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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

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Abstract. The aganippine spiny trapdoor spiders of the genus *Eucanippe* Rix, Main, Raven & Harvey, 2017 are revised, and six new species from south-western Australia's biodiversity hotspot are described: *E. absita* sp. nov., *E. agastachys* sp. nov., *E. eucla* sp. nov., *E. mallee* sp. nov., *E. mouldsi* sp. nov., and *E. nemestrina* sp. nov. Species of *Eucanippe* are among the most enigmatic of Australia's Mygalomorphae, with most taxa known only from pitfall-trapped male specimens. Little is known of their biology, natural history or burrow morphology, and a female specimen was unknown prior to targeted field work in 2017. This revision documents the known diversity of *Eucanippe* in Australia, and reveals a fauna dominated by species with restricted and largely non-overlapping distributions in the heavily-cleared agricultural zone of Australia's south-west.

Keywords: Taxonomy, new species, arid zone, biogeography

ZooBank publication: http://zoobank.org/?lsid=urn:lsid:zoobank.org:pub:277920E5-CB4C-4EDC-9483-57476BA84100

The spiny trapdoor spiders of the Western Australian endemic genus *Eucanippe* Rix, Main, Raven & Harvey, 2017 (Figs. 1–4) are among the most enigmatic of Australia's Mygalomorphae. The genus was only recently formally described (Rix et al. 2017d) following its phylogenetic delimitation by Rix et al. (2017b), and a female specimen (Fig. 3) was unknown prior to targeted field work in 2017. Males were also rare in collections prior to the 'Salinity Action Plan Survey' (later 'State Salinity Strategy') of the Western Australian agricultural zone, conducted by the then Department of Conservation and Land Management (CALM) between 1997 and 2000 (Harvey et al. 2004; Keighery 2004). This ground-breaking survey of much of the threatened south-western Australian biodiversity hotspot (see Myers et al. 2000; Rix et al. 2015) was a whole of Government approach to combating the devastating effects of dryland salinity on the heavily fragmented habitats of the region (Keighery 2004). Due to the scale of the survey, both geographically and temporally, and the use of wet pitfall traps at over 300 sampling sites, the distribution and diversity of *Eucanippe* (and numerous other mygalomorph genera) were revealed in considerable detail.

We now know that species of *Eucanippe* are largely restricted to the Mallee, central and southern Wheatbelt and Esperance Plains IBRA (Interim Biogeographic Regionalisation of Australia) bioregions, with only a limited number of records from the Murchison, Coolgardie, Hampton and Jarrah Forest bioregions (Fig. 11). This distribution is thus centered on one of the most heavily-cleared landscapes in Australia (Laurance et al. 2011; Bradshaw 2012), and extant populations of most species are now severely fragmented. Given the declines being experienced by idiopid populations across arid and semi-arid temperate Australia (Rix et al. 2017c), the documentation of this diversity is an urgent undertaking. This paper is now the third in a series of revisionary works to describe the region's known species of *Eucanippe*, *Bungulla* Rix, Main, Raven & Harvey, 2017 (see Rix et al. 2017d), *Cataxia* Rainbow, 1914 (see Rix et al. 2017a), *Eucyrtops* Pocock, 1897, *Euoplos* Rainbow, 1914, *Gaius* Rainbow, 1914 and *Idiosoma* Ausserer, 1871 (see Rix et al. 2017d). Six new species are here described, taking the total number of species in the genus to seven.

METHODS

Morphological methods, including the format of species descriptions, follow Rix et al. (2017d). 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. 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 prolateral view. Total body length measurements include the chelicerae, in dorsal view. Most available male specimens of *Eucanippe* 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

Figures 1–10.—Live habitus images, burrows and habitats of *Eucanippe* from south-western Australia. 1–3, 5–10, *E. mouldsi* sp. nov. from near Wellstead: 1–2, paratype male (WAM T132002) habitus; 3, paratype female (WAM T143003) habitus; 5–8, images of two burrows with lids open (5, 7) and closed (6, 8); 9–10, mallee eucalypt and *Banksia* woodland at the type locality (April 2017). 4, Habitus image of subadult (likely penultimate) female *E. agastachys* sp. nov. (WAM T143012) from Hopkins Nature Reserve, near Kulin. Note the sculptured, highly camouflaged lid, the slightly raised hinge and broad lower lip typical of burrows of *E. mouldsi* sp. nov. at the type locality. Images 1–3, 9 by M. Harvey; 4–8, 10 by M. Rix.

File 1, online at http://dx.doi.org/10.1636/JoA-S-17-030.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.

Specimens are lodged at the Western Australian Museum, Perth (WAM), and the following abbreviations are used throughout the text: ALE, anterior lateral eye/s; AME, anterior median eye/s; IBRA, Interim Biogeographic Regionalisation of Australia Version 7 (online at https://www.environment.gov.au/land/nrs/science/ibra); PLE, posterior lateral eye/s; PME, posterior median eye/s; RTA, retrolateral tibial apophysis (of male pedipalp).

SYSTEMATICS

Family Idiopidae Simon, 1889
Subfamily Arbanitinae Simon, 1903
Tribe Aganippini Simon, 1903
Genus *Eucanippe* Rix, Main, Raven & Harvey, 2017

Eucanippe Rix, Main Raven & Harvey, 2017 in Rix et al., 2017d: 607.

Type species.—*Eucanippe bifida* Rix, Main, Raven & Harvey, 2017, by original designation.

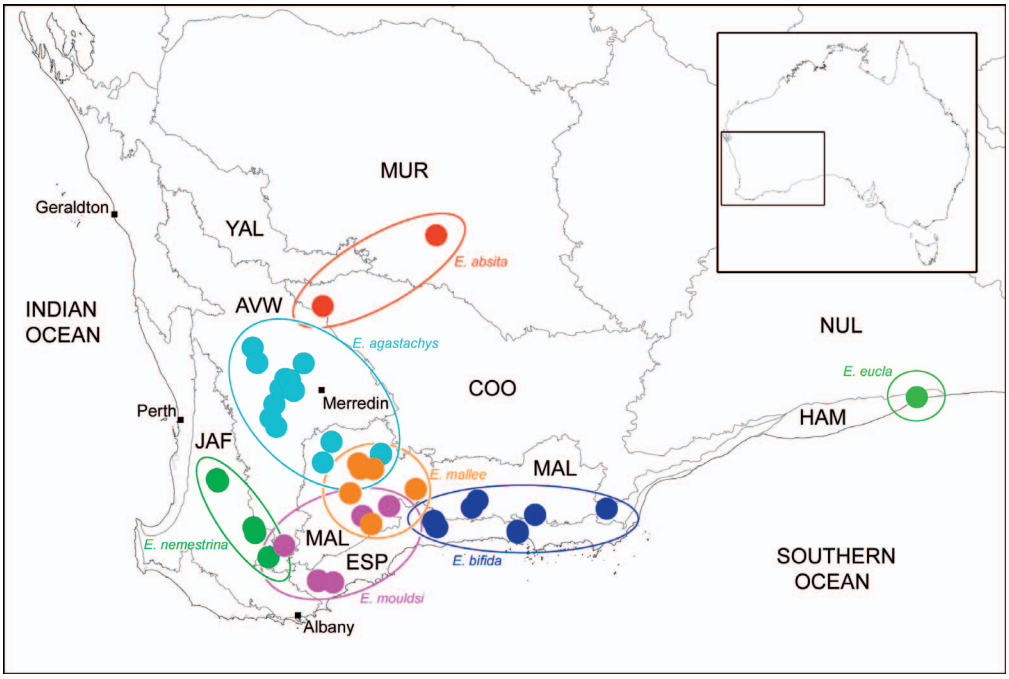


Figure 11.—Map showing collection records of *Eucanippe* from south-western Australia. Select metropolitan centers are labeled, and relevant IBRA 7.0 bioregional acronyms are as follows: AVW, Avon Wheatbelt; COO, Coolgardie; ESP, Esperance Plains; HAM, Hampton; JAF, Jarrah Forest; MAL, Mallee; MUR, Murchison; NUL, Nullarbor; YAL, Yalgoo.

Diagnosis.—Species of *Eucanippe* can be distinguished from all other Arbanitinae by the presence of a forked embolus on the male pedipalp (Fig. 12) (Rix et al. 2017d), and by the unusual aciniform morphology of the female spermathecae (at least in *E. mouldsi* sp. nov.; Fig. 107). They are also the only Idiopidae in Australia, other than *Idiosoma*, to possess a pair of sclerotized sigilla on the dorsal abdomen (Figs. 2–4, 27, 40, 87, 100).

Description.—See Rix et al. (2017d). For a description of the only known adult female specimen of this genus, see *E. mouldsi* sp. nov. (Figs. 99–107).

Distribution.—The genus *Eucanippe* is endemic to south-western Australia, with a distribution centered on the semi-arid Mallee, Esperance Plains and Wheatbelt bioregions (Fig. 11). Outside of these areas they extend marginally west into the south-eastern Jarrah Forest bioregion, east to the western Coolgardie and Hampton bioregions, and north-east to the southern Murchison bioregion. The greatest diversity of species occurs in the western Mallee bioregion, where the ranges of three species intersect (Fig. 11).

Composition and remarks.—*Eucanippe* was found to be the sister-genus to *Idiosoma* by Rix et al. (2017b) (Fig. 12), and together they share the synapomorphic presence of sclerotized dorsal abdominal sigilla (Figs. 2–4, 27, 40, 87, 100). *Eucanippe* includes seven species, six of which are newly described in this study. Specimens are rare in collections, and only a single adult female is known (Figs. 3, 99–107). Burrows of *E. mouldsi* sp. nov. are small and highly camouflaged, with a slightly raised hinge and broad lower lip (Figs. 5–8), and at the type locality these burrows are situated in dense mallee eucalypt and *Banksia* woodland (Figs. 9, 10). Little else is known of the biology or natural history of these spiders, other than that males wander in search of females in late autumn, winter (predominantly) or early spring, and a recently molted adult male of *E. mouldsi* sp. nov. (Figs. 1, 2) was collected from its burrow in mid-April.

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

NB. Females of all species except *E. mouldsi* sp. nov. are unknown. See also Supplementary File 1 for additional images of relevant character states (online at http://dx.doi.org/10.1636/JoA-S-17-030.s1).

1. Tibia of leg I with pair of opposing prolateral clasping spurs (Figs. 20–22, 33–35) 2
– Tibia of leg I without pair of opposing prolateral clasping spurs (Figs. 68, 69)..... ***E. eucla*** sp. nov.
2. RTA short and relatively rounded distally, without prominent distal process (Figs. 23, 24); proximal-most clasping spur on prolateral tibia I with 2–3 modified, similarly-sized setae (Figs. 20, 21) ... ***E. bifida*** Rix, Main, Raven & Harvey, 2017
– RTA longer, more strongly pointed distally and usually with prominent (often aspinose) distal process (Figs. 36, 49, 83, 96, 118); proximal-most clasping spur on prolateral tibia I with 1–3 modified setae (Figs. 34, 47, 81, 94, 116) 3
3. RTA of intermediate length, with only a short distal process (Figs. 83, 84); proximal-most clasping spur on prolateral tibia I with just one enlarged spur-like seta (Figs. 80, 81) (if >1 seta rarely present, spur-like seta remains the largest) ..... ***E. mallee*** sp. nov.

– RTA longer, with large and pointed (usually aspinose) distal process (Figs. 36, 49, 96, 118); proximal-most clasping spur on prolateral tibia I with 1–3 modified setae (Figs. 34, 47, 94, 116) 4
4. Body size relatively small (carapace length < 3.5; Fig. 26); abdomen ornate, with prominent bi-colored pattern (Fig. 27); RTA with slightly curved aspinose distal process and dense, triangular-shaped field of spinules in retrolateral view (Fig. 36) ..... ***E. absita*** sp. nov.
– Body size usually larger; RTA with porrect distal process in retrolateral view (Figs. 49, 96, 118) 5
5. Palpal tibia relatively stout in lateral profile (ca. 1.8 x longer than wide), with proximal mid-point of RTA-base projecting from lower half of tibia (Fig. 49); RTA directed relatively anteriorly, with ventral edge only marginally angled away from ventral face of proximal tibia in retrolateral view (Fig. 49) ..... ***E. agastachys*** sp. nov.
– Palpal tibia less stout in lateral profile (ca. 2.0 x longer than wide), with basal mid-point of RTA projecting from near middle of tibia (Figs. 96, 118); RTA directed away from ventral face of tibia in more strongly oblique ventral orientation (Figs. 96, 118) 6
6. Cephalic region of the carapace and abdomen heavily pigmented (Figs. 86, 87); stiff, porrect black setae on dorsal abdomen with large, strongly-sclerotized sclerotic bases (Fig. 87) ..... ***E. mouldsi*** sp. nov.
– Carapace and abdomen paler (Figs. 108, 109); sclerotic bases of stiff, porrect abdominal setae slightly smaller and less heavily sclerotized (Fig. 109) ..... ***E. nemestrina*** sp. nov.

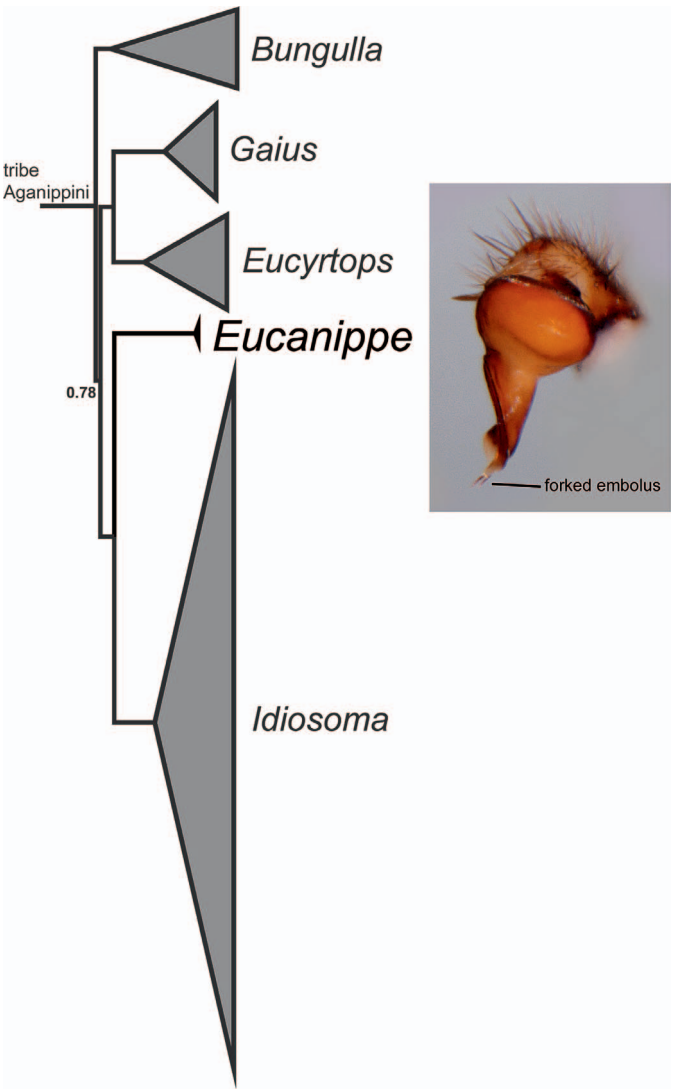


Figure 12.—Summary phylogeny of the tribe Aganippini, from the 'FULL' 12-gene Bayesian analysis of Rix et al. (2017a). Note the sister-group relationship between the genera *Eucanippe* and *Idiosoma*. Inset image shows the pro-distal cymbium and bulb of *E. absita* sp. nov., and the distinctive, finely-forked embolus characteristic of all *Eucanippe*.

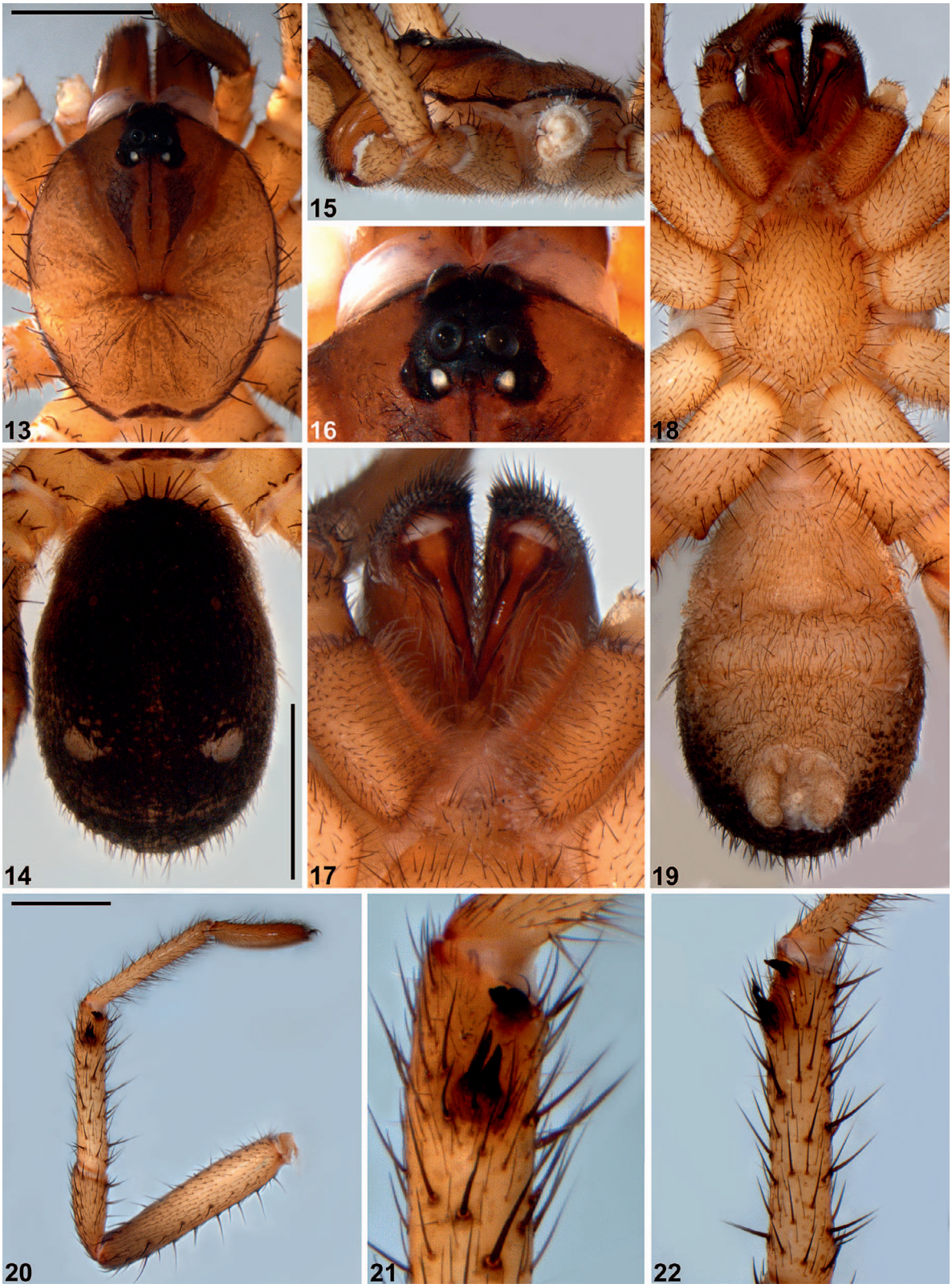
Eucanippe bifida Rix, Main, Raven & Harvey, 2017
(Figs. 11, 13–25)

Eucanippe bifida Rix, Main Raven & Harvey, 2017 in Rix et al., 2017d: 609, figs. 180, 191–204.

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: 24.3 km E. of Ravensthorpe, site RNOCTS1 (IBRA_ESP), 33°34′45″S, 120°18′37″E, dry pitfall, 26 August 2005, R. Teale, Z. Hamilton (WAM T72649; examined).

Paratypes. AUSTRALIA: *Western Australia*: 1 ♂, 25.5 km E. of Ravensthorpe, site RNOCTS3 (IBRA_ESP), 33°34′06″S, 120°19′11″E, dry pitfall, 25 August 2005, R. Teale, Z. Hamilton (WAM T72656); 1 ♂, same data (WAM T72657); 1 ♂, same data (WAM T72655); 1 ♂, same data (WAM T72658); 1 ♂, same data (WAM T72654).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Western Australia: 25.5 km E. of Ravensthorpe, site RNOCTS3 (IBRA_ESP), 33°34′06″S, 120°19′11″E, dry pitfall, 24 August 2005, R. Teale, Z. Hamilton (WAM T72659); 1 ♂, same data except 26 August 2005 (WAM T72653); 1 ♂, same data (WAM T72660); 1 ♂, same data except 24.4 km E. of Ravensthorpe, site RNOCTS2, 33°34′22″S, 120°18′28″E, 25 August 2005 (WAM T72650); 1 ♂, same data (WAM T72651); 1 ♂, same data except 24.6 km E. of Ravensthorpe, site RNOCTS1, 33°34′45″S, 120°18′37″E, 26 August 2005 (WAM T72669); 1 ♂, same data except 30.1 km SE. of Ravensthorpe, site CMS4, 33°39′30″S, 120°21′30″E, 26 August 2005 (WAM T72671); 1 ♂, same data except ca. 37 km SE. of Ravensthorpe, site CMS2, 33°39′46″S, 120°22′40″E, 23–28 August 2005 (WAM T72670); 1 ♂, N. of Edwards Rd, SE. of Lake King, site GP 2 (IBRA_MAL), 33°22′01″S, 120°59′43″E, wet pitfalls, 15 October 1999–1 November 2000, P. Van Heurck, CALM Survey (WAM T139585); 1 ♂, same data (WAM T139586); 1 ♂, Junana Rock, Cape Arid National Park, NW. of Mount Ragged, site 3 (IBRA_MAL), 33°23′S, 123°24′E, 5 April–23 May 1986, B.Y. Main (WAM T139584); 1 ♂, Lake Morgan, Helms Arboretum Reserve, site ES 3 (IBRA_ESP), 33°43′09″S, 121°48′29″E, 15 October 1999–1 November 2000, P. Van Heurck, CALM Survey (WAM T139588); 1 ♂, Norwoods Rd, Wittenoom Hill Nature Reserve, site ES 7 (IBRA_MAL), 33°28′29″S, 122°07′17″E, wet pitfalls, 15 October 1999–1 November 2000, B. Durrant,



Figures 13–22.—*Eucanippe bifida* Rix, Main, Raven & Harvey, 2017, male holotype (WAM T72649) from E. of Ravensthorpe (Western Australia; ESP), somatic morphology: 13–14, carapace and abdomen, dorsal view; 15, cephalothorax, lateral view; 16, eyes, dorsal view; 17, mouthparts, ventral view; 18–19, cephalothorax and abdomen, ventral view; 20, leg I, prolateral view; 21, leg I tibia, clasping spurs, prolateral view; 22, leg I tibia, pro-ventral view. Scale bars = 2.0.

Figures 23–25.—*Eucanippe bifida* Rix, Main, Raven & Harvey, 2017, male holotype (WAM T72649) from E. of Ravensthorpe (Western Australia; ESP), pedipalp: 23, retrolateral view; 24, retro-ventral view; 25, prolateral view. Scale bar = 2.0.

CALM Survey (WAM T143013); 1 ♂, same data (WAM T143014); 1 ♂, Shark Lake Rd, Helms Arboretum Reserve, site ES 1 (IBRA_ESP), 33°44′49″S, 121°48′55″E, wet pitfalls, 15 October 1999–1 November 2000, P. Van Heurck, CALM Survey (WAM T139587); 1 ♂, same data (WAM T139590); 1 ♂, N. of Rollond Rd, near junction with Neds Corner Rd, site GP 3 (IBRA_MAL), 33°15′28″S, 121°05′47″E, wet pitfalls, 15 October 1999–1 November 2000, P. Van Heurck, CALM Survey (WAM T139589).

Diagnosis.—Males of *Eucanippe bifida* can be distinguished from all other known congeners by the shape of the RTA, which is short and relatively rounded distally, without a prominent distal process (Figs. 23, 24; cf. Figs. 36, 49, 70, 83, 96, 118). This species can be further distinguished from the similar species *E. mallee* sp. nov. by the presence of 2 (or rarely 3) modified prolateral setae on the proximal-most leg I clasping spur, each of a similar size and usually with a relatively straight profile in prolateral view (Figs. 20, 21; cf. Figs. 80, 81).

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

Distribution and remarks.—*Eucanippe bifida* has a relatively restricted distribution in the Esperance Plains and south-eastern Mallee bioregions of south-western Australia, from the Ravensthorpe Range east to Cape Arid National Park (Rix et al. 2017d) (Fig. 11). The Cape Arid (Junana Rock) specimen is tentatively assigned to this species, on the basis of its short RTA, however the distribution of RTA spinules is unlike all other specimens of *E. bifida* (see Supplementary File 1, online at http://dx.doi.org/10.1636/JoA-S-17-030.s1). Thus, while it is possible that the Cape Arid record is another undescribed species, we refrain from separating it here until additional specimens or sequence data become available. 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. Females are unknown.

Eucanippe absita sp. nov.
http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:FA1DCBBB-9ADC-4683-8B11-77A0F60C58EE
(Figs. 11, 12, 26–38)

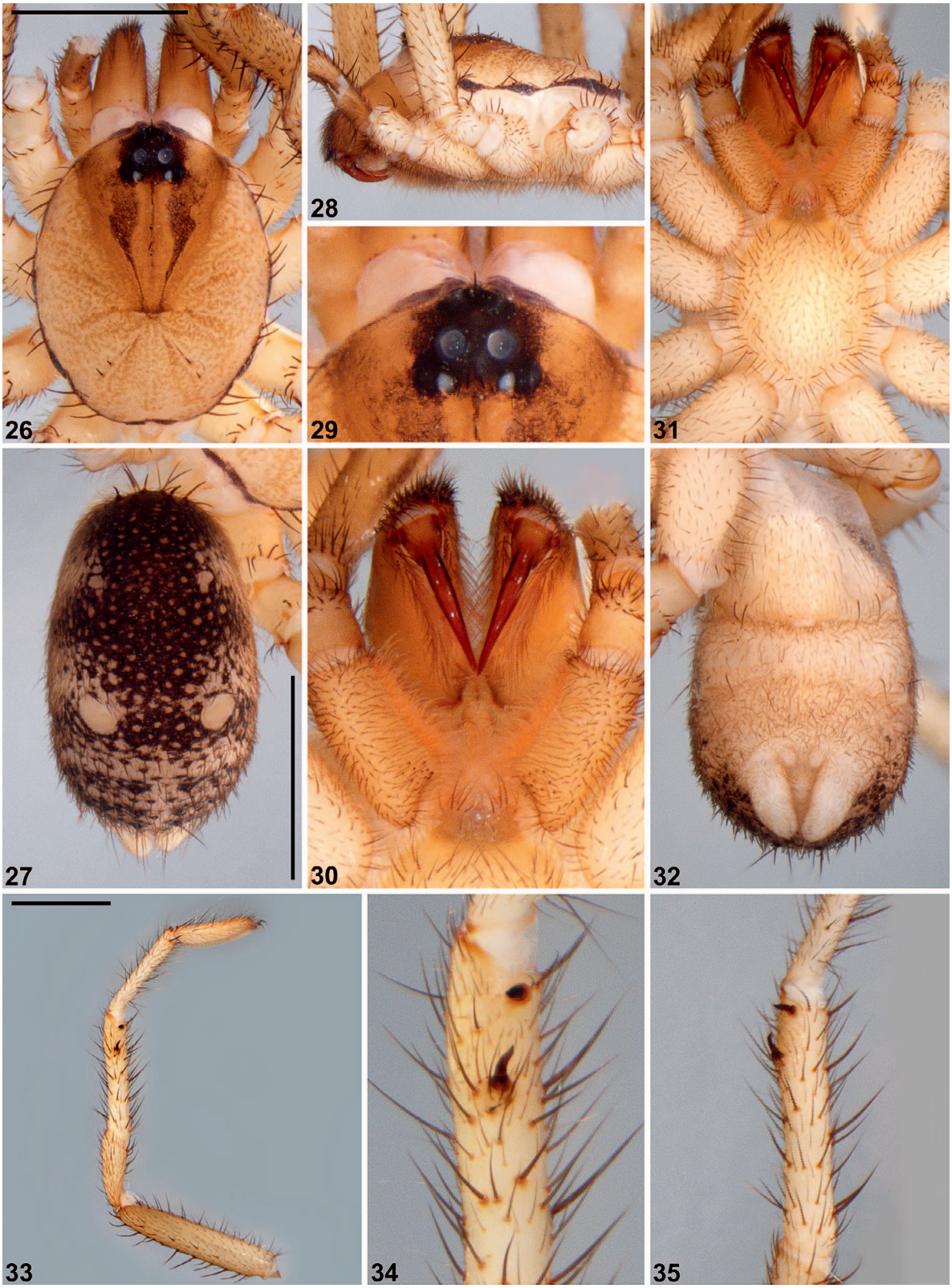
Eucanippe sp. 'Mount Mason' Rix et al., 2017d: 608, figs. 176, 177, 181, 185, 186.

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Mt Mason, 100 km WSW. of Leonora, site MM-1-1J (IBRA_MUR), 29°06′56.4″S, 120°21′40.8″E, pitfall trap, 29 July 2008, M. Quinn, G. Murray (WAM T110226).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Vermin Proof Fence, E. of Beacon, site BE 2 (IBRA_COO), 30°14′17″S, 118°20′09″E, wet pitfalls, 15 September 1998–25 October 1999, P. Van Heurck, CALM Survey (WAM T143015).

Etymology.—The specific epithet is derived from the Latin 'absitus' (adjective: 'distant', 'apart' or 'remote'; see Brown 1956), in reference to the disjunct distribution of this species in the remote Coolgardie and Murchison bioregions.

Diagnosis.—Males of *Eucanippe absita* sp. nov. can be distinguished from all other known congeners by the ornate and markedly bi-colored abdominal pattern (Fig. 27; cf. Figs. 14, 40, 62, 74, 87, 109); combined with the shape of the RTA, which has a slightly curved aspinose distal process and a dense, triangular-shaped field of spinules in retrolateral view (Fig. 36; cf. Figs. 23, 49, 70, 83, 96, 118). *Eucanippe absita* sp.



Figures 26–35.—*Eucanippe absita* sp. nov., male holotype (WAM T110226) from Mount Mason (Western Australia; MUR), somatic morphology: 26–27, carapace and abdomen, dorsal view; 28, cephalothorax, lateral view; 29, eyes, dorsal view; 30, mouthparts, ventral view; 31–32, cephalothorax and abdomen, ventral view; 33, leg I, prolateral view; 34, leg I tibia, clasping spurs, prolateral view; 35, leg I tibia, pro-ventral view. Scale bars = 2.0.

Figures 36–38.—*Eucanippe absita* sp. nov., male holotype (WAM T110226) from Mount Mason (Western Australia; MUR), pedipalp: 36, retrolateral view; 37, retro-ventral view; 38, prolateral view. Scale bar = 2.0.

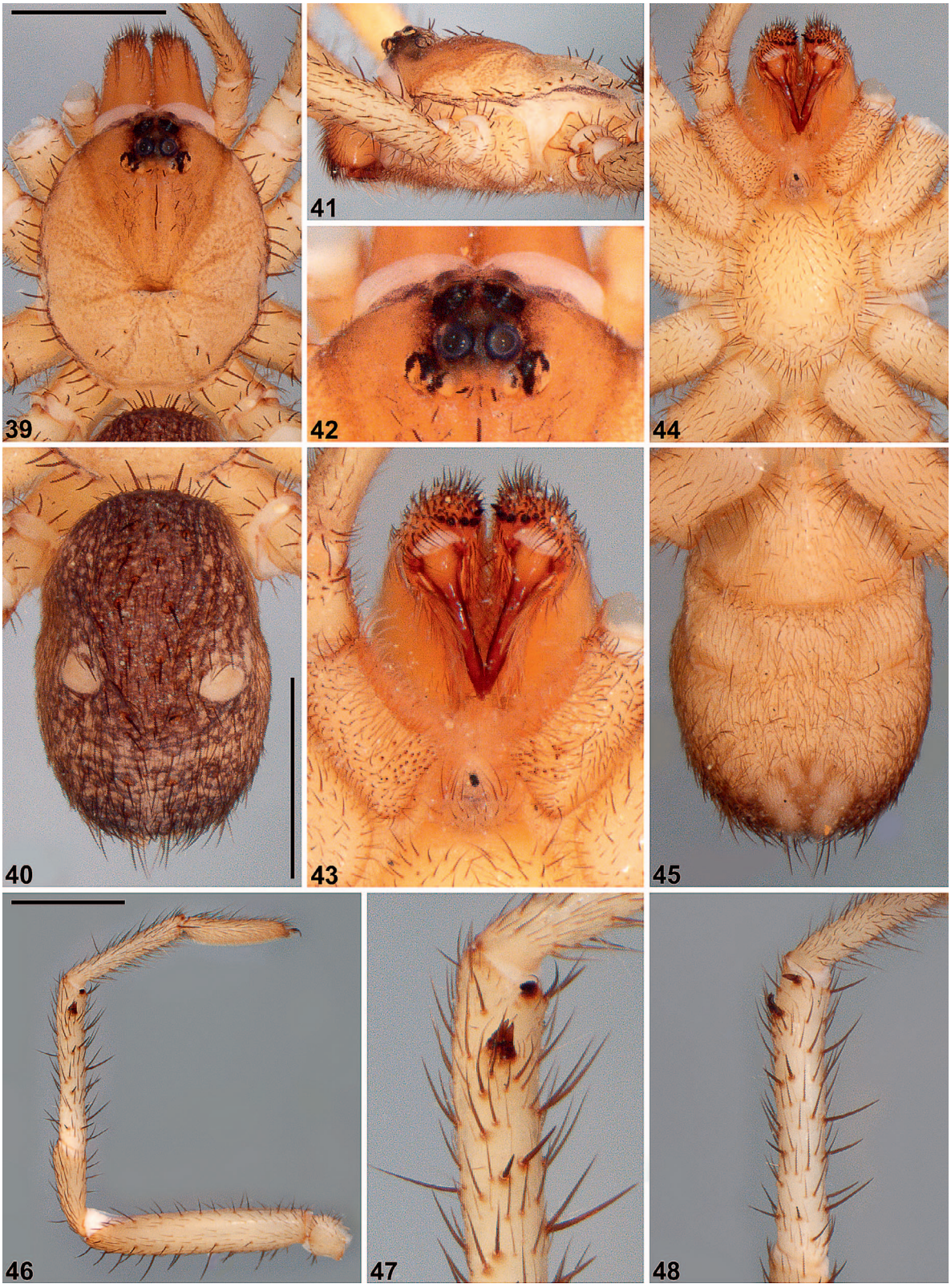
nov. is the smallest known species of *Eucanippe*, with a male carapace length of < 3.5 (Fig. 26).

Description (male holotype).—Total length 7.9. Carapace 3.4 long, 2.7 wide. Abdomen 3.4 long, 2.1 wide. Carapace (Fig. 26) mottled tan, with darker pars cephalica, black ocular region, dark brown lyre-like pattern on pars cephalica and black rim; lateral margins with sparse, irregularly-spaced fringe of porrect black setae; fovea slightly procurved. Eye group (Fig. 29) trapezoidal (anterior eye row strongly procurved), 0.9 x as long as wide, PLE–PLE/ALE–ALE ratio 1.7; ALE almost contiguous, angled antero-laterally; AME separated by slightly less than half their own diameter; PME separated by ca. 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. 30); labium without cuspules. Abdomen (Figs. 27, 32) oval, dark grey-brown in dorsal view with beige-tan mottling, two pairs of prominent beige-tan sigilla spots, beige dorso-lateral markings adjacent to sigilla pairs 1 and 2, and thick beige banding posteriorly. Dorsal surface of abdomen (Fig. 27) covered with stiff, porrect black setae, each with slightly raised, dark brown sclerotic base, the latter largest medially; single pair of large, lightly sclerotized oval sigilla present (sigilla pair 2), separated by nearly 3.0 x their own width. Legs (Figs. 33–35) variable shades of pale tan, with light scopulae on tarsi I–II; tibia I bearing small prolateral clasping spurs; proximal-most clasping spur with single, spur-like macroseta. Leg I: femur 3.4; patella 1.6; tibia 2.4; metatarsus 2.1; tarsus 1.7; total 11.2. Leg I femur–tarsus/carapace length ratio 3.3. Pedipalpal tibia (Figs. 36–38) 1.8 x longer than wide; RTA relatively large, triangular in retro-lateral view, with slightly curved aspinose distal process and dense, triangular-shaped field of retrolateral spinules; tibia also with field of spinules extending along curved retroventral edge (distal to base of RTA), consisting of 2 large and 4 smaller spinules. Cymbium (Figs. 36–38) setose, with only a few long spinules anteriorly. Embolus (Figs. 12, 36–38) ca. 1.5 x length of bulb, sharply tapering distally, with broad twisted morphology, sub-distal flange and finely bifurcate tip; embolic apophysis absent.

Distribution and remarks.—*Eucanippe absita* (formerly known by WAM identification code 'MYG262') is known from only two widely separated locations in the arid inland of south-western Australia: at Mount Mason, in the southern Murchison bioregion; and 51 km north-east of Beacon, in the western Coolgardie bioregion (Fig. 11). The Beacon specimen is poorly preserved and highly discolored, and the pedipalp is damaged (see Supplementary File 1, online at http://dx.doi.org/10.1636/JoA-S-17-030.s1); this specimen is therefore tentatively assigned to the species based on its size, the shape of the RTA and the apparent coloration of the abdomen, on which the diagnostic pale lateral markings seem faintly visible. 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-winter. Females are unknown.

Eucanippe agastachys sp. nov.
http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:C40E62C6-83A8-4760-B4FF-104D62E866FF
(Figs. 4, 11, 39–60)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Durokoppin Nature Reserve, NW. tip, Transect G100 (IBRA_AVW), 31°24′S, 117°45′E, pitfall trap, 23 June–4 August 1987, B.Y. Main (WAM T139546).



Figures 39–48.—*Eucanippe agastachys* sp. nov., male holotype (WAM T139546) from Durokoppin Nature Reserve (Western Australia; AVW), somatic morphology: 39–40, carapace and abdomen, dorsal view; 41, cephalothorax, lateral view; 42, eyes, dorsal view; 43, mouthparts, ventral view; 44–45, cephalothorax and abdomen, ventral view; 46, leg I, prolateral view; 47, leg I tibia, clasping spurs, prolateral view; 48, leg I tibia, pro-ventral view. Scale bars = 2.0.

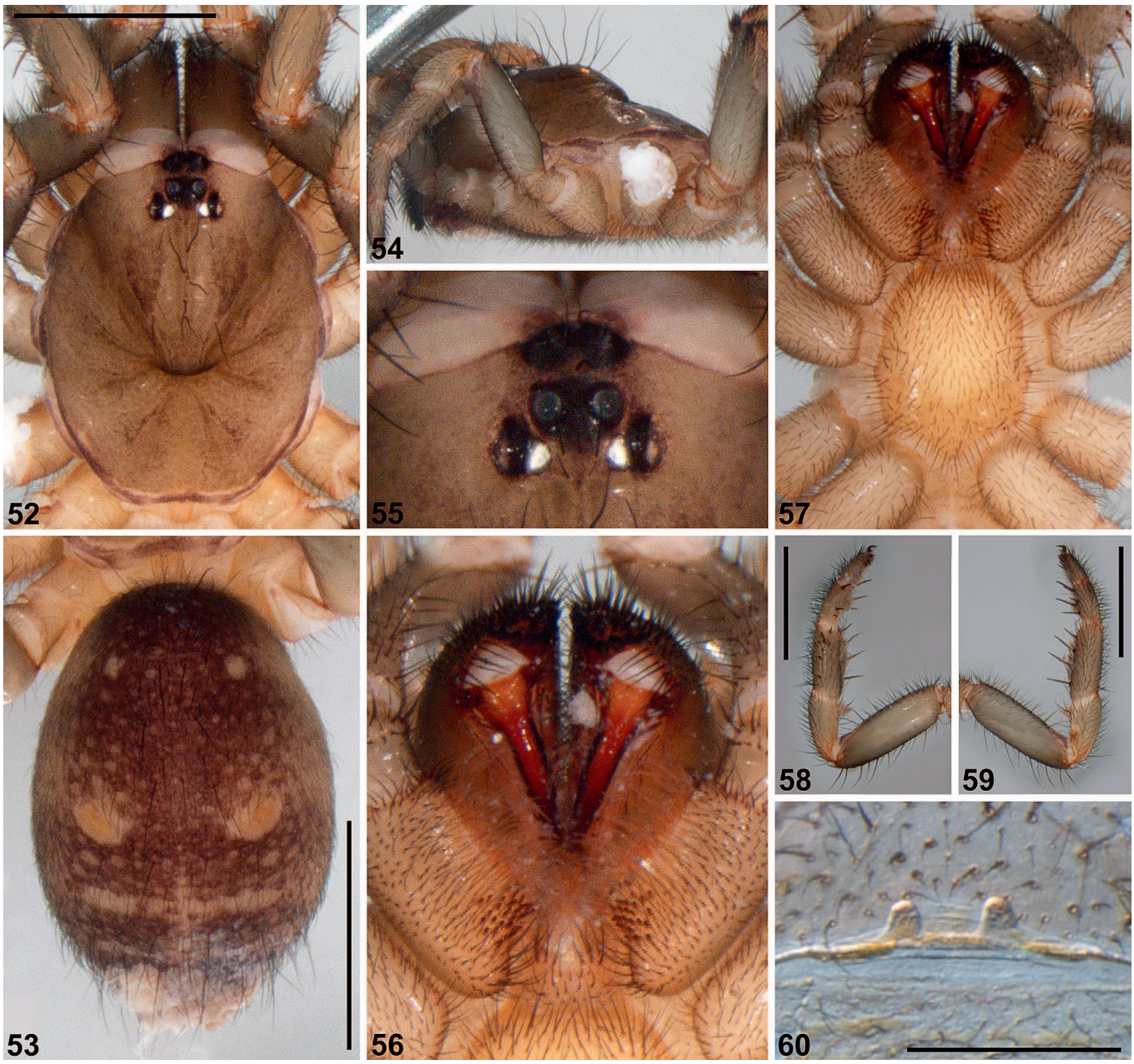
Figures 49–51.—*Eucanippe agastachys* sp. nov., male holotype (WAM T139546) from Durokoppin Nature Reserve (Western Australia; AVW), pedipalp: 49, retrolateral view; 50, retro-ventral view; 51, prolateral view. Scale bar = 2.0.

Paratypes. AUSTRALIA: *Western Australia*: 2 ♂, Durokoppin Nature Reserve, NW. tip, Transect D (IBRA_AVW), 31°24′S, 117°45′E, pitfall trap, 3 May–25 June 1988, B.Y. Main (WAM T139544); 1 ♂, same data except 20 July–11 August 1990 (WAM T139551); 2 ♂, same data except Transect E, 3 May–25 June 1988 (WAM T139545); 1 ♂, same data except 9 July–20 September 1989 (WAM T139547); 1 ♂, same data except 20 July–11 August 1990 (WAM T139549); 1 ♂, same data except 4 June–19 July 1990 (WAM T139550); 1 ♂, same data except Transect F (WAM T139543); 1 ♂, same data except Transect G (WAM T139548); 1 ♂, same data except Transect F100, 6–27 May 1987 (WAM T139542).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Bendering Reserve Road, site KN 11 (IBRA_MAL), 32°21′27″S, 118°29′46″E, wet pitfalls, 30 October 1997–19 May 1998, P. Van Heurck, N. Guthrie, CALM Survey (WAM T143016); 1 ♂, ca. 16 km N. of Doodlakine, bushland remnant K46A NE. (IBRA_AVW), 31°34′S, 117°49′E, pitfall, July 1992, G. Smith et al. (WAM T57305); 1 ♂, East Yorkrakine Nature Reserve, EYR K2 (IBRA_AVW), 31°23′S, 117°40′E, wet pitfall traps, 15–25 September 1989, G. Friend et al. (WAM T44165); 1 ♂, Gardner Reserve Road, north, NE. of Quairading, site QU 3 (IBRA_AVW), 31°46′45″S, 117°28′22″E, wet pitfalls, 30 October 1997–27 May 1998, E. Ladhams, CALM Survey (WAM T139662); 1 ♂, same data (WAM T139664); 1 juvenile (subadult), Hopkins Nature Reserve, SE. of Kulin (IBRA_MAL), 32°43′15″S, 118°16′59″E, hand collected, litter brushing under shrub, 12 April 2017, M. Rix, M. Harvey, J. Cosgrove (WAM T143012); 1 ♂, Jilakin Lake, site KN 1 (IBRA_MAL), 32°40′29″S, 118°20′10″E, wet pitfalls, 30 October 1997–15 May 1998, L. King, CALM Survey (WAM T143017); 1 ♂, Kwelkan (IBRA_AVW), 31°08′21″S, 117°59′43″E, wet pitfall trap, 29 June–7 September 1999, B.Y. Main, J.M. Waldock (WAM T40014); 1 ♂, same data (WAM T39678); 1 ♂, Lake Hurlstone Nature Reserve, site HY 12 (IBRA_MAL), 32°32′32″S, 119°22′42″E, wet pitfalls, 30 October 1997–20 May 1998, P. Van Heurck, N. Guthrie, CALM Survey (WAM T143018); 1 ♂, same data (WAM T143019); 1 ♂, Manmanning Nature Reserve, NW., site WH 10 (IBRA_AVW), 30°53′32″S, 117°05′17″E, wet pitfalls, 15 September 1998–25 October 1999, P. Van Heurck, CALM Survey (WAM T139659); 1 ♂, W. of Minnivale (IBRA_AVW), 31°07′58″S, 117°10′13″E, wet pitfall trap, 21 May–16 September 1996, M.S. Harvey, J.M. Waldock (WAM T38503); 1 ♂, Mt Stirling Road, site QU 10 (IBRA_AVW), 31°59′27″S, 117°24′19″E, wet pitfalls, 30 October 1997–27 May 1998, P. Van Heurck, N. Guthrie, CALM Survey (WAM T139665); 1 ♂, same data (WAM T143020); 1 ♂, North Bungulla Nature Reserve (IBRA_AVW), 31°32′S, 117°35′E, pitfall trap, 22 June–1 August 1983, B.Y. Main (WAM T139658); 1 ♂, Wamenusking Nature Reserve, site QU 6 (IBRA_AVW), 32°07′34″S, 117°30′31″E, wet pitfalls, 26 May–5 October 1998, N. Guthrie, CALM Survey (WAM T143021).

Etymology.—The specific epithet is derived from the Greek 'agastachys' (adjective: 'rich in grain' or 'many ears of grain'; see Brown 1956), in reference to the distribution of this species in the Wheatbelt and north-western Mallee agricultural zones of south-western Australia.

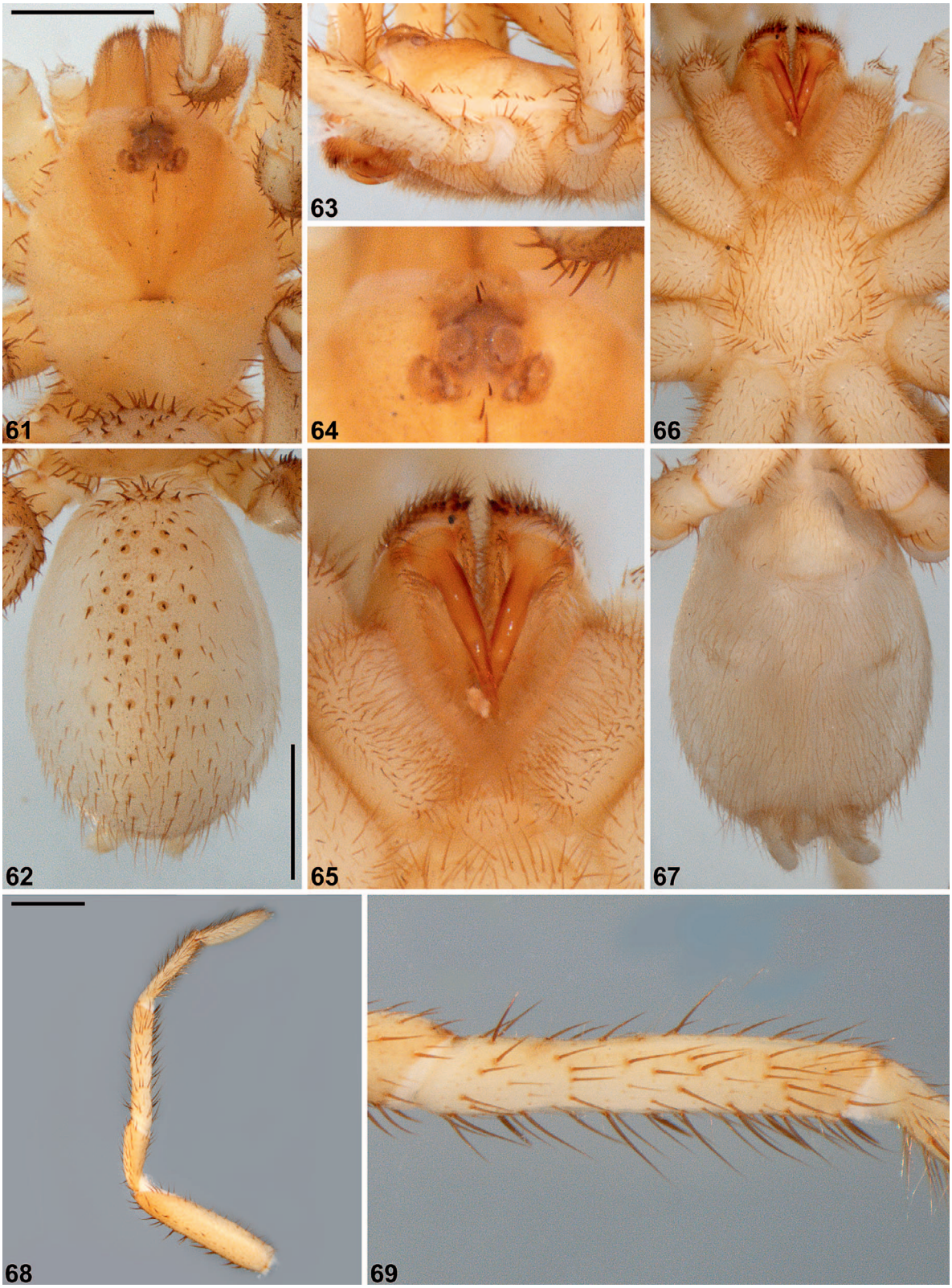
Diagnosis.—Males of *Eucanippe agastachys* sp. nov. can be distinguished from all other known congeners by the combined presence of prolateral clasping spurs on tibia I (Figs. 46–48) (spurs absent in *E. eucla* sp. nov.; Fig. 69); by the presence of a large RTA with a long and aspinose distal



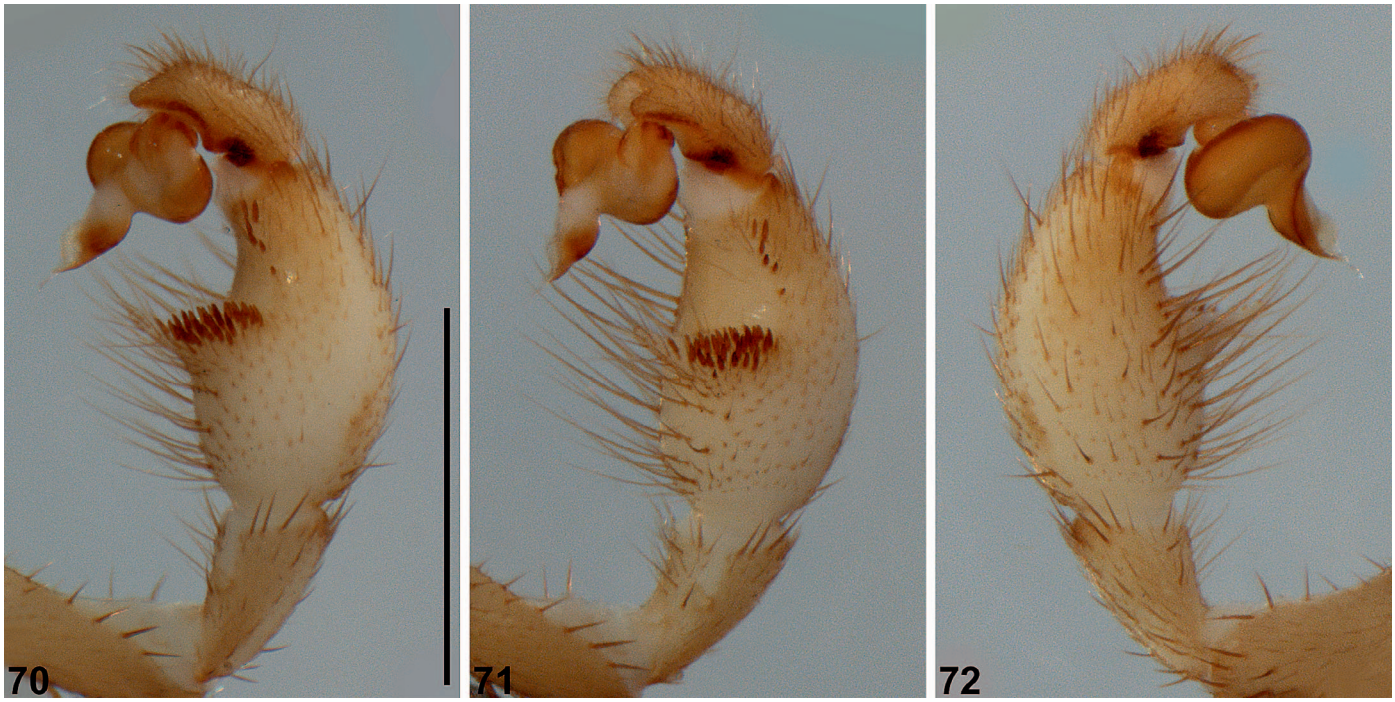
Figures 52–60.—*Eucanippe agastachys* sp. nov., subadult (likely penultimate) female (WAM T143012) from Hopkins Nature Reserve (Western Australia; MAL): 52–53, carapace and abdomen, dorsal view; 54, cephalothorax, lateral view; 55, eyes, dorsal view; 56, mouthparts, ventral view; 57, cephalothorax, ventral view; 58, leg I, prolateral view; 59, leg I, retrolateral view; 60, rudimentary spermathecae, dorsal view. Scale bars = 2.0 (52–53, 58–59), 0.5 (60).

process (Figs. 49, 50) (distal process smaller or absent in *E. bifida* and *E. mallee* sp. nov.; Figs. 23, 83); by the dorsal color pattern of the abdomen, which is not ornately patterned (Fig. 40) (abdomen markedly bi-colored in *E. absita*; Fig. 27); and by the position and shape of the RTA, the proximal mid-point of which projects from the lower half of the palpal tibia, and which is directed away from the ventral face of the tibia in a relatively anterior orientation (Fig. 49) (RTA directed more ventrally in *E. mouldsi* sp. nov. and *E. nemestrina* sp. nov.; Figs. 96, 118).

Description (male holotype).—Total length 8.1. Carapace 3.6 long, 3.0 wide. Abdomen 3.5 long, 2.3 wide. Carapace (Fig. 39) mottled tan, with darker pars cephalica, mostly black ocular region, faint brown lyre-like pattern on pars cephalica and grey-black rim; lateral margins with uniformly-spaced fringe of porrect black setae; fovea slightly procurved. Eye group (Fig. 42) trapezoidal (anterior eye row strongly procurved), 0.9 x as long as wide, PLE–PLE/ALE–ALE ratio 1.5; ALE contiguous, angled antero-laterally; AME separated by slightly less than half their own diameter; PME separated



Figures 61–69.—*Eucanippe eucla* sp. nov., male holotype (WAM T139649) from E. of Eucla (Western Australia; HAM), somatic morphology: 61–62, carapace and abdomen, dorsal view; 63, cephalothorax, lateral view; 64, eyes, dorsal view; 65, mouthparts, ventral view; 66–67, cephalothorax and abdomen, ventral view; 68, leg I, prolateral view; 69, leg I tibia, prolateral view. Scale bars = 2.0.



Figures 70–72.—*Eucanippe eucla* sp. nov., male holotype (WAM T139649) from E. of Eucla (Western Australia; HAM), pedipalp: 70, retrolateral view; 71, retro-ventral view; 72, prolateral view. Scale bar = 2.0.

by ca. 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. 43); labium without cuspules. Abdomen (Figs. 40, 45) oval, grey-brown in dorsal view with tan mottling, pair of prominent beige-tan sigilla spots, and faint tan banding posteriorly. Dorsal surface of abdomen (Fig. 40) covered with stiff, porrect black setae, each with slightly raised, dark brown sclerotic base, the latter largest medially; single pair of large, lightly sclerotized oval sigilla present (sigilla pair 2), separated by nearly 3.0 x their own width. Legs (Figs. 46–48) variable shades of tan, with light scopulae on tarsi I–II; tibia I bearing small prolateral clasping spurs; proximal-most clasping spur with two similarly-sized macrosetae. Leg I: femur 3.9; patella 1.8; tibia 2.9; metatarsus 2.4; tarsus 1.8; total 12.7. Leg I femur–tarsus/carapace length ratio 3.5. Pedipalpal tibia (Figs. 49–51) 1.8 x longer than wide; RTA relatively large, acutely triangular in retrolateral view, with porrect aspinose distal process and sparse field of retrolateral spinules; tibia also with distal field of spinules along curved retroventral edge (distal to base of RTA), consisting of 4 large and 2 smaller spinules. Cymbium (Figs. 49–51) setose, with only a few long spinules anteriorly. Embolus (Figs. 49–51) ca. 1.5 x length of bulb, sharply tapering distally, with broad twisted morphology, subdistal flange and finely bifurcate tip; embolic apophysis absent.

Distribution and remarks.—*Eucanippe agastachys* has a relatively restricted distribution in the central Wheatbelt and north-western Mallee bioregions of south-western Australia, from Manmanning Nature Reserve and Kwelkan in the north, south to Kulin and Lake Hurlstone (Fig. 11). At Hopkins Nature Reserve (near Kulin), a burrow of a single subadult (likely penultimate) specimen (Figs. 4, 52–60) – linked here based on distribution and color pattern – was revealed by brushing compact leaf litter under a low myrtaceous shrub in open sandy heathland. Little else 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, winter and early spring. Adult females are unknown, although the subadult female from near Kulin is illustrated here (Figs. 52–60) for comparative purposes.

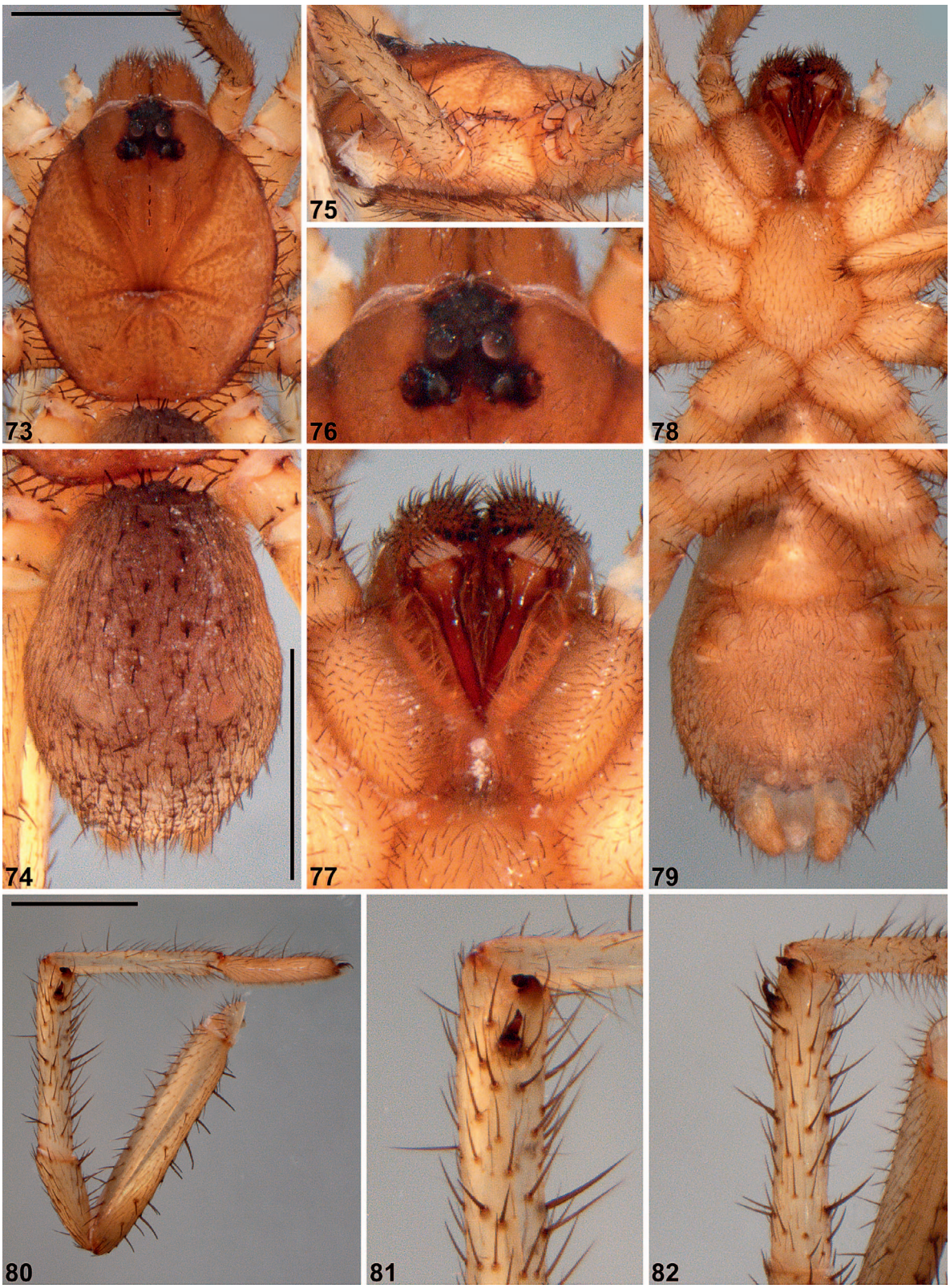
Eucanippe eucla sp. nov.
http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:5A72F843-C35C-4E3A-A4DF-FC0C9B8F968F
(Figs. 11, 61–72)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: 5 km E. of Eucla, site 10 (IBRA_HAM), 31°40′S, 128°56′E, pitfall trap, 21 May 1986, B.Y. Main (WAM T139649).

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

Diagnosis.—Males of *Eucanippe eucla* sp. nov. can be distinguished from all other known congeners by the absence of prolateral clasping spurs on tibia I (Figs. 68, 69; cf. Figs. 21, 34, 47, 81, 94, 116).

Description (male holotype).—Total length 10.8. Carapace 4.4 long, 3.6 wide. Abdomen 5.3 long, 3.7 wide. Carapace (Fig. 61) very pale (faded) mottled tan, with darker pars cephalica and darker ocular region; lateral margins with uniformly-spaced fringe of porrect black setae; fovea slightly procurved. Eye group (Fig. 64) trapezoidal (anterior eye row strongly procurved), 0.9 x as long as wide, PLE–PLE/ALE–ALE ratio 1.8; ALE almost contiguous, angled antero-



Figures 73–82.—*Eucanippe mallee* sp. nov., male holotype (WAM T143025) from north of Lake King-Norseman Rd (Western Australia; MAL), somatic morphology: 73–74, carapace and abdomen, dorsal view; 75, cephalothorax, lateral view; 76, eyes, dorsal view; 77, mouthparts, ventral view; 78–79, cephalothorax and abdomen, ventral view; 80, leg I, prolateral view; 81, leg I tibia, clasping spurs, prolateral view; 82, leg I tibia, pro-ventral view. Scale bars = 2.0.

Figures 83–85.—*Eucanippe mallee* sp. nov., male holotype (WAM T143025) from north of Lake King-Norseman Rd (Western Australia; MAL), pedipalp: 83, retrolateral view; 84, retro-ventral view; 85, prolateral view. Scale bar = 2.0.

laterally; AME separated by slightly less than half their own diameter; PME separated by slightly more than 3.0 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. 65); labium without cuspules. Abdomen (Figs. 62, 67) oval, very pale (faded) beige in dorsal view. Dorsal surface of abdomen (Fig. 62) covered with stiff, porrect black setae, each with slightly raised, dark brown sclerotic base, the latter largest medially; single pair of large, lightly sclerotized oval sigilla present (sigilla pair 2), separated by ca. 4.0 x their own width. Legs (Figs. 68, 69) variable shades of pale (faded) tan, with light scopulae on tarsi I–II; tibia I unmodified, without prolateral clasping spurs or distal macrosetae. Leg I: femur 4.1; patella 2.0; tibia 3.2; metatarsus 2.5; tarsus 2.0; total 13.8. Leg I femur–tarsus/carapace length ratio 3.2. Pedipalpal tibia (Figs. 70–72) 1.8 x longer than wide; RTA relatively large, with porrect aspinose distal process and relatively sparse field of retrolateral spinules; tibia also with field of spinules extending along curved retroventral edge (distal to base of RTA), consisting of 1 large and 5 increasingly smaller spinules. Cymbium (Figs. 70–72) setose, with only a few long spinules anteriorly. Embolus (Figs. 70–72) ca. 1.5 x length of bulb, sharply tapering distally, with broad twisted morphology, sub-distal flange and finely bifurcate tip; embolic apophysis absent.

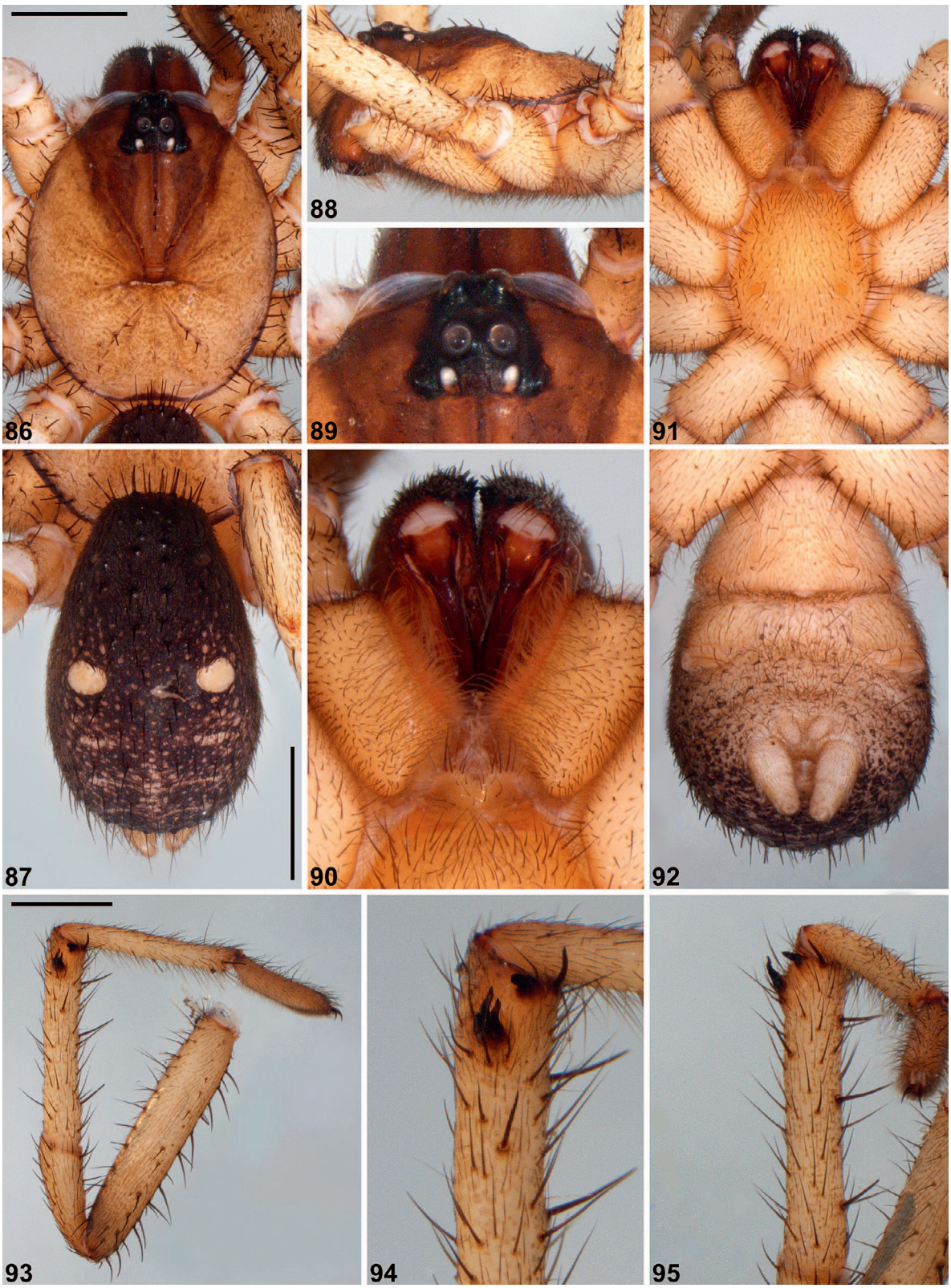
Distribution and remarks.—*Eucanippe eucla* is known only from east of Eucla in southern Western Australia, near the Western Australian/South Australian border (Fig. 11). Nothing is known of the biology of this species, other than that the holotype male specimen was collected wandering in search of females in late autumn. Females are unknown.

Eucanippe mallee sp. nov.
http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:7E75FFE0-937C-499A-B2FC-8A37A5A02FFC
(Figs. 11, 73–85)

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: N. of Lake King-Norseman Rd, site LK 13 (IBRA_MAL), 33°04′54″S, 119°59′53″E, wet pitfalls, 15 October 1999–20 October 2000, N. Guthrie, CALM Survey (WAM T143025).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Dragon Rocks Nature Reserve, northern end, site HY 4 (IBRA_MAL), 32°41′27″S, 118°58′30″E, wet pitfalls, 30 October 1997–20 May 1998, N. Guthrie, CALM Survey (WAM T143022); 2 ♂, Lake Magenta Nature Reserve (E. Central), east, site PI 11 (IBRA_MAL), 33°36′59″S, 119°11′58″E, wet pitfalls, 15 October 1999–1 November 2000, P. Van Heurck, CALM Survey (WAM T143023); 1 ♂, Mount Vernon, site HY 7 (IBRA_MAL), 32°46′40″S, 119°14′01″E, wet pitfalls, 30 October 1997–20 May 1998, P. Van Heurck, N. Guthrie, CALM Survey (WAM T143024); 3 ♂, Pingaring-Varley Road Sth, Dragon Rocks Nature Reserve, site HY 6 (IBRA_MAL), 32°46′10″S, 119°00′32″E, wet pitfalls, 30 October 1997–20 May 1998, P. Van Heurck, N. Guthrie, CALM Survey (WAM T139663); 2 ♂, same data (WAM T143026); 1 ♂, Silver Wattle Hill Nature Reserve site PI 1 (IBRA_MAL), 33°08′56″S, 118°49′46″E, wet pitfalls, 15 October 1999–1 November 2000, P. Van Heurck, CALM Survey (WAM T139660); 1 ♂, same data (WAM T143027); 1 ♂, same data (WAM T143028).

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



Figures 86–95.—*Eucanippe mouldsi* sp. nov., male holotype (WAM T117264) from near Wellstead (Western Australia; ESP), 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, clasping spurs, prolateral view; 95, leg I tibia, pro-ventral view. Scale bars = 2.0.

Figures 96–98.—*Eucanippe mouldsi* sp. nov., male holotype (WAM T117264) from near Wellstead (Western Australia; ESP), pedipalp: 96, retrolateral view; 97, retro-ventral view; 98, prolateral view. Scale bar = 2.0.

Diagnosis.—Males of *Eucanippe mallee* sp. nov. can be distinguished from all other known congeners by the shape of the RTA, which is of an intermediate length, with only a short distal process (Figs. 83, 84; cf. Figs. 23, 36, 49, 70, 96, 118). This species can be further distinguished from the similar species *E. bifida* by the presence of just 1 enlarged spur-like seta on the proximal-most leg I clasping spur (Figs. 80, 81; cf. Fig. 21) (if >1 seta is rarely present, the spur-like seta remains the largest).

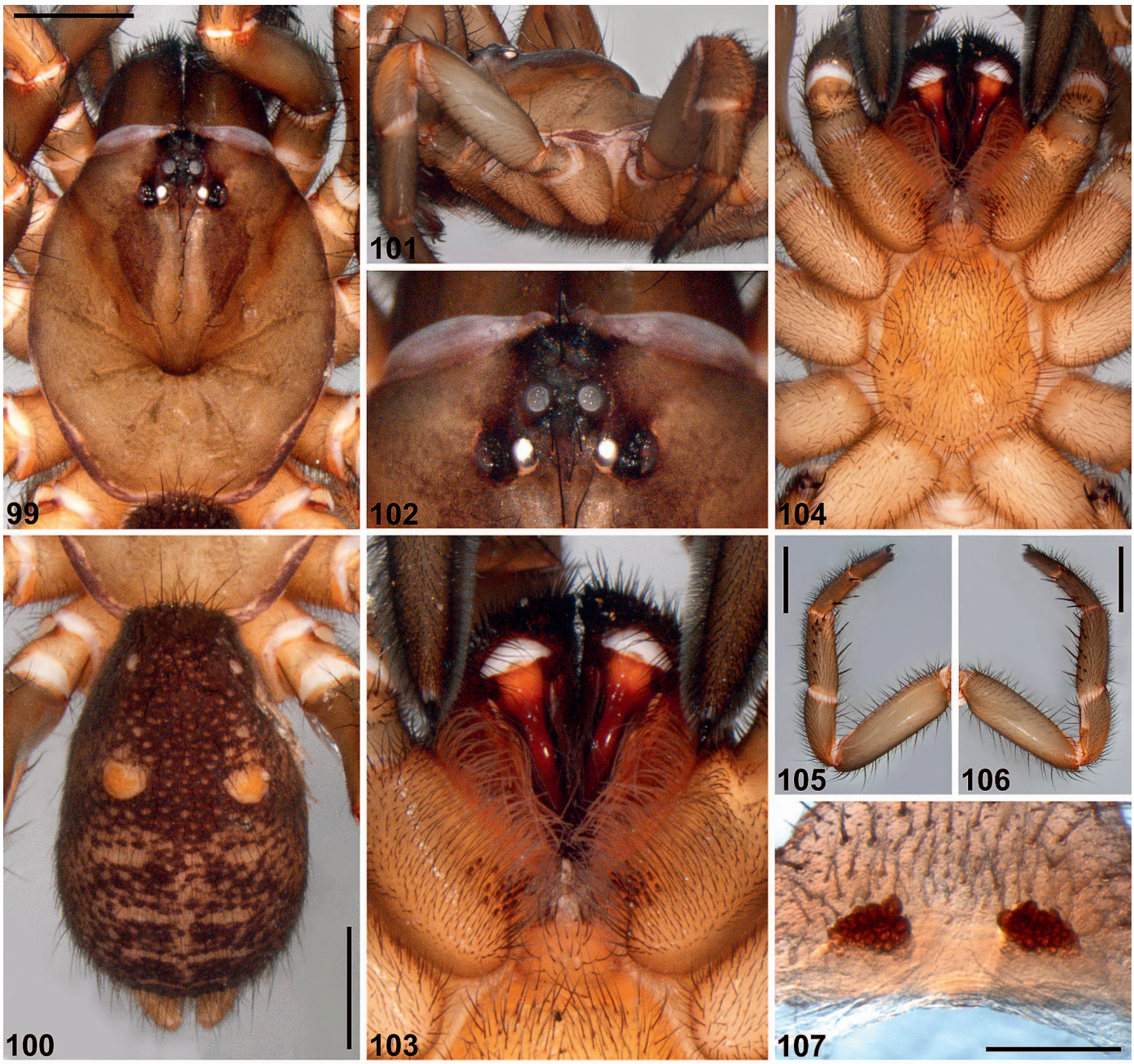
Description (male holotype).—Total length 7.2. Carapace 3.6 long, 3.0 wide. Abdomen 3.1 long, 2.2 wide. Carapace (Fig. 73) mottled dark tan, with darker pars cephalica, black ocular region, and dark brown-black rim; lateral margins with uniformly-spaced fringe of porrect black setae; fovea slightly procurved. Eye group (Fig. 76) trapezoidal (anterior eye row strongly procurved), 0.9 x as long as wide, PLE–PLE/ALE–ALE ratio 1.5; ALE contiguous, angled antero-laterally; AME separated by slightly less than half their own diameter; PME separated by ca. 2.0 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. 77); labium without cuspules. Abdomen (Figs. 74, 79) oval, light brown in dorsal view, palest posteriorly, with pair of prominent light brown sigilla spots. Dorsal surface of abdomen (Fig. 74) covered with stiff, porrect black setae, each with slightly raised, dark brown sclerotic base, the latter largest medially; single pair of large, lightly sclerotized oval sigilla present (sigilla pair 2), separated by slightly more than 3.0 x their own width. Legs (Figs. 80–82) variable shades of tan, with light scopulae on tarsi I–II; tibia I bearing small prolateral clasping spurs; proximal-most clasping spur with single, spur-like macroseta. Leg I: femur 4.0; patella 1.9; tibia 3.0; metatarsus 2.8; tarsus 1.8; total 13.5. Leg I femur–tarsus/carapace length ratio 3.7. Pedipalpal tibia (Figs. 83–85) 1.8 x longer than wide; RTA of intermediate length, roundly-pointed distally, with short distal process and sparse field of retrolateral spinules extending along length of RTA; tibia also with field of spinules along curved retroventral edge (distal to base of RTA), consisting of 1 large and 4 smaller spinules. Cymbium (Figs. 83–85) setose, with only a few long spinules anteriorly. Embolus (Figs. 83–85) ca. 2.0 x length of bulb, sharply tapering distally, with broad twisted morphology, sub-distal flange and finely bifurcate tip; embolic apophysis absent.

Distribution and remarks.—*Eucanippe mallee* has a restricted distribution in the western Mallee bioregion of south-western Australia, from the Silver Wattle Hill and Dragon Rocks Nature Reserves, east to Frank Hann National Park and south to Lake Magenta Nature Reserve (Fig. 11). Nothing is known of the biology of this species, and females are unknown.

Eucanippe mouldsi sp. nov.
http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:0129A99C-C6E9-4A05-AD69-69F9E67D7426
(Figs. 1–3, 11, 86–107)

Eucanippe sp. 'Stirling Range National Park' Rix et al., 2017d: 608, figs. 178–179, 184, 187.
Eucanippe sp. 'Wellstead' Rix et al., 2017d: 608, figs. 182, 188.

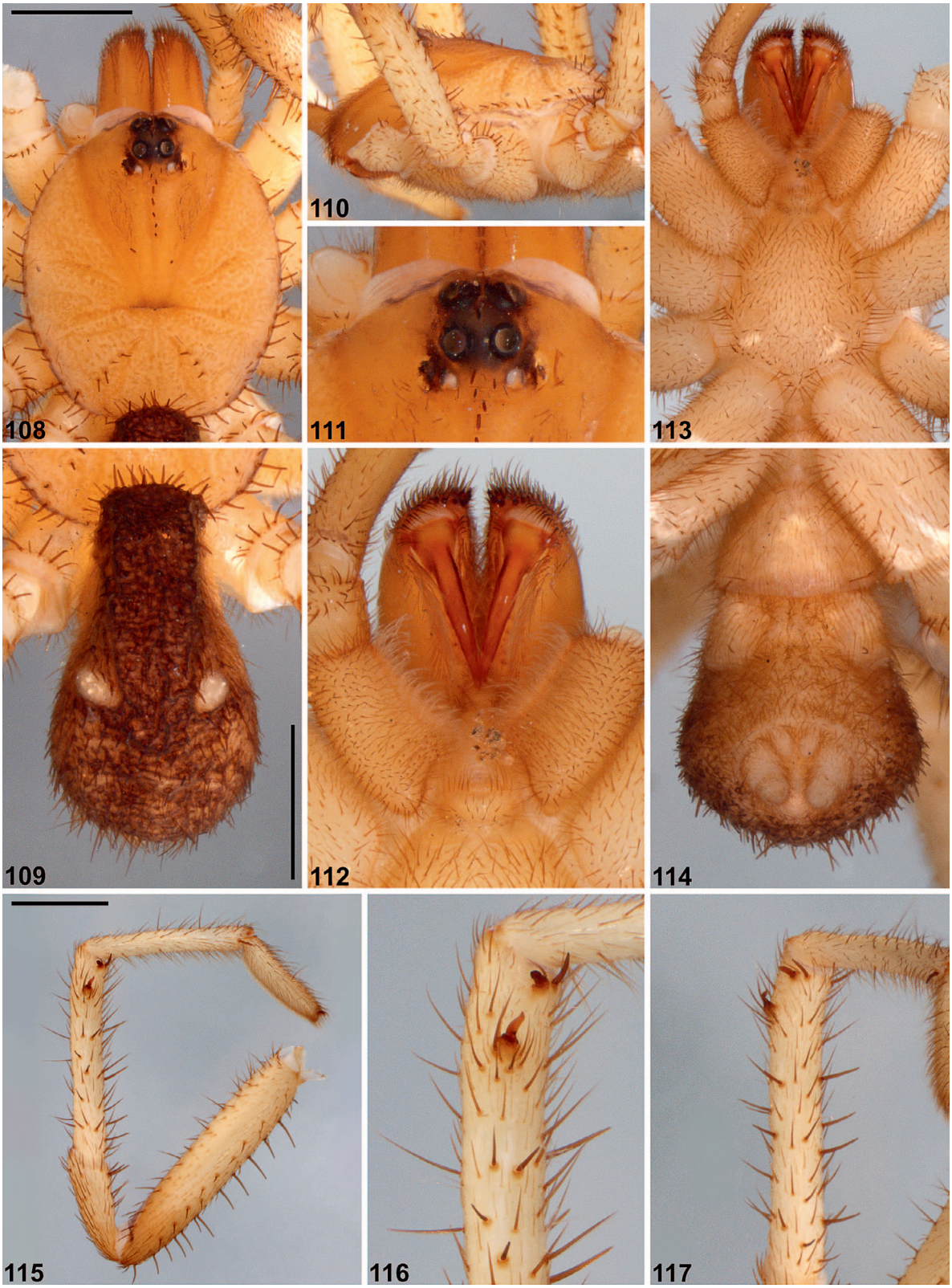
Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Wellstead, Gnowellan Road (IBRA_ESP), 34°30′07.5″S, 118°31′22.5″E, pitfall trap, 13–18 August 2011, T. Moulds, G. Owen (WAM T117264).



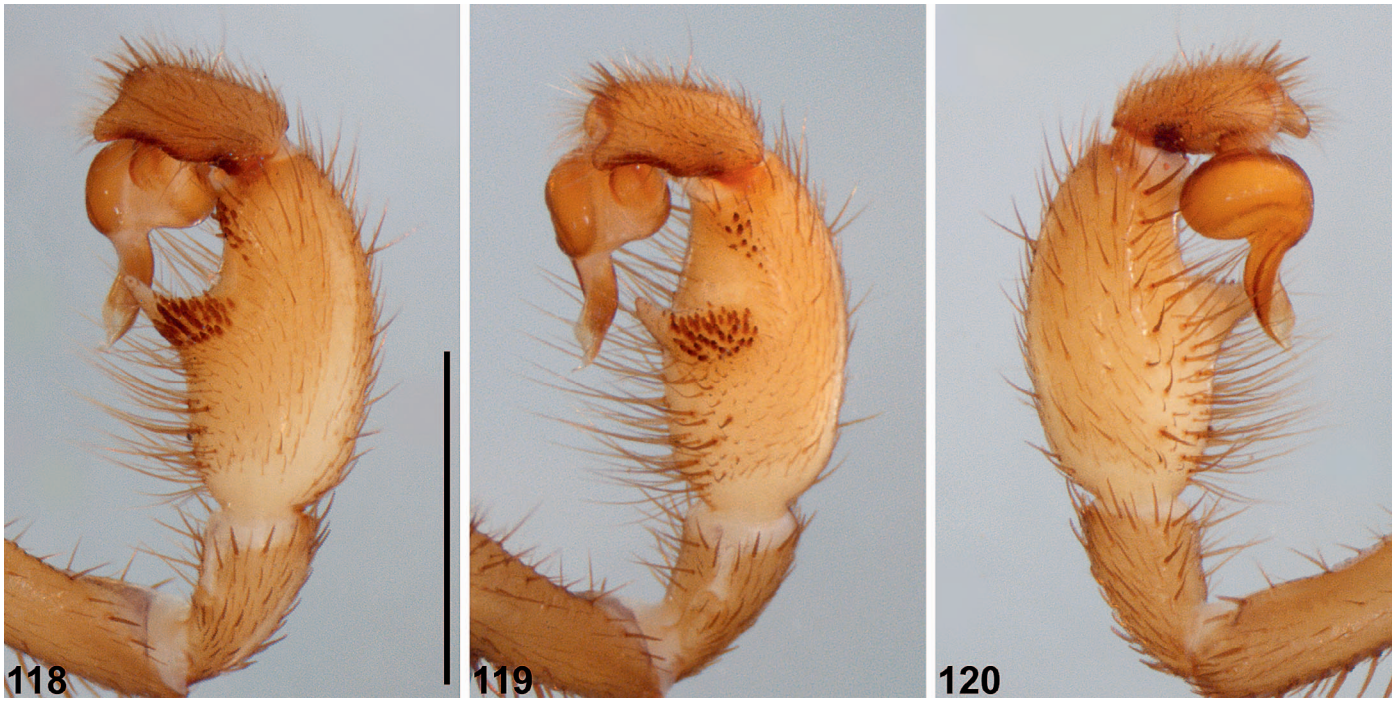
Figures 99–107.—*Eucanippe mouldsi* sp. nov., female paratype (WAM T143003) from near Wellstead (Western Australia; ESP): 99–100, carapace and abdomen, dorsal view; 101, cephalothorax, lateral view; 102, eyes, dorsal view; 103, mouthparts, ventral view; 104, cephalothorax, ventral view; 105, leg I, prolateral view; 106, leg I, retrolateral view; 107, spermathecae, dorsal view. Scale bars = 2.0 (99–100, 105–106), 0.5 (107).

Paratypes. AUSTRALIA: *Western Australia*: 1 ♂, same data as holotype except hand collected from burrow, 9 April 2017, M. Rix, M. Harvey, J. Cosgrove (WAM T143002); 1 ♀, same data (WAM T143003).

Other material examined.—AUSTRALIA: *Western Australia*: 1 juvenile, Wellstead, Gnowellan Road (IBRA_ESP), 34°30′07.5″S, 118°31′22.5″E, hand collected from burrow, 9 April 2017, M. Rix, M. Harvey, J. Cosgrove (WAM T143004); 1 juvenile, same data (WAM T143005); 1 ♂, Dunn Rock Nature Reserve, E. of Dunn Rock, site LK 8 (IBRA_MAL), 33°20′37″S, 119°31′30″E, wet pitfalls, 15 October 1999–20 October 2000, N. Guthrie, CALM Survey (WAM T139666); 1 ♂, same data (WAM T143029); 1 ♂, Lake Magenta Nature Reserve (N. Central), west, site PI 7 (IBRA_MAL), 33°29′41″S, 119°02′53″E, wet pitfalls, 15 October 1999–1 November 2000, P. Van Heurck, CALM Survey (WAM T139661); 1 ♂, Peringillup Nature Reserve, site ST 12 (IBRA_AVW), 33°56′37″S, 117°38′41″E, wet pitfalls, 15 October 1999–1 November 2000, P. Van Heurck, CALM Survey (WAM T143030); 1 ♂, Stirling Range National Park, NW. of Two Mile Lake (STR 5b-4) (IBRA_ESP), 34°28′S, 118°15′E, pitfalls, 10–20 September 1990, G. Friend et al.



Figures 108–117.—*Eucanippe nemestrina* sp. nov., male holotype (WAM T139657) from Mount Saddleback (Western Australia; JAF), somatic morphology: 108–109, carapace and abdomen, dorsal view; 110, cephalothorax, lateral view; 111, eyes, dorsal view; 112, mouthparts, ventral view; 113–114, cephalothorax and abdomen, ventral view; 115, leg I, prolateral view; 116, leg I tibia, clasping spurs, prolateral view; 117, leg I tibia, pro-ventral view. Scale bars = 2.0.



Figures 118–120.—*Eucanippe nemestrina* sp. nov., male holotype (WAM T139657) from Mount Saddleback (Western Australia; JAF), pedipalp: 118, retrolateral view; 119, retro-ventral view; 120, prolateral view. Scale bar = 2.0.

(WAM T44163); 1 ♂, Stirling Range National Park, W. of Two Mile Lake (STR 1-4) (IBRA_ESP), 34°29′S, 118°15′E, pitfall trap, 10–20 September 1990, G. Friend et al. (WAM T41782).

Etymology.—The specific epithet is a patronym in honor of Tim Moulds, in recognition of his contributions to zoology and for collecting the holotype male of this species in 2011.

Diagnosis.—Males of *Eucanippe mouldsi* sp. nov. can be distinguished from all other known congeners except *E. nemestrina* sp. nov. by the combined presence of prolateral clasping spurs on tibia I (Figs. 93–95) (spurs absent in *E. eucla*; Fig. 69); by the presence of a large RTA with a long and usually aspinose distal process (Figs. 96, 97) (distal process smaller or absent in *E. bifida* and *E. mallee* sp. nov.; Figs. 23, 83); by the dorsal color pattern of the abdomen, which is not ornately patterned (Fig. 87) (abdomen markedly bi-colored in *E. absita*; Fig. 27); and by the position and shape of the RTA, the proximal mid-point of which projects from near the middle of the palpal tibia, and which is directed away from the ventral face of the tibia in an antero-ventral orientation (Fig. 96) (RTA directed more anteriorly in *E. agastachys*; Fig. 49). *Eucanippe mouldsi* sp. nov. can be distinguished from *E. nemestrina* sp. nov. by the darker coloration of the carapace and abdomen, which are both heavily pigmented (Figs. 86, 87; cf. Figs. 108–109), combined with the presence of stiff, porrect black setae on the dorsal abdomen which have slightly larger, more strongly-sclerotized sclerotic bases (Fig. 87; cf. Fig. 109).

Description (male holotype).—Total length 11.3. Carapace 5.4 long, 4.4 wide. Abdomen 5.1 long, 3.2 wide. Carapace (Fig. 86) mottled dark tan, with darker brown pars cephalica, black ocular region, dark brown lyre-like pattern on pars cephalica and black rim; lateral margins with uniformly-spaced fringe of porrect black setae; fovea slightly procurved. Eye group (Fig. 89) trapezoidal (anterior eye row strongly procurved), 0.9 x as long as wide, PLE–PLE/ALE–ALE ratio 1.8; ALE almost contiguous, angled antero-laterally; AME separated by slightly less than half their own diameter; PME separated by ca. 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. 90); labium without cuspules. Abdomen (Figs. 87, 92) oval, black and dark charcoal-brown in dorsal view with beige-tan mottling, a pair of prominent beige-tan sigilla spots, and three pairs of thin beige bands posteriorly. Dorsal surface of abdomen (Fig. 87) covered with stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; the latter largest medially; single pair of large, lightly sclerotized oval sigilla present (sigilla pair 2), separated by slightly more than 3.0 x their own width. Legs (Figs. 93–95) variable shades of tan, with light scopulae on tarsi I–II; tibia I bearing small prolateral clasping spurs; proximal-most clasping spur with two similarly-sized macrosetae. Leg I: femur 5.3; patella 2.7; tibia 4.1; metatarsus 3.8; tarsus 2.1; total 17.9. Leg I femur–tarsus/carapace length ratio 3.3. Pedipalpal tibia (Figs. 96–98) nearly 2.0 x longer than wide; RTA relatively large, triangular in retrolateral view, with pointed aspinose distal process and dense field of retrolateral spinules; tibia also with field of spinules extending along curved retroventral edge (distal to base of RTA), consisting of ca. 19 spinules of varying length, the latter longest distally. Cymbium (Figs. 96–98) setose, with only a few long spinules anteriorly. Embolus (Figs. 96–98) ca. 1.5 x length of bulb, sharply tapering distally, with broad twisted morphology, sub-distal flange and finely bifurcate tip; embolic apophysis absent.

Description (female paratype, WAM T143003).—Total length 14.2. Carapace 6.2 long, 5.1 wide. Abdomen 6.4 long, 4.1 wide. Carapace (Fig. 99) dark olive-brown (dark brown-black in life; Fig. 3), with slightly darker pars cephalica, mostly black ocular region, dark brown lyre-like pattern on pars cephalica and dark brown rim; fovea procurved. Eye group (Fig. 102) trapezoidal (anterior eye row strongly procurved), 0.9 x as long as wide, PLE–PLE/ALE–ALE ratio 1.9; ALE almost contiguous, angled antero-laterally; AME separated by slightly less than half their own diameter; PME separated by ca. 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. 103); labium without cuspules. Abdomen (Fig. 100) oval, dark brown in dorsal view with beige-tan mottling, a pair of prominent tan sigilla spots, and four pairs of beige-tan bands posteriorly; single pair of large, sclerotized oval sigilla present (sigilla pair 2), separated by slightly less than 3.0 x their own width. Legs (Figs. 105, 106) variable shades of olive-brown (darker brown-black in life with contrasting red-brown patellae; Fig. 3); scopulae present on tarsi and metatarsi I–II; tibia I with 8 stout prolateral macrosetae, 4 ventral spine-like macrosetae and 7 stout retrolateral macrosetae; metatarsus I with 2 stout prolateral macrosetae and 6 longer retrolateral macrosetae. Leg I: femur 4.1; patella 2.5; tibia 2.3; metatarsus 1.7; tarsus 1.4; total 11.9. Leg I femur–tarsus/carapace length ratio 1.9. Pedipalp olive-brown, spinose on tibia and retrolateral tarsus, with thick tarsal scopula. Genitalia (Fig. 107) with pair of short aciniform spermathecae.

Distribution and remarks.—*Eucanippe mouldsi* has a relatively restricted distribution in the 'Great Southern' region of south-western Australia, from the Dunn Rock and Lake Magenta Nature Reserves, west to Peringillup Nature Reserve and south to the Stirling Range and Wellstead (Fig. 11). As a result of dedicated field work conducted in April 2017, this species is now the best known *Eucanippe*, and the only species for which an adult female specimen and burrow data are available. Burrows of *E. mouldsi* sp. nov. are small and highly camouflaged, less than 30 cm deep, with a slightly raised hinge and broad lower lip (Figs. 5–8). At the type locality near Wellstead, these burrows are situated in dense mallee eucalypt and *Banksia* woodland (Figs. 9, 10) on loamy sand soil. Little else 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 early spring, and a newly-molted adult male (Figs. 1, 2) was collected from its burrow in mid-April.

Eucanippe nemestrina sp. nov.
http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:F49F061A-5B44-4438-BFF5-4B5A530CDD6C
(Figs. 11, 108–120)

Aganippe raphiduca Rainbow & Pulleine: Main, 1957: 435, fig. 13a, b (in part, "aberrant" specimen B.M. 56/174 from Albany Highway).

Eucanippe sp. 'Kojonup' Rix et al., 2017d: 608, figs. 183, 189.

Type material.—*Holotype male*. AUSTRALIA: *Western Australia*: Mount Saddleback, Worsley Alumina Project (IBRA_JAF), 32°58′S, 116°28′E, pitfall trap, 27 July 1980, A. Weston (WAM T139657).

Other material examined.—AUSTRALIA: *Western Australia*: 1 ♂, Albany Highway, 164 Mile Peg [ca. Tunney, S. of Kojonup] (IBRA_AVW), 34°07′S, 117°22′E, 25 March 1956, B.Y. Main (WAM T139650); 1 ♂, 20 km S. of Beaufort River tavern on Albany Highway, site A [ca. Watts Road] (IBRA_JAF), 33°45′S, 117°08′E, pitfall trap, 4 July 1980, B.Y. Main (WAM T139655); 1 ♂, same data except 14 September 1980 (WAM T139651); 1 ♂, same data except 29 September 1980 (WAM T139652); 2 ♂, Boddington, Murray River, Worsley Alumina Project, trap 5 (IBRA_JAF), 32°56′S, 116°27′E, pitfall trap, wandoo forest, 14 July 1980, J. Taylor (WAM T139656); 1 ♂, Crapella Road, quarry site, N. of Kojonup (IBRA_JAF), 33°40′S, 117°06′E, pitfall trap, sandy heath with wandoo, 17 July 1983, B.Y. Main (WAM T139654); 1 ♂, 10 km N. of Kojonup, Albany Highway site F [ca. Watts Road] (IBRA_JAF), 33°45′S, 117°08′E, pitfall trap, 8 January 1981, B.Y. Main (WAM T139596); 1 ♂, same data except 27 September 1981 (WAM T139653).

Etymology.—The specific epithet is derived from the Latin 'nemestrinus' (adjective: 'inhabiting groves or forests'), in reference to the distribution of this species in the heavily wooded Jarrah Forest bioregion.

Diagnosis.— Males of *Eucanippe nemestrina* sp. nov. can be distinguished from all other known congeners except *E. mouldsi* by the combined presence of prolateral clasping spurs on tibia I (Figs. 115–117) (spurs absent in *E. eucla*; Fig. 69); by the presence of a large RTA with a long and usually aspinose distal process (Figs. 118, 119) (distal process smaller or absent in *E. bifida* and *E. mallee* sp. nov.; Figs. 23, 83); by the dorsal color pattern of the abdomen, which is not ornately patterned (Fig. 109) (abdomen markedly bi-colored in *E. absita*; Fig. 27); and by the position and shape of the RTA, the proximal midpoint of which projects from near the middle of the palpal tibia, and which is directed away from the ventral face of the tibia in an antero-ventral orientation (Fig. 118) (RTA directed more anteriorly in *E. agastachys*; Fig. 49). *Eucanippe nemestrina* sp. nov. can be distinguished from *E. mouldsi* by the paler coloration of the carapace and abdomen (Figs. 108, 109; cf. Figs. 86, 87), combined with the presence of stiff, porrect black setae on the dorsal abdomen which have slightly smaller, less strongly-sclerotized sclerotic bases (Fig. 109; cf. Fig. 87).

Description (male holotype).—Total length 11.2. Carapace 5.1 long, 4.3 wide. Abdomen 4.6 long, 2.7 wide. Carapace (Fig. 108) mottled tan, with darker pars cephalica, mostly black ocular region, faint brown lyre-like pattern on pars cephalica and dark grey rim; lateral margins with uniformly-spaced fringe of porrect black setae; fovea slightly procurved. Eye group (Fig. 111) trapezoidal (anterior eye row strongly procurved), 0.9 x as long as wide, PLE–PLE/ALE–ALE ratio 1.5; ALE almost contiguous, angled antero-laterally; AME separated by slightly less than half their own diameter; PME separated by slightly less than 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. 112); labium without cuspules. Abdomen (Figs. 109, 114) oval but somewhat shrivelled anteriorly, dark brown in dorsal view with tan

mottling, a pair of prominent beige sigilla spots, and faint tan banding posteriorly. Dorsal surface of abdomen (Fig. 109) covered with stiff, porrect black setae, each with slightly raised, dark brown sclerotic base; the latter largest medially; single pair of large, lightly sclerotized oval sigilla present (sigilla pair 2), separated by slightly less than 3.0 x their own width. Legs (Figs. 115–117) variable shades of tan, with light scopulae on tarsi I–II; tibia I bearing small prolateral clasping spurs; proximal-most clasping spur with single spur-like macroseta. Leg I: femur 5.4; patella 2.6; tibia 4.2; metatarsus 3.6; tarsus 2.1; total 17.9. Leg I femur–tarsus/carapace length ratio 3.5. Pedipalpal tibia (Figs. 118–120) nearly 2.0 x longer than wide; RTA relatively large, triangular in retrolateral view, with pointed aspinose distal process and sparse field of retrolateral spinules; tibia also with field of spinules extending along curved retroventral edge (distal to base of RTA), consisting of 12 spinules of varying length. Cymbium (Figs. 118–120) setose, with only a few long spinules anteriorly. Embolus (Figs. 118–120) ca. 1.5 x length of bulb, sharply tapering distally, with broad twisted morphology, sub-distal flange and finely bifurcate tip; embolic apophysis absent.

Distribution and remarks.—*Eucanippe nemestrina* has a relatively restricted distribution in the south-eastern Jarrah Forest bioregion of south-western Australia, from south of Kojonup north to Boddington (Fig. 11). Nothing 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 early spring, with an outlying record (possibly mislabeled) from mid-summer. Females are unknown.

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LITERATURE CITED

Bradshaw, C.J.A. 2012. Little left to lose: deforestation and forest degradation in Australia since European colonization. Journal of Plant Ecology 5:109–120.

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.

Harvey, M.S., J.M. Waldock, N.A. Guthrie, B.J. Durrant & N.L. McKenzie. 2004. Patterns of composition of ground-dwelling araneomorph spider communities in the Western Australian wheatbelt. Records of the Western Australian Museum Supplement 67:257–291.

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.

Laurance, W.F., B. Dell, S.M. Turton, M.J. Lawes, L.B. Hutley, H. McCallum, et al. 2011. The ten Australian ecosystems most vulnerable to tipping points. Biological Conservation 144:1472–1480.

Main, B.Y. 1957. Biology of aganippine trapdoor spiders (Mygalomorphae: Ctenizidae). Australian Journal of Zoology 5:402–473.

Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A.B. da Fonseca & J. Kent. 2000. Biodiversity hotspots for conservation priorities. Nature 403:853–858.

Rix, M.G., K. Bain, B.Y. Main, R.J. Raven, A.D. Austin, S.J.B. Cooper et al. 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. Klopfstein, 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., 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, doi: 10.1071/IS16065.

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