The present contribution describes three

further species of *Synsphyronus* from the semi-arid zone in Western Australia that occur in saxicolous habitats.

This project represents a contribution to Taxonomy Australia (2020), a national initiative organised under the auspices of the Australian Academy of Science that brings together the taxonomic community to develop approaches that will significantly increase the rate at which new species are discovered, resolved and named, with a view to completely documenting the Australian biota within a generation.

Methods

The specimens utilised in the present study is lodged in the Western Australian Museum, Perth (WAM). They were examined by preparing temporary slide mounts by

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immersing the specimen in 75% lactic acid at room temperature for one to several days, and mounting them on microscope slides with 10 or 12 mm coverslips supported by small sections of nylon fishing line. Specimens were examined with an Olympus BH-2 compound microscope, and illustrated with the aid of a drawing tube. Auto-montaged images were taken at different focal planes with a Leica DFC500 digital camera attached to a Leica MZ16A stereo microscope, using Leica Application Suite (LAS) version 2.5.OR1 software. Measurements (in mm) were taken at the highest possible magnification using an ocular graticule. After study the specimens were rinsed in water and returned to 75% ethanol with the dissected portions placed in 12 × 3 mm glass genitalia microvials (BioQuip Products, Inc.).

Terminology and mensuration largely follow Chamberlin (1931), with the exception of the nomenclature of the pedipalps, legs and with some minor modifications to the terminology of the trichobothria (Harvey 1992), chelicera (Harvey and Edward 2007; Judson 2007) and faces of the appendages (Harvey et al. 2012). Observations regarding variation were limited to some meristic features, but did not extend to the numbers of setae or blades in the serrula exterior.

Molecular sequence data were obtained from specimens of the new species. The techniques used to obtain the sequence are outlined in Harvey et al. (2020).

Taxonomy

Family GARYPIDAE Simon, 1879

Subfamily SYNSPHYRONINAE Beier, 1932

Genus *Synsphyronus* Chamberlin, 1930

Synsphyronus alisonae Harvey, sp. nov.

Figs 1–17

<http://zoobank.org/NomenclaturalActs/DBF999AC-03E5-4C9A-93AF-4AE1756E8CA9>

Material examined

Holotype

AUSTRALIA: *Western Australia*: ♂, Victoria Rock Nature Reserve, 31°17'25"S, 120°55'50"E, 31 October 2010, under rocks, M.S. Harvey (WAM T145267).

Paratypes

AUSTRALIA: *Western Australia*: 2 ♂, 3 ♀, 4 tritonymphs, 1 deutonymph, 2 protonymphs, collected with holotype (WAM T145264–T145266, T145268–T145276).

Other material

AUSTRALIA: *Western Australia*: 1 ♂, 3 ♀, 2 tritonymphs, 2 deutonymphs, 1 protonymph, Victoria Rock, 31°17'21.1"S, 120°55'56.4"E, 17 November 2011, under rocks, J.M. Waldock, C.A. Car (WAM T118874, T156913, T156916); 6 ♂, 6 ♀, 3 tritonymphs, 1 deutonymph, 13.7

km W. of Boorabbin, 31°11'30"S, 120°26'39"E, 12 November 2002, under granite rocks, M.S. Harvey, M.E. Blossfelds, E.E.B. Harvey, F.S.B. Harvey (WAM T64884, T157537–15748); 2 ♀, 1 tritonymph, Boondi Rock, Goldfields Woodlands National Park, Great Eastern Highway, 31°10'48.8"S, 120°22'58.7"E, 23 September 2011, under rocks, C. Stevenson (WAM T120325, T156926, T156927); 3 ♂, 2 ♀, Burra Rock, Burra Rock Nature Reserve, 31°17'21.1"S, 120°55'56.4"E, 23 August 1985, under granite rocks, M.S. Harvey, T.J. Doeg, R. Marchant (WAM T64877, T156917–156920); 3 ♂, 3 ♀, Yellowdine Rock, 31°17'43"S, 119°38'32"E, 6 August 2006, under granite rocks, R. Engel (WAM T76889, T156921–156925); 1 ♂, 1 tritonymph, 1 deutonymph, 1 protonymph, granite outcrop, ca. 80 km E. of Coolgardie, S. side of Great Eastern Highway, 31°11'21"S, 120°26'23"E, 6 August 2006, under granite rock, R. Engel (WAM T76871, T76872).

Diagnosis

Synsphyronus alisonae most closely resembles *S. lathrius* Harvey, 1987 and *S. magnus* Hoff, 1947 in the possession of seven trichobothria on the fixed finger and two on the movable finger (Figure 13), and separate metatarsi and tarsi (Figure 12). It differs from both of these species by being larger [e.g. chela (with pedicel) 2.350–2.495 (♂), 2.530–2.630 (♀) in *S. alisonae* versus 1.60–1.80 (♂), 1.68–2.055 (♀) mm in *S. lathrius*, and 2.00–2.16 (♂), 1.97–2.36 (♀) mm in *S. magnus*] and the more elongate chelal hand (without pedicel) which is 2.61–2.87 (♂), 2.54–2.59 (♀) × longer than broad (Figure 11). It further differs from *S. magnus* by the broad anterior eye (Figure 10), which is narrow in *S. magnus*.

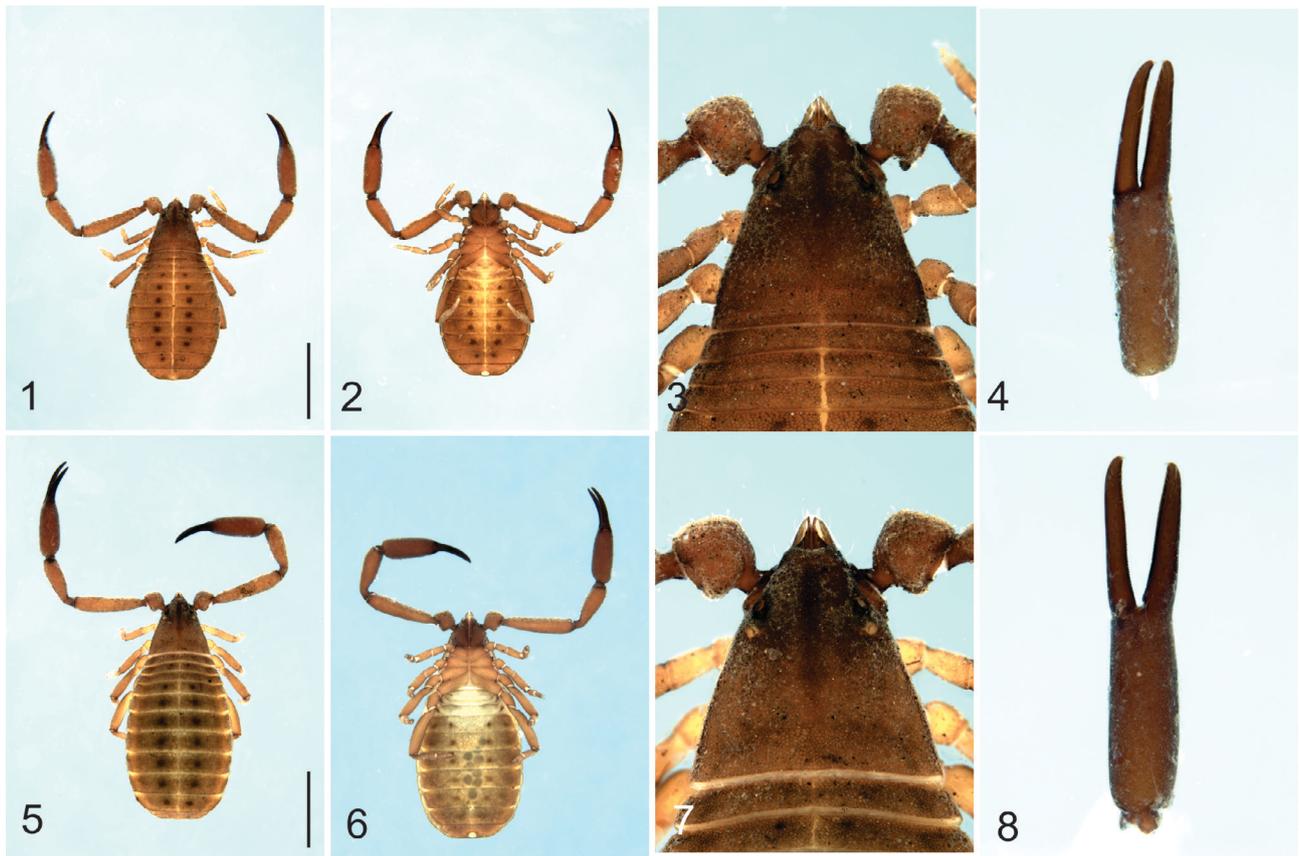
Description

Adults

Colour (Figures 1–8) of sclerotized portions generally dark yellow-brown; tergites IV–X and sternites V–X with paired darker patches. Waxy epicuticle. Setae generally aligned perpendicularly from body, each seta quadricarinate. Most cuticular surfaces roughened, but not granulate.

Chelicera: with 5 setae on hand and 1 subdistal seta on movable finger, all setae acuminate; setae *sbs* and *bs* shorter than others; 2 dorsal lyrifissures and 1 ventral lyrifissure; galea of ♂ and ♀ unbranched; rallum of 3 blades, the most distal blade with spinules on leading edge, other blades smooth; serrula exterior with 21 (♂), 22 (♀) blades; lamina exterior present.

Pedipalp (Figure 11): trochanter 1.31 (♂), 1.35 (♀), femur 4.61–4.92 (♂), 4.68–4.86 (♀), patella 3.43–3.59 (♂), 3.24–3.57 (♀), chela (with pedicel) 5.04–5.37 (♂), 4.48–4.96 (♀), chela (without pedicel) 4.64–4.95 (♂), 4.25–4.75 (♀), hand (without pedicel) 2.61–2.87 (♂), 2.54–2.59 (♀) × longer than broad, movable finger 0.73–0.83 (♂), 0.80–0.86 (♀) × longer than hand (without pedicel). Fixed chelal finger with 7 trichobothria, movable chelal finger with 2 trichobothria (Figure 13): *eb* and



Figures 1–8. *Synsphyronus alisonae*, sp. nov.: 1–4, male holotype (WAM T145267): 1, body, dorsal; 2, body, ventral; 3, cephalothorax, dorsal; 4, left chela, retrolateral; 5–8, female paratype (WAM T145264): 5, body, dorsal; 6, body, ventral; 7, cephalothorax, dorsal; 8, left chela, retrolateral.

esb situated basally, *isb* absent, *est* situated submedially, slightly closer to *esb* than to *et*, *et* situated subdistally, *ib* and *ist* situated basally in diagonal row, and *it* situated subdistally, midway between *ist* and *et*; *b* situated subbasally, *t* situated submedially, *sb* and *st* absent; patch of microsetae present on retrolateral margin of fixed chelal finger near *et*. Venom apparatus present in both chelal fingers, venom ducts long, terminating in nodus ramosus near *et* in fixed finger and midway between *t* and tip of finger in movable finger. Chelal teeth retrorse and acute distally, becoming rounded basally (Figure 14); fixed finger with 60 (♂), 64 (♀) teeth; movable finger with 48 (♂), 56 (♀) teeth; accessory teeth absent.

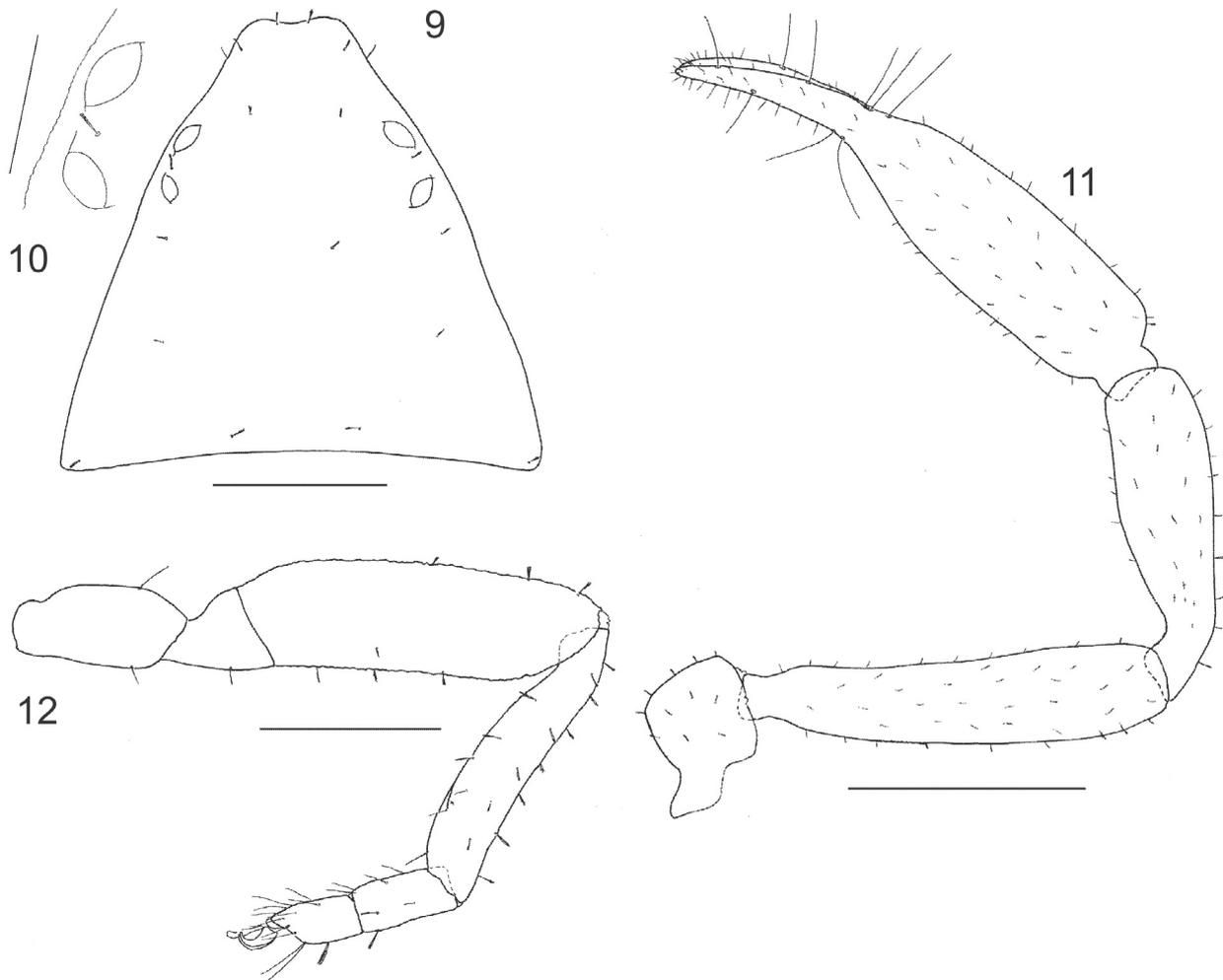
Carapace (Figures 3, 7, 9): 0.89–0.96 (♂), 0.86–0.94 (♀) × longer than broad; anterior margin slightly indented medially; subtriangular; with 2 pairs of corneate eyes (Figure #) situated ca. one-third carapace length from anterior margin; anterior eye large and broad, not constricted; with 2 setae near anterior margin and 4 (♂, ♀) near posterior margin; with numerous lyrifissures; without furrows.

Coxal region: manducatory process rounded, with 4 apical acuminate setae, plus 7 (♂, ♀) additional setae; medial maxillary lyrifissure situated submedially; chaetotaxy of coxae I–IV: ♂, 4: 4: 5: 7; ♀, 4: 4: 6: 14.

Legs (Figure 12): junction between femora and patellae I and II slightly oblique to long axis; junction between femora and patellae III and IV very angulate; femora III and IV much smaller than patellae III and IV; femur + patella of leg IV 4.16 (♂), 4.06 (♀) × longer than broad; metatarsi and tarsi separate; subterminal tarsal setae arcuate and acute; arolium much longer than claws, not divided.

Abdomen: tergites II–X (♂, ♀) and sternites IV–XI (♂), with median suture line, ♀ sternites undivided (Figures 1, 2, 5, 6). Tergal chaetotaxy: ♂, 4: 4: 6: 6: 7: 9: 7: 8: 10: 8: 2: 2; ♀, 5: 6: 6: 6: 8: 8: 10: 10: 9: 6: 2: 2; uniseriate; all setae quadricarinate. Sternal chaetotaxy: ♂, 10: (0) 4 [4 + 4] (0): (0) 2 (0): 4: 6: 7: 6: 6: 6: 4: 2; ♀, 7: (0) 8 (0): (0) 7 (0): 12: 10: 10: 10: 10: 7: 4: 2; uniseriate; all setae quadricarinate except for setae on sternites II–IV and medial setae on sternites V–VI, which are acuminate. Spiracles without helix. Anal plates (tergite XII and sternite XII) situated within sternite XI, surrounded by slightly raised rim. Pleural membrane wrinkled-plicate; without any setae.

Genitalia: male: lateral apodeme laterally extended and distally broadened; anterior apodeme acute; a pair of acute dorsal apodemes; lateral rod very broad ventrally and with a blunt, anterior projection; ejaculatory canal atrium large and cup-shaped. Female: with one pair of



Figures 9–12. *Synsphyronus alisonae*, sp. nov., male holotype (WAM T145267): 9, carapace, dorsal; 10, left eyes, dorsal; 11, right pedipalp, dorsal; 12, left leg IV, retrolateral. Scale lines = 1.0 mm (Figure 11); 0.5 mm (Figures 9, 12); 0.2 mm (Figure 10).

lateral cribriform plates and 2 pairs of median cribriform plates.

Dimensions: male: holotype (WAM T145267) followed by 2 other males (when measured): Body length 4.90 (4.93–4.99). Pedipalps: trochanter 0.655/0.500, femur 1.855/0.395 (1.845–1.870/0.380–0.400), patella 1.405/0.410 (1.415–1.420/0.395–0.410), chela (with pedicel) 2.495/0.495 (2.350–2.475/0.475), chela (without pedicel) 2.295 (2.330–2.350), hand (without pedicel) length 1.290 (1.305–1.365), movable finger length 1.040 (1.000–1.080). Carapace 1.300/1.455 (1.365–1.370/1.420–1.435); eye diameter, anterior 0.105, posterior 0.080. Leg IV: femur + patella 1.270/0.305, tibia 0.750/0.165, metatarsus 0.275/0.135, tarsus 0.230/0.140.

Female: paratype (WAM T145264) followed by 2 other females (when measured): Body length 5.84 (5.46–5.96). Pedipalps: trochanter 0.720/0.535, femur 1.965/0.420 (1.890–1.945/0.395–0.400), patella 1.440/0.445 (1.420–1.500/0.420–0.435), chela (with pedicel) 2.630/0.545 (2.530–2.580/0.520–0.565), chela (without pedicel) 2.495 (2.405–2.470), hand (without pedicel) length 1.410 (1.340–1.435), movable finger length 1.215

(1.135–1.155). Carapace 1.440/1.665 (1.420–1.495/1.585–1.625); eye diameter, anterior 0.105, posterior 0.095. Leg IV: femur + patella 1.460/0.360, tibia 0.870/0.180, metatarsus 0.305/0.160, tarsus 0.270/0.140.

Tritonymph

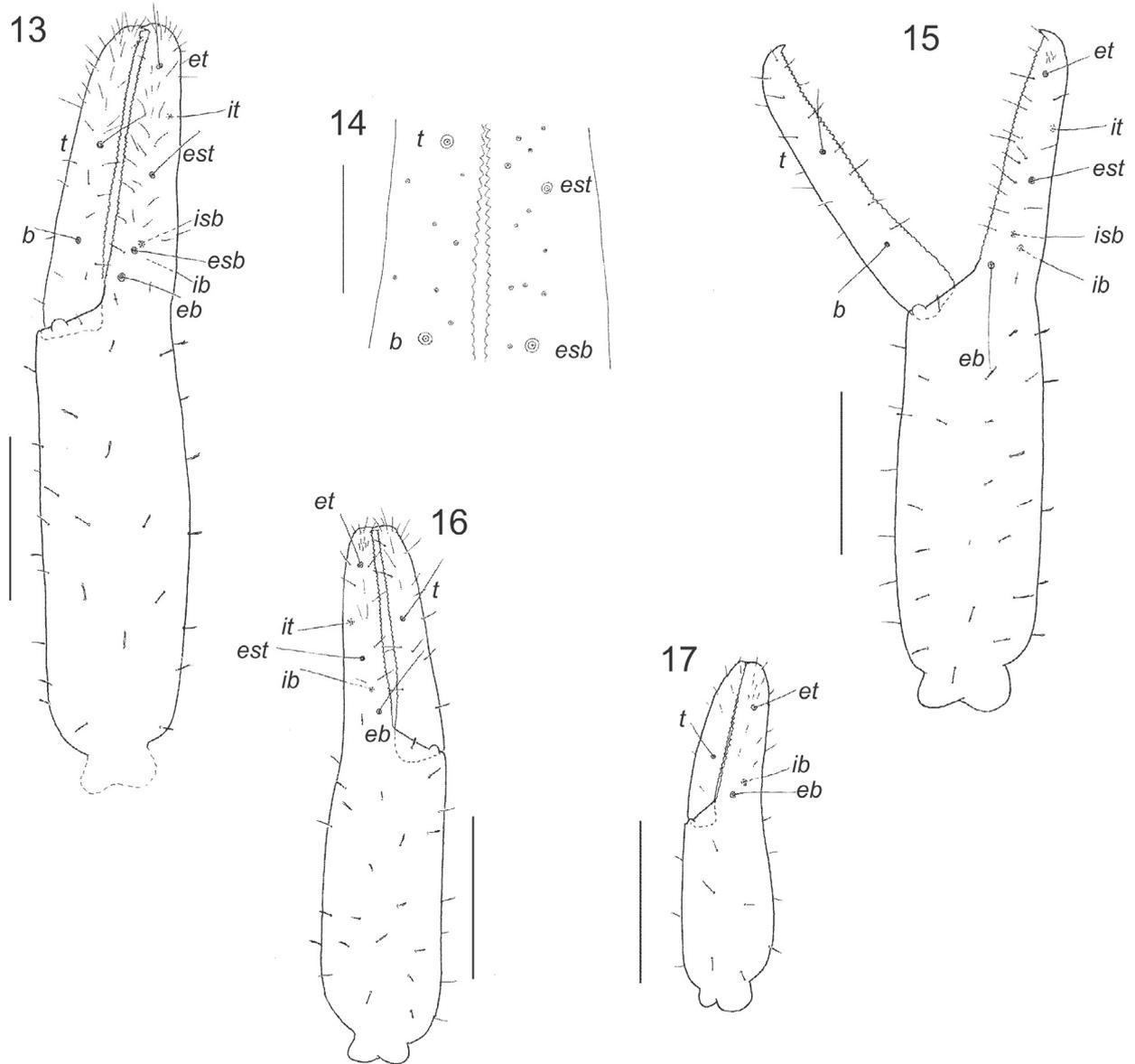
Colour mostly as for adults, but generally paler.

Chelicera: with 5 setae on hand and 1 on movable finger; galea unbranched.

Pedipalp: femur 4.14 ×, patella 2.96 ×, chela (with pedicel) 4.28 ×, chela (without pedicel) 4.12 ×, hand (without pedicel) 2.36 × longer than broad, and movable finger 0.83 × longer than hand (without pedicel). Fixed chelal finger with 6 trichobothria, movable chelal finger with 2 trichobothria (Figure 15): *eb*, *ist* and *ib* situated basally; *est* situated submedially, slightly closer to *eb* than to *et*; *et* situated subdistally; *it* submedially; *t* submedially.

Carapace: 0.81 × longer than broad; with 4 setae near posterior margin.

Legs: metatarsi and tarsi fused.



Figures 13–17. *Synsphyronus alisonae*, sp. nov.: 13, left chela, retrolateral, male holotype (WAM T145267); 14, detail of chelal teeth, retrolateral, male holotype (WAM T145267); 15, left chela, retrolateral, tritonymph paratype (WAM T145270); 16, right chela, retrolateral, deutonymph paratype (WAM T145274); 17 left chela, retrolateral, protonymph paratype (T145275). Scale lines = 0.5 mm (Figures 13, 15–17); 0.2 mm (Figure 14).

Abdomen: tergal chaetotaxy: 4: 4: 4: 4: 6: 6: 8: 8: 8: 8: 4: 2. Sternal chaetotaxy: 0: (0) 4 (0): (0) 4 (0): 6: 5: 6: 7: 8: 9: 4: 2.

Dimensions (mm): WAM T145270: Body length 4.48. Pedipalps: femur 1.490/0.360, patella 1.155/0.390, chela (with pedicel) 2.075/0.485, chela (without pedicel) 2.000, hand (without pedicel) length 1.145, movable finger length 0.945. Carapace 1.200/1.490.

Deutonymph

Colour pale yellow-brown, legs paler.

Chelicera: with 5 setae on hand and 1 on movable finger; galea unbranched.

Pedipalp: femur 3.25 ×, patella 2.67 ×, chela (with pedicel) 3.59 ×, chela (without pedicel) 3.36 ×, hand (without

pedicel) 0.93 × longer than broad, and movable finger 1.59 × longer than hand (without pedicel). Fixed chelal finger with 5 trichobothria, movable chelal finger with 1 trichobothrium (Figure 16): *eb* and *ib* situated basally; *est* situated submedially, closer to *eb* than to *et*; *et* situated submedially; *it* situated submedially; *t* situated submedially.

Carapace: 0.87 × longer than broad; with 4 setae near posterior margin.

Legs: metatarsi and tarsi fused.

Abdomen: tergal chaetotaxy: 4: 4: 4: 5: 5: 5: 6: 6: 7: 7: 3: 2. Sternal chaetotaxy: 0: (0) 2 (0): (0) 4 (0): 4: 4: 4: 5: 6: 5: 4: 2.

Dimensions (mm): WAM T145274: Body length 3.31. Pedipalps: femur 1.055/0.325, patella 0.855/0.320, chela (with pedicel) 1.615/0.450, chela (without pedicel) 1.510, hand (without pedicel) length 0.770, movable finger length 0.715. Carapace 1.030/1.185.

Protonymph

Colour pale yellow-brown, pedipalps slightly darker.

Chelicera: with 4 setae on hand and 0 on movable finger; galea unbranched.

Pedipalp: femur 3.37 ×, patella 2.28 ×, chela (with pedicel) 3.47 ×, chela (without pedicel) 3.32 ×, hand (without pedicel) 1.73 × longer than broad, and movable finger 1.01 × longer than hand (without pedicel). Fixed chelal finger with 3 trichobothria, movable chelal finger with 1 trichobothrium (Figure 17): *eb* and *ib* situated basally; *et* situated subdistally; *t* situated submedially.

Carapace: 0.86 × longer than broad.

Legs: metatarsi and tarsi fused.

Abdomen: tergal chaetotaxy: 2: 2: 3: 4: 4: 4: 4: 4: 4: 2. Sternal chaetotaxy: 0: (0) 2 (0): (0) 2 (0): 2: 2: 2: 2: 2: 4: 2.

Dimensions (mm): WAM T145275: Body length 2.83. Pedipalps: femur 0.690/0.205, patella 0.535/0.235, chela (with pedicel) 1.040/0.300, chela (without pedicel) 0.995, hand (without pedicel) length 0.520, movable finger length 0.525. Carapace 0.660/0.770.

Remarks

All specimens of *Synsphyronus alisonae* were collected from under granite rocks in the Coolgardie Bioregion of south-western Australia. The five sites, Victoria Rock, Burra Rock, Yellowdine Rock and two granite outcrops west of Boorabbin, are situated relatively close to each other, and with the most distant localities (Yellowdine Rock and Burra Rock) 147 km apart.

Etymology

This species is named for Alison Jones.

Synsphyronus spatiosus Harvey, sp. nov.

Figures 18–34

<http://zoobank.org/NomenclaturalActs/6B24D43F-5F8B-4BCB-B153-85EFD3DD45D1>

Material examined

Holotype

AUSTRALIA: *Western Australia*: ♂, Walga Rock, 27°24'03"S, 117°28'06"E, 2 July 2004, under granite rocks, M.S. Harvey (WAM T140404).

Paratypes

AUSTRALIA: *Western Australia*: 16 ♂, 9 ♀, 4 tritonymphs, 2 deutonymphs, collected with holotype (WAM T140405–T140416, T146821, T155369–T155372).

Other material

AUSTRALIA: *Western Australia*: 1 ♂ (without abdomen), collected with holotype (WAM T64683).

Diagnosis

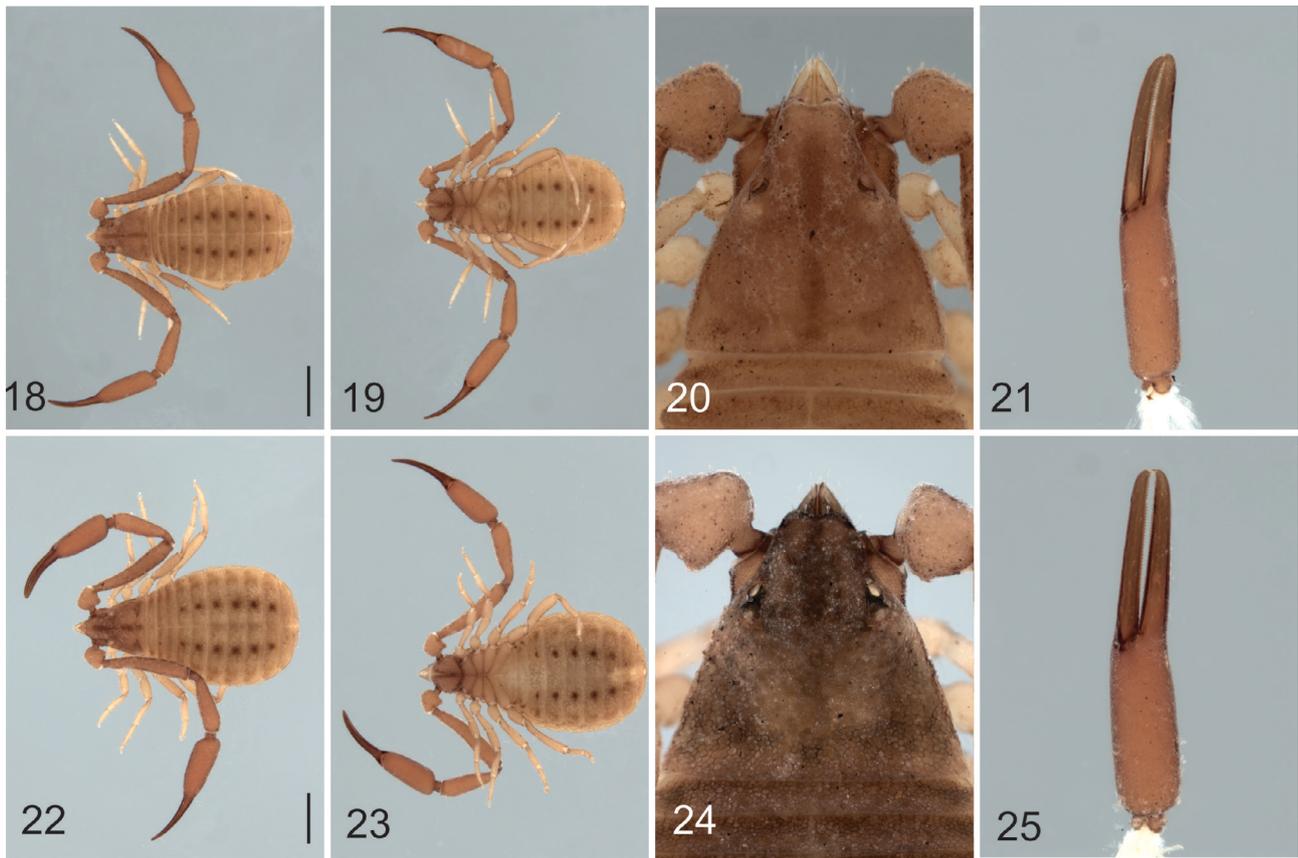
Synsphyronus spatiosus most closely resembles those species of the genus that possess 8 trichobothria on the fixed chelal finger, 3 trichobothria on the movable chelal finger (Figure 31) and have separate metatarsi and tarsi (Figure 30): *S. absitus* Harvey, 1987, *S. amplissimus* Harvey, 1987, *S. apimelus* Harvey, 1987, *S. attiguus* Harvey, 1987, *S. bounites* Harvey, 1987, *S. christopherdarwini* Harvey, 2012, *S. dewae* Beier, 1969, *S. dorothyae* Harvey, 1987, *S. gigas* Beier, 1971, *S. gracilis* Harvey, 1987, *S. gurdoni* Harvey, Abrams & Burger, 2015, *S. hansenii* (With, 1908), *S. mimulus* Chamberlin, 1943, *S. patricki* Cullen & Harvey, 2021, *S. samueli* Cullen & Harvey, 2021 and *S. silveirai* Harvey, 1987, all from Australia, and *S. platnicki* Harvey, 2020 from New Caledonia. It differs from most of these species by the very long, elongate chela (Figure 28) and especially the chelal hand which is 2.77–2.91 (♂), 2.40–2.55 (♀) × longer than broad. It further differs from these species as follows: from *S. bounites*, *S. dorothyae*, *S. hansenii* and *S. silveirai* by the broad anterior eye (Figure 27), which is about the same size as the posterior eye (the others have a narrowed eye); from *S. absitus*, *S. attiguus*, *S. dewae*, *S. gigas* and *S. mimulus* by the procurved pedipalpal femur (Figure 28) but nearly straight in the others; from *S. christopherdarwini* by the position of trichobothrium *st* which is situated closer to *t* than to *b* in *S. spatiosus* (Figure 31) but is substantially closer to *b* than to *t* in *S. christopherdarwini*; from *S. gracilis*, *S. patricki*, *S. platnicki* and *S. samueli* by the long, uniformly cylindrical chelal hand (Figure 28) but less narrow in the others, dorsally sinuate in *S. samueli* and broadened basally in *S. platnicki*; from *S. gurdoni* by the medium-sized basal blades of the rallum (Figure 29) but strongly reduced in *S. gurdoni*; from *S. amplissimus* and *S. apimelus* by the position of trichobothrium *est* which is midway between *ist* and *et* in *S. spatiosus* (Figure 31) but closer to *ist* than *est* in the others.

Description

Adults

Colour: sclerotized portions generally yellow-brown (Figures 18–25); tergites IV–X and sternites V–IX (♂), V–X (♀) with paired darker patches. Waxy epicuticle. Setae generally aligned perpendicularly from body, most seta quadricarinate. Most cuticular surfaces roughened, but not granulate.

Chelicera: with 5 setae on hand and 1 subdistal seta on movable finger, all setae acuminate; setae *sbs* and *bs*



Figures 18–25. *Synsphyronus spatiosus*, sp. nov.: 18–21, male holotype (WAM T140404): 18, dorsal; 19, ventral; 20, cephalothorax, dorsal; 21, left chelal fingers, retrolateral; 22–25, female paratype (WAM T140409): 22, dorsal; 23, ventral; 24, cephalothorax, dorsal; 25, left chelal fingers, retrolateral. Scale lines = 1 mm.

shorter than others; 2 dorsal lyrifissures and 1 ventral lyrifissure; galea of ♂ and ♀ distally bifurcate with short rami; rallum of 3 blades, the most distal blade with 3 spinules on leading edge, median blade with 2 spinules, basal blade with 1 spinule (Figure 29); serrula exterior with 20 (♂, ♀) blades; lamina exterior present.

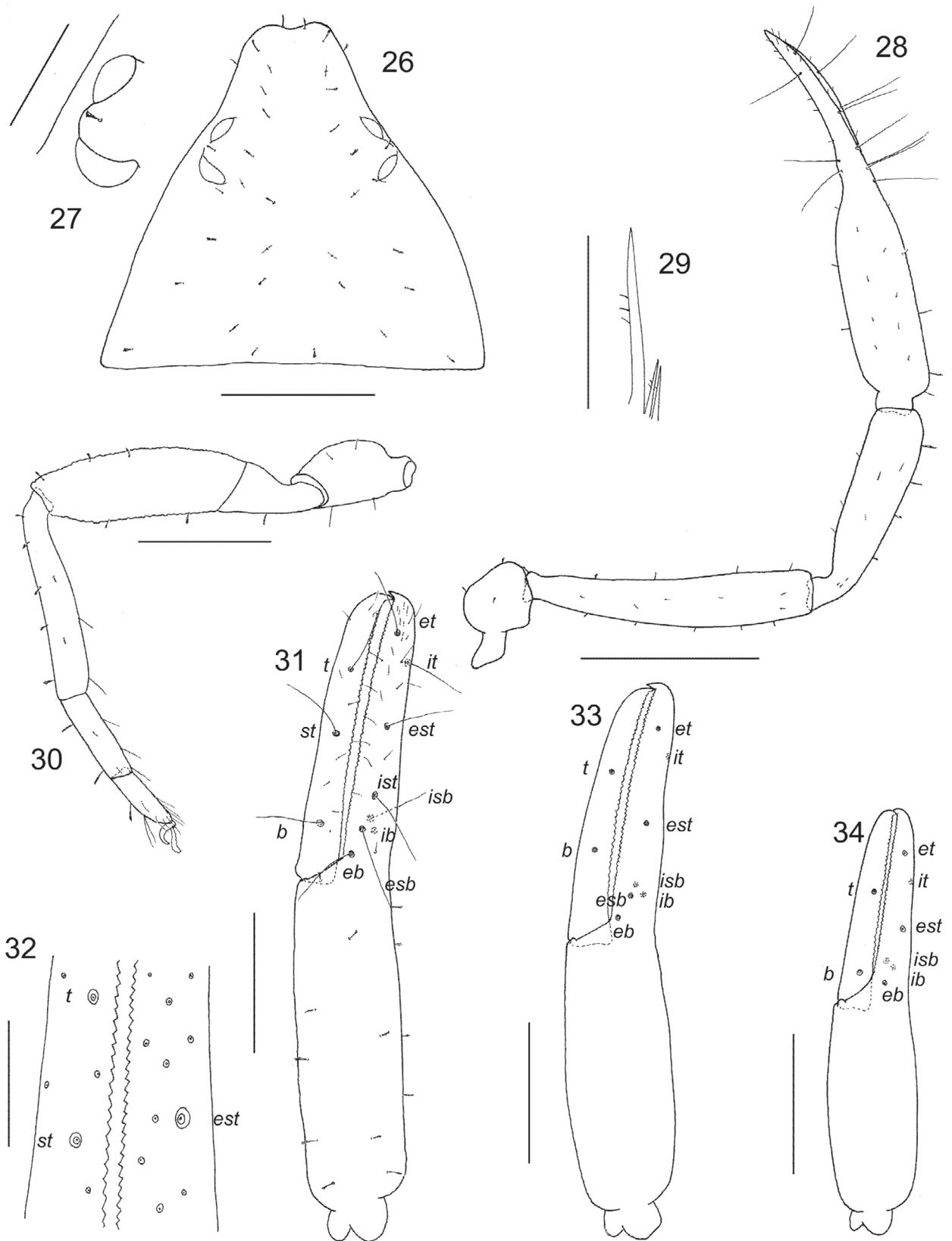
Pedipalp (Figure 28): trochanter 1.52 (♂), 1.44 (♀), femur procurved, 5.26–5.64 (♂), 5.32–5.56 (♀), patella 3.82–4.06 (♂), 3.73–3.96 (♀), chela (with pedicel) 5.66–6.05 (♂), 4.97–5.29 (♀), chela (without pedicel) 5.36–5.77 (♂), 4.71–5.06 (♀), hand cylindrical, 2.77–2.91 (♂), 2.40–2.55 (♀) × longer than broad, movable finger 0.94–1.07 (♂), 1.00–1.03 (♀) × longer than hand (without pedicel). Fixed chelal finger with 8 trichobothria, movable chelal finger with 3 trichobothria (Figure 31): *eb*, *esb* and *isb* situated basally in straight row, *est* submedially, *et* subdistally, *ib* and *ist* basally in diagonal row, and *it* subdistally, well posterior to *et*; *st* situated closer to *t* than to *b*; patch of microsetae present on external margin of fixed chelal finger slightly distal to *et*. Venom apparatus present in both chelal fingers, nodus ramosus not visible. Chelal teeth (Figure 32) strongly retrorse and acute, with basal teeth becoming rounded; fixed finger with 59 (♂), 62 (♀) teeth; movable finger with 44 (♂), 45 (♀) teeth; accessory teeth absent.

Carapace (Figures 20, 24, 26): 0.84–0.93 (♂), 0.89–0.95 (♀) × longer than broad; anterior margin slightly indented medially; subtriangular; with 2 pairs of corneate eyes (Figure 27) situated *ca.* one-third carapace length from anterior margin; anterior eye rounded, not constricted; with 25 (♂), 26 (♀) setae, including 2 (♂, ♀) near anterior margin and 4 (♂, ♀) near posterior margin; with numerous lyrifissures; with faint posterior furrow.

Coxal region: manducatory process rounded, with 3 (♂, ♀) apical acuminate setae, plus 6 (♂, ♀) additional setae; medial maxillary lyrifissure situated submedially; chaetotaxy of coxae I–IV: ♂, 3: 3: 5: 5; ♀, 3: 4: 4: 8.

Legs: junction between femora and patellae I and II slightly oblique to long axis; junction between femora and patellae III and IV very angulate; femora III and IV much smaller than patellae III and IV (Figure 30); femur + patella of leg IV 4.25 (♂), 4.57 (♀) × longer than broad; metatarsi and tarsi not fused and without tactile seta (Figure 30); subterminal tarsal setae arcuate and acute; arolium much longer than claws, not divided.

Abdomen: tergites II–X (♂, ♀) and sternites IV–X (♂), VI–X (♀) with thin median suture line (Figures 18, 19, 22, 23). Tergal chaetotaxy: ♂, 3: 4: 3: 6: 8: 8: 8: 8: 7: 6: 2: 2; ♀, 6: 6: 6: 8: 8: 10: 10: 10: 8: 6: 2: 2; uniseriate; all setae quadricarinate. Sternal chaetotaxy: ♂, 4: (0) 2 [4 + 4] (0): (0) 4 (0): 4: 6: 8: 8: 6: 6: 2: 2; ♀, 2: (0) 6 (0): (0) 7 (0): 10: 9: 11: 9:



Figures 26–34. *Synsphyronus spatiosus*, sp. nov., male holotype (WAM T140404), unless stated otherwise: 26, carapace, dorsal; 27, left ocular region, dorsal; 28, right pedipalp, dorsal; 29, left rallum, lateral; 30, left leg IV, lateral; 31, left chela, retrolateral; 32, chelal teeth, retrolateral; 33, left chela, setae omitted, retrolateral, tritonymph (WAM T140413); 34, left chela, setae omitted, retrolateral, deutonymph (WAM T146821). Scale lines = 1.0 mm (Figures 28); 0.5 mm (Figures 26, 30, 31, 33, 34); 0.2 mm (Figures 27, 32); 0.1 mm (Figure 29).

7: 6: 4: 2; uniseriate; all setae quadricarinate except for those on sternite II (♂) and sternites II–IV (♀), which are acuminate. Spiracles without helix. Anal plates (tergite XII and sternite XII) situated within sternite XI, surrounded by slightly raised rim. Pleural membrane wrinkled-plicate; without any setae.

Genitalia: male: lateral apodeme laterally extended and distally broadened; anterior apodeme acute; a pair of acute dorsal apodemes; lateral rod very broad ventrally and with a blunt, anterior projection; ejaculatory canal atrium large and cup-shaped. Female: with one pair of lateral cribriform plates and 2 pairs of median cribriform plates.

Dimensions (mm): holotype male, followed by 5 other males (when measured): body length 3.86 (3.34–4.04). Pedipalps: trochanter 0.585/0.385, femur 1.635/0.290 (1.565–1.785/0.290–0.325), patella 1.265/0.315 (1.165–1.330/0.305–0.325), chela (with pedicel) 2.290/0.390 (2.215–2.450/0.375–0.415), chela (without pedicel) 2.220 (2.130–2.275), hand (without pedicel) length 1.130 (1.070–1.180), movable finger length 1.120 (1.070–1.120). Carapace 1.075/1.195 (1.010–1.115/1.105–1.280); eye diameter, anterior 0.085, posterior 0.095. Leg IV: femur + patella 1.105/0.260, tibia 0.810/0.130, metatarsus 0.365/0.100, tarsus 0.280/0.090.

Paratype female (WAM T140409), followed by 3 other females (when measured): body length 4.35 (4.10–4.50). Pedipalps: trochanter 0.620/0.430, femur 1.760/0.320 (1.665–1.810/0.305–0.340), patella 1.325/0.355 (1.290–1.360/0.325–0.355), chela (with pedicel) 2.460/0.495 (2.355–2.510/0.445–0.480), chela (without pedicel) 2.335 (2.250–2.400), hand (without pedicel) length 1.185 (1.135–1.205), movable finger length 1.225 (1.140–1.220). Carapace 1.155/1.295 (1.150–1.200/1.250–1.320); eye diameter, anterior 0.095, posterior 0.110. Leg IV: femur + patella 1.165/0.255, tibia 0.890/0.135, metatarsus 0.405/0.110, tarsus 0.310/0.095.

Tritonymph

Colour: uniformly pale brown.

Chelicera: with 5 setae on hand and 1 on movable finger; galea distally bifurcate with short rami.

Pedipalp: trochanter 1.50, femur 5.09, patella 3.61, chela (with pedicel) 5.00, chela (without pedicel) 4.75, hand (without pedicel) 2.40 × longer than broad, and movable finger 0.99 × longer than hand (without pedicel). Fixed chelal finger with 7 trichobothria, movable chelal finger with 2 trichobothria (Figure 33): *eb*, *esb*, *ist* and *ib* situated basally; *est* situated medially; *et* and *it* subdistally; *b* subbasally; *t* subdistally.

Carapace: 0.91 × longer than broad; with 24 setae including 2 setae near anterior margin and 4 near posterior margin.

Coxal region: manducatory process with 3 apical acuminate setae, pedipalpal coxa with 3 additional setae; chaetotaxy of coxae I–IV: 3: 3: 4: 4.

Legs: metatarsi and tarsi fused.

Abdomen: tergal chaetotaxy: 6: 6: 6: 7: 7: 7: 9: 6: 7: 8: 2: 2. Sternal chaetotaxy: 0: (0) 2 (0): (0) 4 (0): 8: 6: 8: 8: 7: 6: 4: 2.

Dimensions (mm) (WAM T140413): body length 3.37. Pedipalps: trochanter 0.510/0.340, femur 1.400/0.275, patella 1.030/0.285, chela (with pedicel) 2.000/0.400, chela (without pedicel) 1.900, hand length (without pedicel) 0.960, movable finger length 0.950. Carapace 0.960/1.055.

Deutonymph

Colour: uniformly pale yellow-brown.

Chelicera: with 5 setae on hand and 1 on movable finger; galea distally bifurcate with short rami.

Pedipalp: trochanter 1.45, femur 4.40, patella 3.02, chela (with pedicel) 4.48, chela (without pedicel) 4.25, hand (without pedicel) 2.19 × longer than broad, and movable finger 1.00 × longer than hand (without pedicel). Fixed chelal finger with 6 trichobothria, movable chelal finger with 2 trichobothria (Figure 34): *eb*, *ist* and *ib* situated basally; *est* situated medially; *et* and *it* subdistally; *b* subbasally; *t* subdistally.

Carapace: 0.86 × longer than broad; with 23 setae including 2 setae near anterior margin and 2 near posterior margin.

Coxal region: manducatory process with 3 apical acuminate setae, pedipalpal coxa with 3 additional setae; chaetotaxy of coxae I–IV: 2: 3: 3: 5.

Legs: metatarsi and tarsi fused.

Abdomen: tergal chaetotaxy: 4: 4: 4: 4: 4: 6: 4: 4: 4: 5: 0: 2. Sternal chaetotaxy: 0: (0) 0 (0): (0) 2 (0): 2: 4: 4: 6: 6: 5: 2: 2.

Dimensions (mm) (WAM T146821): body length 2.57. Pedipalps: trochanter 0.400/0.275, femur 0.990/0.225, patella 0.740/0.245, chela (with pedicel) 1.500/0.335, chela (without pedicel) 1.425, hand length (without pedicel) 0.735, movable finger length 0.735. Carapace 0.775/0.905.

Remarks

The specimens of *Synsphyronus spatiosus* were collected from the underside of granite rocks at Walga Rock.

A COI barcode sequence of a paratype specimen, T155369, is available under the GenBank accession number MZ902325.

Etymology

This species is named for its large size and the large size of Walga Rock (*spatiosus*, Latin, roomy, large) (Brown 1956).

Synsphyronus tenuis Harvey, sp. nov.

Figures 35–54

<http://zoobank.org/NomenclaturalActs/BB505FF8-E7AB-4EE0-A2C3-7779ED4CB4EA>

Material examined

Holotype

AUSTRALIA: *Western Australia*: ♂, Kalbarri National Park, The Loop Trail, 27°33'02"S, 114°26'49"E, 16 August 2016, under sandstone rocks, M.S. Harvey, M.E. Blosfelds (WAM T141121).

Paratypes

AUSTRALIA: *Western Australia*: 1 ♂, 7 ♀, 2 deutonymphs, 1 protonymph, collected with holotype (WAM T140395–T140403, T141122, T141123).

Other material

AUSTRALIA: *Western Australia*: 1 ♀, 3 tritonymphs, 1 deutonymph, Kalbarri National Park, Nature's Window Trail, 27°32'58.1"S, 114°26'55.0"E, 14 August 2012, under sandstone rocks, J.M. Waldock, K. Brimmell (WAM T127597, T140417–140420).

Diagnosis

Synsphyronus tenuis most closely resembles those species of the genus that have fused metatarsi and tarsi (Figure 48) and eight trichobothria on the fixed chelal finger and three trichobothria on the movable finger (Figure 50), all of which are from Australia: *S. codyi* Cullen & Harvey, 2021, *S. ejuncidus* Harvey, 1987, *S. hadronennus* Harvey, 1987, *S. meganennus* Harvey, 1987 and *S. sertus* Cullen & Harvey, 2021. It differs from all of these species by the extremely long and narrow pedipalpal chela, which is 1.840–1.855 (♂), 1.870–2.130 (♀) mm long, and 6.46–6.63 (♂), 5.75–6.09 (♀) × longer than broad (Figure 46) and the shape of the chelal teeth which are strongly retrorse (Figure 51). It further differs from *S. hadronennus* and *S. meganennus* by the broad anterior eye (Figure 45), which is narrowed in the others.

Description

Adults

Colour: most sclerotized portions yellow-brown (Figures 36–43); tergites IV–X and sternites V–X with paired darker patches. Waxy epicuticle. Setae generally aligned perpendicularly from body, most seta quadricarinate. Most cuticular surfaces roughened, but not granulate.

Chelicera: with 5 setae on hand and 1 subdistal seta on movable finger, all setae acuminate; setae *sbs* and *bs* shorter than others; 2 dorsal lyrifissures and 1 ventral

lyrifissure; galea of ♂ and ♀ unbranched; rallum of 3 blades, all blades with spinules on leading edge (Figure 47); serrula exterior with 18 (♂, ♀) blades; lamina exterior present.

Pedipalp (Figure 48): trochanter 1.67 (♂), 1.57 (♀), femur 5.29–5.60 (♂), 5.23–5.85 (♀), patella 3.87–4.08 (♂), 3.85–4.14 (♀), chela (with pedicel) 6.46–6.63 (♂), 5.75–6.09 (♀), chela (without pedicel) 6.09–6.24 (♂), 5.46–5.98 (♀), hand 3.14–3.38 (♂), 2.74–3.05 (♀) × longer than broad, movable finger 0.88–0.93 (♂), 0.91–1.00 (♀) × longer than hand (without pedicel). Fixed chelal finger with 8 trichobothria, movable chelal finger with 3 trichobothria (Figure 50): *eb*, *esb* and *isb* situated basally in straight row, *est* submedially, *et* subdistally, *ib* and *ist* basally in diagonal row, and *it* subdistally, well posterior to *et*; *st* situated slightly closer to *sb* than to *t*; patch of microsetae present on external margin of fixed chelal finger slightly distal to *et*. Venom apparatus present in both chelal fingers, nodus ramosus not visible. Chelal teeth (Figure 51) strongly retrorse, most teeth with pointed tips, but basal teeth of movable finger rounded; fixed finger with 46 (♂), 49 (♀) teeth; movable finger with 35 (♂), 41 (♀) teeth; accessory teeth absent.

Carapace (Figures 38, 42, 44): 0.86–0.91 (♂), 0.81–0.86 (♀) × longer than broad; anterior margin slightly indented medially; subtriangular; with 2 pairs of corneate eyes (Figure 45) situated *ca.* one-third carapace length from anterior margin; anterior eye broad and rounded; with 20 (♂, ♀) setae, including 2 (♂), 2 (♀) near anterior margin and 2 (♂), 3 (♀) near posterior margin; with numerous lyrifissures; with faint posterior furrow.

Coxal region: manducatory process rounded, with 3 (♂, ♀) apical acuminate setae, plus 9 (♂), 8 (♀) additional setae; medial maxillary lyrifissure situated submedially; chaetotaxy of coxae I–IV: ♂, 3: 6: 5: 5; ♀, 3: 4: 7: 11.

Legs: junction between femora and patellae I and II slightly oblique to long axis; junction between femora and patellae III and IV very angulate; femora III and IV much smaller than patellae III and IV (Figure 48); femur + patella of leg IV 3.55 (♂), 4.11 (♀) × longer than broad; metatarsi and tarsi fused and without tactile seta (Figures 48, 49); subterminal tarsal setae arcuate and acute; arolium much longer than claws, not divided.

Abdomen: tergites II–X (♂, ♀) and sternite IV (♂) with thin median suture line, V–X (♂, ♀) with thin suture line in anterior half of sclerite (Figures 36–38, 40–42). Tergal chaetotaxy: ♂, 4: 4: 4: 4: 6: 6: 8: 6: 6: 4: 2: 2; ♀, 3: 4: 4: 4: 6: 6: 7: 8: 7: 7: 2: 2; uniseriate; all setae quadricarinate. Sternal chaetotaxy: ♂, 5: (0) 6 [4 + 4] (0): (0) 6 (0): 6: 4: 6: 8: 6: 6: 4: 2; ♀, 4: (0) 8 (0): (0) 6 (0): 8: 8: 7: 8: 8: 6: 4: 2; uniseriate; all setae quadricarinate except for those on sternite II and median pair of setae on sternite III (♂), and sternites II–IV (♀), which are acuminate. Spiracles without helix. Anal plates (tergite XII and sternite XII) situated within sternite XI, surrounded by slightly raised rim. Pleural membrane wrinkled-plicate; without any setae.



Figure 35. *Synsphyronus tenuis* Harvey, sp. nov., female, habitus (WAM T141121).

Genitalia: male: lateral apodeme laterally extended and distally broadened; anterior apodeme acute; a pair of acute dorsal apodemes; lateral rod very broad ventrally and with a blunt, anterior projection; ejaculatory canal atrium large and cup-shaped. Female: with one pair of lateral cribriform plates and 2 pairs of median cribriform plates.

Dimensions (mm): holotype male, followed by 1 other male (when measured): body length 3.44 (3.74). Pedipalps: trochanter 0.510/0.305, femur 1.400/0.250 (1.375/0.260), patella 1.040/0.255 (1.025/0.265), chela (with pedicel) 1.855/0.280 (1.840/0.285), chela (without pedicel) 1.760 (1.735), hand (without pedicel) length 0.945 (0.895), movable finger length 0.835 (0.830). Carapace 0.970/1.065 (1.000/1.160); eye diameter, anterior 0.090, posterior 0.070. Leg I: femur 0.320/0.145, patella 0.340/0.175, tibia 0.425/0.100, tarsus 0.340/0.075. Leg IV: femur + patella 0.870/0.245, tibia 0.625/0.120, tarsus 0.415/0.095.

Paratype female (WAM T140397), followed by 4 other females (when measured): body length 3.97 (3.66–4.29). Pedipalps: trochanter 0.565/0.360, femur 1.465/0.280 (1.385–1.520/0.250–0.285), patella 1.135/0.295 (1.030–1.180/0.255–0.285), chela (with pedicel) 1.985/0.345 (1.870–2.130/0.320–0.350), chela (without pedicel) 1.885 (1.800–1.985), hand (without pedicel) length 0.945 (0.900–1.040), movable finger length 0.945 (0.880–0.960). Carapace 1.040/1.235 (1.000–1.105/

1.185–1.345); eye diameter, anterior 0.070, posterior 0.075. Leg I: femur 0.365/0.155, patella 0.365/0.185, tibia 0.455/0.095, tarsus 0.390/0.085. Leg IV: femur + patella 0.945/0.230, tibia 0.690/0.125, tarsus 0.450/0.100.

Tritonymph

Colour: pale brown, most tergites and sternites with paired spots; carapace and pedipalps slightly darker than abdomen.

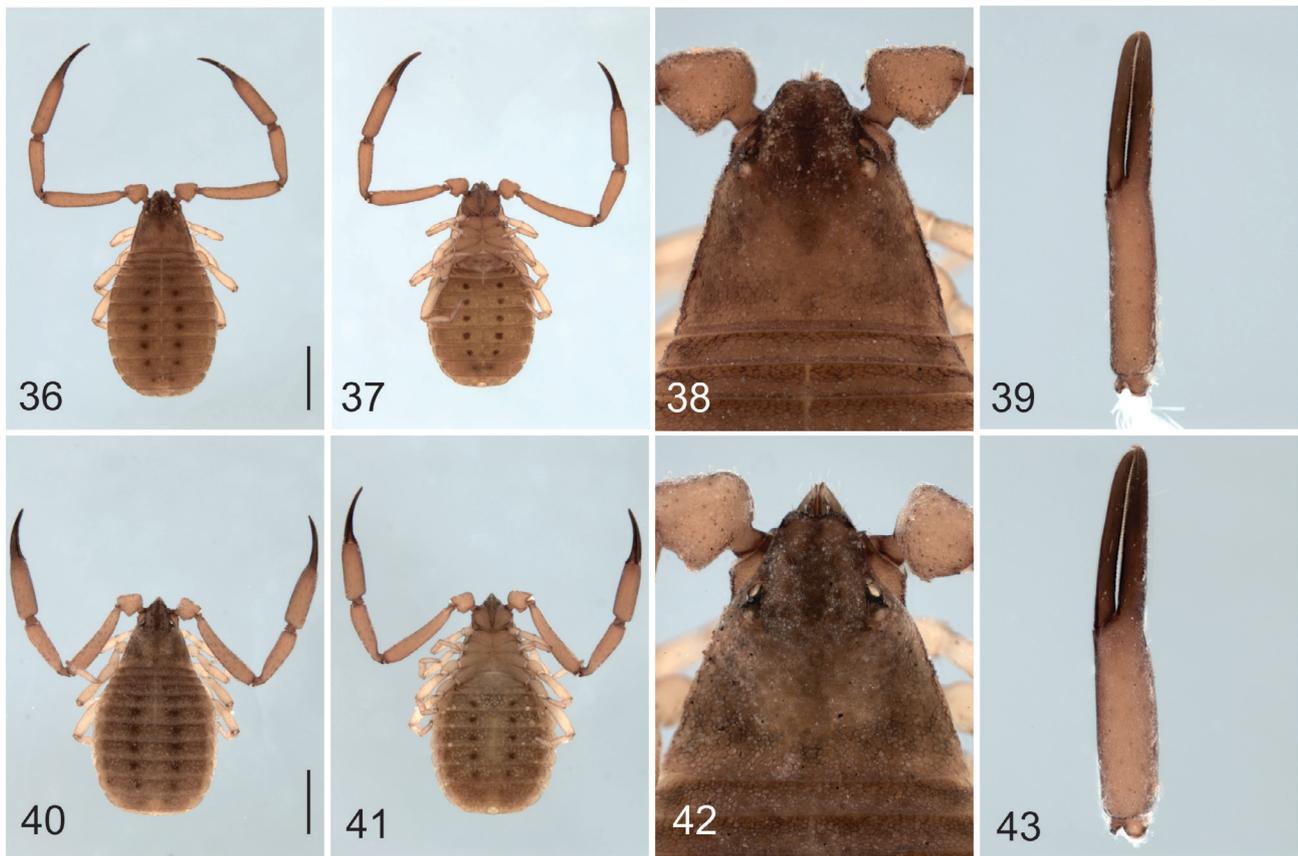
Chelicera: with 5 setae on hand and 1 on movable finger; galea unbranched.

Pedipalp: trochanter 1.67, femur 4.72, patella 3.32, chela (with pedicel) 5.18, chela (without pedicel) 4.93, hand (without pedicel) 2.53 × longer than broad, and movable finger 0.96 × longer than hand (without pedicel). Fixed chelal finger with 7 trichobothria, movable chelal finger with 2 trichobothria (Figure 52): *eb*, *esb*, *ist* and *ib* situated basally; *est* situated medially; *et* and *it* subdistally; *b* subbasally; *t* submedially.

Carapace: 0.88 × longer than broad; with 18 setae including 2 setae near anterior margin and 4 near posterior margin.

Coxal region: manducatory process with 3 apical acuminate setae, pedipalpal coxa with 7 additional setae; chaetotaxy of coxae I–IV: 2: 3: 4: 5.

Legs: metatarsi and tarsi fused.



Figures 36–43. *Synsphyronus tenuis*, sp. nov.: 36–39, male holotype (WAM T141121): 36, dorsal; 37, ventral; 38, cephalothorax, dorsal; 39, left chelal fingers, retrolateral; 40–43, female paratype (WAM T140397): 40, dorsal; 41, ventral; 42, cephalothorax, dorsal; 43, left chelal fingers, retrolateral. Scale lines = 1 mm.

Abdomen: tergal chaetotaxy: 4: 4: 4: 4: 5: 6: 7: 7: 6: 5: 2: 2. Sternal chaetotaxy: 0: (0) 5 (0): (0) 4 (0): 8: 7: 6: 6: 7: 6: 2: 2.

Dimensions (mm) (WAM T140417): body length 3.03. Pedipalps: trochanter 0.500/0.300, femur 1.110/0.235, patella 0.830/0.250, chela (with pedicel) 1.555/0.300, chela (without pedicel) 1.480, hand length (without pedicel) 0.760, movable finger length 0.730. Carapace 0.880/0.9950.

Deutonymph

Colour: pale yellow-brown, most tergites and sternites with paired spots; carapace and pedipalps slightly darker than abdomen.

Chelicera: with 5 setae on hand and 1 on movable finger; galea unbranched.

Pedipalp: trochanter 1.56, femur 3.91, patella 2.71, chela (with pedicel) 4.81, chela (without pedicel) 4.44, hand (without pedicel) 2.03 × longer than broad, and movable finger 1.17 × longer than hand (without pedicel). Fixed chelal finger with 6 trichobothria, movable chelal finger with 2 trichobothria (Figure 53): *eb*, *ist* and *ib* situated basally; *est* situated medially; *et* and *it* subdistally; *b* sub-basally; *t* subdistally.

Carapace: 0.80 × longer than broad; with 17 setae including 2 setae near anterior margin and 3 near posterior margin.

Coxal region: manducatory process with 3 apical acuminate setae, pedipalpal coxa with 6 additional setae; chaetotaxy of coxae I–IV: 2: 3: 3: 4.

Legs: metatarsi and tarsi fused.

Abdomen: tergal chaetotaxy: 4: 4: 4: 4: 5: 5: 5: 6: 6: 2: 2. Sternal chaetotaxy: 0: (0) 2 (0): (0) 2 (0): 4: 4: 4: 6: 6: 6: 4: 2.

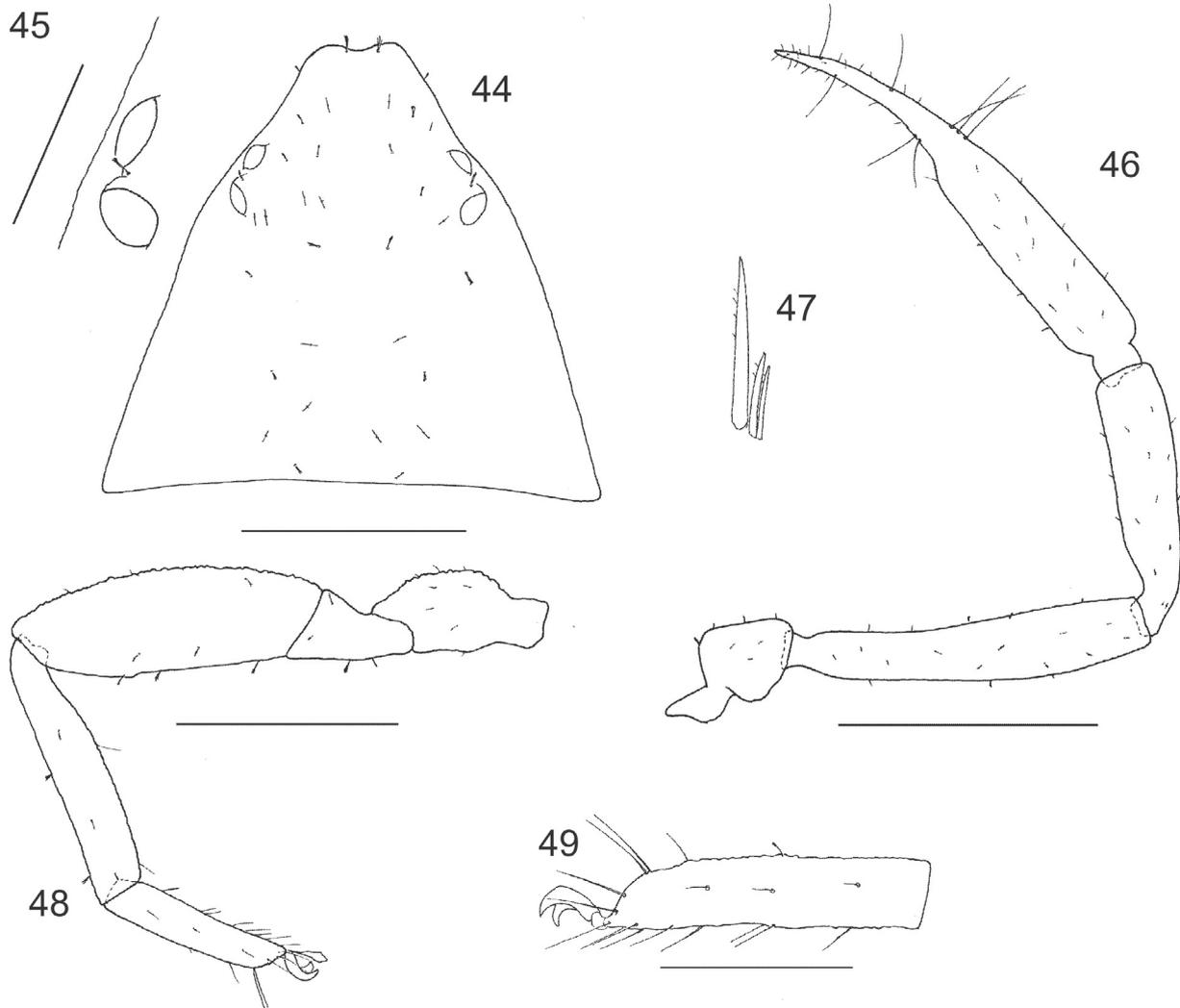
Dimensions (mm) (WAM T140401): body length 2.72. Pedipalps: trochanter 0.405/0.260, femur 0.900/0.230, patella 0.665/0.245, chela (with pedicel) 1.420/0.295, chela (without pedicel) 1.310, hand length (without pedicel) 0.600, movable finger length 0.700. Carapace 0.745/0.930.

Protonymph

Colour: pale yellow-brown.

Chelicera: with 4 setae on hand and 0 on movable finger; galea unbranched.

Pedipalp: trochanter 1.76, femur 3.50, patella 2.31, chela (with pedicel) 4.02, chela (without pedicel) 3.84, hand (without pedicel) 1.71 × longer than broad, and movable



Figures 44–49. *Synsphyronus tenuis*, sp. nov., male holotype (WAM T141121): 44, carapace, dorsal; 45, left ocular region, dorsal; 46, right pedipalp, dorsal; 47, left rallum, lateral; 48, left leg IV, lateral; 49, left tarsus IV, lateral. Scale lines = 1.0 mm (Figure 46); 0.5 mm (Figures 44, 48, 49); 0.2 mm (Figure 45).

finger 1.26 × longer than hand (without pedicel). Fixed chelal finger with 3 trichobothria, movable chelal finger with 1 trichobothria (Figure 54): *eb* and *ist* situated basally; *et* situated sub-medially; *t* situated sub-medially.

Carapace: 0.80 × longer than broad.

Coxal region: manducatory process with 2 apical acuminate setae, pedipalpal coxa with 2 additional setae; chaetotaxy of coxae I–IV: 1: 1: 1: 1.

Legs: metatarsi and tarsi fused.

Abdomen: tergal chaetotaxy: 2: 4: 4: 4: 4: 4: 4: 4: 4: 2. Sternal chaetotaxy: 0: (0) 2 (0): (0) 2 (0): 2: 2: 2: 2: 2: 2: 2: 2.

Dimensions (mm) (WAM T140403): Body length 2.335. Pedipalps: trochanter 0.325/0.185, femur 0.665/0.190, patella 0.485/0.210, chela (with pedicel) 1.025/0.255, chela (without pedicel) 0.980, hand length (without pedi-

cel) 0.435, movable finger length 0.550. Carapace 0.590/0.735.

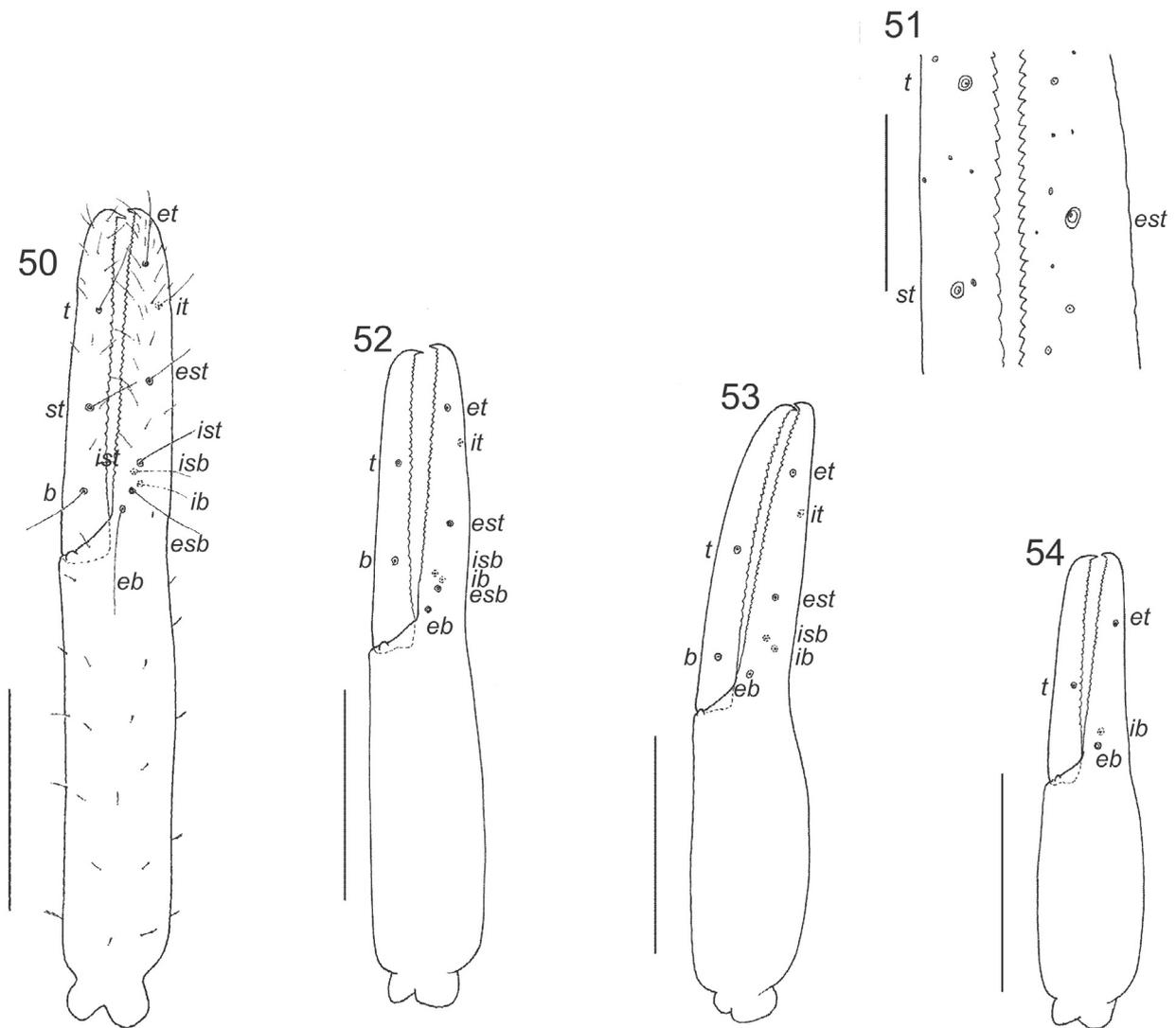
Remarks

Synsphyronus tenuis has only been collected from within a small area of Kalbarri National Park, where they occur under sandstone rocks.

COI barcode sequences of two paratype specimens, T141122 and T141123, are available under the GenBank accession numbers MZ902323 and MZ902324, respectively.

Etymology

This species is named for its extremely slender appendages, especially the pedipalps (*tenuis*, Latin, thin) (Brown 1956).



Figures 50–54. *Synsphyronus tenuis*, sp. nov.: 50, left chela, retrolateral, male holotype (WAM T141121); 51, chelal teeth, retrolateral, male holotype (WAM T141121); 52, left chela, setae omitted, lateral, tritonymph (WAM T140417); 53, left chela, setae omitted, retrolateral, deutonymph (WAM T140401); 54, left chela, setae omitted, retrolateral, protonymph (WAM T140403). Scale lines = 0.5 mm (Figures 51–54); 0.2 mm (Figure 50).

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