

Systematics of the spiny trapdoor spider genus *Bungulla* (Mygalomorphae: Idiopidae): revealing a remarkable radiation of mygalomorph spiders from the Western Australian arid zone

Michael G. Rix^{1,2,3}, Robert J. Raven¹, Andrew D. Austin², Steven J. B. Cooper^{2,4} and Mark S. Harvey^{3,5,6}: ¹Biodiversity and Geosciences Program, Queensland Museum, South Brisbane, Queensland 4101, Australia. E-mail: michael.rix@qm.qld.gov.au; ²Australian Centre for Evolutionary Biology and Biodiversity, and Department of Ecology and Evolutionary Biology, School of Biological Sciences, The University of Adelaide, Adelaide, South Australia 5005, Australia; ³Department of Terrestrial Zoology, Western Australian Museum, Welshpool, Western Australia 6106, Australia; ⁴Evolutionary Biology Unit, South Australian Museum, Adelaide, South Australia 5005, Australia; ⁵School of Biological Sciences, The University of Western Australia, Crawley, Western Australia 6009, Australia; ⁶School of Natural Sciences, Edith Cowan University, Joondalup, Western Australia 6027, Australia

Abstract. The aganippine spiny trapdoor spiders of the genus *Bungulla* Rix, Main, Raven & Harvey are revised, and 30 new species are described from Western Australia: *B. ajana* sp. nov., *B. aplini* sp. nov., *B. banksia* sp. nov., *B. bella* sp. nov., *B. bidgemia* sp. nov., *B. biota* sp. nov., *B. bringo* sp. nov., *B. burbridgei* sp. nov., *B. dipsodes* sp. nov., *B. disrupta* sp. nov., *B. ferraria* sp. nov., *B. fusca* sp. nov., *B. gibba* sp. nov., *B. hamelinensis* sp. nov., *B. harrisonae* sp. nov., *B. hillyerae* sp. nov., *B. inermis* sp. nov., *B. iota* sp. nov., *B. keigheryi* sp. nov., *B. keirani* sp. nov., *B. kendricki* sp. nov., *B. laevigata* sp. nov., *B. mckenziei* sp. nov., *B. oraria* sp. nov., *B. parva* sp. nov., *B. quobba* sp. nov., *B. sampeyae* sp. nov., *B. weld* sp. nov., *B. westi* sp. nov. and *B. yeni* sp. nov. The type species, *B. bertmaini* Rix, Main, Raven & Harvey, 2017, is re-illustrated and re-diagnosed, and *B. riparia* (Main, 1957) is re-described. Molecular data from seven genes for a subset of taxa are analyzed with Bayesian methods, to complement the morphological descriptions, to help delimit three species known only from female specimens, and to generate a provisional phylogeny of the genus. Species of *Bungulla* exhibit a remarkable range of genitalic and somatic morphologies, and we here document this diversity, demonstrating that the characteristic loss of the retrolateral tibial apophysis has not been associated with a concomitant loss of genitalic complexity. We further provide a key to all known species and highlight the southern Carnarvon Basin (including the western Yalgoo and northern Geraldton Sandplains) as a hotspot of diversity.

Keywords: Taxonomy, tribe Aganippini, subfamily Arbanitinae, biogeography, Shark Bay

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:pub:8544DABD-1B89-47C9-A4DC-09E552329F5D>

The spiny trapdoor spiders of the Western Australian endemic genus *Bungulla* Rix, Main, Raven & Harvey, 2017 (Figs. 1–10) are a major component of the idiopid fauna of western continental Australia (Fig. 11), and among the genera of Aganippini, second only to *Idiosoma* Ausserer, 1871 in known diversity (Rix et al. 2017d; M. Rix unpubl. data). Prior to 2017, the only described species in the genus, *B. riparia* (Main, 1957), was placed in the genus *Eucyrtops* Pocock, 1897, along with numerous recognized but undescribed species present in Australian collections. The molecular phylogenetic study of Rix et al. (2017b) was the first to highlight the presence of two main clades of *Eucyrtops* (Fig. 10), and subsequent morphological analysis clarified the identity of the *Bungulla*-clade relative to *E. latior* (O. P.-Cambridge, 1877) and its closest relatives (i.e., *Eucyrtops* s. s.). As a result, Rix et al. (2017d) formally described *Bungulla* (for which a genus-group name was not previously available), and removed the closely related genus *Gaius* Rainbow, 1914 from synonymy with *Anidiops* Pocock, 1897.

As the only lineage of Arbanitinae without a retrolateral tibial apophysis (RTA) on the male pedipalp, species of *Bungulla* are among the most recognizable of Australasian Idiopidae. Thanks to collections made for environmental impact assessments since 2000, and to major biotic surveys throughout Western Australia since the 1990s (Burbidge et al. 2000; Keighery 2004; McKenzie et al. 2009), all of which

utilized wet pitfall trapping methods and long-term sampling, we now know that the genus has a widespread distribution throughout much of western, central and south-western Western Australia (Fig. 11). Relatively few specimens were known prior to the 1990s, due in part to the rarity and low diversity of species from temperate regions, and a dearth of collections from more remote areas. However, during the then CALM (Department of Conservation and Land Management) ‘Biodiversity Survey of the Southern Carnarvon Basin’, run from 1994–1995 (Burbidge et al. 2000; Main et al. 2000), the remarkable diversity of arid zone *Bungulla* was revealed for the first time. This comprehensive biological survey resulted in the collection of over one third (i.e., 13) of all new species of *Bungulla* described in the current study, over 90% of which appear to be endemic to the region. At a number of sites (e.g., Zuytdorp and Nanga Station), unprecedented levels of sympatry or parapatry were documented (as ‘*Eucyrtops*’; Main et al. 2000). Additional survey work in subsequent years has resulted in the discovery of other new species, especially in the Murchison bioregion, however nowhere else exhibits the same level of species diversity as the southern Carnarvon Basin (including the adjacent western Yalgoo and northern Geraldton Sandplains). Documenting this remarkable diversity is therefore the aim of our study, not least because the conservation of Australian trapdoor spiders is dependent on a robust taxonomy (Rix et al. 2017c).



Figures 1–9.—Live habitus images and burrows of *Bungulla*: 1–3, holotype male (WAM T126205) and burrow of *B. biota* sp. nov. from Mount Richardson (Western Australia); 4, holotype male *B. hillyerae* sp. nov. (WAM T144352) from Madura Caravan Park (Western Australia); 5–6, burrow of holotype female *B. harrisonae* sp. nov. (WAM T129257) from John Forrest National Park (Western Australia), with Australian two dollar coin of diameter 20 mm for scale; 7–9, paratype female (WAM T143010) and burrow of *B. gibba* sp. nov. from Two Peoples Bay Nature Reserve (Western Australia). Images 1–3 by R. Teale; 4, 7 by M. Harvey; 5–6, 8–9 by M. Rix.

This paper is the fourth in a series of revisionary works to describe Western Australia's known species of *Bungulla*, *Cataxia* Rainbow, 1914 (see Rix et al. 2017a), *Eucanippe* Rix, Main, Raven & Harvey, 2017 (see Rix et al. 2018), *Eucyrtops*, *Euoplos* Rainbow, 1914, *Gaius* Rainbow, 1914 and *Idiosoma* (see Rix et al. 2017d). Thirty new species of *Bungulla* are here described, taking the total number of species in the genus to 32.

METHODS

Morphological methods.—Morphological methods, including the format of species descriptions, follow Rix et al. (2017d). All species are distinguished and diagnosed according to a generalized species concept, whereby morphological and (where available) molecular data are combined to provide the operational criteria for distinguishing “separately evolving metapopulation lineages” (de Queiroz 2007: 880). Most

species are described from only one sex, due largely to male collection biases in pitfall trap surveys, and to the requirement of molecular data for adequately distinguishing *Bungulla* females from similar females of *Eucyrtops*. Specimens were examined using a Zeiss Stemi SV11 stereomicroscope, and female genitalia were cleared in 100% lactic acid at room temperature. Measurements (in millimeters, to one decimal place) and digital automontage images were taken using a Leica M165C stereomicroscope with mounted DFC425 digital camera and processed using Leica Application Suite Version 3.7 software; one specimen (WAM T3961) was imaged using a Leica MZ16A stereomicroscope with mounted DFC500 digital camera and processed using Leica Application Suite Version 4.6.1 software. Species are presented in this paper in alphabetical order (following the generic type species), and leg segments were measured along the dorsal prolateral edge, in lateral view. Total body length measurements include the chelicerae, in dorsal view. Most available male specimens of

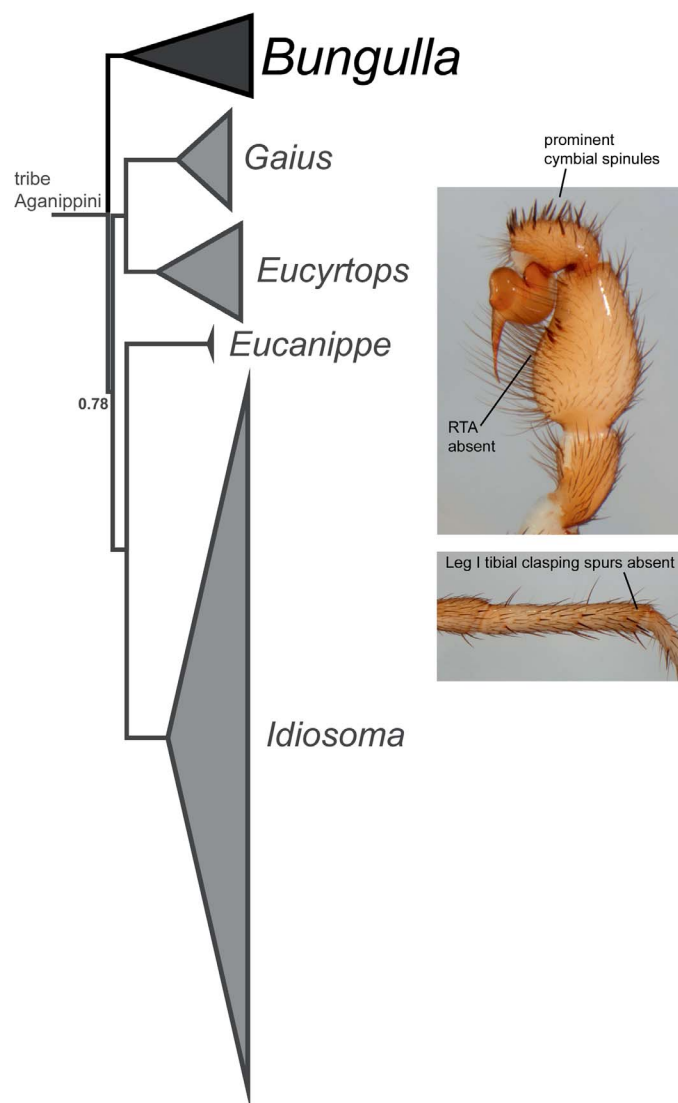


Figure 10.—Summary phylogeny of the tribe Aganippini, from the ‘FULL’ 12-gene Bayesian analysis of Rix et al. (2017b), showing the phylogenetic position of *Bungulla*. Inset images show the retrolateral pedipalp and prolatateral leg I tibia of *B. bringo* sp. nov., and the three male apomorphies characteristic of all *Bungulla*. Unlabelled nodes have a posterior probability of 1.0.

Bungulla were illustrated for this study, either within the primary numbered plates or, for additional (non-holotype) specimens, as an ‘Atlas’ series of more rapidly assembled single-shot images in four standard views (see Supplementary File 1, Online at <http://dx.doi.org/10.1636/JoA-S-17-057.s1>). The latter are included for ease of comparison to the type specimens, to directly illustrate the subtle morphological variation in key characters typical of Mygalomorphae, and to provide a comprehensive digital compendium of the material available in collections. For records with multiple specimens per vial, in most cases only a single exemplar specimen was imaged. For the species *B. bertmaini* Rix, Main, Raven & Harvey, 2017 and *B. yeni* sp. nov., for which > 20 records were available, a geographically and morphologically representative selection of 22 (*B. bertmaini*) and 12 (*B. yeni* sp.

nov.) specimens was imaged for each. Maps were generated using the online Atlas of Living Australia (online at <http://www.ala.org.au/>) and are reproduced under a Creative Commons Attribution 3.0 Australia license.

Specimens are lodged at the Western Australian Museum, Perth (WAM), the Queensland Museum, Brisbane (QMB) and the South Australian Museum, Adelaide (SAM), and the following abbreviations are used throughout the text: ALE, anterior lateral eye/s; AME, anterior median eye/s; *COI*, cytochrome *c* oxidase subunit I; *CYB*, cytochrome *b*; IBRA, Interim Biogeographic Regionalisation of Australia Version 7 (available online at <https://www.environment.gov.au/land/nrs/science/ibra>); ITS1–2, internal transcribed spacer 1–2; *MRPL45*, 39S ribosomal protein L45 mitochondrial; PLE, posterior lateral eye/s; PME, posterior median eye/s; *RPF2*, ribosome production factor 2 homolog; RTA, retrolateral tibial apophysis (of male pedipalp); *XPNPEP3*, probable Xaa-Pro aminopeptidase 3. For readability and ease of diagnosis, ‘sp. nov.’ epithets are removed from the body text after the key to species.

Molecular methods.—Nucleotide sequences for seven genes (*COI*, *CYB*, ITS1–2, *MRPL45*, *RPF2*, *XPNPEP3*) were generated for 19 specimens of *Bungulla* for which tissue was available (older pitfall trap material was not sequenced for this study), using a next-generation parallel tagged amplicon sequencing (TAS) approach, described in detail by Rix et al. (2017b). For each specimen sequenced, DNA voucher codes and GenBank accession numbers are provided next to repository registration numbers in the material examined section for each species (below), in the form: [Registration^{DNA_Voucher_Code}; GenB_*COI*_No., GenB_*CYB*_No., GenB_*MRPL45*_No., GenB_*RPF2*_No., GenB_*XPNPEP3*_No., GenB_*ITS*_No.]. Outgroup sequences were obtained from data previously published by Rix et al. (2017b). The ultimate outgroup for the molecular analyses was the diplurid spider *Cethegus fugax* (Simon, 1908), and other outgroups included an undescribed species of *Prothemnops* Schwendinger, 1991 and *Euoplos spinnipis* Rainbow, 1914. In total, sequences were analyzed for 22 specimens (see Supplementary File 2, online at <http://dx.doi.org/10.1636/JoA-S-17-057.s2>).

Individual gene alignments were conducted in Geneious R6 (Biomatters Ltd.; online at <http://www.geneious.com/>) using the MAFFT v7.017 plugin with default parameters, and these alignments were concatenated to generate a ‘FULL’ dataset (Supplementary File 2) which included all available data for all taxa, and a ‘NUCLEAR’ dataset (Supplementary File 3, online at <http://dx.doi.org/10.1636/JoA-S-17-057.s3>) which included only the nuclear sequences for 21 specimens (nuclear sequences were not available for ‘274_T131634_F_BU~disrupta’). PartitionFinder Version 1.1.1 (Lanfear et al. 2012) was used to choose an optimal partitioning scheme, favoring a 10 partition model for the ‘FULL’ dataset; for the ‘NUCLEAR’ dataset, four mitochondrial partitions were excluded (see Supplementary Files 2, 3 for a detailed summary of the models used in each analysis). Both datasets (Supplementary Files 2, 3) were analyzed in MrBayes Version 3.2.6 (Huelsenbeck & Ronquist 2001; Ronquist & Huelsenbeck 2003) via the CIPRES Science Gateway (Miller et al. 2010), with substitution model parameters estimated independently for each partition

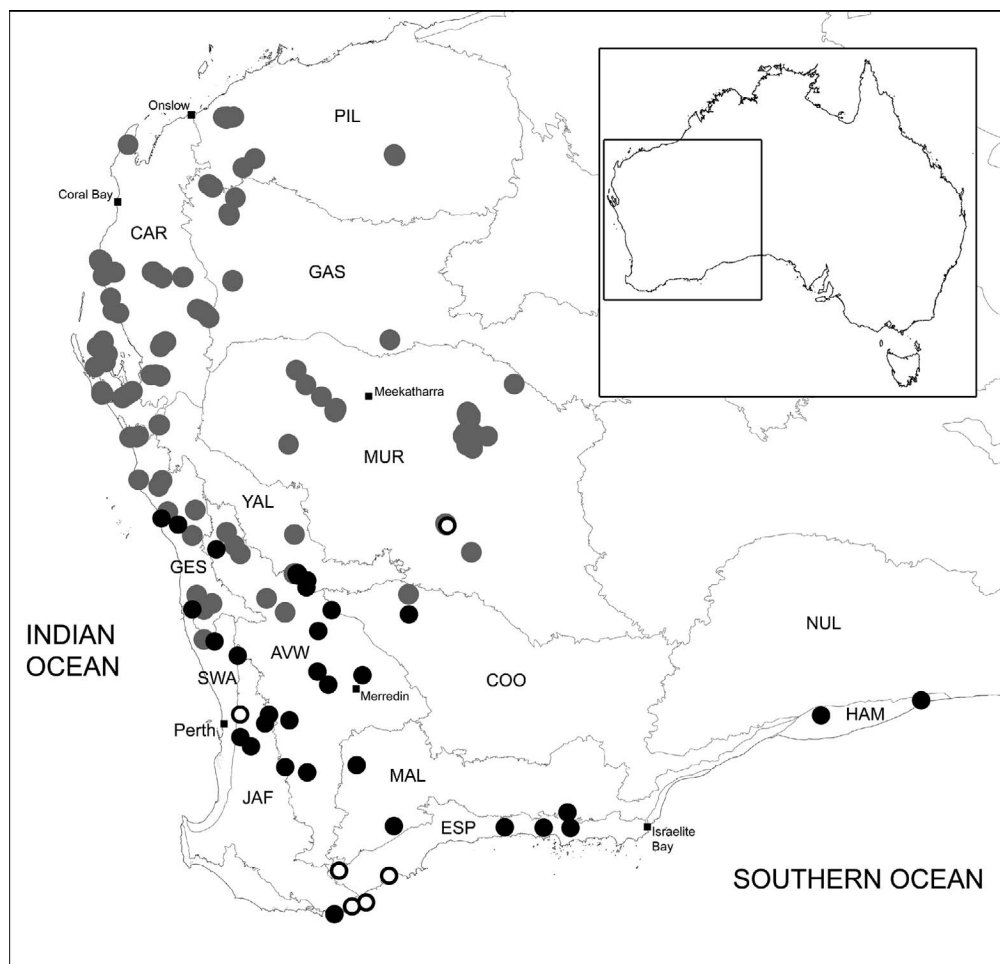


Figure 11.—Map showing collection records of *Bungulla* from Australia. Black circles denote temperate species with < 5 retrolateral spinules on the male palpal tibia (see Fig. 12); grey circles denote species with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13); open circles denote species/sites represented only by female specimens (all of which are likely to have males with < 5 spinules; see Fig. 14). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; ESP, Esperance Plains; GAS, Gascoyne; GES, Geraldton Sandplains; HAM, Hampton; JAF, Jarrah Forest; MAL, Mallee; MUR, Murchison; NUL, Nullarbor; PIL, Pilbara; SWA, Swan Coastal Plain; YAL, Yalgoo.

((Unlink tratio = (all) pinvar=(all) shape=(all) statefreq=(all) revmat=(all))) and rates allowed to vary across partitions ([Prset applyto=(all) ratepr=variable]). Four Markov Chain Monte Carlo (MCMC) chains were run for 10 million generations for each analysis, sampling every 1000 generations, with the first 10% of sampled trees discarded as 'burnin' ([burnin = 1000]). Two additional 40 million generation analyses were also run for each dataset, to ensure adequate sampling and topological congruence. Summary statistics of estimated parameters, including ESS values, were assessed using Tracer Version 1.6 (Rambaut et al. 2014), and FigTree Version 1.4.2 (online at <http://tree.bio.ed.ac.uk/software/figtree/>) was used to visualize 50% majority-rule consensus trees (Fig. 14).

RESULTS AND DISCUSSION

Bayesian analyses of both the 'FULL' dataset (2 mitochondrial genes, 5 nuclear genes; 22 specimens for 4,265 bp) and the

'NUCLEAR' dataset (5 nuclear genes; 21 specimens for 2,912 bp) recovered a similar topology (Fig. 14) consistent with that inferred by Rix et al. (2017b) for a subset of the same taxa. Male specimens identified as conspecific according to morphological criteria were also inferred as monophyletic lineages, although overall coverage of the genus at the species level was low (22%). Early-branching lineages were temperate in distribution and, although no males of these lineages were directly sequenced for the molecular analyses, an absence of spinules on the male palpal tibia (Fig. 12) is inferred as symplesiomorphic for *Bungulla* given the distributions of sequenced females (relative to Fig. 14) and the phylogenetic position of *B. disrupta* sp. nov. (WAM T131634), the latter of which is tentatively linked to male conspecifics. Sequenced species with > 10 retrolateral spinules on the male palpal tibia (i.e., *B. bertmaini*, *B. biota* sp. nov. and *B. yeni* sp. nov.; Fig. 13) were derived relative to other taxa – a result consistent with a hypothesis of 'derived xeric adaptation' out of temperate south-western Australia (Rix et al. 2015, 2017b) in

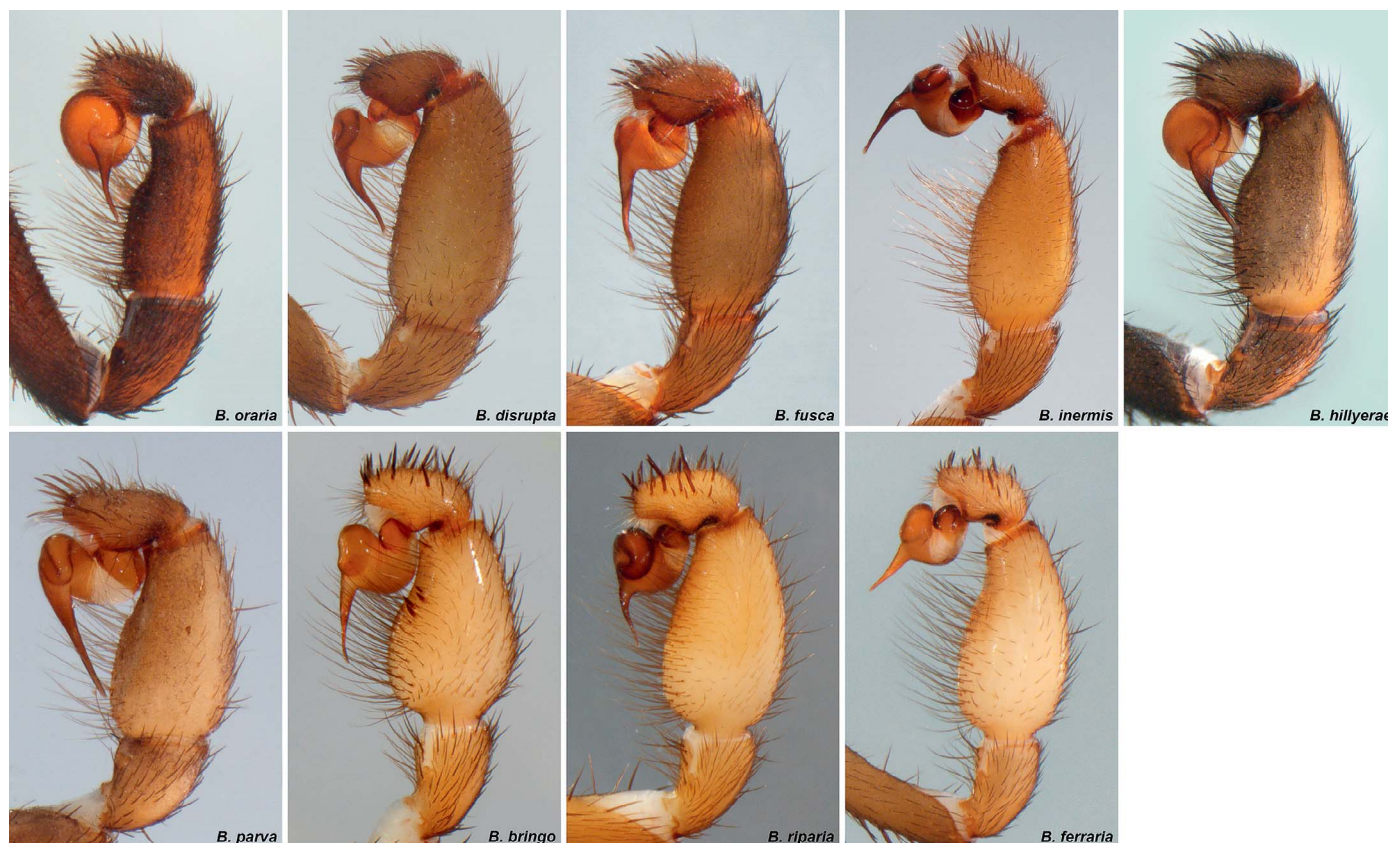


Figure 12.—Montage of pedipalps of species of *Bungulla* with < 5 retrolateral spinules on the male palpal tibia. Note the two main types of cymbial spinules.

at least one clade of taxa with numerous spinules on the palpal tibia. Pronounced mitochondrial and to a lesser extent nuclear genetic structure was also evident among disparate populations of some arid species – namely *B. bertmaini* and *B. biota* sp. nov. (Fig. 14) – however, determining whether such uncorrected pairwise divergences for *COI* (up to 15.4% for *B. biota* sp. nov., and 15.6% for *B. bertmaini*) are the result of inadequate sampling, incipient or cryptic speciation and/or distance effects requires a much larger taxon sample. Future molecular sampling in this genus should therefore focus on genetically diverse (Fig. 14) and geographically widespread (Fig. 36) taxa like *B. bertmaini*, for which cryptic speciation cannot be ruled out, and on the highly diverse fauna of the southern Carnarvon Basin, for which molecular and phylogenetic data are currently lacking. Similarly, given the diversity and apparent levels of sympatry in the southern Carnarvon Basin (as revealed by pitfall trap data), future research exploring actual levels of syntopy, patterns of spatial segregation, micro-habitat preferences, size class distributions and burrow morphologies among different species would also be useful to understand how so many congeners can potentially occur in such close proximity.

SYSTEMATICS

Family **Idiopidae** Simon, 1889

Subfamily **Arbanitinae** Simon, 1903

Tribe **Aganippini** Simon, 1903

Genus ***Bungulla*** Rix, Main, Raven & Harvey, 2017

Bungulla Rix, Main, Raven & Harvey, 2017 in Rix et al., 2017d: 602.

Type species.—*Bungulla bertmaini* Rix, Main, Raven & Harvey, 2017, by original designation.

Diagnosis.—Males of *Bungulla* can be distinguished from all other Arbanitinae by the absence of a retrolateral tibial apophysis (RTA) on the male pedipalp (Rix et al. 2017d) (Fig. 10). They can be further characterized by the absence of prolateral clasp spurs on the leg I tibia (Fig. 10; cf. Rix et al. 2017d, figs. 10, 139, 213), by the presence of a field of strong spinules on the dorsal cymbium (Fig. 10; cf. Rix et al. 2017d, figs. 48, 142, 218), and by the absence of a complete fringe of porrect setae around the lateral margins of the male carapace (Figs. 15, 99; cf. Rix et al. 2017d, figs. 35, 132, 178). Seven species have re-evolved a rudimentary RTA-like bulge on the male palpal tibia (Figs. 108, 134, 147, 280, 306, 406, 432), but can be easily placed in *Bungulla* by those features otherwise characteristic of the genus.

Females of *Bungulla* are very similar to females of *Eucyrtops* but can be distinguished from most species of *Idiosoma* and *Eucanippe* by the absence of sclerotized abdominal sigilla (Figs. 77, 200), and from species of *Gaius* by their smaller body size and relatively less setose somatic morphology. Seven autapomorphic nucleotide substitutions can also be used to

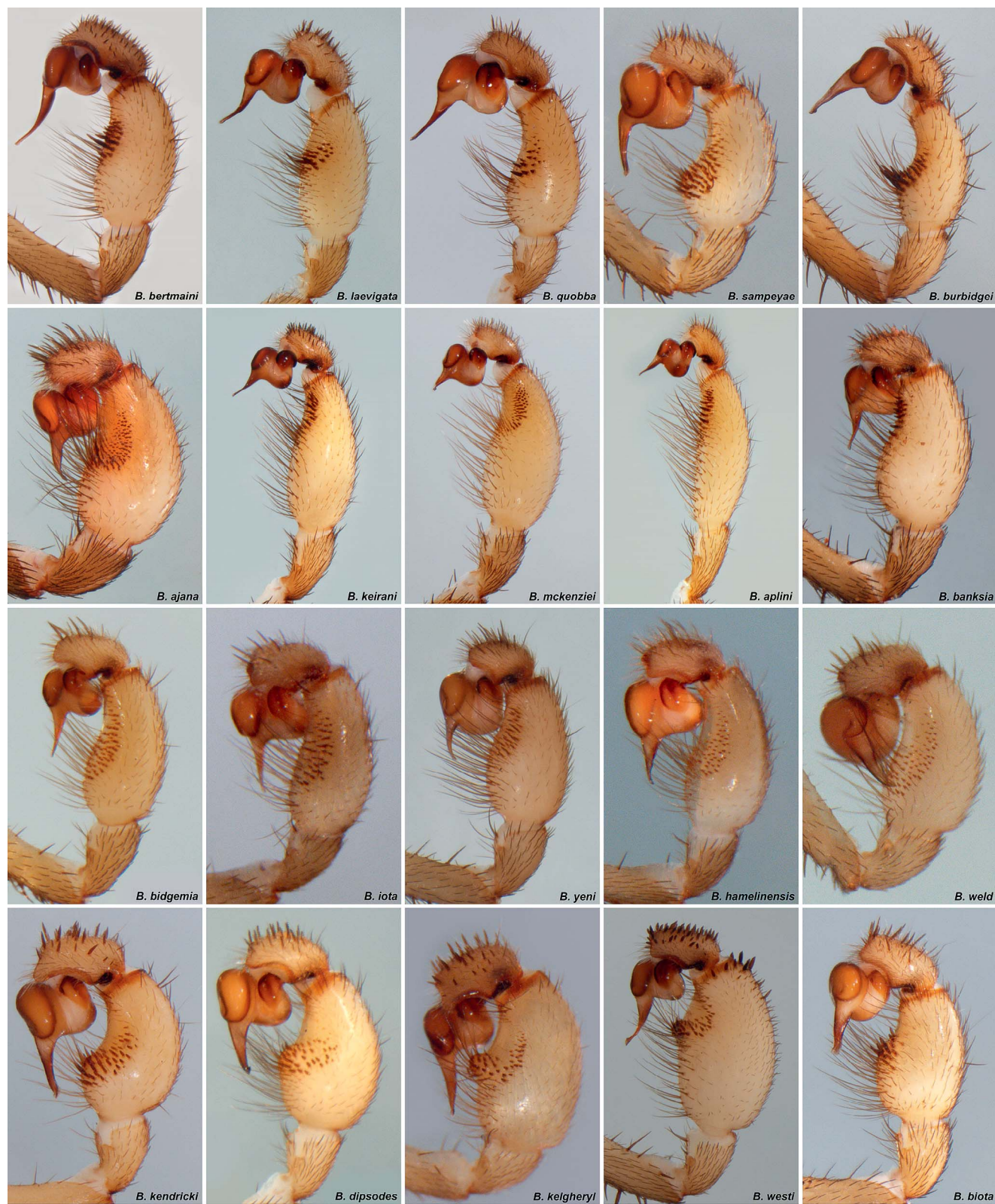


Figure 13.—Montage of pedipalps of species of *Bungulla* with > 10 retrolateral spinules on the male palpal tibia. Note the enormous variation in the shape of the tibia, the length and shape of the embolus, the distribution of tibial spinules, and the morphology of the cymbial spinules.

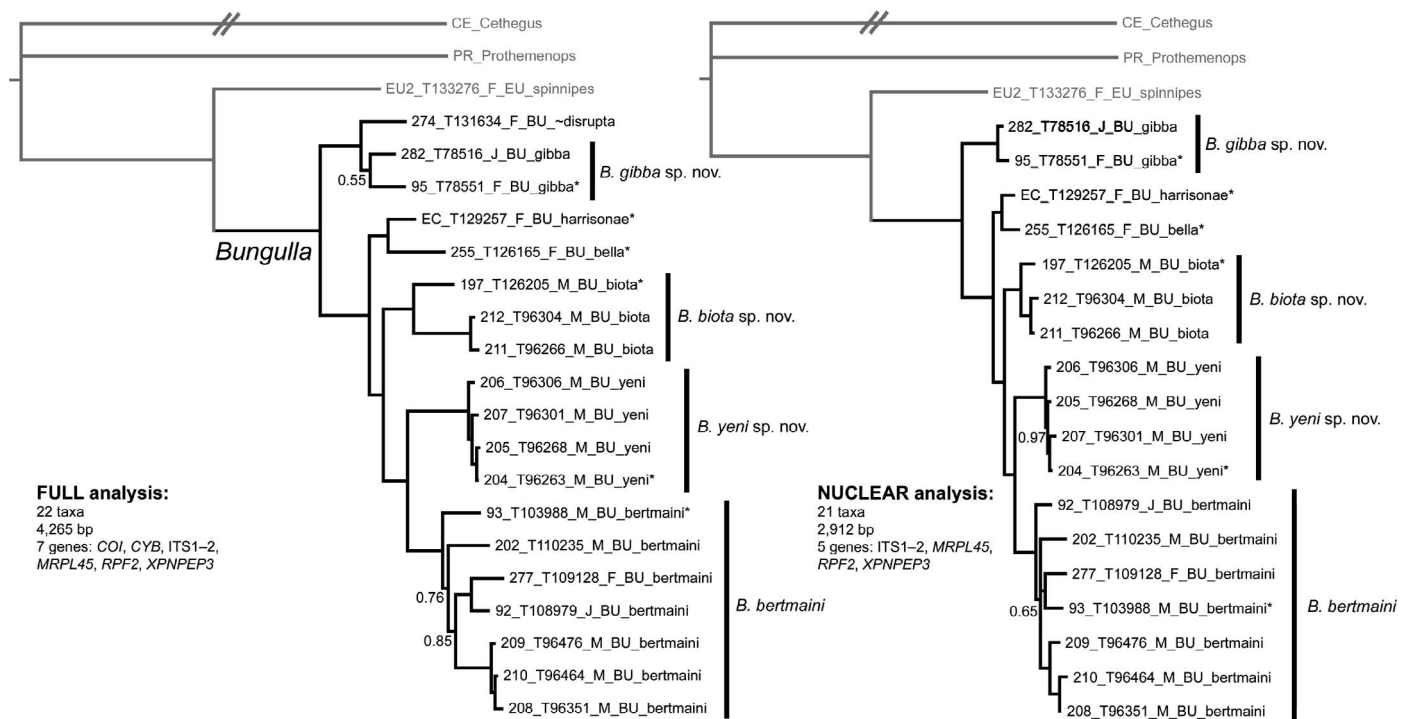


Figure 14.—Bayesian 50% majority-rule consensus trees resulting from partitioned phylogenetic analyses of the 7 gene ‘FULL’ dataset (at left) and the 5 gene ‘NUCLEAR’ dataset (at right). Posterior probabilities < 0.99 are shown adjacent to nodes (all other nodes have a posterior probability of 1.0), and holotype specimens are highlighted (*).

distinguish females, males and juveniles of *Bungulla* from species of *Eucyrtops* and all other Aganippini (see Rix et al. 2017d: 602).

Description.—See Rix et al. (2017d).

Distribution.—The genus *Bungulla* is endemic to Western Australia, with a broad distribution that extends from the temperate southern forests and south-eastern coastal heathlands, north to the Pilbara and east to the Murchison and Gascoyne bioregions (Fig. 11). Species of *Bungulla* are a major component of the idiopid fauna of central-western Western Australia, with the highest diversity of species found in the northern Geraldton Sandplains, western Yalgoo and southern Carnarvon Basin.

Composition and remarks.—*Bungulla* was found to be the sister-genus to all other Aganippini by Rix et al. (2017b; Fig. 10), and includes 32 known species, 30 of which are newly described in this study. The monophyly of the genus is

strongly supported by both molecular and morphological characters, although females remain difficult to distinguish from *Eucyrtops* in the absence of molecular data. Most species are relatively small, pale trapdoor spiders (e.g., Figs. 1, 86, 87, 138, 139), although larger and darker taxa are known from some areas (e.g., Figs. 186, 187, 222, 223, 336, 337). The characteristic loss of the RTA has not been associated with a concomitant loss of genitalic complexity, and indeed species of *Bungulla* exhibit a remarkable range of genitalic and somatic morphologies, including male pedipalps which are often unusually autapomorphic and species-specific (Figs. 12, 13). While diverse throughout much of arid and semi-arid Western Australia, little is known of their biology or burrow-building behavior, due largely to the requirement of males for morphological identification (most of which have been collected in pitfall traps) and the remote distributions of most species.

KEY TO THE AUSTRALIAN SPECIES OF *BUNGULLA* (MALES ONLY)

NB. Males of *Bungulla bella* sp. nov., *B. gibba* sp. nov. and *B. harrisonae* sp. nov. are unknown. See also Supplementary File 1 (online at <http://dx.doi.org/10.1636/JoA-S-17-057.s1>) for additional images of relevant character states.

1. Palpal tibia with < 5 (and usually without) retrolateral spinules (Fig. 12) 2
 - Palpal tibia with > 10 retrolateral spinules (Fig. 13) 10
2. Spinules on cymbium porrect, thorn-like, covering most of dorsal surface of cymbium (Figs. 12, 121, 182, 393) 3
 - Spinules on cymbium curved, anteriorly-directed and restricted to distal half of segment (Figs. 12, 160, 195, 241, 254, 345, 358) 5
3. Palpal tibia with very small field of < 5 retrolateral spinules (Figs. 121, 122) *B. bringo* sp. nov.
 - Palpal tibia without retrolateral spinules (Figs. 182, 393) 4

4. Prolateral tibia I with staggered row of ≥ 4 medial spine-like setae (Fig. 392); palpal tibia relatively stout, without strongly concave disto-ventral margin in retrolateral view (Fig. 393)..... *B. riparia* (Main, 1957)
- Prolateral tibia I with 1–3 medial spine-like setae (Fig. 181); palpal tibia more tapered distally, with strongly concave disto-ventral margin in retrolateral view (Fig. 182)..... *B. ferraria* sp. nov.
5. Body size very small (carapace width < 2.5) (Fig. 349)..... *B. parva* sp. nov.
- Body size larger (carapace width ≥ 3.0) (Figs. 151, 186, 232, 245, 336)..... 6
6. Body coloration dark, carapace usually dark brown (depending on state of preservation) (Figs. 151, 186, 336; see also Supplementary File 1)..... 7
- Body coloration lighter, carapace usually shades of tan brown with darker caput (depending on state of preservation) (Figs. 232, 245; see also Supplementary File 1)..... 9
7. Legs bi-colored, leg I with dark femur and distinctly lighter patella, tibia, metatarsus and tarsus (Fig. 158); abdomen with ornate dorsal pattern of broad pale chevrons (Fig. 152; see also Supplementary File 1)..... *B. disrupta* sp. nov.
- Legs more uniformly-colored, without distinctly lighter patellae, tibiae, metatarsi and tarsi (Figs. 193, 343); abdomen with smaller, thinner dorsal chevrons (Figs. 187, 337; see also Supplementary File 1)..... 8
8. Palpal tibia sub-rectangular in retrolateral view, with strongly concave disto-ventral margin (Fig. 345); pro-ventral metatarsus I with 2 or more medial spine-like setae (Fig. 343)..... *B. oraria* sp. nov.
- Palpal tibia more bulbous in retrolateral view, with less strongly concave disto-ventral margin (Fig. 195); pro-ventral metatarsus I with at most 1 medial spine-like seta (Fig. 193)..... *B. fusca* sp. nov.
9. Tarsus I with row of small prolateral macrosetae (Fig. 239); ALE almost contiguous (Fig. 235)..... *B. hillyerae* sp. nov.
- Tarsus I without row of small prolateral macrosetae (Fig. 252); ALE more widely spaced (Fig. 248)..... *B. inermis* sp. nov.
10. Palpal tibia with field of thorn-like spinules on disto-dorsal margin (Figs. 432–434)..... *B. westi* sp. nov.
- Palpal tibia without spinules on disto-dorsal margin (Figs. 24, 59, 108, 134, 445)..... 11
11. Embolus with broad, distally-flattened, truncate tip (Figs. 108, 109)..... *B. biota* sp. nov.
- Embolus otherwise, usually tapered, with or without distal modifications (Figs. 24, 95, 147, 280, 319)..... 12
12. Proximal half of palpal tibia with RTA-like ventral bulge in retrolateral view (Figs. 134, 147, 280, 306, 406)..... 13
- Palpal tibia piriform or sub-cylindrical, unmodified, without pronounced ventral bulge (Figs. 24, 46, 59, 95, 267, 393, 445)..... 17
13. RTA-like bulge of palpal tibia with field of porrect dagger-like spinules at apex (Figs. 134, 135)..... *B. burbridgei* sp. nov.
- Spinules on RTA-like bulge of palpal tibia smaller, cuspule-like or thorn-like (Figs. 147, 280, 306, 406)..... 14
14. RTA-like bulge of palpal tibia developed into relatively acute, attenuate process (Figs. 280, 281) ... *B. keigheryi* sp. nov.
- RTA-like bulge of palpal tibia broadly rounded (Figs. 147, 306, 406)..... 15
15. Dorsal abdomen with mottled ‘sandy’ coloration and thin chevrons (Fig. 398; see also Supplementary File 1)..... *B. sampeyae* sp. nov.
- Dorsal abdomen bi-colored, pale tan in color with dark anterior markings and dark posterior chevrons (Figs. 139, 298; see also Supplementary File 1)..... 16
16. Palpal tibia strongly arched dorsally, with ‘pistol-like’ profile in retrolateral view (Fig. 306)..... *B. kendricki* sp. nov.
- Palpal tibia less strongly arched dorsally, with relatively symmetrical, bulbous profile in retrolateral view (Fig. 147)..... *B. dipsodes* sp. nov.
17. Palpal tibia with medial ‘ledge’ situated closely proximal to field of spinules, bearing brush of filiform setae (Figs. 46, 47, 59, 60, 293, 294, 332, 333)..... 18
- Palpal tibia without ledge (Figs. 24, 72, 95, 218, 267, 319, 371, 419, 445)..... 21
18. Palpal tibia stout, bulbous and strongly arched dorsally (Fig. 46); medial ledge broad, with relatively large brush of filiform setae (Figs. 46, 47)..... *B. ajana* sp. nov.
- Palpal tibia longer (Figs. 59, 293, 332); medial ledge shorter with smaller brush of filiform setae (Figs. 59, 60, 293, 294, 332, 333)..... 19
19. Spinules on cymbium short, thorn-like (Fig. 293)..... *B. keirani* sp. nov.
- Spinules on cymbium poorly developed, with thinner, almost filiform morphology (Figs. 59, 332)..... 20
20. Palpal tibia long, with sub-cylindrical profile in retrolateral view (Fig. 59)..... *B. aplini* sp. nov.
- Palpal tibia broader proximally, with crescent-shaped field of spinules distally (Fig. 332)..... *B. mckenziei* sp. nov.
21. Palpal tibia with small field of spinules restricted to disto-ventral margin, situated closely proximal to small retro-distal bulge (Figs. 72, 73)..... *B. banksia* sp. nov.
- Palpal tibia with larger field of retrolateral spinules and retro-distal bulge absent (Figs. 24, 95, 218, 267, 319, 371, 419, 445) 22
22. Embolus relatively long (longer than bulb) (Figs. 24, 319, 371)..... 23
- Embolus relatively short ($\sim$ length of bulb) (Figs. 95, 218, 267, 419, 445)..... 25
23. Embolus relatively straight in standard retrolateral view (Fig. 371); palpal tibia extended distally (distal to spinules), with strongly concave disto-ventral margin in retrolateral view (Fig. 371)..... *B. quobba* sp. nov.
- Embolus slightly longer and more strongly curved in standard retrolateral view (Figs. 24, 319); palpal tibia not as extended distally (Figs. 24, 319)..... 24
24. Abdomen usually relatively heavily pigmented (Fig. 16; see also Supplementary File 1); pars cephalica covered with short setae (Fig. 15)..... *B. bertmaini* Rix, Main, Raven & Harvey, 2017

- Abdomen lighter, with pale ‘sandy’ coloration and thin chevrons (Fig. 311; see also Supplementary File 1); pars cephalica glabrous, with relatively few setae (Fig. 310) *B. laevigata* sp. nov.
- 25. Spinules on cymbium poorly developed, with thinner filiform morphology (Figs. 218–220) *B. hamelinensis* sp. nov.
- Spinules on cymbium relatively thick, spine-like (Figs. 95, 267, 419, 445) 26
- 26. Palpal tibia with relatively small, rectangular field of retrolateral spinules on distal half of segment (Fig. 445) *B. yeni* sp. nov.
- Palpal tibia with larger, crescent-shaped field of retrolateral spinules covering most of retro-ventral surface (Figs. 95, 267, 419) 27
- 27. Palpal tibia with uniformly crescent-shaped field of spinules in retrolateral view (Figs. 95, 267) 28
- Palpal tibia with asymmetric ‘wave-shaped’ field of spinules in retrolateral view (Fig. 419) *B. weld* sp. nov.
- 28. Carapace with marginal lateral indentations between coxae II–III (Fig. 86); carapace width ≥ 2.0 (Fig. 86) *B. bidgemia* sp. nov.
- Carapace without lateral indentations between coxae II–III (Fig. 258); carapace width < 2.0 (Fig. 258) ... *B. iota* sp. nov.

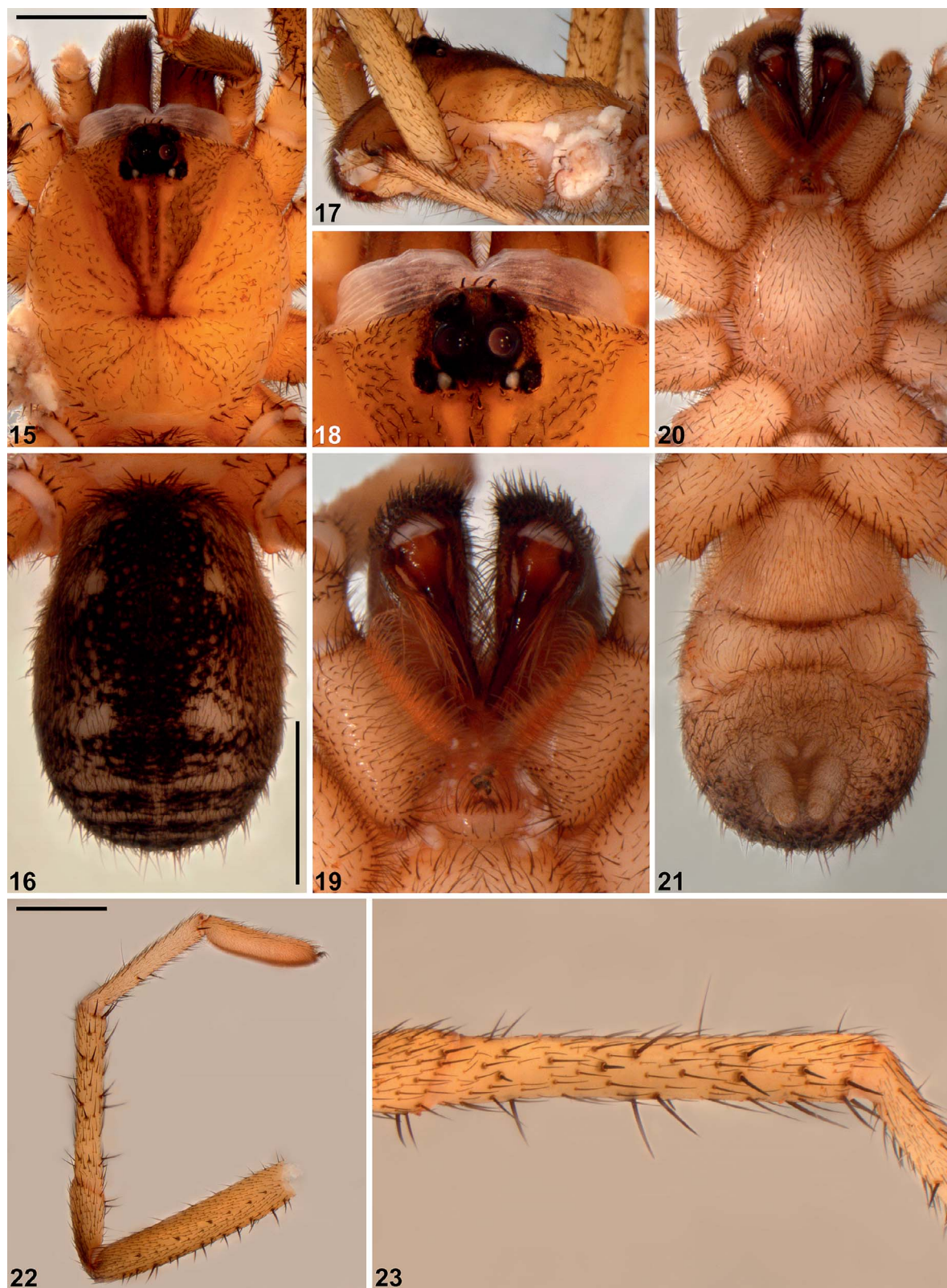
Bungulla bertmaini Rix, Main, Raven & Harvey, 2017
(Figs. 13–36)

Bungulla bertmaini Rix, Main, Raven & Harvey, 2017 in Rix et al., 2017d: 602, figs. 152, 159, 163–175.

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Deception [Hill], 102.5 km N. of Koolyanobbing (IBRA_COO), 29°55'10"S, 119°15'26"E, leaf litter, 1 July 2010, Z. Hamilton, J. Cairnes (WAM T103988^{DNA_Voucher_93}), GenB–COI–KY295289, GenB–CYB–KY295410, GenB–MRPL45–KY295533, GenB–RPF2–KY295654, GenB–XPNPEP3–KY295782, GenB–ITS–KY295035).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Ajana Back Road, site NO 7 (IBRA_GES), 27°59'57"S, 114°37'55"E, wet pitfall trap, 30 March–18 October 1999, N. Guthrie, CALM Survey (WAM T142987); 1 ♂, Albion Downs, 78.3 km NNW. of Leinster (IBRA_MUR), 27°12'25"S, 120°23'52"E, dry pitfall trap, 28 August–3 September 2008, Z. Hamilton & R. Teale (WAM T96351^{DNA_Voucher_208}); GenB–COI–MG516834, GenB–CYB–MG516845, GenB–MRPL45–MG516873, GenB–RPF2–MG516878, GenB–XPNPEP3–MG516894, GenB–ITS–MG516859; 1 ♂, same data (WAM T96477); 1 ♂, same data except 62.6 km NNW. of Leinster, 27°25'03"S, 120°23'45"E (WAM T96464^{DNA_Voucher_210}); GenB–COI–MG516832, GenB–CYB–MG516843, GenB–MRPL45–MG516872, GenB–RPF2–MG516877, GenB–XPNPEP3–MG516893, GenB–ITS–MG516857; 1 ♂, same data (WAM T96478); 1 ♂, same data (WAM T96481); 1 ♂, same data except 62.7 km NNW. of Leinster, 27°25'02"S, 120°23'41"E (WAM T96484); 1 ♂, same data except 66.3 km NNW. of Leinster, 27°24'06"S, 120°21'08"E (WAM T96474); 1 ♂, same data except 76.1 km NNW. of Leinster, 27°17'37"S, 120°22'09"E (WAM T96473); 1 ♂, same data (WAM T96471); 1 ♂, same data except 76.6 km NNW. of Leinster, 27°17'28"S, 120°21'51"E (WAM T96444); 1 ♂, same data except 78.8 km NNW. of Leinster, 27°14'45"S, 120°25'41"E (WAM T96476^{DNA_Voucher_209}); GenB–COI–MG516833, GenB–CYB–MG516844, GenB–MRPL45–MG516875, GenB–RPF2–MG516879, GenB–XPNPEP3–MG516896, GenB–ITS–MG516858; 1 ♂, same data except 79.0 km NNW. of Leinster, 27°14'42"S, 120°29'11"E (WAM T96482); 1 ♂, same data (WAM T96349); 1 ♂, same data except 81.3 km NNW. of Leinster, 27°15'33"S, 120°19'46"E (WAM T96480); 1 ♂, same data except 84.0 km NNW. of Leinster, 27°12'03"S, 120°18'48"E (WAM T96472); 1 ♂, same data except 84.9 km NNW. of

Leinster, 27°14'38"S, 120°16'57"E (WAM T96511); 1 ♂, same data (WAM T96496); 1 ♂, same data except 27°14'40"S, 120°16'54"E (WAM T96479); 1 ♂, Barlee Range Nature Reserve, quadrat 9 (IBRA_GAS), 23°06'06"S, 116°00'28"E, wet pitfall trap, August 1993, S. van Leeuwen, B. Bromilow (WAM T57654); 2 ♂, Bidgemia Station, site GJ1 (IBRA_CAR), 25°12'34.5"S, 115°30'50.5"E, wet pitfall trap, 5 June–20 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98663); 3 ♂, same data except 3–8 June 1995 (WAM T98664); 2 ♂, same data (QMB); 2 ♂, same data except site GJ2, 25°10'30.9"S, 115°29'16.7"E, 4 June–20 August 1995 (WAM T98665); 1 ♂, same data except site GJ3, 25°07'08.1"S, 115°25'33.1"E, 6 June–20 August 1995 (WAM T98666); 2 ♂, same data (WAM T98667); 3 ♂, same data except 3–8 June 1995 (WAM T98668); 2 ♂, same data except site GJ5, 25°03'17.2"S, 115°17'37.5"E (WAM T98669); 1 ♂, same data except 6 June–20 August 1995 (WAM T98670); 3 ♂, Boolathana Station, site BO1 (IBRA_CAR), 24°24'48.4"S, 113°39'47.2"E, wet pitfall trap, 29 May–25 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98659); 5 ♂, same data (WAM T98660); 11 ♂, same data except site BO3, 24°24'48.5"S, 113°42'23.5"E (WAM T98661); 7 ♂, same data except site BO4, 24°24'48.7"S, 113°44'40.6"E, 31 May–25 August 1995 (WAM T98657); 1 ♂, same data except 15 January–31 May 1995 (WAM T98658); 1 ♂, Buntine Rocks Nature Reserve (IBRA_AVW), 29°59'06"S, 116°35'35"E, wet pitfall trap, 22 May–17 September 1996, M.S. Harvey & J.M. Waldock (WAM T38552); 1 ♂, same data (WAM T38553); 6 ♂, Bush Bay, site BB1 (IBRA_CAR), 25°07'30.8"S, 113°49'21.6"E, wet pitfall trap, 23 May–23 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98692); 1 ♂, same data except site BB3, 25°04'39.8"S, 113°42'36.9"E (WAM T98693); 1 ♂, Canna Nature Reserve, site MO 6 (IBRA_AVW), 28°52'45"S, 115°50'33"E, wet pitfall traps, 15 September 1998–18 October 1999, P. Van Heurck, CALM Survey (WAM T142962); 6 ♂, Cape Cuvier, Quobba Station, site CU2 (IBRA_CAR), 24°13'24.0"S, 113°30'13.1"E, wet pitfall trap, 30 May–24 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T142999); 1 ♂, same data (WAM T143000); 1 ♂, Cape Range, 8 m outside Cave C-118 (IBRA_CAR), 22°09'41"S, 113°59'41"E, pitfall trap, 27 July 1989, E.C. Pryor (WAM T28514); 1 ♂, same data except 3 August 1989 (WAM T28515); 1 ♂, 1 km SSE. of Cowra Line Camp, site RHNW13 (IBRA_PIL), 22°21'41.2"S, 119°00'24.5"E, wet pitfall trap, 28 August 2003–20 October 2004, CALM Pilbara Survey (WAM



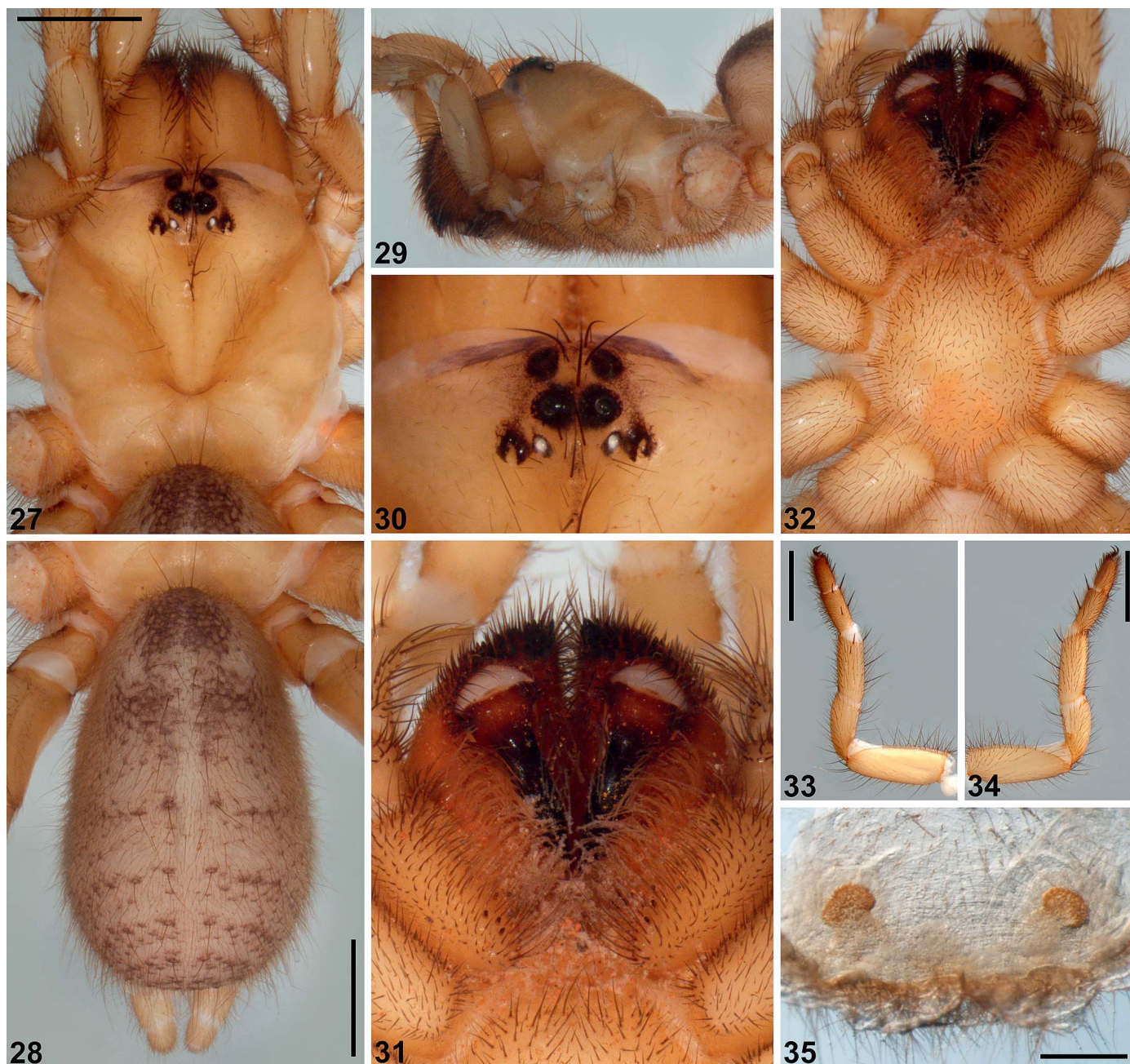
Figures 15–23.—*Bungulla bertmaini* Rix, Main, Raven & Harvey, 2017, male holotype (WAM T103988) from Deception Hill, 102.5 km N. of Koolyanobbing (Western Australia; COO), somatic morphology: 15–16, carapace and abdomen, dorsal view; 17, cephalothorax, lateral view; 18, eyes, dorsal view; 19, mouthparts, ventral view; 20–21, cephalothorax and abdomen, ventral view; 22, leg I, prolateral view; 23, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 24–26.—*Bungulla bertmaini* Rix, Main, Raven & Harvey, 2017, male holotype (WAM T103988) from Deception Hill, 102.5 km N. of Koolyanobbing (Western Australia; COO), pedipalp: 24, retrolateral view; 25, retro-ventral view; 26, prolateral view. Scale bar = 2.0 mm.

T134982); 3 ♂, Francois Peron National Park, site PE2 (IBRA_CAR), 25°52'30.9"S, 113°32'59.0"E, wet pitfall trap, 25 May–30 August 1995, N Hall, WAM/CALM Carnarvon Survey (WAM T98683); 2 ♂, same data except site PE3, 25°49'14.1"S, 113°32'24.3"E, 24 May–30 August 1995 (WAM T98684); 1 ♂, same data except site PE4, 25°50'20.0"S, 113°36'23.1"E, 23 May–30 August 1995 (WAM T98685); 1 ♂, same data except site PE5, 25°58'33.6"S, 113°34'14.7"E, 26 May–30 August 1995 (WAM T98686); 1 ♂, Glen Florrie, 48 km WNW. of homestead, site WYW11 (IBRA_PIL), 22°51'48.6"S, 115°30'11.1"E, wet pitfall trap, 1 October 2003–30 September 2004, CALM Pilbara Survey (WAM T134978); 1 ♂, Glen Florrie Station, W. of homestead, Pilbara survey site WYW12 (IBRA_PIL), 22°55'05"S, 115°34'39"E, wet pitfall trap, 1 October 2003–October 2004, CALM Pilbara Survey (WAM T96996); 1 ♂, 53 km N. of Glen Station Homestead (1084) (IBRA_MUR), 26°34'22.51"S, 117°37'30.04"E, wet pitfall trap, 5 May–28 June 2009, N. Dight & L. Quinn (WAM T115190); 1 ♂, Highway Tod Bore (West Robe), ca. 50 km W. of Pannawonica (IBRA_PIL), site TOD01, 21°41'37.0"S, 115°49'55.7"E, 18–31 May 2015, M. Quinn (WAM T137423); 1 ♂, same data except site TOD03, 21°39'55.9"S, 115°50'56.9"E (WAM T137428); 1 ♂, Jack Hills, site 17 (IBRA_MUR), 26°07'S, 117°09'E, 24 August–24 November 2006, Ecologia staff (WAM T142973); 1 ♂, Kennedy Range National Park, site KE1 (IBRA_CAR), 24°29'33.7"S, 115°01'50.1"E, wet pitfall trap, 29 May–28 August 1995, N Hall, WAM/CALM Carnarvon Survey (WAM T98688); 4 ♂, same data except site KE2, 24°30'01.5"S, 115°01'07.1"E (WAM T98689); 1 ♂, same data (WAM T98690); 1 ♂, same data except site KE4, 24°33'03.5"S, 115°57'31.7"E (WAM T98691); 3 ♂, same data except site KE5, 24°34'14.3"S,

115°57'11.9"E (WAM T98687); 1 ♂, Lake Way Station, Honeymoon Well lease (IBRA_MUR), 26°53'49"S, 120°25'07"E, glycol pitfall trap, mulga-spinifex, 20 October 2006, S. Thompson (WAM T80619); 1 ♂, same data except 26°56'22"S, 120°24'35"E, spinifex (WAM T80612); 1 ♂, same data except 26°56'05"S, 120°24'11"E (WAM T80613); 12 ♂, same data except 26°55'41"S, 120°23'59"E (WAM T80620); 1 ♂, same data except 26°54'40"S, 120°23'14"E, open mulga (WAM T80617); 2 ♂, same data except 26°57'04"S, 120°24'45"E (WAM T80615); 1 ♂, same data except 26°54'50"S, 120°22'15"E (WAM T80614); 1 ♂, same data except 26°52'07"S, 120°21'49"E, chenopod vegetation (WAM T80611); 2 ♂, same data except 26°52'01"S, 120°21'16"E (WAM T80616); 3 ♂, same data except 26°51'01"S, 120°22'11"E (WAM T80618); 1 ♂, same data except 26°50'08"S, 120°21'59"E, sand dune (WAM T80610); 1 ♂, same data except 26°50'52"S, 120°22'53"E (WAM T80609); 1 ♂, Koolanooka Dam Road, SE. of Morawa, site MO 3 (IBRA_AVW), 29°14'40"S, 116°06'06"E, wet pitfall traps, 15 September 1998–18 October 1999, P. Van Heurck, CALM Survey (WAM T142961); 1 juvenile, Lake MacLeod (IBRA_CAR), 24°28'33.9"S, 113°31'32.7"E, dry pitfall trap, samphire flats, edge of salt lake, 5 November 2010, P.R. Langlands (WAM T108979^{DNA_Voucher_92}; GenB-COI-KY295290, GenB-MRPL45-KY295534, GenB-RPF2-KY295655, GenB-XPNPEP3-KY295783, GenB-ITS-KY295036); 1 ♂, Lorna Glen Station, site Sherwood 3 (IBRA_MUR), 26°21'17"S, 121°14'40"E, pitfall trap, 19 March 2004, G. Owen (WAM T60786); 1 ♂, Mardathuna Station, site MR1 (IBRA_CAR), 24°30'41.0"S, 114°38'13.8"E, wet pitfall trap, 26 May–26 August 1995, N Hall, WAM/CALM Carnarvon Survey (WAM T98671); 13 ♂, same data except site MR2, 24°26'35.7"S, 114°30'41.5"E, 25 May–26



Figures 27–35.—*Bungulla bertmaini* Rix, Main, Raven & Harvey, 2017, female (WAM T109128) from Robe Valley, WSW. of Pannawonica (Western Australia; PIL): 27–28, carapace and abdomen, dorsal view; 29, cephalothorax, lateral view; 30, eyes, dorsal view; 31, mouthparts, ventral view; 32, cephalothorax, ventral view; 33, leg I, prolateral view; 34, leg I, retrolateral view; 35, spermathecae, dorsal view. Scale bars = 2.0 mm (27–28, 33–34), 0.5 mm (35).

August 1995 (WAM T98672); 2 ♂, same data except site MR3, 24°25'42.7"S, 114°30'00.5"E, 24 May–26 August 1995 (WAM T98673); 1 ♂, same data except site MR4, 24°24'42.7"S, 114°28'24.4"E (WAM T98674); 3 ♂, same data except site MR5, 24°24'23.3"S, 114°26'42.1"E (WAM T98675); 2 ♂, Meedo Station, site MD1 (IBRA_CAR), 25°37'31.3"S, 114°42'18.8"E, wet pitfall trap, 17 May–21 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98695); 1 ♂, same data except site MD2, 25°37'23.4"S, 114°41'39.8"E, 18 May–21 August 1995

(WAM T98697); 2 ♂, same data except site MD3, 25°39'13.5"S, 114°37'37.5"E, 19 May–22 August 1995 (WAM T98696); 4 ♂, same data except site MD5, 25°42'41.6"S, 114°35'58.5"E (WAM T98694); 1 ♂, Meka Station, Shire of Murchison (IBRA_MUR), 27°23'09.92"S, 117°00'14.00"E, wet pitfall trap, 5 May–28 June 2009, N. Dight & L. Quinn (WAM T98145); 1 ♂, Mesa B C (West Robe), ca. 50 km W. of Pannawonica, site RVM05 (IBRA_PIL), 21°40'36.9"S, 115°55'23.3"E, 18–31 May 2015, M. Quinn (WAM T137417); 1 ♂, Mileura Station, Ejah

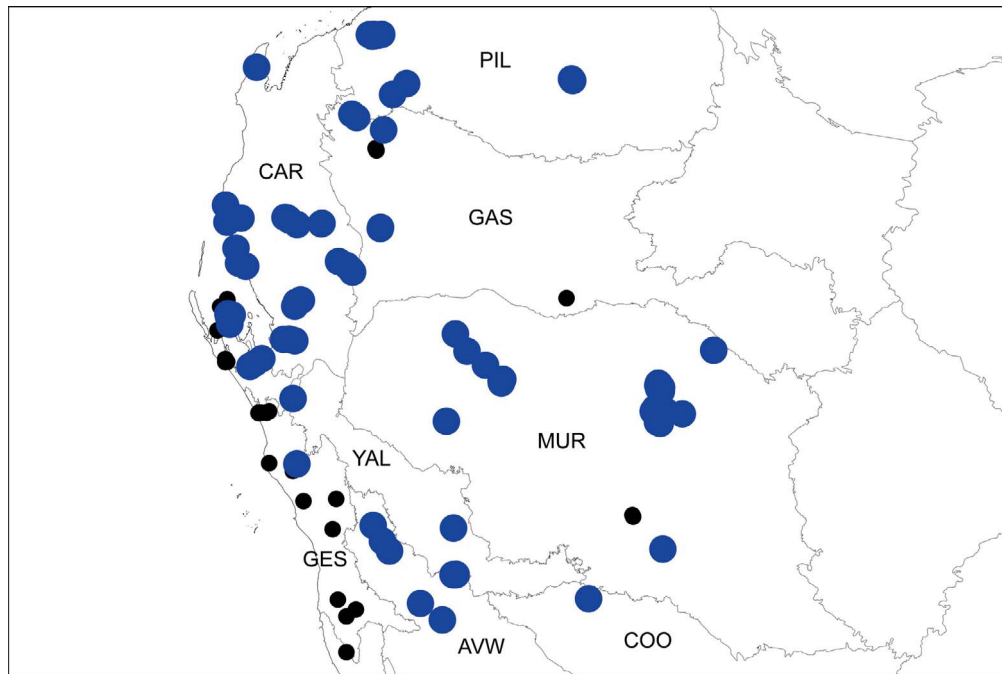


Figure 36.—Map showing collection records of *Bungulla bertmaini* Rix, Main, Raven & Harvey, 2017 (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.

Paddock (IBRA_MUR), 26°22'S, 117°20'E, 1 June 1980, P.A. Woolley & T. Valente (WAM T28387); 1 ♂, same data (WAM T28388); 1 ♂, same data (WAM T28389); 1 ♂, same data (WAM T28390); 1 ♂, 8 km NNE. of Mount Edith, Mount Stuart Station, site WYE05 (IBRA_PIL), 22°34'16.9"S, 116°08'53.8"E, wet pitfall trap, 11 September 2003–7 October 2004, CALM Pilbara Survey (WAM T135152); 1 ♂, Mount Ida, 100 km WSW. of Leonora, site MI-08-8C (IBRA_MUR), 29°12'59"S, 120°26'10"E, active search, 29 July 2008, M. Quinn & G. Murray (WAM T110235^{DNA_Voucher_202}; GenB-COI-MG516831, GenB-MRPL45-MG516874, GenB-RPF2-MG516883, GenB-XPNPEP3-MG516895, GenB-ITS-MG516860); 1 ♂, Mount Gibson iron-ore mine, Banded Ironstone Range, Extension Hill, east facing (IBRA_AVW), 29°34'27"S, 117°09'39"E, wet pitfall traps, 31 May–11 June 2005, S. Thompson (WAM T72327); 1 ♂, same data (WAM T71715); 1 ♂, same data (WAM T72317); 1 ♂, same data except Ironstone Slope, Extension Hill, west facing, 29°34'38"S, 117°09'35"E (WAM T72326); 1 ♂, same data except sandplains 4 (D), control site (N. of road), 29°34'34"S, 117°07'34"E, 30 May–11 June 2005 (WAM T71637); 1 ♂, same data except sandplains 1 (A), impact site (S. of road), 29°34'33"S, 117°06'35"E (WAM T71636); 1 ♂, 19.9 km E. of Mount Keith (IBRA_MUR), 27°16'56"S, 120°45'24"E, October 2003, R. Teale (WAM T88605); 1 ♂, NW. of Mount Wilkie, site DRW02, Crown Land Reserve (IBRA_PIL), 20°50'41.0"S, 116°22'03.0"E, wet pitfall trap, 23 September 2003–2 October 2004, CALM Pilbara Survey (WAM T135055); 1 ♂, 1.8 km SSE. of Mulga Downs Outcamp, site RHNW04 (IBRA_PIL), 22°20'04.7"S, 118°59'19.5"E, wet pitfall trap, 13 August 2003–18 October 2004, CALM Pilbara Survey (WAM T135003); 1 ♂, Nanga Station, site NA1 (IBRA_CAR), 26°28'40.1"S, 114°04'33.6"E,

wet pitfall trap, 11 May–30 August 1995, N Hall, WAM/CALM Carnarvon Survey (WAM T98677); 3 ♂, same data except site NA4 (IBRA_YAL), 26°32'47.3"S, 113°57'47.0"E (WAM T98676); 2 ♂, same data except site NA5, 26°35'31.8"S, 113°53'22.3"E (WAM T98678); 2 ♂, Nerren Nerren Station, site NE2 (IBRA_YAL), 27°03'24.1"S, 114°34'22.6"E, wet pitfall trap, 11 May–18 August 1995, N Hall, WAM/CALM Carnarvon Survey (WAM T98662); 3 ♂, Paynes Find Rock [ca. 8 miles from junction of Yalgoo/Paynes Find Roads] (IBRA_YAL), 28°55'S, 117°07'E, pitfall trap, 4–5 July 1970, R. Jones (WAM T142975); 1 ♂, same data except 12 July 1969 (WAM T142976); 1 ♂, Paynes Find Rock on Yalgoo Road (site no. 6) (IBRA_YAL), 28°55'S, 117°07'E, pitfall trap, 24 July–27 August 1985, B.Y. & A.R. Main (WAM T 142974); 1 ♂, Pintharuka (IBRA_AVW), 29°06'03"S, 115°59'14"E, wet pitfall trap, 23 May 1996–17 September 1996, M.S. Harvey & J.M. Waldock (WAM T38502); 1 ♂, same data (WAM T44214); 1 ♀, Robe Valley, 36 km WSW. of Pannawonica (IBRA_PIL), 21°40'00"S, 115°58'37"E, dug from burrow, 26 October 2010, Z. Hamilton (WAM T109128^{DNA_Voucher_277}; GenB-COI-KY295241, GenB-CYB-KY295366, GenB-MRPL45-KY295489, GenB-RPF2-KY295608, GenB-XPNPEP3-KY295735, GenB-ITS-KY304512); 1 ♂, Snake Gully Nature Reserve, site WU 11 (IBRA_AVW), 30°13'05"S, 116°56'36"E, wet pitfall traps, 15 September 1997–7 April 1998, N. Guthrie, CALM Survey (WAM T142963); 1 ♂, same data (WAM T142964); 1 ♂, ca. 5 km SW. of Warrambo, Alinta Dampier to Bunbury Natural Gas Pipeline (IBRA_PIL), 21°40'11.9"S, 115°46'50.3"E, in trench, 16 July 2007, P. Hinchy, C. Day (WAM T95784); 1 ♂, Water Supply Island (WSI), Gascoyne River, ca. 4 km NNE. of Carnarvon (IBRA_CAR), 24°51'36"S, 113°40'08"E, wet pitfall trap, 23–30 September 2002, I. Stemp (WAM T57304);

1 ♂, Weld Range North mine lease, site WN 12, 67 km SW. of Meekatharra (IBRA_MUR), 26°49'55.69"S, 117°52'30.47"E, wet pitfall trap, 30 August 2007, Ecologia staff (WAM T130912); 2 ♂, same data except site WN 15, 66 km SW. of Meekatharra, 26°48'34.52"S, 117°52'20.05"E, 29 August 2007 (WAM T130916); 1 ♂, same data except site WN 6, 63 km SW. of Meekatharra, 26°46'48.64"S, 117°53'54.99"E, 3 September 2007 (WAM T130896); 1 ♂, Weld Range (no specific locality) (IBRA_MUR), Ecologia staff (WAM T142966); 1 ♂, same data (WAM T142967); 1 ♂, same data (WAM T142968); 1 ♂, same data (WAM T142969); 2 ♂, same data (WAM T142970); 1 ♂, same data (WAM T142971); 1 ♂, same data (WAM T142972); 1 ♂, Woodleigh Station, site WO1 (IBRA_CAR), 26°13'01.2"S, 114°35'59.4"E, wet pitfall trap, 17 May–21 August 1995, N Hall, WAM/CALM Carnarvon Survey (WAM T98679); 2 ♂, same data except site WO2, 26°12'30.0"S, 114°34'35.0"E (WAM T98680); 2 ♂, same data except site WO4, 26°11'31.1"S, 114°30'33.0"E (WAM T98681); 2 ♂, same data except site WO5, 26°11'45.3"S, 114°25'23.6"E (WAM T98682); 1 ♂, 26.5 km SW. of Woodleigh Homestead (IBRA_CAR), 26°12'S, 114°32'E, 5 July 1997, M. Peterson (WAM T44353).

Diagnosis.—Males of *Bungulla bertmaini* can be distinguished from all other known congeners with > 10 retrolateral spinules on the palpal tibia (Fig. 13) – except *B. banksia*, *B. bidgemia*, *B. hamelinensis*, *B. iota*, *B. laevigata*, *B. quobba*, *B. weld* and *B. yeni* – by the shape of the proximal half of the palpal tibia, which is without a pronounced ventral bulge (Fig. 24), combined with the absence of a medial 'ledge' on the palpal tibia (Figs. 24, 25) (palpal tibia is with a ledge or bulges ventrally in other species). *Bungulla bertmaini* can be further distinguished from *B. banksia*, *B. bidgemia*, *B. hamelinensis*, *B. iota*, *B. weld* and *B. yeni* by the shape of the embolus, which is relatively long (i.e., longer than the bulb) (Fig. 24; cf. Figs. 72, 95, 218, 267, 419, 445); from *B. quobba* by the shape of the embolus, which is slightly longer and more strongly curved in standard retrolateral view (Fig. 24; cf. Fig. 371); and from *B. laevigata* by the morphology of the pars cephalica, which is covered in short setae (Fig. 15; cf. Fig. 310), combined with the (usually) darker coloration of the dorsal abdomen (Fig. 16; cf. Fig. 311 and Supplementary File 1).

Description (male holotype).—See Rix et al. (2017d).

Description (female WAM T109128).—Total length 14.3. Carapace 5.5 long, 4.7 wide. Abdomen 6.9 long, 4.3 wide. Carapace (Fig. 27) pale tan, with slightly darker ocular region; fovea strongly procurved. Eye group (Fig. 30) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide, PLE–PLE/ALE–ALE ratio 1.6; ALE separated by their own diameter; AME separated by their own diameter; PME separated by 4.5 x their own diameter; PME and PLE separated by diameter of PME, PME positioned slightly anterior to level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 31); labium without cuspules. Abdomen (Fig. 28) oval, sandy-beige in dorsal view with three darker olive-brown markings anteriorly and five pairs of thin, spotted, dark olive-brown chevrons posteriorly, each divided along midline; sclerotized sigilla absent. Legs (Figs. 33, 34) variable shades of tan; thick scopulae present on tarsus I (metatarsus II missing); tibia I with 2 stout prolateral macrosetae and 4 retro-ventral spine-like macrosetae; meta-

tarsus I with 2 stout pro-ventral macrosetae and 2 longer retro-ventral macrosetae; tarsus I with distal cluster of 5 stout ventral macrosetae. Leg I: femur 2.9; patella 2.0; tibia 1.6; metatarsus 1.3; tarsus 1.1; total 8.8. Leg I femur–tarsus/carapace length ratio 1.6. Pedipalp pale tan, spinose on tibia and tarsus, with thick tarsal scopula. Genitalia (Fig. 35) with pair of short, widely spaced, mushroom-shaped spermathecae.

Distribution and remarks.—*Bungulla bertmaini* (formerly known by WAM identification codes 'MYG150' and 'MYG131') is a medium to large species with an extremely widespread distribution in arid Western Australia, in the northern Avon Wheatbelt, Coolgardie, Yalgoo, Murchison, Carnarvon, Gascoyne and Pilbara bioregions (Fig. 36; see also Rix et al. 2017d, fig. 175, for which fewer specimens were examined). Molecular data are consistent with morphology, and convincingly unite populations from the northern Coolgardie, central and southern Murchison, western Carnarvon and western Pilbara bioregions (Fig. 14). Specimens from sub-coastal locations and lower latitudes are generally smaller than those from the arid inland, and there is some variation in the length of the cymbial spinules (see Supplementary File 1), but in the absence of consistent genitalic or somatic variation, this entire clade is regarded as representing a single species. No other congener has such an enormous distributional range, and *B. bertmaini* remains the only known species of *Bungulla* in the Pilbara (Fig. 36). However, despite this broad distribution, the vast majority of specimens have been collected from pitfall traps, and thus little is known of the biology of the species, other than that it is largely restricted to habitats that receive less than 300 mm of annual rainfall, and that males have been collected wandering in search of females in autumn, winter and spring, with a peak in winter.

***Bungulla ajana* Rix, Raven & Harvey, sp. nov.**

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:47244D2D-680A-4978-8246-CEE3103782C0>

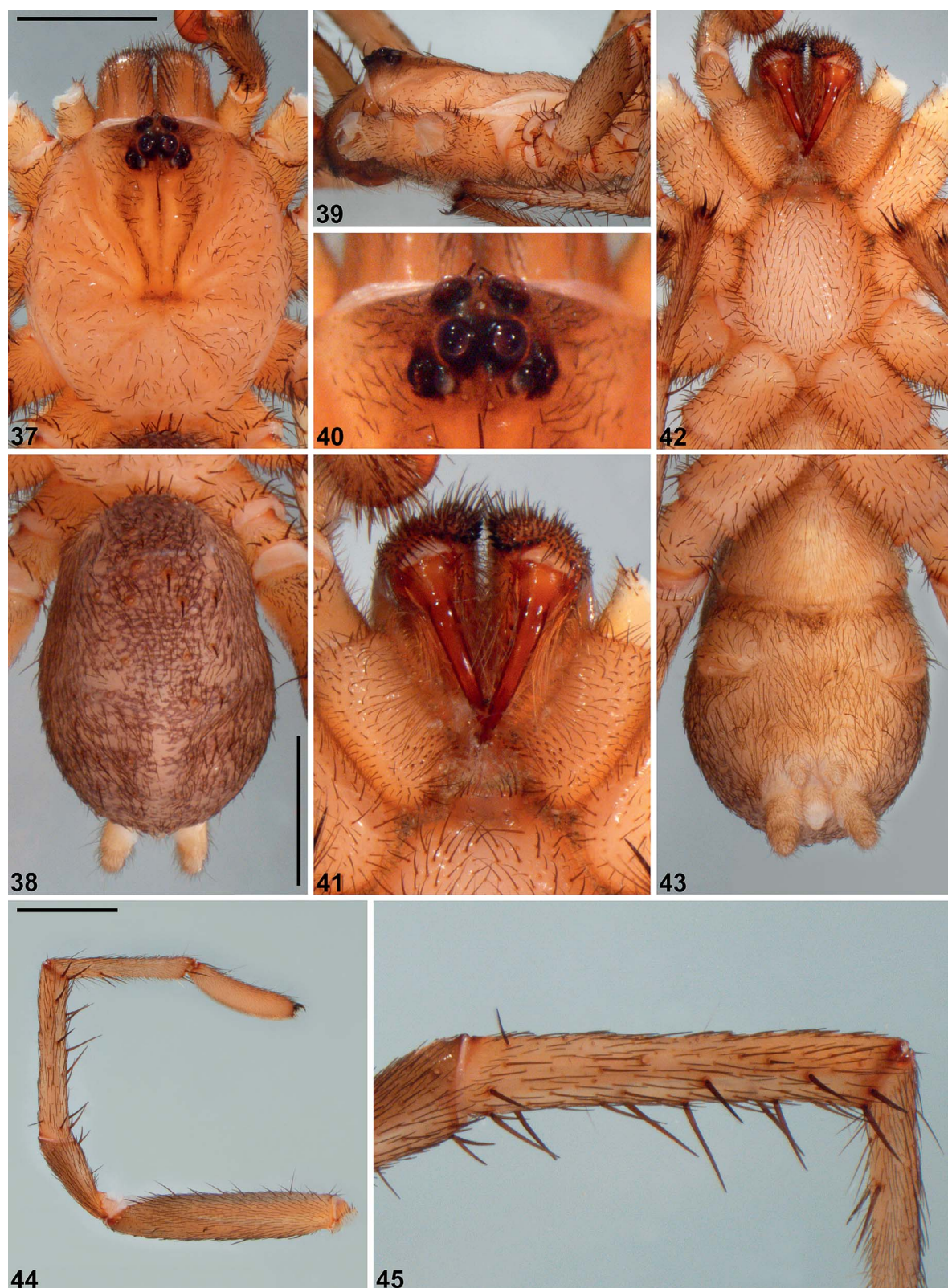
(Figs. 13, 37–49)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Ogilvie Road, west, c. 40 km SW. of Ajana, site NO 11 (IBRA_GES), 27°59'29"S, 114°11'40"E, wet pitfall trap, 16 September 1998–18 October 1999, P. Van Heurck et al., CALM Survey (WAM T143033).

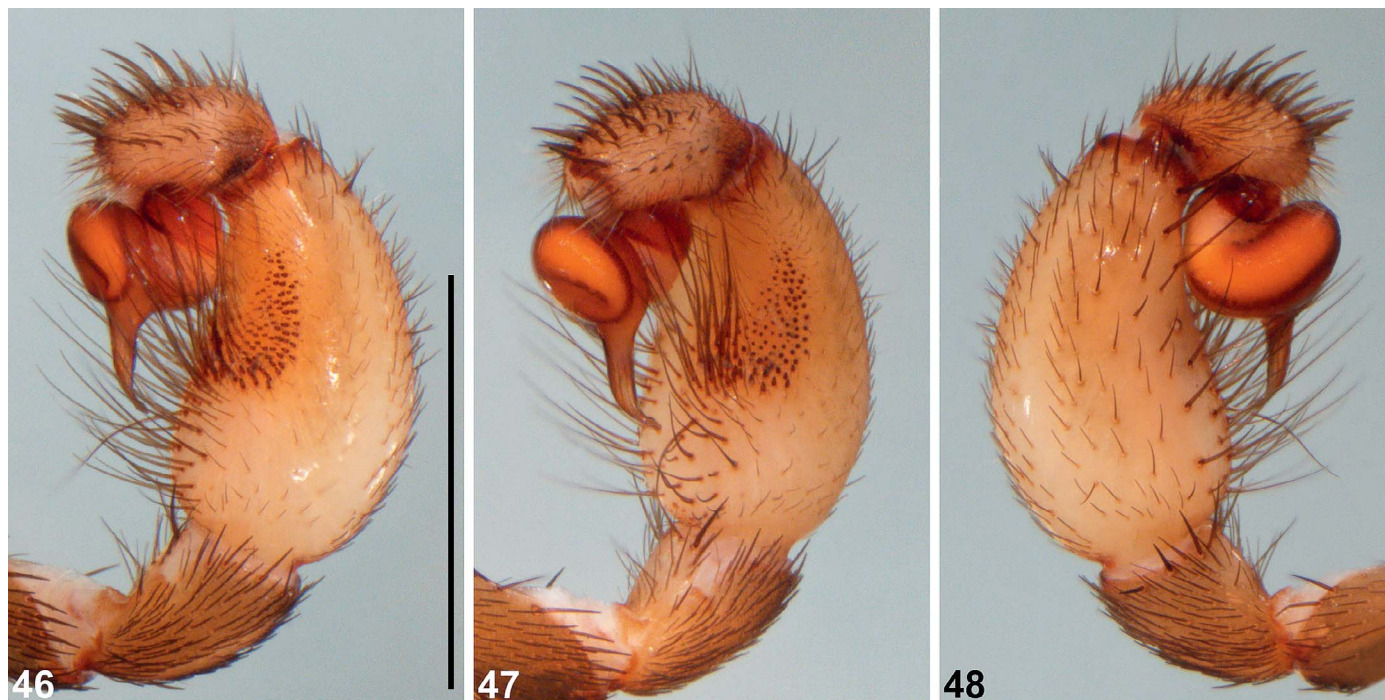
Paratypes. AUSTRALIA: *Western Australia*: 5 ♂, same data as holotype (WAM T142977).

Etymology.—The specific epithet is a noun in apposition, in reference to the type locality of this species.

Diagnosis.—Males of *Bungulla ajana* can be distinguished from all other known congeners with > 10 retrolateral spinules on the palpal tibia (Fig. 13) – except *B. aplini*, *B. keirani* and *B. mckenziei* – by the shape of the proximal half of the palpal tibia, which is without a pronounced ventral bulge (Fig. 46), combined with the presence of a medial 'ledge' on the palpal tibia, this ledge situated closely proximal to the field of retrolateral spinules and bearing a brush of filiform setae (Figs. 46, 47) (palpal tibia is without a ledge or bulges ventrally in other species). *Bungulla ajana* can be further distinguished from *B. aplini*, *B. keirani* and *B. mckenziei* by the shape of the palpal tibia, which is stout, bulbous and strongly arched dorsally (Fig. 46; cf. Figs. 59, 293, 332), combined with the presence of a broad medial ledge bearing a relatively large



Figures 37–45.—*Bungulla ajana* sp. nov., male holotype (WAM T143033) from Ogilvie Road, SW. of Ajana (Western Australia; GES), somatic morphology: 37–38, carapace and abdomen, dorsal view; 39, cephalothorax, lateral view; 40, eyes, dorsal view; 41, mouthparts, ventral view; 42–43, cephalothorax and abdomen, ventral view; 44, leg I, prolateral view; 45, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 46–48.—*Bungulla ajana* sp. nov., male holotype (WAM T143033) from Ogilvie Road, SW. of Ajana (Western Australia; GES), pedipalp: 46, retrolateral view; 47, retro-ventral view; 48, prolateral view. Scale bar = 2.0 mm.

brush of filiform setae (Figs. 46, 47; cf. Figs. 59, 60, 293, 294, 332, 333). Females are unknown.

Description (male holotype).—Total length 9.8. Carapace 4.3 long, 3.8 wide. Abdomen 4.6 long, 3.1 wide. Carapace (Fig. 37) tan, with slightly darker pars cephalica, darker brown lyre-

like pattern on pars cephalica and mostly black ocular region; postero-lateral corners near abdomen each with pair of porrect black setae; fovea straight. Eye group (Fig. 40) trapezoidal (anterior eye row strongly procurved), 0.9 x as long as wide, PLE–PLE/ALE–ALE ratio 1.5; ALE separated

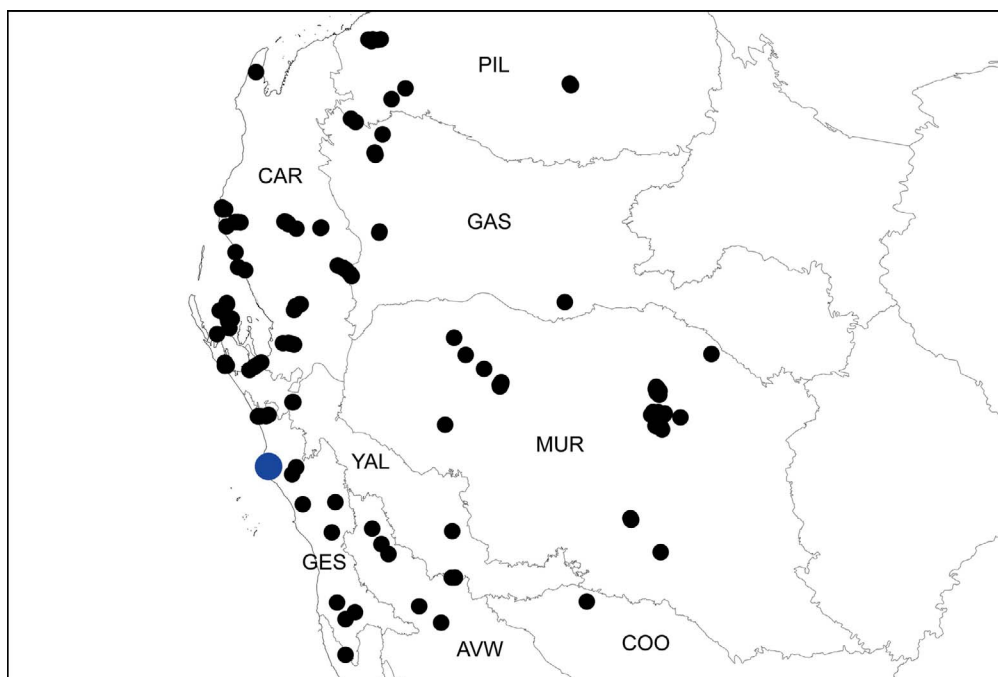


Figure 49.—Map showing collection records of *Bungulla ajana* sp. nov. (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.

by ca. half their own diameter; AME separated by ca. half their own diameter; PME separated by 3.0 x their own diameter; PME and PLE separated by slightly less than diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 41); labium without cuspules. Abdomen (Fig. 38) oval, dark olive-brown in dorsal view with beige-tan mottling, two pairs of beige-tan sigilla spots, and three indistinct pairs of beige-tan chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 38) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 44, 45) variable shades of tan, with light scopulae on tarsi I–II; tibia I spinose, without prolateral clasping spurs. Leg I: femur 4.6; patella 2.1; tibia 3.5; metatarsus 3.0; tarsus 2.2; total 15.2. Leg I femur–tarsus/carapace length ratio 3.5. Pedipalpal tibia (Figs. 46–48) stout, bulbous and strongly arched dorsally, nearly 2.0 x longer than wide, with broad medial ‘ledge’ bearing a relatively large brush of filiform setae; field of retrolateral spinules oval–subtriangular in shape, positioned medially (distal to medial ledge), consisting of > 50 spinules of varying length, the latter longest proximally; RTA absent. Cymbium (Figs. 46–48) setose, with dense field of long, slightly curved spine-like spinules covering most of dorsal surface. Embolus (Figs. 46–48) slightly longer than bulb, strongly curved, with slightly expanded tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla ajana* is a rare and highly restricted species known only from south-west of Ajana, near Kalbarri National Park in the northern Geraldton Sandplains bioregion of south-western Australia (Fig. 49). Nothing is known of the biology of this species, other than that the known male specimens were collected wandering in search of females in spring.

Bungulla aplini Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:953F008F-4F27-4389-9513-F59D231CE404>
(Figs. 13, 50–62)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Nerren Nerren Station, site NE2 (IBRA_YAL), 27°03'24.1"S, 114°34'22.6"E, wet pitfall trap, 11 May–18 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T142981).

Paratypes. AUSTRALIA: *Western Australia*: 2 ♂, same data as holotype (WAM T98653).

Etymology.—This species is named in honor of Ken Aplin, in recognition of his contributions to the Southern Carnarvon Basin Survey (Burbidge et al. 2000) and to the study of Australasian biodiversity.

Diagnosis.—Males of *Bungulla aplini* can be distinguished from all other known congeners with > 10 retrolateral spinules on the palpal tibia (Fig. 13) – except *B. ajana*, *B. keirani* and *B. mckenziei* – by the shape of the proximal half of the palpal tibia, which is without a pronounced ventral bulge (Fig. 59), combined with the presence of a medial ‘ledge’ on the palpal tibia, this ledge situated closely proximal to the field of retrolateral spinules and bearing a brush of filiform setae (Figs. 59, 60) (palpal tibia is without a ledge or bulges ventrally in other species). *Bungulla aplini* can be further

distinguished from *B. ajana*, *B. keirani* and *B. mckenziei* by the shape of the palpal tibia, which is long with a sub-cylindrical profile in retrolateral view (Fig. 59; cf. Figs. 46, 293, 332). Females are unknown.

Description (male holotype).—Total length 10.8. Carapace 4.6 long, 3.8 wide. Abdomen 4.6 long, 3.0 wide. Carapace (Fig. 50) tan, with slightly darker pars cephalica, darker brown lyre-like pattern on pars cephalica, black lateral rims and mostly black ocular region; postero-lateral corners near abdomen each with pair of porrect black setae; fovea straight. Eye group (Fig. 53) trapezoidal (anterior eye row strongly procurved), as long as wide, PLE–PLE/ALE–ALE ratio 1.7; ALE almost contiguous; AME separated by less than their own diameter; PME separated by 2.4 x their own diameter; PME and PLE separated by diameter of PME, PME positioned slightly posterior to level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 54); labium without cuspules. Abdomen (Fig. 51) oval, sandy-beige-tan in dorsal view with darker brown-black markings anteriorly and five pairs of thin, spotted, brown-black chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 51) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 57, 58) variable shades of tan, with light scopulae on tarsi I–II; metatarsus I and tarsus I lighter in color; tibia I heavily spinose, without prolateral clasping spurs. Leg I: femur 5.1; patella 2.1; tibia 4.0; metatarsus 3.7; tarsus 2.7; total 17.6. Leg I femur–tarsus/carapace length ratio 3.8. Pedipalpal tibia (Figs. 59–61) long and sub-cylindrical, 3.0 x longer than wide, with very small medial ‘ledge’ bearing a relatively small brush of filiform setae; field of retrolateral spinules rectangular in shape, positioned distally (distal to medial ledge), consisting of 18 spinules of varying length, the latter longest proximally; RTA absent. Cymbium (Figs. 59–61) setose, with field of slightly curved and relatively poorly developed (almost filiform) spinules covering most of dorsal surface. Embolus (Figs. 59–61) as long as bulb, relatively straight, with unmodified tip; embolic apophysis absent.

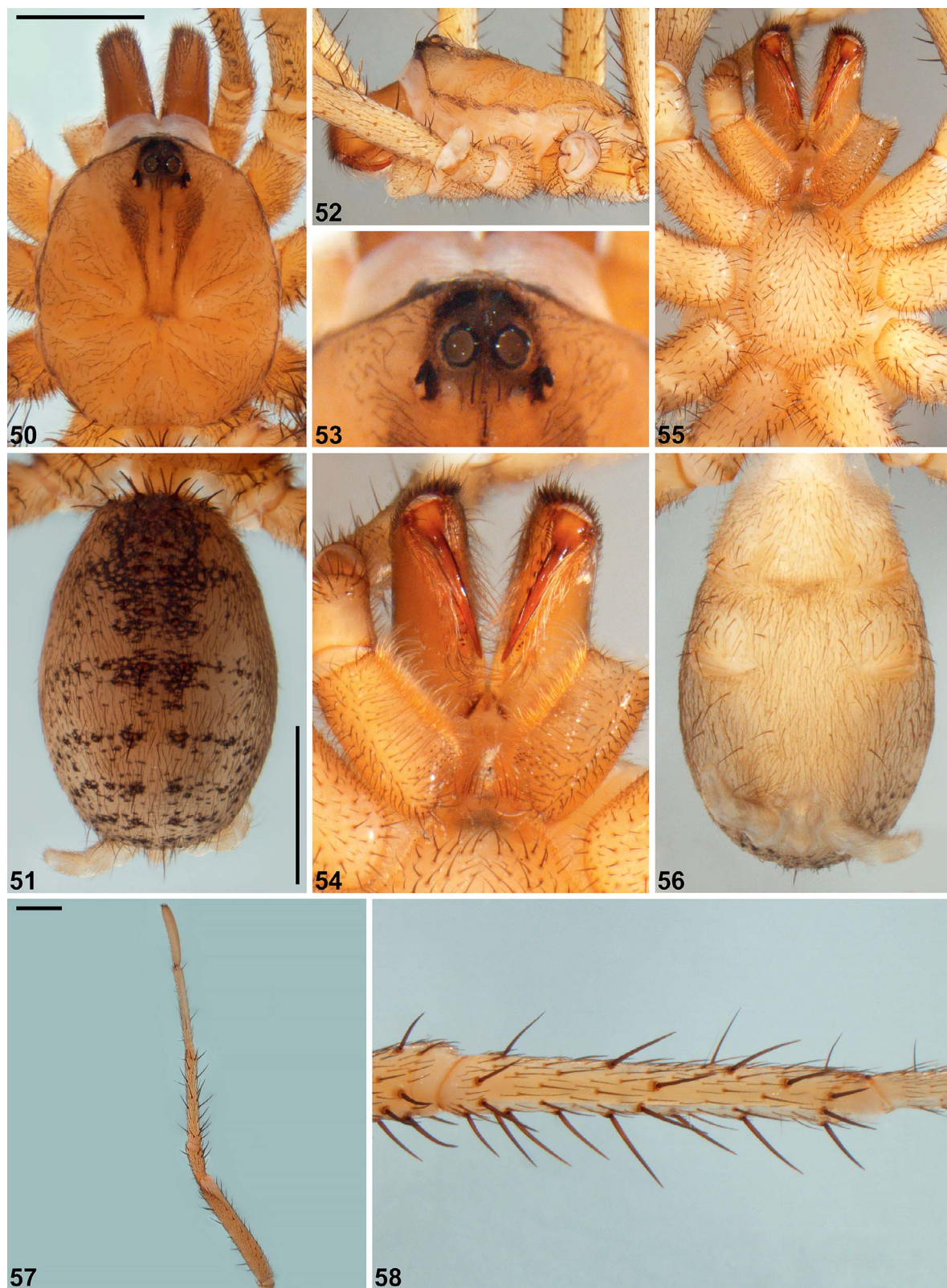
Distribution and remarks.—*Bungulla aplini* (formerly confused with WAM identification code ‘MYG155’) is a rare and highly restricted species known only from Nerren Nerren Station, in the north-western Yalgoo (Edel) bioregion of south-western Australia (Fig. 62). Nothing is known of the biology of this species, other than that the known male specimens were collected wandering in search of females in winter or possibly late autumn.

Bungulla banksia Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:B082E5B0-3F54-47E3-AA94-EECCAF2E4525>
(Figs. 13, 63–75)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Cooljarloo Mining Lease, between Brand Highway, Cooljarloo Road and Wongonderrah Road (IBRA_GES), 30°40'S, 115°25'E, *Banksia* low woodland on sand, 17–21 August 2007, M. Bamford (WAM T67132).

Paratype. AUSTRALIA: *Western Australia*: 1 ♂, near Coomallo Hill, Cooljarloo lease (Tiwest Joint Venture) (IBRA_GES), 30°10'S, 115°25'E, dry pitfall trap, 16–21 August 2006, M. Bamford (WAM T77024).



Figures 50–58.—*Bungulla aplini* sp. nov., male holotype (WAM T142981) from Nerren Nerren Station (Western Australia; YAL), somatic morphology: 50–51, carapace and abdomen, dorsal view; 52, cephalothorax, lateral view; 53, eyes, dorsal view; 54, mouthparts, ventral view; 55–56, cephalothorax and abdomen, ventral view; 57, leg I, prolateral view; 58, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 59–61.—*Bungulla aplini* sp. nov., male holotype (WAM T142981) from Nerren Nerren Station (Western Australia; YAL), pedipalp: 59, retrolateral view; 60, retro-ventral view; 61, prolateral view. Scale bar = 2.0 mm.

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Bindoo Hill Nature Reserve, south boundary, site ML 11 (IBRA_GES), 28°30'12"S, 115°15'17"E, wet pitfall traps, 15 September 1998–15 January 1999, N. Guthrie, CALM Survey (WAM T142943); 1 ♂, Burma Road Reserve,

30 km E. of Walkaway (IBRA_GES), 28°56'S, 115°12'E, 15 September 1986, R.P. McMillan (WAM T27094); 1 ♂, S. of Coorow-Green Head Road, site DN 10 (IBRA_GES), 30°04'15"S, 115°34'07"E, wet pitfall traps, 15 October 1999–1 November 2000, P. Van Heurck, CALM Survey (WAM

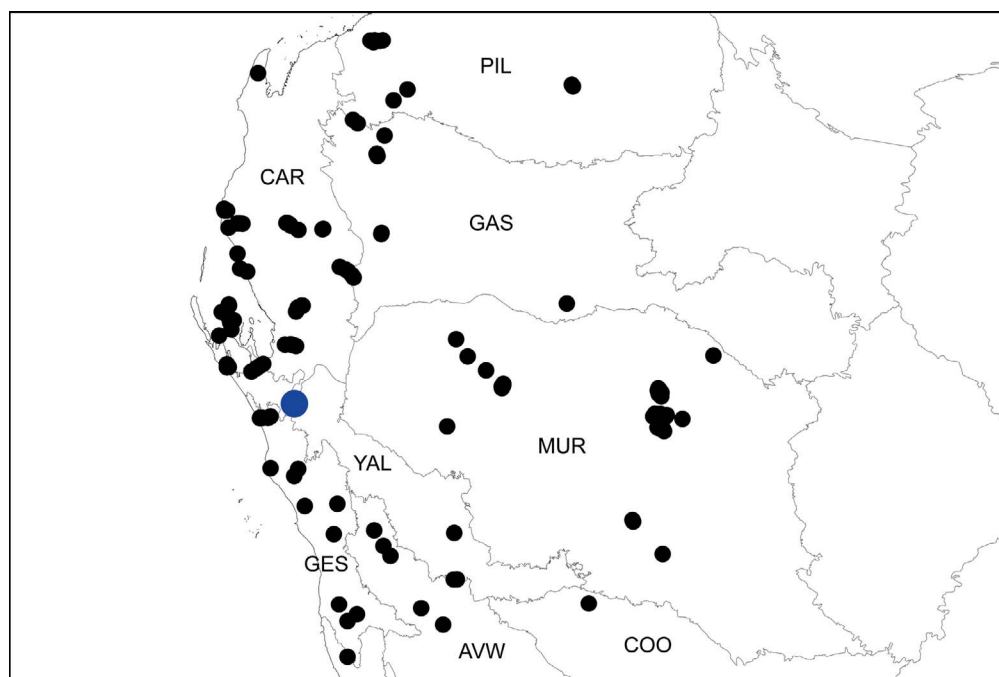
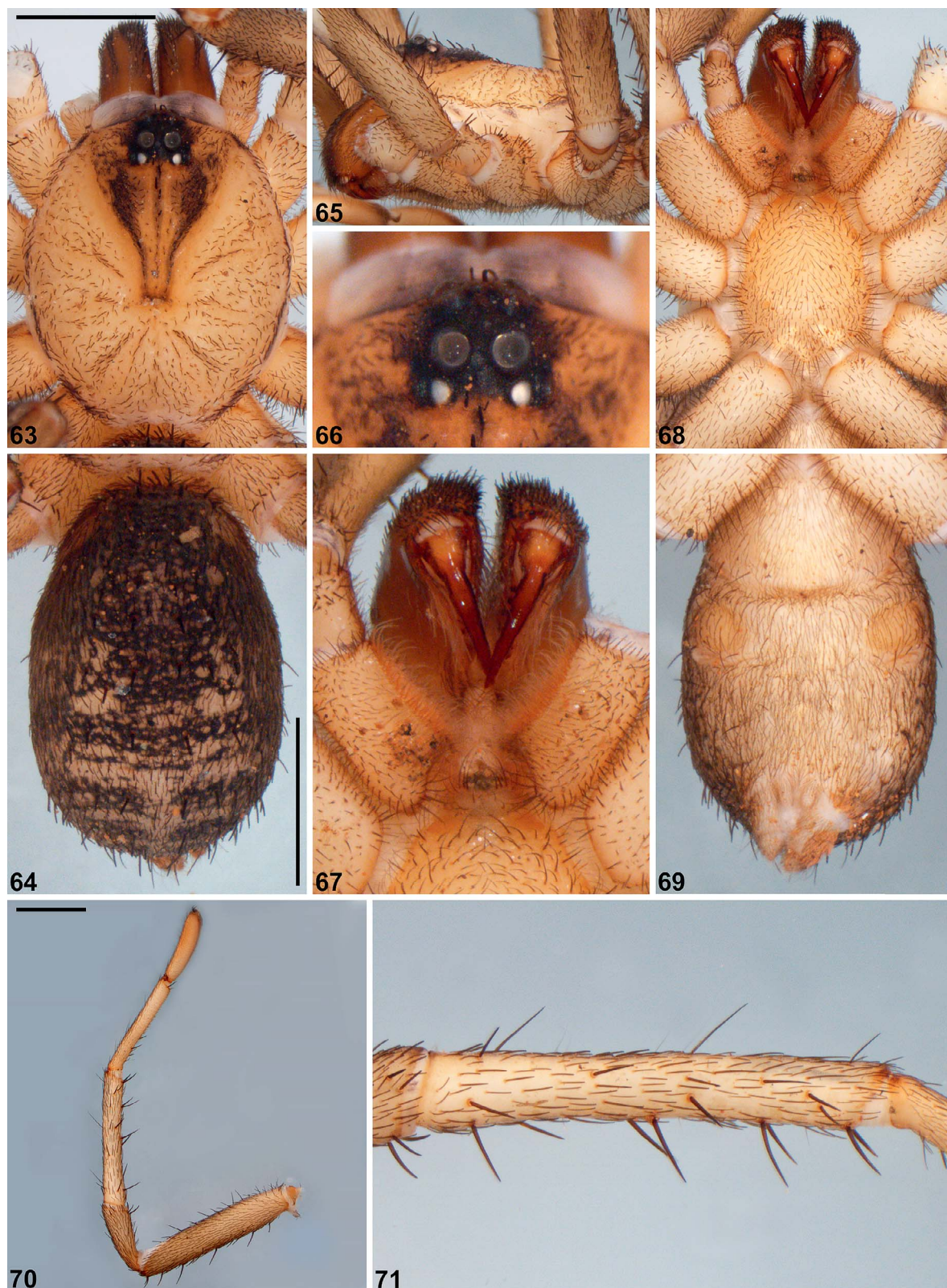


Figure 62.—Map showing collection records of *Bungulla aplini* sp. nov. (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.



Figures 63–71.—*Bungulla banksia* sp. nov., male holotype (WAM T67132) from Cooljarloo Mining Lease (Western Australia; GES), somatic morphology: 63–64, carapace and abdomen, dorsal view; 65, cephalothorax, lateral view; 66, eyes, dorsal view; 67, mouthparts, ventral view; 68–69, cephalothorax and abdomen, ventral view; 70, leg I, prolateral view; 71, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 72–74.—*Bungulla banksia* sp. nov., male holotype (WAM T67132) from Cooljarloo Mining Lease (Western Australia; GES), pedipalp: 72, retrolateral view; 73, retro-ventral view; 74, prolateral view. Scale bar = 2.0 mm.

T142940); 1 ♂, same data (WAM T142941); 1 ♂, same data (WAM T142942); 2 ♂, Eneabba, R.G.C. Mineral Sands, site 8 (IBRA_GES), 29°56'S, 115°17'E, pitfall trap, 8 August 1998, P.L.J. West et al. (WAM T40636); 1 ♂, 10 km S. of Eneabba, R.G.C. Mineral Sands, site 6 (IBRA_GES), 29°56'S, 115°17'E,

9 August 1998, P.L.J. West et al. (WAM T44185); 2 ♂, Tip Road, SW. of Nabawa, site NO 6 (IBRA_GES), 28°31'57"S, 114°44'18"E, wet pitfall traps, 15 September 1998–18 October 1999, N. Guthrie, CALM Survey (WAM T142944).

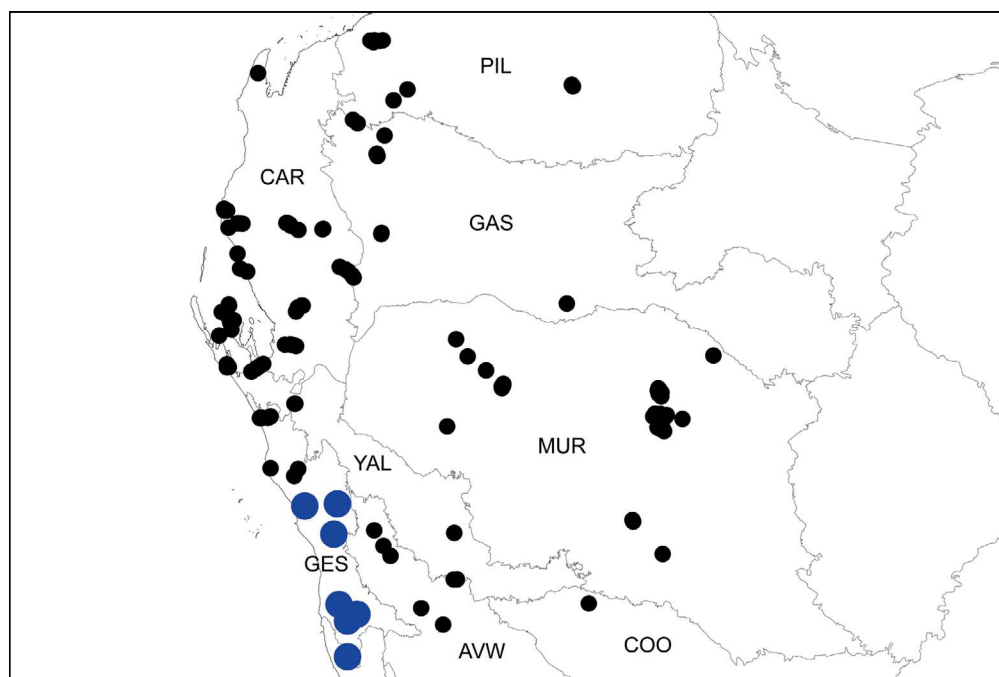


Figure 75.—Map showing collection records of *Bungulla banksia* sp. nov. (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.

Etymology.—The specific epithet is a noun in apposition, in reference to the distribution of this species in the ‘kwongan’ *Banksia* heathlands of south-western Australia’s northern sandplains.

Diagnosis.—Males of *Bungulla banksia* can be distinguished from all other known congeners with > 10 retro-lateral spinules on the palpal tibia (Fig. 13) – except *B. bertmaini*, *B. bidgemia*, *B. hamelinensis*, *B. iota*, *B. laevigata*, *B. quobba*, *B. weld* and *B. yeni* – by the shape of the proximal half of the palpal tibia, which is without a pronounced ventral bulge (Fig. 72), combined with the absence of a medial ‘ledge’ on the palpal tibia (Figs. 72, 73) (palpal tibia is with a ledge or bulges ventrally in other species). *Bungulla banksia* can be further distinguished from *B. bertmaini*, *B. bidgemia*, *B. iota*, *B. hamelinensis*, *B. laevigata*, *B. quobba*, *B. weld* and *B. yeni* by the presence of a small field of spinules restricted to the disto-ventral margin of the palpal tibia, and situated closely proximal to a small retro-distal bulge (Figs. 72, 73; cf. Figs. 24, 95, 218, 267, 319, 371, 419, 445). Females are unknown.

Description (male holotype).—Total length 10.3. Carapace 4.6 long, 3.8 wide. Abdomen 4.5 long, 3.0 wide. Carapace (Fig. 63) tan, with darker pars cephalica, darker brown lyre-like pattern on pars cephalica, black lateral rims and black ocular region; fovea straight. Eye group (Fig. 66) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide, PLE–PLE/ALE–ALE ratio 1.5; ALE separated by ca. half their own diameter; AME separated by less than their own diameter; PME separated by 3.0 x their own diameter; PME and PLE separated by slightly less than diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 67); labium without cuspules. Abdomen (Fig. 64) oval, dark brown-black in dorsal view with beige-tan mottling, two pairs of beige-tan sigilla spots, and three pairs of beige-tan chevrons posteriorly. Dorsal surface of abdomen (Fig. 38) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 70, 71) variable shades of tan, with light scopulae on tarsi I–II; tibia I spinose, without prolateral clasping spurs. Leg I: femur 4.7; patella 2.3; tibia 3.8; metatarsus 3.1; tarsus 2.2; total 16.0. Leg I femur–tarsus/carapace length ratio 3.5. Pedipalpal tibia (Figs. 72–74) nearly 2.0 x longer than wide; field of retrolateral spinules rectangular in shape, positioned distally (along disto-ventral margin, closely proximal to a small retro-distal bulge), consisting of 18 spinules of largely similar length; RTA absent. Cymbium (Figs. 72–74) setose, with field of spine-like spinules covering most of dorsal surface. Embolus (Figs. 72–74) as long as bulb, curved, with unmodified tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla banksia* has a relatively restricted distribution in the ‘kwongan’ heathlands of the Geraldton Sandplains bioregion of south-western Australia, from near Kalbarri in the north, south to Cooljarloo (Fig. 75). Nothing is known of the biology of this species, other than that the known male specimens were collected wandering in search of females in late winter and possibly early spring.

Bungulla bella Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank>.

org:act:FC39EBF1-8FCD-4E5A-B8DF-3ABFEAB4F1CC
(Figs. 14, 76–85)

Type material.—*Holotype female*. AUSTRALIA: *Western Australia*: Mount Richardson, 225.8 km SE. of Mount Magnet (IBRA_MUR), 28°46'13"S, 119°59'09"E, dug from burrow, 24 June 2012, N. Watson & R. Teale (WAM T126165^{DNA_Voucher_255}, GenB–COI–MG516838, GenB–CYB–MG516849, GenB–MRPL45–MG516865, GenB–RPF2–MG516876, GenB–XPNPEP3–MG516888, GenB–ITS–MG516853).

Etymology.—The specific epithet is derived from the Latin ‘bellus’ (adjective: ‘pretty’, ‘lovely’ or ‘fine’; see Brown 1956), in reference to the attractive abdominal coloration of this species.

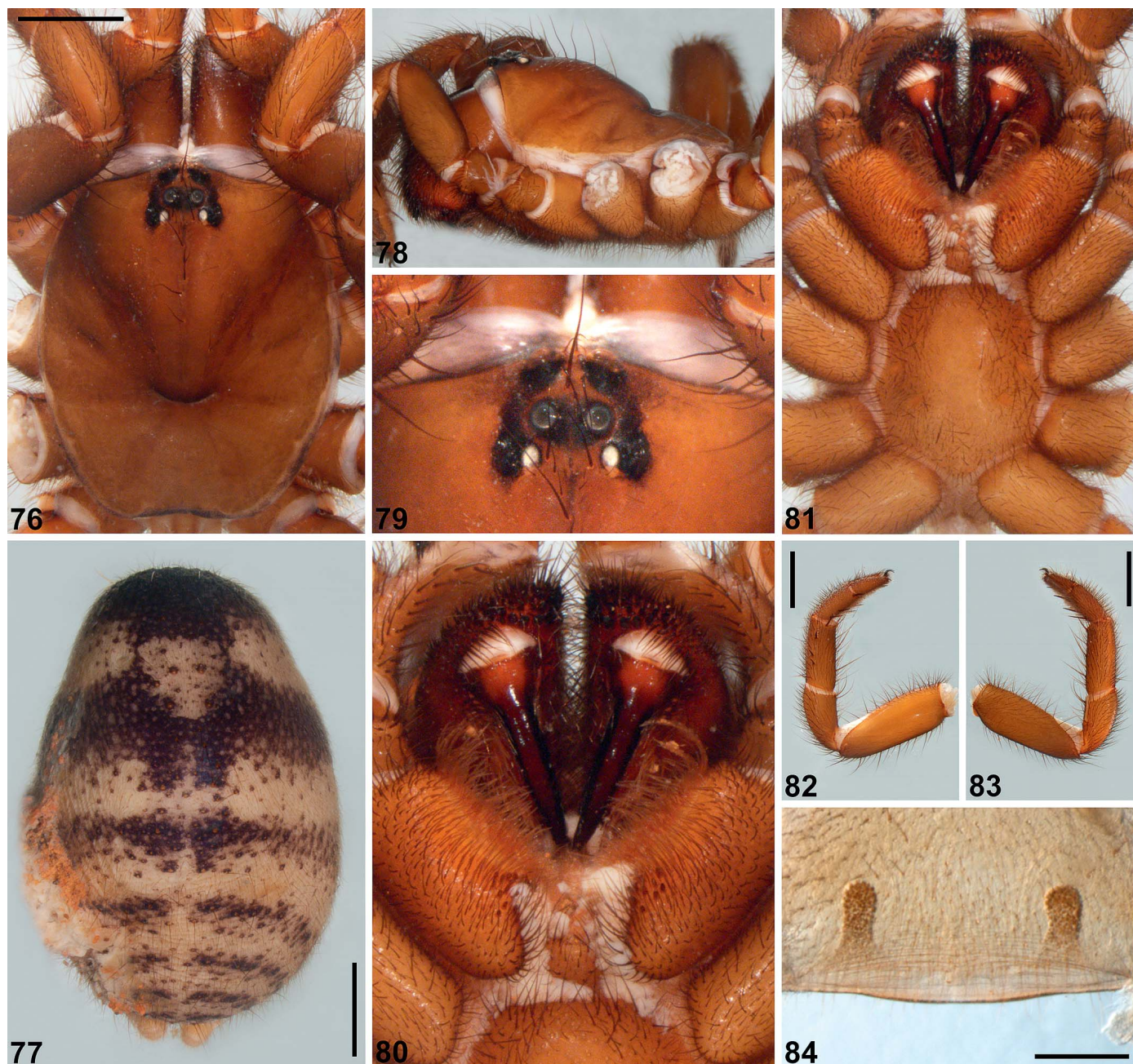
Diagnosis.—*Bungulla bella* is known from only a single female specimen, for which sequence data are available (Fig. 14). It can be distinguished from the other two species known only from females – *B. gibba* and *B. harrisonae* – by the ornate coloration of the dorsal abdomen (Fig. 77; cf. Figs. 200, 236). While it is possible that *B. bella* may be conspecific with a species here described separately from male specimens, we consider this highly unlikely given the size, coloration and morphology of those congeners known from the vicinity of the type locality.

Description (female holotype).—Total length 19.1. Carapace 6.7 long, 5.6 wide. Abdomen 9.9 long, 6.8 wide. Carapace (Fig. 76) light chocolate-brown with mostly black ocular region; fovea strongly procurved. Eye group (Fig. 79) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide, PLE–PLE/ALE–ALE ratio 1.6; ALE separated by ca. half their own diameter; AME separated by their own diameter; PME separated by 3.2 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 80); labium without cuspules. Abdomen (Fig. 77) oval, beige in dorsal view with contrasting pattern of three darker purple-brown markings anteriorly and five pairs of thin, spotted, dark purple-brown chevrons posteriorly, each divided along midline; sclerotized sigilla absent. Legs (Figs. 82, 83) variable shades of tan; thick scopulae present on tarsi and metatarsi I–II; tibia I with 4 stout prolateral macrosetae and 4 retro-ventral spine-like macrosetae; metatarsus I with 3 stout pro-ventral macrosetae and 3 longer retro-ventral macrosetae; tarsus I with distal cluster of 2 stout ventral macrosetae. Leg I: femur 4.1; patella 2.7; tibia 2.4; metatarsus 1.8; tarsus 1.4; total 12.5. Leg I femur–tarsus/carapace length ratio 1.9. Pedipalp tan, spinose on tibia and tarsus, with thick tarsal scopula. Genitalia (Fig. 84) with pair of short, widely spaced, bud-shaped spermathecae.

Distribution and remarks.—*Bungulla bella* is an enigmatic species known only from Mount Richardson, in the southern-central Murchison bioregion of Western Australia (Fig. 85). Genetic data reveal that *B. bella* is closely related to *B. harrisonae* (Fig. 14), the latter found in the mesic jarrah forest east of Perth (Fig. 231). Nothing is known of the biology of this species.

Bungulla bidgemia Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank>.



Figures 76–84.—*Bungulla bella* sp. nov., female holotype (WAM T126165) from Mount Richardson, SE. of Mount Magnet (Western Australia; MUR): 76–77, carapace and abdomen, dorsal view; 78, cephalothorax, lateral view; 79, eyes, dorsal view; 80, mouthparts, ventral view; 81, cephalothorax, ventral view; 82, leg I, prolateral view; 83, leg I, retrolateral view; 84, spermathecae, dorsal view. Scale bars = 2.0 mm (76–77, 82–83), 0.5 mm (84).

org:act:CB2AC8D2-4BB4-4339-8130-35E93E261155
(Figs. 13, 86–98)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Bidgeamia Station, Gascoyne Junction, site GJ1 (IBRA_CAR), 25°12'34.5"S, 115°30'50.5"E, wet pitfall trap, 5 June–20 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98533).

Paratype. AUSTRALIA: *Western Australia*: 1 ♂, same data as holotype (WAM T142979).

Etymology.—The specific epithet is a noun in apposition, in reference to the type locality of this species.

Diagnosis.—Males of *Bungulla bidgeamia* can be distinguished from all other known congeners with > 10 retrolateral spinules on the palpal tibia (Fig. 13) – except *B. banksia*, *B. bertmaini*, *B. hamelinensis*, *B. iota*, *B. laevigata*, *B. quobba*, *B. weld* and *B. yeni* – by the shape of the proximal half of the palpal tibia, which is without a pronounced ventral bulge (Fig. 95), combined with the absence of a medial 'ledge' on the palpal tibia (Figs. 95, 96) (palpal tibia is with a ledge or bulges ventrally in other species). *Bungulla bidgeamia* can be further

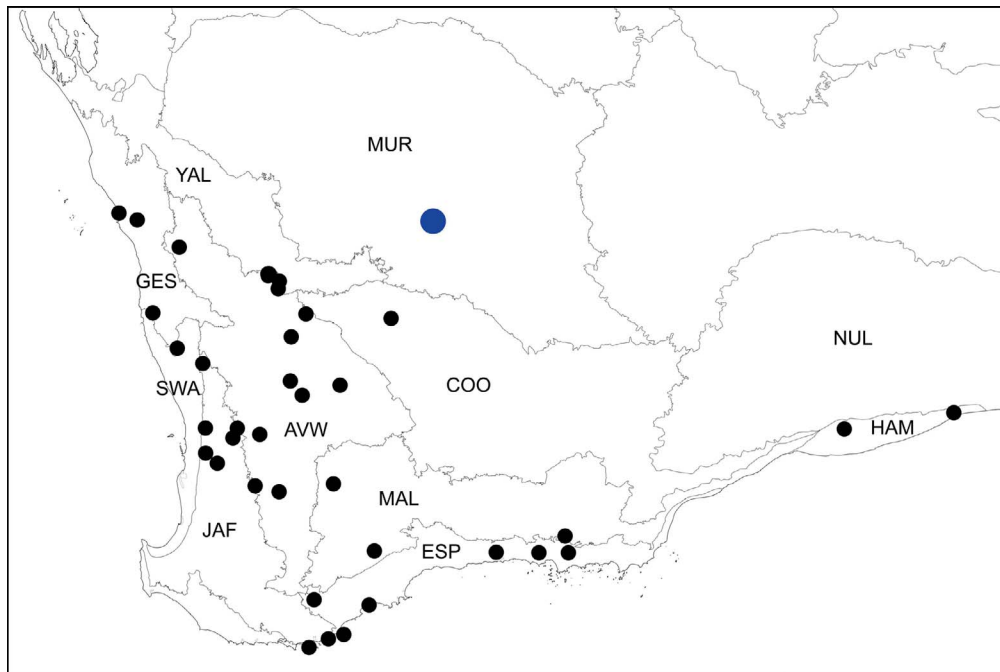


Figure 85.—Map showing collection records of *Bungulla bella* sp. nov. (large blue circle), relative to other taxa with < 5 retrolateral spinules on the male palpal tibia (see Fig. 12). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; COO, Coolgardie; ESP, Esperance Plains; GES, Geraldton Sandplains; HAM, Hampton; JAF, Jarrah Forest; MAL, Mallee; MUR, Murchison; NUL, Nullarbor; SWA, Swan Coastal Plain; YAL, Yalgoo.

distinguished from *B. banksia* by the larger field of retrolateral spinules on the palpal tibia (Fig. 95; cf. Fig. 72); from *B. bertmaini*, *B. laevigata* and *B. quobba* by the shape of the embolus, which is relatively short (i.e., ~as long as bulb) (Fig. 95; cf. Figs. 24, 319, 371); from *B. hamelinensis* by the morphology of the cymbial spinules, which are thicker and more spine-like (Figs. 95–97; cf. Figs. 218–220); from *B. yeni* and by the presence of a larger, crescent-shaped field of retrolateral spinules on the palpal tibia (Fig. 95; cf. Fig. 445); from *B. weld* by the presence of relatively symmetric field of retrolateral spinules on the palpal tibia (Fig. 95; cf. Fig. 419); and from *B. iota* by its larger body size (carapace width ≥ 2.0) (Fig. 86; cf. Fig. 258), combined with the presence of marginal lateral indentations on the carapace between coxae II–III (Fig. 86; cf. Fig. 258). Females are unknown.

Description (male holotype).—Total length 7.1. Carapace 2.9 long, 2.2 wide. Abdomen 3.4 long, 2.0 wide. Carapace (Fig. 86) pale tan, with darker pars cephalica and mostly black ocular region; fovea straight; marginal lateral indentations present between coxae II–III. Eye group (Fig. 89) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide, PLE–PLE/ALE–ALE ratio 1.5; ALE separated by nearly their own diameter; AME separated by less than their own diameter; PME separated by 2.9 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 90); labium without cuspules. Abdomen (Fig. 87) elongate-oval, beige-tan in dorsal view with five faded pairs of thin, spotted brown chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 87) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla

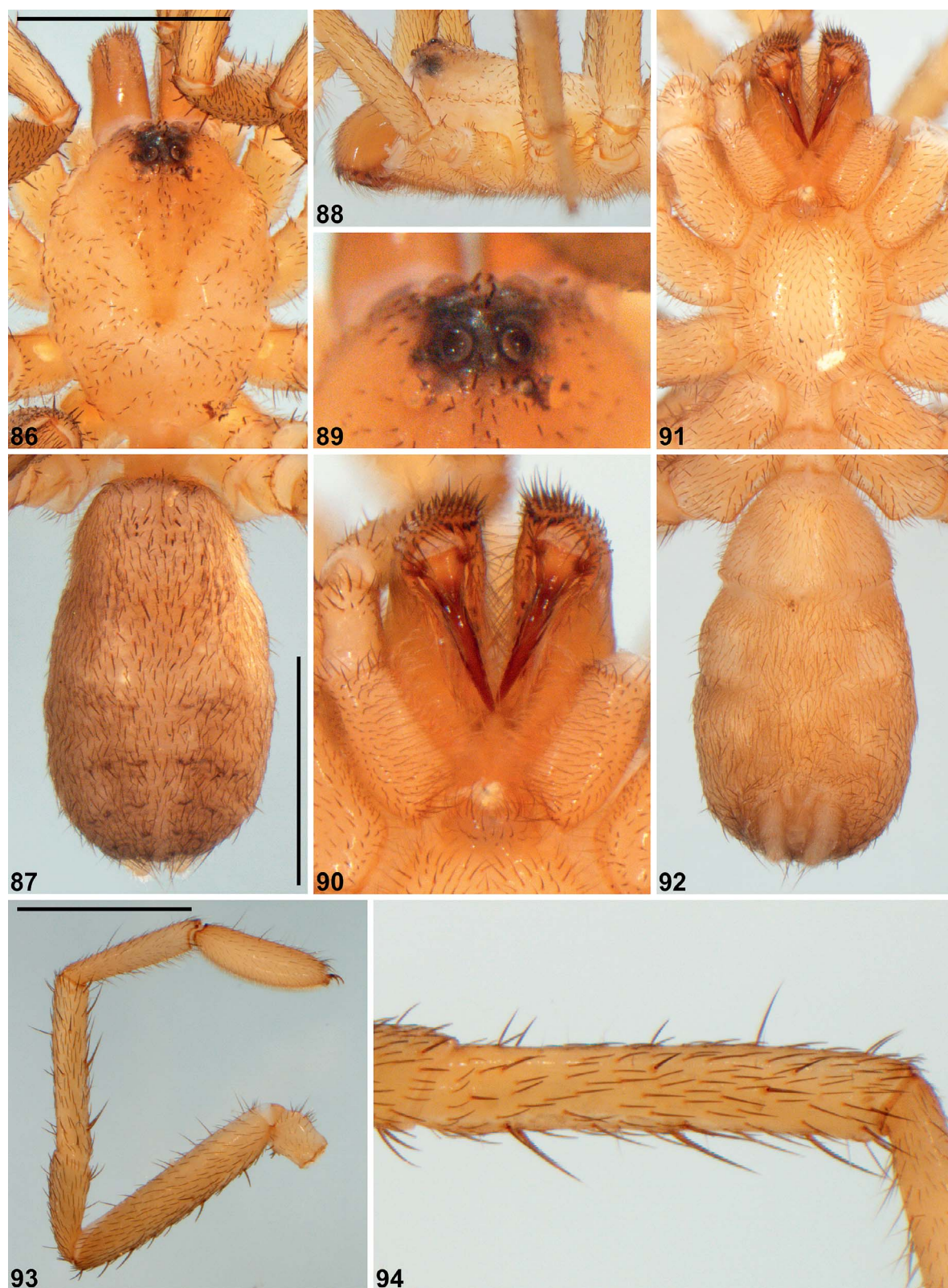
absent. Legs (Figs. 93, 94) variable shades of pale tan, with light scopulae on incrassate tarsi I–II; tibia I spinose, without prolateral clasp spurs. Leg I: femur 2.7; patella 1.3; tibia 2.0; metatarsus 1.7; tarsus 1.5; total 9.3. Leg I femur–tarsus/carapace length ratio 3.2. Pedipalpal tibia (Figs. 95–97) 2.0 x longer than wide; field of retrolateral spinules large and symmetrically crescent-shaped in retrolateral view, positioned medially–distally (along most of retro-ventral margin), consisting of ca. 50 spinules of largely similar length; RTA absent. Cymbium (Figs. 95–97) setose, with sparse field of spine-like spinules covering most of dorsal surface. Embolus (Figs. 95–97) as long as bulb, slightly curved, with unmodified tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla bidgemia* (formerly known by WAM identification code ‘MYG138’) is known only from Bidgemia Station in the far eastern Carnarvon bioregion (Western Australia), just west of the Gascoyne River near the junction of Pell Creek and Daurie Creek (Fig. 98). Nothing is known of the biology of this species, other than that the known male specimens were collected wandering in search of females in winter.

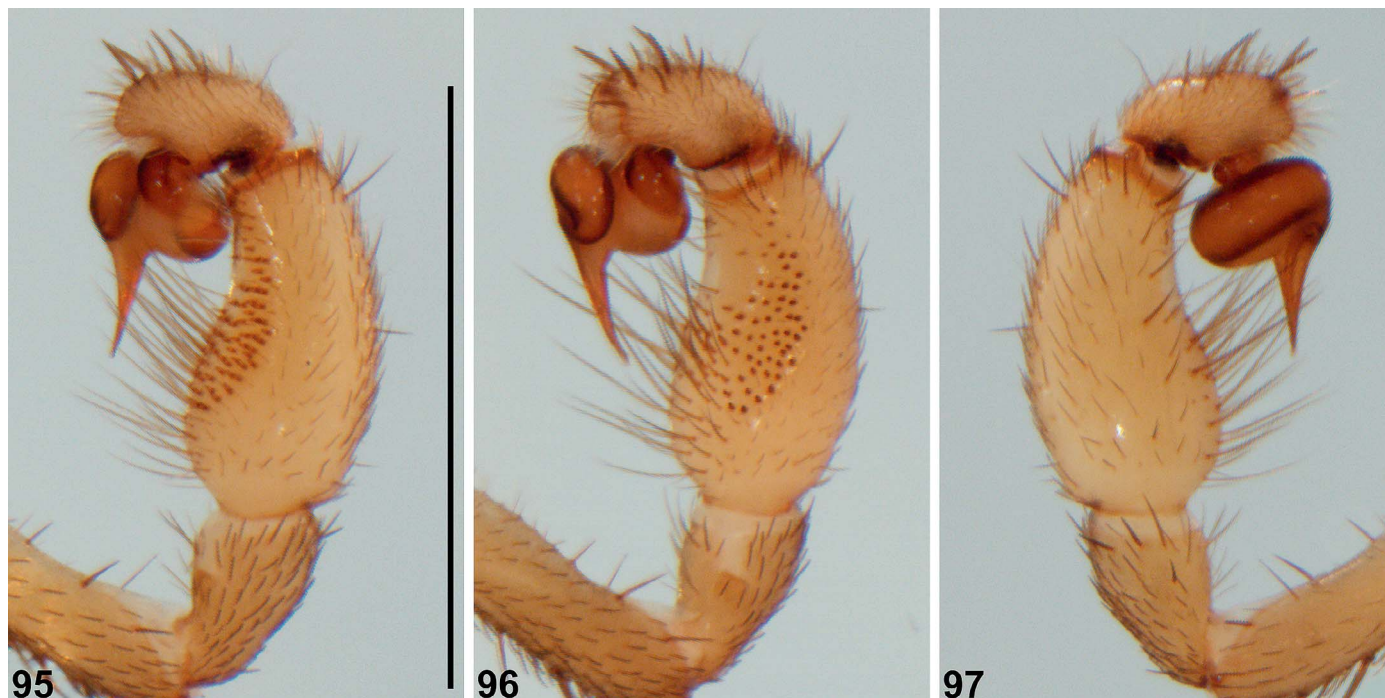
***Bungulla biota* Rix, Raven & Harvey, sp. nov.**

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:5138917E-CF75-46C7-8D54-D53CECF594AA>
(Figs. 1–3, 13, 14, 99–111)

Type material.—*Holotype male*. AUSTRALIA: Western Australia: Mount Richardson, 222 km SE. of Mount Magnet (IBRA_MUR), 28°45'13"S, 119°57'55"E, dug from burrow, 28 June 2012, N. Watson & R. Teale (WAM T126205^{DNA_Voucher_197}; GenB–COI–MG516830, GenB–CYB–MG516852, GenB–MRPL45–MG516868, GenB–



Figures 86–94.—*Bungulla bidgemia* sp. nov., male holotype (WAM T98533) from Bidgemia Station, Gascoyne Junction (Western Australia; CAR), somatic morphology: 86–87, carapace and abdomen, dorsal view; 88, cephalothorax, lateral view; 89, eyes, dorsal view; 90, mouthparts, ventral view; 91–92, cephalothorax and abdomen, ventral view; 93, leg I, prolateral view; 94, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 95–97.—*Bungulla bidgemia* sp. nov., male holotype (WAM T98533) from Bidgemia Station, Gascoyne Junction (Western Australia; CAR), pedipalp: 95, retrolateral view; 96, retro-ventral view; 97, prolateral view. Scale bar = 2.0 mm.

RPF2–MG516886, GenB–XPNPEP3–MG516891, GenB–ITS–MG516856).

Paratypes. AUSTRALIA: *Western Australia:* 1 ♂, Albion Downs, 84.9 km NNW. of Leinster (IBRA_MUR), 27°14'40"S, 120°16'54"E, dry pitfall trap, 29 August 2008, Z Hamilton & R.

Teale (WAM T96266^{DNA_Voucher_211}; GenB–COI–MG516829, GenB–CYB–MG516851, GenB–MRPL45–MG516867, GenB–RPF2–MG516885, GenB–XPNPEP3–MG516890, GenB–ITS–MG516855); 1 ♂, same data except 28 August–3 September 2008 (WAM T96303); 1 ♂, same data except 62.6 km NNW. of

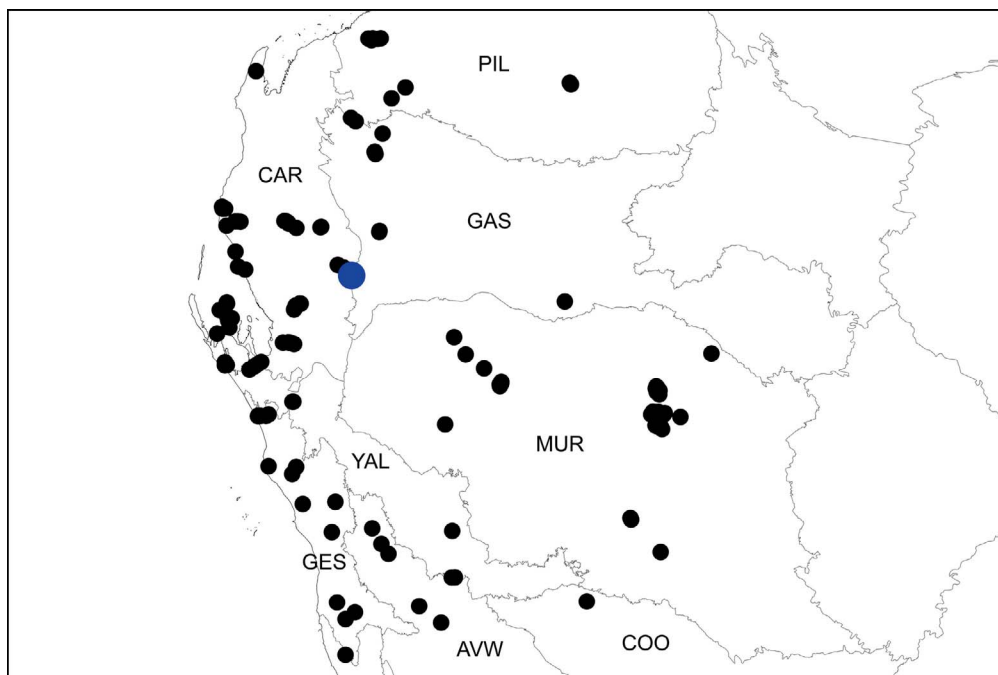
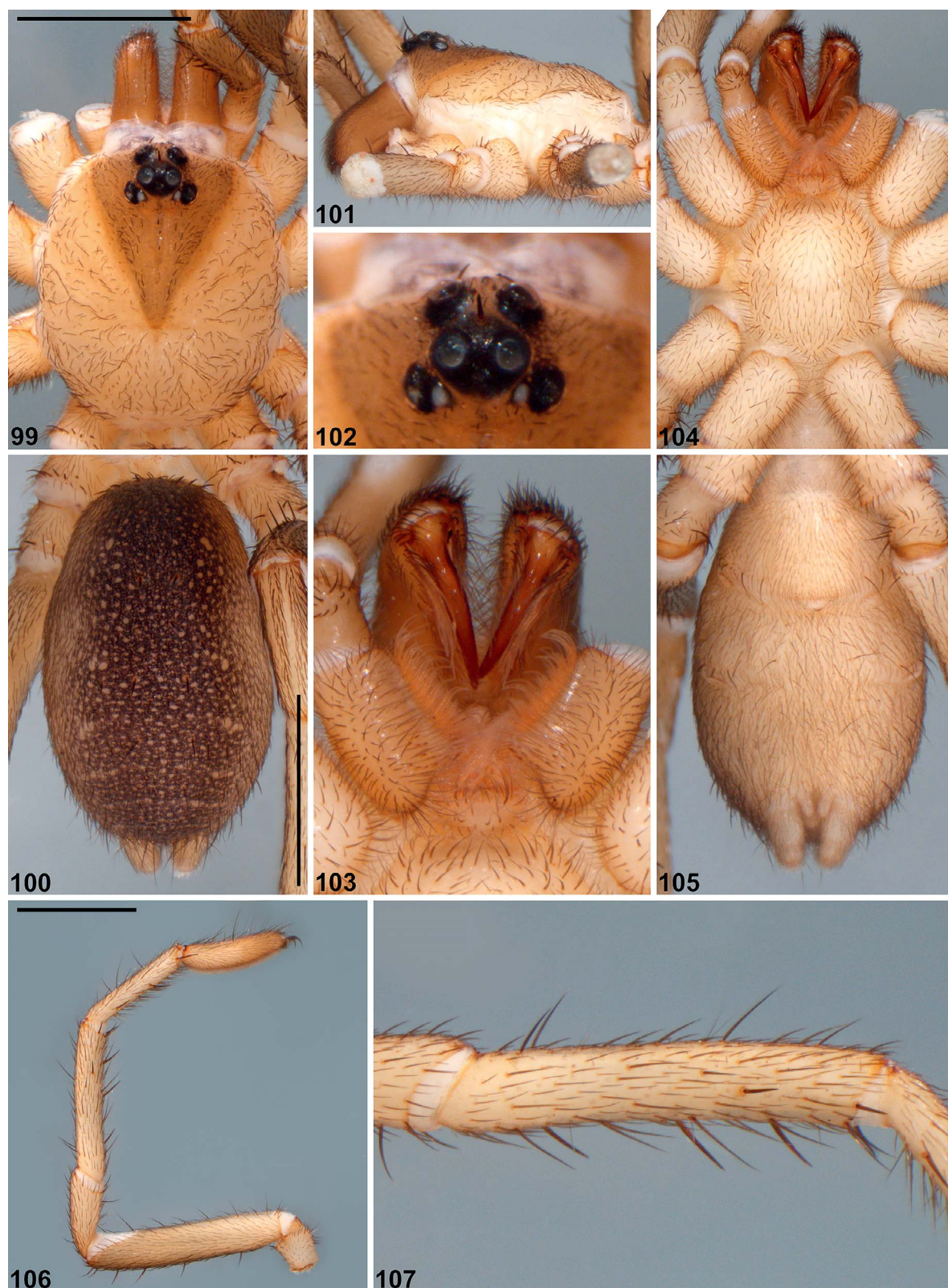
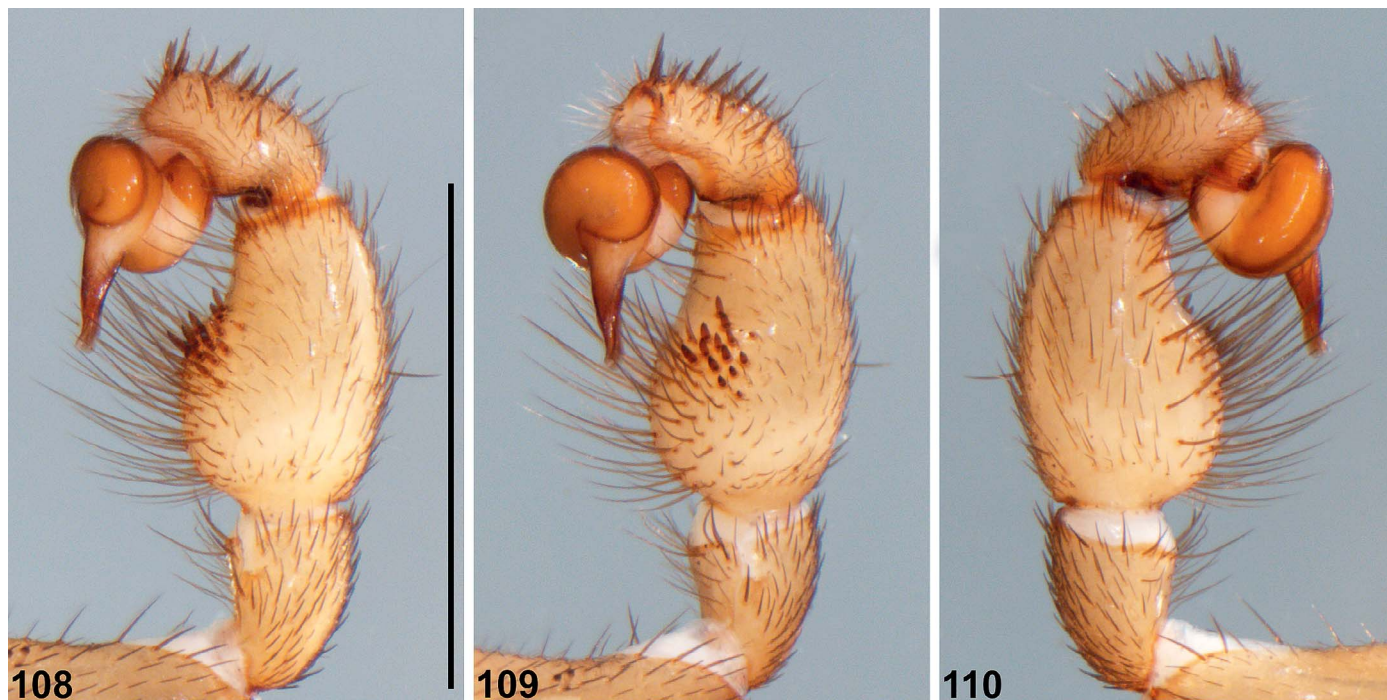


Figure 98.—Map showing collection records of *Bungulla bidgemia* sp. nov. (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.



Figures 99–107.—*Bungulla biota* sp. nov., male holotype (WAM T126205) from Mount Richardson (Western Australia; MUR), somatic morphology: 99–100, carapace and abdomen, dorsal view; 101, cephalothorax, lateral view; 102, eyes, dorsal view; 103, mouthparts, ventral view; 104–105, cephalothorax and abdomen, ventral view; 106, leg I, prolateral view; 107, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 108–110.—*Bungulla biota* sp. nov., male holotype (WAM T126205) from Mount Richardson (Western Australia; MUR), pedipalp: 108, retrolateral view; 109, retro-ventral view; 110, prolateral view. Scale bar = 2.0 mm.

Leinster, 27°25'03"S, 120°23'45"E (WAM T96297); 1 ♂, same data (WAM T96304^{DNA_Voucher_212}; GenB-COI-MG516828, GenB-CYB-MG516850, GenB-MRPL45-MG516866, GenB-RPF2-MG516884, GenB-XPNPEP3-MG516889, GenB-ITS-MG516854).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Albion Downs, 62.7 km NNW. of Leinster (IBRA_MUR), 27°25'02"S, 120°23'41"E, dry pitfall trap, 28 August–3 September 2008, Z Hamilton & R. Teale (WAM T96307); 1 ♂, same data (WAM T96302); 1 ♂, same data

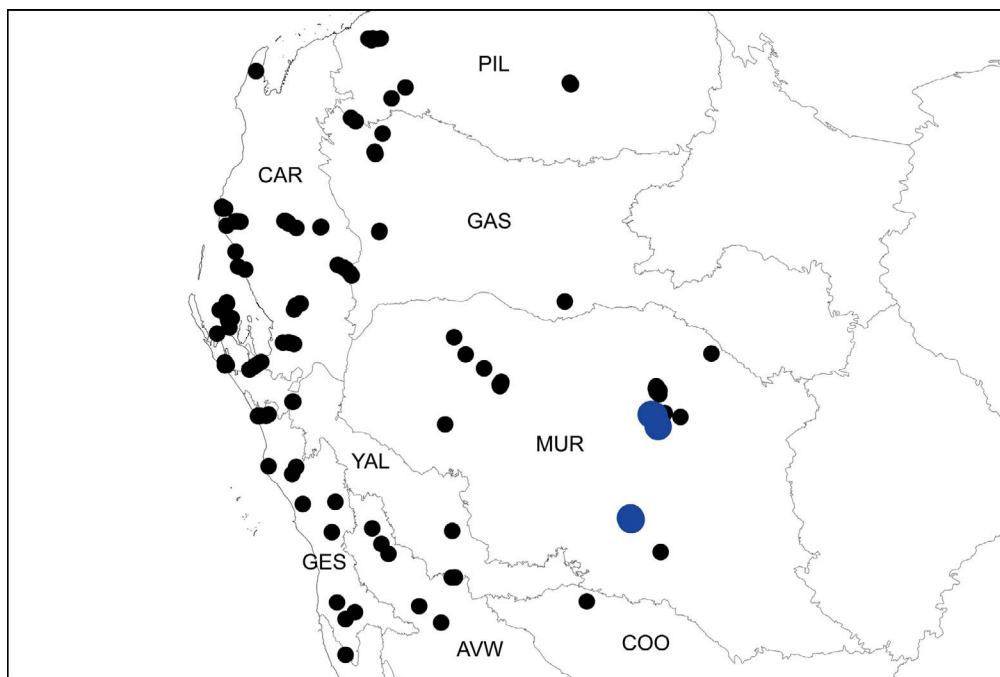


Figure 111.—Map showing collection records of *Bungulla biota* sp. nov. (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.

except 81.2 km NNW. of Leinster, 27°15'32"S, 120°19'50"E (WAM T96293); 1 ♂, same data (WAM T96292); 1 ♂, same data (WAM T96296); 1 ♂, same data (WAM T96294); 1 ♂, Dingo North, ca. 63 km WNW. Mount Ida (IBRA_MUR), 28°43'47.88"S, 119°57'5.360"E, hand foraging, 14 September 2013, M.K. Curran & S.R. Bennett (WAM T135207).

Etymology.—The specific epithet is a noun in apposition, in reference to 'Biota Environmental Sciences', for their wonderful support of the Australian Research Council (ARC) idiopid project since its commencement in 2012, and whose staff first discovered and provided sequenceable specimens of this rare species in 2008.

Diagnosis.—Males of *Bungulla biota* can be distinguished from all other known congeners by the shape of the distal embolus, which is broad and distally-flattened with a truncate tip (Figs. 108, 109) (embolus is usually tapered, with or without distal modifications in other species). Females are unknown.

Description (male holotype).—Total length 8.4. Carapace 3.3 long, 2.7 wide. Abdomen 3.8 long, 2.4 wide. Carapace (Fig. 99) pale tan, with much darker olive-tan pars cephalica and mostly black ocular region (carapace tan with brown-black pars cephalica in life; Figs. 1, 2); postero-lateral corners near abdomen each with marginal cluster of longer black setae; fovea straight. Eye group (Fig. 102) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide, PLE–PLE/ALE–ALE ratio 1.4; ALE separated by nearly their own diameter; AME separated by less than their own diameter; PME separated by 4.3 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 103); labium without cuspules. Abdomen (Fig. 100) oval, mostly dark purple-brown in dorsal view, lighter dorso-laterally (as in life; Figs. 1, 2), with beige-tan mottling, two pairs of small beige-tan sigilla spots, and four indistinct pairs of beige-tan chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 100) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 106, 107) variable shades of pale tan, with light scopulae on tarsi I–II; tibia I spinose, without prolateral claspings spurs. Leg I: femur 3.3; patella 1.6; tibia 2.5; metatarsus 2.0; tarsus 1.7; total 11.1. Leg I femur–tarsus/carapace length ratio 3.4. Pedipalpal tibia (Figs. 108–110) stout, 1.5 x longer than wide, with RTA-like ventral bulge proximally; field of retrolateral spinules sub-triangular in shape, positioned medially (at apex of RTA-like bulge), consisting of 14 spinules of largely similar length; RTA absent. Cymbium (Figs. 108–110) setose, with field of porrect, thorn-like spinules covering most of dorsal surface. Embolus (Figs. 108–110) as long as bulb, relatively straight, with broad, distally-flattened, truncate tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla biota* (formerly known by WAM identification codes 'MYG270' and 'MYG032') has a relatively restricted distribution in the central Murchison bioregion of Western Australia, at Albion Downs (near Leinster) and in the vicinity of Mount Richardson (Fig. 111). Little is known of the biology of this unusual species, other than that the known male specimens were collected wandering in search of females in late winter and early spring,

with a single male (Figs. 1–2) collected in its burrow (pre-emergence) in mid-winter.

Bungulla bringo Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:333DE2CC-8CF5-4A7A-B830-4ED18E505D88>

(Figs. 10, 12, 112–124)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: 1 km SE. of Bringo railway cutting (IBRA_GES), 28°45'S, 114°56'E, gully with York Gum, 13 May 2000, S. Slack-Smith (WAM T41571).

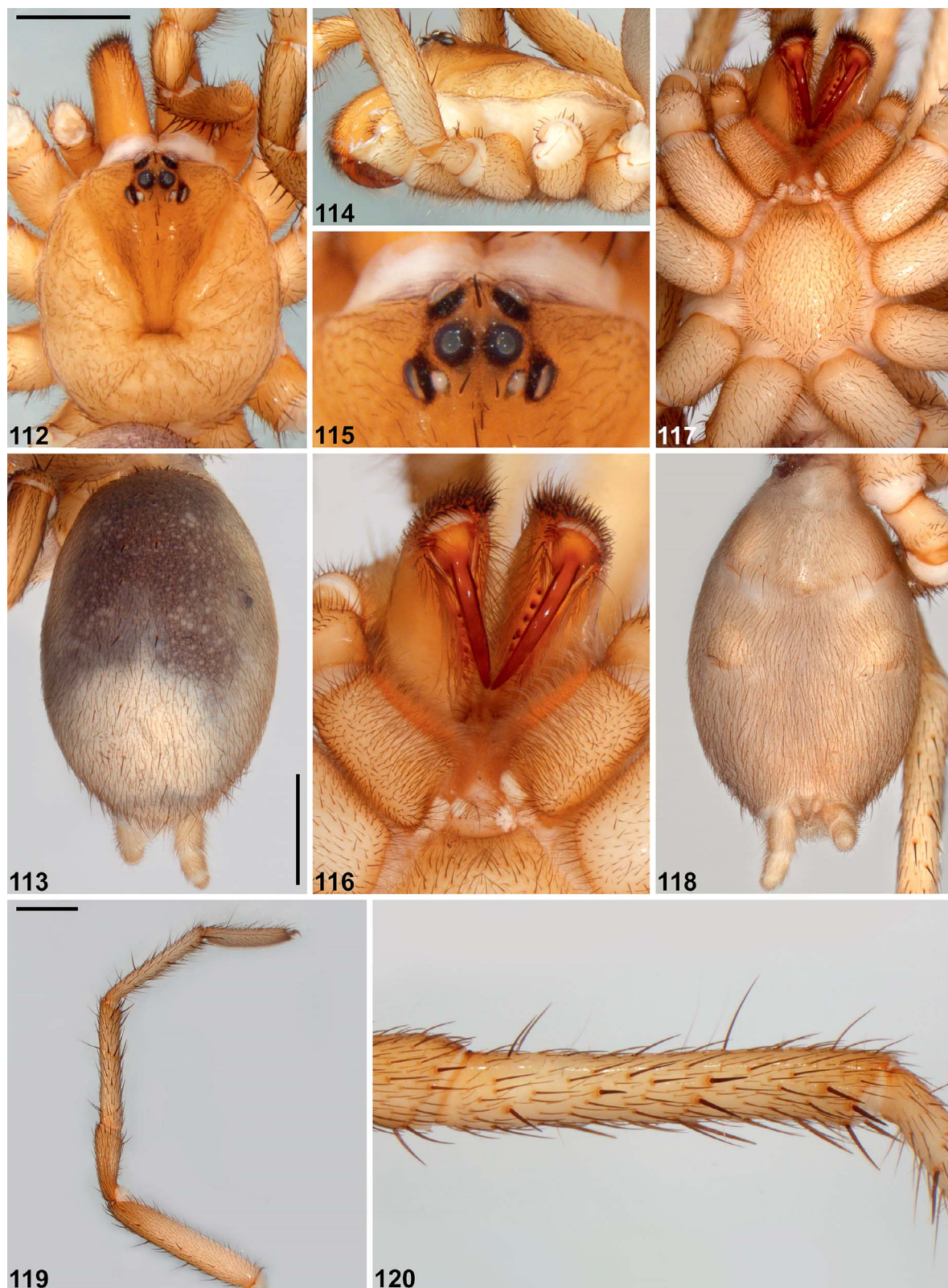
Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Ebano Creek, ca. 22 miles SW. of Morawa on Morawa-Mingenew Road (IBRA_AVW), 29°10'S, 115°39'E, 5 August 1953, B.Y. Main (WAM T142938).

Etymology.—The specific epithet is a noun in apposition, in reference to the distribution of this species near Bringo, Western Australia.

Diagnosis.—Males of *Bungulla bringo* can be distinguished from all other known congeners by the presence of a very small field of < 5 retrolateral spinules on the palpal tibia (Figs. 121, 122) (> 10 spinules or spinules absent in other species). Females are unknown.

Description (male holotype).—Total length 13.5. Carapace 4.9 long, 4.3 wide. Abdomen 6.4 long, 4.3 wide. Carapace (Fig. 112) tan, with darker pars cephalica and slightly darker ocular region; postero-lateral corners near abdomen each with marginal cluster of longer black setae; fovea slightly recurved. Eye group (Fig. 115) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide, PLE–PLE/ALE–ALE ratio 1.5; ALE separated by nearly their own diameter; AME separated by less than their own diameter; PME separated by 3.2 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 116); labium without cuspules. Abdomen (Fig. 113) oval, mostly dark grey in dorsal view, with beige mottling and large beige patch posteriorly (the latter a preservation artefact). Dorsal surface of abdomen (Fig. 103) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 119, 120) variable shades of tan, with light scopulae on tarsi I–II; tibia I spinose, without prolateral claspings spurs. Leg I: femur 5.3; patella 2.6; tibia 4.1; metatarsus 2.8; tarsus 2.8; total 18.7. Leg I femur–tarsus/carapace length ratio 3.8. Pedipalpal tibia (Figs. 121–123) stout, 1.6 x longer than wide, with very small field of 4 retrolateral spinules positioned medially; RTA absent. Cymbium (Figs. 121–123) setose, with field of porrect, thorn-like spinules covering most of dorsal surface. Embolus (Figs. 121–123) slightly longer than bulb, slightly curved, with unmodified tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla bringo* (formerly known by WAM identification code 'MYG152') is a rare species known only from near Bringo railway cutting and Ebano Creek, east and south-east of Geraldton (Western Australia) (Fig. 124). Nothing is known of the biology of this species, other than that the known male specimens were collected wandering in search of females in late autumn and winter.



Figures 112–120.—*Bungulla bringo* sp. nov., male holotype (WAM T41571) from SE. of Bringo railway cutting (Western Australia; GES), somatic morphology: 112–113, carapace and abdomen, dorsal view; 114, cephalothorax, lateral view; 115, eyes, dorsal view; 116, mouthparts, ventral view; 117–118, cephalothorax and abdomen, ventral view; 119, leg I, prolateral view; 120, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 121–123.—*Bungulla bringo* sp. nov., male holotype (WAM T41571) from SE. of Bringo railway cutting (Western Australia; GES), pedipalp: 121, retrolateral view; 122, retro-ventral view; 123, prolateral view. Scale bar = 2.0 mm.

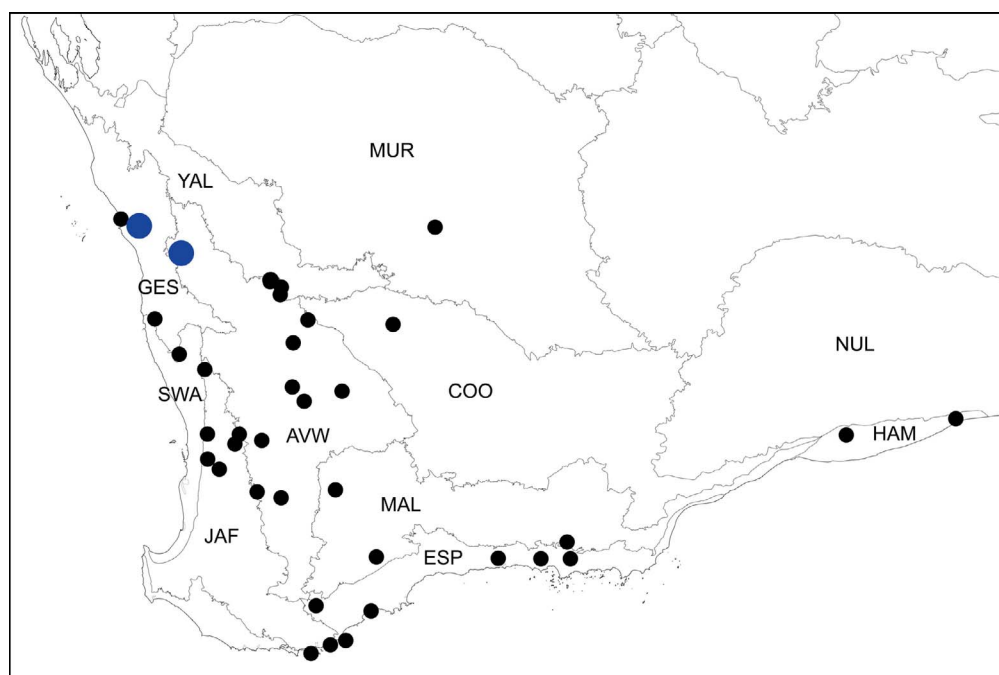


Figure 124.—Map showing collection records of *Bungulla bringo* sp. nov. (large blue circles), relative to other taxa with < 5 retrolateral spinules on the male palpal tibia (see Fig. 12). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; COO, Coolgardie; ESP, Esperance Plains; GES, Geraldton Sandplains; HAM, Hampton; JAF, Jarrah Forest; MAL, Mallee; MUR, Murchison; NUL, Nullarbor; SWA, Swan Coastal Plain; YAL, Yalgoo.

***Bungulla burbridgei* Rix, Raven & Harvey, sp. nov.**

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:64FAAD08-2D57-46CF-848F-7B2D47EF1229>

(Figs. 13, 125–137)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Zuytdorp, site ZU1 (IBRA_GES), 27°15'42"S, 114°01'09"E, dry pitfall trap, 14 October 1994, A. Sampey (WAM T142988).

Paratype. AUSTRALIA: *Western Australia*: 1 ♂, same data as holotype (142989).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Zuytdorp, site ZU2 (IBRA_GES), 27°15'59.7"S, 114°01'82.2"E, wet pitfall trap, 26 August–15 October 1994, A. Sampey et al., WAM/CALM Carnarvon Survey (WAM T142990); 2 ♂, same data except dry pitfall trap, 14–19 October 1994 (WAM T142991); 2 ♂, same data except site ZU3, 27°15'49.9"S, 114°04'13.7"E, wet pitfall trap, 18 May–16 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T142992); 1 ♂, same data except 26 August–17 October 1994, A. Sampey et al., WAM/CALM Carnarvon Survey (WAM T142993).

Etymology.—This species is named in honor of Allan Burbridge, in recognition of his contributions to the Southern Carnarvon Basin Survey (Burbridge et al. 2000) and to the study of Australian biodiversity.

Diagnosis.—Males of *Bungulla burbridgei* can be distinguished from all other known congeners with > 10 retrolateral spinules on the palpal tibia (Fig. 13) – except *B. biota*, *B. dipsodes*, *B. keigheryi*, *B. kendricki*, *B. sampeyae* and *B. westi* – by the shape of the proximal half of the palpal tibia, which has a pronounced RTA-like ventral bulge in retrolateral view (Fig. 134) (palpal tibia is piriform and unmodified in other species). *Bungulla burbridgei* can be further distinguished from *B. biota*, *B. dipsodes*, *B. keigheryi*, *B. kendricki*, *B. sampeyae* and *B. westi* by the presence of a field of porrect, dagger-like spinules at the apex of the RTA-like bulge (Figs. 134, 135; cf. Figs. 108, 147, 280, 306, 406, 432). Females are unknown.

Description (male holotype).—Total length 12.1. Carapace 4.8 long, 4.1 wide. Abdomen 5.4 long, 3.4 wide. Carapace (Fig. 125) tan, with slightly darker pars cephalica, darker brown lyre-like pattern on pars cephalica and mostly black ocular region; fovea slightly procurved. Eye group (Fig. 128) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide, PLE–PLE/ALE–ALE ratio 1.3; ALE separated by their own diameter; AME separated by less than their own diameter; PME separated by 4.4 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 129); labium without cuspules. Abdomen (Fig. 126) oval, dark charcoal-brown in dorsal view, with beige-tan mottling, two large pairs of beige-tan sigilla spots, and three pairs of large, beige-tan chevron-like bands posteriorly. Dorsal surface of abdomen (Fig. 126) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 132, 133) variable shades of tan, with light scopulae on tarsi I–II; tibia I largely aspinose, without prolateral clasping spurs. Leg I: femur 4.4; patella 2.3; tibia 3.3; metatarsus 2.8; tarsus 2.1; total 14.9. Leg I femur–tarsus/carapace length ratio 3.1. Pedipalpal tibia (Figs. 134–136) 2.0

x longer than wide, with RTA-like ventral bulge proximally; field of retrolateral spinules crescent-shaped, positioned medially (on and adjacent to RTA-like bulge), consisting of ca. 30 spinules, the latter longest and with dagger-like morphology at apex of RTA-like bulge; RTA absent. Cymbium (Figs. 134–136) setose, with field of spine-like spinules covering most of dorsal surface. Embolus (Figs. 134–136) slightly longer than bulb, strongly curved, with slightly expanded tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla burbridgei* is a rare and highly restricted species known only from Zuytdorp, in the northern Geraldton Sandplains bioregion of south-western Australia (Fig. 137). Nothing is known of the biology of this species, other than that the known male specimens were collected wandering in search of females in winter, spring and possibly late autumn.

***Bungulla dipsodes* Rix, Raven & Harvey, sp. nov.**

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:A829DD35-85CF-4A23-A7A5-112DAF3413DD>

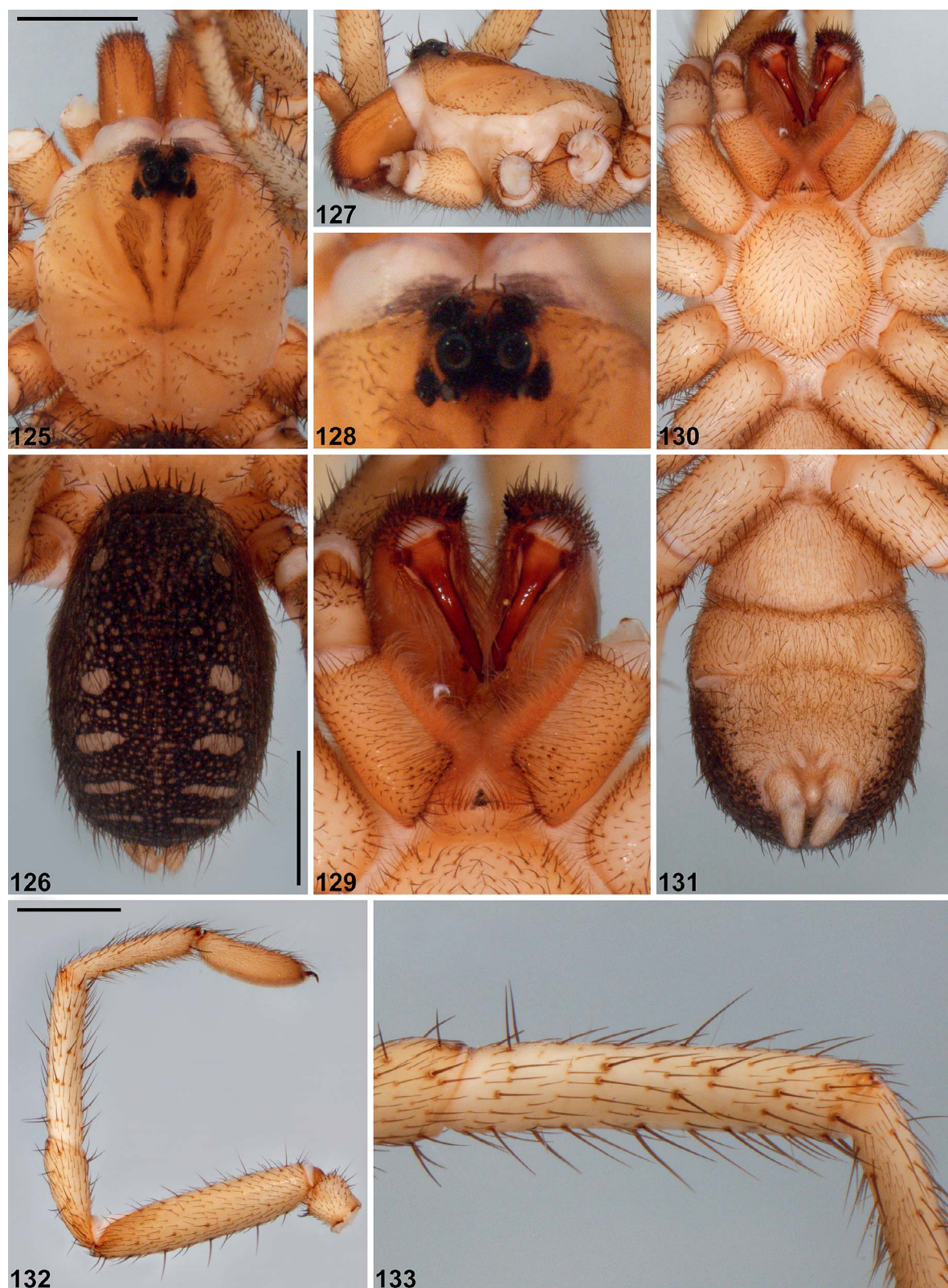
(Figs. 13, 138–150)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Meekatharra, ca. 130 km N., site 3 (IBRA_GAS), 25°35'29.83"S, 118°54'36.64"E, forage, bulk sample, 6–16 November 2009, M. Peterson (WAM T100061).

Etymology.—The specific epithet is derived from the Greek 'dipsodes' ('thirsty' or 'the thirsty ones'; see Brown 1956), in reference to the arid landscape in which this species lives.

Diagnosis.—Males of *Bungulla dipsodes* can be distinguished from all other known congeners with > 10 retrolateral spinules on the palpal tibia (Fig. 13) – except *B. biota*, *B. burbridgei*, *B. keigheryi*, *B. kendricki*, *B. sampeyae* and *B. westi* – by the shape of the proximal half of the palpal tibia, which has a pronounced RTA-like ventral bulge in retrolateral view (Fig. 147) (palpal tibia is piriform and unmodified in other species). *Bungulla dipsodes* can be further distinguished from *B. biota* by the shape of the embolus, which is without a truncate tip (Figs. 147, 148; cf. Fig. 108); from *B. burbridgei* by the absence of dagger-like spinules at the apex of the RTA-like bulge (Fig. 147; cf. Fig. 134); from *B. keigheryi* by the broadly-rounded shape of the RTA-like bulge (Fig. 147; cf. Fig. 280); from *B. sampeyae* by the coloration of the dorsal abdomen, which is bi-colored (i.e., pale tan in color with dark anterior markings and dark posterior chevrons) (Fig. 139; cf. Fig. 398 and Supplementary File 1); from *B. kendricki* by the shape of the palpal tibia, which is less strongly arched dorsally, with a relatively symmetrical, bulbous profile in retrolateral view (Fig. 147; cf. Fig. 306); and from *B. westi* by the absence of spinules on the disto-dorsal margin of the palpal tibia (Figs. 147–149; cf. Fig. 432). Females are unknown.

Description (male holotype).—Total length 9.5. Carapace 3.2 long, 2.4 wide. Abdomen 5.1 long, 2.7 wide. Carapace (Fig. 138) tan, with slightly darker pars cephalica, darker olive lyre-like pattern on pars cephalica and mostly black ocular region; fovea straight. Eye group (Fig. 141) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide, PLE–PLE/ALE–ALE ratio 1.3; ALE separated by nearly their own diameter; AME separated by less than their own diameter; PME separated by 2.3 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with



Figures 125–133.—*Bungulla burbidgei* sp. nov., male holotype (WAM T142988) from Zuytdorp (Western Australia; GES), somatic morphology: 125–126, carapace and abdomen, dorsal view; 127, cephalothorax, lateral view; 128, eyes, dorsal view; 129, mouthparts, ventral view; 130–131, cephalothorax and abdomen, ventral view; 132, leg I, prolateral view; 133, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 134–136.—*Bungulla burbridgei* sp. nov., male holotype (WAM T142988) from Zuytdorp (Western Australia; GES), pedipalp: 134, retrolateral view; 135, retro-ventral view; 136, prolateral view. Scale bar = 2.0 mm.

level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 142); labium without cuspules. Abdomen (Fig. 139) elongate-oval, pale beige-tan in dorsal view with contrasting pattern of four darker charcoal-grey markings anteriorly and five pairs of thin, spotted, dark charcoal-grey

chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 139) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 145, 146) variable shades of pale tan, with light scopulae on incrassate

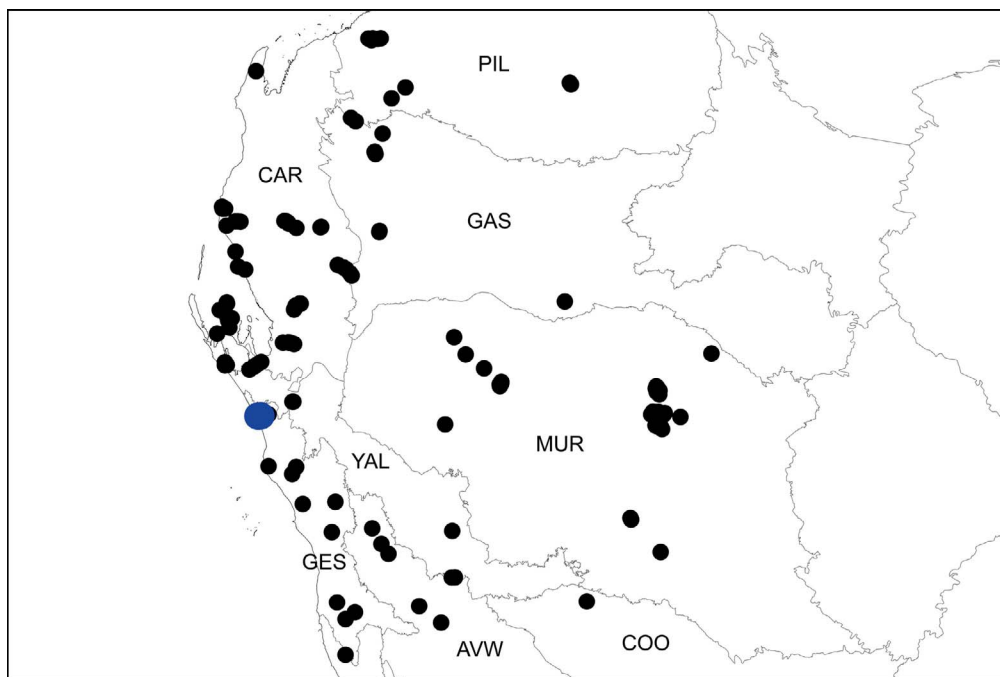
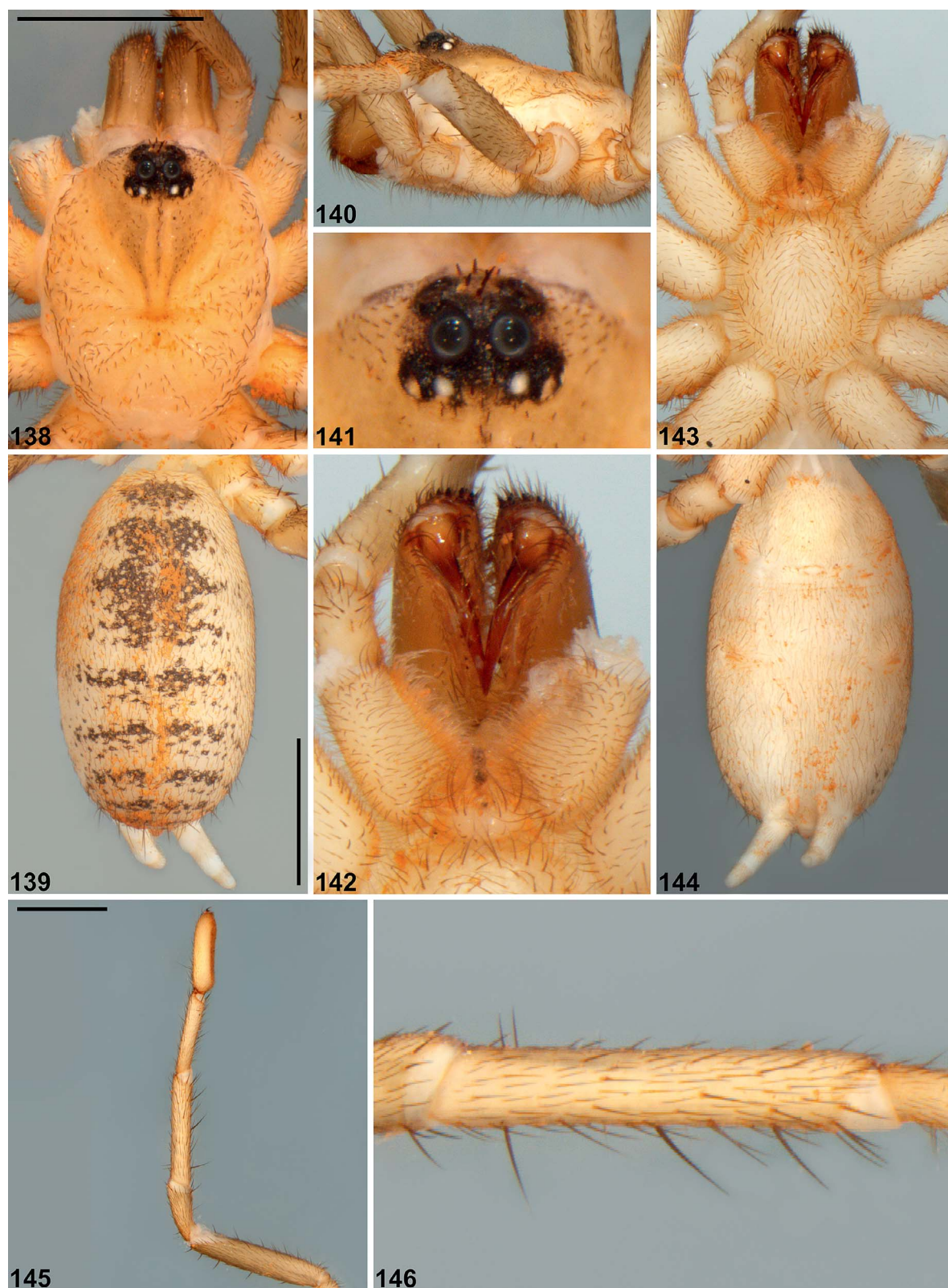


Figure 137.—Map showing collection records of *Bungulla burbridgei* sp. nov. (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.



Figures 138–146.—*Bungulla dipsodes* sp. nov., male holotype (WAM T100061) from ca. 130 km N. of Meekatharra (Western Australia; GAS), somatic morphology: 138–139, carapace and abdomen, dorsal view; 140, cephalothorax, lateral view; 141, eyes, dorsal view; 142, mouthparts, ventral view; 143–144, cephalothorax and abdomen, ventral view; 145, leg I, prolateral view; 146, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 147–149.—*Bungulla dipsodes* sp. nov., male holotype (WAM T100061) from ca. 130 km N. of Meekatharra (Western Australia; GAS), pedipalp: 147, retrolateral view; 148, retro-ventral view; 149, prolateral view. Scale bar = 2.0 mm.

tarsi I–II; tibia I largely aspinose, without prolateral clasp spurs. Leg I: femur 3.0; patella 1.5; tibia 2.3; metatarsus 1.9; tarsus 1.8; total 10.5. Leg I femur–tarsus/carapace length ratio 3.2. Pedipalpal tibia (Figs. 147–149) stout, bulbous, 1.6 x longer than wide, with rounded RTA-like ventral bulge

proximally; field of retrolateral spinules oval in shape, positioned medially (on and adjacent to RTA-like bulge), consisting of ca. 40 spinules, the latter longest at apex of RTA-like bulge; RTA absent. Cymbium (Figs. 147–149) setose, with field of porrect, thorn-like spinules covering most of dorsal

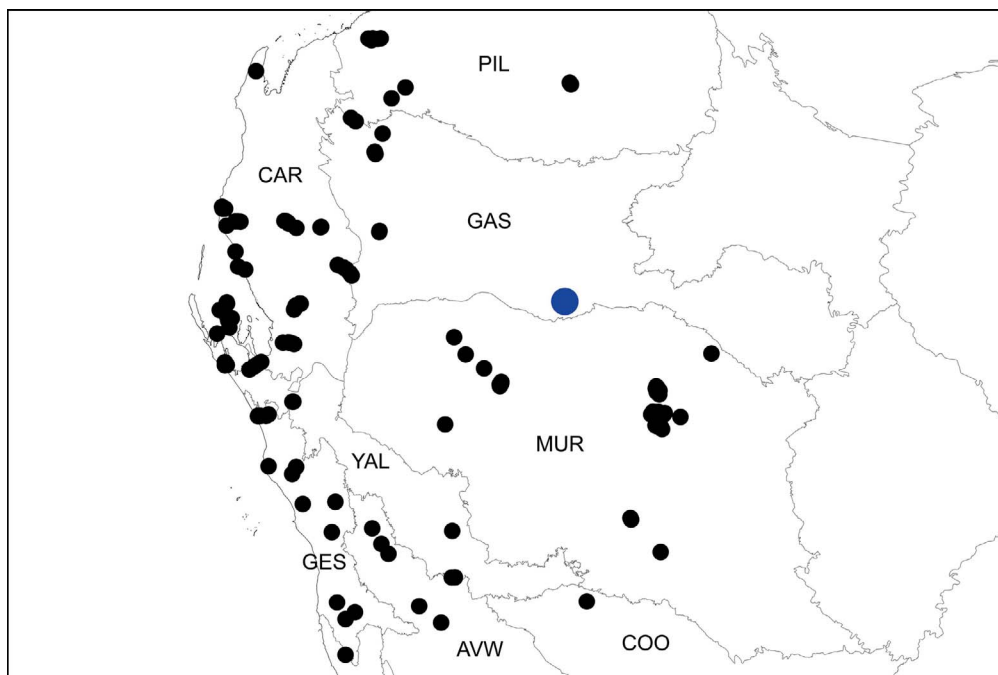


Figure 150.—Map showing collection records of *Bungulla dipsodes* sp. nov. (large blue circle), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.

surface. Embolus (Figs. 147–149) slightly longer than bulb, strongly curved, with slightly expanded tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla dipsodes* is known only from north of the Robinson Ranges, in the southern Gascoyne (Augustus) bioregion of Western Australia (Fig. 150). Nothing is known of the biology of this species, other than that the single known male specimen was collected wandering in search of females in late spring.

Bungulla disrupta Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:8DC29324-76A7-4E3C-8228-C63962534FED>
(Figs. 12, 14, 151–172)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Lake Magenta Nature Reserve (S. Central), south, site PI 13 (IBRA_MAL), 33°42'11"S, 118°58'59"E, wet pitfall traps, 15 October 1999–1 November 2000, P. Van Heurck, CALM Survey (WAM T142954).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Durokoppin Nature Reserve, Bencubbin-Kellerberrin Road, site KL 9 (IBRA_AVW), 31°24'37"S, 117°45'06"E, wet pitfall traps, 22 May–22 September 1998, N. Guthrie, CALM Survey (WAM T139539); 1 ♂, same data (WAM T139540); 1 ♂, Gillingarra (IBRA_JAF), 30°56'S, 116°03'E, 5 April 1956, B.Y. Main (WAM T142937); 1 ♂, Gura Road, north-east, NW. of Narrogin, site NR 10 (IBRA_JAF), 32°45'12"S, 116°56'43"E, wet pitfall traps, 30 October 1997–12 May 1998, E. Ladhams, CALM Survey (WAM T142959); 1 ♂, Hopkins Road, west, SE. of Kulin, site KN 2 (IBRA_MAL), 32°43'15"S, 118°16'59"E, wet pitfall traps, 15 May–22 September 1998, N. Guthrie, CALM Survey (WAM T142955); 1 ♂, Mackie Creek Reserve, west, site YO 2 (IBRA_AVW), 31°59'33"S, 117°01'28"E, wet pitfall traps, 30 October 1997–26 May 1998, P. Van Heurck, N. Guthrie, CALM Survey (WAM T142958); 1 ♂, 3 km W. of Nembudding (IBRA_AVW), 31°11'49"S, 117°32'51"E, wet pitfall traps, 30 March–29 June 1999, M.S. Harvey et al. (WAM T40108); 1 ♂, Wambyn Nature Reserve, site YO 10 (IBRA_JAF), 31°54'02"S, 116°38'22"E, wet pitfall traps, 15 October 1997–25 May 1998, N. Guthrie, CALM Survey (WAM T142956); 1 ♂, Wardering Spring Nature Reserve, site WK 12 (IBRA_AVW), 32°50'17"S, 117°21'31"E, wet pitfall traps, 30 October 1997–14 May 1998, N. Guthrie, CALM Survey (WAM T142960); 1 ♂, Warrigal Road, SW. of Beverley, site YO 8 (IBRA_JAF), 32°02'40"S, 116°33'56"E, wet pitfall traps, 30 October 1997–20 May 1998, P. Van Heurck, N. Guthrie, CALM Survey (WAM T142957); 1 ♀, Stirling Range National Park, Talyuberlup Picnic Area (IBRA_ESP), 34°24'49"S, 117°57'22"E, dug from burrow in bank of gully, 24 October 2012, M.S. Harvey, A. Beavis, M. Castalanelli, D. Harms (WAM T131634^{DNA_Voucher_274}; GenB-COI-MG516840, GenB-CYB-MG516842).

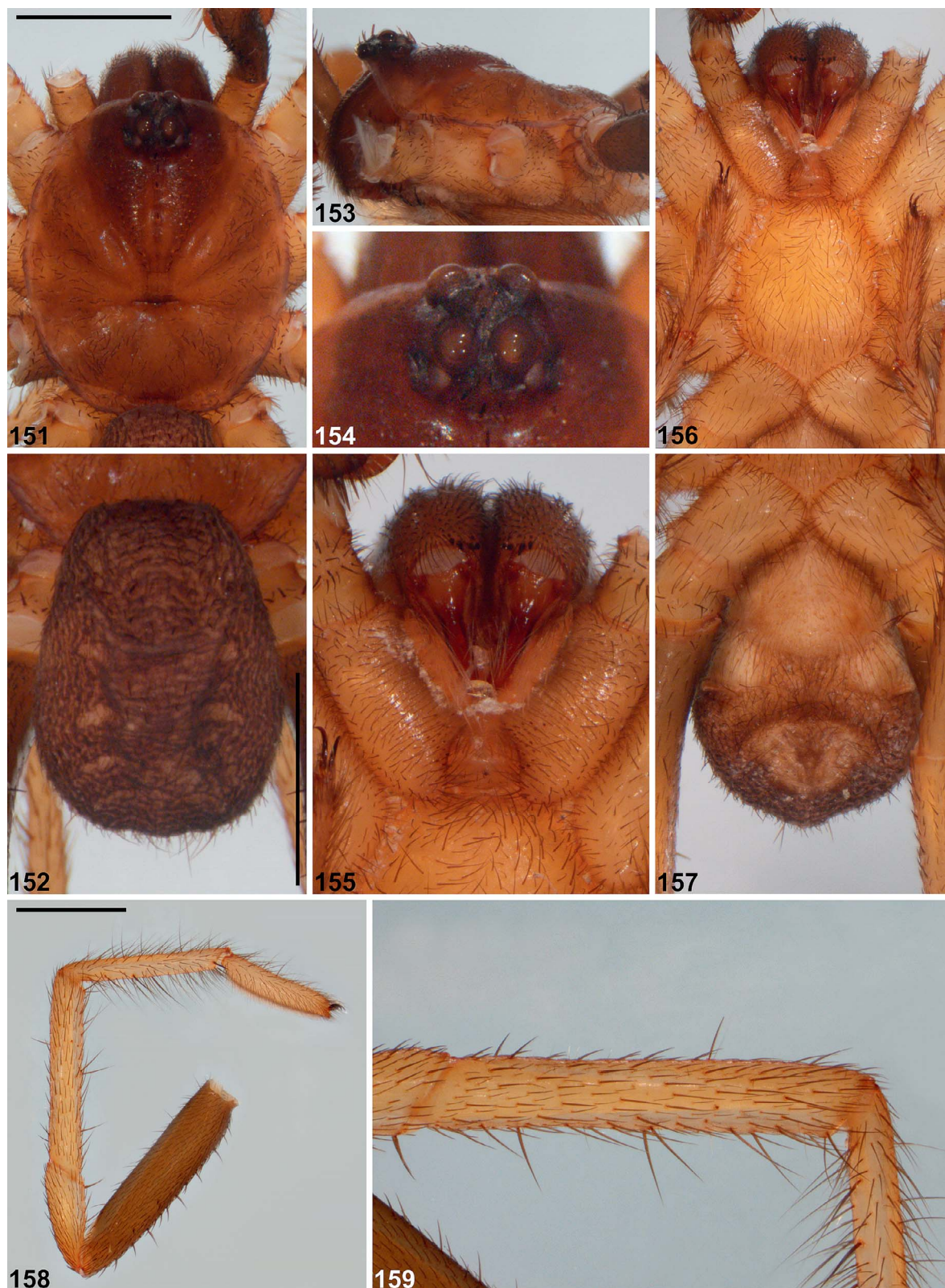
Etymology.—The specific epithet is derived from the Latin 'disruptus' (adjective: 'broken up' or 'separated'; see Brown 1956), in reference to the now highly fragmented distribution of this species in the heavily cleared Avon Wheatbelt and western Mallee bioregions.

Diagnosis.—Males of *Bungulla disrupta* can be distinguished from all other known congeners with < 5 retrolateral spinules

on the palpal tibia (Fig. 12) – except *B. fusca*, *B. hillyerae*, *B. inermis*, *B. oraria* and *B. parva* – by the shape of the cymbial spinules, which are curved, anteriorly-directed and restricted to the distal half of the cymbium (Figs. 160–162) (spinules are porrect, thorn-like, and cover most of the dorsal surface of the cymbium in other species). *Bungulla disrupta* can be further distinguished from *B. parva* by its larger body size (carapace width ≥ 3.0) (Fig. 151; cf. Fig. 349); from *B. hillyerae* and *B. inermis* by the darker carapace coloration (depending on the state of preservation; see Supplementary File 1) (Fig. 151; cf. Figs. 232, 245); and from *B. fusca* and *B. oraria* by the color of the legs, which are bi-colored with pale patellae, tibiae, metatarsi and tarsi (Fig. 158; cf. Figs. 193, 343), combined with the color of the dorsal abdomen, which has an ornate pattern of broad pale chevrons (Fig. 152; cf. Figs. 187, 337 and Supplementary File 1).

Description (male holotype).—Total length 8.0. Carapace 4.2 long, 3.5 wide. Abdomen 3.2 long, 2.4 wide. Carapace (Fig. 151) chocolate-brown, with darker pars cephalica and black ocular region; fovea straight. Eye group (Fig. 154) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide, PLE–PLE/ALE–ALE ratio 1.5; ALE separated by nearly their own diameter; AME separated by less than their own diameter; PME separated by 3.4 x their own diameter; PME and PLE separated by slightly less than diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 155); labium without cuspules. Abdomen (Fig. 152) oval, dark brown in dorsal view with tan mottling, two pairs of tan sigilla spots and three pairs of tan chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 152) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 158, 159) variable shades of tan on patellae–tarsi, with darker brown femora and light scopolae on tarsi I–II; tibia I largely aspinose, without prolateral claspings spurs. Leg I: femur 4.1; patella 2.1; tibia 3.5; metatarsus 3.1; tarsus 2.1; total 14.9. Leg I femur–tarsus/carapace length ratio 3.5. Pedipalpal tibia (Figs. 160–162) sub-rectangular, 2.2 x longer than wide, without retrolateral spinules; RTA absent. Cymbium (Figs. 160–162) setose, with field of curved, anteriorly-directed spine-like spinules restricted to distal half of segment. Embolus (Figs. 160–162) nearly twice length of bulb, slightly curved, with unmodified tip; embolic apophysis absent.

Description (female WAM T131634).—Total length 17.3. Carapace 6.1 long, 5.6 wide. Abdomen 8.7 long, 6.7 wide. Carapace (Fig. 163) slightly damaged, light chocolate-brown with slightly darker ocular region; fovea strongly procurved. Eye group (Fig. 166) trapezoidal (anterior eye row strongly procurved), 0.7 x as long as wide, PLE–PLE/ALE–ALE ratio 1.7; ALE separated by their own diameter; AME separated by their own diameter; PME separated by 3.3 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 167); labium without cuspules. Abdomen (Fig. 164) oval, dark grey-brown in dorsal view with beige mottling, darker cardiac marking, two pairs of beige sigilla spots, and four pairs of beige chevrons posteriorly, each divided along midline; sclerotized sigilla absent. Legs (Figs. 169, 170) variable shades of tan; thick



Figures 151–159.—*Bungulla disrupta* sp. nov., male holotype (WAM T142954) from Lake Magenta Nature Reserve (Western Australia; MAL), somatic morphology: 151–152, carapace and abdomen, dorsal view; 153, cephalothorax, lateral view; 154, eyes, dorsal view; 155, mouthparts, ventral view; 156–157, cephalothorax and abdomen, ventral view; 158, leg I, prolateral view; 159, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 160–162.—*Bungulla disrupta* sp. nov., male holotype (WAM T142954) from Lake Magenta Nature Reserve (Western Australia; MAL), pedipalp: 160, retrolateral view; 161, retro-ventral view; 162, prolateral view. Scale bar = 2.0 mm.

scopulae present on tarsi and metatarsi I–II; tibia I with distal cluster of 4 stout prolateral macrosetae and 2 retro-ventral spine-like macrosetae; metatarsus I with 2 stout pro-ventral macrosetae and 4 longer retro-ventral macrosetae; tarsus I with distal cluster of 4 stout ventral macrosetae. Leg I: femur 3.6; patella 2.4; tibia 2.1; metatarsus 1.7; tarsus 1.4; total 11.3. Leg I femur–tarsus/carapace length ratio 1.8. Pedipalp tan, spinose on tibia and tarsus, with thick tarsal scopula. Genitalia (Fig. 171) with pair of obliquely-angled, handle-shaped spermathecae.

Distribution and remarks.—*Bungulla disrupta* has a moderately widespread but now highly fragmented distribution in the Avon Wheatbelt, western Mallee and eastern Jarrah Forest bioregions of south-western Australia, from Gillingarra and near Nembudding in the north, south to at least Lake Magenta (Fig. 172). A single female specimen from the Stirling Range National Park (Figs. 163–171), described above, is also tentatively assigned to this species, based on its abdominal coloration and distribution. Genetic data reveal that *B. disrupta* is likely closely related to *B. gibba*, together forming a deeply-divergent clade sister to all other *Bungulla* (Fig. 14). This relationship is further evidenced by the unusual morphology of the spermathecae (Fig. 171; cf. Fig. 207). Little is known of the biology of this species, other than that the known male specimens were collected wandering in search of females in autumn, winter and possibly early spring. The single, tentatively-assigned female specimen was unwittingly collected from the clay bank of a deep gully, while excavating a burrow of another mygalomorph.

Bungulla ferraria Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:7E7F242B->

EF64-4967-92F2-A84D7CEB2DAC
(Figs. 12, 173–185)

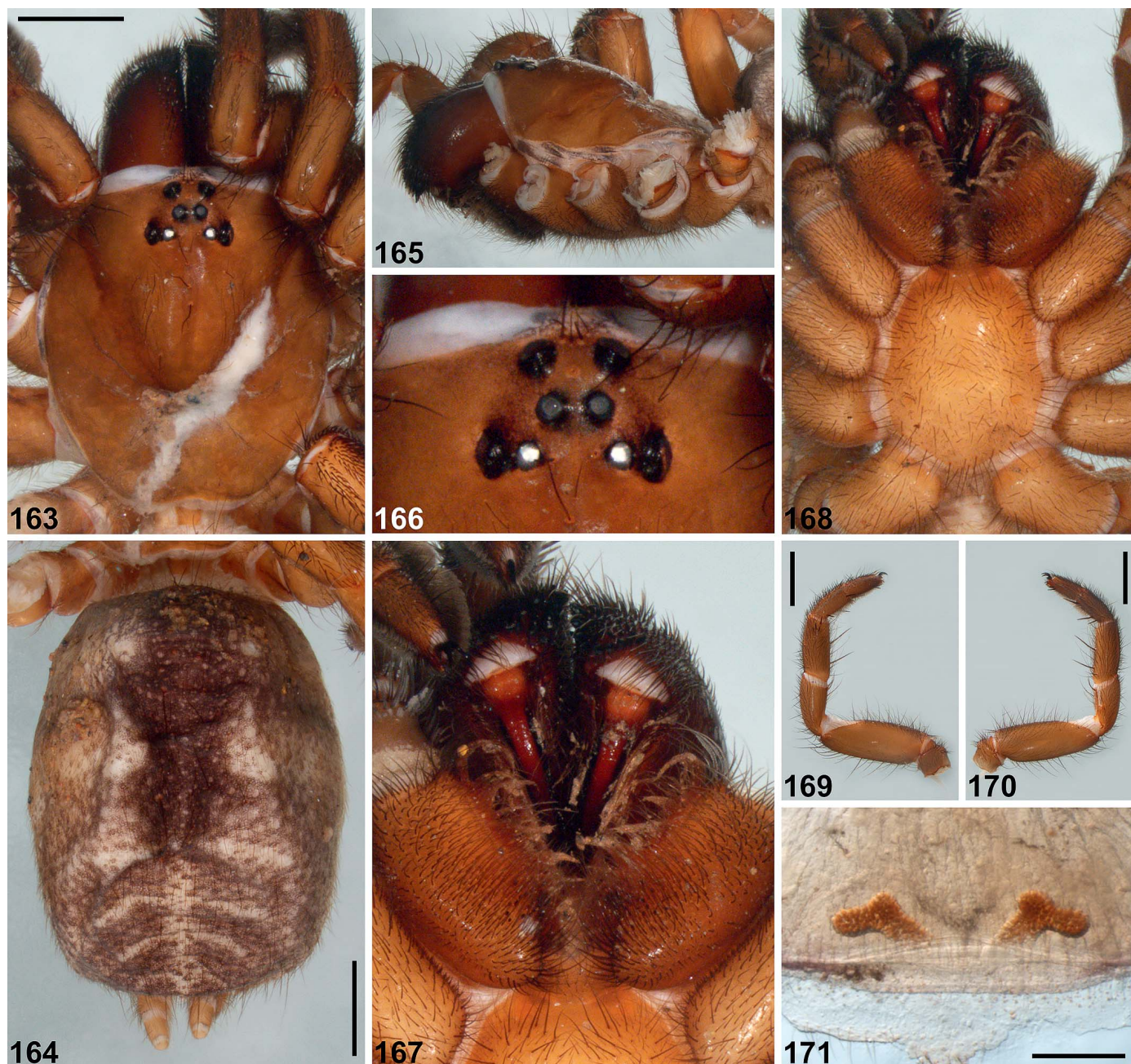
Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Mount Gibson iron-ore mine, woodlands 1 (A), impact site (IBRA_AVW), 29°34′09″S, 117°10′36″E, wet pitfall trap, 30 April–11 May 2005, S. Thompson (WAM T72319).

Paratype. AUSTRALIA: *Western Australia*: 1 ♂, same data as holotype except Ironstone Slope, Mount Gibson, west facing, 29°35′36″S, 117°10′55″E, 31 May–11 June 2005 (WAM T72325).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Mount Gibson Station, site 9 (IBRA_YAL), 29°41′13″S, 117°21′37″E, dry pitfall trap, 20–31 August 2001 (WAM T46011); 1 ♂, Mount Gibson Station, 93 km NE. of Wubin (IBRA_AVW), 29°48′02″S, 117°20′34″E, pitfall trap, 21–29 August 2001, K. Ottewell & R. Leys (SAM NN19643); 1 ♂, Regional Geraldton and Buller River, Ecologia Project 1102 (IBRA_GES), 28°38′36.61″S, 114°37′15.70″E, litter/soil sift, 10–14 July 2009, L. Roque-Albelo & S. White (WAM T97847); 1 ♂, Mount Jackson, site MJR5 (IBRA_COO), 30°15′S, 119°16′E, hand collected, 1 September 1979, R.A. How (WAM T16219).

Etymology.—The specific epithet is derived from the Latin ‘ferrarius’ (adjective: ‘pertaining to iron’; see Brown 1956), in reference to the type locality of this species at the Mount Gibson iron-ore mine.

Diagnosis.—Males of *Bungulla ferraria* can be distinguished from all other known congeners with < 5 retrolateral spinules on the palpal tibia (Fig. 12) – except *B. bringo* and *B. riparia* – by the shape of the cymbial spinules, which are porrect, thorn-



Figures 163–171.—*Bungulla disrupta* sp. nov., tentatively assigned female (WAM T131634) from Stirling Range National Park, Talyuberlup Picnic Area (Western Australia; ESP): 163–164, carapace and abdomen, dorsal view; 165, cephalothorax, lateral view; 166, eyes, dorsal view; 167, mouthparts, ventral view; 168, cephalothorax, ventral view; 169, leg I, prolateral view; 170, leg I, retrolateral view; 171, spermathecae, dorsal view. Scale bars = 2.0 mm (163–164, 169–170), 0.5 mm (171).

like, and cover most of the dorsal surface of the cymbium (Figs. 182–184) (spinules more curved, anteriorly-directed and restricted to distal half of cymbium in other species). *Bungulla ferraria* can be further distinguished from *B. bringo* by the absence of retrolateral spinules on the palpal tibia (Fig. 182; cf. Figs. 121, 122); and from *B. riparia* by the presence of only 1–3 prolateral (medial) spine-like setae on tibia I (Fig. 181; cf. Fig. 392), combined with the shape of the palpal tibia, which is relatively tapered distally, with a strongly concave disto-

ventral margin in retrolateral view (Fig. 182; cf. Fig. 393). Females are unknown.

Description (male holotype).—Total length 10.6. Carapace 4.3 long, 3.3 wide. Abdomen 4.7 long, 2.9 wide. Carapace (Fig. 173) tan, with slightly darker pars cephalica and slightly darker ocular region; postero-lateral corners near abdomen each with marginal cluster of longer black setae; fovea straight. Eye group (Fig. 176) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide, PLE–PLE/ALE–ALE ratio 1.6; ALE separated by their own diameter; AME

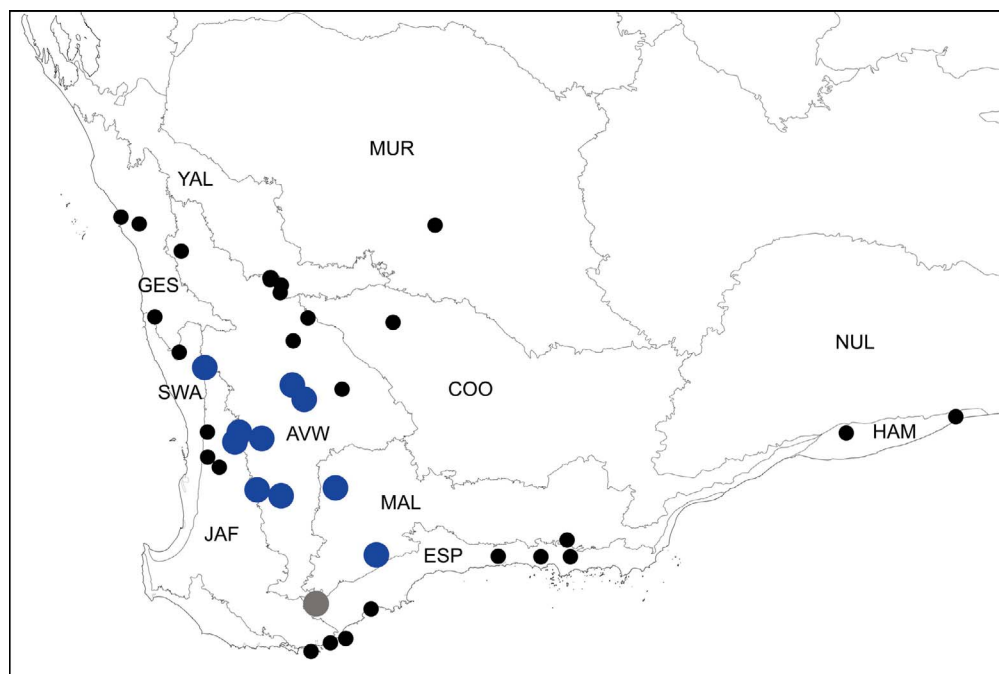


Figure 172.—Map showing collection records of *Bungulla disrupta* sp. nov. (large blue circles), relative to other taxa with < 5 retrolateral spinules on the male palpal tibia (see Fig. 12). The grey circle represents a tentatively assigned female specimen. Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; COO, Coolgardie; ESP, Esperance Plains; GES, Geraldton Sandplains; HAM, Hampton; JAF, Jarrah Forest; MAL, Mallee; MUR, Murchison; NUL, Nullarbor; SWA, Swan Coastal Plain; YAL, Yalgoo.

separated by less than their own diameter; PME separated by 3.1 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 177); labium without cuspules. Abdomen (Fig. 174) oval, dark grey in dorsal view with faint beige-tan mottling. Dorsal surface of abdomen (Fig. 174) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 180, 181) variable shades of tan, with light scopulae on tarsi I–II; tibia I spinose, without prolateral clasp spurs. Leg I: femur 4.7; patella 2.3; tibia 3.7; metatarsus 3.2; tarsus 2.4; total 16.3. Leg I femur–tarsus/carapace length ratio 3.8. Pedipalpal tibia (Figs. 182–184) 2.0 x longer than wide, without retrolateral spinules; RTA absent. Cymbium (Figs. 182–184) setose, with field of porrect, thorn-like spinules covering most of dorsal surface. Embolus (Figs. 182–184) as long as bulb, slightly curved, with unmodified tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla ferraria* (formerly known by WAM identification code ‘MYG149’) has a disjunct distribution in the Avon Wheatbelt and Geraldton Sandplains bioregions of Western Australia, at Mount Gibson (near Lake Moore) and in the vicinity of Geraldton (Fig. 185). A single male specimen from Mount Jackson, in the northern Coolgardie bioregion, is also tentatively assigned to this species on the basis of its pedipalp and leg I morphology, however it is somewhat smaller than other specimens of *B. ferraria*, and the specimen is severely faded (see Supplementary File 1). Nothing is known of the biology of this species, other than that the known male specimens were collected wandering in search of females in late autumn and winter.

***Bungulla fusca* Rix, Raven & Harvey, sp. nov.**

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:27AA3A3D-0D19-4B7A-891A-5C6AA90EF13E>

(Figs. 12, 186–198)

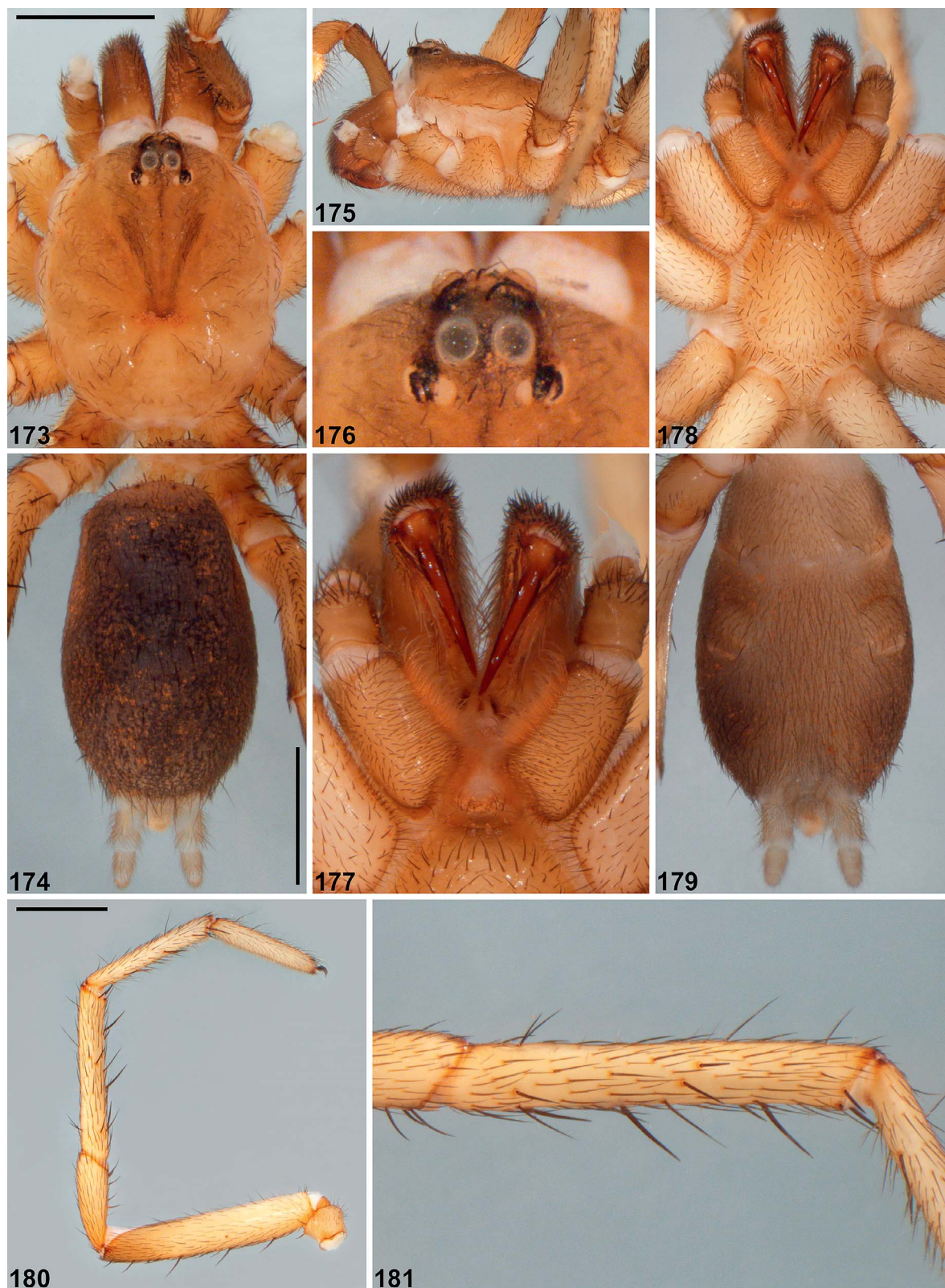
Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Junction of Neds Corner & Yerritup Roads, site GP 13 (IBRA_ESP), 33°43′21″S, 121°03′56″E, wet pitfall traps, 15 October 1999–26 November 2000, B. Durrant, CALM Survey (WAM T142947).

Paratype: 1 ♂, same data as holotype (WAM T142948).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Backmans Road, nr Burdett Road junction, SE. of Mount Burdett, site ES 9 (IBRA_MAL), 33°29′05″S, 122°14′27″E, wet pitfall traps, 15 October 1999–1 November 2000, P. Van Heurck, CALM Survey (WAM T142946); 1 ♂, Brockway Road, Helms Arboretum Reserve, site ES 2 (IBRA_ESP), 33°43′42″S, 121°47′50″E, wet pitfall traps, 15 October 1999–1 November 2000, P. Van Heurck, CALM Survey (WAM T142949); 1 ♂, Coolinup Nature Reserve, east, site ES 11 (IBRA_ESP), 33°43′53″S, 122°17′50″E, wet pitfall traps, 15 October 1999–29 November 2000, P. Van Heurck, CALM Survey (WAM T142950).

Etymology.—The specific epithet is derived from the Latin ‘fuscus’ (adjective: ‘dark’, ‘swarthy’ or ‘dusky’; see Brown 1956), in reference to the dark brown body coloration of this species.

Diagnosis.—Males of *Bungulla fusca* can be distinguished from all other known congeners with < 5 retrolateral spinules on the palpal tibia (Fig. 12) – except *B. disrupta*, *B. hillyerae*, *B. inermis*, *B. oraria* and *B. parva* – by the shape of the cymbial



Figures 173–181.—*Bungulla ferraria* sp. nov., male holotype (WAM T72319) from Mount Gibson iron-ore mine (Western Australia; AVW), somatic morphology: 173–174, carapace and abdomen, dorsal view; 175, cephalothorax, lateral view; 176, eyes, dorsal view; 177, mouthparts, ventral view; 178–179, cephalothorax and abdomen, ventral view; 180, leg I, prolateral view; 181, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 182–184.—*Bungulla ferraria* sp. nov., male holotype (WAM T72319) from Mount Gibson iron-ore mine (Western Australia; AVW), pedipalp: 182, retrolateral view; 183, retro-ventral view; 184, prolateral view. Scale bar = 2.0 mm.

spinules, which are curved, anteriorly-directed and restricted to the distal half of the cymbium (Figs. 195–197) (spinules are correct, thorn-like, and cover most of the dorsal surface of the cymbium in other species). *Bungulla fusca* can be further

distinguished from *B. parva* by its larger body size (carapace width ≥ 4.5) (Fig. 186; cf. Fig. 349); from *B. hillyerae* and *B. inermis* by the darker carapace coloration (depending on the state of preservation; see Supplementary File 1) (Fig. 186; cf.

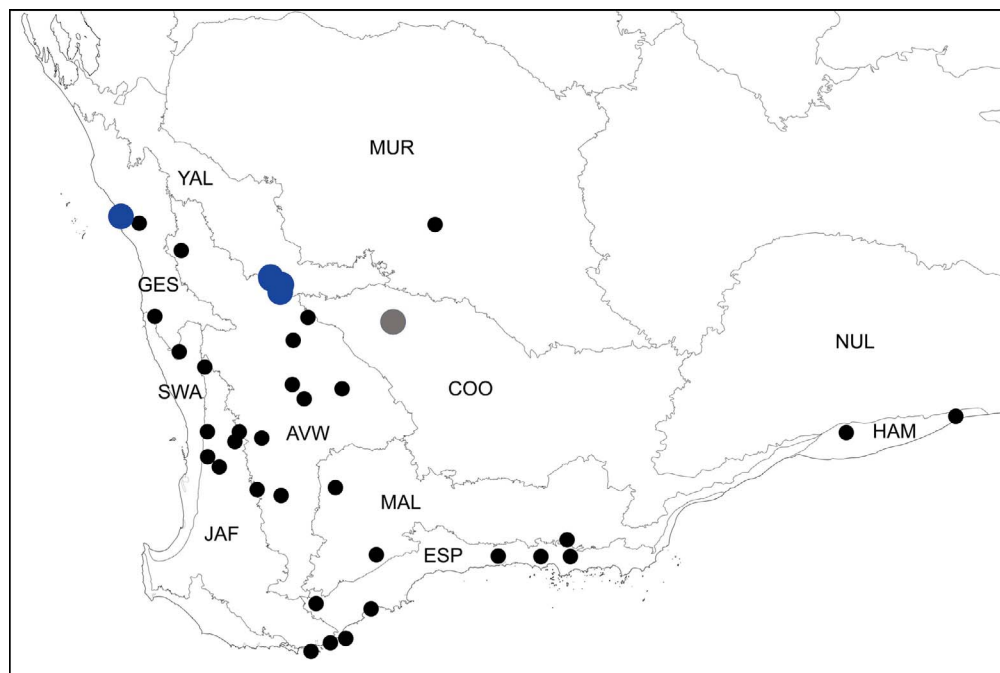
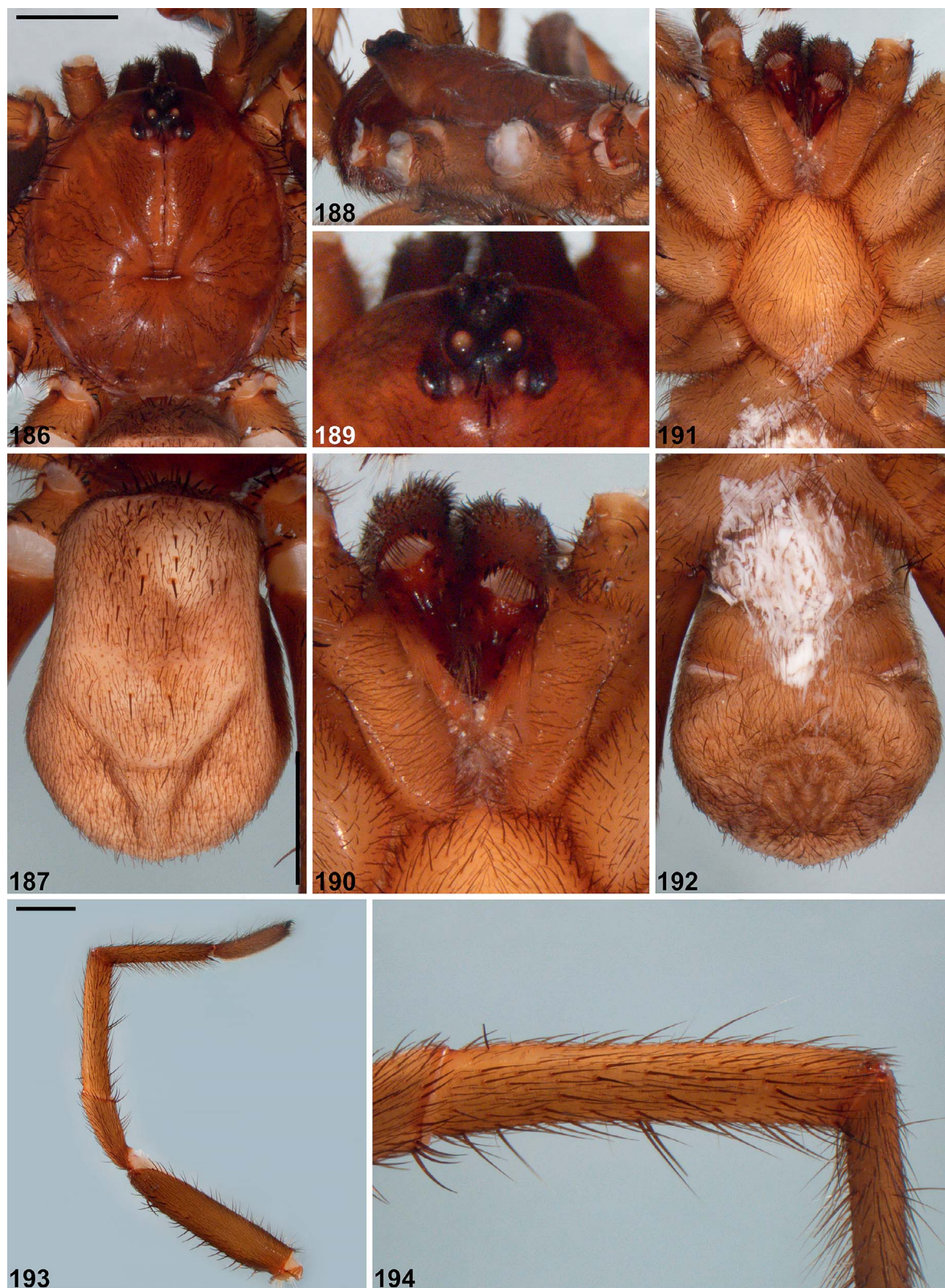


Figure 185.—Map showing collection records of *Bungulla ferraria* sp. nov. (large blue circles), relative to other taxa with < 5 retrolateral spinules on the male palpal tibia (see Fig. 12). The grey circle represents a tentatively assigned male specimen. Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; COO, Coolgardie; ESP, Esperance Plains; GES, Geraldton Sandplains; HAM, Hampton; JAF, Jarrah Forest; MAL, Mallee; MUR, Murchison; NUL, Nullarbor; SWA, Swan Coastal Plain; YAL, Yalgoo.



Figures 186–194.—*Bungulla fusca* sp. nov., male holotype (WAM T142947) from junction of Neds Corner and Yerritup Roads (Western Australia; ESP), somatic morphology: 186–187, carapace and abdomen, dorsal view; 188, cephalothorax, lateral view; 189, eyes, dorsal view; 190, mouthparts, ventral view; 191–192, cephalothorax and abdomen, ventral view; 193, leg I, prolateral view; 194, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 195–197.—*Bungulla fusca* sp. nov., male holotype (WAM T142947) from junction of Neds Corner and Yerritup Roads (Western Australia; ESP), pedipalp: 195, retrolateral view; 196, retro-ventral view; 197, prolateral view. Scale bar = 2.0 mm.

Figs. 232, 245); from *B. disrupta* by the presence of smaller, thinner chevrons on the dorsal abdomen (Fig. 187; cf. Fig. 152), combined with the presence of more uniformly-colored (i.e., not bi-colored) legs (Fig. 193; cf. Fig. 158); and from *B.*

oraria by the shape of the palpal tibia, which is more bulbous in retrolateral view, with a less strongly concave disto-ventral margin (Fig. 195; cf. Fig. 345). Females are unknown.

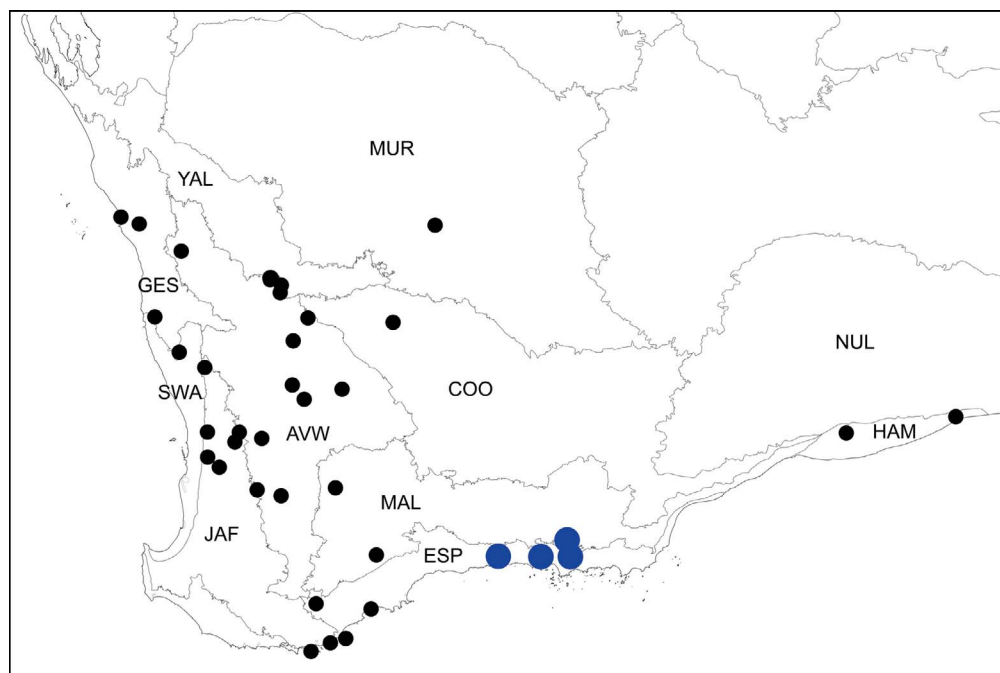


Figure 198.—Map showing collection records of *Bungulla fusca* sp. nov. (large blue circles), relative to other taxa with < 5 retrolateral spinules on the male palpal tibia (see Fig. 12). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; COO, Coolgardie; ESP, Esperance Plains; GES, Geraldton Sandplains; HAM, Hampton; JAF, Jarrah Forest; MAL, Mallee; MUR, Murchison; NUL, Nullarbor; SWA, Swan Coastal Plain; YAL, Yalgoo.

Description (male holotype).—Total length 12.5. Carapace 6.2 long, 5.1 wide. Abdomen 5.7 long, 4.0 wide. Carapace (Fig. 186) dark chocolate-brown with black ocular region; fovea straight. Eye group (Fig. 189) trapezoidal (anterior eye row strongly procurved), 0.9 x as long as wide, PLE–PLE/ALE–ALE ratio 2.0; ALE separated by ca. half their own diameter; AME separated by less than their own diameter; PME separated by 3.4 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with level of PLE. Maxillae slightly shrivelled, cuspules (if present) obscured (Fig. 190); labium without cuspules. Abdomen (Fig. 187) oval, beige-tan in dorsal view. Dorsal surface of abdomen (Fig. 187) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 193, 194) variable shades of tan, with light scopulae on tarsi I–II; tibia I largely aspinose, without prolateral claspings spurs. Leg I: femur 6.2; patella 3.1; tibia 4.8; metatarsus 4.1; tarsus 2.5; total 20.8. Leg I femur–tarsus/carapace length ratio 3.4. Pedipalpal tibia (Figs. 195–197) 2.0 x longer than wide, without retrolateral spinules; RTA absent. Cymbium (Figs. 195–197) setose, with field of curved, anteriorly-directed spine-like spinules restricted to distal half of segment. Embolus (Figs. 195–197) nearly twice length of bulb, slightly curved, with unmodified tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla fusca* has a relatively restricted distribution in the Esperance Plains (Recherche) and south-eastern Mallee bioregions of southern Western Australia, from near Munglinup in the west, east to Coolinup Nature Reserve (Fig. 198). Nothing is known of the biology of this species.

Bungulla gibba Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:E98CF431-C9F1-448C-8FAC-1E328A576796>
(Figs. 7–9, 14, 199–208)

Type material.—*Holotype female*. AUSTRALIA: *Western Australia*: Two Peoples Bay Nature Reserve, Little Beach, gully, site 15 (IBRA_JAF), 34°58'32"S, 118°12'00"E, hand collected in burrow, 30 November 2006, M.L. Moir & K.E.C. Brennan (WAM T78551^{DNA_Voucher_95}; GenB–COI–KY295287, GenB–CYB–KY295408, GenB–MRPL45–KY295531, GenB–RPF2–KY295652, GenB–XPNPEP3–KY295780, GenB–ITS–KY295033).

Paratypes. AUSTRALIA: *Western Australia*: 1 ♀, same data as holotype (WAM T78554); 1 ♀, same data (WAM T78553); 1 ♀, same data as holotype except 11 April 2017, M.G. Rix, M.S. Harvey, J.G. Cosgrove (WAM T143010).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♀, Bald Island (IBRA_ESP), 34°54'52"S, 118°27'37"E, edge of petrel burrow, 16 October 2003, S. Comer (WAM T58764); 1 juvenile, Mount Groper, in gully, site 5 (IBRA_ESP), 34°29'32"S, 118°53'30"E, hand collected in burrow, 25 October 2006, M.L. Moir & K.E.C. Brennan (WAM T78516^{DNA_Voucher_282}; GenB–COI–MG516839, GenB–CYB–MG516841, GenB–RPF2–MG516887, GenB–XPNPEP3–MG516892, GenB–ITS–MG516864).

Etymology.—The specific epithet is derived from the Latin 'gibbus' (adjective: 'humped', 'hump-backed' or 'protuberant';

see Brown 1956), in reference to the bulging, protuberant morphology of the fovea of this species.

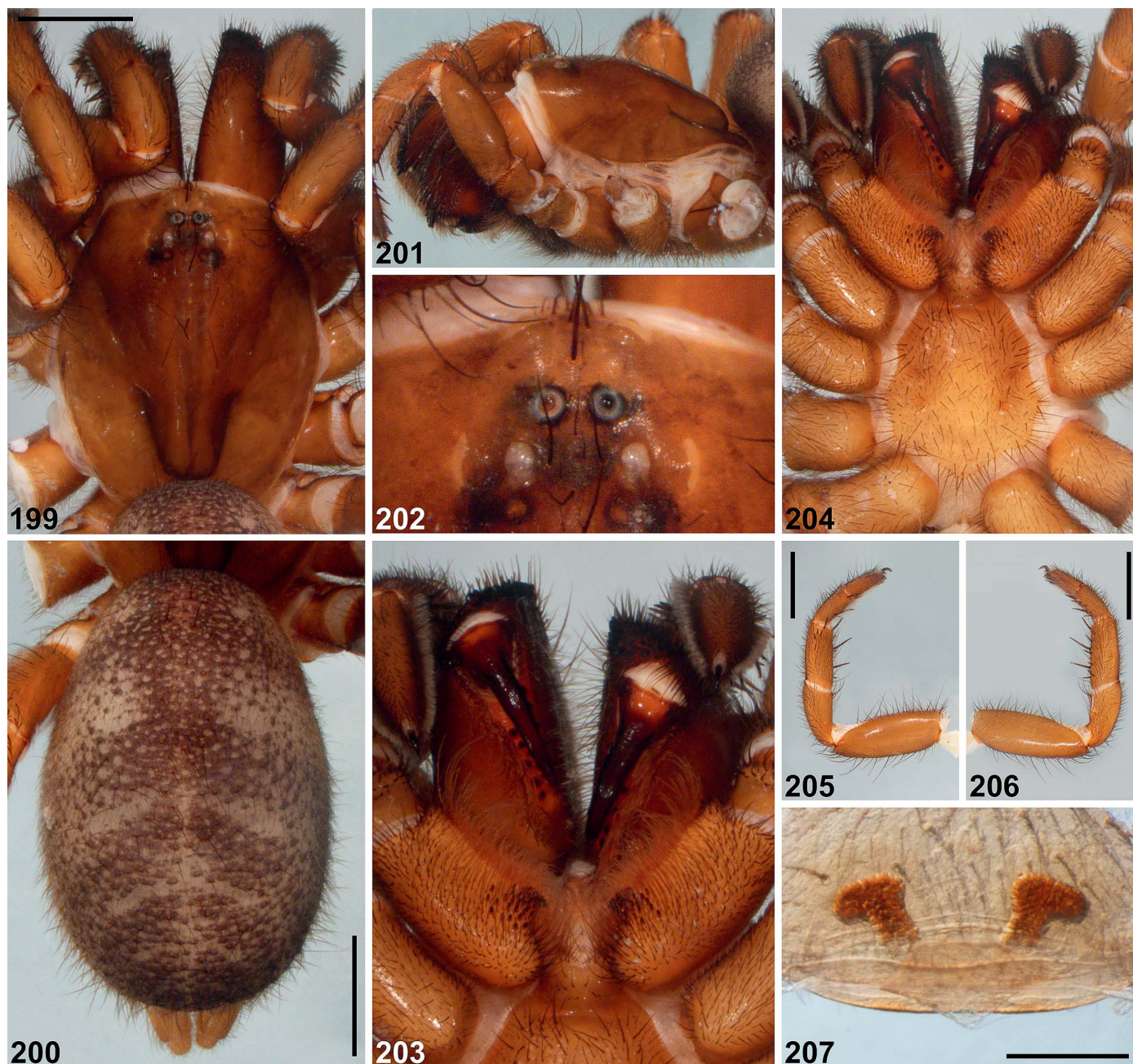
Diagnosis.—*Bungulla gibba* is known from only six female specimens, for which sequence data are available (Fig. 14). It can be distinguished from the other two species known only from females – *B. bella* and *B. harrisonae* (and all other known species of *Bungulla*) – by the strongly efoveate carapace morphology (Figs. 7, 199, 201; cf. Figs. 76, 222).

Description (female holotype).—Total length 15.6. Carapace 5.6 long, 4.5 wide. Abdomen 7.4 long, 4.8 wide. Carapace (Fig. 199) chocolate-brown with slightly darker ocular region; fovea strongly everted into adpressed horn-like protrusion (Fig. 201). Eye group (Fig. 202) trapezoidal (anterior eye row strongly procurved), 0.7 x as long as wide, PLE–PLE/ALE–ALE ratio 1.7; ALE separated by their own diameter; AME separated by their own diameter; PME separated by 2.8 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 203); labium without cuspules. Abdomen (Fig. 200) oval, dark grey-brown in dorsal view with beige-grey mottling, two pairs of beige-grey sigilla spots, and three pairs of beige-grey chevrons posteriorly, each divided along midline; sclerotized sigilla absent. Legs (Figs. 205, 206) variable shades of tan; thick scopulae present on tarsi and metatarsi I–II; tibia I with distal cluster of 5 stout prolateral macrosetae, 3 retro-ventral spine-like macrosetae and 6 shorter retro-ventral macrosetae; metatarsus I with 2 stout pro-ventral macrosetae and 7 mostly longer retro-ventral macrosetae; tarsus I with distal cluster of 3 stout ventral macrosetae. Leg I: femur 3.2; patella 2.2; tibia 1.8 metatarsus 1.4; tarsus 1.2; total 9.8. Leg I femur–tarsus/carapace length ratio 1.8. Pedipalp tan, spinose on tibia and tarsus, with thick tarsal scopula. Genitalia (Fig. 207) with pair of obliquely-angled, handle-shaped spermathecae.

Distribution and remarks.—*Bungulla gibba* is known from only three locations along the southern coastline of Western Australia, at Little Beach (Two Peoples Bay Nature Reserve), Bald Island and Mount Groper (Fig. 208). Genetic data reveal that *B. gibba* is likely closely related to *B. disrupta*, together forming a deeply-divergent clade sister to all other *Bungulla* (Fig. 14). This relationship is further evidenced by the unusual morphology of the spermathecae (Fig. 207; cf. Fig. 171). A female with an egg sac was collected in late November, and at Little Beach burrows are built in the sandy banks of a coastal gully, with a burrow entrance morphology similar to that of *B. harrisonae* (Figs. 8, 9; cf. Figs. 5, 6). All sites at which *B. gibba* has been found are within 1 km of the Southern Ocean coastline, suggesting that the preferred habitat may be coastal, sandy gullies. It is unknown why this species has evolved an 'efoveate' carapace morphology, although analogous modifications are found in species of *Eucyrtops* and *Idiosoma*, including an undescribed *Eucyrtops* species closely sympatric or parapatric with *B. gibba* at Two Peoples Bay Nature Reserve and Bald Island.

Bungulla hamelinensis Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:35057156>



Figures 199–207.—*Bungulla gibba* sp. nov., female holotype (WAM T78551) from Two Peoples Bay Nature Reserve, Little Beach (Western Australia; JAF): 199–200, carapace and abdomen, dorsal view; 201, cephalothorax, lateral view; 202, eyes, dorsal view; 203, mouthparts, ventral view; 204, cephalothorax, ventral view; 205, leg I, prolateral view; 206, leg I, retrolateral view; 207, spermathecae, dorsal view. Scale bars = 2.0 mm (199–200, 205–206), 0.5 mm (207).

2279-4AD1-8659-495F74E302D2
(Figs. 13, 209–221)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Nanga Station, site NA1 (IBRA_CAR), 26°28'40.2"S, 114°04'33.6"E, wet pitfall trap, 11 May–30 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98562).

Paratypes. AUSTRALIA: *Western Australia*: 4 ♂, same data (WAM T98563).

Etymology.—The specific epithet is a reference to the type locality of this species, near Hamelin Pool (Western Australia).

Diagnosis.—Males of *Bungulla hamelinensis* can be distinguished from all other known congeners with > 10 retrolateral spinules on the palpal tibia (Fig. 13) – except *B. banksia*, *B. bertmaini*, *B. bidgeamia*, *B. iota*, *B. laevigata*, *B. quobba*, *B. weld* and *B. yeni* – by the shape of the proximal half of the palpal tibia, which is without a pronounced ventral bulge (Fig. 218), combined with the absence of a medial 'ledge' on the palpal

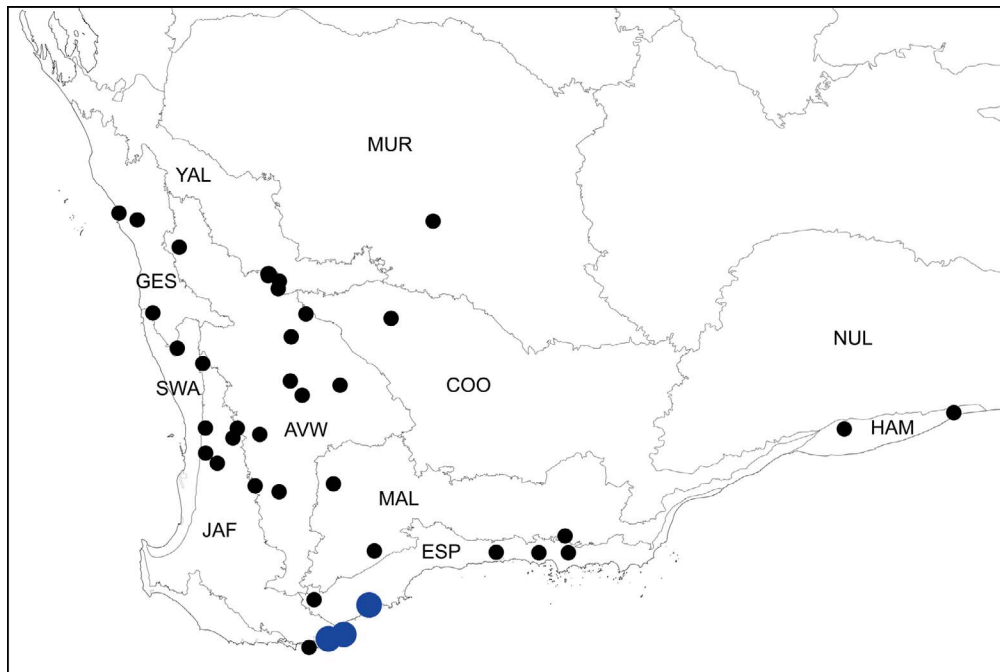


Figure 208.—Map showing collection records of *Bungulla gibba* sp. nov. (large blue circles), relative to other taxa with < 5 retrolateral spinules on the male palpal tibia (see Fig. 12). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; COO, Coolgardie; ESP, Esperance Plains; GES, Geraldton Sandplains; HAM, Hampton; JAF, Jarrah Forest; MAL, Mallee; MUR, Murchison; NUL, Nullarbor; SWA, Swan Coastal Plain; YAL, Yalgoo.

tibia (Figs. 218, 219) (palpal tibia is with a ledge or bulges ventrally in other species). *Bungulla hamelinensis* can be further distinguished from *B. banksia* by the larger field of retrolateral spinules on the palpal tibia (Fig. 218; cf. Fig. 72); from *B. bertmaini*, *B. laevigata* and *B. quobba* by the shape of the embolus, which is relatively short (i.e., ~as long as bulb) (Fig. 218; cf. Figs. 24, 319, 371); and from *B. bidgemia*, *B. iota*, *B. weld* and *B. yeni* by the morphology of the cymbial spinules, which are thinner with a more filiform morphology (Figs. 218–220; cf. Figs. 95, 267, 419, 445). Females are unknown.

Description (male holotype).—Total length 6.7. Carapace 2.3 long, 2.0 wide. Abdomen 3.6 long, 2.1 wide. Carapace (Fig. 209) tan, with darker pars cephalica and slightly darker ocular region; fovea straight. Eye group (Fig. 212) trapezoidal (anterior eye row strongly procurved), 0.9 x as long as wide, PLE–PLE/ALE–ALE ratio 1.3; ALE separated by ca. half their own diameter; AME separated by less than their own diameter; PME separated by 3.0 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 213); labium without cuspules. Abdomen (Fig. 210) elongate-oval, damaged, faded beige in dorsal view. Dorsal surface of abdomen (Fig. 210) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 216, 217) variable shades of tan, with light scopulae on semi-incrassate tarsi I–II; tibia I spinose, without prolateral clasp spurs. Leg I: femur 2.8; patella 1.2; tibia 2.2; metatarsus 1.9; tarsus 1.5; total 9.6. Leg I femur–tarsus/carapace length ratio 4.2. Pedipalpal tibia (Figs. 218–220) 2.0 x longer than wide; field of retrolateral spinules large and asymmetrically crescent-shaped ('wave-shaped') in retrolateral

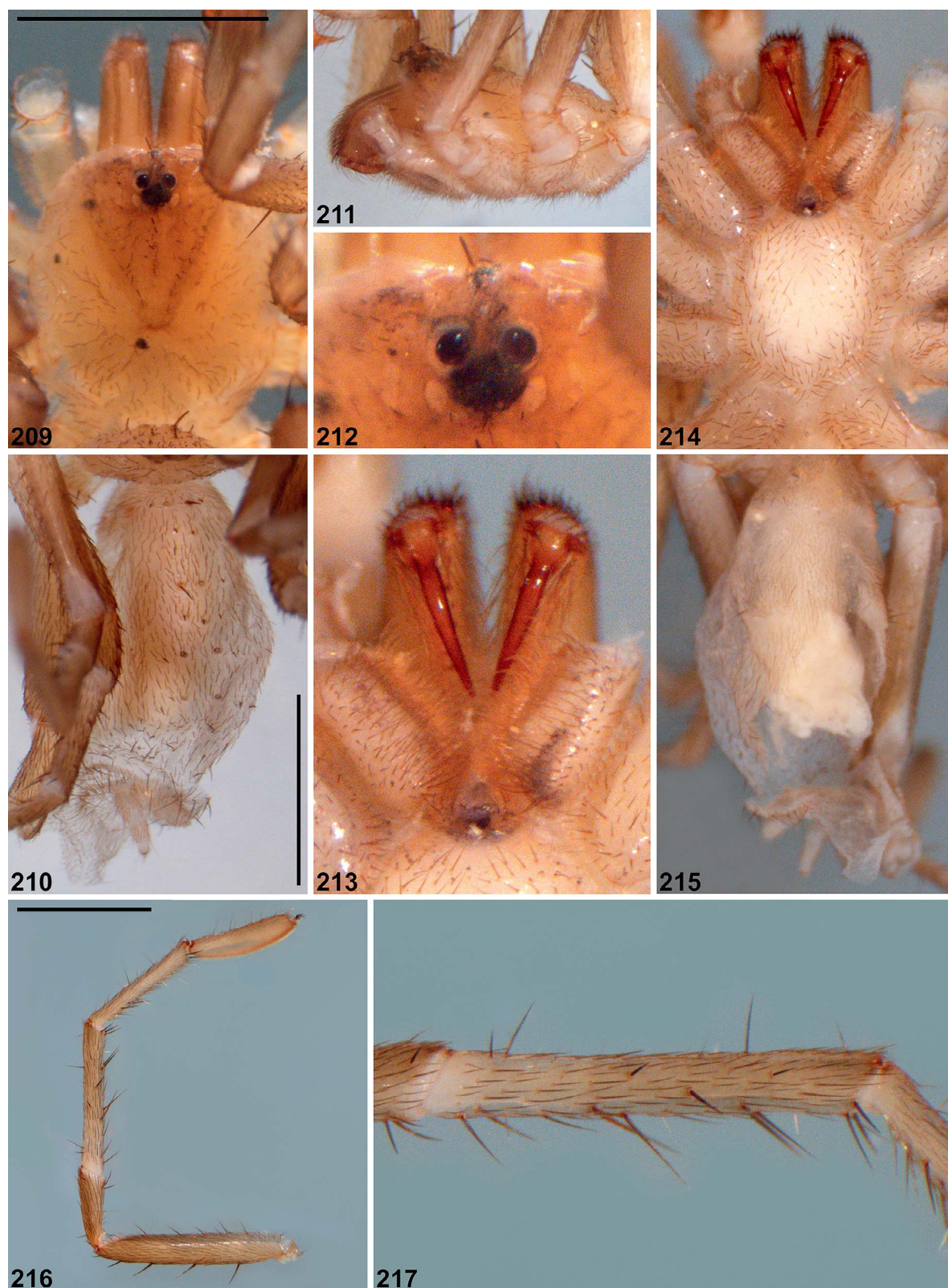
view, positioned medially–distally (along most of retro-ventral margin), consisting of ca. 45 spinules of largely similar length; RTA absent. Cymbium (Figs. 218–220) setose, with field of slightly curved and relatively poorly developed (almost filiform) spinules covering most of dorsal surface. Embolus (Figs. 218–220) as long as bulb, slightly curved, with unmodified tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla hamelinensis* (formerly known by WAM identification code 'MYG140') is a rare, highly restricted and extremely small species known only from Nanga Station, in the far southern Carnarvon (Wooramel) bioregion of Western Australia (Fig. 221). The type and only known locality of this species is situated on an unusual, near-tidal sandplain at the far southern tip of the Hamelin Pool Marine Reserve, 13 km south-west of Hamelin Pool. This site is also home to the similarly restricted species *B. laevigata*. Nothing else is known of the biology of *B. hamelinensis*, other than that the known male specimens were collected wandering in search of females in winter or possibly late autumn.

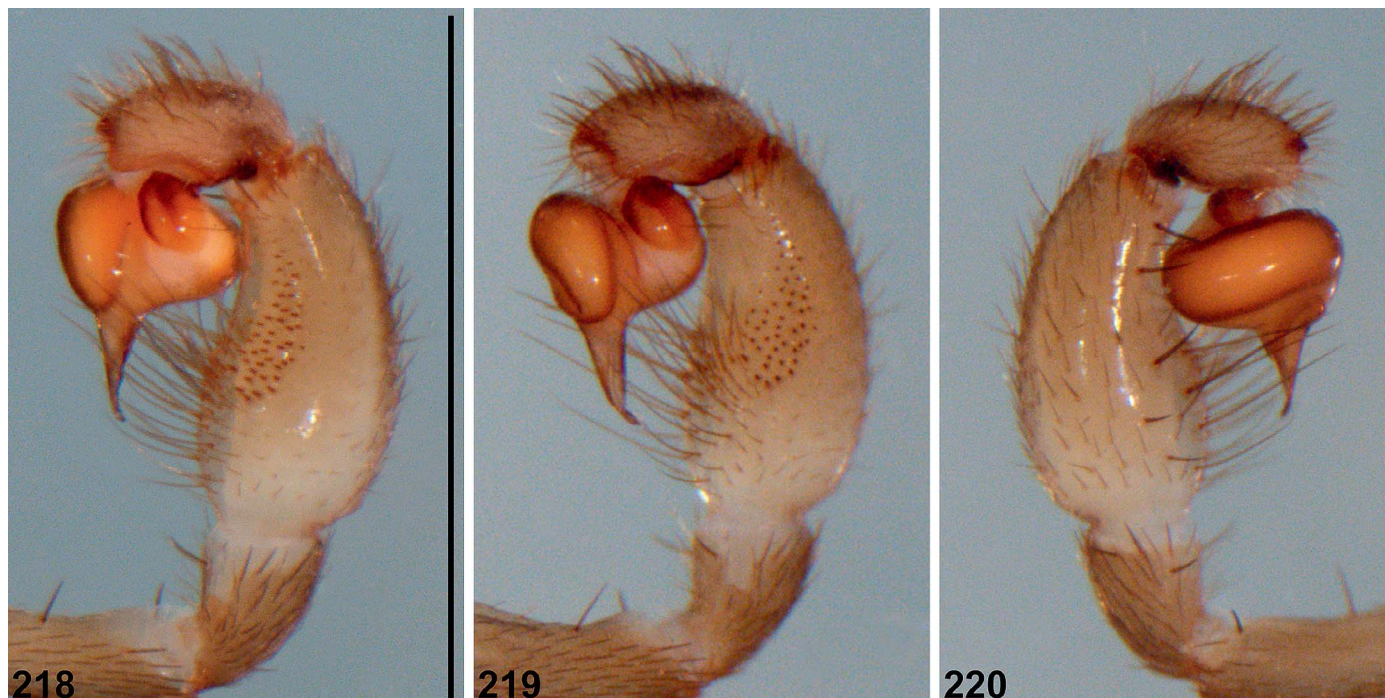
***Bungulla harrisonae* Rix, Raven & Harvey, sp. nov.**

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:F63F9B16-7E37-4C94-BF20-8B0F21E2AC15>
(Figs. 5, 6, 14, 222–231)

Type material.—*Holotype female*. AUSTRALIA: Western Australia: John Forrest National Park, off Park Road, N. of Great Eastern Highway (IBRA_JAF), 31°53'54"S, 116°05'49"E, dug from burrow in jarrah forest, 231 m, 11 February 2013, S.E. Harrison & M.G. Rix (WAM T129257^{DNA_Voucher_EC}; GenB–COI–KY295236, GenB–



Figures 209–217.—*Bungulla hamelinensis* sp. nov., male holotype (WAM T98562) from Nanga Station (Western Australia; CAR), somatic morphology: 209–210, carapace and abdomen, dorsal view; 211, cephalothorax, lateral view; 212, eyes, dorsal view; 213, mouthparts, ventral view; 214–215, cephalothorax and abdomen, ventral view; 216, leg I, prolateral view; 217, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 218–220.—*Bungulla hamelinensis* sp. nov., male holotype (WAM T98562) from Nanga Station (Western Australia; CAR), pedipalp: 218, retrolateral view; 219, retro-ventral view; 220, prolateral view. Scale bar = 2.0 mm.

MRPL45–KY295483, GenB–RPF2–KY295602, GenB–XPNPEP3–KY295730, GenB–ITS–KY294982).

Etymology.—This species is named in honor of Sophie Harrison, in recognition of her contributions to idiopid systematics, especially the taxonomy of *Blakistonia* Hogg,

1902, and for discovering the holotype and only known specimen of this species.

Diagnosis.—*Bungulla harrisonae* is known from only a single female specimen, for which sequence data are available (Fig. 14). It can be distinguished from the other two species known

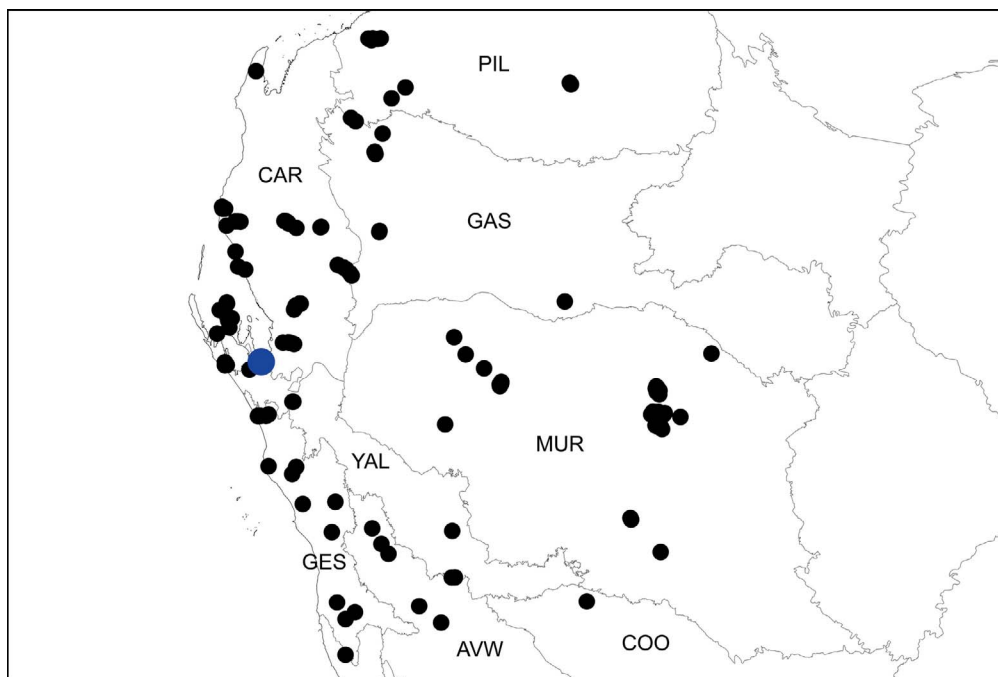
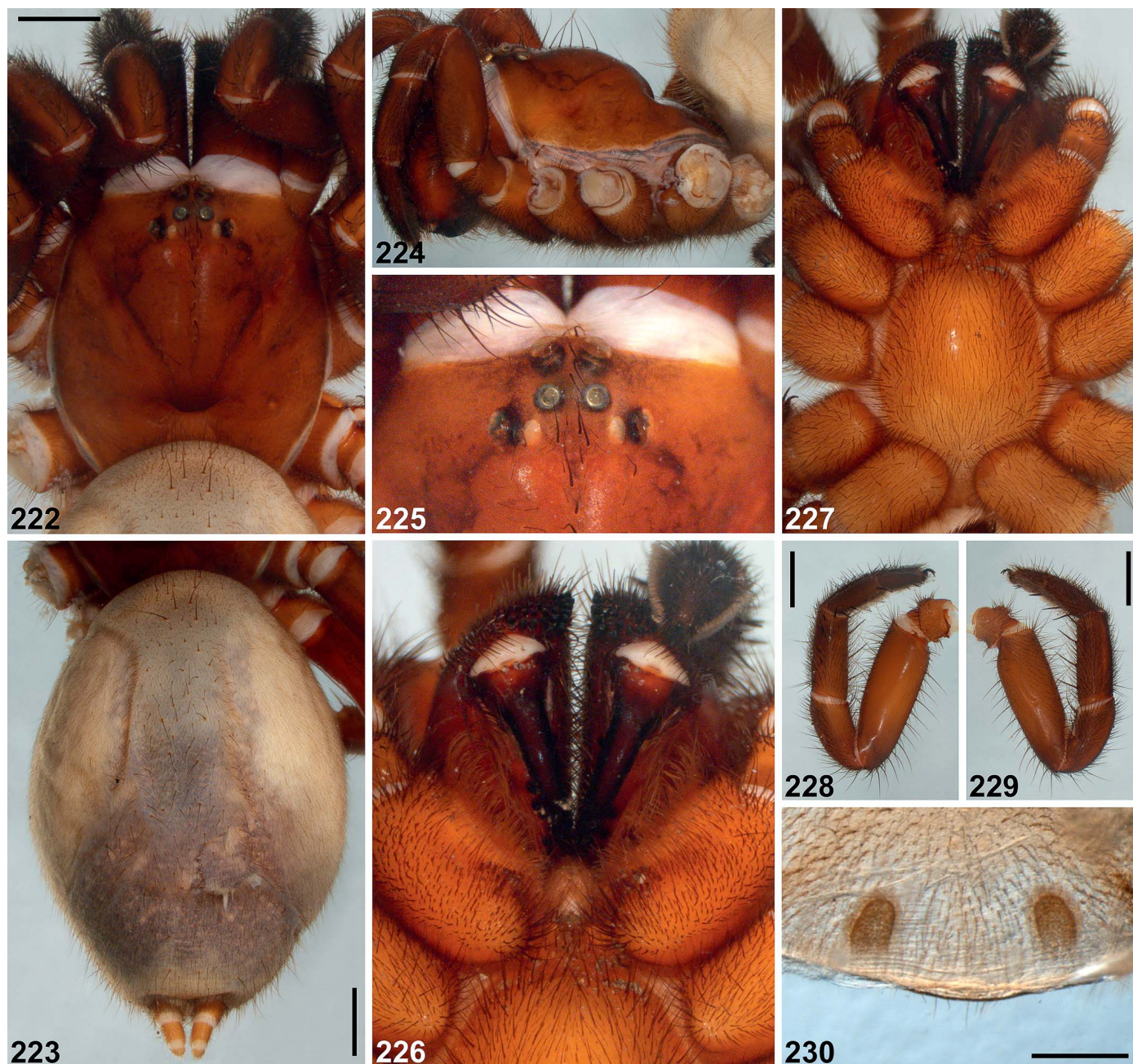


Figure 221.—Map showing collection records of *Bungulla hamelinensis* sp. nov. (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.



Figures 222–230.—*Bungulla harrisonae* sp. nov., female holotype (WAM T129257) from John Forrest National Park (Western Australia; JAF): 222–223, carapace and abdomen, dorsal view; 224, cephalothorax, lateral view; 225, eyes, dorsal view; 226, mouthparts, ventral view; 227, cephalothorax, ventral view; 228, leg I, prolateral view; 229, leg I, retrolateral view; 230, spermathecae, dorsal view. Scale bars = 2.0 mm (222–223, 228–229), 0.5 mm (230).

only from females – *B. bella* and *B. gibba* – by the relatively uniform coloration of the dorsal abdomen (Fig. 223) (cf. *B. bella*; Fig. 77) and the unmodified morphology of the fovea (Fig. 222) (cf. *B. gibba*; Fig. 199). While it is possible that *B. harrisonae* may be conspecific with a species here described separately from male specimens, we consider this highly unlikely given the size, coloration and morphology of those few congeners known from the vicinity of the type locality.

Description (female holotype).—Total length 24.1. Carapace 7.6 long, 6.9 wide. Abdomen 13.2 long, 9.3 wide. Carapace

(Fig. 222) chocolate-brown with slightly darker ocular region; fovea strongly procurved. Eye group (Fig. 225) trapezoidal (anterior eye row strongly procurved), 0.7 x as long as wide, PLE–PLE/ALE–ALE ratio 2.0; ALE separated by ca. half their own diameter; AME separated by nearly their own diameter; PME separated by 3.6 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cusps confined to inner corner (Fig. 226); labium without cusps. Abdomen (Fig. 223) oval, slightly damaged, beige and grey in dorsal

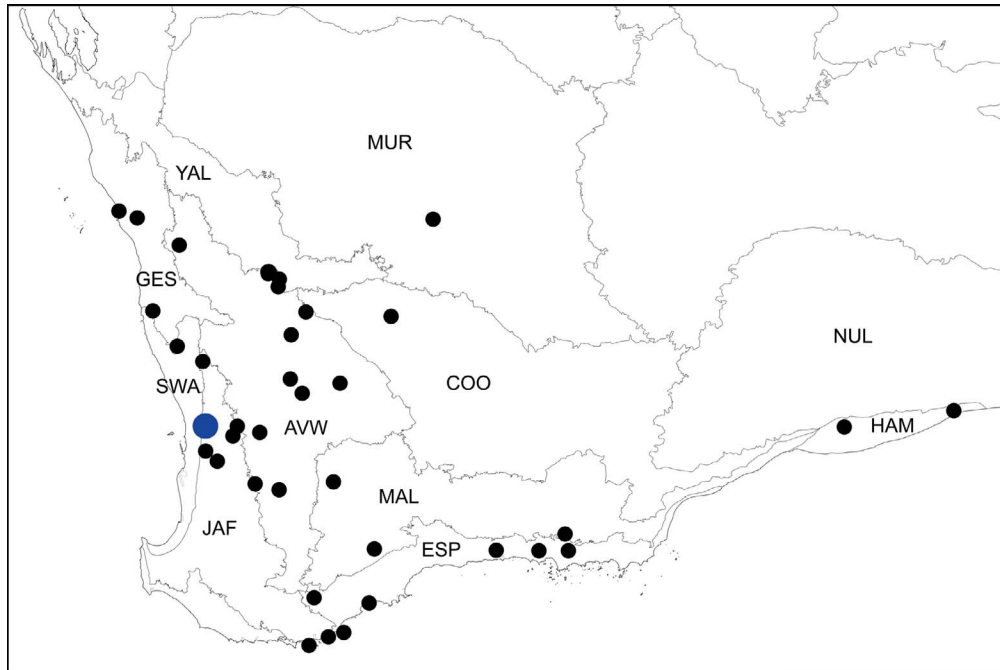


Figure 231.—Map showing collection records of *Bungulla hillyerae* sp. nov. (large blue circle), relative to other taxa with < 5 retrolateral spinules on the male palpal tibia (see Fig. 12). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; COO, Coolgardie; ESP, Esperance Plains; GES, Geraldton Sandplains; HAM, Hampton; JAF, Jarrah Forest; MAL, Mallee; MUR, Murchison; NUL, Nullarbor; SWA, Swan Coastal Plain; YAL, Yalgoo.

view; sclerotized sigilla absent. Legs (Figs. 228, 229) variable shades of dark tan; thick scopulae present on tarsi and metatarsi I–II; tibia I with 5 stout prolateral macrosetae and 4 retro-ventral spine-like macrosetae; metatarsus I with 3 stout pro-ventral macrosetae and 3 longer retro-ventral macrosetae; tarsus I with distal cluster of 5 stout ventral macrosetae. Leg I: femur 5.2; patella 3.3; tibia 3.0; metatarsus 2.4; tarsus 1.8; total 15.8. Leg I femur–tarsus/carapace length ratio 2.1. Pedipalp dark tan, spinose on tibia and tarsus, with thick tarsal scopula. Genitalia (Fig. 230) with pair of short, widely spaced, bud-shaped spermathecae.

Distribution and remarks.—*Bungulla hillyerae* is an extremely rare species known only from John Forrest National Park, in the northern jarrah forest due east of Perth (Fig. 231). Genetic data reveal that *B. hillyerae* is closely related to *B. bella* (Fig. 14), the latter found much further inland in the vicinity of Mount Richardson (Fig. 85). Little is known of the biology of this species, other than the unusual morphology of the burrow, the latter of which consists of a highly camouflaged, convex lid with a broadly flanged lower ‘lip’ around the burrow entrance (Figs. 5, 6).

***Bungulla hillyerae* Rix, Raven & Harvey, sp. nov.**

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:738C1B6C-8C8B-4AD9-AF7A-6AF2C203A8F7>

(Figs. 4, 12, 232–244)

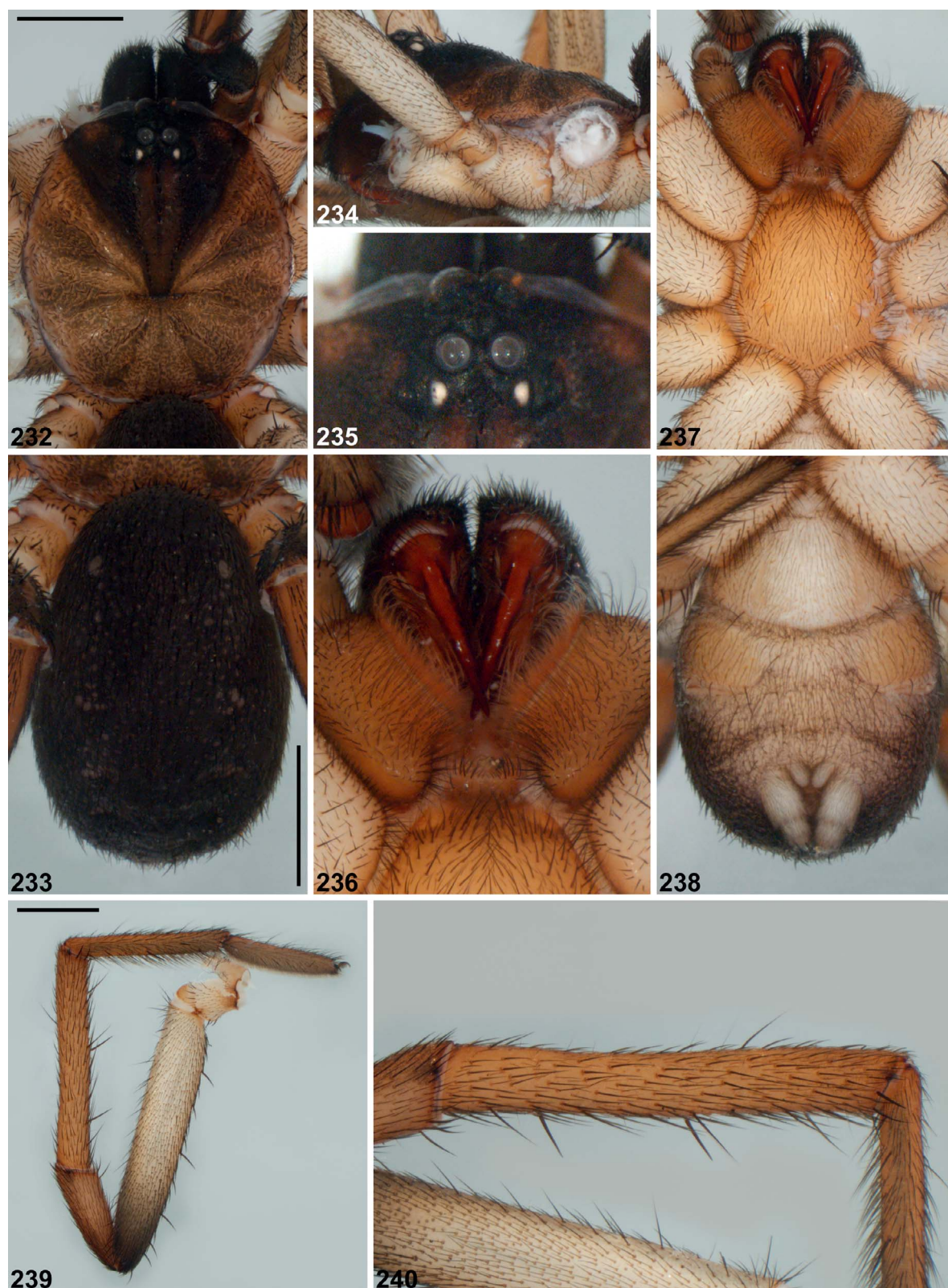
Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Madura Caravan Park, Roe Plain (IBRA_HAM), 31°54′02″S, 127°01′14″E, running on ground at night, 11 September 2017, M.J. Hillyer (WAM T144352).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Eucla Campsite (IBRA_HAM), 31°40′S, 128°53′E, A.R. Main (WAM T142983).

Etymology.—This species is named in honor of Mia Hillyer, in recognition of her contributions to molecular systematics, and for discovering the holotype specimen of this species.

Diagnosis.—Males of *Bungulla hillyerae* can be distinguished from all other known congeners with < 5 retrolateral spinules on the palpal tibia (Fig. 12) – except *B. disrupta*, *B. fusca*, *B. inermis*, *B. oraria* and *B. parva* – by the shape of the cymbial spinules, which are curved, anteriorly-directed and restricted to the distal half of the cymbium (Figs. 241–243) (spinules are porrect, thorn-like, and cover most of the dorsal surface of the cymbium in other species). *Bungulla hillyerae* can be further distinguished from *B. parva* by its larger body size (carapace width > 4.0) (Fig. 232; cf. Fig. 349); from *B. disrupta*, *B. fusca* and *B. oraria* by the lighter carapace coloration (depending on the state of preservation; see Supplementary File 1) (Fig. 232; cf. Figs. 151, 186, 336); and from *B. inermis* by the presence of a row of small macrosetae on the prolateral tarsus I (Fig. 239; cf. Fig. 252), and by the almost contiguous ALE (Fig. 235; cf. Fig. 248). Females are unknown.

Description (male holotype).—Total length 12.2. Carapace 5.7 long, 5.2 wide. Abdomen 5.4 long, 3.7 wide. Carapace (Fig. 232) dark mottled tan, with darker brown pars cephalica, dark brown lyre-like pattern on pars cephalica, dark grey lateral rims and black ocular region (carapace brown-black and dark maroon-brown in life; Fig. 4); fovea straight. Eye group (Fig. 235) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide, PLE–PLE/ALE–ALE ratio 1.8; ALE almost contiguous; AME separated by less than their own diameter;



Figures 232–240.—*Bungulla hillyerae* sp. nov., male holotype (WAM T144352) from Madura Caravan Park (Western Australia; HAM), somatic morphology: 232–233, carapace and abdomen, dorsal view; 234, cephalothorax, lateral view; 235, eyes, dorsal view; 236, mouthparts, ventral view; 237–238, cephalothorax and abdomen, ventral view; 239, leg I, prolateral view; 240, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 241–243.—*Bungulla hillyerae* sp. nov., male holotype (WAM T144352) from Madura Caravan Park (Western Australia; HAM), pedipalp: 241, retrolateral view; 242, retro-ventral view; 243, prolateral view. Scale bar = 2.0 mm.

PME separated by 3.0 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 236); labium without cuspules. Abdomen (Fig.

233) oval, dark charcoal-black in dorsal view with beige mottling (as in life; Fig. 4), two pairs of tan sigilla spots and two pairs of faint beige chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 233) with

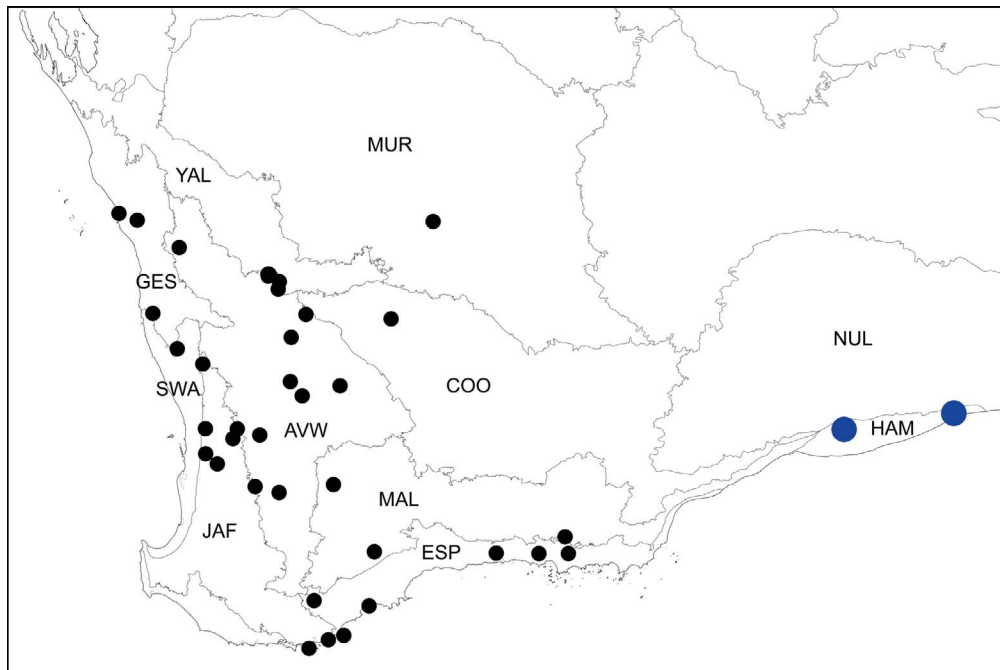


Figure 244.—Map showing collection records of *Bungulla hillyerae* sp. nov. (large blue circles), relative to other taxa with < 5 retrolateral spinules on the male palpal tibia (see Fig. 12). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; COO, Coolgardie; ESP, Esperance Plains; GES, Geraldton Sandplains; HAM, Hampton; JAF, Jarrah Forest; MAL, Mallee; MUR, Murchison; NUL, Nullarbor; SWA, Swan Coastal Plain; YAL, Yalgoo.

sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 239, 240) variable shades of tan, with lighter femora and light scopulae on tarsi I–II; tibia I largely aspinose, without prolateral claspings spurs. Leg I: femur 6.6; patella 3.1; tibia 5.3; metatarsus 4.1; tarsus 2.8; total 21.9. Leg I femur–tarsus/carapace length ratio 3.8. Pedipalpal tibia (Figs. 241–243) 2.0 x longer than wide, without retrolateral spinules; RTA absent. Cymbium (Figs. 241–243) setose, with field of curved, anteriorly-directed spine-like spinules restricted to distal half of segment. Embolus (Figs. 241–243) slightly longer than bulb, slightly curved, with unmodified tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla hillyerae* is known from only two locations in the Hampton bioregion of south-eastern Western Australia, at Eucla (near the Western Australian/South Australian border), and on the Roe Plain at Madura (Fig. 244). However, the precise collection locality of the Eucla specimen is unknown given the municipal changes that have occurred in the Eucla region since the dismantling of the Old Telegraph Station in the 1950s. Nothing is known of the biology of this species, other than that the holotype male specimen was collected wandering in search of females in mid-September (Fig. 4).

Bungulla inermis Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:E878F99E-34B2-4402-8F4B-63AB049D43D8>
(Figs. 12, 245–257)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: 2 km N. of Bunce Bin, N. of Beacon [ca. junction of Bimbijy & Stone Roads] (IBRA_AVW), 30°11'S, 117°49'E, 28 June–26 July 1985, B.Y. Main (WAM T142953).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Lake Mollerin, west, site BE 10 (IBRA_AVW), 30°31'41"S, 117°33'54"E, wet pitfall traps, 15 September 1998–25 October 1999, P. Van Heurck, CALM Survey (WAM T142952); 1 ♂, Mount Gibson iron-ore mine, Banded Ironstone Range, Extension Hill, west facing (IBRA_AVW), 29°34'33"S, 117°09'38"E, wet pitfall trap, 30 April–11 May 2005, S. Thompson (WAM T71639); 1 ♂, same data except Iron Hill, west facing, 29°36'13"S, 117°10'17"E (WAM T72318); 1 ♂, same data except woodlands 3 (C), impact site, 29°34'38"S, 117°11'19"E, 30 April–11 May 2005 (WAM T71638); 1 ♂, Talgomine Reserve (south), N. of Merredin, site MN 11 (IBRA_AVW), 31°15'24"S, 118°23'46"E, wet pitfall traps, 15 December 1997–22 September 1998, N. Guthrie, CALM Survey (WAM T142951).

Etymology.—The specific epithet is derived from the Latin 'inermis' (adjective: 'unarmed', 'defenseless' or 'toothless'; see Brown 1956), in reference to the smooth morphology of the male palpal tibia, which is devoid of spinules.

Diagnosis.—Males of *Bungulla inermis* can be distinguished from all other known congeners with < 5 retrolateral spinules on the palpal tibia (Fig. 12) – except *B. disrupta*, *B. fusca*, *B. hillyerae*, *B. oraria* and *B. parva* – by the shape of the cymbial spinules, which are curved, anteriorly-directed and restricted to the distal half of the cymbium (Figs. 254–256) (spinules are porrect, thorn-like, and cover most of the dorsal surface of the cymbium in other species). *Bungulla inermis* can be further

distinguished from *B. parva* by its larger body size (carapace width > 3.0) (Fig. 245; cf. Fig. 349); from *B. disrupta*, *B. fusca* and *B. oraria* by the lighter carapace coloration (depending on the state of preservation; see Supplementary File 1) (Figs. 245; cf. Figs. 151, 186, 336); and from *B. hillyerae* by the absence of a row of small macrosetae on the prolateral tarsus I (Fig. 252; cf. Fig. 239), and by the more widely separated ALE (Fig. 248; cf. Fig. 235). Females are unknown.

Description (male holotype).—Total length 13.2. Carapace 5.3 long, 4.3 wide. Abdomen 6.2 long, 3.2 wide. Carapace (Fig. 245) tan, with slightly darker pars cephalica, darker brown lyre-like pattern on pars cephalica and mostly black ocular region; fovea straight. Eye group (Fig. 248) trapezoidal (anterior eye row strongly procurved), 0.9 x as long as wide, PLE–PLE/ALE–ALE ratio 1.5; ALE separated by their own diameter; AME separated by less than their own diameter; PME separated by 3.0 x their own diameter; PME and PLE separated by slightly less than diameter of PME, PME positioned in line with level of PLE. Maxillae and labium without cuspules (Fig. 249). Abdomen (Fig. 246) oval, slightly damaged, dark grey in dorsal view. Dorsal surface of abdomen (Fig. 246) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 252, 253) variable shades of tan, with light scopulae on tarsi I–II; tibia I largely aspinose, without prolateral claspings spurs. Leg I: femur 5.7; patella 2.5; tibia 4.5; metatarsus 4.3; tarsus 2.8; total 19.8. Leg I femur–tarsus/carapace length ratio 3.7. Pedipalpal tibia (Figs. 254–256) 2.0 x longer than wide, without retrolateral spinules; RTA absent. Cymbium (Figs. 254–256) setose, with field of curved, anteriorly-directed spine-like spinules restricted to distal half of segment. Embolus (Figs. 254–256) ca. 1.5 x length of bulb, slightly curved, with unmodified tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla inermis* (formerly known by WAM identification code 'MYG147') has a relatively restricted distribution in the north-eastern Avon Wheatbelt bioregion of south-western Australia, from Mount Gibson south to Merredin (Fig. 257). Nothing is known of the biology of this species, other than that the known male specimens were collected wandering in search of females in late autumn and winter.

Bungulla iota Rix, Raven & Harvey, sp. nov.

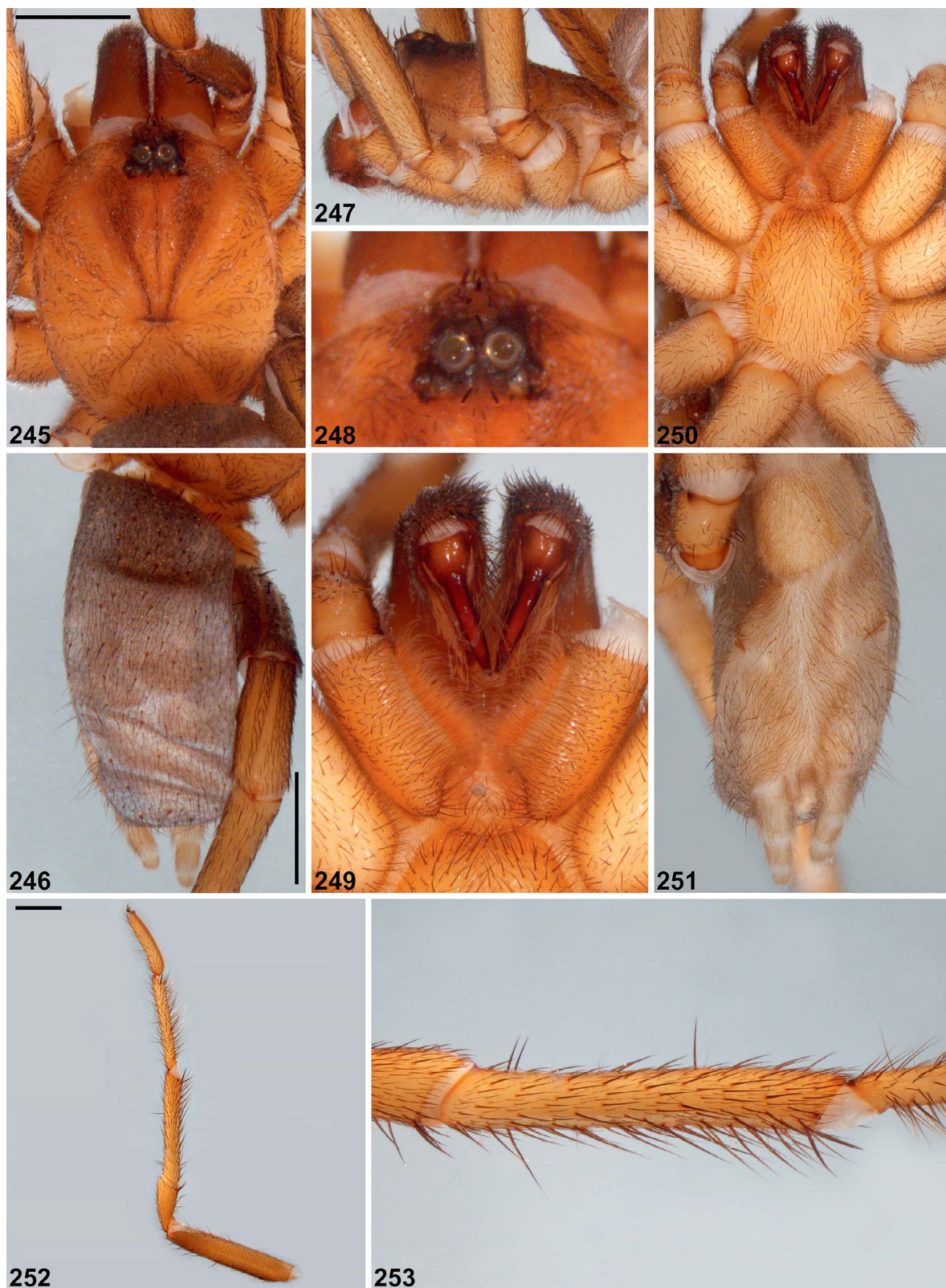
<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:58F78F41-5403-485A-9843-7B700AAFF615>
(Figs. 13, 258–270)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Woodleigh Station, site MO4 (IBRA_CAR), 26°11'31.1"S, 114°30'33.0"E, wet pitfall trap, 17 May–21 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T142984).

Paratypes. AUSTRALIA: *Western Australia*: 6 ♂, same data as holotype (WAM T98534).

Etymology.—The specific epithet is a noun in apposition derived from the Greek 'iota' ('anything very small'; see Brown 1956), in reference to the very small size of this species.

Diagnosis.—Males of *Bungulla iota* can be distinguished from all other known congeners with > 10 retrolateral spinules on the palpal tibia (Fig. 13) – except *B. banksia*, *B. bertmaini*, *B. hamelinensis*, *B. iota*, *B. laevigata*, *B. quobba*, *B.*



Figures 245–253.—*Bungulla inermis* sp. nov., male holotype (WAM T142953) from 2 km N. of Bunce Bin, N. of Beacon (Western Australia; AVW), somatic morphology: 245–246, carapace and abdomen, dorsal view; 247, cephalothorax, lateral view; 248, eyes, dorsal view; 249, mouthparts, ventral view; 250–251, cephalothorax and abdomen, ventral view; 252, leg I, prolateral view; 253, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 254–256.—*Bungulla inermis* sp. nov., male holotype (WAM T142953) from 2 km N. of Bunce Bin, N. of Beacon (Western Australia; AVW), pedipalp: 254, retrolateral view; 255, retro-ventral view; 256, prolateral view. Scale bar = 2.0 mm.

weld and *B. yeni* – by the shape of the proximal half of the palpal tibia, which is without a pronounced ventral bulge (Fig. 267), combined with the absence of a medial ‘ledge’ on the palpal tibia (Figs. 267, 268) (palpal tibia is with a ledge or

bulges ventrally in other species). *Bungulla iota* can be further distinguished from *B. banksia* by the larger field of retrolateral spinules on the palpal tibia (Fig. 267; cf. Fig. 72); from *B. bertmaini*, *B. laevigata* and *B. quobba* by the shape of the

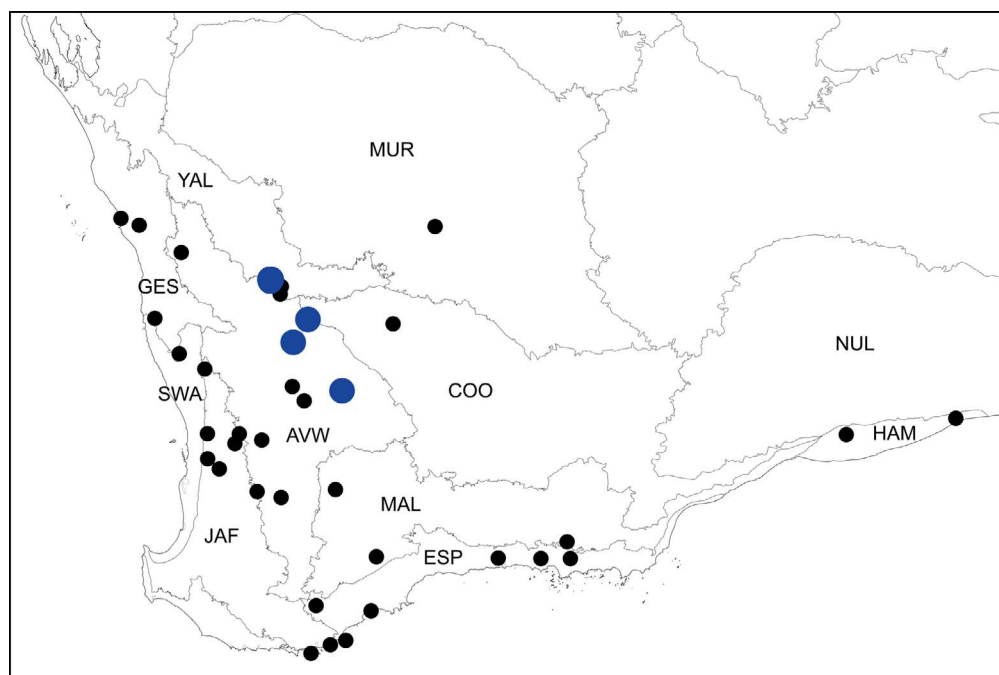
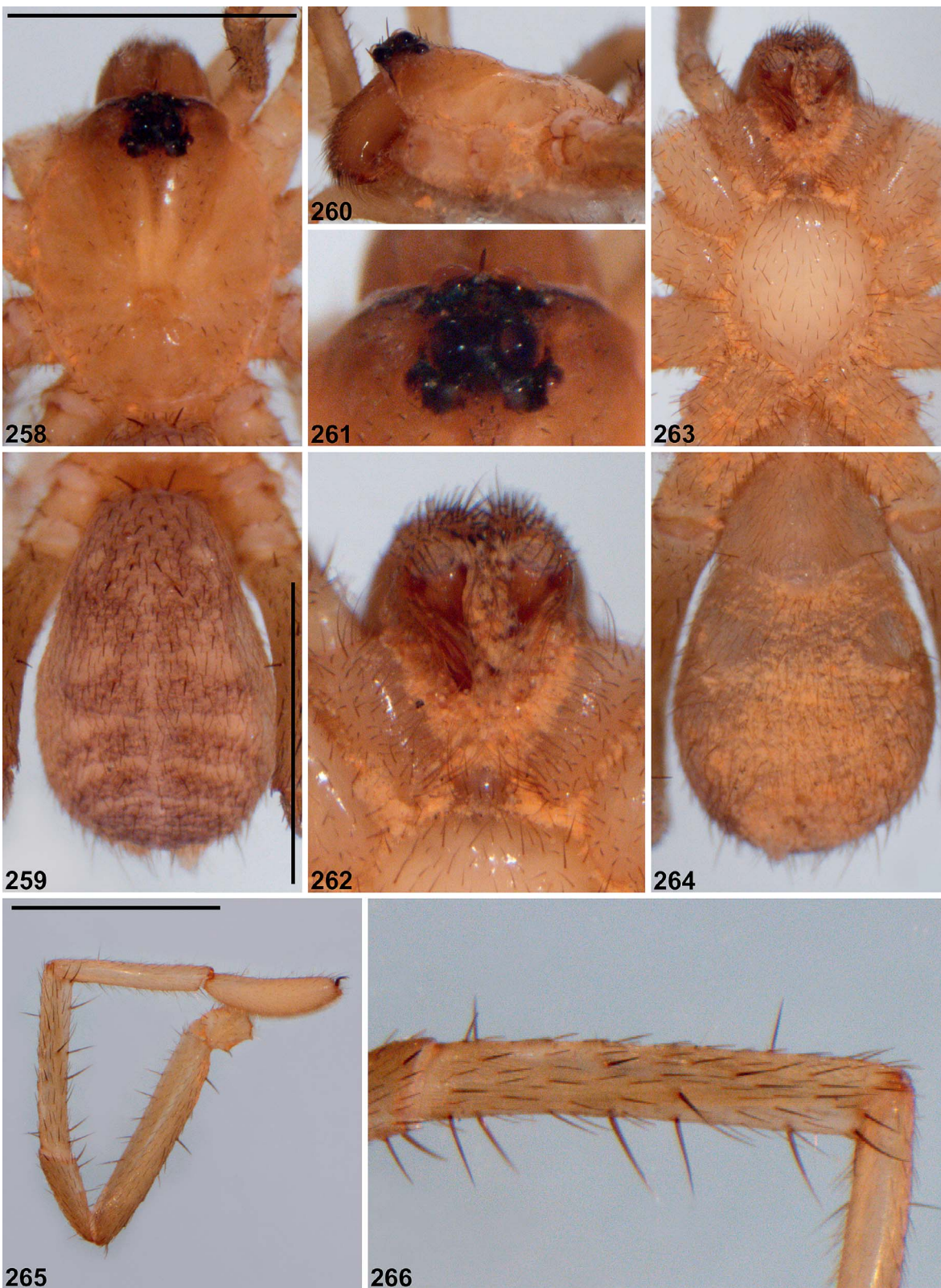


Figure 257.—Map showing collection records of *Bungulla inermis* sp. nov. (large blue circles), relative to other taxa with < 5 retrolateral spinules on the male palpal tibia (see Fig. 12). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; COO, Coolgardie; ESP, Esperance Plains; GES, Geraldton Sandplains; HAM, Hampton; JAF, Jarrah Forest; MAL, Mallee; MUR, Murchison; NUL, Nullarbor; SWA, Swan Coastal Plain; YAL, Yalgoo.



Figures 258–266.—*Bungulla iota* sp. nov., male holotype (WAM T142984) from Woodleigh Station (Western Australia; CAR), somatic morphology: 258–259, carapace and abdomen, dorsal view; 260, cephalothorax, lateral view; 261, eyes, dorsal view; 262, mouthparts, ventral view; 263–264, cephalothorax and abdomen, ventral view; 265, leg I, prolateral view; 266, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 267–269.—*Bungulla iota* sp. nov., male holotype (WAM T142984) from Woodleigh Station (Western Australia; CAR), pedipalp: 267, retrolateral view; 268, retro-ventral view; 269, prolateral view. Scale bar = 2.0 mm.

embolus, which is relatively short (i.e., ~as long as bulb) (Fig. 267; cf. Figs. 24, 319, 371); from *B. hamelinensis* by the morphology of the cymbial spinules, which are thicker and more spine-like (Figs. 267–269; cf. Figs. 218–220); from *B. yeni* and by the presence of a larger, crescent-shaped field of

retrolateral spinules on the palpal tibia (Fig. 267; cf. Fig. 445); from *B. weld* by the presence of relatively symmetric field of retrolateral spinules on the palpal tibia (Fig. 267; cf. Fig. 419); and from *B. bidgeia* by the smaller body size (carapace width < 2.0) (Fig. 258; cf. Fig. 86), combined with the absence of

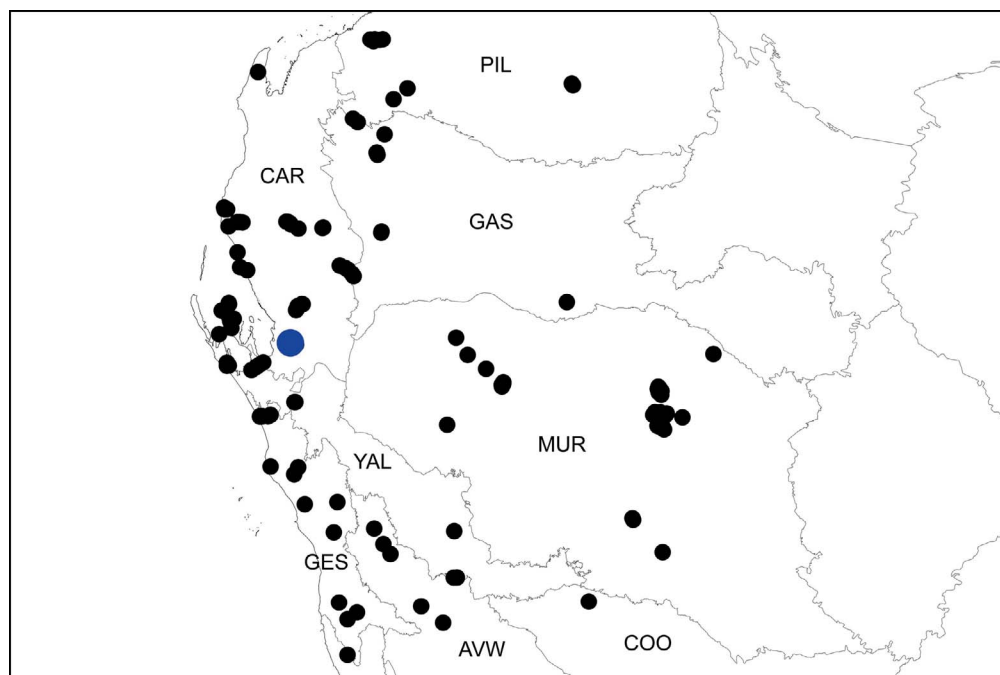


Figure 270.—Map showing collection records of *Bungulla iota* sp. nov. (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.

marginal lateral indentations on the carapace between coxae II–III (Fig. 258; cf. Fig. 86). Females are unknown.

Description (male holotype).—Total length 5.0. Carapace 2.2 long, 1.7 wide. Abdomen 2.4 long, 1.6 wide. Carapace (Fig. 258) tan, with darker pars cephalica and mostly black ocular region; fovea straight. Eye group (Fig. 261) trapezoidal (anterior eye row strongly procurved), 0.9 x as long as wide, PLE–PLE/ALE–ALE ratio 1.4; ALE almost contiguous; AME separated by less than their own diameter; PME separated by 2.2 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with level of PLE. Maxillae partially covered by debris, cuspules (if present) obscured (Fig. 262); labium without cuspules. Abdomen (Fig. 259) oval, pale olive-brown in dorsal view with beige-tan mottling, two pairs of beige-tan sigilla spots and three pairs of beige-tan chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 259) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 265, 266) variable shades of tan, with light scopulae on incrassate tarsi I–II; tibia I spinose, without prolateral clasping spurs. Leg I: femur 2.2; patella 1.1; tibia 1.8; metatarsus 1.6; tarsus 1.2; total 7.8. Leg I femur–tarsus/carapace length ratio 3.5. Pedipalpal tibia (Figs. 267–269) 2.2 x longer than wide; field of retrolateral spinules large and symmetrically crescent-shaped in retrolateral view, positioned medially–distally (along most of retro-ventral margin), consisting of ca. 40 spinules of largely similar length; RTA absent. Cymbium (Figs. 267–269) setose, with sparse field of spine-like spinules covering most of dorsal surface. Embolus (Figs. 267–269) as long as bulb, slightly curved, with unmodified tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla iota* (formerly confused with WAM identification code ‘MYG138’) is known only from Nerren Nerren Station, in the southern Carnarvon (Wooramel) bioregion of Western Australia (Fig. 270). Nothing is known of the biology of this species, other than that the known male specimens were collected wandering in search of females in winter or possibly late autumn.

Bungulla keigheryi Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:F95533E3-2AC2-4124-B3BA-6A3A9D7C2B27>
(Figs. 13, 271–283)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Bidgemia Station, Gascoyne Junction, site GJ3 (IBRA_CAR), 25°07′08.1″S, 115°25′33.1″E, wet pitfall trap, 6 June–20 August 1995, wet pitfall trap, N. Hall, WAM/CALM Carnarvon Survey (WAM T98531).

Other material examined.—AUSTRALIA: *Western Australia*: 3 ♂, same data as holotype except site GJ4, 25°05′17.4″S, 115°22′48.0″E (WAM T98532).

Etymology.—This species is named in honor of Greg Keighery, in recognition of his contributions to the Southern Carnarvon Basin Survey (Burbidge et al. 2000) and to the study of Australian biodiversity.

Diagnosis.—Males of *Bungulla keigheryi* can be distinguished from all other known congeners with > 10 retrolateral spinules on the palpal tibia (Fig. 13) – except *B. biota*, *B. burbridgei*, *B. dipsodes*, *B. kendricki*, *B. sampeyae* and *B. westi* –

by the shape of the proximal half of the palpal tibia, which has a pronounced RTA-like ventral bulge in retrolateral view (Fig. 280) (palpal tibia is piriform and unmodified in other species). *Bungulla keigheryi* can be further distinguished from *B. biota*, *B. burbridgei*, *B. dipsodes*, *B. kendricki* and *B. sampeyae* by the shape of the RTA-like bulge of the palpal tibia, which is developed into a relatively acute, attenuate process (Fig. 280; cf. Figs. 108, 134, 147, 306, 406); and from *B. westi* by the absence of spinules on the disto-dorsal margin of the palpal tibia (Fig. 280; cf. Fig. 432). Females are unknown.

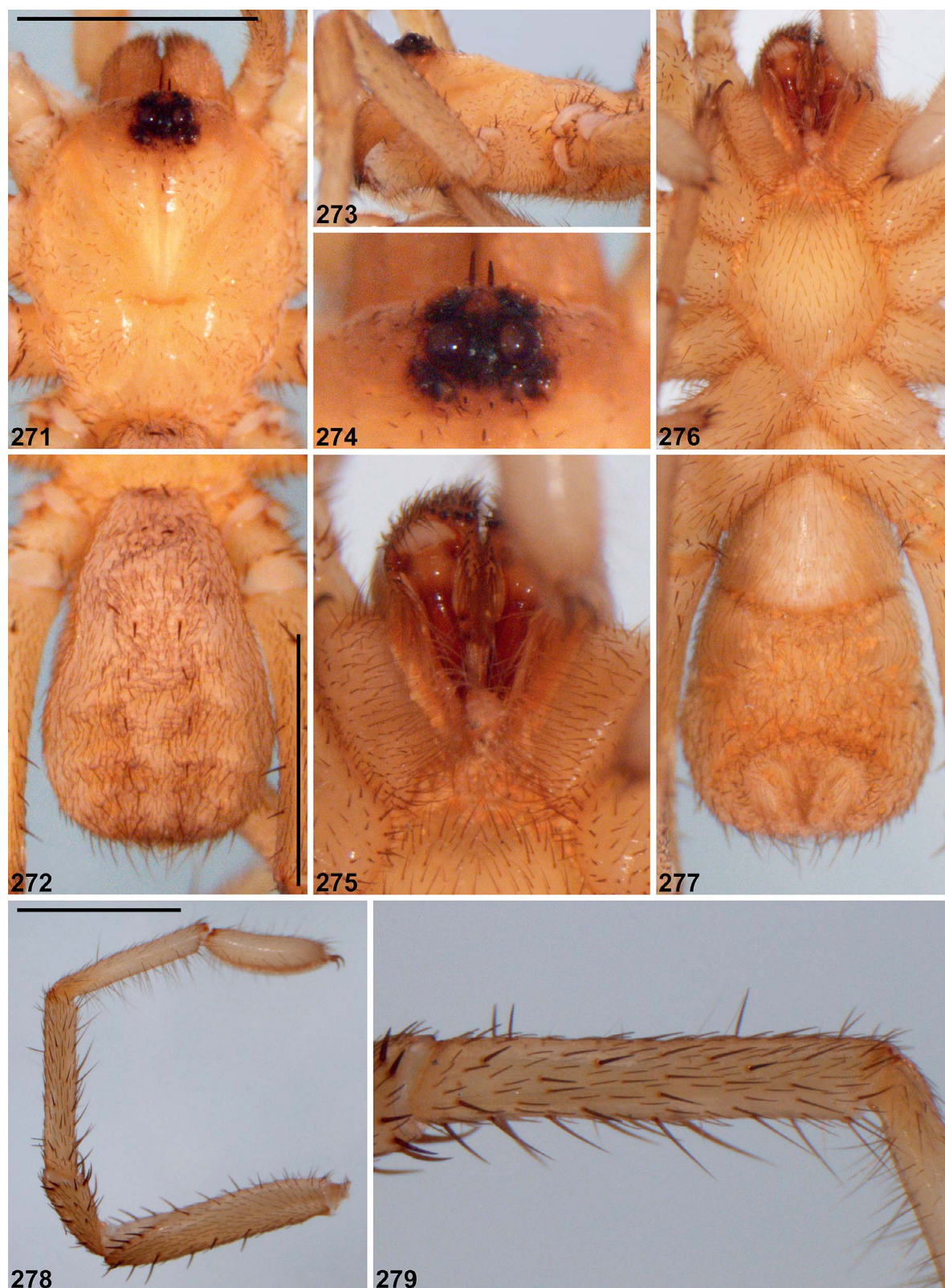
Description (male holotype).—Total length 6.1. Carapace 2.8 long, 2.2 wide. Abdomen 2.8 long, 1.8 wide. Carapace (Fig. 271) pale tan, with slightly darker pars cephalica and mostly black ocular region; fovea slightly procurved. Eye group (Fig. 274) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide, PLE–PLE/ALE–ALE ratio 1.3; ALE separated by their own diameter; AME separated by less than their own diameter; PME separated by 2.9 x their own diameter; PME and PLE separated by slightly less than diameter of PME, PME positioned in line with level of PLE. Maxillae and labium without cuspules (Fig. 275). Abdomen (Fig. 272) elongate-oval, beige-tan in dorsal view with beige mottling and faint pattern of chevrons posteriorly. Dorsal surface of abdomen (Fig. 272) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 278, 279) variable shades of tan, with light scopulae on incrassate tarsi I–II; tibia I largely aspinose, without prolateral clasping spurs. Leg I: femur 2.8; patella 1.3; tibia 2.2; metatarsus 2.1; tarsus 1.4; total 9.8. Leg I femur–tarsus/carapace length ratio 3.5. Pedipalpal tibia (Figs. 280–282) stout, bulbous, 1.8 x longer than wide, with pronounced RTA-like ventral bulge proximally, the latter developed into a relatively acute, attenuate process; field of retrolateral spinules reverse L-shaped in retrolateral view, positioned medially (on and adjacent to RTA-like bulge), consisting of ca. 45 spinules, the latter longest at apex of RTA-like bulge; RTA absent. Cymbium (Figs. 280–282) setose, with field of porrect, thorn-like spinules covering most of dorsal surface. Embolus (Figs. 280–282) slightly longer than bulb, curved, with slightly expanded tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla keigheryi* (formerly known by WAM identification code ‘MYG137’) is known only from Bidgemia Station in the far eastern Carnarvon bioregion (Western Australia), just south of the Gascoyne River ca. 10 km south-east of Bidgemia Station Homestead (Fig. 283). Nothing is known of the biology of this species, other than that the known male specimens were collected wandering in search of females in winter.

Bungulla keirani Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:5035E1FA-F6D5-450B-B155-BC3A1655C70B>
(Figs. 13, 284–296)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Nanga Station, site NA2 (IBRA_CAR), 26°29′23.0″S, 114°03′24.3″E, wet pitfall trap, 11 May–30 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T142982).



Figures 271–279.—*Bungulla keigheryi* sp. nov., male holotype (WAM T98531) from Bidgemia Station, Gascoyne Junction (Western Australia; CAR), somatic morphology: 271–272, carapace and abdomen, dorsal view; 273, cephalothorax, lateral view; 274, eyes, dorsal view; 275, mouthparts, ventral view; 276–277, cephalothorax and abdomen, ventral view; 278, leg I, prolateral view; 279, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 280–282.—*Bungulla keigheryi* sp. nov., male holotype (WAM T98531) from Bidgemia Station, Gascoyne Junction (Western Australia; CAR), pedipalp: 280, retrolateral view; 281, retro-ventral view; 282, prolateral view. Scale bar = 2.0 mm.

Paratypes. AUSTRALIA: *Western Australia*: 3 ♂, same data as holotype (WAM T98655).

Other material examined.—AUSTRALIA: *Western Australia*: 2 ♂, Nanga Station, site NA4 (IBRA_YAL), 26°32'47.3"S, 113°57'47.0"E, wet pitfall trap, 11 May–30 August 1995, N.

Hall, WAM/CALM Carnarvon Survey (WAM T98656); 15 ♂, same data except site NA5, 26°35'31.8"S, 113°53'22.3"E (WAM T98654); 1 ♂, Chilimony Road, east, SW. of Binnu, site NO 10 (IBRA_GES), 28°06'09"S, 114°34'09"E, wet pitfall traps, 15 September 1998–18 October 1999, N. Guthrie,

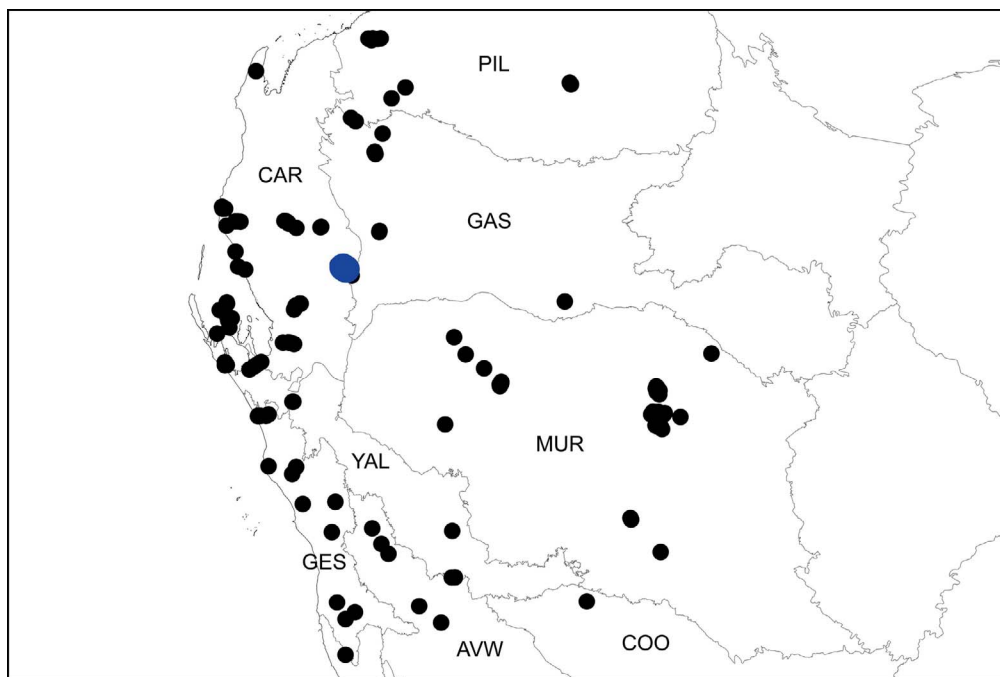
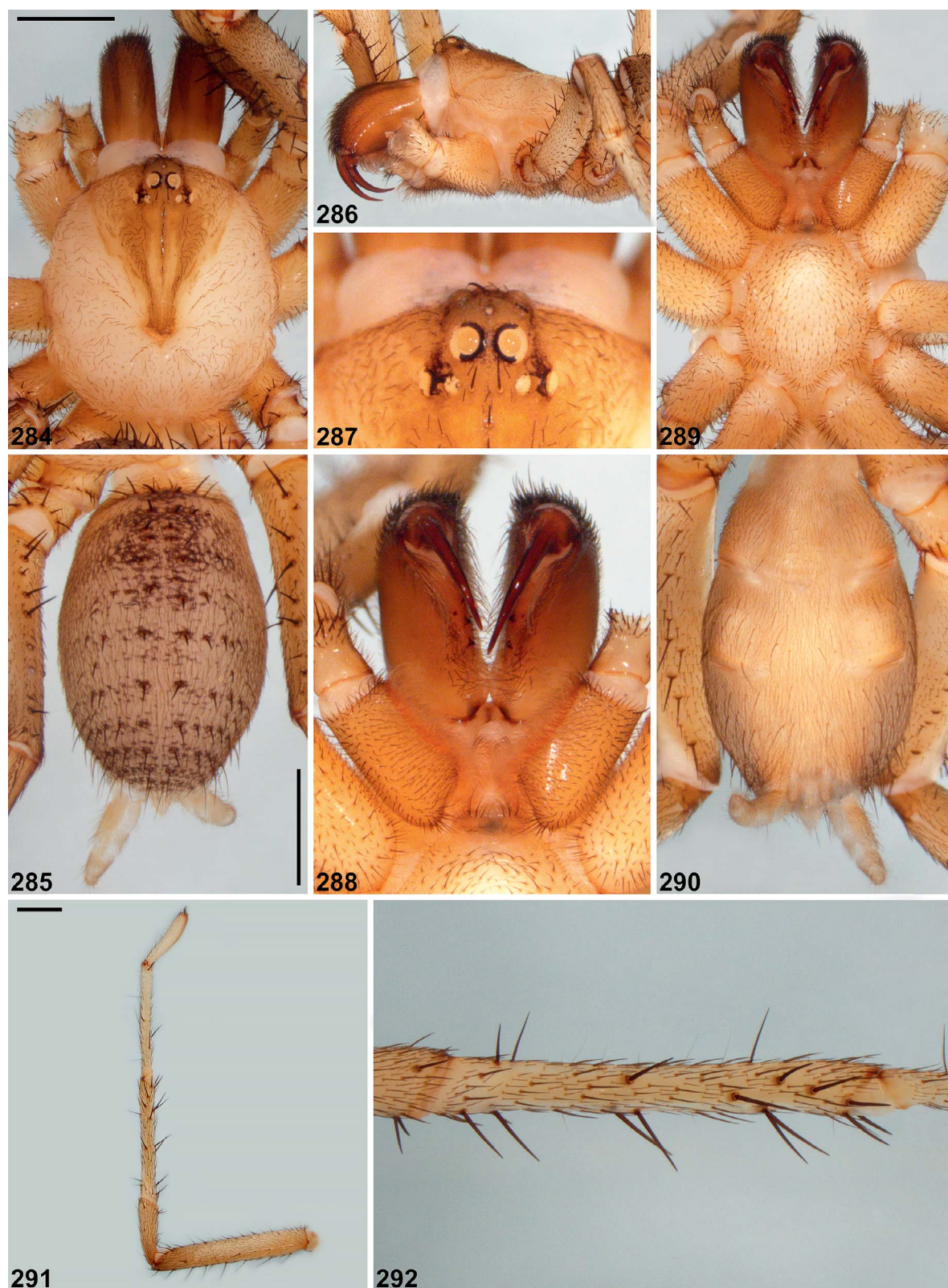


Figure 283.—Map showing collection records of *Bungulla keigheryi* sp. nov. (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.



Figures 284–292.—*Bungulla keirani* sp. nov., male holotype (WAM T142982) from Nanga Station, site NA2 (Western Australia; CAR), somatic morphology: 284–285, carapace and abdomen, dorsal view; 286, cephalothorax, lateral view; 287, eyes, dorsal view; 288, mouthparts, ventral view; 289–290, cephalothorax and abdomen, ventral view; 291, leg I, prolateral view; 292, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 293–295.—*Bungulla keirani* sp. nov., male holotype (WAM T142982) from Nanga Station, site NA2 (Western Australia; CAR), pedipalp: 293, retrolateral view; 294, retro-ventral view; 295, prolateral view. Scale bar = 2.0 mm.

CALM Survey (WAM T142939); 2 ♂, Francois Peron National Park, site PE3 (IBRA_CAR), 25°49'14.1"S, 113°32'24.3"E, wet pitfall trap, 24 May–30 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98652); 2 ♂, Zuytdorp Nature Reserve, site ZU2 (IBRA_GES),

27°15'41"S, 114°01'47.6"E, wet pitfall trap, 18 May–17 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98646); 1 ♂, same data except 26 August–15 October 1995 (WAM T98647); 1 ♂, Zuytdorp, site ZU1 (IBRA_GES), 27°15'42"S, 114°01'09"E, wet pitfall trap, 18 May–17 August

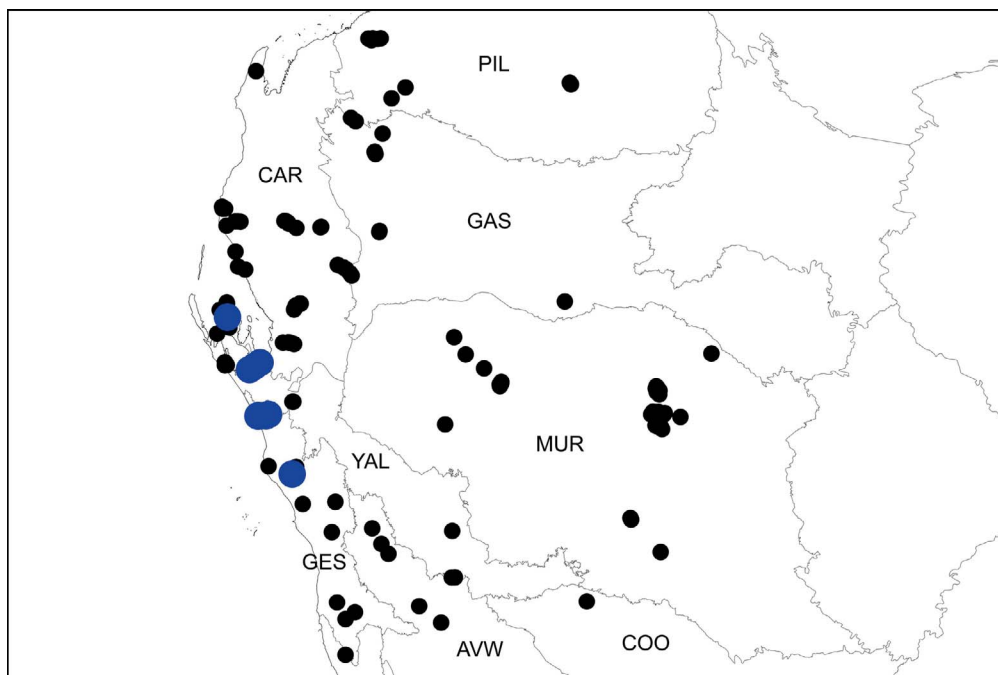


Figure 296.—Map showing collection records of *Bungulla keirani* sp. nov. (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.

1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98644); 1 ♂, same data (WAM T98645); 1 ♂, same data except site ZU3, 27°15'49.9"S, 114°04'13.7"E, 18 May–16 August 1995 (WAM T98648); 3 ♂, same data except site ZU4, 27°15'45.1"S, 114°09'12.9"E (WAM T98649); 4 ♂, same data (WAM T98650); 2 ♂, same data except site ZU5, 27°14'42.9"S, 114°11'36.1"E, 17 May–16 August 1995 (WAM T98651).

Etymology.—This species is named in honor of the late Keiran McNamara (1954–2013), in recognition of his considerable efforts in securing funding for the Biological Survey of the southern Carnarvon Basin (run by the then Department of Conservation and Land Management from 1994–1995), which resulted in the collection of this and numerous other species of *Bungulla*.

Diagnosis.—Males of *Bungulla keirani* can be distinguished from all other known congeners with > 10 retrolateral spinules on the palpal tibia (Fig. 13) – except *B. ajana*, *B. aplini* and *B. mckenziei* – by the shape of the proximal half of the palpal tibia, which is without a pronounced ventral bulge (Fig. 293), combined with the presence of a medial ‘ledge’ on the palpal tibia, this ledge situated closely proximal to the field of retrolateral spinules and bearing a brush of filiform setae (Figs. 293, 294) (palpal tibia is without a ledge or bulges ventrally in other species). *Bungulla keirani* can be further distinguished from *B. ajana* by the shape of the palpal tibia, which is longer, less bulbous and less strongly arched dorsally (Fig. 293; cf. Fig. 46); and from *B. aplini* and *B. mckenziei* by the morphology of the cymbial spinules, which are short and thorn-like (Figs. 293–295; cf. Figs. 59–61, 332–334). Females are unknown.

Description (male holotype).—Total length 13.3. Carapace 5.5 long, 4.8 wide. Abdomen 5.3 long, 3.6 wide. Carapace (Fig. 284) pale tan, with darker pars cephalica, darker olive-brown lyre-like pattern on pars cephalica and slightly darker ocular region; postero-lateral corners near abdomen each with pair of correct black setae; fovea straight. Eye group (Fig. 287) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide, PLE–PLE/ALE–ALE ratio 1.6; ALE separated by their own diameter; AME separated by less than their own diameter; PME separated by 3.5 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 288); labium without cuspules. Abdomen (Fig. 285) oval, sandy-beige in dorsal view with darker olive-brown markings anteriorly and seven pairs of thin, spotted, faint olive-brown chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 285) with sparse arrangement of stiff, correct black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 291, 292) variable shades of tan, with light scopulae on tarsi I–II; metatarsus I and tarsus I lighter in color; tibia I heavily spinose, without prolateral clasping spurs. Leg I: femur 7.0; patella 3.1; tibia 5.5; metatarsus 5.2; tarsus 2.8; total 23.5. Leg I femur–tarsus/carapace length ratio 4.3. Pedipalpal tibia (Figs. 293–295) relatively long, 2.4 x longer than wide, with small medial ‘ledge’ bearing a brush of filiform setae; field of retrolateral spinules rectangular in shape, positioned distally (distal to medial ledge), consisting of 20 spinules of largely similar length; RTA absent. Cymbium

(Figs. 293–295) setose, with field of short, correct, thorn-like spinules covering most of dorsal surface. Embolus (Figs. 293–295) as long as bulb, relatively straight, with unmodified tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla keirani* (formerly known by WAM identification code ‘MYG155’) is a large species with a relatively restricted distribution in the northern Geraldton Sandplains, north-western Yalgoo and southern Carnarvon bioregions of Western Australia, from Zuytdorp north to the Peron Peninsula (Fig. 296). Nothing is known of the biology of this species, other than that known male specimens were collected wandering in search of females in winter or possibly late autumn.

Bungulla kendricki Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:2F87D1B8-EE30-4917-9C97-E1D526365891>

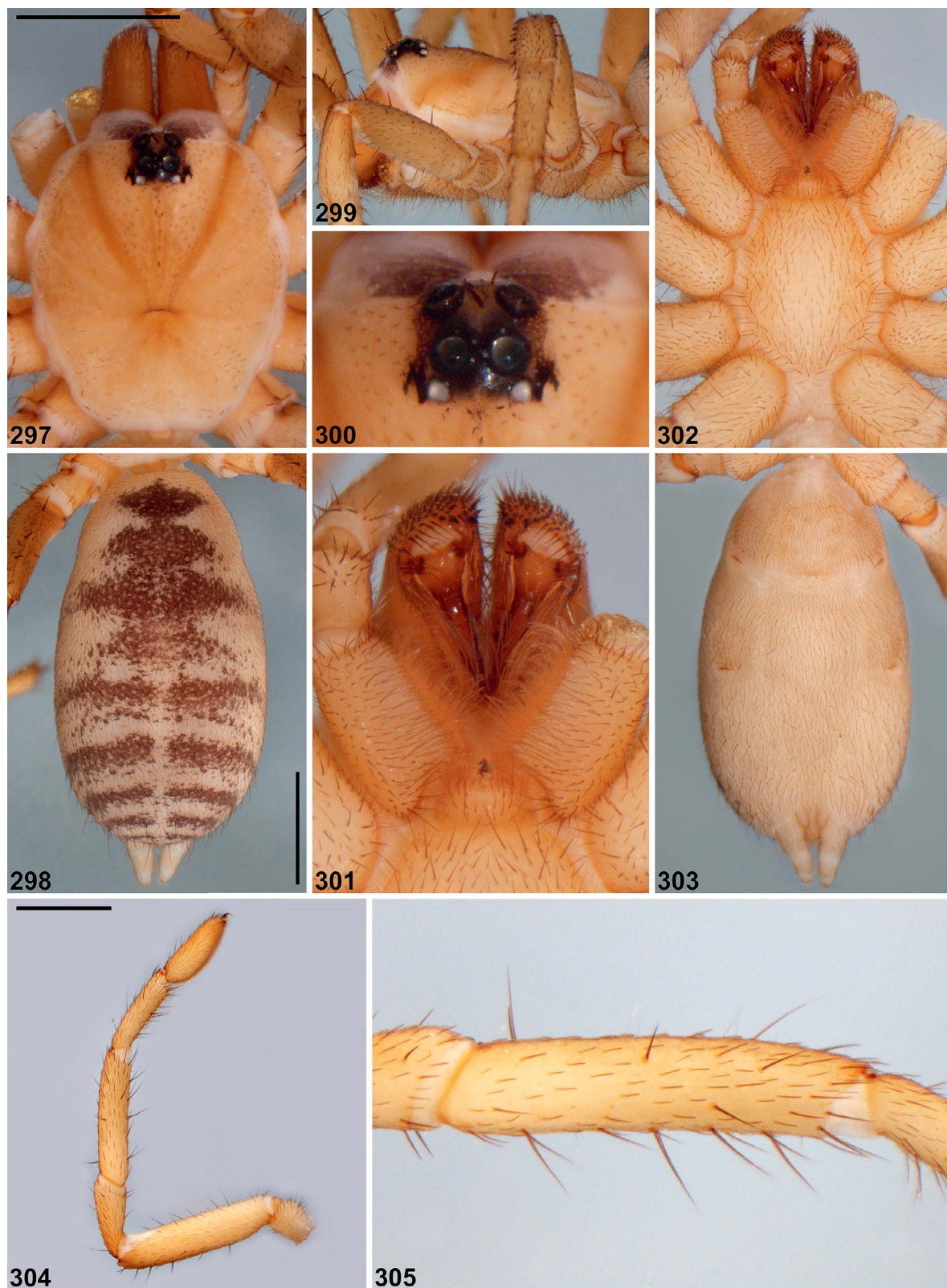
(Figs. 13, 297–309)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Barlee Range Nature Reserve, quadrat 7 (IBRA_GAS), 23°22'45"S, 115°52'50"E, wet pitfall trap, August 1993, S. van Leeuwen & B. Bromilow (WAM T98565).

Paratypes. AUSTRALIA: *Western Australia*: 1 ♂, Barlee Range Nature Reserve, quadrat 6 (IBRA_GAS), 23°23'21"S, 115°53'12"E, wet pitfall trap, June 1994, S. van Leeuwen & B. Bromilow (WAM T44352); 1 ♂, same data except site BRNR5, Emu Spring Creek, 23°24'41"S, 115°53'39"E, dry pitfall trap, open *Acacia citrinoviridis*/*Eucalyptus terminalis* woodland, 11–14 June 1994, P.G. Kendrick & G.W. Kendrick (WAM T31149); 1 ♂, same data except site BRNR7, Snappy Gum Hills, 23°22'45"S, 115°52'50"E, *Eucalyptus leucophloeia* woodland over *Triodia* (WAM T31150); 1 ♂, same data except site BRNR8, Snakewood on Cracking Clays, 23°22'31"S, 115°52'57"E, *Acacia ziphophylla* over sparse *Triodia* (WAM T31151).

Etymology.—This species is named in honor of the late George Kendrick (1929–2014), for collecting a number of the paratypes of this species, and in recognition of his contributions to the study of fossil invertebrates.

Diagnosis.—Males of *Bungulla kendricki* can be distinguished from all other known congeners with > 10 retrolateral spinules on the palpal tibia (Fig. 13) – except *B. biota*, *B. burbridgei*, *B. dipsodes*, *B. keigheryi*, *B. sampeyae* and *B. westi* – by the shape of the proximal half of the palpal tibia, which has a pronounced RTA-like ventral bulge in retrolateral view (Fig. 306) (palpal tibia is piriform and unmodified in other species). *Bungulla kendricki* can be further distinguished from *B. biota* by the shape of the embolus, which is without a truncate tip (Figs. 306, 307; cf. Fig. 108); from *B. burbridgei* by the absence of dagger-like spinules at the apex of the RTA-like bulge (Fig. 306; cf. Fig. 134); from *B. keigheryi* by the broadly-rounded shape of the RTA-like bulge (Fig. 306; cf. Fig. 280); from *B. sampeyae* by the coloration of the dorsal abdomen, which is bi-colored (i.e., pale tan in color with dark anterior markings and dark posterior chevrons) (Fig. 298; cf. Fig. 398 and Supplementary File 1); from *B. dipsodes* by the shape of the palpal tibia, which is strongly arched dorsally, with a ‘pistol-like’ profile in retrolateral view (Fig. 306; cf. Fig. 147); and from *B. westi* by the absence of spinules on the disto-dorsal



Figures 297–305.—*Bungulla kendricki* sp. nov., male holotype (WAM T98565) from Barlee Range Nature Reserve (Western Australia; GAS), somatic morphology: 297–298, carapace and abdomen, dorsal view; 299, cephalothorax, lateral view; 300, eyes, dorsal view; 301, mouthparts, ventral view; 302–303, cephalothorax and abdomen, ventral view; 304, leg I, prolateral view; 305, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 306–308.—*Bungulla kendricki* sp. nov., male holotype (WAM T98565) from Barlee Range Nature Reserve (Western Australia; GAS), pedipalp: 306, retrolateral view; 307, retro-ventral view; 308, prolateral view. Scale bar = 2.0 mm.

margin of the palpal tibia (Figs. 306–308; cf. Fig. 432). Females are unknown.

Description (male holotype).—Total length 11.6. Carapace 3.6 long, 3.0 wide. Abdomen 6.7 long, 3.8 wide. Carapace (Fig.

297) pale tan with mostly black ocular region; fovea slightly recurved. Eye group (Fig. 300) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide, PLE–PLE/ALE–ALE ratio 1.3; ALE separated by nearly their own diameter;

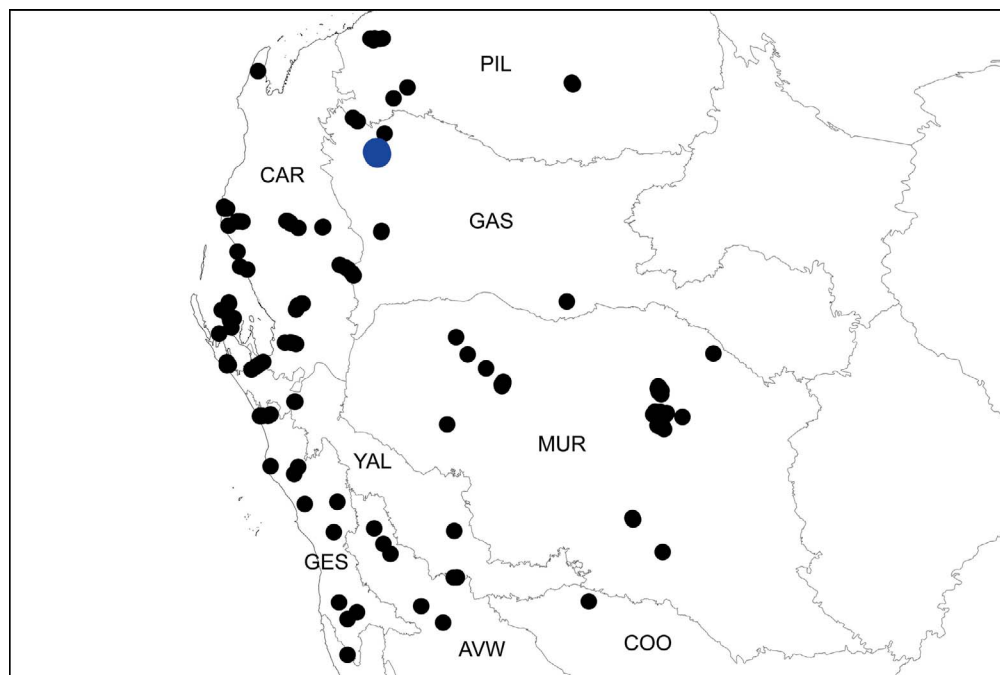


Figure 309.—Map showing collection records of *Bungulla kendricki* sp. nov. (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.

AME separated by less than their own diameter; PME separated by 2.7 x their own diameter; PME and PLE separated by slightly less than diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 301); labium without cuspules. Abdomen (Fig. 298) elongate-oval, beige-tan in dorsal view with contrasting pattern of four darker brown markings anteriorly and five pairs of thin brown chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 298) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 304, 305) variable shades of pale tan, with light scopulae on incrassate tarsi I–II; tibia I largely aspinose, without prolateral clasping spurs. Leg I: femur 3.3; patella 1.8; tibia 2.7; metatarsus 2.0; tarsus 1.6; total 11.5. Leg I femur–tarsus/carapace length ratio 3.2. Pedipalpal tibia (Figs. 306–308) stout, bulbous and strongly arched dorsally, with ‘pistol-like’ profile in retrolateral view, 1.6 x longer than wide, with rounded RTA-like ventral bulge proximally; field of retrolateral spinules broadly crescent-shaped, positioned medially (on and adjacent to RTA-like bulge), consisting of ca. 40 spinules, the latter longest at apex of RTA-like bulge; RTA absent. Cymbium (Figs. 306–308) setose, with field of porrect, thorn-like spinules covering most of dorsal surface. Embolus (Figs. 306–308) slightly longer than bulb, strongly curved, with slightly expanded tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla kendricki* (formerly known by WAM identification code ‘MYG154’) is known only from the Barlee Range, in the north-western Gascoyne bioregion of Western Australia (Fig. 309). Nothing is known of the biology of this species, other than that the known male specimens were collected wandering in search of females in winter.

Bungulla laevigata Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:D8198EBB-C26F-4DFB-92A6-F3545B93B4FC>

(Figs. 13, 310–322)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Nanga Station, site NA1 (IBRA_CAR), 26°28'40.2"S, 114°04'33.6"E, wet pitfall trap, 11 May–30 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T143001).

Paratypes. AUSTRALIA: *Western Australia*: 2 ♂, same data as holotype (WAM T142994); 3 ♂, same data (WAM T142995).

Etymology.—The specific epithet is derived from the Latin ‘laevigatus’ (adjective: ‘smooth’; see Brown 1956), in reference to the glabrous morphology of the carapace of this species.

Diagnosis.—Males of *Bungulla laevigata* can be distinguished from all other known congeners with > 10 retrolateral spinules on the palpal tibia (Fig. 13) – except *B. banksia*, *B. bertmaini*, *B. bidgemia*, *B. hamelinensis*, *B. iota*, *B. quobba*, *B. weld* and *B. yeni* – by the shape of the proximal half of the palpal tibia, which is without a pronounced ventral bulge (Fig. 319), combined with the absence of a medial ‘ledge’ on the palpal tibia (Figs. 319, 320) (palpal tibia is with a ledge or bulges ventrally in other species). *Bungulla laevigata* can be further distinguished from *B. banksia*, *B. bidgemia*, *B. iota*, *B.*

hamelinensis, *B. weld* and *B. yeni* by the shape of the embolus, which is relatively long (i.e., longer than the bulb) (Fig. 319; cf. Figs. 72, 95, 218, 267, 419, 445); from *B. quobba* by the shape of the embolus, which is slightly longer and more strongly curved in standard retrolateral view (Fig. 319; cf. Fig. 371); and from *B. bertmaini* by the morphology of the pars cephalica, which is glabrous with relatively few setae (Fig. 310; cf. Fig. 15), combined with the lighter ‘sandy’ coloration of the dorsal abdomen (Fig. 311; cf. Fig. 16 and Supplementary File 1). Females are unknown.

Description (male holotype).—Total length 8.7. Carapace 3.6 long, 2.9 wide. Abdomen 3.9 long, 2.5 wide. Carapace (Fig. 310) pale tan, with slightly darker pars cephalica, pale olive-brown lyre-like pattern on pars cephalica and slightly darker ocular region; fovea slightly procurved. Eye group (Fig. 313) trapezoidal (anterior eye row strongly procurved), 0.9 x as long as wide, PLE–PLE/ALE–ALE ratio 1.4; ALE separated by nearly their own diameter; AME separated by less than their own diameter; PME separated by 2.9 x their own diameter; PME and PLE separated by slightly less than diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 314); labium without cuspules. Abdomen (Fig. 311) oval, sandy-beige in dorsal view with faint charcoal-brown mottling and faint posterior chevrons. Dorsal surface of abdomen (Fig. 311) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 317, 318) variable shades of tan, with light scopulae on tarsi I–II; tibia I spinose, without prolateral clasping spurs. Leg I: femur 4.0; patella 1.7; tibia 3.0; metatarsus 2.9; tarsus 2.0; total 13.6. Leg I femur–tarsus/carapace length ratio 3.8. Pedipalpal tibia (Figs. 319–321) 2.2 x longer than wide; field of retrolateral spinules oval in shape, positioned medially, consisting of 18 spinules, the latter longest proximally; RTA absent. Cymbium (Figs. 319–321) setose, with field of relatively short, porrect, thorn-like spinules covering most of dorsal surface. Embolus (Figs. 319–321) ca. 1.5 x length of bulb, slightly curved, with unmodified tip; embolic apophysis absent.

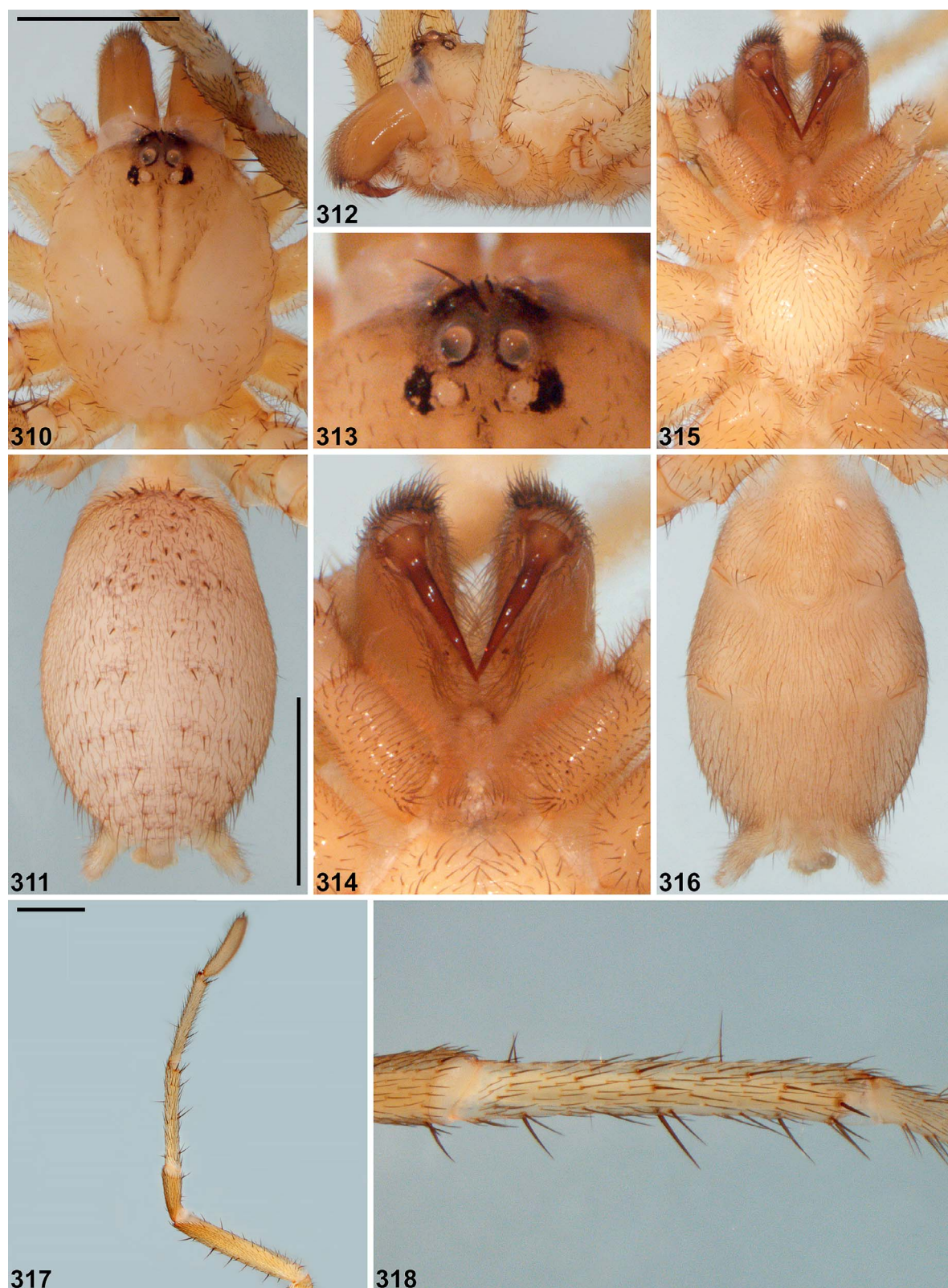
Distribution and remarks.—*Bungulla laevigata* is a rare and highly restricted species known only from Nanga Station, in the far southern Carnarvon (Wooramel) bioregion of Western Australia (Fig. 322). The type and only known locality of this species is situated on an unusual, near-tidal sandplain at the far southern tip of the Hamelin Pool Marine Reserve, 13 km south-west of Hamelin Pool. This site is also home to the similarly restricted species *B. hamelinensis*. Nothing else is known of the biology of *B. laevigata*, other than that the known male specimens were collected wandering in search of females in winter or possibly late autumn.

Bungulla mckenziei Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:B2489421-A09A-457D-A25F-24C6B17CC1C6>

(Figs. 13, 323–335)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Zuytdorp, site ZU5 (IBRA_GES), 27°14'42.9"S, 114°11'36.1"E, wet pitfall trap, 17 May–16 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T142978).



Figures 310–318.—*Bungulla laevigata* sp. nov., male holotype (WAM T143001) from Nanga Station (Western Australia; CAR), somatic morphology: 310–311, carapace and abdomen, dorsal view; 312, cephalothorax, lateral view; 313, eyes, dorsal view; 314, mouthparts, ventral view; 315–316, cephalothorax and abdomen, ventral view; 317, leg I, prolateral view; 318, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 319–321.—*Bungulla laevigata* sp. nov., male holotype (WAM T143001) from Nanga Station (Western Australia; CAR), pedipalp: 319, retrolateral view; 320, retro-ventral view; 321, prolateral view. Scale bar = 2.0 mm.

Paratypes. AUSTRALIA: *Western Australia*: 3 ♂, same data as holotype (WAM T98556).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Zuytdorp Nature Reserve, site ZU2 (IBRA_GES), 27°15'41"S, 114°01'47.6"E, wet pitfall trap, 18 May–17 August

1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98528); 1 ♂, Zuytdorp, site ZU1 (IBRA_GES), 27°15'42"S, 114°01'09"E, wet pitfall trap, 19 May–17 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98554); 2 ♂, same data except site ZU3, 27°15'49.9"S, 114°04'13.7"E, 18

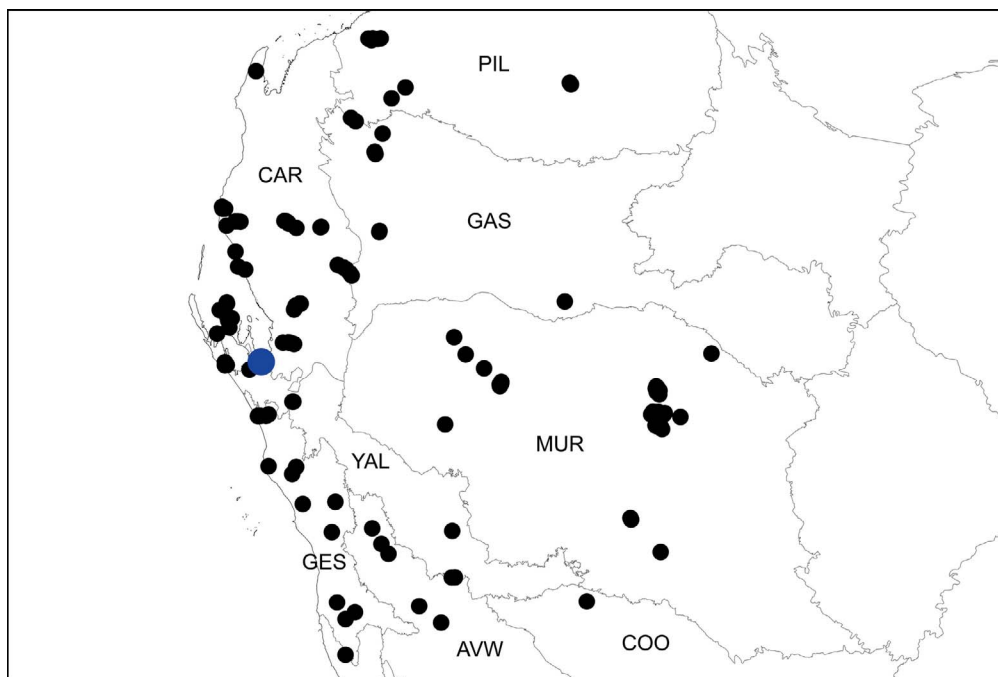


Figure 322.—Map showing collection records of *Bungulla laevigata* sp. nov. (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.



Figures 323–331.—*Bungulla mckenziei* sp. nov., male holotype (WAM T142978) from Zuytdorp (Western Australia; GES), somatic morphology: 323–324, carapace and abdomen, dorsal view; 325, cephalothorax, lateral view; 326, eyes, dorsal view; 327, mouthparts, ventral view; 328–329, cephalothorax and abdomen, ventral view; 330, leg I, prolateral view; 331, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 332–334.—*Bungulla mckenziei* sp. nov., male holotype (WAM T142978) from Zuytdorp (Western Australia; GES), pedipalp: 332, retrolateral view; 333, retro-ventral view; 334, prolateral view. Scale bar = 2.0 mm.

May–16 August 1995 (WAM T98527); 1 ♂, same data except site ZU4, 27°15'45.1"S, 114°09'12.9"E, 19 May–16 August 1995 (WAM T98555); 1 ♂, Cape Lesueur, North Peron Peninsula (IBRA_CAR), 25°43'S, 113°25'E, pitfall trap, 4 August 1989, G. Harold (WAM T22313); 1 ♂, Edel Land

(IBRA_YAL), 26°03'45"S, 113°22'30"E, 15–20 September 1989, G. Harold (WAM T22819); 1 ♂, Edel Land, site EL2 (IBRA_YAL), 26°31'39"S, 113°31'40"E, wet pitfall trap, 9 May–30 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98557); 1 ♂, False Entrance Well, near stone

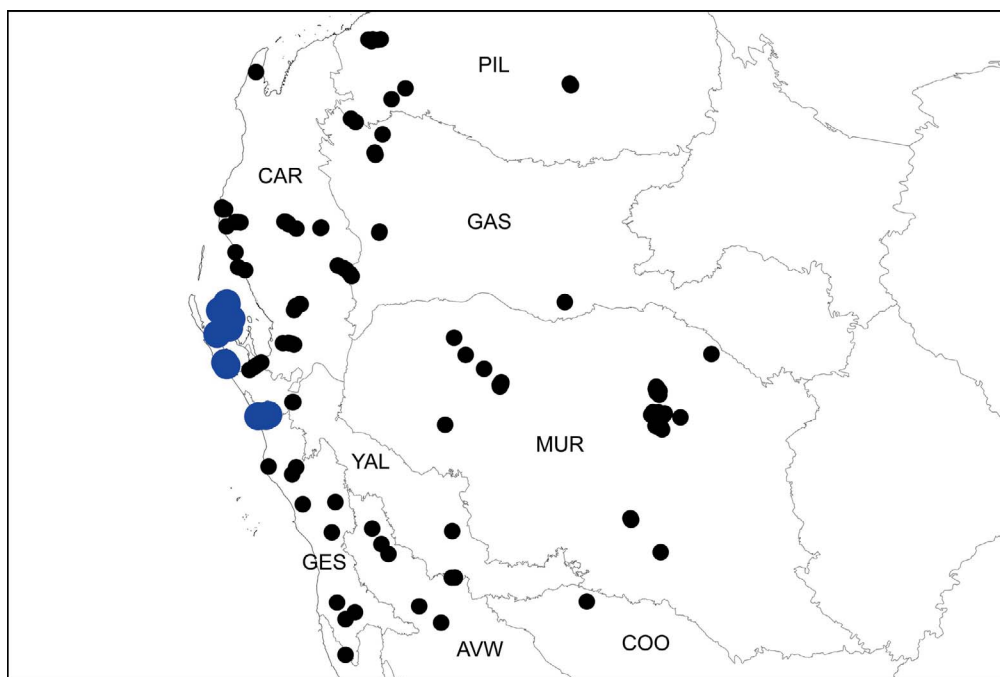


Figure 335.—Map showing collection records of *Bungulla mckenziei* sp. nov. (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.

tank, Carrarang Station, W. side of Shark Bay (IBRA_YAL), 26°29'S, 113°30'E, pitfall trap, 31 May–2 June 1980, D. King & J.D. Roberts (WAM T142980); 1 ♂, Francois Peron National Park, site PE2 (IBRA_CAR), 25°52'30.9"S, 113°32'59.0"E, wet pitfall trap, 25 May–30 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98558); 1 ♂, same data (WAM T98559); 2 ♂, same data except site PE3, 25°49'14.1"S, 113°32'24.3"E (WAM T98560); 1 ♂, same data except 24 August–11 October, A. Sampey et al., WAM/CALM Carnarvon Survey (WAM T133857); 1 ♂, same data except site PE4, 25°50'20.0"S, 113°36'23.1"E, 23 May–30 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98561); 1 ♂, same data except site PE5, 25°58'33.6"S, 113°34'14.7"E, 26 May–30 August 1995 (WAM T98526); 1 ♂, Herald Bight (IBRA_CAR), 25°37'30"S, 113°31'50"E, pitfall trap, 30 July 1989, G. Harold (WAM T22820); 1 ♂, same data (WAM T22821); 1 ♂, same data except 25°36'30"S, 113°31'40"E (WAM T27096).

Etymology.—This species is named in honor of Norm McKenzie, in recognition of his contributions to the Southern Carnarvon Basin Survey (Burbidge et al. 2000) and to the study of Australian biodiversity.

Diagnosis.—Males of *Bungulla mckenziei* can be distinguished from all other known congeners with > 10 retrolateral spinules on the palpal tibia (Fig. 13) – except *B. ajana*, *B. aplini* and *B. keirani* – by the shape of the proximal half of the palpal tibia, which is without a pronounced ventral bulge (Fig. 332), combined with the presence of a medial 'ledge' on the palpal tibia, this ledge situated closely proximal to the field of retrolateral spinules and bearing a brush of filiform setae (Figs. 332, 333) (palpal tibia is without a ledge or bulges ventrally in other species). *Bungulla mckenziei* can be further distinguished from *B. ajana* by the shape of the palpal tibia, which is longer, less bulbous and less strongly arched dorsally (Fig. 332; cf. Fig. 46); from *B. keirani* by the morphology of the cymbial spinules, which are poorly developed and more filiform (Figs. 332–334; cf. Figs. 293–295); and from *B. aplini* by the shape of the palpal tibia, which is broader proximally (Fig. 332; cf. Fig. 59), combined with the presence of a crescent-shaped field of spinules distally (Fig. 332; cf. Fig. 59). Females are unknown.

Description (male holotype).—Total length 9.8. Carapace 4.1 long, 3.2 wide. Abdomen 4.2 long, 2.6 wide. Carapace (Fig. 323) tan, with slightly darker pars cephalica, darkened lateral rims and mostly black ocular region; postero-lateral corners near abdomen each with pair of porrect black setae; fovea straight. Eye group (Fig. 326) trapezoidal (anterior eye row strongly procurved), 0.9 x as long as wide, PLE–PLE/ALE–ALE ratio 1.6; ALE separated by ca. half their own diameter; AME separated by less than their own diameter; PME separated by 3.5 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 327); labium without cuspules. Abdomen (Fig. 324) oval, sandy-beige in dorsal view with darker brown-black markings anteriorly and six pairs of thin, spotted, brown-black chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 324) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 330, 331)

variable shades of tan, with light scopulae on tarsi I–II; metatarsus I and tarsus I lighter in color; tibia I heavily spinose, without prolateral clasping spurs. Leg I: femur 3.8; patella 1.7; tibia 3.1; metatarsus 2.9; tarsus 1.8; total 13.4. Leg I femur–tarsus/carapace length ratio 3.3. Pedipalpal tibia (Figs. 332–334) relatively long, 2.3 x longer than wide, with small medial 'ledge' bearing a brush of filiform setae; field of retrolateral spinules crescent-shaped, positioned distally (separated from retro-ventral margin in retrolateral view), consisting of ca. 60 spinules of largely similar length; RTA absent. Cymbium (Figs. 332–334) setose, with field of relatively poorly developed (almost filiform) spinules covering most of dorsal surface. Embolus (Figs. 332–334) as long as bulb, strongly curved, with unmodified tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla mckenziei* (formerly known by WAM identification codes 'MYG134' and 'MYG135') has a relatively restricted distribution in the northern Geraldton Sandplains, Yalgoo and southern Carnarvon bioregions of Western Australia, from Zuytdorp north to the Peron Peninsula (Fig. 335). Nothing is known of the biology of this species, other than that the known male specimens were collected wandering in search of females in winter, spring and possibly late autumn.

Bungulla oraria Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:84F1D51F-FE7E-4DB5-9240-7500AD4E4BE7>

(Figs. 12, 336–348)

Bungulla sp. 'Torndirrup National Park' Rix et al., 2017d: 603, figs 146–147, 151, 154, 157.

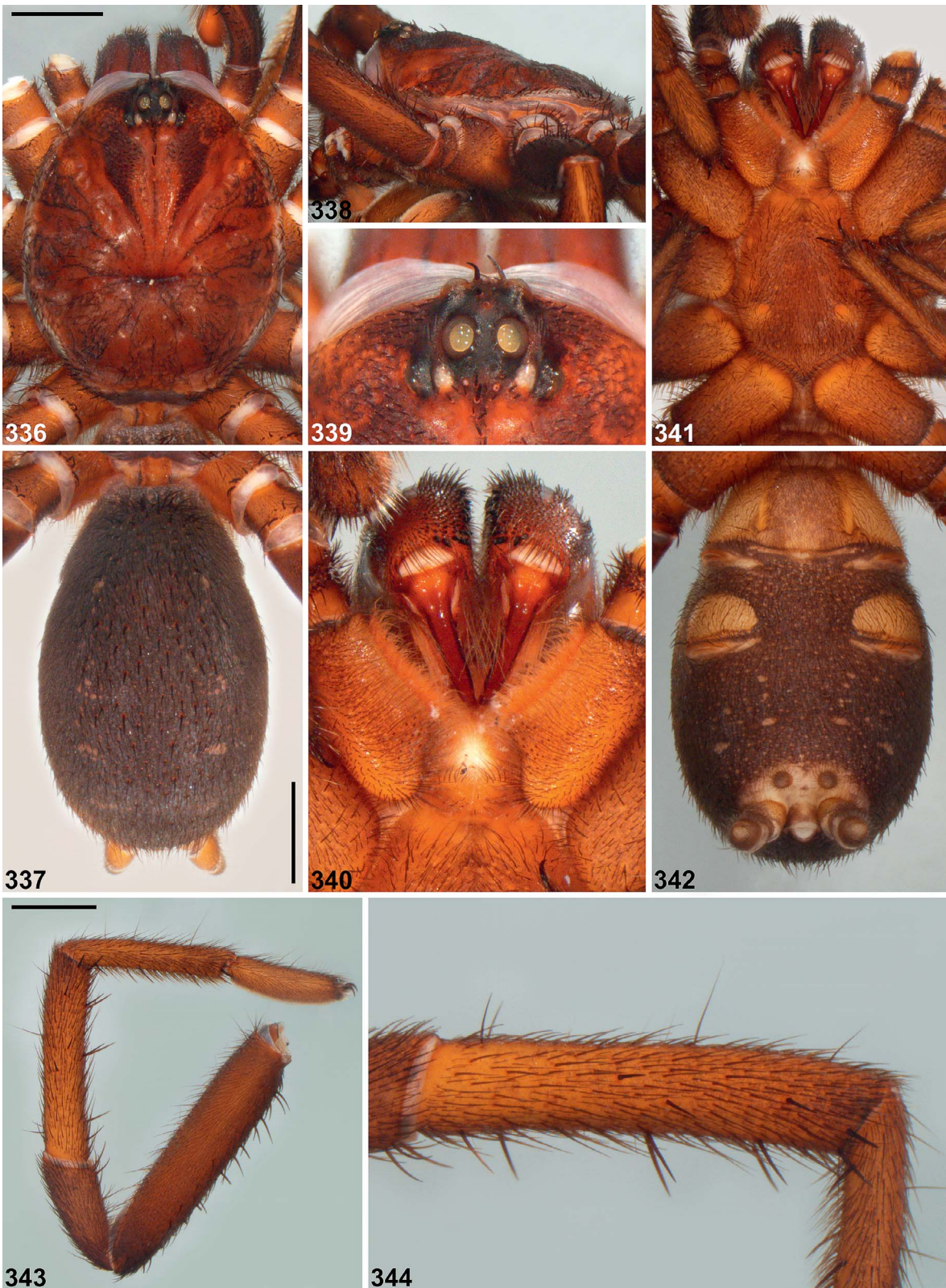
Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Torndirrup National Park (IBRA_WAR), 35°06'S, 117°52'E, pitfall trap, 1983, P. Dyon & J. Lyon (WAM T139595).

Paratype. AUSTRALIA: *Western Australia*: 1 ♂, same data as holotype (WAM T142945).

Etymology.—The specific epithet is derived from the Latin 'orarius' (adjective: 'of the coast'; see Brown 1956), in reference to the coastal distribution of this species at Torndirrup National Park.

Diagnosis.—Males of *Bungulla oraria* can be distinguished from all other known congeners with < 5 retrolateral spinules on the palpal tibia (Fig. 12) – except *B. disrupta*, *B. fusca*, *B. hillyerae*, *B. inermis* and *B. parva* – by the shape of the cymbial spinules, which are curved, anteriorly-directed and restricted to the distal half of the cymbium (Figs. 345–347) (spinules are porrect, thorn-like, and cover most of the dorsal surface of the cymbium in other species). *Bungulla oraria* can be further distinguished from *B. parva* by its larger body size (carapace width ≥ 4.5) (Fig. 336; cf. Fig. 349); from *B. hillyerae* and *B. inermis* by the darker carapace coloration (depending on the state of preservation; see Supplementary File 1) (Fig. 336; cf. Figs. 232, 245); and from *B. disrupta* and *B. fusca* by the shape of the palpal tibia, which is sub-rectangular in retrolateral view, with a strongly concave disto-ventral margin (Fig. 345; cf. Figs. 160, 195).

Description (male holotype).—Total length 15.3. Carapace 7.1 long, 5.7 wide. Abdomen 7.2 long, 4.5 wide. Carapace (Fig.



Figures 336–344.—*Bungulla oraria* sp. nov., male holotype (WAM T139595) from Torndirrup National Park (Western Australia; WAR), somatic morphology: 336–337, carapace and abdomen, dorsal view; 338, cephalothorax, lateral view; 339, eyes, dorsal view; 340, mouthparts, ventral view; 341–342, cephalothorax and abdomen, ventral view; 343, leg I, prolateral view; 344, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 345–347.—*Bungulla oraria* sp. nov., male holotype (WAM T139595) from Torndirrup National Park (Western Australia; WAR), pedipalp: 345, retrolateral view; 346, retro-ventral view; 347, prolateral view. Scale bar = 2.0 mm.

336) dark chocolate-brown, with darker brown lyre-like pattern on pars cephalica and black ocular region; fovea straight. Eye group (Fig. 339) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide, PLE–PLE/ALE–

ALE ratio 1.8; ALE separated by nearly their own diameter; AME separated by less than their own diameter; PME separated by 3.0 x their own diameter; PME and PLE separated by slightly less than diameter of PME, PME

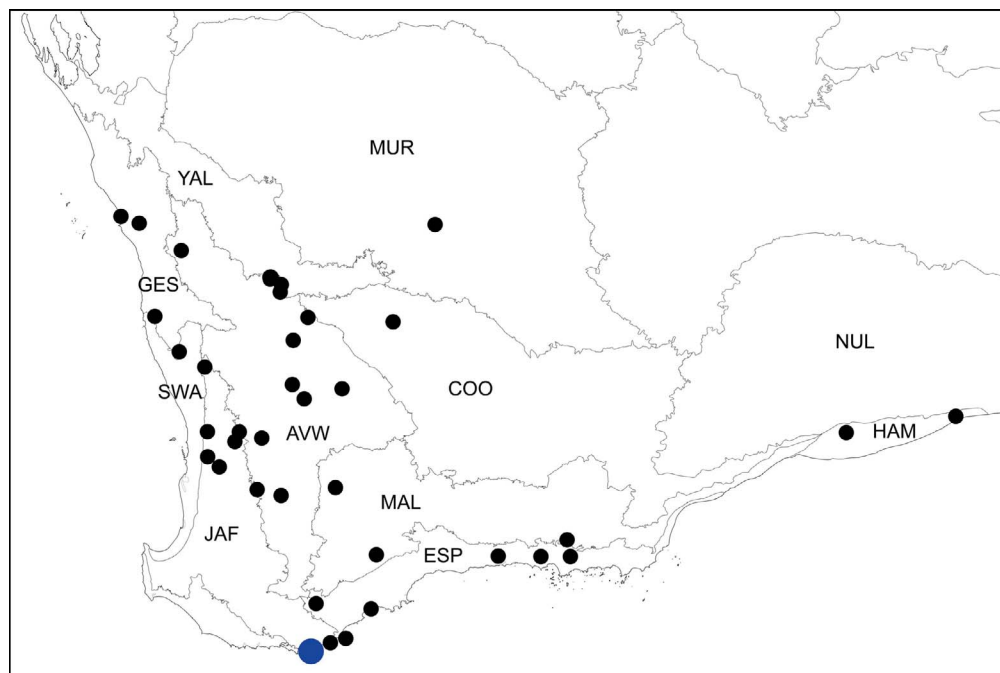


Figure 348.—Map showing collection records of *Bungulla oraria* sp. nov. (large blue circles), relative to other taxa with < 5 retrolateral spinules on the male palpal tibia (see Fig. 12). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; COO, Coolgardie; ESP, Esperance Plains; GES, Geraldton Sandplains; HAM, Hampton; JAF, Jarrah Forest; MAL, Mallee; MUR, Murchison; NUL, Nullarbor; SWA, Swan Coastal Plain; YAL, Yalgoo.

positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 340); labium without cuspules. Abdomen (Fig. 337) oval, dark brown-black in dorsal view with faint beige-tan mottling, two pairs of small beige-tan sigilla spots and two indistinct pairs of beige-tan chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 337) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 343, 344) variable shades of dark tan on tibiae–tarsi, with slightly darker brown femora–patellae and light scopulae on tarsi I–II; tibia I spinose, without prolateral clasping spurs. Leg I: femur 6.5; patella 3.2; tibia 4.8; metatarsus 4.2; tarsus 2.6; total 21.2. Leg I femur–tarsus/carapace length ratio 3.0. Pedipalpal tibia (Figs. 345–347) sub-rectangular, 2.0 x longer than wide, without retrolateral spinules; RTA absent. Cymbium (Figs. 345–347) setose, with field of curved, anteriorly-directed spine-like spinules restricted to distal half of segment. Embolus (Figs. 345–347) slightly longer than bulb, slightly curved, with unmodified tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla oraria* is a rare and highly restricted species known only from the Torndirrup Peninsula, near Albany (Western Australia) (Fig. 348). Nothing is known of the biology of this species.

Bungulla parva Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:D1ED4C2C-E5CE-4D3C-9ECD-5DA27B92F4A7>

(Figs. 12, 349–361)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Mount Cooke (IBRA_JAF), 32°25'S, 116°18'E, hand collected, 31 July 1991, M.S. Harvey & J.M. Waldock (WAM T27102).

Paratypes. AUSTRALIA: *Western Australia*: 1 ♂, same data as holotype (WAM T27104); 1 ♂, same data (WAM T27105).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, ALCOA minesite and forests, N. and NW. of Jarrahdale (IBRA_JAF), 32°16'S, 116°06'E, 1 March–1 August 1993, S.J. Simmonds (WAM T31782).

Etiymology.—The specific epithet is derived from the Latin 'parvus' (adjective: 'little'; see Brown 1956), in reference to the very small size of this species.

Diagnosis.—Males of *Bungulla parva* can be distinguished from all other known congeners with < 5 retrolateral spinules on the palpal tibia (Fig. 12) – except *B. disrupta*, *B. fusca*, *B. hillyerae*, *B. inermis* and *B. oraria* – by the shape of the cymbial spinules, which are curved, anteriorly-directed and restricted to the distal half of the cymbium (Figs. 358–360) (spinules are porrect, thorn-like, and cover most of the dorsal surface of the cymbium in other species). *Bungulla parva* can be further distinguished from *B. disrupta*, *B. fusca*, *B. hillyerae*, *B. inermis* and *B. oraria* by its very small body size, with a carapace width of < 2.5 (Fig. 349; cf. Figs. 151, 186, 232, 245, 336). Females are unknown.

Description (male holotype).—Total length 6.2. Carapace 2.9 long, 2.3 wide. Abdomen 2.9 long, 2.1 wide. Carapace (Fig. 349) chocolate-brown, with darker pars cephalica and black ocular region; fovea straight. Eye group (Fig. 352) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide,

PLE–PLE/ALE–ALE ratio 1.4; ALE separated by ca. half their own diameter; AME separated by less than their own diameter; PME separated by 3.9 x their own diameter; PME and PLE separated by slightly less than diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 353); labium without cuspules. Abdomen (Fig. 350) oval, dark olive-brown in dorsal view with beige-tan mottling, two pairs of beige-tan sigilla spots and four pairs of beige-tan chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 350) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 356, 357) variable shades of tan, with light scopulae on semi-incrassate tarsi I–II; tibia I largely aspinose, without prolateral clasping spurs. Leg I: femur 2.3; patella 1.2; tibia 1.8; metatarsus 1.3; tarsus 1.0; total 7.7. Leg I femur–tarsus/carapace length ratio 2.7. Pedipalpal tibia (Figs. 358–360) nearly 2.0 x longer than wide, without retrolateral spinules; RTA absent. Cymbium (Figs. 358–360) setose, with field of curved, anteriorly-directed spine-like spinules restricted to distal half of segment. Embolus (Figs. 358–360) twice length of bulb, relatively straight, with unmodified tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla parva* (formerly known by WAM identification code 'MYG151') is known only from the northern Jarrah Forest bioregion of south-western Australia, from Jarrahdale south to Mount Cooke (Fig. 361). Nothing is known of the biology of this small and extremely rare species, other than that the known male specimens were collected wandering in search of females in winter, spring and possibly autumn.

Bungulla quobba Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:8F3279ED-4910-4F24-9EA2-C55B869A03D0>

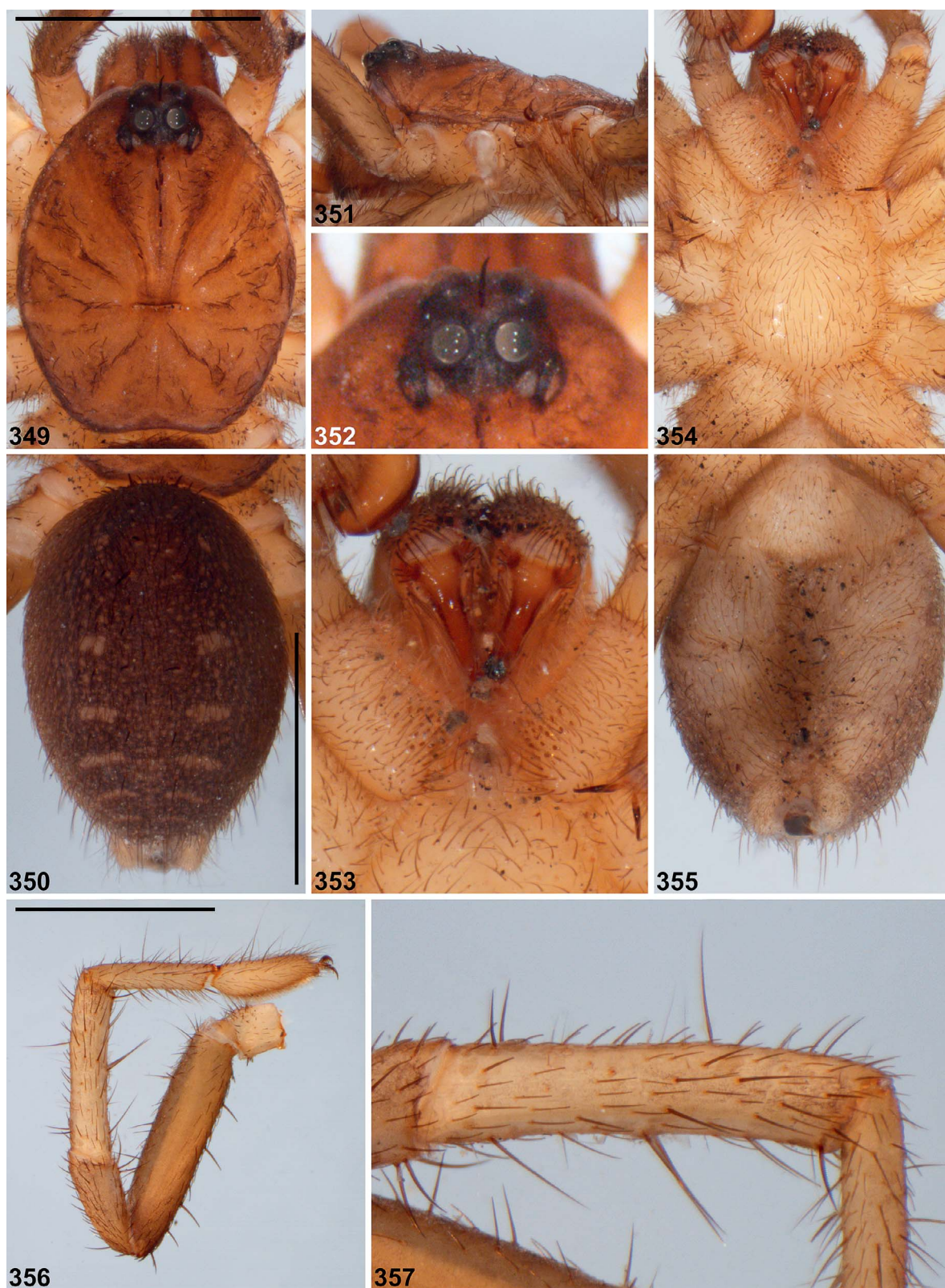
(Figs. 13, 362–374)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Cape Cuvier, Quobba Station, site CU4 (IBRA_CAR), 24°13'27.1"S, 113°27'40.8"E, wet pitfall trap, 30 May–24 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T142996).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Cape Cuvier, Quobba Station, site CU3 (IBRA_CAR), 24°13'25.3"S, 113°29'30.7"E, wet pitfall trap, 30 May–24 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T142998); 1 ♂, same data except site CU5, 24°11'34.0"S, 113°27'17.4"E, 29 May–25 August 1995 (WAM T142997).

Etiymology.—The specific epithet is a noun in apposition, in reference to the type locality of this species.

Diagnosis.—Males of *Bungulla quobba* can be distinguished from all other known congeners with > 10 retrolateral spinules on the palpal tibia (Fig. 13) – except *B. banksia*, *B. bertmaini*, *B. bidgemia*, *B. hamelinensis*, *B. iota*, *B. laevigata*, *B. weld* and *B. yeni* – by the shape of the proximal half of the palpal tibia, which is without a pronounced ventral bulge (Fig. 371), combined with the absence of a medial 'ledge' on the palpal tibia (Figs. 371, 372) (palpal tibia is with a ledge or bulges ventrally in other species). *Bungulla quobba* can be further distinguished from



Figures 349–357.—*Bungulla parva* sp. nov., male holotype (WAM T27102) from Mount Cooke (Western Australia; JAF), somatic morphology: 349–350, carapace and abdomen, dorsal view; 351, cephalothorax, lateral view; 352, eyes, dorsal view; 353, mouthparts, ventral view; 354–355, cephalothorax and abdomen, ventral view; 356, leg I, prolateral view; 357, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 358–360.—*Bungulla parva* sp. nov., male holotype (WAM T27102) from Mount Cooke (Western Australia; JAF), pedipalp: 358, retrolateral view; 359, retro-ventral view; 360, prolateral view. Scale bar = 2.0 mm.

B. banksia, *B. bidgemia*, *B. iota*, *B. hamelinensis*, *B. weld* and *B. yeni* by the shape of the embolus, which is relatively long (i.e., longer than the bulb) (Fig. 371; cf. Figs. 72, 95, 218, 267, 419, 445); and from *B. bertmaini* and *B. laevigata* by the

shape of the embolus, which is slightly shorter and relatively straight in standard retrolateral view (Fig. 371; cf. Figs. 24, 319), combined with the shape of the palpal tibia, which is extended distally (distal to spinules), with a strongly concave

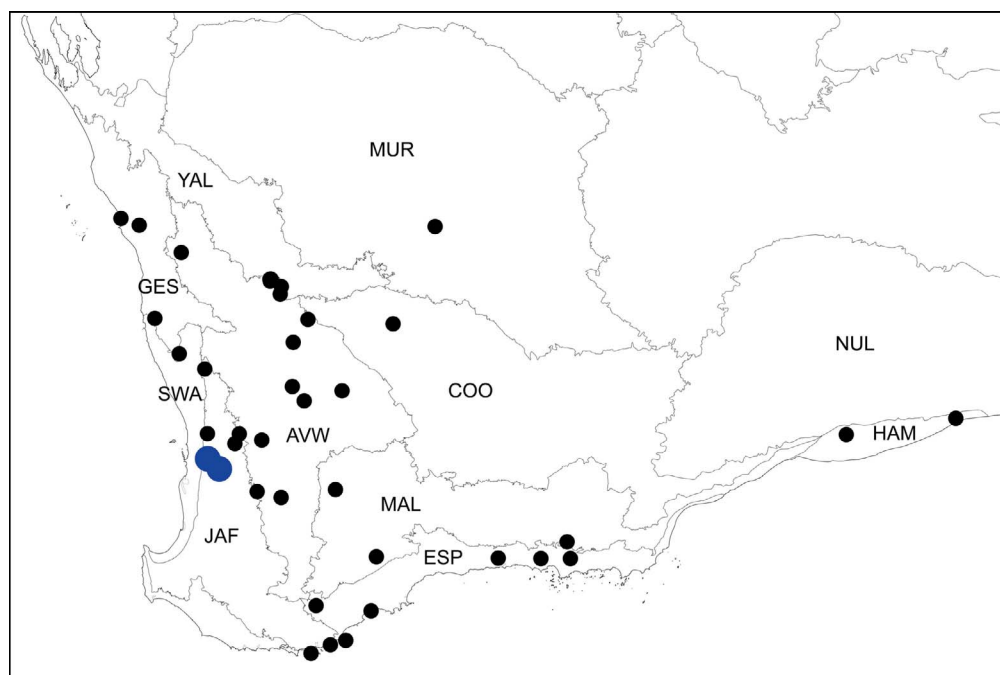
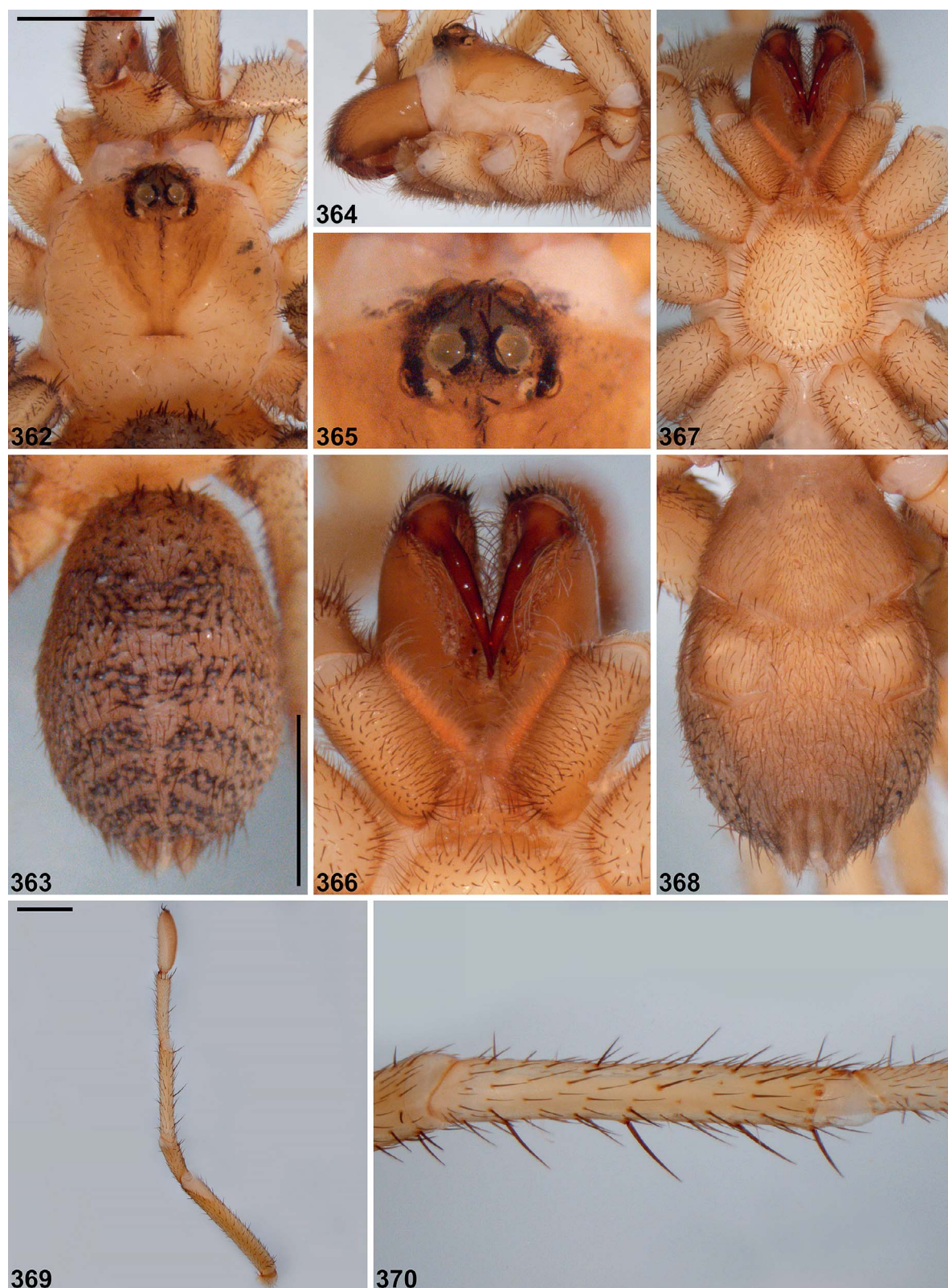


Figure 361.—Map showing collection records of *Bungulla parva* sp. nov. (large blue circles), relative to other taxa with < 5 retrolateral spinules on the male palpal tibia (see Fig. 12). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; COO, Coolgardie; ESP, Esperance Plains; GES, Geraldton Sandplains; HAM, Hampton; JAF, Jarrah Forest; MAL, Mallee; MUR, Murchison; NUL, Nullarbor; SWA, Swan Coastal Plain; YAL, Yalgoo.



Figures 362–370.—*Bungulla quobba* sp. nov., male holotype (WAM T142996) from Cape Cuvier, Quobba Station (Western Australia; CAR), somatic morphology: 362–363, carapace and abdomen, dorsal view; 364, cephalothorax, lateral view; 365, eyes, dorsal view; 366, mouthparts, ventral view; 367–368, cephalothorax and abdomen, ventral view; 369, leg I, prolateral view; 370, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 371–373.—*Bungulla quobba* sp. nov., male holotype (WAM T142996) from Cape Cuvier, Quobba Station (Western Australia; CAR), pedipalp: 371, retrolateral view; 372, retro-ventral view; 373, prolateral view. Scale bar = 2.0 mm.

disto-ventral margin in retrolateral view (Fig. 371; cf. Figs. 24, 319). Females are unknown.

Description (male holotype).—Total length 10.0. Carapace 3.8 long, 3.3 wide. Abdomen 4.2 long, 2.9 wide. Carapace (Fig.

362) pale tan, with darker pars cephalica, darker tan lyre-like pattern on pars cephalica and mostly grey-black ocular region; fovea straight. Eye group (Fig. 365) trapezoidal (anterior eye row strongly procurved), 0.7 x as long as wide, PLE–PLE/

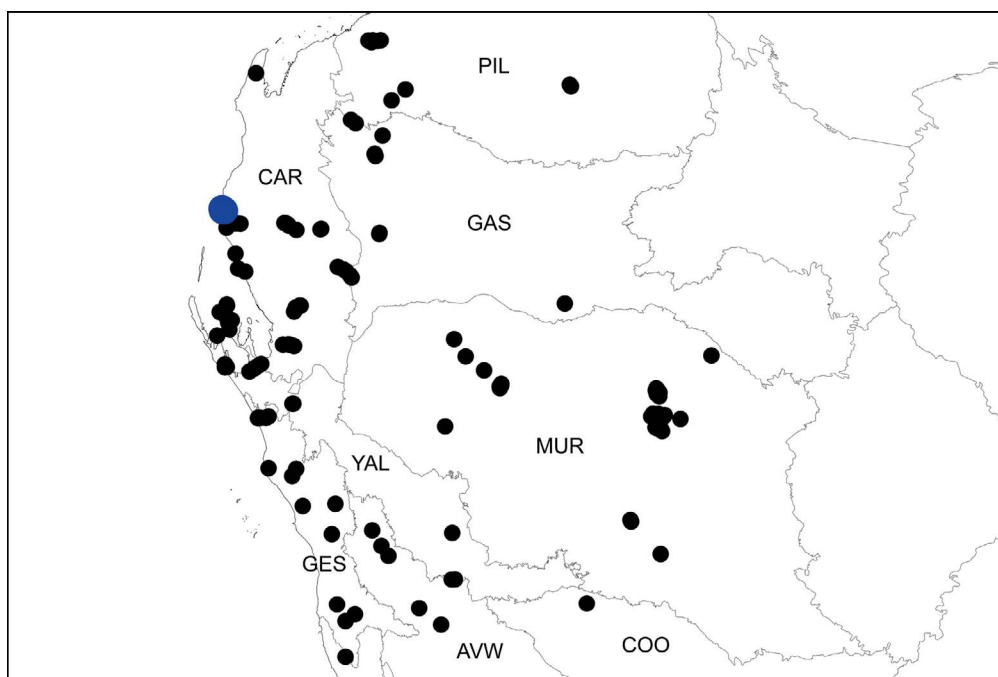


Figure 374.—Map showing collection records of *Bungulla quobba* sp. nov. (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.

ALE–ALE ratio 1.5; ALE separated by ca. their own diameter; AME separated by less than their own diameter; PME separated by 4.3 x their own diameter; PME and PLE separated by diameter of PME, PME positioned slightly posterior to level of PLE. Maxillae and labium without cuspules (Fig. 366). Abdomen (Fig. 363) oval, sandy-tan in dorsal view with darker brown-black markings anteriorly and five pairs of spotted, brown-black chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 363) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 369, 370) variable shades of tan, with light scopulae on tarsi I–II; tibia I spinose, without prolateral clasp spurs. Leg I: femur 4.3; patella 1.9; tibia 3.3; metatarsus 2.5; tarsus 2.1; total 14.2. Leg I femur–tarsus/carapace length ratio 3.7. Pedipalpal tibia (Figs. 371–373) nearly 2.0 x longer than wide; field of retrolateral spinules oval in shape, positioned medially, consisting of 18 spinules, the latter longest proximally; RTA absent. Cymbium (Figs. 371–373) setose, with field of spine-like spinules covering most of dorsal surface. Embolus (Figs. 371–373) ca. 1.5 x length of bulb, relatively straight, with unmodified tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla quobba* is known only from Quobba Station, on the Cuvier Peninsula north of Carnarvon (Western Australia) (Fig. 374). Nothing is known of the biology of this species, other than that the known male specimens were collected wandering in search of females in winter or possibly late autumn.

Bungulla riparia (Main, 1957)
(Figs. 12, 375–396)

Eucyrtops riparius Main, 1957: 419, figs 3A, 4D–F, 7B, 8A (NB. figs 5D, 8D, 8E probably not conspecific).

Bungulla riparia (Main): Rix et al., 2017d: 607, figs 150, 155, 156.

Type material.—*Holotype female*. AUSTRALIA: *Western Australia*: 1 mile S. of Mount Misery, W. of Moora (IBRA_GES), 30°42'S, 115°37'E, 26 May 1954, B.Y. Main (WAM T3961; examined).

Paratype. AUSTRALIA: *Western Australia*: 1 ♂, same data as holotype except 5 April 1956 (WAM T17708).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Mount Misery, W. of Moora (IBRA_GES), 30°42'S, 115°37'E, 5 April 1956, B.Y. Main (WAM T139594); 1 ♂, same data (WAM T142933); 1 ♂, same data (WAM T142934); 1 ♂, same data (WAM T142935); 1 ♂, same data (WAM T142936); 1 ♂, Mount Lesueur (IBRA_GES), 30°10'S, 115°12'E, pitfall trap, 1989, K. Gaul (WAM T142932).

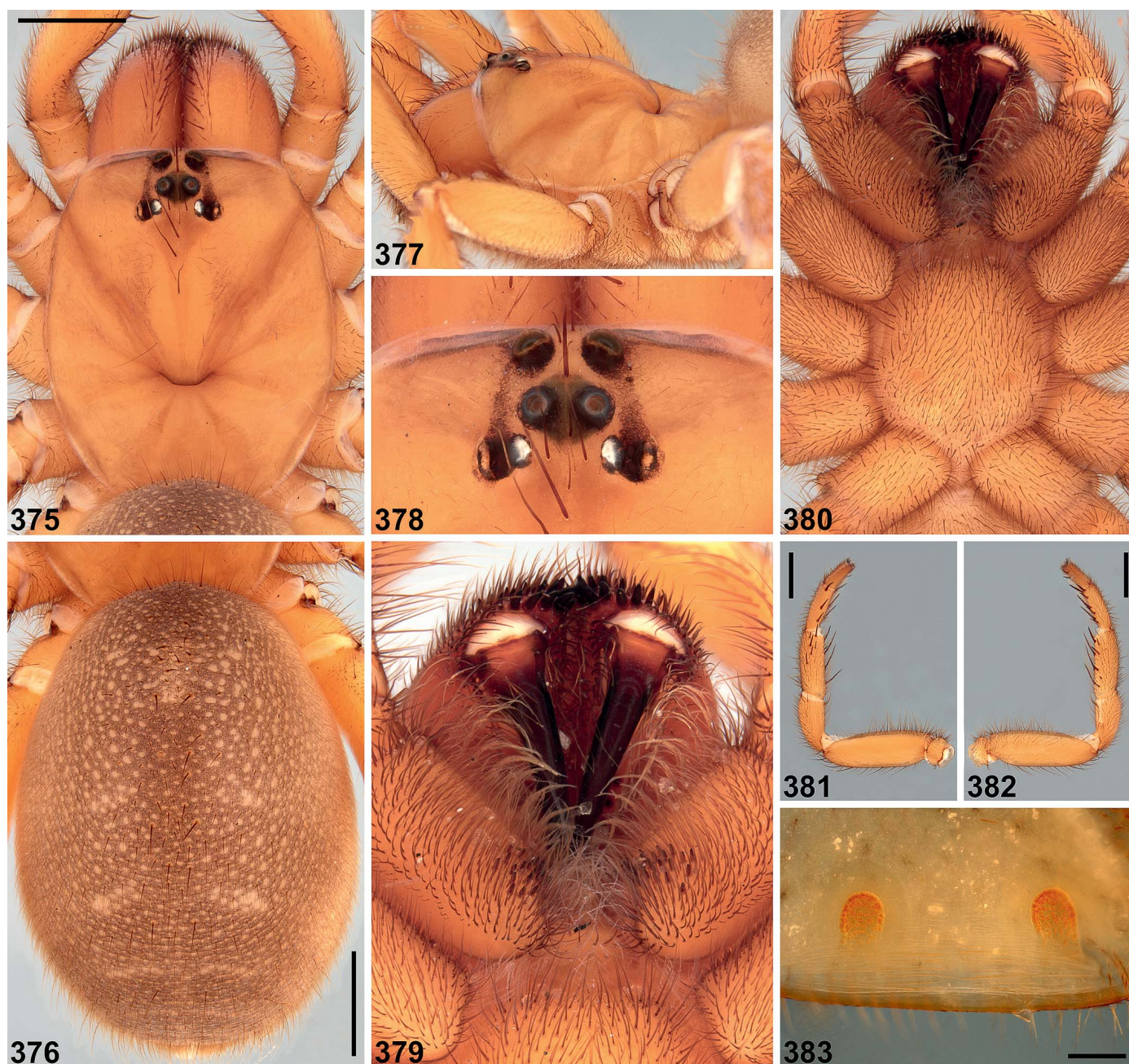
Diagnosis.—Males of *Bungulla riparia* can be distinguished from all other known congeners with < 5 retrolateral spinules on the palpal tibia (Fig. 12) – except *B. bringo* and *B. ferraria* – by the shape of the cymbial spinules, which are porrect, thorn-like, and cover most of the dorsal surface of the cymbium (Figs. 393–395) (spinules more curved, anteriorly-directed and restricted to distal half of cymbium in other species). *Bungulla riparia* can be further distinguished from *B. bringo* by the absence of retrolateral spinules on the palpal tibia (Fig. 393; cf. Figs. 121, 122); and from *B. ferraria* by the presence of ≥ 4

prolateral (medial) spine-like setae on tibia I (Fig. 392; cf. Fig. 181), combined with the shape of the palpal tibia, which is relatively stout, without a strongly concave disto-ventral margin in retrolateral view (Fig. 393; cf. Fig. 182).

Description (female holotype).—Total length 18.7. Carapace 6.5 long, 5.4 wide. Abdomen 10.2 long, 7.5 wide. Carapace (Fig. 375) tan with slightly darker ocular region; fovea strongly procurved. Eye group (Fig. 378) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide, PLE–PLE/ALE–ALE ratio 1.6; ALE separated by nearly their own diameter; AME separated by their own diameter; PME separated by 3.1 x their own diameter; PME and PLE separated by diameter of PME, PME positioned slightly anterior to level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 379); labium without cuspules. Abdomen (Fig. 376) oval, olive-brown in dorsal view, with two pairs of beige sigilla spots, and three pairs of beige chevrons posteriorly, each divided along midline; sclerotized sigilla absent. Legs (Figs. 381, 382) variable shades of tan; thick scopulae present on tarsi and metatarsi I–II; tibia I with 6 stout prolateral macrosetae, 4 retro-ventral spine-like macrosetae and 5 shorter retro-ventral macrosetae; metatarsus I with 3 stout pro-ventral macrosetae and 7 mostly longer retro-ventral macrosetae; tarsus I with distal cluster of 2 stout ventral macrosetae. Leg I: femur 4.6; patella 2.8; tibia 2.8; metatarsus 2.1; tarsus 1.4; total 13.7. Leg I femur–tarsus/carapace length ratio 2.1. Pedipalp tan, spinose on tibia and tarsus, with thick tarsal scopula. Genitalia (Fig. 383) with pair of short, widely spaced, bud-shaped spermathecae.

Description (male WAM T139594).—Total length 12.3. Carapace 5.4 long, 4.4 wide. Abdomen 5.5 long, 3.6 wide. Carapace (Fig. 384) tan, with slightly darker pars cephalica and slightly darker ocular region; postero-lateral corners near abdomen each with marginal cluster of longer black setae; fovea straight. Eye group (Fig. 387) trapezoidal (anterior eye row strongly procurved), 0.9 x as long as wide, PLE–PLE/ALE–ALE ratio 1.4; ALE separated by ca. half their own diameter; AME separated by less than their own diameter; PME separated by 3.9 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 388); labium without cuspules. Abdomen (Fig. 385) oval, dark olive-brown in dorsal view with beige-tan mottling, two pairs of small beige-tan sigilla spots, and three indistinct pairs of beige-tan chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 385) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 391, 392) variable shades of tan, with light scopulae on tarsi I–II; tibia I spinose, without prolateral clasp spurs. Leg I: femur 5.5; patella 2.7; tibia 4.0; metatarsus 3.6; tarsus 2.6; total 18.4. Leg I femur–tarsus/carapace length ratio 3.4. Pedipalpal tibia (Figs. 393–395) stout, 2.0 x longer than wide, without retrolateral spinules; RTA absent. Cymbium (Figs. 393–395) setose, with field of porrect, thorn-like spinules covering most of dorsal surface. Embolus (Figs. 393–395) as long as bulb, slightly curved, with unmodified tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla riparia* has a relatively restricted distribution in the southern Geraldton Sandplains



Figures 375–383.—*Bungulla riparia* (Main, 1957), female holotype (WAM T3961) from S. of Mount Misery, W. of Moora (Western Australia; GES): 375–376, carapace and abdomen, dorsal view; 377, cephalothorax, lateral view; 378, eyes, dorsal view; 379, mouthparts, ventral view; 380, cephalothorax, ventral view; 381, leg I, prolateral view; 382, leg I, retrolateral view; 383, spermathecae, dorsal view. Scale bars = 2.0 mm (375–376, 381–382), 0.5 mm (383).

bioregion of south-western Australia, from Lesueur National Park, south to Mount Misery (Fig. 396). Burrows were documented by Main (1957, pl. 1, fig. 1), who reported collecting specimens from a creek bank, and known male specimens were collected (wandering in search of females or possibly in burrows) in mid- to late autumn.

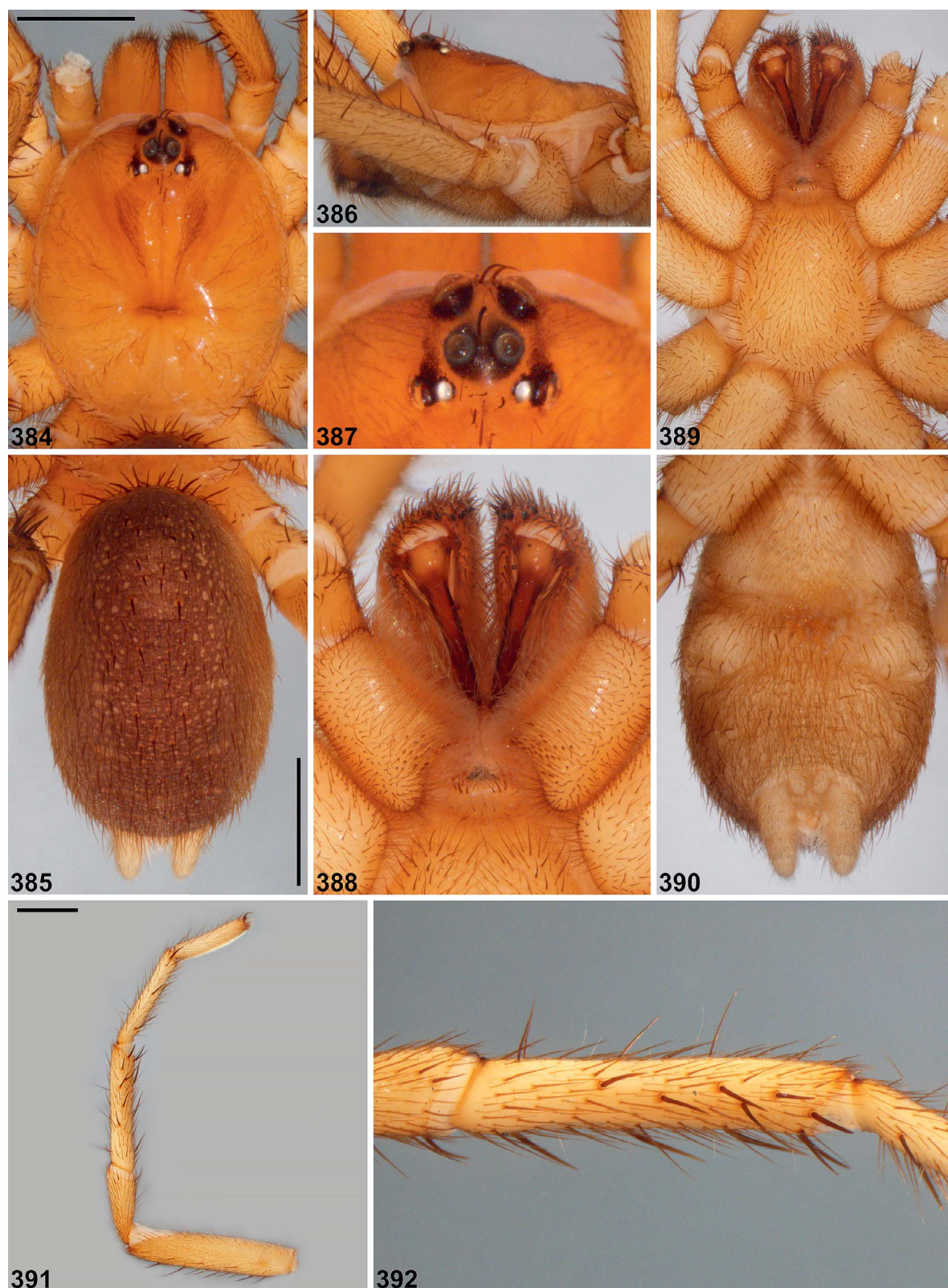
Bungulla sampeyae Rix, Raven & Harvey, sp. nov.

[http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:468B7133-](http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:468B7133-7938-4215-A499-948CF1F78662)

7938-4215-A499-948CF1F78662
(Figs. 13, 397–409)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Zuytdorp, site ZU4 (IBRA_GES), 27°15'45.1"S, 114°09'12.9"E, wet pitfall trap, 18 May–16 August 1995, N. Hall (WAM T98523).

Other material examined.—AUSTRALIA: *Western Australia*: 3 ♂, Edel Land, site EL1 (IBRA_YAL), 26°31'44"S,



Figures 384–392.—*Bungulla riparia* (Main, 1957), male (WAM T139594) from Mount Misery, W. of Moora (Western Australia; GES), somatic morphology: 384–385, carapace and abdomen, dorsal view; 386, cephalothorax, lateral view; 387, eyes, dorsal view; 388, mouthparts, ventral view; 389–390, cephalothorax and abdomen, ventral view; 391, leg I, prolateral view; 392, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 393–395.—*Bungulla riparia* (Main, 1957), male (WAM T139594) from Mount Misery, W. of Moora (Western Australia; GES), pedipalp: 393, retrolateral view; 394, retro-ventral view; 395, prolateral view. Scale bar = 2.0 mm.

113°29'56"E, wet pitfall trap, 9 May–30 August 1995, N. Hall (WAM T98525); 1 ♂, same data except site EL2, 26°31'39"S, 113°31'40"E (WAM T142985); 1 ♂, same data (WAM T142986); 1 ♂, Nanga Station, site NA4 (IBRA_YAL),

26°32'47.3"S, 113°57'47.0"E, wet pitfall trap, 11 May–30 August 1995, N. Hall (WAM T98524).

Etymology.—This species is named in honor of Alison Sampey, in recognition of her herculean efforts in setting and

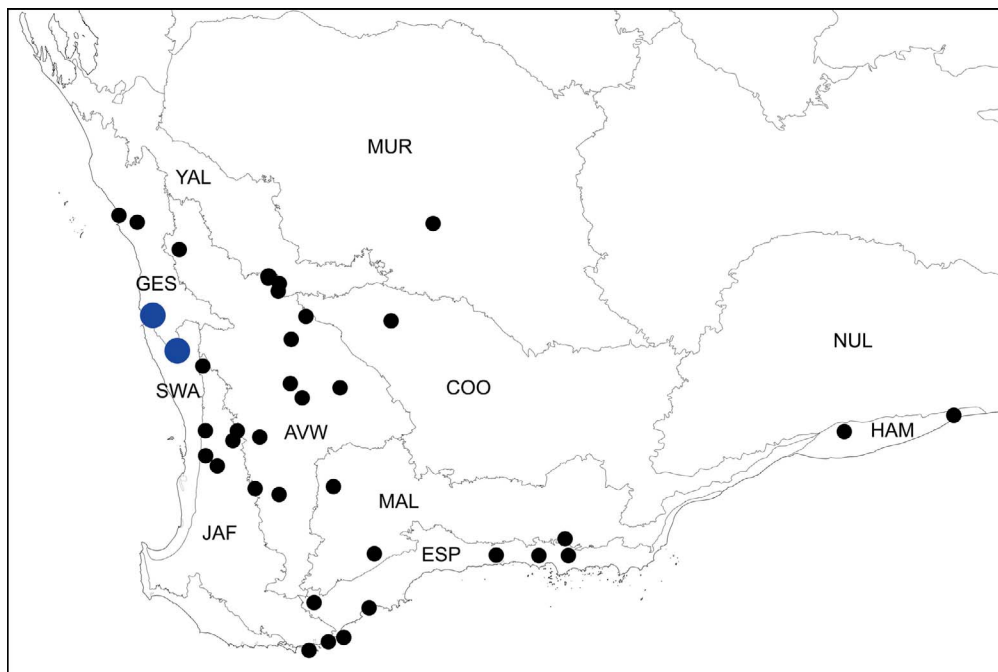
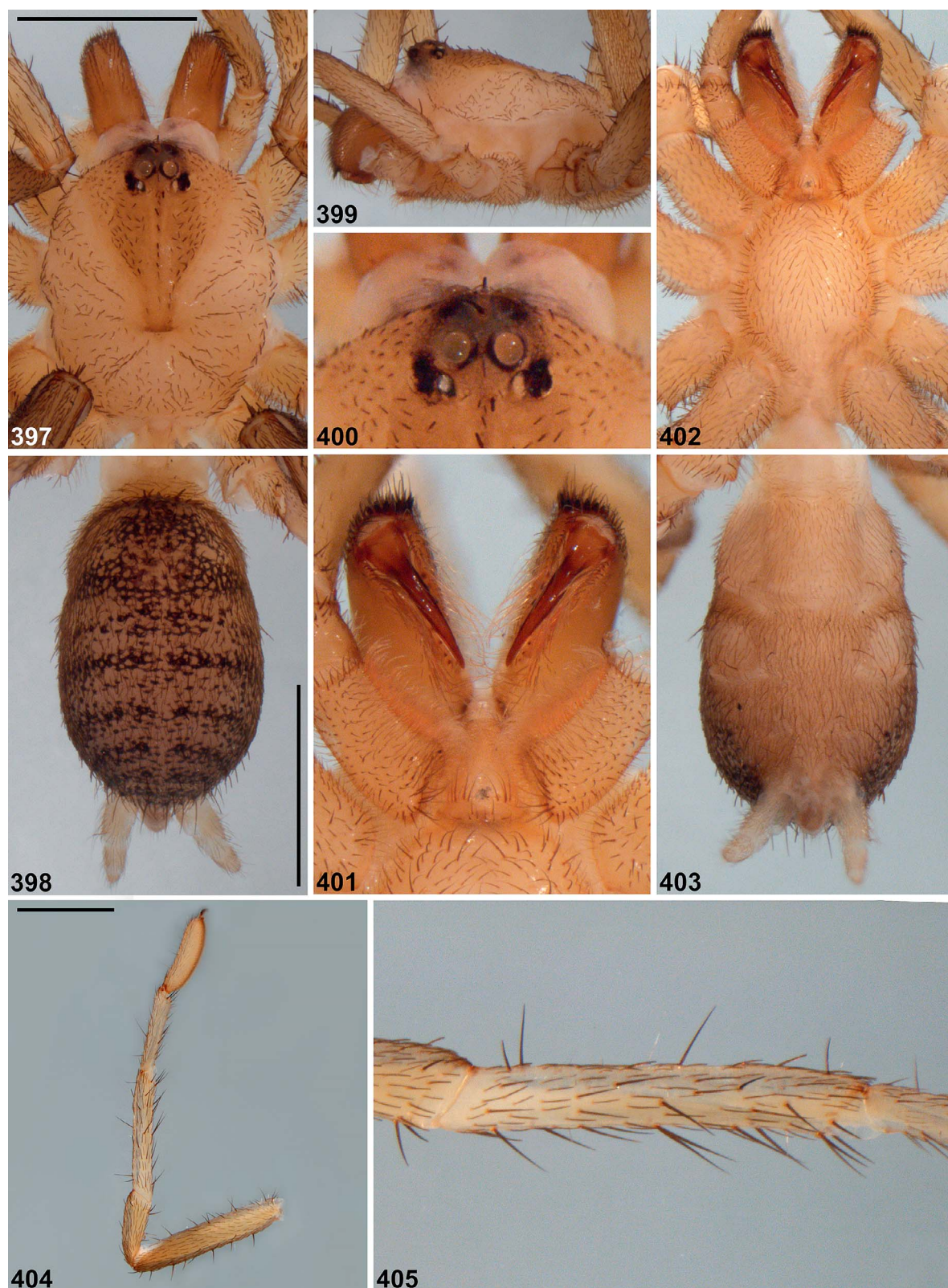


Figure 396.—Map showing collection records of *Bungulla riparia* (Main, 1957) (large blue circles), relative to other taxa with < 5 retrolateral spinules on the male palpal tibia (see Fig. 12). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; COO, Coolgardie; ESP, Esperance Plains; GES, Geraldton Sandplains; HAM, Hampton; JAF, Jarrah Forest; MAL, Mallee; MUR, Murchison; NUL, Nullarbor; SWA, Swan Coastal Plain; YAL, Yalgoo.



Figures 397–405.—*Bungulla sampeyae* sp. nov., male holotype (WAM T98523) from Zuytdorp (Western Australia; GES), somatic morphology: 397–398, carapace and abdomen, dorsal view; 399, cephalothorax, lateral view; 400, eyes, dorsal view; 401, mouthparts, ventral view; 402–403, cephalothorax and abdomen, ventral view; 404, leg I, prolateral view; 405, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 406–408.—*Bungulla sampeyae* sp. nov., male holotype (WAM T98523) from Zuytdorp (Western Australia; GES), pedipalp: 406, retrolateral view; 407, retro-ventral view; 408, prolateral view. Scale bar = 2.0 mm.

monitoring pitfall traps during the Carnarvon Biological Survey (1994–1995), and for assisting in the analysis and publication of the resulting data (see Harvey et al. 2000; Main et al. 2000).

Diagnosis.—Males of *Bungulla sampeyae* can be distinguished from all other known congeners with > 10 retrolateral spinules on the palpal tibia (Fig. 13) – except *B. biota*, *B. burbridgei*, *B. dipsodes*, *B. keigheryi*, *B. kendricki* and *B. westi* – by the shape of the proximal half of the palpal tibia,

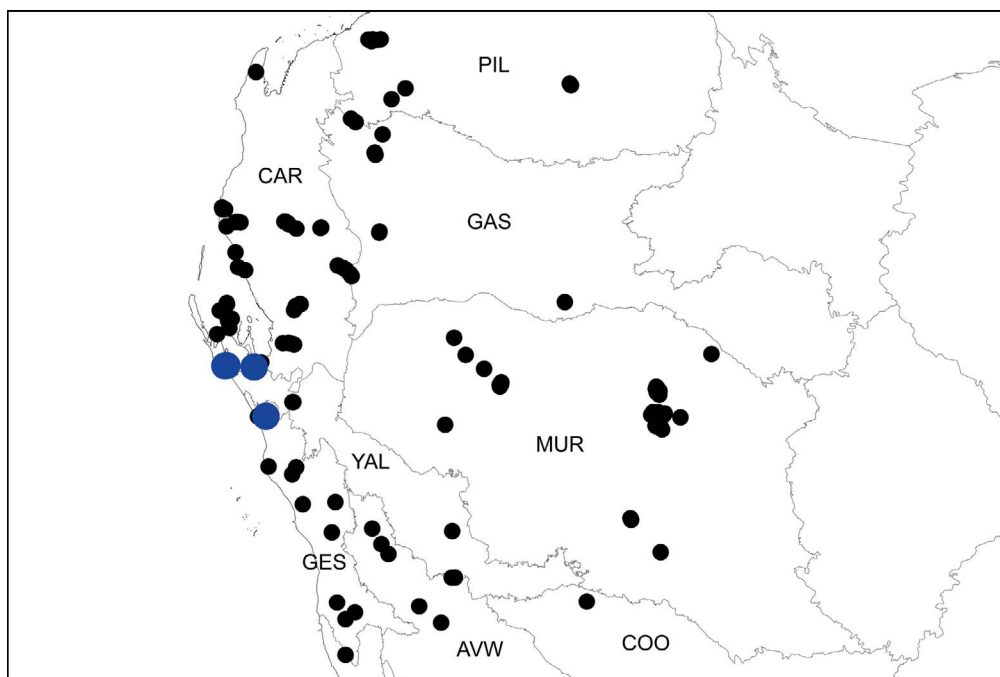


Figure 409.—Map showing collection records of *Bungulla sampeyae* sp. nov. (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.

which has a pronounced RTA-like ventral bulge in retrolateral view (Fig. 406) (palpal tibia is piriform and unmodified in other species). *Bungulla sampeyae* can be further distinguished from *B. biota* by the shape of the embolus, which is without a truncate tip (Figs. 406, 407; cf. Fig. 108); from *B. burbridgei* by the absence of dagger-like spinules at the apex of the RTA-like bulge (Fig. 406; cf. Fig. 134); from *B. keigheryi* by the broadly-rounded shape of the RTA-like bulge (Fig. 406; cf. Fig. 280); from *B. dipsodes* and *B. kendricki* by the coloration of the dorsal abdomen, which is mottled and ‘sandy’ colored with thin chevrons (Fig. 398; cf. Figs. 139, 298 and Supplementary File 1); and from *B. westi* by the absence of spinules on the disto-dorsal margin of the palpal tibia (Figs. 406–408; cf. Fig. 432). Females are unknown.

Description (male holotype).—Total length 7.5. Carapace 3.1 long, 2.6 wide. Abdomen 3.1 long, 2.0 wide. Carapace (Fig. 397) pale tan, with slightly darker pars cephalica, darker tan lyre-like pattern on pars cephalica and slightly darker ocular region; fovea straight. Eye group (Fig. 400) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide, PLE–PLE/ALE–ALE ratio 1.8; ALE separated by ca. half their own diameter; AME separated by less than their own diameter; PME separated by 3.7 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 401); labium without cuspules. Abdomen (Fig. 398) oval, sandy-tan in dorsal view with darker brown-black markings anteriorly and six pairs of thin, spotted, brown-black chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 398) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 404, 405) variable shades of tan, with light scopulae on tarsi I–II; tibia I spinose, without prolateral clasping spurs. Leg I: femur 3.2; patella 1.6; tibia 2.5; metatarsus 1.8; tarsus 1.6; total 10.6. Leg I femur–tarsus/carapace length ratio 3.4. Pedipalpal tibia (Figs. 406–408) stout, 1.6 x longer than wide, with broadly rounded RTA-like ventral bulge proximally; field of retrolateral spinules oval-subtriangular in shape, positioned medially (on and adjacent to RTA-like bulge), consisting of ca. 45 spinules, the latter longest at apex of RTA-like bulge; RTA absent. Cymbium (Figs. 406–408) setose, with field of relatively short, spine-like spinules covering most of dorsal surface. Embolus (Figs. 406–408) slightly longer than bulb, strongly curved, with unmodified tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla sampeyae* (formerly known by WAM identification code ‘MYG133’) is a rare species with a relatively restricted distribution in the northern Geraldton Sandplains and north-western Yalgoo bioregions of Western Australia, from Zuytdorp north to the Carrarang Peninsula (Fig. 409). Nothing is known of the biology of this species, other than that the known male specimens were collected wandering in search of females in winter or possibly late autumn.

Bungulla weld Rix, Raven & Harvey, sp. nov.
<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:310E0AED-91A5-4FC3-B99B-B5229ECB0DD8>

org:act:310E0AED-91A5-4FC3-B99B-B5229ECB0DD8
 (Figs. 13, 410–422)

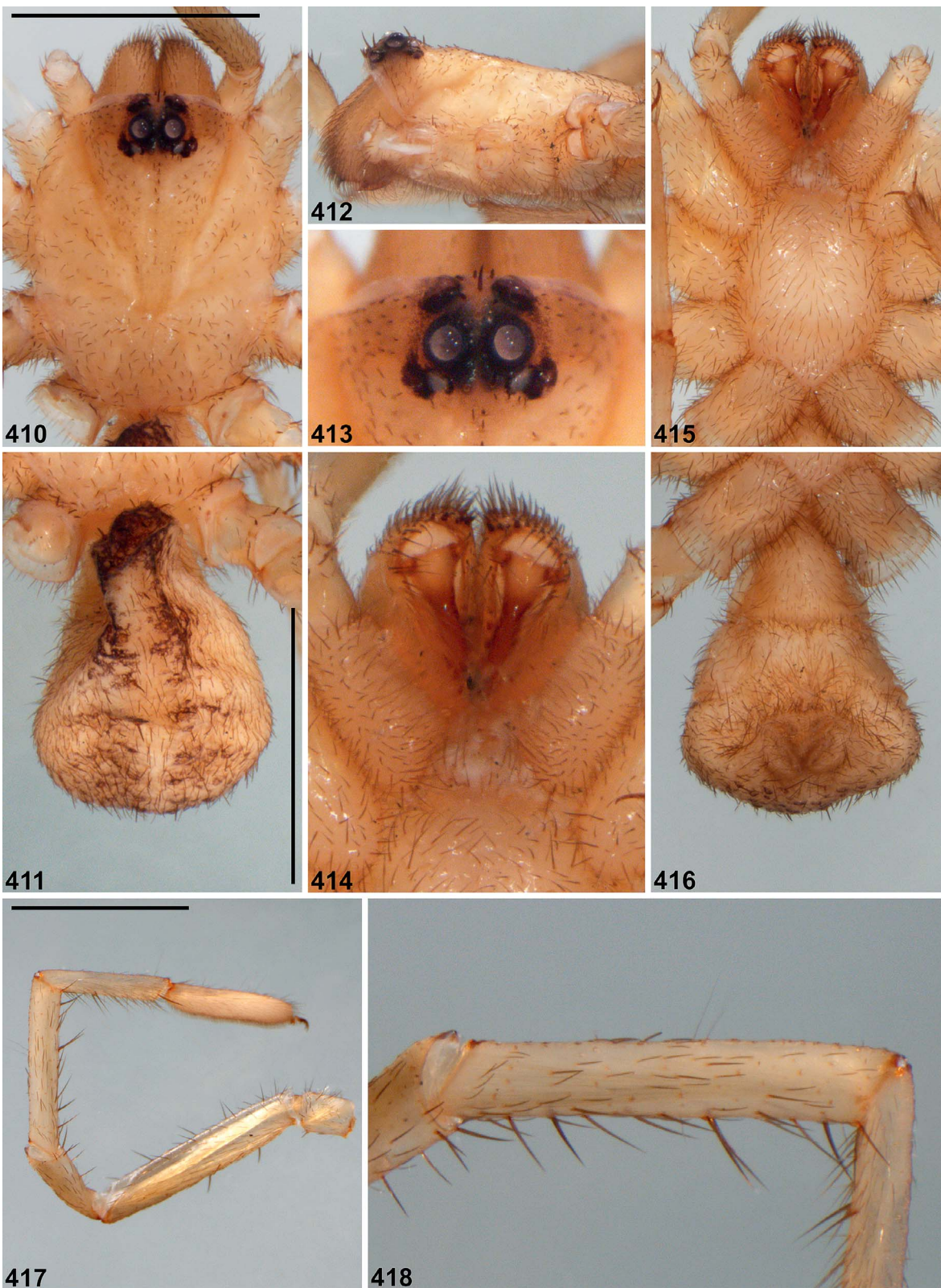
Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Weld Range North mine lease, site WN 8, 64 km SW. of Meekatharra (IBRA_MUR), 26°47′50.21″S, 117°53′38.97″E, wet pitfall trap, 31 August 2007, Ecologia staff (WAM T130911).

Other material examined.—AUSTRALIA: *Western Australia*: 2 ♂, Weld Range North mine lease, site WN 1, 63 km SW. of Meekatharra (IBRA_MUR), 26°46′13.67″S, 117°53′59.65″E, wet pitfall trap, 30 August 2007, Ecologia staff (WAM T130917); 1 ♂, Weld Range (no specific locality) (IBRA_MUR), 24 August–24 November 2006, Ecologia staff (WAM T142965).

Etymology.—The specific epithet is a noun in apposition, in reference to the type locality of this species.

Diagnosis.—Males of *Bungulla weld* can be distinguished from all other known congeners with > 10 retrolateral spinules on the palpal tibia (Fig. 13) – except *B. banksia*, *B. bertmaini*, *B. bidgemia*, *B. hamelinensis*, *B. iota*, *B. laevigata*, *B. quobba* and *B. yeni* – by the shape of the proximal half of the palpal tibia, which is without a pronounced ventral bulge (Fig. 419), combined with the absence of a medial ‘ledge’ on the palpal tibia (Figs. 419, 420) (palpal tibia is with a ledge or bulges ventrally in other species). *Bungulla weld* can be further distinguished from *B. banksia* by the larger field of retrolateral spinules on the palpal tibia (Fig. 419; cf. Fig. 72); from *B. bertmaini*, *B. laevigata* and *B. quobba* by the shape of the embolus, which is relatively short (i.e., ~as long as bulb) (Fig. 419; cf. Figs. 24, 319, 371); from *B. hamelinensis* by the morphology of the cymbial spinules, which are thicker and more spine-like (Figs. 419–421; cf. Figs. 218–220); from *B. yeni* and by the presence of a larger, crescent-shaped field of retrolateral spinules on the palpal tibia (Fig. 419; cf. Fig. 445); and from *B. bidgemia* and *B. iota* by the presence of a relatively asymmetric (‘wave-shaped’) field of retrolateral spinules on the palpal tibia (Fig. 419; cf. Figs. 95, 267). Females are unknown.

Description (male holotype).—Total length 5.3. Carapace 2.6 long, 2.0 wide. Abdomen 2.3 long, 1.7 wide. Carapace (Fig. 410) pale tan, with slightly darker pars cephalica and mostly black ocular region; fovea slightly procurved. Eye group (Fig. 413) trapezoidal (anterior eye row strongly procurved), 0.8 x as long as wide, PLE–PLE/ALE–ALE ratio 1.4; ALE separated by ca. half their own diameter; AME separated by less than their own diameter; PME separated by 3.2 x their own diameter; PME and PLE separated by diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 414); labium without cuspules. Abdomen (Fig. 411) oval, slightly shrivelled, beige-tan in dorsal view with three darker brown markings anteriorly and four pairs of thin, spotted, dark brown chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 411) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 417, 418) variable shades of pale tan, with light scopulae on semi-incrassate tarsi I–II; tibia I spinose, without prolateral clasping spurs. Leg I: femur 2.5; patella 1.2; tibia 1.9; metatarsus 1.5; tarsus 1.4; total 8.4. Leg



Figures 410–418.—*Bungulla weld* sp. nov., male holotype (WAM T130911) from Weld Range North mine lease (Western Australia; MUR), somatic morphology: 410–411, carapace and abdomen, dorsal view; 412, cephalothorax, lateral view; 413, eyes, dorsal view; 414, mouthparts, ventral view; 415–416, cephalothorax and abdomen, ventral view; 417, leg I, prolateral view; 418, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 419–421.—*Bungulla weld* sp. nov., male holotype (WAM T130911) from Weld Range North mine lease (Western Australia; MUR), pedipalp: 419, retrolateral view; 420, retro-ventral view; 421, prolateral view. Scale bar = 2.0 mm.

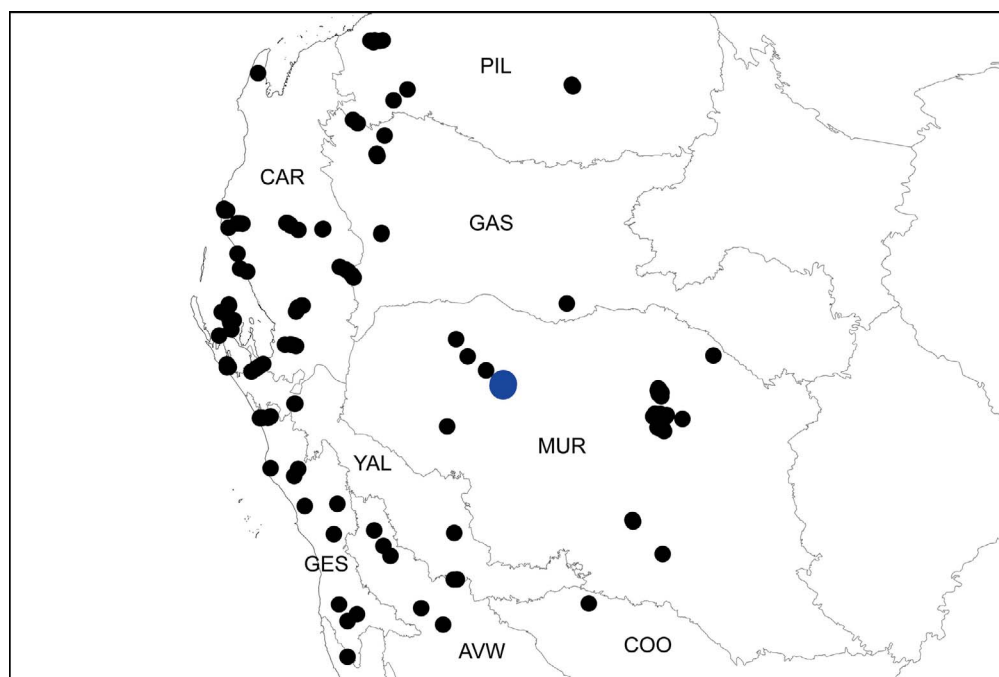


Figure 422.—Map showing collection records of *Bungulla weld* sp. nov. (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.

I femur–tarsus/carapace length ratio 3.3. Pedipalpal tibia (Figs. 419–421) nearly 2.0 x longer than wide; field of retrolateral spinules large and asymmetrically crescent-shaped ('wave-shaped') in retrolateral view, positioned medially–distally (along most of retro-ventral margin), consisting of ca. 50 spinules of largely similar length; RTA absent. Cymbium (Figs. 419–421) setose, with sparse field of spine-like spinules covering most of dorsal surface. Embolus (Figs. 419–421) as long as bulb, slightly curved, with unmodified tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla weld* is known only from the Weld Range, in the western Murchison bioregion of Western Australia (Fig. 422). Nothing is known of the biology of this species, other than that the known male specimens were collected wandering in search of females in late winter and spring.

Bungulla westi Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:011A73B9-B5C7-498E-9068-1CB0EB9144BD>
(Figs. 13, 423–435)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Zuytdorp, site ZU1 (IBRA_GES), 27°15'42"S, 114°01'09"E, wet pitfall trap, 16–21 May 1995, M.S. Harvey et al., WAM/CALM Carnarvon Survey (WAM T98537).

Paratypes. AUSTRALIA: *Western Australia*: 1 ♂, same data as holotype except 11 January–19 May 1995 (WAM T98539); 2 ♂, same data except 19 May–17 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98538).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Zuytdorp Nature Reserve, site ZU2 (IBRA_GES), 27°15'41"S, 114°01'47.6"E, wet pitfall trap, 16–21 May 1995, M.S. Harvey et al., WAM/CALM Carnarvon Survey (WAM T98540); 1 ♂, Zuytdorp, site ZU4 (IBRA_GES), 27°15'45.1"S, 114°09'12.9"E, wet pitfall trap, 18 May–16 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98541); 3 ♂, Francois Peron National Park, site PE2 (IBRA_CAR), 25°52'30.9"S, 113°32'59.0"E, wet pitfall trap, 25 May–30 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98553); 1 ♂, Meedo Station, site MD4 (IBRA_CAR), 25°40'49.1"S, 114°37'19.8"E, wet pitfall trap, 18 May–22 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98542); 1 ♂, same data (WAM T98543); 3 ♂, same data except site MD5, 25°42'41.6"S, 114°35'58.5"E, 19 May–22 August 1995 (WAM T98544); 1 ♂, Nanga Station, site NA2 (IBRA_CAR), 26°29'23.0"S, 114°03'24.3"E, wet pitfall trap, 11 May–30 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98536); 2 ♂, same data except site NA3 (IBRA_YAL), 26°31'20.9"S, 114°00'08.3"E, 12 May–30 August 1995 (WAM T98545); 1 ♂, same data except site NA4, 26°32'47.3"S, 113°57'47.0"E, 11 May–30 August 1995 (WAM T98535); 1 ♂, same data except site NA5, 26°35'31.8"S, 113°53'22.3"E (WAM T98546); 2 ♂, Nerren Nerren Station, site NE1 (IBRA_YAL), 27°03'23.6"S, 114°35'21.3"E, wet pitfall trap, 11 May–18 August 1995, N. Hall, WAM/CALM Carnarvon Survey (WAM T98547); 1 ♂, same data except site NE2, 27°03'24.1"S, 114°34'22.6"E (WAM T98548); 3 ♂, Woodleigh Station, site WO1 (IBRA_CAR), 26°13'01.2"S, 114°35'59.4"E, wet pitfall trap, 17 May–21 August 1995, N.

Hall, WAM/CALM Carnarvon Survey (WAM T98549); 2 ♂, same data except site WO3, 26°11'44.5"S, 114°32'14.4"E (WAM T98550); 1 ♂, same data except site WO4, 26°11'31.1"S, 114°30'33.0"E (WAM T98551); 2 ♂, same data (WAM T98552).

Etymology.—This species is named in honor of Paul West, in recognition of his herculean efforts in setting and monitoring pitfall traps during the Carnarvon Biological Survey (1994–1995), and for assisting in the analysis and publication of the resulting data (see Harvey et al. 2000; Main et al. 2000).

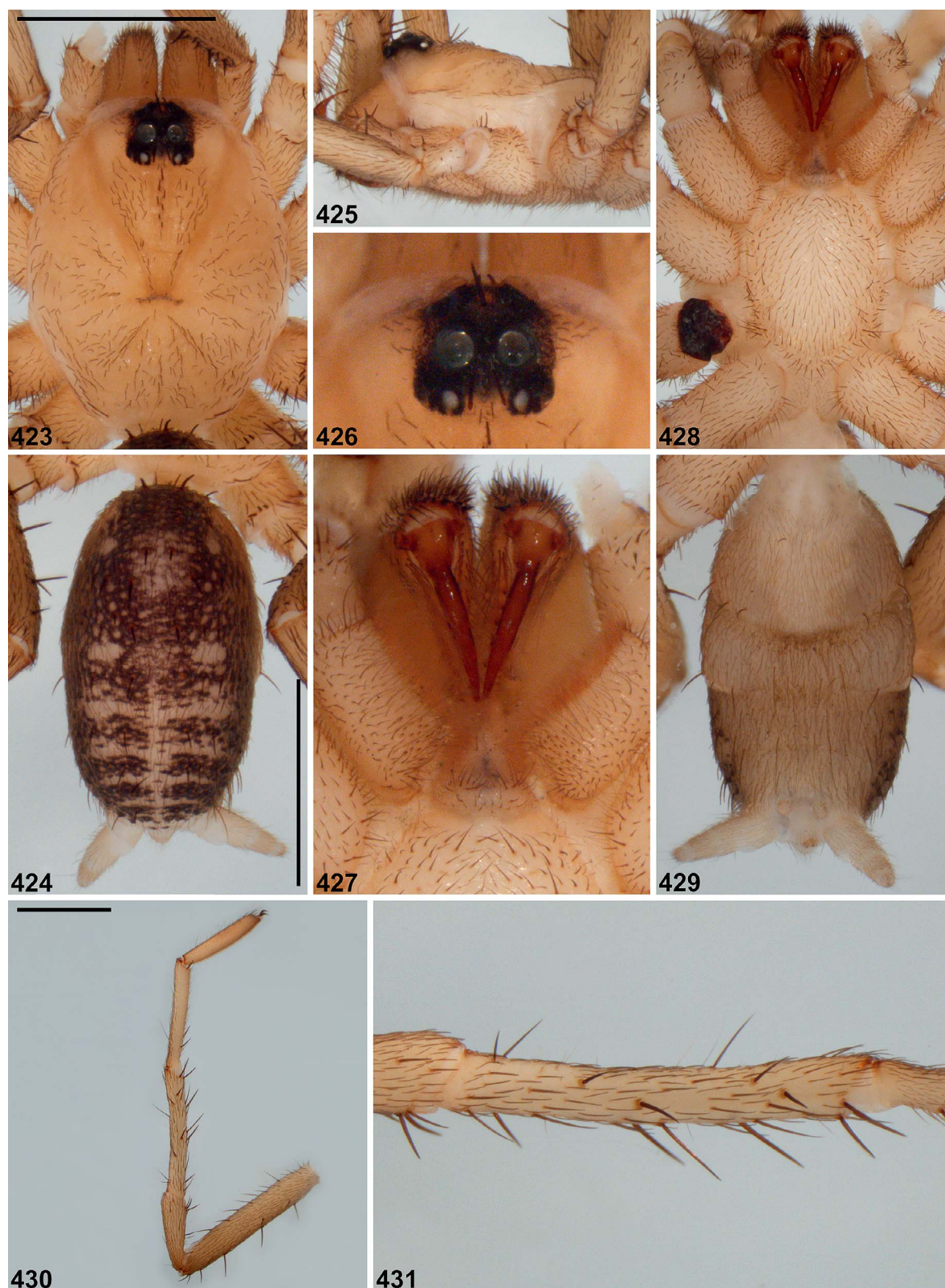
Diagnosis.—Males of *Bungulla westi* can be distinguished from all other known congeners by the presence of thorn-like spinules on the disto-dorsal margin of the palpal tibia (Figs. 432–434) (disto-dorsal spinules absent in other species). Females are unknown.

Description (male holotype).—Total length 7.5. Carapace 3.3 long, 2.6 wide. Abdomen 3.4 long, 2.0 wide. Carapace (Fig. 423) pale tan with black ocular region; fovea slightly recurved. Eye group (Fig. 426) trapezoidal (anterior eye row strongly procurved), as long as wide, PLE–PLE/ALE–ALE ratio 1.3; ALE separated by ca. half their own diameter; AME separated by less than their own diameter; PME separated by 3.1 x their own diameter; PME and PLE separated diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cusps confined to inner corner (Fig. 427); labium without cusps. Abdomen (Fig. 424) oval, dark olive-brown in dorsal view, with beige mottling, two large pairs of beige-tan sigilla spots, and four pairs of large chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 424) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 430, 431) variable shades of pale tan, with light scopulae on tarsi I–II; tibia I spinose, without prolateral clasping spurs. Leg I: femur 3.5; patella 1.8; tibia 2.6; metatarsus 2.4; tarsus 1.8; total 12.1. Leg I femur–tarsus/carapace length ratio 3.7. Pedipalpal tibia (Figs. 432–434) stout and bulbous, 1.9 x longer than wide, with pronounced RTA-like ventral bulge proximally, the latter developed into a relatively acute, attenuate process; field of retrolateral spinules reverse C-shaped, positioned medially–distally (along distal third of retro-ventral margin), consisting of ca. 35 spinules, the latter longest at apex of RTA-like bulge; tibia also with field of porrect, thorn-like spinules on disto-dorsal margin; RTA absent. Cymbium (Figs. 432–434) setose, with field of porrect, stout, thorn-like spinules covering most of dorsal surface. Embolus (Figs. 432–434) slightly longer than bulb, strongly curved, with distinctly expanded tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla westi* has a relatively restricted distribution in the greater Shark Bay region of Western Australia, from Zuytdorp (Geraldton Sandplains bioregion) north to Meedo Station in the southern Carnarvon bioregion (Fig. 435). Nothing is known of the biology of this species, other than that the known male specimens were collected wandering in search of females in late autumn and winter.

Bungulla yeni Rix, Raven & Harvey, sp. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank>.



Figures 423–431.—*Bungulla westi* sp. nov., male holotype (WAM T98537) from Zuytdorp, site ZU1 (Western Australia; GES), somatic morphology: 423–424, carapace and abdomen, dorsal view; 425, cephalothorax, lateral view; 426, eyes, dorsal view; 427, mouthparts, ventral view; 428–429, cephalothorax and abdomen, ventral view; 430, leg I, prolateral view; 431, leg I tibia, prolateral view. Scale bars = 2.0 mm.



Figures 432–434.—*Bungulla westi* sp. nov., male holotype (WAM T98537) from Zuytdorp, site ZU1 (Western Australia; GES), pedipalp: 432, retrolateral view; 433, retro-ventral view; 434, prolateral view. Scale bar = 2.0 mm.

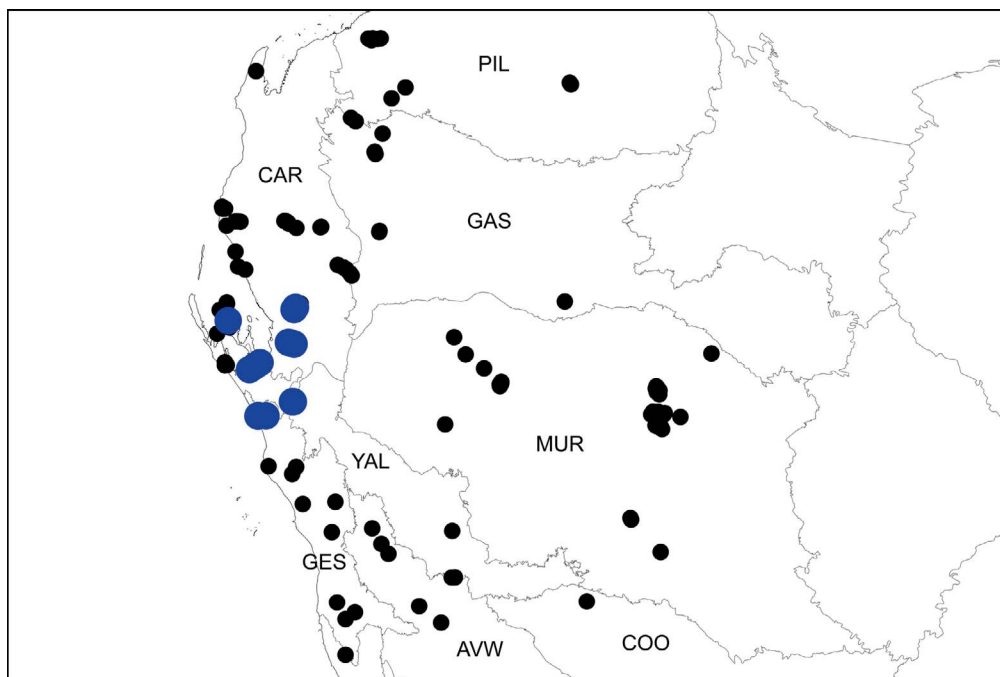


Figure 435.—Map showing collection records of *Bungulla westi* sp. nov. (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.

org:act:A6BF6A12-AEF4-41CC-BDD5-25D1CBCED629
(Figs. 13, 14, 436–448)

Bungulla sp. ‘Albion Downs’ Rix et al., 2017d: 603, figs 148, 149, 153, 158.

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Albion Downs, 84.1 km NNW. of Leinster (IBRA_MUR), 27°14'17"S, 120°18'43"E, dry pitfall trap, 30 August 2008, Z Hamilton & R. Teale (WAM T96263^{DNA_Voucher_204}; GenB-COI-KY295251, GenB-CYB-KY295375, GenB-MRPL45-KY295499, GenB-RPF2-KY295618, GenB-XPNPEP3-KY295745, GenB-ITS-KY294997).

Paratypes. AUSTRALIA: *Western Australia*: 1 ♂, same data as holotype (WAM T96264); 1 ♂, same data except 28 August–3 September 2008 (WAM T96328); 1 ♂, same data except 55.8 km NNW. of Leinster, 27°27'26"S, 120°27'41"E (WAM T96301^{DNA_Voucher_207}; GenB-COI-MG516835, GenB-CYB-MG516846, GenB-MRPL45-MG516869, GenB-RPF2-MG516880, GenB-XPNPEP3-MG516897, GenB-ITS-MG516861); 1 ♂, same data except 62.7 km NNW. of Leinster, 27°25'02"S, 120°23'41"E (WAM T96306^{DNA_Voucher_206}; GenB-COI-MG516836, GenB-CYB-MG516848, GenB-MRPL45-MG516870, GenB-RPF2-MG516882, GenB-XPNPEP3-MG516899, GenB-ITS-MG516862); 1 ♂, same data (WAM T96300); 1 ♂, same data (WAM T96350); 1 ♂, same data except 78.3 km NNW. of Leinster, 27°15'26"S, 120°24'29"E, 30 August 2008 (WAM T96268^{DNA_Voucher_205}; GenB-COI-MG516837, GenB-CYB-MG516847, GenB-MRPL45-MG516871, GenB-RPF2-MG516881, GenB-XPNPEP3-MG516898, GenB-ITS-MG516863); 1 ♂, same data (WAM T96269).

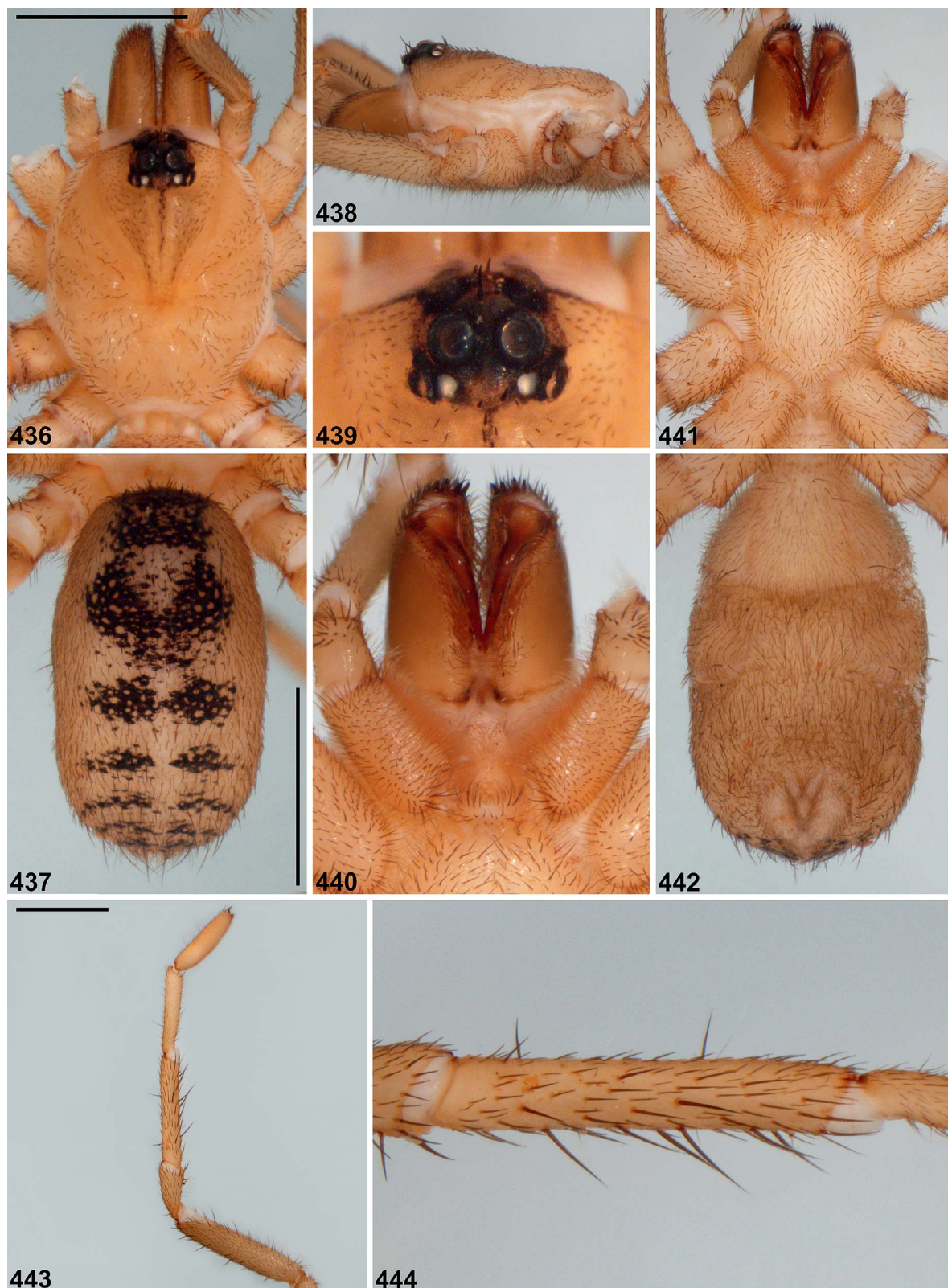
Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Albion Downs, 60.4 km NNW. of Leinster (IBRA_MUR), 27°25'13"S, 120°26'23"E, dry pitfall trap, 30 August 2008, Z Hamilton & R. Teale (WAM T96262); 1 ♂, same data except 62.6 km NNW. of Leinster, 27°25'03"S, 120°23'45"E, 28 August–3 September 2008 (WAM T96305); 1 ♂, same data (WAM T96298); 1 ♂, same data (WAM T96299); 1 ♂, same data except 78.6 km NNW. of Leinster, 27°14'18"S, 120°27'41"E, 30 August 2008 (WAM T96265); 1 ♂, same data except 28 August–3 September 2008 (WAM T96291); 1 ♂, same data except 79.2 km NNW. of Leinster, 27°13'21"S, 120°30'01"E (WAM T96324); 1 ♂, same data (WAM T96325); 1 ♂, same data except 30 August 2008 (WAM T96261); 1 ♂, same data except 81.2 km NNW. of Leinster, 27°15'32"S, 120°19'50"E, 28 August–3 September 2008 (WAM T96364); 1 ♂, same data (WAM T96295); 1 ♂, same data except 84.9 km NNW. of Leinster, 27°14'40"S, 120°16'54"E, 30 August 2008 (WAM T96267); 1 ♂, Lake Way Station, Honeymoon Well lease (IBRA_MUR), 26°56'13"S, 120°24'35"E, glycol pitfall trap in spinifex, 20 October 2006, S. Thompson (WAM T80606); 1 ♂, same data except 26°53'49"S, 120°25'07"E, mulga-spinifex (WAM T80607); 1 ♂, ca. 10 km NW. of Lake Way homestead, spinifex site 1 (IBRA_MUR), 26°55'41"S, 120°23'59"E, wet pitfall trap, 20 October 2006, S. Thompson (WAM T94066); 1 ♂, ca. 7 km W. of Lake Way homestead, spinifex site 4 (IBRA_MUR), 26°56'05"S, 120°24'11"E, wet pitfall trap, 20 October 2006, S. Thompson (WAM T94197).

Etymology.—This species is named in honor of the late Alan Yen (1950–2017), in recognition of his seminal contributions to systematics and invertebrate conservation in Australia.

Diagnosis.—Males of *Bungulla yeni* can be distinguished from all other known congeners with > 10 retrolateral spinules on the palpal tibia (Fig. 13) – except *B. banksia*, *B. bertmaini*, *B. bidgemia*, *B. hamelinensis*, *B. iota*, *B. laevigata*, *B. quobba* and *B. weld* – by the shape of the proximal half of the palpal tibia, which is without a pronounced ventral bulge (Fig. 445), combined with the absence of a medial ‘ledge’ on the palpal tibia (Figs. 445, 446) (palpal tibia is with a ledge or bulges ventrally in other species). *Bungulla yeni* can be further distinguished from *B. banksia* by the larger field of retrolateral spinules on the palpal tibia (Fig. 445; cf. Fig. 72); from *B. bertmaini*, *B. laevigata* and *B. quobba* by the shape of the embolus, which is relatively short (i.e., ~as long as bulb) (Fig. 445; cf. Figs. 24, 319, 371); from *B. hamelinensis* by the morphology of the cymbial spinules, which are thicker and more spine-like (Figs. 445–447; cf. Figs. 218–220); and from *B. bidgemia*, *B. iota* and *B. weld* by the presence of a relatively small, rectangular field of retrolateral spinules on the distal half of the palpal tibia (Fig. 445; cf. Figs. 95, 267, 419). Females are unknown.

Description (male holotype).—Total length 8.2. Carapace 3.2 long, 2.5 wide. Abdomen 3.7 long, 2.5 wide. Carapace (Fig. 436) tan, with slightly darker pars cephalica, pale olive lyre-like pattern on pars cephalica and mostly black ocular region; fovea straight. Eye group (Fig. 439) trapezoidal (anterior eye row strongly procurved), 0.9 x as long as wide, PLE–PLE/ALE–ALE ratio 1.4; ALE separated by ca. half their own diameter; AME separated by less than their own diameter; PME separated by 3.0 x their own diameter; PME and PLE separated by slightly less than diameter of PME, PME positioned in line with level of PLE. Maxillae with field of cuspules confined to inner corner (Fig. 440); labium without cuspules. Abdomen (Fig. 437) elongate-oval, beige-tan in dorsal view with contrasting pattern of three darker black markings anteriorly and five pairs of spotted black chevrons posteriorly, each divided along midline. Dorsal surface of abdomen (Fig. 437) with sparse arrangement of stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; sclerotized sigilla absent. Legs (Figs. 443, 444) variable shades of tan, with light scopulae on incrassate tarsi I–II; tibia I spinose, without prolateral clasping spurs. Leg I: femur 2.8; patella 1.3; tibia 2.3; metatarsus 2.0; tarsus 1.6; total 10.0. Leg I femur–tarsus/carapace length ratio 3.1. Pedipalpal tibia (Figs. 445–447) 1.9 x longer than wide; field of retrolateral spinules relatively small and rectangular in shape, positioned medio-distally (on distal half of tibia), consisting of 31 spinules of largely similar length; RTA absent. Cymbium (Figs. 445–447) setose, with sparse field of spine-like spinules covering most of dorsal surface. Embolus (Figs. 445–447) as long as bulb, curved, with unmodified tip; embolic apophysis absent.

Distribution and remarks.—*Bungulla yeni* (formerly known by WAM identification code ‘MYG029’) is known only from the Albion Downs region north of Leinster, in the central Murchison bioregion of Western Australia (Fig. 448). Nothing is known of the biology of this species, other than that the known male specimens were collected wandering in search of females in late winter and spring.



Figures 436–444.—*Bungulla yeni* sp. nov., male holotype (WAM T96263) from Albion Downs, NNW. of Leinster (Western Australia; MUR), somatic morphology: 436–437, carapace and abdomen, dorsal view; 438, cephalothorax, lateral view; 439, eyes, dorsal view; 440, mouthparts, ventral view; 441–442, cephalothorax and abdomen, ventral view; 443, leg I, prolateral view; 444, leg I tibia, prolateral view. Scale bars = 2.0 mm



Figures 445–447.—*Bungulla yeni* sp. nov., male holotype (WAM T96263) from Albion Downs, NNW. of Leinster (Western Australia; MUR), pedipalp: 445, retrolateral view; 446, retro-ventral view; 447, prolateral view. Scale bar = 2.0 mm.

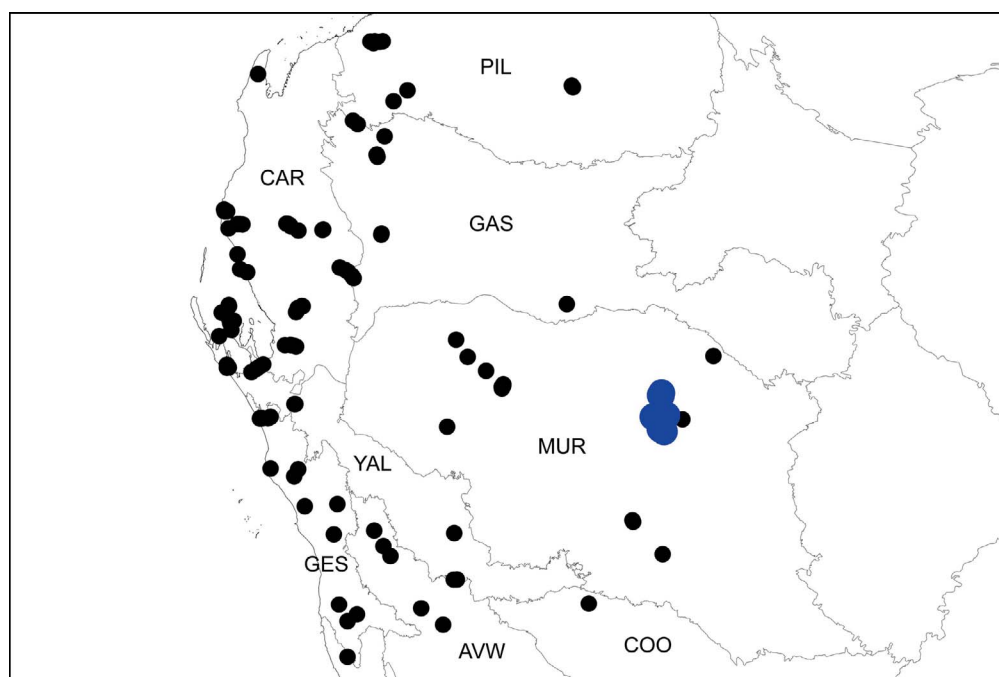


Figure 448.—Map showing collection records of *Bungulla yeni* sp. nov. (large blue circles), relative to other taxa with > 10 retrolateral spinules on the male palpal tibia (see Fig. 13). Relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; CAR, Carnarvon; COO, Coolgardie; GAS, Gascoyne; GES, Geraldton Sandplains; MUR, Murchison; PIL, Pilbara; YAL, Yalgoo.

ACKNOWLEDGMENTS

This work would have been significantly diminished without the collections provided by the then CALM (Department of Conservation and Land Management) 'Biodiversity Survey of the Southern Carnarvon Basin', run from 1994–1995. Other important specimens were provided by CALM's 'Salinity Action Plan Survey' (later 'State Salinity Strategy') of the Western Australian Agricultural Zone (1997–2000), and by numerous other individual collectors, especially Roy Teale, Zoe Hamilton and Barbara Main. Thanks also to Roy Teale for providing his images of a live male *B. biota*, and to Jeremy Wilson for his contribution to the development of the 'Atlas' approach to mygalomorph systematics. This work was funded by an Australian Biological Resources Study (ABRS) Taxonomy Research Grant (No. RF21506) to MGR, RJR and MSH, an Australian Research Council (ARC) Linkage Grant (No. LP120200092) to ADA, MGR, SJBC and MSH, and a Bioplatforms Australia (BPA) Grant to ADA and SJBC.

LITERATURE CITED

- Burbidge, A.H., N.L. McKenzie & M.S. Harvey. 2000. A biogeographic survey of the southern Carnarvon Basin, Western Australia: background and methods. Records of the Western Australian Museum Supplement 61:1–12.
- Brown, R.W. 1956. Composition of Scientific Words: A Manual of Methods and a Lexicon of Materials for the Practice of Logotechnics. Smithsonian Books, Washington, D.C.
- de Queiroz, K. 2007. Species concepts and species delimitation. Systematic Biology 56:879–886.
- Harvey, M.S., A. Sampey, P.L.J. West & J.M. Waldock. 2000. Araneomorph spiders from the southern Carnarvon Basin, Western Australia: a consideration of regional biogeographic relationships. Records of the Western Australian Museum Supplement 61:295–321.
- Huelsenbeck, J.P. & F. Ronquist. 2001. MRBAYES: Bayesian inference of phylogenetic trees. Bioinformatics 17:754–755.
- Keighery, G.J. 2004. State Salinity Strategy biological survey of the Western Australian wheatbelt: background. Records of the Western Australian Museum Supplement 67:1–6.
- Lanfear, R., B. Calcott, S.Y.W. Ho & S. Guindon. 2012. PartitionFinder: combined selection of partitioning schemes and substitution models for phylogenetic analyses. Molecular Biology and Evolution 29:1695–1701.
- Main, B.Y. 1957. Biology of aganippine trapdoor spiders (Mygalomorphae: Ctenizidae). Australian Journal of Zoology 5:402–473.
- Main, B.Y., A. Sampey & P.L.J. West. 2000. Mygalomorph spiders of the southern Carnarvon Basin, Western Australia. Records of the Western Australian Museum Supplement 61:281–293.
- McKenzie, N.L., S. van Leeuwen & A.M. Pinder. 2009. Introduction to the Pilbara Survey, 2002–2007. Records of the Western Australian Museum Supplement 78:3–89.
- Miller, M.A., W. Pfeiffer & T. Schwartz. 2010. Creating the CIPRES Science Gateway for inference of large phylogenetic trees. Proceedings of the Gateway Computing Environments Workshop (GCE), 14 Nov. 2010, pp. 1–8, New Orleans, LA.
- Rambaut, A., M.A. Suchard, D. Xie & A.J. Drummond. 2014. Tracer v1.6. Available online at <http://beast.bio.ed.ac.uk/Tracer> (accessed June 2017).
- Rix, M.G., K. Bain, B.Y. Main, R.J. Raven, A.D. Austin, S.J.B. Cooper & M.S. Harvey. 2017a. Systematics of the spiny trapdoor spiders of the genus *Cataxia* (Mygalomorphae: Idiopidae) from south-western Australia: documenting a threatened fauna in a sky-island landscape. Journal of Arachnology 45:395–423.
- Rix, M.G., S.J.B. Cooper, K. Meusemann, S. Klopstein, S.E. Harrison, M.S. Harvey et al. 2017b. Post-Eocene climate change across continental Australia and the diversification of Australasian spiny trapdoor spiders (Idiopidae). Molecular Phylogenetics and Evolution 109:302–320.
- Rix, M.G., D.L. Edwards, M. Byrne, M.S. Harvey, L. Joseph & J.D. Roberts. 2015. Biogeography and speciation of terrestrial fauna in the south-western Australian biodiversity hotspot. Biological Reviews 90:762–793.
- Rix, M.G., J. Huey, B.Y. Main, J.M. Waldock, S.E. Harrison, S. Comer et al. 2017c. Where have all the spiders gone? The decline of a poorly known invertebrate fauna in the agricultural and arid zones of southern Australia. Austral Entomology 56:14–22.
- Rix, M.G., B.Y. Main, R.J. Raven & M.S. Harvey. 2018. Systematics of the spiny trapdoor spiders of the genus *Eucanippe* (Mygalomorphae: Idiopidae: Aganippini) from south-western Australia: documenting a poorly-known lineage from Australia's biodiversity hotspot. Journal of Arachnology 46:133–154.
- Rix, M.G., R.J. Raven, B.Y. Main, S.E. Harrison, A.D. Austin, S.J.B. Cooper et al. 2017d. The Australasian spiny trapdoor spiders of the family Idiopidae (Mygalomorphae: Arbanitinae): a relimitation and revision at the generic level. Invertebrate Systematics 31:566–634.
- Ronquist, F. & J.P. Huelsenbeck. 2003. MrBayes 3: Bayesian phylogenetic inference under mixed models. Bioinformatics 19:1572–1574.

Manuscript received 27 July 2017, revised 16 November 2017.