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Systematics of the New Australasian Orb-weaving Spider Genus *Backobourkia* (Araneae: Araneidae: Araneinae)

Volker W. Framenau [1,2,*], Nadine Dupérré [3], Todd A. Blackledge [4] & Cor J. Vink [5,6]

[1] Department of Terrestrial Zoology, Western Australian Museum, Locked Bag 49, Welshpool DC, Western Australia, 6986, Australia
[volker.framenau@museum.wa.gov.au]

[2] School of Animal Biology, University of Western Australia, Crawley, Western Australia 6009, Australia

[3] American Museum of Natural History, Division of Invertebrate Zoology, Central Park West at 79th Street, New York, NY 10024, USA
[nduperre@amnh.org]

[4] Department of Biology and Integrated Bioscience Program, University of Akron, Akron, OH 44325-3908, USA
[blackledge@uakron.edu]

[5] Biosecurity Group, AgResearch, Lincoln Science Centre, Private Bag 4749, Christchurch 8140, New Zealand
[cor.vink@agresearch.co.nz]

[6] Entomology Research Museum, PO Box 84, Lincoln University, Canterbury 7647, New Zealand

* Corresponding author

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> Abstract

Backobourkia, a new Australasian genus of orb-weaving spider (family Araneidae Clerck, 1758) is proposed with *Backobourkia heroine* (L. Koch, 1871) as type species. Two other species are included in the genus: *B. brounii* (Urquhart, 1885) comb. nov. (here removed from synonymy with *B. heroine*) and *B. collina* (Keyserling, 1886) comb. nov. (= *Araneus reversus* Hogg, 1914, new synonymy). A phylogenetic analysis places *Backobourkia* within the 'coxal hook clade' of the subfamily Araneinae Clerck, 1758 and close to *Eriophora* Simon, 1864; however, *Backobourkia* differs from other Australasian Araneinae by the proposed synapopomorphy of a long flange at the base of the median apophysis in males. Molecular phylogenetic analysis of a fragment of the mitochondrial gene cytochrome *c* oxidase subunit 1 (COI) supports the monophyly of *Backobourkia* in a limited dataset that includes exemplars of Australasian Araneidae and *Eriophora ravilla* (C.L. Koch, 1844) (type species of *Eriophora* Simon, 1864). *Backobourkia brounii* and *B. heroine* are sister taxa in this analysis. *Backobourkia collina* is unusual within the genus and amongst most Araneinae as it displays extreme sexual size dimorphism (SSD), with females on average more than four times the size of males. Comparison with the other two *Backobourkia* species (and other Araneinae) suggests male dwarfism rather than female gigantism for this SSD. Some morphological differences of *B. collina* males to its congeners are evident, possibly due to its reduced size. These include characters of putative phylogenetic signal at the genus level such as eye position, shape of male pedipalp sclerites and the absence or presence of endite teeth or coxal hooks. *Backobourkia* species are common throughout Australia, with *B. heroine* more prevalent in the western and *B. brounii* in the eastern parts of the country. *Backobourkia collina* is mainly found throughout the arid regions. *Backobourkia brounii* is also found in New Zealand and *B. heroine* in New Caledonia. *Araneus felinus* (Butler, 1876), originally described as 'Allied to *E. heroine*', is here considered a nomen dubium as the type specimen appears to be lost and an accurate identification based on the original description is not possible. The New Zealand *Eriophora decorosa* (Urquhart, 1894) is transferred to *Acroaspis* Karsch, 1878, *A. decorosa* (Urquhart, 1894) comb. nov.

> Key words

Eriophora, *Acroaspis*, Australia, New Zealand, New Caledonia, sexual size dimorphism, SSD, male dwarfism, cytochrome *c* oxidase subunit 1, COI, remote diagnostics.

1. Introduction

The orb-weaving spider family Araneidae Clerck, 1758 is among the most diverse of all spider families worldwide (PLATNICK 2009) and also omnipresent throughout Australia and New Zealand. In Australia, the systematics of the Araneidae remains rudimentary despite some recent taxonomic treatments (e.g., LEVI 1983; SMITH 2006; HARMER & FRAMENAU 2008; FRAMENAU & SCHARFF 2008, 2009). Some 150 species are described within the subfamily Araneinae Clerck, 1758 alone and about two thirds of these are currently misplaced in the Holarctic genus *Araneus* Clerck, 1758 (see PLATNICK 2009), where many araneid species have been 'dumped'. The most recent key to the genera of eight families of Australian Orbiculariae is more than 20 years old and only allows a generic level identification of some Araneidae, including 11 genera of Araneinae (DAVIES 1988). In this key, DAVIES (1988) illustrated *Eriophora transmarina* (Keyserling, 1865) as an Australian representative of *Eriophora* Simon, 1864, commonly known as the 'Garden Orb-weaving Spiders'. Earlier, she had taxonomically reviewed *E. transmarina* and *E. biapicata* (L. Koch, 1871), the two largest and most common Australian species of the genus (DAVIES 1980). Her generic placement mainly followed ARCHER (1951), who had also placed the Australian *E. collina* (Keyserling 1886) into *Eriophora*, a genus that had originally been described from the Americas (LEVI 1970).

The New Zealand members of the Araneinae have been comprehensively revised and a number of indigenous genera established (COURT & FORSTER 1988) (see also FRAMENAU et al. 2009; PAQUIN et al. 2008). However, three species of New Zealand Araneinae were considered of Australian origin and tentatively transferred to *Eriophora* based on general morphological similarities to the Australian species treated by DAVIES (1980) (COURT & FORSTER 1988): *Eriophora decorosa* (Urquhart, 1894), *E. heroine* (L. Koch, 1871), and *E. pustulosa* (Walckenaer, 1842). These three species are of considerable morphological diversity and the latter two were considered only "distantly related" to *E. heroine* (COURT & FORSTER 1988: 99).

Due to a large variation in size differences between the sexes, with females generally larger than males, orb-weaving spiders represent an excellent model system to investigate the evolutionary phenomenon of sexual size dimorphism (SSD). A phylogenetic analysis suggested that extreme SSD, i.e. females being at least twice the size of males, has evolved only four times in a sample of 80 genera of Orbiculariae (HORMIGA et al. 2000). HORMIGA et al. (2000) hypothesised that size increase of females due to fecundity advantage (e.g., HEAD 1995; CODDINGTON et al. 1998) was a more likely explanation for SSD in orb-weaving spiders than male dwarfism due to selection for early maturation (VOLLRATH & PARKER 1992; GUNNARSSON & JOHNSSON 1990) or gravity advantages (MOYA-LARAÑO et al. 2002). The incidence of extreme SSD was low within the Araneinae in the analysis; only the genus *Kaira* O. Pickard-Cambridge, 1889 had significantly smaller males than females (see also LEVI 1993) although extreme SSD is known from other araneine genera (e.g., PIEL 1996). Independent of its origin, evolutionary pressure towards SSD is expected to result in morphological changes in relation to closely related monomorphic species, in particular in regard to reproductive characters (RAMOS et al. 2005; EBERHARD et al. 1998).

Here, we recognise distinct morphological differences between three Australian and New Zealand species currently placed in *Eriophora* and the type species of the genus from America, *E. ravilla* (C.L. Koch, 1844) that serve as synapomorphies for a monophyletic clade and that warrant the establishment of a new genus. One of the species shows extreme sexual dimorphism, which is unusual in the Araneinae, allowing an interpretation of morphological changes that go hand in hand with male dwarfism (rather than female gigantism).

2. Material and methods

2.1. Morphology

This review is based on an exhaustive examination of araneid spiders in most Australian museum collections as well as some type material deposited overseas. Descriptions are based on specimens preserved in 70% ethanol. Male pedipalps were repeatedly soaked in 10% KOH and subsequently transferred into distilled water until complete expansion was achieved to explore morphology and topology of sclerites. The description of the views of the male pedipalp relate to their position as a limb, i.e. a full view of the bulb is a retrolateral view as in Araneidae the cymbium is situated mesally. Female epigynes were prepared for internal examination by submersion in lactic acid. In order to illustrate specimens, they were first photographed with a Nikon Coolpix 950 digital camera attached to a SMZ-U Nikon dissection microscope. The digital photos were then used to establish proportions and the illustrations were detailed and shaded by referring back to the structure under the microscope. For clarity, the illustrations of male pedipalps and female epigynes

omit non-diagnostic setae. Leg measurements are given as: femur + patella + tibia + metatarsus + tarsus = total length and were taken dorsally for all segments. All measurements are given in millimetres.

Images of live spiders (Fig. 1A–E) were taken with a Canon setup (Rebel 300D digital SLR camera, MP-E 65 mm 1–5x f/2.8 Macro lens and Macro Twin Lite MT-24EX). Images of dead specimens (Fig. 5A–F) were taken in different focal planes with a Nikon D300 digital SLR camera attached via a C-mount adapter from LM-Scope (http://www.lmscope.com/index_e.html) to a Leica M16A stereomicroscope and combined with Auto Montage (vers. 5.02) software from Syncroscopy to increase depth of field. We used 2 Nikon R1C1 wireless speedlights instead of fibre optics to illuminate the exposures. The latter were used as guide-light for focusing. Photographs of an expanded male pedipalp (Fig. 8A–B) were taken with a BK+ Imaging System from Visionary Digital (http://www.visionarydigital.com) equipped with a Canon EOS 40D camera. Single images were combined with Helicon Focus (version 4.77.4) software from Helicon Soft Ltd., to increase depth of field. A female specimen was prepared for SEM imaging (Figs. 4A–D, 7A–C) by passing morphological preparations through graded ethanol series of 70% to 100%, and by subsequent critical point drying in a Baltec CPC-030 Critical Point Dryer. Specimens were then coated with Platinum-Palladium in a JEOL JFC-2300HR high resolution coater prior to scanning at 7kV in a JEOL JSM-6335F Field Emission Electron Microscope.

2.2. Remote Diagnostics

Some New Zealand specimens of *Backobourkia* were examined by VWF using a remote diagnostic approach. Specimens were placed by CJV under a Leica MZ12 stereomicroscope with an eight megapixel Leica DFC490 camera attached at a laboratory at Plant and Food Research in Lincoln, New Zealand. Live images were transmitted via the Kiwi Advanced Research & Education Network (www.karen.net.nz; verified April 2009) using the video conferencing application WebEx (www.webex.com.au; verified April 2009) to a computer at the University of Western Australia, where they were viewed by VWF. The combination of live, transmitted images and an audio link, using Mirial Softphone (www.mirial.com; verified April 2009), between VWF and CJV enabled the remote diagnosis of the New Zealand *Backobourkia* specimens and thereby avoided the time delays and possible damage of specimens incurred due to postage between New Zealand and Western Australia.

2.3. Morphological phylogeny

Scharff & Coddington (1997) presented a comprehensive cladistic analysis at the tribal and subfamily level of 57 genera of orb-web spiders from the family Araneidae and 13 outgroup terminals (70 taxa in total). This analysis was based on 82 characters, 73 morphological and 9 behavioural (data matrix available from TreeBASE at www.treebase.org; verified 18 April 2009). Coding within the Nephilidae was amended here following Kuntner (2006, 2007) and Kuntner et al. (2008): character 40 (sustentaculum: coded (1) present instead of (0) absent for *Nephila* and *Nephilengys*); character 41 (carapace: coded (0) hirsute instead of (1) glabrous for *Nephila*); character 50 (lateral and median eyes separation: coded (1) wide instead of (0) narrow for both *Nephila* and *Nephilengys*); character 51 (posterior median eyes with canoe tapetum: coded (0) absent instead of (1) present for *Nephilengys*).

We added the putative synapomorphy of *Backobourkia*, the basal flange of the median apophysis, as character 83 to the matrix. This flange was coded 'present' (= 1) for *Backobourkia* and *Verrucosa* (see Levi 1976: fig. 8), absent (character state '0') for all other species with median apophysis (character 10, state '1') after consulting primary taxonomic literature. It was coded not applicable ('–') for those terminal taxa without median apophysis and unknown ('?') for *Deinopis*, as character 10 (median apophysis absent/present) was coded '?' in the original analysis by Scharff & Coddington (1997).

Two species of *Backobourkia*, *B. heroine* (type species) and *B. collina* (extreme SSD), were subjected to an analysis based on this amended data matrix to explore sister group relationships of the genus and to test for effects of SSD in *B. collina*. We did not include *B. brounii* into the analysis as character coding was identical to *B. heroine*. Coding followed the methods described in Scharff & Coddington (1997) and was trivial for most characters of the genus for *B. heroine*: 1111110000|0000011110|-10000110|1011001011|0000100011|110000-000|0001000100|2101000000|001. Character coding of *B. collina* was similar to that of *B. heroine*, with the exception of character 1 (tibia II in males 'normal' (0) instead of 'modified' (1)), character 2 (male leg II tibial macrosetae 'equal to leg I' (0) instead of 'stronger than leg I' (1)), character 33 (coxal hook in males 'absent' (0) instead of 'present' (1), character 45 (male endite tooth 'absent' (0) instead of 'present' (1)), and character 61 (female : male size ratio '>2' (1) instead of '<2' (0)).

The morphological phylogenetic analysis was performed with TNT version 1.1 (Willi Hennig Society

Edition) (GOLOBOFF et al. 2008) using the "Traditional Search" option (100 random addition sequences followed by branch-swapping, saving up to 10,000 trees per replication, with the maximum trees in memory set to 1,000,000). All characters were equally weighted and zero length branches were collapsed to polytomies. Bootstrap values (FELSENSTEIN 1985) for monophyletic groups were calculated by resampling the matrix with replacement 1000 times. Trees were illustrated using WinClada version 1.00.08 (NIXON 2002).

2.4. Molecular phylogeny

To explore monophyly of *Backobourkia*, to develop a phylogenetic hypothesis for relationships between *Backobourkia* species, and to facilitate the identification of immature *Backobourkia* specimens, we sequenced a fragment of the mitochondrial gene cytochrome *c* oxidase subunit 1 (COI) from specimens from Western Australia, Queensland and New Zealand (Tab. 1). COI is one of the fastest evolving mitochondrial markers and has been used to examine genetic differences between spider species and populations (e.g., VINK et al. 2008) and species in the family Araneidae (SMITH 2006; TANIKAWA et al. 2008). We did not attempt to amplify DNA from other specimens collected elsewhere in Australia and New Zealand as they had not been stored in optimal conditions for DNA preservation (see VINK et al. 2005) and were unlikely to yield usable DNA. COI sequences of *Eriophora ravilla* (C.L. Koch, 1844) (the type species of *Eriophora*), *E. pustulosa*, *Argiope trifasciata* (Forsskål, 1775), *Novakiella trituberculosa* (Roewer, 1942) and *Anepsion* sp. were used for outgroup comparison.

DNA of *Backobourkia* and *E. pustulosa* was extracted from either one femur or one leg (depending on the size of the specimen) using a ZR Genomic DNA II Kit™ (Zymo Research, Orange, CA, USA). The primers initially used to amplify and sequence a 1261 base pair (bp) COI fragment were LCO-1490 (5'-GGTC AACAAATCATAAAGATATTGG-3') (FOLMER et al. 1994) plus C1-N-2776-spider (5'-GGATAATCAGA ATANCGNCGAGG-3') (VINK et al. 2005). However, not all specimens successfully PCR amplified using these primers and a shorter COI fragment (1057 bp) was successfully amplified and sequenced from the other specimens using the forward primer C1-J-1718-spider (5'-GGNGGATTTGGAAATTGRTTRGT TCC-3') (VINK et al. 2005) instead of LCO-1490. PCR amplification was performed using *i*-StarTaq™ DNA Polymerase (iNtRON Biotechnology, Seongnam, South Korea) in a Mastercycler® (Eppendorf, Hamburg, Germany) thermocycler with a cycling profile of 35 cycles of 94ºC denaturation (30 s), 48°C annealing (30 s), 72ºC extension (1 min) with an initial denaturation of 3 min and a final extension of 5 min. Excess primers and salts were removed from the resulting double-stranded DNA using a DNA Clean & Concentrator™ Kit (Zymo Research). Purified PCR fragments were sequenced in both directions at the Allan Wilson Centre Genome Service (Massey University, Palmerston North, New Zealand). DNA from outgroup taxa other than *E. pustulosa* was extracted from one to two legs using Qiagen DNEasy Tissue extraction kits and then amplified using Qiagen TAQ PCR Mastermix in Mastercycler® (Eppendorf, Hamburg, Germany) thermocycler. The same primers and profile parameters as detailed above were used. Amplified products were then sent to Macrogen USA (Rockville, MD, USA), where they were cleaned and sequenced. Different amplifications were sequenced for the forward and reverse directions. Sequence data were deposited in GenBank (www.ncbi.nlm.nih.gov/Genbank/index.html; verified April 2009; see Tab. 1 for accession numbers). The sequence data of *Argiope trifasciata* had been published in a previous study (AGNARSSON & BLACKLEDGE 2009).

Sequences were edited, compared to each other and aligned using Sequencher 4.6 (Gene Codes Corporation, Ann Arbor, MI, USA). Alignment was straightforward and there were no insertions/deletions or stop codons, which would have indicated the possible amplification of pseudogenes.

Uncorrected pairwise distances were calculated using PAUP* version 4.0b10 (SWOFFORD 2002). Partitioned Bayesian analyses, based on the methods of BRANDLEY et al. (2005), were implemented in MrBayes version 3.1.2 (RONQUIST & HUELSENBECK 2003) to estimate the COI phylogenetic tree topology. MrModeltest version 2.2 (NYLANDER 2005) implemented in PAUP* version 4.0b10 was used to select the model parameters. Within MrModeltest, the Akaike Information Criterion was used for model selection (POSADA & BUCKLEY 2004). The COI data were partitioned by codon, using the general time reversible model with a proportion of invariable sites (GTR+Γ; LANAVE et al. 1984; TAVARÉ 1986; RODRÍGUEZ et al. 1990; YANG et al. 1994; YANG 1994) for 1st and 3rd codon positions, and GTR for 2nd codon positions. Bayesian analyses were conducted by running two simultaneous, completely independent analyses each with four heated chains, sampling every 1000th tree. The analyses were run for at least 2×10^7 generations until the average standard deviation of split frequencies had dropped below 0.002, which indicated that the two tree samples had converged. MrBayes was used to construct majority rule consensus trees, discarding the first 25% of trees generated as burn-in. TreeView 1.6.6 (PAGE 1996) was used to view and save trees in graphic format.

Tab. 1. Specimens used for molecular analysis.

Specimen registration	Species	Sex	Location and collection date	GenBank accession number
WAM T71611	*Backobourkia brounii*	male	WA, Capel, 24 February 2006	FJ873120
WAM T84329	*Backobourkia brounii*	female	Qld, Holland Park, 18 December 2007	FJ873121
AgR 9420	*Backobourkia brounii*	female	NZ, Christchurch, 16 January 2007	FJ873122
WAM T81519	*Backobourkia collina*	female	WA, Gibson Desert, 9 September 2007	FJ873123
WAM T81520	*Backobourkia collina*	juvenile	WA, Gibson Desert, 9 September 2007	FJ873124
WAM T69839	*Backobourkia heroine*	female	WA, Kundip, 9 January 2004	FJ873125
WAM T81447	*Backobourkia heroine*	female	WA, Cape Arid National Park, 1 January 2008	FJ873126
AgR 9660	*Eriophora pustulosa*	male	NZ, Rotorua, 6 March 2008	FJ873127
WAM T81707	*Novakiella trituberculosa*	female	WA, Two Peoples Bay Nature Reserve, 1 May 2008	GU301905
	Anepsion sp.	?	Indonesia, Sulawesi, 13 July 2007	GU301906
	Eriophora ravilla	female	USA, FL, Gainesville, 18–19 August 2003	GU301904
	Argiope trifasciata	female	Agnarsson & Blackledge (2009)	FJ525316

Tab. 2. Distribution of *Backobourkia*.

Species	Distribution	Remarks
Backobourkia collina	Australia (NSW, NT, Qld, SA, WA)	
Backobourkia brounii	Australia (ACT, NSW, NT, Qld, SA, Tas, Vic, WA), New Zealand (North Island: ND, AK, BP, HB, WI, WN; South Island: NN, MB, KA, NC, MC, CO)	Types of nominal species lost, single syntype of subspecies available
Backobourkia heroine	Australia (ACT, NSW, Qld, SA, Tas, Vic, WA), New Caledonia	Types lost

3. Abbreviations

Morphology

AL (AW)	abdomen length (width)
ALE (AME)	anterior lateral (median) eyes
CL (CW)	carapace length (width)
PLE (PME)	posterior lateral (median) eyes
TL	total length

Collections

AgR	Biosecurity Group collection, AgResearch, Lincoln (New Zealand)
AM	Australian Museum, Sydney (Australia)
BMNH	Natural History Museum, London (England)
CNC	Canadian National Collection, Ottawa (Canada)
LUNZ	Entomology Research Museum, Lincoln University (New Zealand)
MONZ	Museum of New Zealand Te Papa Tongarewa, Wellington (New Zealand)
NHMV	Natural History Museum, Vienna (Austria)
NMV	Museum Victoria, Melbourne (Australia)
NZAC	New Zealand Arthropod Collection, Auckland (New Zealand)
OMNZ	Otago Museum, Dunedin (New Zealand)
QM	Queensland Museum, Brisbane (Australia)
SAM	South Australian Museum, Adelaide (Australia)
UWP	Museum of Natural History, Wrocław University (Poland)
WAM	Western Australian Museum, Perth (Australia)
ZMB	Museum für Naturkunde, Zentralinstitut der Humboldt-Universität, Berlin (Germany)
ZMH	Zoologisches Institut und Zoologisches Museum, Universität Hamburg (Germany)
ZMUC	Zoological Museum, University of Copenhagen (Denmark)

Australian States

ACT	Australian Capital Territory
NSW	New South Wales
NT	Northern Territory
Qld	Queensland
SA	South Australia
Tas	Tasmania
Vic	Victoria
WA	Western Australia

New Zealand areas (Crosby et al. 1998)

ND	Northland
AK	Auckland
BP	Bay of Plenty
HB	Hawkes Bay
WI	Wanganui
WN	Wellington
NN	Nelson
MB	Marlborough
KA	Kaikoura
NC	North Canterbury
MC	Mid Canterbury
CO	Central Otago

Fig. 1. *Backobourkia* spp. **A–B**: *B. brounii*, female from Holland Park, Qld (WAM T84329); A: antero-dorsal view; B: detail of cephalic region and eyes. **C–D**: *B. heroine*, female from Cape Arid, WA (WAM T81447). **E**: *B. heroine*, male from Cape Arid, WA (WAM T81448). Photos: V.W. Framenau.

4. Results

Three species of *Backobourkia* are recognised for Australia, New Zealand and New Caledonia (Tab. 2; also Figs. 1, 5). The genus is very common in Australia; of 9,549 araneine spider records in major Australian museum collections examined as part of a comprehensive revision of the Australian Araneidae, almost 10% (n = 919) belong to one of the three species of *Backobourkia* (*B. brounii*, n = 255; *B. collina*, n = 376; *B. heroine*, n = 288) (see also Appendices A–C and maps Figs. 9, 11, 13). We examined a total of 42 records of *B. brounii* from New Zealand (Appendix B).

Tab. 3. Uncorrected distance matrix for COI.

			1	2	3	4	5	6	7
1	*Backobourkia brounii*	WAM T71611							
2	*Backobourkia brounii*	WAM T84329	0.008						
3	*Backobourkia brounii*	AgR 9420	0.008	0.000					
4	*Backobourkia collina*	WAM T81519	0.092	0.090	0.090				
5	*Backobourkia collina*	WAM T81520	0.087	0.087	0.087	0.021			
6	*Backobourkia heroine*	WAM T69839	0.055	0.054	0.054	0.099	0.095		
7	*Backobourkia heroine*	WAM T81447	0.056	0.055	0.055	0.100	0.096	0.001	
8	*Eriophora pustulosa*	AgR 9660	0.137	0.133	0.133	0.133	0.135	0.141	0.142
9	*Novakiella trituberculosa*		0.141	0.135	0.135	0.134	0.131	0.140	0.139
10	*Anepsion* sp.		0.152	0.150	0.150	0.143	0.146	0.157	0.157
11	*Eriophora ravilla*		0.145	0.144	0.144	0.137	0.129	0.143	0.144
12	*Argiope trifasciata*		0.131	0.127	0.127	0.123	0.124	0.129	0.130

4.1. Phylogenetic analyses

Morphology. The phylogenetic analysis based on a modified data matrix of Scharff & Coddington (1997) resulted in 32 equally parsimonious trees (TL = 314, CI = 0.31, RI = 0.72). The strict consensus tree collapsed many of the clades within the Araneinae recognised by Scharff & Coddington (1997) into a polytomy, however, it retained 'clade 53' where the two *Backobourkia* species are placed in a trichotomy with *Eriophora* (Fig. 2). There were few clades supported by bootstrap values over 50%, one of which was the clade containing only *Backobourkia* and *Eriophora* (71%). *Backobourkia* + *Eriophora* is sister to *Verrucosa* McCook, 1888 in a clade that also contained *Araniella* Chamberlin & Ivie, 1942 and *Cyclosa* Menge, 1866 (= 'clade 53' of Scharff & Coddington's 1997 original analysis). *Backobourkia*, *Eriophora* and *Verrucosa* share an elongated scape of the female epigyne (character 29) and the basal flange of the median apophysis (character 83) (reduced in *Eriophora*). *Eriophora* and *Backobourkia* share the lack of a conductor lobe (character 8), the presence of a paramedian apophysis (character 18), the presence of a stipes (character 19), and a large number of metatarsal IV trichobothria (character 37). However, all of these characters were homoplasious within the scope of the analysis (Fig. 2).

Molecular analysis. Uncorrected pairwise distances between COI sequences of *B. brounii*, *B. collina*, *B. heroine* and the outgroup species identify *B. heroine* and *B. brounii* together as sister taxa to *B. collina* (Tab. 3). Specimens of *B. brounii* from Queensland and New Zealand share identical COI haplotypes. The phylogenetic analysis of the COI data (Fig. 3), although only based on a few specimens, showed that *Backobourkia* is monophyletic and branch lengths between specimens of the same species were much shorter than those between species. The representatives of *Anepsion* (placed outside 'clade 53' in Scharff & Coddington 1997) and *Novakiella* (not included in Scharff & Coddington 1997) formed a clade together with *E. pustulosa*, and this clade is sister to *Backobourkia*. *Eriophora ravilla*, the type species of *Eriophora*, is placed outside this entire Australasian assemblage (Fig. 3).

4.2. Sexual dimorphism

The average body length (±s.d.) of female *Backobourkia collina* (10.23 ± 2.11 mm; n = 14) is 4.2 times that of males (2.43 ± 0.21 mm, n = 12) representing a case of extreme SSD (Hormiga et al. 2000). This contrasts the values of its congeners, which only show average body length ratios of females to males of 1.5 for both *E. heroine* (body length males 11.31 ± 2.43 mm, n = 12; females 17.31 ± 3.50 mm, n = 16) and *E. brounii* (body length males 8.75 ± 1.43 mm, n = 11; females 13.30 ± 2.24 mm, n = 16). Females of all species are of similar size suggesting a reduction of male size (male dwarfism) to be responsible for the extreme SSD in *B. collina*.

Five homoplasious character states, evident in *B. collina*, are possibly related to the smallness of males, i.e. lack of modification on leg II in males (characters 1 and 2), lack of coxal hook (character 33), femoral groove (character 34), and endite tooth (character 45), in addition to the extreme SSD itself (character 61) (Fig. 2). Some other morphological differences of male *B. collina* that were not coded as part of the phylogenetic analysis are evident in comparison to its congeners with normal-sized males, including the eye pattern in males (we coded character 50 of Scharff & Coddington 1997 for the female), and within the genitalia a reduced terminal apophysis (flat lamellar instead of bubble-shaped with sclerotised tip) and only a single apical tip of the median apophysis (two tips in *B. heroine* and *B. brounii*) (Figs. 6A, 10A, 12A).

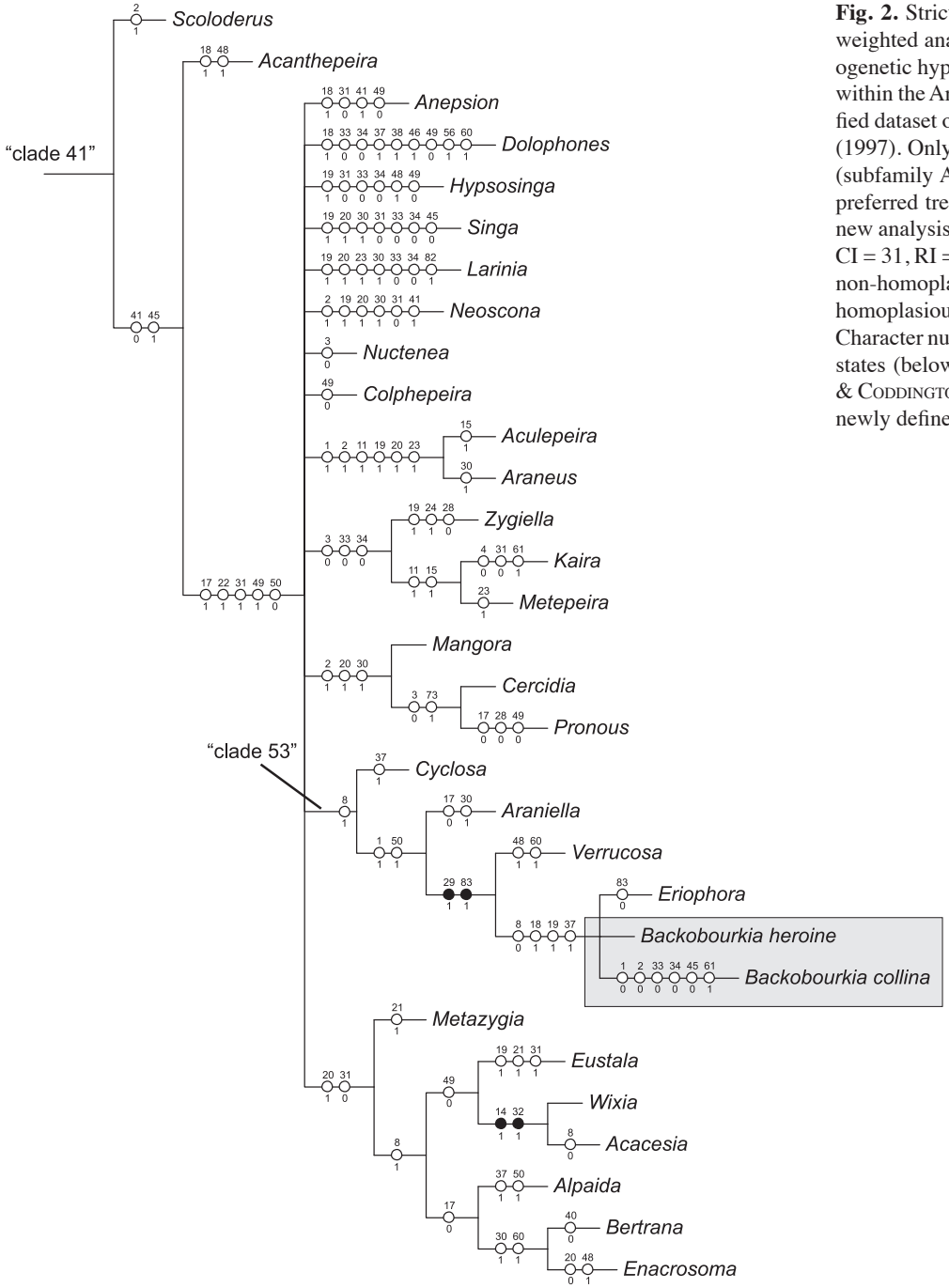

Fig. 2. Strict consensus tree (equally weighted analysis) illustrating a phylogenetic hypothesis for *Backobourkia* within the Araneidae based on a modified dataset of SCHARFF & CODDINGTON (1997). Only the result for "clade 41" (subfamily Araneinae) of the original preferred tree is shown, based on our new analysis (entire tree length = 314, CI = 31, RI = 72). Full circles indicate non-homoplasious and open circles homoplasious character state change. Character numbers (above circles) and states (below circles) follow SCHARFF & CODDINGTON (1997). Character 83 is newly defined herein.

5. Discussion

5.1. Phylogeny

Our phylogenetic analysis based on a preliminary morphological data matrix by SCHARFF & CODDINGTON (1997) suggests a close relationship of *Backobourkia* and *Eriophora* within a clade that also includes *Verrucosa* (Fig. 2). The clade *Backobourkia* + *Eriophora* is supported by mainly genitalic characters including the lack of a conductor lobe (character 8) and the presence of a paramedian apophysis (character 18). However, coding these two characters provided some problems. The paramedian apophysis (originally named in *Eriophora* by COMSTOCK 1910) clearly originates at the base of the conductor both in *Backobourkia* and *Eriophora* and therefore the paramedian apophysis could be considered an elongated conductor lobe and consequently both characters would be equivalent within the Araneinae. LEVI (1976, 1985) had already suggested that the paramedian apophysis is fused proximally to the conductor in *Verrucosa* and other genera, but SCHARFF & CODDINGTON (1997) coded a paramedian apophysis in *Verrucosa* as absent. SCHARFF & CODDINGTON (1997) also noted substantial homoplasy for both characters

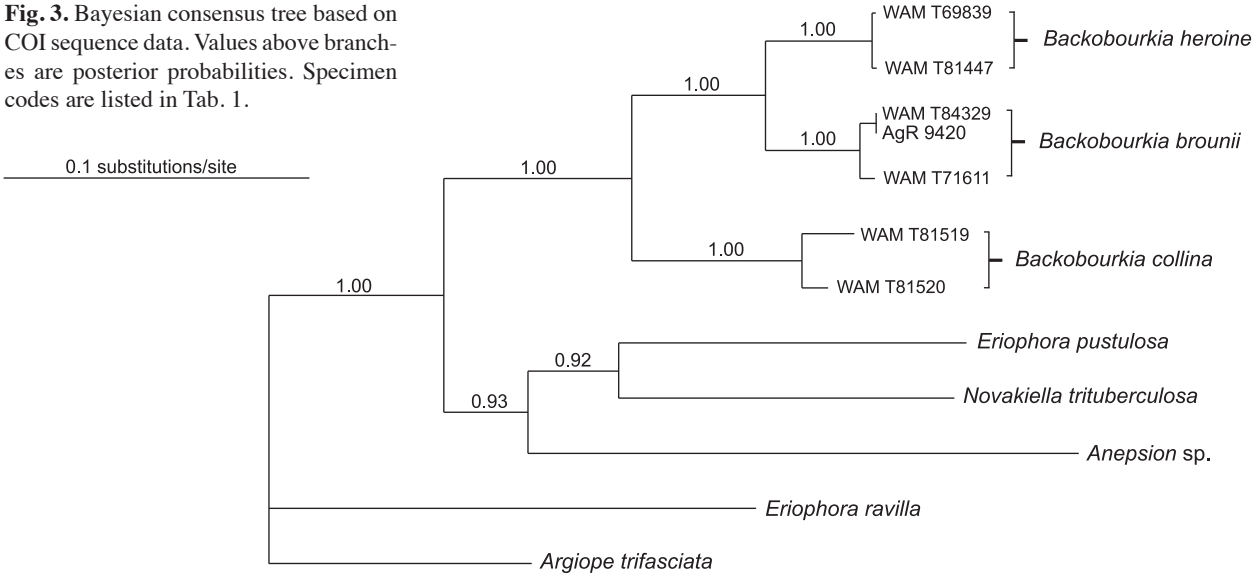

Fig. 3. Bayesian consensus tree based on COI sequence data. Values above branches are posterior probabilities. Specimen codes are listed in Tab. 1.

and stated (p. 411): "*Without commenting on its relation to the paramedian apophysis, one can see* (…) *that even as an independent character, 'conductor with lobe' contains relatively little phylogenetic information*." It is far beyond the scope of this study to solve homology hypotheses for the paramedian apophysis in Araneidae. In respect to characters 8 and 18, we have scored *Backobourkia* like *Eriophora* based on a detailed comparison of the pedipalps of *B. heroine* (WAM T73693) and *B. collina* (WAM T75858) with those of the type species of *Eriophora*, *E. ravilla* (C.L. Koch, 1844) (WAM T77438, T77440). Sister-group relationships to *Eriophora* have previously been recovered for Asian Araneinae when added to Scharff & Coddington's (1997) phylogenetic analysis (Tanikawa 2000). Based on genitalic morphology these spiders are very similar to *Eriophora* and were consequently transferred to this genus (Tanikawa 2000). However, it appears that Japanese *Eriophora* only show remote somatic resemblance to the type species of *Eriophora* from the New World and are more closely related to a group of Australian species with affinities to *Araneus eburnus* (Keyserling, 1886) (VWF, unpublished data).

Results obtained for Australasian Araneidae when added to the data matrix of Scharff & Coddington (1997) are also questioned by the outcome of our molecular analysis (Fig. 3). In this analysis, *Backobourkia* is not sister to *E. ravilla*, the type species of *Eriophora*, but to a clade of Australasian Araneidae of considerable morphological diversity. The genus *Anepsion* Strand, 1929 was part of Scharff & Coddington's (1997) original analysis and placed basal within the 'coxal hook clade'. However, our molecular analysis supports phylogenetic affinities of these small and distinct orb-weaving spiders with much larger species from Australia and New Zealand, *E. pustulosa* and *N. trituberculosa*. The genital morphology of *Novakiella* Court & Forster, 1993 is very different from any of the other araneine species included in our analysis (see Court & Forster 1988: figs. 554–556) and, unusual for the Araneinae, these spiders build horizontal rather than vertical orb-webs. Our analysis therefore supports the notion of a monophyletic Australasian clade of 'eriophorine' orb-weaving spiders of significant morphological diversity of which some are similar but not immediately related to true *Eriophora* from the New World. This Australasian 'eriophorine' clade, which contains, amongst others, the genera *Novakiella* and *Anepsion*, but also *E. pustulosa* (see below for nomenclatural comments), is also supported by the phylogenetic analysis of a multi-gene data set that includes many more exemplars of Araneidae (TAB, unpublished data). Similarly, molecular data have recovered large monophyletic but morphologically weakly supported clades of Australasian or Gondwanan origin in other major araneomorph spider families, such as the Lycosidae Sundevall, 1833 and Salticidae Blackwall, 1841 (Murphy et al. 2006; Maddison et al. 2008).

***Backobourkia* synapomorphy.** We have added the putative synapomorphy of *Backobourkia*, a basal flange on the median apophysis, as new character 83 to Scharff & Coddington's (1997) data matrix. A similar flange is also present in *Verrucosa* and character 83 therefore unites the clade *Verrucosa* + *Eriophora* + *Backobourkia* (with secondary loss in *Eriophora*) and can as such not serve as synapomorphy for *Backobourkia*. Our inclusion of two *Backobourkia* species in Scharff & Coddington's (1997) analysis (to assess phylogenetic effects of SSD in *B. collina*) and the resulting trichotomy of the two *Backobourkia* species with *Eriophora* optimise the evolution of character 83 with two steps, i.e. a gain at the base of *Verrucosa* + *Eriophora* + *Backobourkia*

and secondary loss in *Eriophora*. However, including only a single *Backobourkia* species as terminal taxon would allow a second, equally parsimonious solution, with independent gains of a flange of the median apophysis in both *Backobourkia* and *Verrucosa*. An independent gain of the flange is supported by distinct differences in the basal part of the median apophysis in both genera. In *Backobourkia*, the base of the median apophysis forms an arch over the radix to which the basal flange is attached (e.g. Figs. 6A, 12A). The flange itself is thin and almost transparent. In contrast, a basal arch over the radix is absent in *Verrucosa*; here this basal flange appears to be simply a strong elongation of the median apophysis (see LEVI 1976: figs. 8–9). Therefore, we consider the following character as synapomorphy of *Backobourkia*: "median apophysis with basal, semitransparent flange that originates on an arch of the median apophysis over the radix."

Speciation in *Backobourkia*. Although only a few specimens were sequenced, it is clear that all three species of *Backobourkia* are genetically distinct from each other. The genetic distances (see Tab. 3) within and between species are typical of the distances seen in other Araneidae (SMITH 2006; TANIKAWA et al. 2008) and between the chelicerate species surveyed by HEBERT et al. (2003). Molecular data strongly support *B. heroine* and *B. brounii* as sister species (Fig. 3). This close relationship is reflected in morphological similarities of these two species. The only constant differences between *B. heroine* and *B. brounii* are in the shape of the conductor of the male pedipalp (Figs. 6C vs. 10C) and whilst there are some good characters to distinguish the female genitalia of these two species (i.e. presence/absence of baso-lateral flaps and central epigyne division; Figs. 6F,J & 10F), these can in some cases vary to an extent that it remains difficult to identify females.

New Zealand *Eriophora*. Following this revision of *Backobourkia*, two New Zealand araneids remained in *Eriophora*, namely *E. pustulosa* and *E. decorosa*. Our molecular analysis strongly suggests that *E. pustulosa* is not congeneric with *Eriophora* (Fig. 3). This species belongs to a new and unnamed genus that also contains the Australian *Araneus inquietus* (Keyserling, 1887), *Araneus sydneyicus* (Keyserling, 1887), *Araneus senicaudatus* Simon, 1908 and other undescribed species (VWF, unpublished data). In contrast, *E. decorosa* is here transferred to the genus *Acroaspis* Karsch, 1878, *A. decorosa* (Urquhart, 1894) new combination. The type species of this genus is *A. olorina* Karsch, 1878 originally described from the Perth region, Western Australia (female holotype from "Swan River", ZMB 1423, VWF examined). *Acroaspis* is widespread in the temperate zones of Australia and is currently under revision by the senior author. The genus has very distinctive somatic (e.g., protruding cephalic region, multiple abdominal tubercles) and genitalic (e.g., shape of median apophysis with central process and shovel-like apical edge) characters and *Acroaspis decorosa* undoubtedly corresponds to this generic concept (see for example COURT & FORSTER 1988). The genus *Acroaspis* was not part of SCHARFF & CODDINGTON's (1997) morphological phylogeny, however, the type species of the genus is included in the abovementioned multi-gene analysis and forms part of the Australian 'eriophorine' clade (TAB, unpublished data).

5.2. Sexual Size Dimorphism (SSD)

Extreme sexual size dimorphism is rare within the Araneinae and *Kaira* was the only genus within this subfamily displaying this phenomenon in a phylogenetic analysis of the Orbiculariae (HORMIGA et al. 2000) although SSD was reported in other genera (e.g., PIEL 1996). *Backobourkia collina* represents the only incidence of extreme size dimorphism reported for Australian Araneinae in addition to *Parawixia dehaani* (Doleschall, 1859) (see YIN et al. 1997) and *Araneus albidus* (L. Koch, 1871) (VWF, unpublished data). The lack of pronounced size dimorphism in other *Backobourkia* and most members of the subfamily Araneinae as a whole (HORMIGA et al. 2000) strongly suggest that the difference in size between male and female *B. collina* is more likely explained by male dwarfism than female gigantism. Therefore, this species could serve as an ideal model system to study competing hypotheses for male size reduction such as protandry (VOLLRATH & PARKER 1992) or gravity advantage (MOYA-LARAÑO et al. 2002). Currently, detailed ecological requirements or factors characterising the mating system (e.g., sperm priority patterns, sexual cannibalism) of *B. collina* are unknown and therefore the causes of its extreme SSD remain speculative. However, comparative analyses incorporating the biology of its congener could shed light on the evolutionary forces that have driven the size reduction of male *B. collina* (e.g., PIEL 1996).

Some morphological differences, such as eye pattern, the shape and arrangement of setae on tibia II, the shape of some pedipalp sclerites and the absence of pedipalp femur tubercles, endite teeth and coxal hooks appear to be linked to the reduction of male size when *B. collina* is compared to the other two *Backobourkia* species. In addition to SSD itself, most of these characters have been considered as phylogenetically informative at the generic level in the Araneidae (characters 1, 2, 33, 34, 45 and 61 in SCHARFF & CODDINGTON 1997) (see also Fig. 2). The morphology of *B. collina*

males suggests a cautionary approach should be taken when conducting higher level phylogenetic analyses and to consider all representatives of a genus when coding characters and character state changes. Size, in particular 'smallness', may act as a confounding factor in phylogenetic studies.

5.3. Biogeography

Australia is the most likely place of origin for *Backobourkia* as all three species are widespread there (Figs. 9, 11, 13). The closely related *B. brounii* and *B. heroine* show an interesting distribution pattern with *B. brounii* more common in eastern Australia (Fig. 11) and *B. heroine* more common in western parts of the country (Fig. 9). We observed 5.4–5.6% pairwise sequence divergence between *B. brounii* and *B. heroine*. Brower (1994) estimated a rate of 2.3% pairwise divergence per million years in mitochondrial markers in arthropods, which also appears to apply to spiders (e.g., Hedin 2001). This would indicate that *B. brounii* and *B. heroine* diverged approximately two million years ago. However, it is unclear whether this divergence resulted from a vicariant event or by dispersal of the ancestor of both species to the east and west of Australia. The low pairwise divergence between *B. brounii* from localities in Western Australia and Queensland (about 3,600 km apart) suggests a recent split of these populations.

A shared haplotype between the specimens from Queensland and Christchurch suggests the New Zealand population of *B. brounii* originated from eastern Australia. *Backobourkia brounii* may have ballooned to New Zealand as dispersal on a strand of silk is common in the Araneidae (Bell et al. 2005). Other araneid species found in New Zealand appear to have also originated in Australia (e.g., *Eriophora pustulosa* and *Acroaspis decorosa* – see above for nomenclatural comments). New Zealand wolf spiders show a similar pattern with the majority of the fauna being indigenous complemented by a few highly dispersive species from Australia (Vink 2002; Framenau et al. 2006).

6. Taxonomy

Family Araneidae Clerck, 1758
Subfamily Araneinae Clerck, 1758

6.1. *Backobourkia* gen. nov.

Type species: *Epeira heroine* L. Koch, 1871; designated here. Gender female.

Diagnosis. Our modified phylogenetic analysis after Scharff & Coddington (1997) (Fig. 2) places two *Backobourkia* species in a trichotomy with *Eriophora* as part of the 'coxal hook clade' of the Araneinae. However, *Backobourkia* differs from *Eriophora* by the basal flange of the median apophysis in the male pedipalp. A similar flange is also evident in *Verrucosa arenata* (Walckenaer, 1842) (see Levi 1976: fig. 8), but the overall structure of the pedipalp in this genus is unlike that of *Backobourkia* in addition to somatic dissimilarities (e.g., abdomen shape, Levi 1976: fig. 1). We here consider the following character as synapomorphy for *Backobourkia*: median apophysis with basal, semitransparent flange that originates on an arch of the median apophysis over the radix (see also Discussion above). Female *Backobourkia* differ from *Eriophora* by the much shorter epigyne scape (e.g., Levi 1970: fig. 9).

Description. Very small to large (TL males ca. 2.00–14.50, females 6.50–25.00 mm) orb-weaving spiders, with males of similar size as females (except *B. collina* that has dwarf males). Carapace longer than wide, pear-shaped (Fig. 5A–F); centre of cephalic region protruding more in males than in females; fovea forms an elongated cross in males (except in *B. collina*) and is wider than long and recurved in females and *B. collina* males; colouration brown in variable shades, cephalic area generally lighter; females with dense white pubescence on whole carapace (also evident in freshly moulted males) and small cuticular tubercles in cephalic area (Fig. 1A–B,D–E). Eyes: anterior median eyes largest, their row wider than that of posterior median eyes; row of posterior eyes slightly recurved; lateral eyes almost touching and separated by more than their diameter from posterior median eyes; lateral eye groups elevated, a small horn of this elevation protrudes anteriorly. Sternum longer than wide. Labium wider than long (except males of *B. brounii*), subtriangular, front end bulging and white. Endites with large lateral tooth present in males (except in *B. collina*). Chelicerae with 4 (rarely 5) promarginal teeth, 3 retromarginal teeth (sometimes reduced in the small chelicerae of males); distinct baso-lateral boss

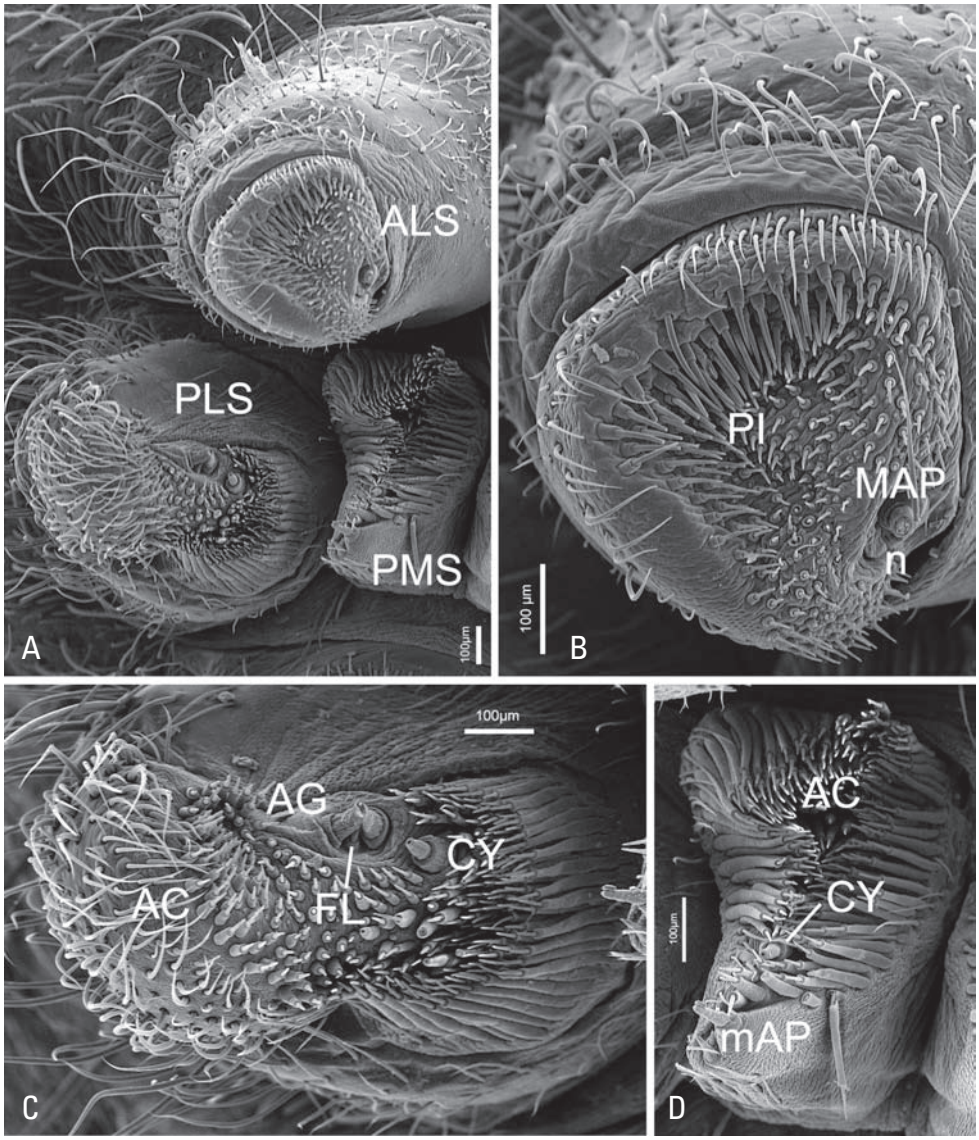

Fig. 4. Spinneret morphology of *B. heroine* (L. Koch), female from Western Australia (WAM 96/96), scanning electron micrographs. **A**: Right spinnerets, ventral view. **B**: Right anterior lateral spinneret (ALS), ventral view. **C**: Right posterior lateral spinneret (PLS), ventral view. **D**: Right posterior median spinneret (PMS), ventral view. Abbreviations: AC, aciniform gland spigots; AG, aggregate gland spigots; ALS, anterior lateral spinneret; CY, cylindrical gland spigot; FL, flagelliform gland spigot; MAP, major ampullate gland spigots; mAP, minor ampullate gland spigots; n, nubbin; PI, piriform gland spigot; PLS, posterior lateral spinneret; PMS, posterior median spinneret.

that is orange-red in live specimens. Legs: leg formula I>IV>II>III (except male *B. collina*: I>II>IV>III); tibiae II of males much stronger than tibiae I and with strong and stout spines (Fig. 5A,C), metatarsi and tarsi II slightly curved ventrally (except in *B. collina* in which tibia I and II are similarly strong and with similar setation, and metatarsi and tarsi II straight; Fig. 5E); coxae I of male with hook and femora II with opposing groove (except in *B. collina*). Abdomen longer than wide; two distinct humeral humps in anterior half (e.g., Figs. 1A, 5A–D,F) (except in male *B. collina*; Fig. 5E); sometimes with small posterior hump above spinnerets; booklung covers with grooves; dorsum of abdomen with folium pattern but within this very variable in colouration from very light yellow-brown to almost black (Fig. 1A–B,D–E); strong erect bristles evident, these are generally bicoloured with brown base and light tip (e.g., Fig. 1A); ventral abdomen with broad transverse light band (Fig. 1C) (light patch covering whole venter in *B. collina*).

Spinnerets (see Fig. 4A–D: *B. heroine* as an example): Anterior lateral spinnerets (ALS) with large field of piriform gland spigots (PI) (piriform spigots with normal bases), a major ampullate gland spigot (MAP) and a nubbin (n) (Fig. 4B); posterior lateral spinnerets (PLS) with large field of aciniform gland spigots (AC), two aggregate gland spigots (AG) with a flagelliform gland spigot (FL) in between and a cylindriform gland spigot (CY) mesally (Fig. 4C); posterior median spinneret with large field of aciniform gland spigots, a cen-

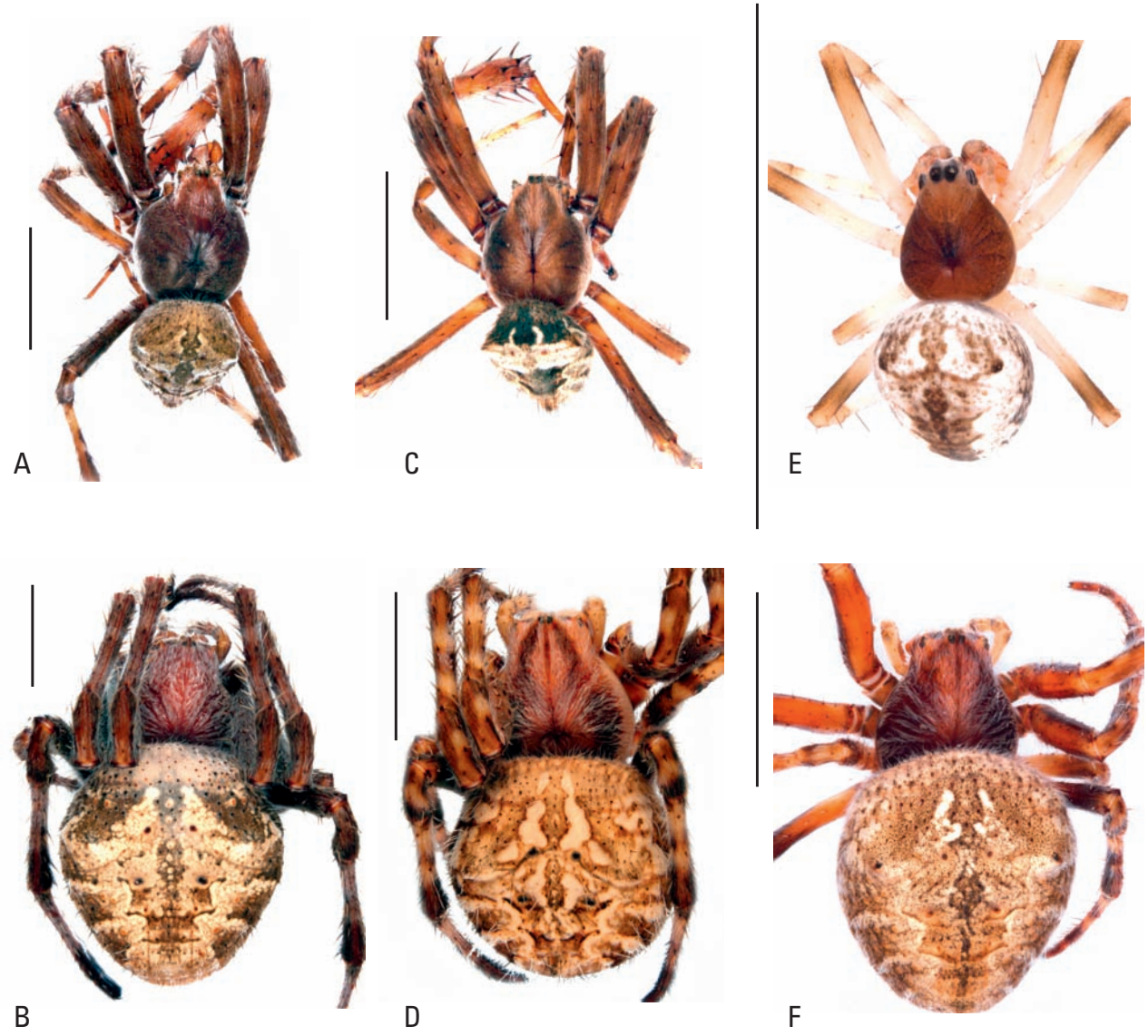

Fig. 5. *Backobourkia* spp., males and females, dorsal view. **A**, **B**: *B. heroine* (L. Koch); A: male from Kondidin, WA (WAM T73455); B: female from Boolathana Station, WA (WAM T68087). **C**, **D**: *B. brounii* (Urquhart); C: male from Clarkson, WA (WAM T73531); D: female from Walpole-Nornalup National Park, WA (ZMUC 12316). **E**, **F**: *B. collina* (Keyserling); E: male from the Simpson Desert, SA (WAM T75743); F: female, same data. Scale bars: 5 mm.

tral cylindriform gland spigot and a posterior minor ampullate gland spigot (mAP) (Fig. 4D).

Male pedipalp femora with tubercle; patellae with a single strong macroseta (e.g., Fig. 8A). Paracymbium present, simple and rounded (Figs. 6B, 10B, 12B). Cymbium narrow. Conductor entire, with distinct apical tip and basal lobe forming an elongated paramedian apophysis (Figs. 6A, 10A, 12A). Median apophysis elongated, transverse, tip with two small spines (one in *B. collina*) and base with apically directed flange (Figs. 6A, 10A, 12A). Embolic division with radix, stipes, terminal apophysis and embolus (e.g., Fig. 8A,B). Radix elongated, well-sclerotised. Terminal apophysis bubble-shaped with narrow, strongly-sclerotised tip (Figs. 6A, 10A) (but thin and lamellar in *B. collina*, Fig. 12A). Distal haematodocha well-developed. The base of the embolus is broad and well-defined (separated from stipes by a membrane); tip of the embolus uncapped and resting in close proximity to the tip of the terminal apophysis in a cavity of the conductor; embolus sinuous, directed clockwise.

Epigyne with comparatively long, wrinkled scape that is directed anteriorly at its base but immediately turns posteriorly, tapering along its whole length, no terminal pocket (Figs. 6D,E,H, 10D,E, 12D,E); spermathecae large and spherical (Figs. 6G,K, 10G, 12G).

Web: conventional vertical orb-web with sticky silk (VWF, personal observation); nocturnal.

Composition. *Backobourkia heroine* (L. Koch, 1871) (type species), *B. brounii* (Urquhart, 1885), *B. collina* (Keyserling, 1886).

Distribution. Australia, New Zealand, New Caledonia.

Etymology. *Backobourkia* is derived from the Australian colloquial expression “Back o’ Bourke” (= back of

Bourke), which refers to the remote Australian town Bourke in New South Wales. The term loosely translates into 'in the middle of nowhere' and generally refers to the Australian Outback. *Backobourkia*, in particular *B. collina*, is commonly found in Outback Australia.

6.2. *Backobourkia heroine* (L. Koch, 1871) comb. nov.

Figs. 1C–E, 4A–D, 5A–B, 6 A–K, 7A–C, 8A–C, 9

Epeira transmarina Keyserling, 1865 (misidentification): KOCH 1871: 59–61, plate 5, figs. 2, 2a (see KEYSERLING 1886: 141 and 'Remarks' below).

Epeira heroine Koch, 1871: 51–52, plate 4, figs. 2, 2a. KEYSERLING 1886: 138–139, plate 11, figs. 3, 3a (misidentification of females, these are *B. brounii*; first description of male, which could not be verified as whereabouts of specimen unknown); KARSCH 1878: 789.

Epeira annulata Keyserling, 1886: 141 (synonymy established in DONDALE 1966, but see 'Remarks' below).

Aranea heroine (L. Koch). ROEWER 1942: 828.

Araneus heroine (L. Koch). RAINBOW 1911: 187; RAINBOW 1912: 196; HICKMAN 1967: 65, figs. 115–117.

Type material. ***Holotype*** of *Epeira heroine* L. Koch, 1871: ♀, "Neuholland" (= Australia), no exact locality given in KOCH (1871) (Naturalienkabinett Stuttgart, Germany) (collection destroyed in WWII: Lars Krogmann, personal communication; see also RACK 1961) (not examined). ***Lectotype*** (designated here) of *Epeira annulata* Keyserling, 1886: ♀, Sydney (catalogued as "Sidney") [33°53′S 151°13′E, New South Wales, Australia], leg. Frauenfeld, Novara-Reise 1857–1859 (NHMV1866.I.2) (examined as photograph supplied by C. Hörweg; collection data from NHMV catalogue). ***Paralectotypes*** of *Epeira annulata* Keyserling, 1886: 2 ♀♀, Australia (no exact locality on label) (BMNH 4235–6) (labelled "*transmarina* L. K., *Epeira annulata*, Keys."); 1 ♀, Australia, no exact locality, ZMH (Museum Godeffroy 292) (SCHMELTZ 1865 lists "N.H." [= Neu Holland] as collecting locality) (ZMH, RACK (1961)-catalog 221); 4 immatures, Sydney [33°53′S 151°13′E, New South Wales, Australia] (ZMH, RACK (1961)-catalog 221); 1♀, Sydney [33°53′S 151°13′E, New South Wales, Australia] (BMNH 1915.3.5.1238) (examined); 1 ♀, Sydney [33°53′S 151°13′E, New South Wales, Australia] (BMNH 1915.3.5.1239) (misidentification, this female is *B. collina*); 1 ♀, Bowen [20°00′S 148°14′E, Queensland, Australia] (ZMH, RACK (1961)-catalog 221) (misidentification, this female is *B. collina*) (all examined); 1 ♀, Sydney [33°53′S 151°13′E, New South Wales, Australia] (NHMV) (not examined).

Other material examined. See Appendix A.

Diagnosis. Male *B. heroine* differ from the very similar *B. brounii* in the shape of the conductor of the pedipalp in which the tip forms a much wider angle (Fig. 6C *vs*. Fig. 10C); females differ in the presence of large baso-lateral subtriangular flaps at the epigyne in posterior view (Fig. 6F–G,J–K), which are much smaller or absent in *B. brounii* (Fig. 10F–G). In addition, the central division of the epigyne in posterior view forms a narrow V in *B. heroine* (Fig. 6F,J), whereas this division is much narrower in *B. brounii* and with a minor central gap (Fig. 10F). In addition, the spermathecae are comparatively smaller in *B. heroine* (Fig. 6G,K) than in *B. brounii* (Fig. 10G). Overall, *B. heroine* are larger than *B. brounii* but size ranges overlap.

Description, male (from Guildford, WA; WAM T73693)**.** Total length 13.25. Carapace (Figs. 1E, 5A) 7.50 long, 6.25 wide; reddish-brown, cephalic area somewhat lighter; white setae mainly in cephalic area and in wide band along lateral margins, few black setae centrally; 3–4 sinuous light bristles in row behind PE, 1 dark brown seta on each side between median and lateral eye groups, 1 brown curved seta between each AME and PME; fovea cross-shaped, longer than wide; clypeus 0.39 high. Eyes: AME 0.27, ALE 0.15, PME 0.24, PLE 0.18; row of eyes: AME 0.88, ALE 2.61, PME 0.70, PLE 2.73. Sternum 3.13 long, 1.88 wide; orange-brown; covered with white setae; few brown bristles in anterior half. Labium subtriangular, 0.61 long, 0.88 wide; basally dark reddish-brown; anterior margin bulging and white and with ca. 10 black setae centrally. Endites reddish-brown, antero-mesal corner white; few brown setae. Chelicerae yellow-brown; few black setae in apical half; dentition reduced to few irregular humps. Pedipalps (Figs. 6A–C, 8A–C): median apophysis with basal flange and two apical tips; terminal apophysis bubble-shaped, distal haematodocha long and wrinkled; embolus sinuous; tip of conductor forms wide angle with its basal plate (Fig. 6C). Legs: leg formula I>IV>II>III; dark brown with indistinct lighter annulations; lengths of segments: pedipalp 1.13 + 0.63 + 0.63 + – + 2.00 = 4.38, I 8.38 + 3.75 + 6.88 + 6.25 + 2.00 = 27.25, II 7.63 + 3.88 + 5.38 + 4.50 + 1.50 = 22.88, III 6.00 + 2.38 + 3.38 + 3.25 + 1.38 = 16.38, IV 8.50 + 3.00 + 5.63 + 5.88 + 1.75 = 24.75. Abdomen (Figs. 1E, 5A) 7.25 long, 6.25 wide; two distinct humeral humps anteriorly; off-white and brown marmorated folium pattern on dark olive-brown base (see Fig. 5A); weak cover of strong bristles that are basally brown and apically white; few brown short adpressed setae; venter yellow-brown with central rectangular brown patch that is wider than long; dense setae corresponding to background colour and brown macrosetae in posterior half; spinnerets light brown.

Variation. TL 6.25–14.50, CL 3.38–7.38, CW 2.63–6.38 (n = 12).

Description, female (from Goongarrie Station, WA; WAM T70011)**.** Total length 17.00. Carapace (Figs. 1D, 5B) 8.00 long, 6.63 wide; dark reddish-brown, centrally slightly lighter; small cuticular tubercles in cephalic region; dense cover of white pubescence; some longer white setae around cephalic area; fovea a deep pit that is wider than long and somewhat recurved; clypeus 0.45 high. Eyes: AME 0.33, ALE

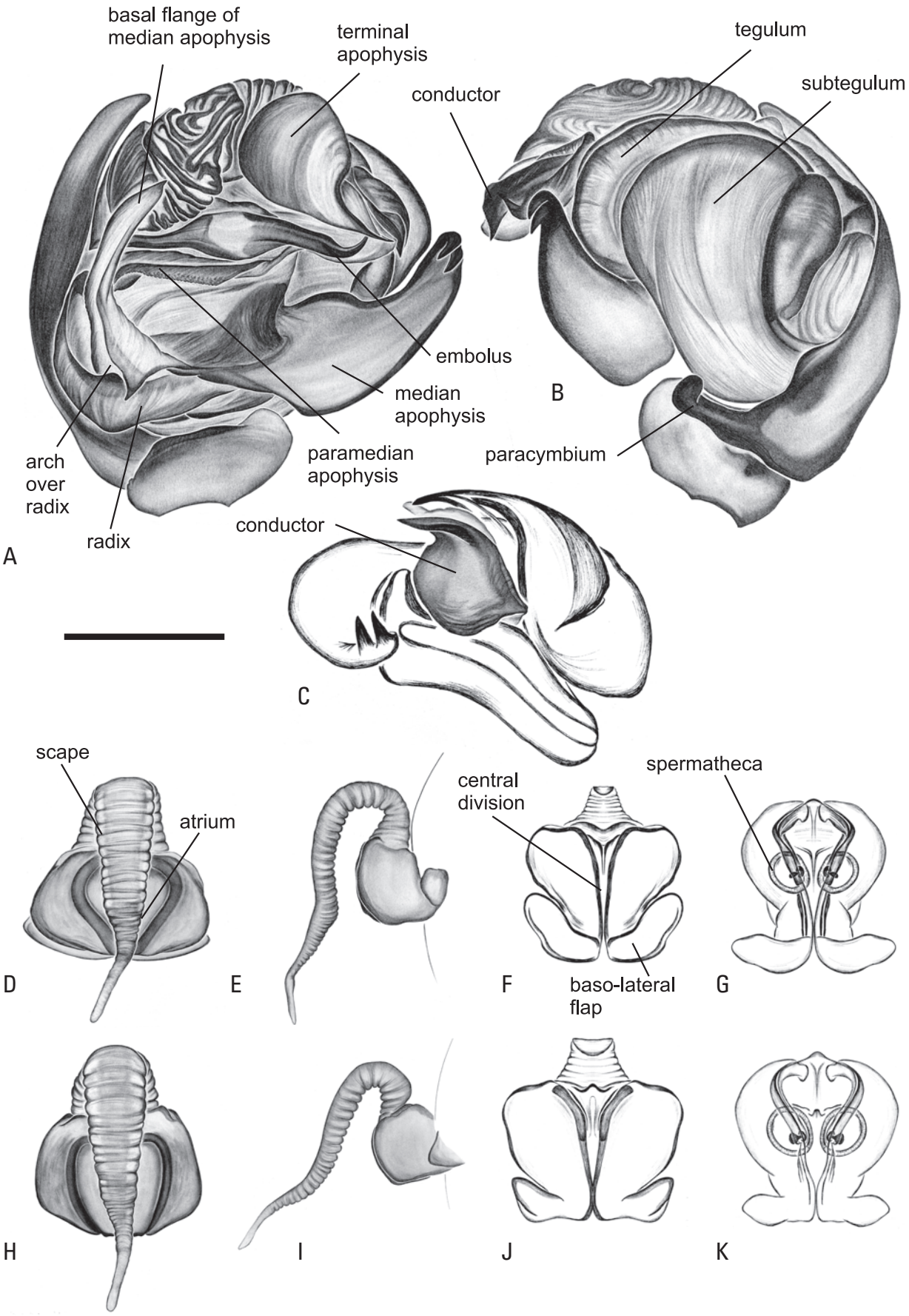

Fig. 6. *Backobourkia heroine* (L. Koch). **A–C**: Male (WAM T68008) from Talbot Road Reserve, WA: left male pedipalp, ventral (A), dorsal (B), and apical (C) views. **D–G**: Female (WAM T67968) from Mundaring, WA: epigyne, ventral (D), lateral (E), posterior (F), and dorsal (G) views. **H–K**: Female (WAM T75823) from Cocklebiddy Cave, WA: epigyne, ventral (H), lateral (I), posterior (J) and dorsal (K) view. Scale bar: A–C 1.0 mm; D–K 1.5 mm.

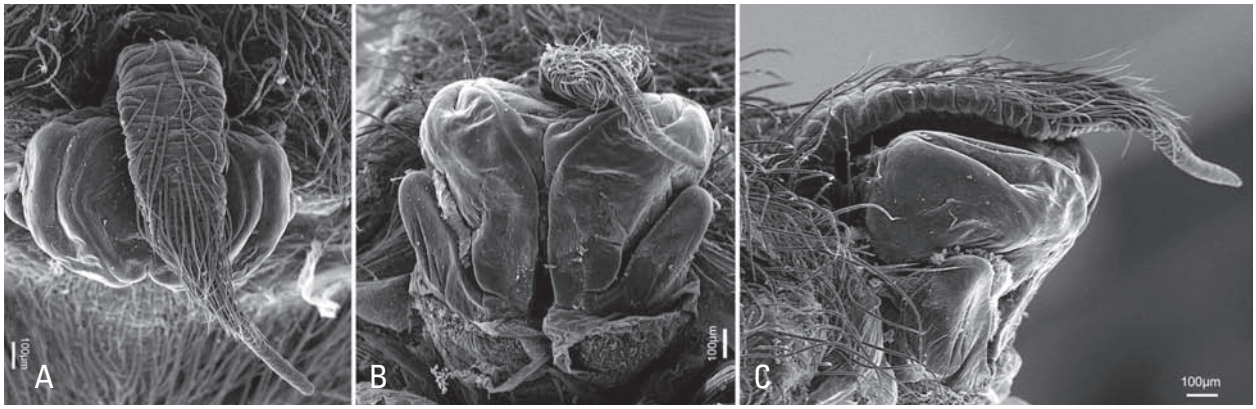

Fig. 7. *Backobourkia heroine* (L. Koch), scanning electron micrographs of epigyne of female (WAM 96/96) (no locality data): ventral (A), posterior (B) and lateral (C) view.

0.21, PME 0.30, PLE 0.21; row of eyes: AME 0.85, ALE 3.12, PME 0.67, PLE 3.21. Sternum 3.75 long, 3.00 wide; dark reddish-brown; covered with ca. 70 small cuticular tubercles; covered with white setae that are denser near the coxal attachment areas; few black bristles in anterior half. Labium 1.06 long, 1.58 wide, colouration as male. Endites as male. Chelicerae orange-brown, apically darker; white setae in basal half, black setae mesally in apical half; four promarginal teeth, with the apical and third one largest, the second and fourth smaller; three retromarginal teeth with the central smallest. Legs: leg formula I>IV>II>III; dark brown with indistinct lighter annulations mainly on tibiae and metatarsi; lengths of segments: pedipalp 2.25 + 1.38 + 1.63 + – + 2.63 = 7.88, I 8.88 + 4.13 + 7.50 + 7.00 + 2.25 = 29.75, II 8.75 + 4.25 + 6.50 + 6.25 + 2.00 = 27.75, III 6.00 + 2.50 + 3.38 + 3.50 + 1.75 = 17.13, IV 10.13 + 4.00 + 6.38 + 6.50 + 1.88 = 28.88. Abdomen (Fig. 5B) 11.88 long, 8.63 wide; two distinct humeral humps anteriorly; off-white marmorated folium pattern on dark olive-grey base; weak cover of strong bristles that are basally brown and apically white; dense cover of short adpressed white setae; venter with broad and white band behind epigastric furrow followed by broad brown band and a further white band in front of spinnerets; thin white lines laterally; dense setae corresponding to background colour and brown macrosetae in posterior half; spinnerets brown. Epigyne scape 2.16 long; base directed anteriorly but turning sharply posteriorly; tapering along its whole length into a narrow tip that is pointing ventrally; covered with white setae; base with lateral subtriangular flaps in posterior view (Figs. 6D–K, 7A–C); spermathecae spherical and comparatively small (Fig. 6G,K).

Variation. TL 11.88–23.75, CL 5.38–10.88, CW 5.00– 9.25 (n = 16). Colouration, in particular that of the abdomen extremely variable from almost entirely light to entirely black specimens with the folium pattern barely visible. Some specimens have a dark brown to black patch instead of a marmorated folium pattern (Fig. 1D).

Remarks. The holotype of *Epeira heroine* was lodged in the Natural History Museum, Stuttgart (Germany) (then Königliches Naturalienkabinett, Stuttgart) and appears to have been destroyed during WWII (L. Krogmann, personal communication; see also DONDALE 1966). Two mature specimens lodged in the Wrocław Museum, Poland, collected by Salmin (see Appendix A) were possibly part of the original Godeffroy collection (W. Wesełowska, personal communication) and therefore probably identified by L. Koch. These specimens serve here as reference material to identify this species in comparison to the similar *B. brounii*.

LUDWIG KOCH (1871) described morphological variations of *Epeira transmarina* Keyserling, 1865 (today listed in *Eriophora*) based on an undisclosed number of specimens from Bowen (Port Denisson) and New South Wales in the Museum Godeffroy, and a female from Sydney in the Natural History Museum (then K.K. Museum), Vienna. KEYSERLING (1886: 141) later recognised that these specimens were not conspecific with his *E. transmarina* and provided a new name for them, *Epeira annulata* Keyserling, 1886. The specimens listed by L. KOCH (1871) must be considered the syntypes of this species. We investigated a number of specimens that based on L. KOCH's (1871) original descriptions and the labels accompanying them can be considered part of the type series (see above). Two of these were misidentified by L. KOCH and are females of *B. collina* (see 'Type material' above). To provide nomenclatural stability for the species-group name *Epeira annulata*, we here designated a female specimen as lectotype. This specimen does not differ in general morphological detail, in particular the genitalia, from the spiders here revised as *B. heroine*. Therefore, we can here confirm *E. annulata* as junior synonym of *B. heroine* as originally suggested by DONDALE (1966).

KEYSERLING (1886) listed three females from Caigan (New South Wales) in *Epeira heroine*; how-

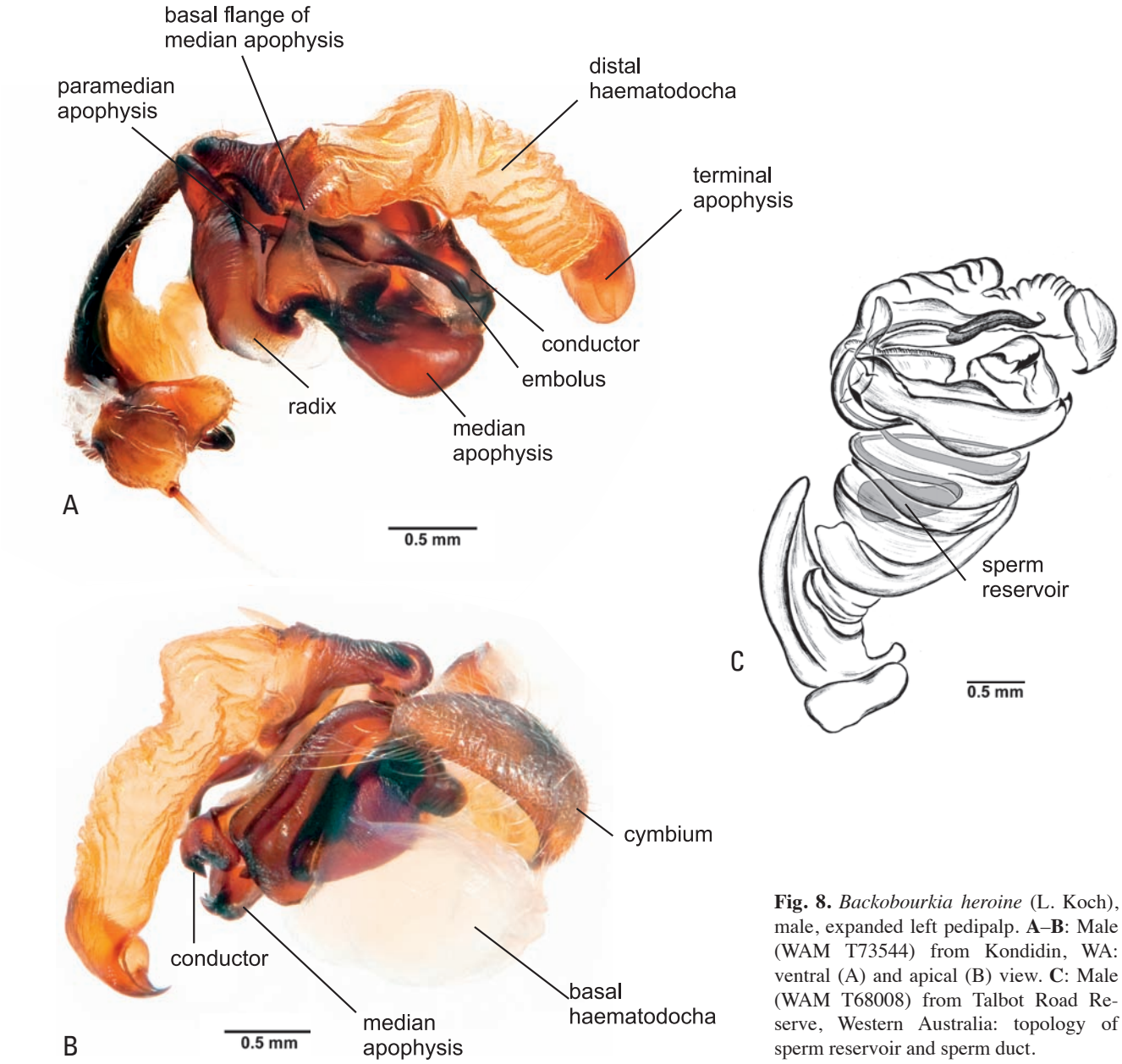

Fig. 8. *Backobourkia heroine* (L. Koch), male, expanded left pedipalp. **A–B**: Male (WAM T73544) from Kondidin, WA: ventral (A) and apical (B) view. **C**: Male (WAM T68008) from Talbot Road Reserve, Western Australia: topology of sperm reservoir and sperm duct.

ever, an examination of these specimens showed them to be *B. brounii* (see Appendix B). He also illustrated the male of *E. heroine* for the first time but we could not verify this identification as the specimen could not be found in any of the historical collections where it is expected to be housed (BMNH, ZMH, ZMB).

Dondale (1966) illustrated *B. heroine* (in *Araneus*) and recognised it as senior synonym of *Epeira annulata*. Curiously, he misidentified at least some specimens of his study of deciduous orchard spiders in the Australian Capital Territory. We re-examined some of the spiders he listed and recognised them as *B. brounii* (see Appendix B). His misidentification, however, does not affect the synonymy he established; some of the material he listed from other localities was indeed *B. heroine*. Hickman (1967) illustrated *B. heroine* (also in *Araneus*) in his treatment of Tasmanian spiders. The Australian Museum holds specimens of both *B. heroine* and *B. brounii* from the V.V. Hickman collection in Tasmania and due to their similarity it is not possible to ascertain which species he illustrated.

The holotype female of *Araneus felinus* (Butler, 1876) from Rockhampton (Queensland) is not present in the BMNH or in any other collection of Australian spiders where historical types are expected to be housed. Butler (1876: 352) described the species as "Allied to *E. heroine* of Koch." Considering the morphological similarities of *B. heroine* and *B. brounii* it is impossible to confidently identify this species based on Butler's (1876) description and illustrations alone without examination of type material. Therefore, we consider '*Araneus felinus*' a nomen dubium.

Distribution. *Backobourkia heroine* is currently known from Australia and New Caledonia. In Aus-

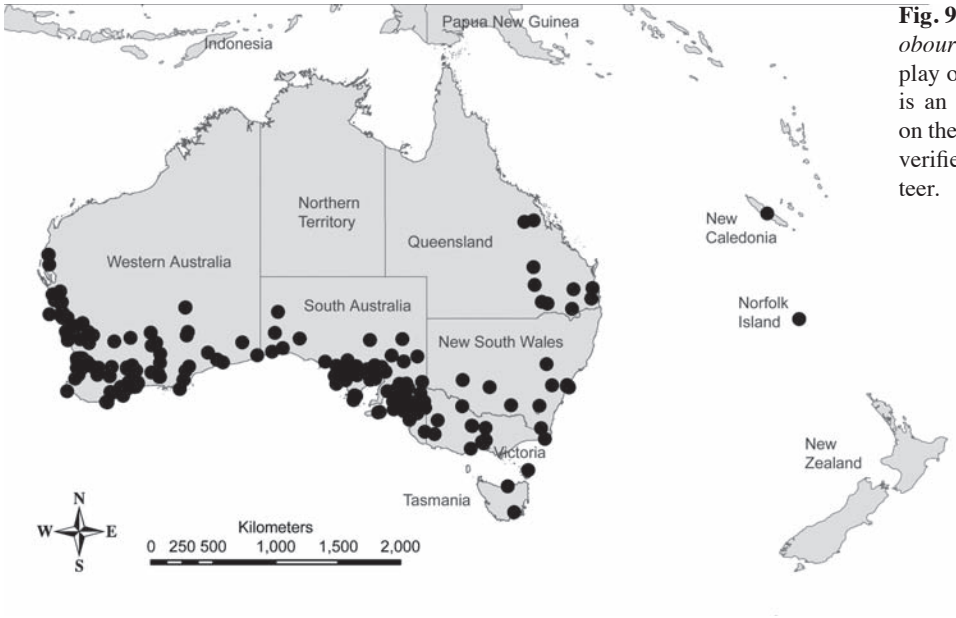

Fig. 9. Distribution records of *Backobourkia heroine* (L. Koch). The display of the record in New Caledonia is an approximation, as the locality on the label, 'Konakue', could not be verified through a geographic gazetteer.

tralia it is more common in the western parts of the country (Fig. 9).

Life history and habitat preferences. Adult males and females are generally found from September to April peaking in January and December. They do not appear to have very strong habitat preferences as long as they find large shrubs and trees where they can fix their webs. *Backobourkia heroine* is not uncommon in suburban parks and gardens throughout its range. RAINBOW (1896: 334) provided some information on the web-building behaviour and broodcare of this species: "The cocoon of *Epeira herione* [sic], Koch, is made of withered leaves closely bound together, and suspended to one of the supporting lines or guys above the orbitular [sic] portion of the mesh, and looks more like a discoloured mass of rubbish rather than a nest containing eggs." Unfortunately, it remains unclear if RAINBOW (1896) described the behaviour of *B. heroine* or the very similar *B. brounii*.

6.3. *Backobourkia brounii* (Urquhart, 1885) comb. nov.

Figs. 1A–B, 5C–D, 10A–G, 11

Epeira transmarina Keyserling, 1865 (misidentification): KARSCH 1878: 789.

Epeira brounii Urquhart, 1885: 32–33, plate 10, figs. 5a–d [female only; male is *Eriophora pustulosa* (DALMAS 1917; MYERS 1921)]. URQUHART 1892: 226.

Epeira brounii indistincta Urquhart, 1885: 33 (synonymy established in COURT & FORSTER 1988).

Epeira orientalis Urquhart, 1887 (misidentification): URQUHART 1887: 79–81, figs. 3, 3a [male illustrated is *B. brounii* (see MYERS 1921)].

Araneus brouni (Urquhart). DALMAS 1917: 382–384, figs. 47–48, 50; BONNET 1955: 449.

Epeira brouni Urquhart. BRYANT 1933: 25.

Aranea brounii (Urquhart). ROEWER 1942: 825.

Araneus heroine (L. Koch) (misidentification): DONDALE 1966: 1166–1168, figs. 2A–C; GIBBS 1982: 4–5, fig. 1.

Eriophora heroine (L. Koch) (misidentification): COURT & FORSTER 1988: 100, figs. 352, 504–506, 508–513.

Type material. ***Syntypes*** of *Epeira brounii* Urquhart, 1885: Unknown number of ♂♂ and ♀♀, Whangarei Harbour [35º43′S 174º19′E, New Zealand], T. Broun; and near Auckland [36º51′S 174º46′E, New Zealand], A.T. Urquhart (considered lost, not examined). ***Syntypes*** of *Epeira brounii indistincta* Urquhart, 1885: 1 ♀, Karaka, Auckland [36º07′S 174º52′E, New Zealand], T. Broun, Chamberlain collection (MONZ AS.001408) (examined); also "numerous specimens" from Tairua [37º00′S 175º51′E, New Zealand] and Whangarei Harbour [35º43′S 174º19′E, New Zealand], coll. Capt. T. Broun, M.E.S; and near Auckland [36º51′S 174º46′E, New Zealand], A.T. Urquhart (considered lost, not examined).

Other material examined. See Appendix B.

Diagnosis. *Backobourkia brounii* is most similar to *B. heroine* (see Diagnosis in 6.2.).

Description, male (from Rockingham, WA; WAM T75751)**.** Total length 8.77. Carapace (Fig. 5C) 4.77 long, 3.85 wide; brown, centrally and cephalic area somewhat lighter; elongated diamond-shaped pattern of two dark brown lines in cephalic area; light brown marginal bands mainly in posterior half; white setae mainly in cephalic area and in marginal bands; 3–4 sinuous light bristles in row behind PE, 1 brown seta on each side between median and lateral eye groups, 1 brown curved seta between each AME and PME; fovea cross-shaped, longer than wide; clypeus 0.10 high. Eyes: AME 0.23, ALE 0.10, PME 0.20, PLE 0.14; row of eyes: AME 0.65, ALE 1.79, PME 0.44, PLE 1.80. Sternum 2.00 long, 1.46 wide; yellow-brown, dark grey irregular pigmentation around margins that is densest near coxae; covered with white setae. Labium subtriangular, 0.54 long, 0.48 wide; basally brown; anterior

margin bulging and white. Endites light brown, anteromesal corner white. Chelicerae yellow-brown; four irregular small promarginal teeth, the basal separated from the apical group of three; ca. 3 irregular and small retromarginal teeth. Pedipalps (Fig. 10A–C): median apophysis with basal flange and two apical tips; terminal apophysis bubble-shaped, distal haematodocha long and wrinkled; embolus sinuous; tip of conductor forms narrow angle with its basal plate (Fig. 10C). Legs: leg formula I>IV>II>III; brown with indistinct lighter annulations; lengths of segments: pedipalp 0.69 + 0.42 + 0.38 + – + 1.42 = 2.92, I 5.77 + 2.61 + 4.61 + 4.08 + 1.38 = 18.46, II 5.00 + 2.38 + 3.85 + 3.08 + 1.15 = 15.46, III 3.77 + 1.54 + 2.15 + 2.08 + 0.92 = 10.46, IV 5.46 + 1.92 + 3.38 + 3.61 + 1.31 = 15.69. Abdomen (Fig. 5C) 4.46 long, 3.92 wide; two distinct humeral humps anteriorly, single hump posteriorly above spinnerets; off-white marmorated folium pattern on olive-brown base; weak cover of strong brown and fewer white bristles; few white short adpressed setae; venter with yellow broad transverse band behind spinnerets that reaches laterally around the venter to the spinnerets where these arms widen; central subrectangular brown patch that is wider than long; dense setae corresponding to background colour and brown macrosetae in posterior half; spinnerets light brown.

Variation. TL 5.38–10.50, CL 2.88–5.88, CW 2.25–4.88 (*n* = 11). Three males of *B. brounii* from Victoria (Carnegie, Kew and Swan Hill) are extremely small and fall well below the normal size variation here described for the species (NMV K9861, K9863; WAM T75800: TL 3.63–4.00, CL 2.00–2.25, CW 1.63–1.75). However, the specimens are indistinguishable based on their pedipalp morphology (except size).

Description, female (from Gelorup, WA; WAM T75787)**.** Total length 12.95. Carapace (Figs. 1A–B, 5D) 5.43 long, 4.66 wide; brown, light marginal bands mainly in posterior half; small cuticular tubercles in cephalic region; dense cover of white pubescence; some longer white setae around cephalic area; fovea a deep pit that is wider than long and somewhat recurved; clypeus 0.29 high. Eyes: AME 0.27, ALE 0.15, PME 0.20, PLE 0.12; row of eyes: AME 0.67, ALE 2.44, PME 0.54, PLE 2.56. Sternum 2.67 long, 2.09 wide; colour and setae as male. Labium 0.85 long, 1.17 wide; subtriangular; basally brown anterior margin bulging and white; ca. 7 brown setae anteriorly. Endites as male. Chelicerae yellow-brown; white setae, brown setae mesally in apical half; 4 promarginal teeth, with the apical and third ones largest, the second and fourth smaller; 3 retromarginal teeth with the central smallest. Legs: leg formula I>IV>II>III; brown with indistinct lighter annulations mainly on tibae and metatarsi; lengths of segments: pedipalp 1.43 + 0.86 + 1.05 + – + 2.82 = 5.14, I 5.71 + 2.86 + 4.66 + 4.76 + 2.71 = 19.71, II 5.62 + 2.76 + 4.28 + 4.47 + 2.52 = 18.66, III 4.09 + 1.90 + 2.28 + 2.19 + 1.14 = 11.61, IV 6.00 + 2.28 + 4.00 + 4.00 + 1.43 = 17.71. Abdomen (Figs. 1A, 5D) 9.52 long, 8.09 wide; two distinct humeral humps anteriorly, a small posterior hump above spinnerets; off-white marmorated folium pattern on yellow light base colour; weak cover of strong whitish bristles; dense cover of short adpressed white setae; venter as male but dark central patch less distinct; covered with white setae and brown macrosetae in posterior half; spinnerets light brown. Epigyne (Fig. 10D–G) scape 1.93 long; base directed anteriorly but turning sharply posteriorly; tapering along its whole length into a narrow tip that is pointing ventrally; covered with white setae; base without lateral subtriangular flaps in posterior view; spermathecae spherical, comparatively large (Fig. 10G).

Variation. TL 8.75–16.88, CL 4.13–7.50, CW 3.50–6.38 (*n* = 16). Colouration, in particular that of the abdomen extremely variable from almost entirely light to entirely black specimens with the folium pattern barely visible. Three females collected in Finley (NSW) (NMV K9829) are very small (TL 7.00–9.25, CL 3.25–4.00, CW 2.75–3.25).

Remarks. Dalmas (1917) considered *E. orientalis* described from New Zealand as synonym of *E. brounii* and at the same time realized that this species might be conspecific with *Epeira annulata* from Australia (here considered a junior synonym of *B. heroine*). Myers (1921) rejected the synonymy of *E. orientalis* with *E. brounii* and re-established *E. orientalis* based on the unique female epigyne morphology as separate species. However, he conceded that Dalmas (1917) was correct in considering the male illustrated by Urquhart (1887) as *Epeira brounii*.

Court & Forster (1988) established *Epeira brounii* and its subspecies *Epeira brounii indistincta* as junior synonyms of *Eriophora heroine*. We here reject this synonymy and consider *Epeira brounii* a valid species in the new genus *Backobourkia*, *B. brounii* (Urquhart) comb. nov. based on the examination of one of the syntypes of *Epeira brounii indistincta*. Apparently, *Backobourkia heroine* does not occur in New Zealand (Fig. 9).

The abovementioned extremely small males from Victoria and females from New South Wales may represent a different species although they are morphologically indistinguishable from (other) *B. brounii*. Examination of more material from these localities and inclusion of COI sequence data into the molecular analysis are required to test the species status of these populations.

Distribution. Australia and New Zealand; in Australia, this species is more common in the eastern parts of the country (Fig. 11).

Life history and habitat preferences. Adult males and females were mainly found between September

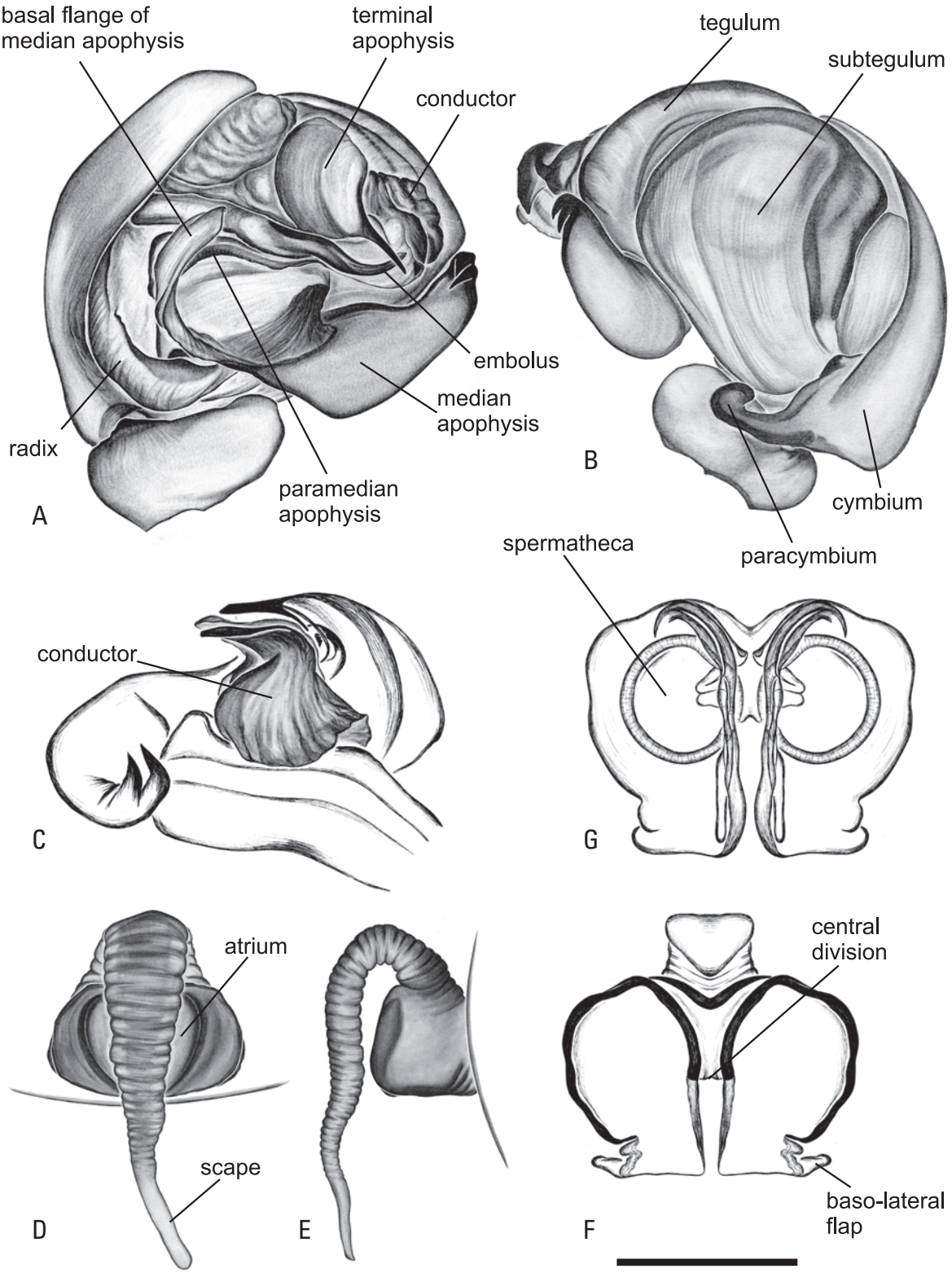

Fig. 10. *Backobourkia brounii* (Urquhart). **A–C**: Male (WAM T73547) from Mt Barker, WA: left male pedipalp, ventral (A), dorsal (B), and apical (C) views. **D–G**: Female (WAM T73549) from Wagga Wagga, NSW: epigyne, ventral (D), lateral (E), posterior (F), and dorsal (G) views. Scale bar: A–C 0.52 mm; D–G 0.64 mm.

and May. Males peak in January, whereas females appear to show two peaks of maturation, in October and February.

Within its range, *B. brounii* appears to have similar habitat preferences as *B. heroine*, such as open to closed sclerophyll forests but also parklands and gardens. Due to its slightly smaller size, this species may be able to build its webs in less sturdy vegetation and was therefore occasionally found in grassland.

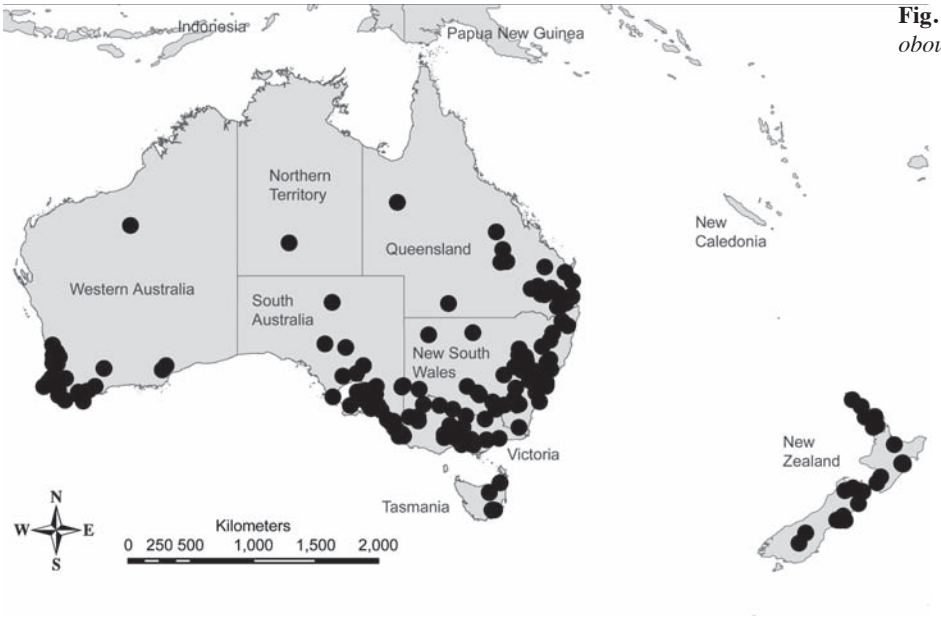

Fig. 11. Distribution records of *Backobourkia brounii* (Urquhart).

6.4. *Backobourkia collina* (Keyserling, 1886) comb. nov.

Figs. 12A–G, 13

Epeira transmarina Keyserling, 1865 (misidentification of two specimens): L. Koch 1871: 59–61, plate 5, figs. 2, 2a (see 'Remarks' below).
Epeira collina Keyserling, 1886: 141–142, plate 11, figs. 5, 5a.
Araneus collinus (Keyserling). Rainbow 1911: 183; Rainbow 1916: 99; Bonnet 1955: 462.
Araneus reversus Hogg, 1914: 77, plate 1, figs. 5, 5a–d. Bonnet 1955: 586 (new synonymy).
Aranea collina (Keyserling). Roewer 1942: 826.
Aranea reversa Hogg. Roewer 1942: 832.
Eriophora collina (Keyserling). Archer 1951: 21.

Type material. ***Syntypes*** of *Epeira collina* Keyserling, 1886: 2 ♀♀, Peak Downs [22°56′S 148°05′E, Queensland, Australia], Museum Godeffroy (BMNH 890.7.1.4867–8); 7 ♀♀, same data (ZMH, Rack (1961)-catalog no. 230) (all examined). ***Syntypes*** of *Araneus reversus* Hogg, 1914: 1 ♀, Hermite Island, Montebello Islands [20°28′S 115°31′E, Western Australia, Australia], ca. 5 June 1912, P.D. Montague, Monte Bello Expedition, G124 (BMNH 1924.III.1.400); 1 penultimate ♂, Montebello Islands [20°26′S 115°31′E, Western Australia, Australia], 1913, P.D. Montague, G123 (BMNH 1924.III.1.399) (all examined).
Other material examined. See Appendix C.

Diagnosis. *Backobourkia collina* is the most distinctive of all species in the genus. Males are easily diagnosed by their tiny size (TL <3 mm) in comparison to *B. brounii* (TL >5 mm) and *B. heroine* (TL >6 mm) resulting in considerable size dimorphism between males and females. On average, *B. collina* females are also considerably smaller than those of *B. brounii*, however, sizes overlap for large *B. collina* and small *B. brounii* specimens. Female genitalia differ considerably in particular in posterior view, where *B. heroine* and *B brounii* have a somewhat V-shaped central division (Figs. 6F,J, 10F), which is Y-shaped in *B. collina* (Fig. 12F). There is no trace of baso-lateral flaps in *B. collina*. In addition, the scape of *B. collina* is significantly shorter (<1 mm) than that of both *B. heroine* and *B. brounii* (>1 mm).

Description, male (from 30 km S of Wiluna, WA; WAM T75854)**.** Total length 2.58. Carapace (Fig. 5E) 1.30 long, 1.03 wide; brown, cephalic area somewhat lighter; elongated triangular discolouration in front of fovea; few white setae mainly around eyes; fovea wide inverted U-shaped; clypeus 0.06 high. Eyes: AME 0.12, ALE 0.06, PME 0.09, PLE 0.06; row of eyes: AME 0.33, ALE 0.57, PME 0.25, PLE 0.42. Sternum 0.61 long, 0.52 wide; brown, anteriorly lighter; few white setae mainly marginally. Labium subtriangular, 0.13 long, 0.17 wide; basally brown; anterior margin bulging and white. Endites light brown, antero-mesal corners lighter. Chelicerae yellow-brown; 3 promarginal teeth, the basal smallest; 2 retromarginal teeth. Pedipalps (Fig. 12A–C): median apophysis with basal flange and single apical tip; terminal apophysis lamellar and thin with pointy tip; embolus weakly sclerotised with narrow tip. Legs: leg formula I>II>IV>III; yellow-brown, femora and patella apically darker, tibiae with 3 dark annulations; lengths of segments: pedipalp 0.27 + 0.14 + 0.12 + – + 0.36 = 0.89, I 1.55 + 0.64 + 1.24 + 1.06 + 0.55 = 5.03, II 1.39 + 0.55 + 1.09 + 0.92 + 0.52 = 4.47, III 0.88 + 0.27 + 0.45 + 0.50 + 0.36 = 2.47, IV 1.30 + 0.48 + 0.67 + 0.85 + 0.44 = 3.74. Abdomen (Fig. 5E) 2.58 long, 1.21 wide; dark folium pattern surrounded by off-white margins); weak cover of strong light brown bristles; venter with two wide lateral bands, dark grey in centre; spinnerets dark brown.

Variation. TL 2.21–2.97, CL 1.15–1.33, CW 0.85–1.06 ($n = 11$). *Backobourkia collina* males are, in comparison to the other two species, quite conservative in

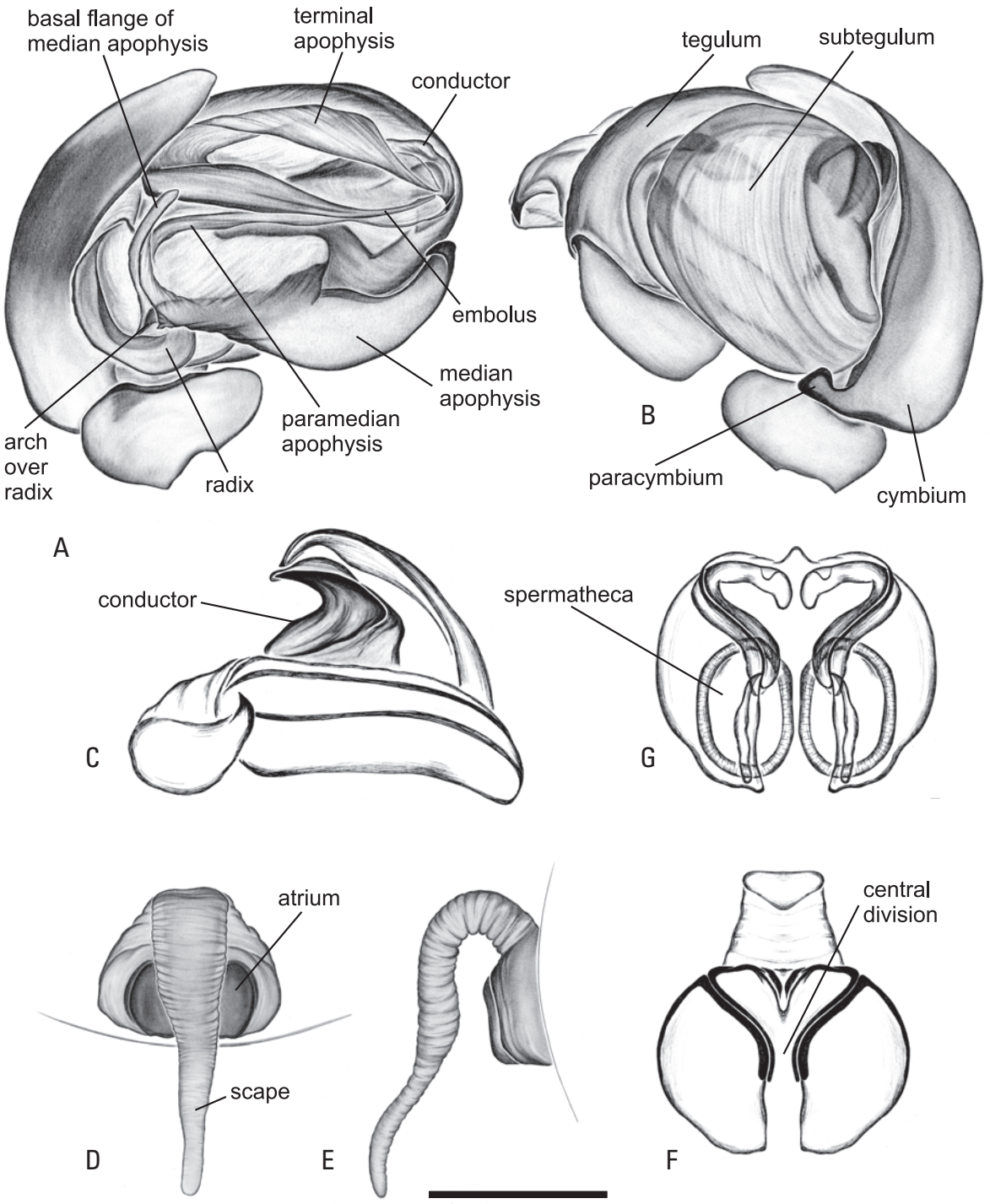

Fig. 12. *Backobourkia collina* (Keyserling). **A–C**: Male (WAM T75858) from Clune's property, WA: left male pedipalp, ventral (A), dorsal (B), and apical (C) views. **D–G**: Female (WAM T75858) from Clune's property, WA: epigyne, ventral (D), lateral (E), posterior (F), and dorsal (G) views. Scale bar: A–C 0.19 mm; D–G 0.36 mm.

their colouration. The light carapace discolouration may be lacking in some males, but abdominal patterns are similar in most specimens.

Description, female (from Barrow Island, WA; WAM T88891)**.** Total length 9.88. Carapace (Fig. 5F) 4.50 long, 3.63 wide; dark brown, cephalic area light brown; small cuticular tubercles in cephalic region; dense cover of white pubescence; some longer white setae around cephalic area; fovea a deep pit that is wider than long and somewhat recurved; clypeus 0.25 high. Eyes: AME 0.25, ALE 0.15, PME 0.17, PLE 0.15; row of eyes: AME 0.60, ALE 1.92, PME 0.42, PLE 1.98. Sternum 2.00 long, 1.63 wide; brown, lighter anteriorly and around coxal attachment areas; covered with white setae, ca. 8–10 bristles anteriorly. Labium 0.19 long, 0.15 wide; subtriangular; basally brown anterior margin bulging and white; ca. 5 brown setae anteriorly. Endites light brown, antero-mesal

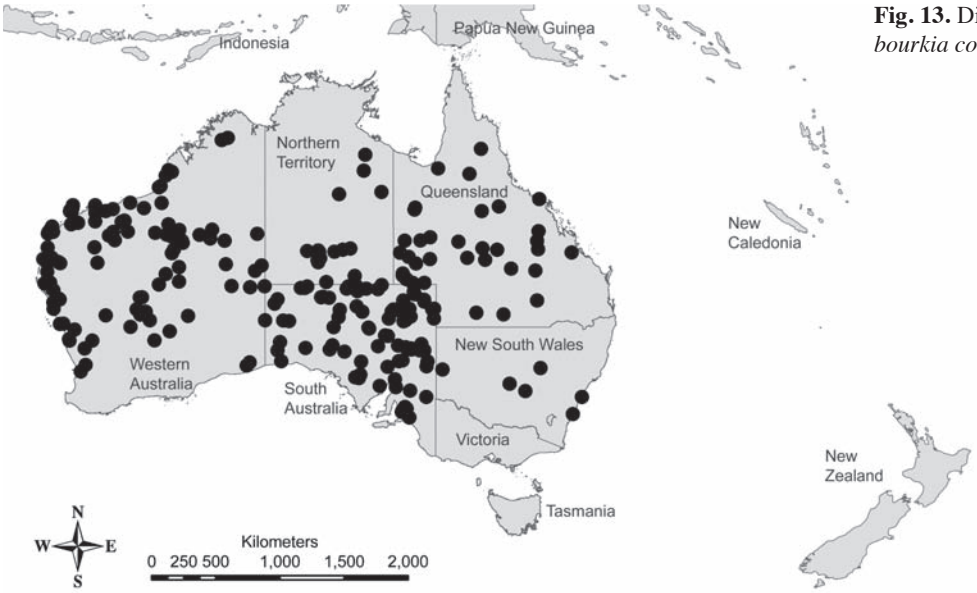

Fig. 13. Distribution records of *Backobourkia collina* (Keyserling).

corner white. Chelicerae yellow-brown; white setae, brown setae mesally in apical half; 5 promarginal teeth, with the apical and fourth one largest, the second very small; 3 retromarginal teeth with the central smallest. Legs: leg formula I>IV>II>III; leg I and II brown, tibia, metatarsi and tarsi with dark annulations; leg III and IV yellow-brown with similar annulations; lengths of segments: pedipalp 1.25 + 0.63 + 0.88 + – + 1.63 = 4.38, I 4.25 + 2.13 + 3.50 + 3.63 + 1.25 = 14.75, II 4.00 + 1.50 + 2.50 + 3.38 + 1.13 = 12.50, III 2.75 + 1.25 + 1.75 + 1.75 + 0.88 = 8.38, IV 4.63 + 1.88 + 3.00 + 3.25 + 1.13 = 13.88. Abdomen (Fig. 5F) 7.38 long, 6.63 wide; two small humeral humps anteriorly; off-white marmorated folium pattern on olive-grey base colour; weak cover of strong bristles that are basally dark brown and apically white; cover of short adpressed white setae; venter yellow-white with indistinct dark central rectangular patch; covered with white setae and few brown macrosetae; spinnerets dark olive-grey. Epigyne (Fig. 12D–G) scape 0.77 long; base directed anteriorly but turning sharply posteriorly; tapering along its whole length into a narrow tip that is pointing ventrally; covered with white setae; spermathecae ovoid, comparatively large (Fig. 12G).

Variation. TL 6.88–14.25, CL 3.25–5.13, CW 2.88–4.25 (n = 14). Colouration, in particular that of the abdomen extremely variable from almost entirely light to entirely black specimens with the folium pattern barely visible. Keyserling (1886: fig. 5) illustrated a female, which had the uniformly dark folium against light surroundings (see also Fig. 1D for *B. heroine*). This colour form was not uncommon in the material examined for this study.

Remarks. Keyserling (1886) provided a new name, *Epeira annulata*, for specimens that L. Koch (1871) had listed as *Epeira transmarina* (Keyserling) (see 'Remarks' under *B. heroine*). Within the specimens L. Koch (1871) examined, he noted (p. 61, from German) "in the Museum Godeffroy there is a specimen from Bowen [Port Denisson, northeast Australia], which is remarkably smaller." This specimen was examined as part of this study and is here recognised as *B. collina* (see Appendix C).

Distribution. All mainland states of Australia except Victoria (Fig. 13).

Life history and habitat preferences. Adult males and females were found almost all year round. Lowest numbers were collected between November and February with a subsequent increase and peak in May. Numbers crash in June for both sexes, but significant numbers were again found between July and October. Female spiders with eggsacs are recorded from May, July and October.

Backobourkia collina is mainly found in the arid parts of the country, including dry coastal heath- and grassland. Here, spiders build their webs generally in low vegetation, such as spinifex (*Triodia* sp.) grass tussocks, but also in *Melaleuca* and *Acacia* bushes.

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8. Appendix A: Material examined of *Backobourkia heroine* (L. Koch)

NEW CALEDONIA: 1 ♀, Konakue, no exact locality (BMNH 1927.II.1.40). **AUSTRALIA**: 2 ♀♀, no locality (ZMH). ***Australian Capital Territory***: 2 ♀♀, Canberra, 35°18′S 149°08′E (NMV K2541–2); 1 ♀, Canberra, 35°18′S 149°08′E (CNC) (listed in DONDALE 1966 as *Araneus heroine*). ***New South Wales***: 1 ♀, Bombala, 36°55′S 149°15′E (AM KS3295); 2 ♀♀, Enfield, 33°53′S 151°06′E (AM KS3296); 1 ♂, Gulgong, 15 km NE, near Deadmans Creek, 32°17′S 149°39′E (AM KS62181); 1 ♀, Jenolan, 33°49′S 150°02′E (AM KS33335); 1 ♂, Mandelmann Station, 33°26′33″S 143°36′32″E (AM KS66581); 1 ♀, Marlabar, 33°58′S 151°15′E (AM KS33061); 2 ♀♀, Maroubra, 33°57′S 151°15′E (AM KS3285, KS33529); 2 ♀♀, North Ryde, 33°48′S 151°07′E (AM KS34188); 1 ♀, Petersham, 33°53′S 151°09′E (AM KS32853); 1 ♀, Sydney, 33°53′S 151°13′E (BMNH 1915.3.5.1238); 1 ♀, The Rock Nature Reserve, 30 km SW of Wagga Wagga, 35°16′S 147°05′E (AM KS93965). ***Norfolk Island***: 1 ♂, Palm Glen, 29°02′S 167°52′E (QM S69382). ***Queensland***: 2 ♀♀, Altonvale Station, 27°48′S 149°18′E (QM S83980); 1 ♀, 'Carbeau', near Gore, 60 mi W Warwick, 28°18′S 151°29′E (QM S83983); 2 ♀♀, Dipperu National Park, 21°56′S 148°43′E (QM S83981–2); 1 ♀, Endfield Station, 64.4 km W Westmar, 27°55′S 149°43′E (QM S83979); 1 ♀, Landsborough, 26°48′S 152°58′E (QM S63707); 1 ♀, Marlaybrook, Bunya Mountains, 26°54′S 151°35′E (QM S83978); 1 ♀, Moggill, 27°34′S 152°52′E (BMNH 1924.III.I.411–412) (listed as *Araneus heroine* from "Magill" in DONDALE 1966); 1 ♂, Moranbah, 5 km S 22°02′S 148°03′E (QM S57015); 1 ♀, Rockhampton, 23°22′S 150°30′E (UWP); 1 ♀, 1 juv., same locality (UWP); 1 ♀, Roma, 26°35′S 148°47′E (QM S20862); 1 ♀, 'Separation', no exact locality (QM S73380); 1 ♀, Tailem Bend, 35°15′S 139°27′E (SAM NN25156); 1 ♀, Wallaroo Station, 45 mi N Injune, 25°18′S 148°42′E (QM S83977). ***South Australia***: 1 ♀, no exact locality (BMNH 1924.III.1.410–423); 4 ♀♀, 1 juv., SE South Australia, no exact locality (BMNH 10 1924. III.1.413–417); 1 ♀, SW South Australia, no exact locality (SAM NN24977); 1 ♀, no exact locality (SAM NN25680); 1 ♀, Adelaide, 34°55′S 138°36′E (SAM NN25051); 3 ♀♀, Adelaide, 34°55′S 138°36′E (ZMB 759); 1 ♀, Baird Bay, 33°09′S 134°22′E (WAM T73536); 1 ♀, Bald Hill Beach, near Port Wakefield, 34°15′S 138°10′E (SAM NN25124); 1 ♀, Barmera, 34°15′S 140°27′E (SAM NN24984); 1 ♀, Billiat Conservation Park, 34°59′23″S 140°28′24″E (SAM NN25822); 2 ♀♀, Birchmoore Lagoon, Kangaroo Island, 35°47′S 137°29′E (AM KS33512); 2 ♀♀, same locality (AM KS33383); 1 ♀, Canopus, 9.8 km S 33°35′37″S 140°40′E (SAM NN24906); 1 ♂, Ceduna, 32°07′S 133°40′E (SAM NN24695); 1 ♀, Charlton Gully, 34°33′S 135°47′E (SAM NN25234); 1 ♀, Cortina Station, Coorong, via Kingston, 36°19′S 139°45′E (SAM NN25048–9); 1 ♀, Cowell, N of, 33°25′S 136°55′E (SAM NN25076); 1 ♀, Crowharven, 1 km SSW, 32°34′08″S 134°49′31″E (SAM NN25071); 1 ♀, Deadmans Swamp, Comaum Forest Reserve, 37°10′S 140°52′E (SAM NN24976); 1 ♀, Edwardstown, 34°59′S 138°34′E (SAM NN25053); 1 ♂, Elder Range, 31°40′S 138°28′E (SAM NN25081); 1 ♀, Euro Bluff, NW Port Augusta, 32°30′S 137°45′E (SAM NN24907); 2 ♀♀, Flinders Island, 33°43′S 134°29′E (SAM NN25072–3); 3 ♀♀, Gilbert River, Riverton, 34°10′S 138°45′E (BMNH 1924.III.1.376); 1 ♀, Gluepot Reserve, 8.4 km NW-WNW Gluepot Homestead, 33°43′25″S 139°02′38″E (SAM NN18719); 6 ♀♀, Goolwa, 35°30′S 138°46′E (BMNH 1924.III.1.418–423) (listed in DONDALE 1966 as *Araneus heroine*); 1 ♀, Hambidge Conservation Park, 32°27′S 135°56′E (SAM NN25235); 1 ♀, Hope Valley, Adelaide, 34°50′S 138°42′E (SAM NN25055); 1 ♀, Jimmys Well, Mt Rescue Conservation Park, 35°51′S 140°18′E (SAM NN25113); 1 ♀, Kangaroo Island, 35°45′S 137°37′E (SAM NN25815); 1 ♀, Karoonda, 35°05′S 139°53′E (SAM NN25148); 1 ♀, Knowles Cave, Nullarbor Plains, 31°08′S 130°37′E (SAM NN25159); 1 ♀, Koonalda Cave, N of Eucla, 31°24′S 129°50′E (SAM NN24963); 1 ♂, Koonamore, T.G.B. Osborn Vegetation Reserve, 32°06′42″S 139°21′07″E (SAM NN25160); 1 ♂, Kulliparu Conservation Park, NW corner, 33°03′S 134°58′E (SAM NN25238); 1 ♀, Lake Acraman, near Acraman Bore, 32°01′S

135°17′E (SAM NN25250); 1 ♀, Lake Gilles National Park, 33°03′S 136°40′E (SAM NN25090); 1 ♀, Lake Meningie, near salt lake, 35°41′S 139°20′E (SAM NN25318); 1 ♂, Middleback Range, 33°04′S 137°08′E (SAM NN25392); 1 ♂, Middleback Station, 32°57′S 137°23′E (SAM NN25075); 1 ♂, Minister of Lands Conservation Park, 10 km N Kulliparu Conservation Park, 32°56′S 134°58′E (SAM NN25237); 1 ♀, 3 juv., sam locality (SAM NN25236); 1 ♀, Morgan, near Scott Creek, 34°02′S 139°40′E (SAM NN25154); 1 ♀, Mt Lofty, 34°58′S 138°42′E (SAM NN25283); 1 ♀, Mt Remarkable National Park, Mambray Creek, W of Park Headquarter, 32°50′45″S 138°01′41″E (AM KS77369); 3 ♀♀, Mt Wedge, 1 km NW summit, 33°28′S 135°09′E (SAM NN25067–9); 1 ♀, Muckera Rockhole, 30°02′S 130°03′E (SAM NN25158); 1 ♂, Munyeroo Conservation Park, 32°23′S 137°15′E (SAM NN25817); 1 ♂, Munyeroo Conservation Park, 9 km SE Murninnie, 33°21′02″S 137°17′29″E (SAM NN25816); 1 ♂, Murray Bridge, 35°07′S 139°16′E (SAM NN25150); 1 ♀, Murray River, 34°24′S 140°33′E (SAM NN24957); 1 ♀, Murray River West, Renmark, 34°10′S 140°46′E (WAM T75868); 1 ♀, Mylor, 35°02′S 138°45′E (SAM NN25134); 1 ♀, Ooldea, 30°27′S 131°50′E (SAM NN25824); 1 ♀, Palmer Estate Conservation Park, E of Tanunda, 34°31′S 138°57′E (SAM NN25129); 1 ♀, same locality (SAM NN25127–8); 1 ♀, Peebinga Conservation Park, 33 km NNW Pinnaroo, 34°59′16″S 140°48′12″E (SAM NN25821); 1 ♀, 1 juv., Pinkawillinie Conservation Park, 33°03′S 135°50′E (SAM NN25239); 1 ♀, 3 juv., same locality (SAM NN25818); 1 ♀, same locality (SAM NN25819); 1 ♀, same localiy, but 33°06′52″S 135°59′50″E (SAM NN25820); 1 ♀, Purnong, River Murray, 34°51′S 139°37′E (SAM NN25155); 1 ♀, Redcliffe, 33°42′S 139°32′E (SAM NN25008); 1 ♀, Roxby Downs, 30°33′S 136°54′E (SAM NN25087–8); 1 ♂, Scorpion Springs Conservation Park, 35°27′S 140°53′E (SAM NN25121); 1 ♀, 1 juv., Scorpion Springs Conservation Park, near Nanams Soakage, 35°27′S 140°53′E (SAM NN24919); 1 ♀, Scorpion Springs Conservation Park, near Scorpion Soakage, 35°27′S 140°53′E (SAM NN24914); 1 ♂, 1 juv., Scrubby Peak, 32°31′S 135°19′E (SAM NN25256–7); 2 ♀♀, Sinclair Gap, salt lake camp site, 33°07′35″S 137°03′15″E (SAM NN25077–8); 1 ♀, Sleaford Bay, Eyre Peninsula, 34°53′S 135°43′E (SAM NN25079); 1 ♀, Strathearn Homestead, 31°44′S 140°20′E (SAM NN25162); 1 ♀, Tod River mouth, N of Port Lincoln, 34°36′S 135°54′E (SAM NN25066); 1 ♀, 2 juv., Uno Ranges, 32°40′S 136°42′E (SAM NN25814); 1 ♀, 1 juv., Victor Harbor, 35°33′S 138°37′E (SAM NN24958–9); 1 ♀, Vokes Hill Corner, 41 km W, 28°32′S 130°16′E (SAM NN25091); 1 ♀, Wayville, Adelaide, 34°56′S 138°35′E (SAM NN24980); 1 ♀, Weetootla Well, 2 km E, Balcanoona Creek, Gammon Ranges National Park, 30°29′S 139°15′E (SAM NN25083); 1 ♀, Wirrula, 5 km W, at road junction to Petina, 32°25′00″S 134°29′30″E (SAM NN25241). ***Tasmania***: 1 ♀, Babel Island, Furneaux Group, 39°56′S 148°19′E (NMV K2566); 1 ♂, 2 ♀♀, George Town, 41°06′S 146°50′E (AM KS28666); 1 ♀, Kingston, 42°59′S 147°18′E (AM KS33350); 1 ♀, NW Tasmania, no exact locality (AM KS28890). ***Victoria***: 1 ♀, no exact locality (NMV K2564); 1 ♀ (NMV K2676); 1 ♀, ?Victoria, exchange material, no exact locality (QM); 1 ♀, ?Victoria, no exact locality, Salinitri collection (QM);1 ♀, Anglesea, 38°24′S 144°11′E (NMV K2534); 1 ♀, Avenel, 36°54′S 145°14′E (NMV K2655); 1 ♀, Bendigo, 36°46′S 144°17′E (NMV K2730); 1 ♀, Croydon, 37°47′S 145°16′E (NMV K2663); 1 ♀, Eaglehawk, 36°44′S 144°15′E (AM KS33519); 1 ♂, Gembrook, Gippsland, 33°57′S 145°32′E (BMNH 1924.III.1.438); 1 ♂, Kiata, 36°21′S 141°47′E (NMV K2641); 2 ♀♀, Moon Mines, Bendigo, 36°45′S 144°16′E (NMV K2659–60); 1 ♀, Mordialloc district, 37°59′S 145°05′E (NMV K9812); 1 ♀, Sandringham, 37°56′S 145°00′E (NMV K2670); 1 ♀, South Brighton, 37°54′S 144°59′E (NMV K2648); 1 ♂, Swan Hill, 35°20′S 143°33′E (NMV K2652); 2 ♀, Warrack, 37°21′S 141°34′E (NMV K2580, K2590); 1 ♀, Warrandyte, 37°44′S 145°13′E (NMV K2559); 1 ♀, Wingan, 37°41′S 149°31′E (NMV K9337). ***Western Australia***: 1 ♂, no exact locality (WAM T68014); 1 ♀, no exact locality (WAM 96/96); 1 ♂, Ajana Back Road, 27°59′57″S 114°37′55″E (WAM T74717); 1 ♂, Albany, 35°01′S 117°53′E (WAM 32/978); 1 ♀, ALCOA mine, NE Jarrahdale, 32°17′S 116°08′E (WAM T44687); 1 ♀, Applecross, 32°00′S 115°50′E (WAM T67974); 1 ♀, Balladonia, via Norseman, 32°28′S 123°52′E (AM KS33330); 1 ♂, Beverly, ca. 19 km SW, E of Darkin Road, 32°08′26″S 116°31′45″E (WAM T74724); 1 ♂, Black Swan Nickel Mine, 50 km NE Kalgoorlie, 30°23′29″S 121°39′10″E (WAM T53322); 3 ♀♀, Booanya, Balladonia, 32°46′S 123°36′E (AM KS33356, KS33388, KS33556); 1 ♂, Boolathana Station, 24°24′49″S 113°42′24″E (WAM T70147); 1 ♀, same locality (WAM T68087); 1 ♂, same locality, but 24°24′49″S 113°44′41″E (WAM T70149); 1 ♀, Boulder, 33 Cavalier Crs, 30°46′S 121°29′E (WAM T75871); 1 ♀, Bowgada Nature Reserve, 29°20′07″S 116°10′01″E (WAM T70163); 1 ♂, Boyagin Rock, 32°28′S 116°52′E (WAM T87195); 1 ♀, Brown Bone Cave, campsite, 30°34′S 115°07′E (WAM T70144); 1 ♂, Bunbury, 33°20′S 115°39′E (WAM T70104); 1 ♀, Buningonia Spring, 31°26′45″S 123°31′25″E (WAM T75832); 1 ♂, Buntine Nature Reserve, north, 29°58′16″S 116°35′05″E (WAM T74722); 1 ♂, Buntine Rocks Nature Reserve, 29°59′06″S 116°35′35″E (WAM T73679); 2 ♀♀, 1 juv., Burma Road Reserve, 28°56′S 115°05′E (WAM T70142); 4 ♀♀, 4 juv., Burma Road Reserve, 30 km E Walkaway, 28°56′S 115°05′E (WAM T67999); 1 ♂, Bush Bay, 25°07′54″S 113°46′05″E (WAM T70161); 1 ♀, Cape Arid National Park, Thomas Fisheries Track, no. 13, 33°58′14″S 13°46′E (WAM T95100); 1 ♂, Cardup, 32°16′02″S 116°00′44″E (WAM T73662); 1 ♂, Caversham, 31°52′34″S 115°58′24″E (WAM T70088); 1 ♀, Chittering and Pearce, between, 30°30′S 116°00′E (WAM T68018); 1 ♂, Cocanarup Timber Reserve, 33°38′S 119°54′E (WAM T73555); 1 ♀, Cocklebiddy Cave, 31°59′S 125°52′E (WAM T75823); 1 ♂, 1 juv., Cocklebiddy Cave doline, 31°58′S 125°53′E (WAM 93/2899–900); 1 ♀, Cooleenup Island, Yunderup, 32°34′S 115°46′E (WAM T70175); 1 ♂, Coolgardie, Forrest St, 30°57′S 121°10′E (WAM T70096); 2 ♂♂, Cunderdin Road, south, NE of Mukinbudin, 30°39′37″S 118°28′37″E (WAM T74719, T74723); 1 ♀, 3 juv., Darling Range, 32°36′S 116°07′E (BMNH 1892.6.12.4–20) (listed in Dondale 1966 as *Araneus heroine*); 3 ♀♀, Darlington, 31°54′S 116°04′E (WAM T68007, T68019, T70129); 1 ♀, 1 juv., same locality (WAM T75769); 1 ♂, same locality (WAM T70171); 1 ♀, Deepdene Cave area, on top of ridge, 34°15′S 115°03′E (WAM T67973); 1 ♀, Drovers Cave, Jurien, 30°15′S 115°05′E (ZMUC 12314); 1 ♀, East Chapman, 28°40′S 114°48′E (WAM 32/1872); 7 ♀♀, East Mt Barren, Fitzgerald River National Park, 33°55′S 120°01′E (WAM T75791); 1 ♀, Eneabba, RGC mine, 29°49′S 115°16′E (WAM T73684); 1 ♀, Eyre Homestead, 8 km N, 32°10′S 126°18′E (WAM T75816); 1 ♀, 1 juv., Fitzgerald River National Park, 34°04′S 119°25′E (WAM T70073); 3 ♀♀, same locality (WAM T70145); 1 ♀, Fitzgerald River Reserve, 1 mi E Hamersley River Inlet, 33°56′S 119°55′E (WAM T67970); 1 ♀, Floreat Park, 31°56′S 115°47′E (WAM T70138); 1 ♀, Forrest, 30°44′S 127°41′E (WAM T70133); 1 ♀, 8 juv., Glen Forrest, 31°55′S 116°06′E (WAM T77283); 1 ♀, Goongarrie Station, 30°01′S 121°05′E (WAM T70011); 2 ♂♂, Grass Patch, 5 km E, Fitzgerald Locality 41, 33°13′56″S 121°43′00″E (WAM T70086, T73539); 1 ♀, 1 juv., Greenough, 28°57′S 114°44′E (WAM T67967); 1 ♂, Guildford, Swan St, 31°54′S 115°59′E (WAM T73693); 1 ♀, Harvey, 33°04′S 115°53′E (AM KS108589); 1 ♂, same locality (WAM T70177); 1 ♂, Helena-

Aurora Ranges, 30º24′S 119º38′E (WAM T73529); 1 ♀, Highbury, 33º04′S 117º14′E (WAM T68083); 1 ♀, Hollywood School, 31º58′S 115º48′E (WAM T67972); 1 ♂, Hurlstone Nature Reserve, 32º32′32″S 119º22′42″E (WAM T74851); 1 ♂, Hyden-Lake Hurlstone Road, 32º38′35″S 119º22′18″E (WAM T74718); 1 ♂, Jerramungup, 33º56′S 118º55′E (WAM T70020); 1 ♀, John Forrest National Park, 31º53′S 116º05′E (NMV K2708); 1 ♀, Kalbarri, 27º41′S 114º12′E (WAM T68061); 2 ♀♀, same locality (WAM T67961); 3 ♀♀, Kalbarri Road, 24-mi peg, Loop turnoff, 27º32′S 114º27′E (WAM T68066, T70112, T70139); 1 ♀, Kalbarri, 4 mi W of 2nd bend, 27º39′S 114º25′E (WAM T67993); 2 ♀♀, Kalgoorlie, 30º45′S 121º27′E (WAM T67964); 1 ♀, same locality (WAM T67965); 1 ♀, 1 juv., same locality (WAM T67976); 1 ♂, 1 juv., Kelmscott, 32º07′S 116º01′E (WAM T70141); 1 ♀, Kelmscott High School, 32º07′S 116º01′E (WAM T68057); 1 ♀, King George Sound, 35º03′S 117º58′E (AM KS32842); 1 ♂, Kings Park, 31º57′10″S 115º49′55″E (WAM T68010); 1 ♂, Kondidin, 32º30′S 118º16′E (WAM T73544); 1 ♂, Kukerin, 3 mi E, 33º10′S 118º08′E (WAM T87416); 1 ♀, Kundip, Ravensthorpe, 33º41′20″S 120º11′54″E (WAM T69839); 2 ♂♂, Kychering Soak, 24 mi W, on overland railway, no exact locality (NMV K2546–7); 1 ♂, Lake Cronin, 32º23′10″S 119º45′05″E (WAM T70081); 1 ♀, Lake Magenta Reserve, near Greenshield Soak, 34º35′S 119º06′E (WAM T68027); 1 ♂, Lake Varley, 10 km E, 32º40′S 119º30′E (WAM T70143); 1 ♂, 1 ♀, 1 juv., Leeman Swamp, 29º56′S 114º58′E (WAM T70137); 1 ♂, Lesmurdie, 32º00′37″S 116º02′49″E (WAM T70010); 1 ♀, Mahogany Creek, 31º54′S 116º08′E (WAM 29/1524); 1 ♂, Marvel Loch South, Southern Cross, St Barbara Operation, Cornishman area, 31º18′18″S 119º23′35″E (WAM T96025); 1 ♀, Marvel Loch Townsite, S Southern Cross, 31º28′S 119º29′E (WAM T96026); 1 ♀, McDermid Rock, 32º45′20″S 120º03′20″E (WAM T67978); 1 ♀, Middle Island, Recherche Archipelago, 34º06′S 123º11′E (WAM T73538); 2 ♀♀, Moonyoonooka, ca. 5 km E, Clune's Property, NE of Chintapee Road, 28º45′13″S 114º51′40″E (WAM T75879); 1 ♀, Mt Lawley, 31º55′S 115º52′E (WAM T75820); 1 ♀, Mt Pleasant Primary School, 32º01′S 115º50′E (WAM T70170); 1 ♀, Mt Ragged Campsite, Cape Arid National Park, 33º27′58″S 123º27′37″E (WAM T81447); 1 ♂, same locality (WAM T81448); 1 ♀, Mt Ragged, Cape Arid National Park, 33º26′S 123º28′E (WAM T67966); 1 ♀, Mt Rupert, 30º47′S 116º38′E (WAM 94/1874); 1 ♀, Mt Tarcoola, 28º48′S 114º37′E (WAM T67971); 1 ♀, Mundaring, 31º53′S 116º10′E (WAM T67968); 1 ♀, Mundaring Weir, 31º57′S 116º09′E (WAM T70075); 1 ♂, Murchison River Crossing at Galena, 27º49′S 114º41′E (WAM T77191); 1 ♂, Murdoch, 32º04′S 115º49′E (WAM T55907); 1 ♂, Nedlands, UWA Zoology Department, 31º59′S 115º48′E (WAM T70095); 1 ♂, Nerren Nerren Station, 27º03′24″S 114º34′23″E (WAM T70146); 1 ♀, same locality, but 27º03′00″S 114º34′32″E (WAM T75819); 1 ♂, Norseman, 32º12′S 121º46′E (WAM 96/85); 1 ♂, Norseman, 45 mi N, 31º33′S 121º47′E (WAM 78/7); 1 ♀, Northern Highway, between 30 and 34-mi peg, no exact locality (WAM T70127); 1 ♂, same locality (WAM T70134); 1 ♂, Officer Basin, 29º58′S 123º46′E (WAM T75799); 2 ♀♀, Palmyra, 32º02′S 115º47′E (WAM T67969, T68060); 2 ♀♀, Peak Charles, Peak Charles National Park, 32º53′07″S 121º09′51″E (WAM T70035); 1 ♀, Perth, 31º57′S 115º51′E (WAM T68020); 1 ♀, Perth, New Museum, 31º57′S 115º51′E (WAM T67962); 1 ♂, Point Salvation, 7–8k m WNW, 28º12′S 123º36′E (WAM T70082); 3 ♂♂, Queen Victoria Springs Nature Reserve, 30º14′S 123º41′E (WAM T52748–9, T52686); 1 ♀, same locality (WAM T53172); 1 ♀, Rat Island, Abrolhos, 28º42′S 113º47′E (WAM T68059); 1 ♀, Ravensthorpe, 40 mi W, Camp Creek (near Susetta River), 33º36′S 119º30′E (WAM T70055); 1 ♀, Ravensthorpe, Ravensthorpe Ranges South, 33º36′51″S 120º09′08″E (WAM T81167); 1 ♂, Salmon Gums, SE, 32º58′S 121º38′E (WAM T70089); 1 ♂, Shenton Park Bushland, 31º58′S 115º48′E (WAM T70094); 1 ♂, Nullarbor Plain, sinkhole at, 31º28′13″S 125º13′15″E (WAM T70091); 1 ♂, Snake Gully Nature Reserve, 30º13′05″S 116º56′36″E (WAM T74721); 1 ♀, Spalding Park, S side of Chapman River, 28º39′S 114º38′E (WAM T73558); 1 ♂, Stirling Range Caravan Park, 34º18′55″S 118º11′14″E (WAM T70093); 1 ♀, Stirling Range National Park, near W end of Ellen Track, 34º22′53″S 118º17′18″E (WAM T75789); 1 ♀, Stirling Range National Park, S face of Pyungoorup Peak, 34º22′17″S 118º19′20″E (WAM T70059); 1 ♂, Talbot Road Reserve, 31º52′05″S 116º03′04″E (WAM T68009); 1 ♂, same locality, but 31º52′25″S 116º03′03″E (WAM T68008); 1 ♂, Three Springs, 29º32′S 115º45′E (WAM T73657); 1 ♂, Tutanning Nature Reserve, south, 32º33′17″S 117º20′03″E (WAM T74720); 1 ♂, University of Western Australia bushland, Underwood Avenue, 31º57′02″S 115º48′05″E (WAM T68029); 1 ♂, Weebubbie, 31º39′S 128º46′E (SAM NN24772); 1 ♀, 1 juv., Wembley, 80 Simper Street, 31º56′S 115º48′E (WAM T67963); 1 ♂, Yamarna Station, B-area, 28º13′30″S 123º35′30″E (WAM T70019); 1 ♂, Zuytdorp, 27º16′00″S 114º01′21″E (WAM T70148); 1 ♀, Zuytdorp Nature Reserve, 27º15′25″S 114º11′16″E (WAM T70084); 2 ♀♀, 1 juv., same locality, but 27º15′28″S 114º09′02″E (WAM T75864).

9. Appendix B: Material examined of *Backobourkia brounii* (Urquhart)

UNKNOWN: 2 ♀♀, labeled: "Loc?" (BMNH 1924.III.1.1490–91). **AUSTRALIA**: ***Australian Capital Territory***: 2 ♀♀, 1 juv., Canberra, 35º18′S 149º08′E (QM S83936); 1 ♂, Cook, 23 Grylls Crescent, 35º16′S 149º04′E (WAM T70162); 1 ♀, Ginninderra, Canberra, 35º12′S 149º05′E (AM KS32849) (listed in DONDALE 1966 as *Araneus heroine*); 1 ♂, Ginninderra, Canberra, 35º12′S 149º05′E (CNC) (listed in DONDALE 1966 as *Araneus heroine*). ***New South Wales***: 2 ♀♀, Antonio, via Rydal, 33º32′S 150º01′E (AM KS32844); 1 ♀, Barrington Tops, 32º01′S 151º29′E (NMV K9815); 1 ♀, Bombala, 36º55′S 149º15′E (AM KS33298); 1 ♂, Botany, 33º57′S 151º12′E (AM KS34058); 1 ♀, same locality (AM KS34127); 2 ♀♀, 2 juv., Bourke, 30º05′S 145º56′E (AM KS34076); 3 ♀♀, Caigan, 31º42′S 149º14′E (BMNH 1890.7.1.4194–4197) (listed as *Epeira heroine* in Keyserling 1886; listed as *Araneus heroine* from "CAYGAN" in DONDALE 1966); 2 ♀♀, Caldwell, 35º37′S 144º30′E (NMV K9342); 1 ♀, 1 juv., Cessnock, 32º49′S 151º21′E (QM S83937); 2 ♂♂, Clarence River, Copmanhurst, 29º35′S 152º46′E (SAM NN25808–9); 1 ♀, Colo Vale, 34º24′S 150º29′E (AM KS32843); 2 ♀♀, 6 juv., Coolah Valley, 31º50′S 149º43′E (AM KS33386); 2 ♀♀, same locality (AM KS33394); 1 ♀, 2 juv., same locality (AM KS33397); 1 ♀, same locality

(AM KS33341); 1 ♂, same locality (AM KS33514); 1 ♂, Coonabarabran, 'Smokey Hole', 31°16′S 149°17′E (AM KS7542); 1 ♂, 1 ♀, Curryall, 32°07′S 149°47′E (AM KS8853); 1 ♂, 1 ♀, Enfield, 33°53′S 151°06′E (AM KS3050); 1 ♀, Epping Strip, 33°46′S 151°05′E (AM KS51593); 1 ♀, Fairfield, 33°52′S 150°57′E (AM KS3051); 3 ♀♀, 3 juv., Finley, 35°37′S 145°34′E (NMV K9829); 1 ♀, Hargraves, W of Mudgee, 32°48′S 149°28′E (AM KS34378); 1 ♂, Jervis Bay, 35°03′S 150°44′E (AM KS34185); 1 ♀, Katoomba, 33°43′S 150°19′E (AM KS33293); 1 ♀, Ku-Ring-Gai Chase National Park, Smiths Creek, 33°39′46″S 151°13′19″E (ZMUC 12317); 3 ♂♂, Lachlan River, Whealbar Bridge, 34°05′S 149°01′E (NMV K2654, K2656, K2665); 1 ♀, same locality (NMV K2653); 2 ♀♀, same locality (NMV K9824); 1 ♀, Lakemba, 33°55′S 151°04′E (AM KS33346); 1 ♀, Lawsen, 33°43′S 150°26′E (AM KS33374); 1 ♀, Leura, 33°43′S 150°19′E (AM KS32847); 1 ♀, Lithgow, 33°29′S 150°08′E (AM KS32852); 1 ♂, Livingstone National Park, 35°37′06″S 147°35′31″E (AM KS92570); 10 ♀♀, Llangothlin, near Guyra, 30°08′S 151°41′E (AM KS34123); 1 ♂, Maitland area, 32°44′S 151°33′E (AM KS21572); 1 ♀, Mascot, 33°56′S 151°12′E (AM KS16241); 1 ♀, Mt Coricudgy, 32°50′S 150°21′E (AM KS91422); 1 ♀, Mt Druitt, 33°46′S 150°49′E (AM KS32860); 1 ♂, Mudgee, 32°36′S 149°35′E (AM KS40699); 1 ♂, 1 ♀, Murrami, 34°25′02″S 146°18′55″E (AM KS94361); 1 ♀, Newnes State Forest, 33°23′S 150°13′E (AM KS94938); 1 ♀, Newnes State Forest, Waratah Ridge Road, 1.4 km from Glowworm Tunnel Road, 33°23′45″S 150°14′17″E (AM KS94539); 1 ♂, North Richmond, 33°34′S 150°42′E (AM KS34192); 1 ♀, Parkes, 33°08′S 148°11′E (AM KS45843); 1 ♂, Pomingalarna Park, 8 km W Wagga Wagga, 35°04′S 147°22′E (AM KS93873); 2 ♀♀, same locality (AM KS93953, KS94004); 1 ♀, Springwood, 33°41′S 150°33′E (AM KS34130); 1 ♀, Sydney, 33°52′S 151°13′E (AM KS32700); 1 ♂, Tamworth, 31°05′S 150°56′E (AM KS17508); 1 ♀, 'Tuglo', near Singleton, Carrow Brook, 32°14′S 151°16′E (AM KS8500); 1 ♀, Upper Tumut Gorge, Snowy Mountains, 35°18′S 148°13′E (QM S83976); 1 ♀, Uralla, 30°38′S 151°30′E (AM KS34187); 1 ♀, Wagga Wagga, Gregadoo Road, 35°07′S 147°22′E (WAM T73549); 1 ♂, Wamboin, 6 Cooper Road, 35°15′38″S 149°16′46″E (WAM T68091); 1 ♀, Washpool State Forest, 8 km W of swamp, on Gwyder Highway, 29°16′S 152°21′E (AM KS9257); 1 ♀, W of Washpool State Forest, Gwyder Highway, 29°16′S 152°21′E (AM KS9085); 1 ♂, same locality (AM KS9090); 1 ♂, Wellington, 32°33′S 148°57′E (AM KS32859); 1 ♀, Wentworth Falls, 33°43′S 150°22′E (AM KS29966); 1 ♀, Yagoona, 33°54′S 151°01′E (AM KS34205); 3 ♀♀, Yancannia, NNE Broken Hill, 30°15′S 142°46′E (NMV K2649, K2664, K2666); 3 ♀♀, 1 juv., Yanco, N of Tibooburra, 34°35′S 146°25′E (SAM NN25772–5); 1 ♀, Yass, 34°51′S 148°55′E (AM KS33361). ***Northern Territory***: 1 ♀, Ormiston Gorge, 23°38′S 132°43′E (AM KS58709). ***Queensland***: 1 ♀, Annerley, 27°30′S 153°02′E (QM S83960); 1 ♂, Aratula, 6 mi E, 27°58′S 152°38′E (QM S83965); 1 ♀, Bunya National Park, 26°54′S 151°34′E (QM S83970); 1 ♀, 'Carodon', via McKinlay, near Cloncurry, 20°42′S 140°30′E (QM S83971); 1 ♂, Chinchilla, 26°44′S 150°38′E (QM S83973); 1 ♀, Clermont, Central West Tableland, 22°50′S 147°38′E (AM KS33380); 1 ♂, Condamine, 26°56′S 150°08′E (AM KS33398); 1 ♀, Crows Nest, 27°16′S 152°03′E (SAM NN25559); 1 ♂, 1 ♀, Dargonelly Rock Holes, Mt Moffat, 25°01′S 147°57′E (QM S15929); 1 ♀, 5 juv., Eidsvold, 25°22′S 151°07′E (AM KS32681); 1 ♀, 1 juv., same locality (QM S83967); 1 ♀, Gatton, 27°34′S 152°17′E (AM KS32845); 1 ♂, 1 ♀, same locality (AM KS32658); 3 ♀♀, 1 juv., Gatton, Queensland Agricultural College, 27°34′S 152°20′E (QM S66758); 1 ♀, same locality (QM S66767); 1 ♀, Holland Park, 118 Arnold St, 27°30′55″S 153°04′03″E (WAM T84329); 1 ♀, Kenniffs Lookout, Mt Moffat National Park, 25°01′S 147°57′E (QM S83966); 1 ♂, 1 ♀, Kumbarilla, 28 mi W Dalby, 27°19′S 150°51′E (QM S83969); 1 ♀, Lake Bindegolly National Park, 28°00′S 144°11′E (QM S29601); 1 ♀, Lake Broadwater, 27°21′S 151°06′E (QM S83958); 1 ♀, Lake Broadwater, Cottage, 27°21′S 151°06′E (QM S83975); 1 ♂, 1 ♀, 2 juv., Mt Colliery, Yangan, 28°12′S 152°13′E (QM S83963); 1 ♂, 1 ♀, Mt Moffat National Park, top shelter shed, 25°01′S 147°57′E (QM S83966); 2 ♂♂, 1 ♀, 1 juv., Mt Pleasant, Dalby, 27°10′S 151°23′E (QM S83962); 1 ♂, Noosa Heads, 26°23′S 153°07′E (QM S83961); 1 ♀, South Brisbane, 27°28′S 153°01′E (QM S83964); 4 ♀♀, 1 juv., Springsure, 24°07′S 148°05′E (QM S83974); 1 ♀, The Crater, Rewan, 24°58′S 148°23′E (QM S83934); 1 ♀, Themeda, Mt Zahl, via Laidley, 27°38′S 152°24′E (QM S83972); 1 ♂, Tiaro, Mt Bauple, 25°44′S 152°35′E (QM S18435); 1 ♂, Warwick, Mt Colliery district, 28°13′S 152°02′E (QM S83933). ***South Australia***: 1 ♀, Adelaide, 34°55′S 138°36′E (ZMH 780); 1 ♀, Adelaide, 34°55′S 138°36′E (SAM NN25052); 1 ♀, Aldinga, 8.2 km S 36°28′S 140°14′E (QM S83935); 1 ♀, 1 juv., same locality (QM S83959); 1 ♀, 1 juv., Algebuckina Waterhole, 27°54′S 135°49′E (SAM NN25095); 1 ♀, Avenue Range, 36°37′S 140°06′E (SAM NN25111); 1 ♀, Bald Hill Beach, near Port Wakefield, 34°15′S 138°10′E (SAM NN25125); 1 ♀, Belalie Creek, Jamestown, 33°13′S 136°35′E (SAM NN25126); 2 ♂♂, Blakiston, 35°02′S 138°52′E (SAM NN25812–3); 13 ♀♀, Blakiston, Little Hampton, 35°02′S 138°52′E (BMNH 1924.III.1.424–436); 1 ♀, Blue Cottage, Belair National Park, 34°59′S 138°38′E (SAM NN25157); 1 ♀, Chowilla, 34°01′S 140°50′E (SAM NN25139); 1 ♀, Chowilla, 1 km WSW of Brandy Bottle Waterhole, 34°01′S 140°50′E (SAM NN25140); 1 ♀, 1 juv., Chowilla, 2 km SE Lake Werta Wert, 34°01′S 140°50′E (SAM NN25142); 1 ♀, Chowilla, Lake Limbra, 33°54′S 140°56′E (SAM NN25143); 3 ♀♀, 3 juv., Chowilla, Lake Werta Wert, 33°56′S 140°52′E (SAM NN25144–6); 1 ♀, Chowilla, same locality (SAM NN25147); 1 ♂, Edwardstown, 34°59′S 138°34′E (SAM NN25054); 1 ♀, Emu Downs, 5.5 km SSE, 33°57′55″S 139°00′23″E (SAM NN22781); 1 ♂, Felixstow, River Torrens banks, Adelaide, 34°53′S 138°38′E (SAM NN24711); 1 ♀, Gilbert River, Riverton, 34°10′S 138°45′E (BMNH 1924.III.1.376); 2 ♂♂, Hindmarsh Park Station, Coorong, 36°21′S 139°47′E (SAM NN25164–5); 1 ♀, Islington, Adelaide, 34°52′S 138°34′E (SAM NN25056); 1 ♀, Kalangadoo, 37°33′00″S 140°38′35″E (SAM NN25114); 1 ♀, Kangarilla, Mt Lofty Ranges, 35°08′S 138°39′E (SAM NN25133); 1 ♀, Keilira Station, 13 km N, Hirst's old farm, 36°37′38″S 140°10′E (SAM NN25316); 2 ♀♀, 1 juv., Kingoonya, 30°54′S 135°18′E (SAM NN25085–6); 1 ♂, Kirton Point Caravan Park, Port Lincoln, 34°43′S 135°52′E (SAM NN24663); 1 ♂, Langhorne Creek, 35°17′S 139°02′E (SAM NN25149); 1 ♀, Lockleys, 34°55′S 138°32′E (SAM NN25057); 1 ♂, Lucindale, 36°58′S 140°22′E (SAM NN25115); 1 ♀, Meningie, 35°41′S 139°20′E (SAM NN25116); 1 ♂, 1 ♀, Minlaton, S of, 34°53′S 137°38′E (SAM NN25166–7); 1 ♀, Monbulla Cave, road to on gate, 37°26′S 140°38′E (SAM NN25112); 1 ♀, Mt Brown, 7 km NE, 32°28′04″S 138°04′03″E (SAM NN25082); 1 ♀, Mylor, 35°02′S 138°45′E (SAM NN25811); 1 ♀, Nappyalla, 35°20′S 139°07′E (SAM NN25152); 1 ♀, same locality (SAM NN25151); 1 ♀, Nappyalla, near Langhorne Creek, 35°20′S 139°07′E (SAM NN24842); 1 ♀, Netherby, Waite Institute, Adelaide, 34°58′S 138°37′E (SAM NN25062); 1 ♀, Normans Scrub, Penola, 37°22′S 140°50′E (SAM NN25118); 1 ♀, 1 juv., North Adelaide, 34°54′S 138°35′E (SAM NN25058); 1 ♀, Palmer Estate Conservation Park, E of Tanunda, 34°31′S 138°57′E (SAM NN25810); 1 ♂, 1 ♀, Penola, SW of, 37°26′S 140°38′E (SAM NN25122–3); 1 ♀, Sellicks-Aldinga Scrub, 35°17′S 138°27′E (SAM NN25135); 1 ♀, Topperweins Scrub margin, Penola Forest Reserve, 37°32′S 140°57′E (SAM

NN25120); 1 ♂, Victor Harbor, 35°33′S 138°37′E (SAM NN25136); 1 ♀, Warradale, Adelaide, 34°59′S 138°32′E (SAM NN25063); 1 ♀, Whyalla, 33°02′S 137°34′E (NMV K9341); 1 ♀, Wistow, Mt Barker, 35°06′S 138°53′E (SAM NN25138); 1 ♀, Woomera, 31°09′S 136°48′E (SAM NN25845); 1 ♀, York [sic] (=Yorke) Peninsula, 34°21′S 137°37′E (SAM NN25168). ***Tasmania***: 1 ♀, Boot Jack area, Flinders Island, 40°54′S 147°54′E (AM KS36896); 1 ♀, Lindisfarne, 42°51′S 147°21′E (AM KS28872); 1 ♀, Longford, 41°36′S 147°08′E (AM KS28570); 1 ♀, Queens Domain, Hobart, 42°52′S 147°19′E (AM KS28622); 1 ♀, Seven Mile Beach, 42°52′S 147°30′E (AM KS28628); 1 ♂, 1 ♀, Seven Mile Beach, 42°52′S 147°30′E (AM KS28627). ***Victoria***: 4 ♀, 1 juv., ?Victoria (no exact locality), exchange material (QM); 2 ♀♀, ?Victoria (no exact locality), exchange material (QM S83932);1 ♀, ?Victoria (no locality data) (NMV K2643); 3 ♀♀, Victoria (no exact locality), (ZMUC 12319, ZMUC 12315); 6 ♀♀, Victoria (no exact locality) (ZMB 13570); 3 ♀♀, Avenel, 36°54′S 145°14′E (NMV K2601, K2668, K9823); 1 ♀, Bacchus Marsh, 5 km NE, 37°35′S 144°30′E (WAM T75863); 1 ♀, Bendigo, 36°46′S 144°17′E (NMV K2731); 1 ♂, Bendigo area, 36°46′S 144°17′E (NMV K9413); 1 ♀, Broughton, 36°10′S 141°22′E (SAM NN25546); 1 ♀, Bruthen, 37°42′S 147°50′E (NMV K2662); 1 ♀, Buninyong, 37°39′S 143°53′E (NMV K9339); 1 ♂, Carnegie, 37°53′S 145°03′E (NMV K9861); 1 ♀, Castlemaine on Mt Alexander, Crocodile Reservoir, 37°04′S 144°15′E (AM KS44463); 1 ♀, Cheltenham, 37°58′S 145°04′E (NMV K2667); 4 ♀♀, Cheniston, Macedon, 37°25′S 144°33′E (BMNH 1924. III.1.364–369); 1 ♂, 1 ♀, Creswick, 37°25′S 143°53′E (NMV K2657–8); 2 ♀♀, Dermodys Camp, Avon River State Forest, 37°48′17″S 146°55′03″E (WAM T68048); 2 ♀♀, Dimboola, 36°27′S 142°01′E (NMV K2642, K2650); 1 ♀, Frankston, 38°09′S 145°08′E (NMV K2548); 1 ♂, Gembrook, Gippsland, 33°57′S 145°32′E (BMNH 1924.III.1.439); 1 ♂, Gifford, 37°46′S 145°49′E (NMV K9450); 4 ♀♀, same locality (NMV K2672–5); 1 ♀, Gypsum, 35°16′S 142°23′E (NMV K9822); 1 ♀, Jeparit, 36°08′S 141°59′E (NMV K9353); 1 ♂, Kew, 37°48′S 145°02′E (WAM T75800); 1 ♀, Lilydale, 37°45′S 145°21′E (NMV K2669); 1 ♀, Merbein, 34°10′S 142°04′E (AM KS28620); 1 ♀, Mordialloc district, 37°59′S 145°05′E (NMV K9813); 1 ♀, Mt William, 37°13′S 144°48′E (AM KS20429); 1 ♀, Nilma, 38°10′S 145°58′E (NMV K9333); 1 ♀, Numurkah, 36°05′S 145°26′E (NMV K9821); 2 ♀♀, 2 juv., South Brighton, 37°54′S 144°59′E (NMV K2644–7); 1 ♀, South Melbourne, 37°50′S 144°57′E (NMV K9351); 1 ♀, Swan Hill, 35°20′S 143°33′E (NMV K2729); 1 ♂, Swan Hill, 35°20′S 143°33′E (NMV K9863); 1 ♀, Toorak, 37°50′S 145°01′E (NMV K2671); 1 ♀, Warrandyte, 37°44′S 145°13′E (NMV K2560); 1 ♀, Whisky Flat, 36°19′S 146°49′E (NMV K2661). ***Western Australia***: 1 ♂, Albany, 35°01′S 117°54′E (WAM T70131); 1 ♀, Australind, 33°16′S 115°43′E (WAM T75776); 1 ♀, Balladonia, 32°28′S 123°52′E (AM KS33349); 1 ♀, Booanya, 32°46′S 123°36′E (AM KS33290); 2 ♂♂, Canning Well, 22°22′S 121°18′E (NMV K2555–6); 1 ♂, Capel, 33°33′S 115°33′E (WAM T71611); 1 ♀, Chittering and Pearce, between, 31°30′S 116°00′E (WAM T75790); 2 ♂♂, Clarkson, 36 Carberry Square, 31°42′S 115°44′E (WAM T73526, T73531); 1 ♀, Collie River, Bunbury, 33°20′S 115°38′E (WAM T75752); 2 ♀♀, Darlington, 31°54′S 116°04′E (WAM T75833); 1 ♂, 3 juv., same locality (WAM T68005); 1 ♀, 1 juv., same locality (WAM T75770); 2 ♂♂, same locality (WAM T70172, T77190); 1 ♀, Gelorup, 33°23′S 115°38′E (WAM T75787); 1 ♀, Gelorup, Gelorup Rise, Lot 101, 33°23′12″S 116°38′43″E (WAM T75792); 3 ♂♂, same locality (WAM T70087, T73528, T73602); 1 ♂, 1 ♀, Gidgegunnup, Waterford Road, 31°51′S 116°11′E (WAM T70092); 2 ♀♀, Glen Forrest, 31°54′S 116°06′E (WAM T75750, T75788); 2 ♀♀, Greenmount, 31°51′S 116°03′E (WAM T75772); 1 ♀, Holt Rock, 32°40′S 119°24′E (WAM T75821); 1 ♀, Jarrahdale, 32°20′S 116°03′E (WAM T75773); 1 ♂, Koongamia, 31°54′20″S 116°02′18″E (WAM T77279); 1 ♂, Leda, 32°16′S 115°48′E (WAM T70110); 1 ♀, Manjimup, 34°14′S 116°08′E (WAM T75749); 1 ♂, Margaret River, 33°58′S 115°04′E (WAM 33/1155); 1 ♀, Middle Swan, 31°51′S 116°01′E (WAM T75747); 2 ♂♂, Mt Barker, 16 Osborne Road, 34°38′S 117°40′E (WAM T73547); 1 ♀, Mussel Pool, 7 km NW Midland, 31°50′S 115°56′E (WAM T75829); 1 ♀, Needilup, 33°57′S 118°46′E (WAM T75774); 1 ♂, Northcliffe, 34°37′S 116°08′E (WAM T67987); 1 ♀, Northcliffe, 7 km N (towards Pemberton), 34°32′S 116°08′E (WAM T75822); 1 ♀, Parmelia, 32°15′S 115°47′E (WAM T73543); 1 ♂, same locality (WAM T68016); 1 ♀, 1 juv., Perth, 31°57′S 115°51′E (AM KS108590); 1 ♂, Regans Ford, Moore River, 30°59′S 115°42′E (AM KS34327); 1 ♂, 2 juv., Rockingham, 32°17′S 115°43′E (WAM T75751); 1 ♀, Roleystone, 32°06′S 116°04′E (WAM T87408); 1 ♀, Rossmoyne, 32°02′S 115°45′E (WAM T75841); 2 ♀♀, 9 juv., Sabina River, 33°39′S 115°24′E (WAM T77290); 1 ♀, Scarborough, 31°53′S 115°46′E (WAM T75746); 1 ♀, Stirling Range Retreat, caravan park, 34°18′55″S 118°11′14″E (WAM T75843); 2 ♀♀, 15 juv., Swan River, 31°45′S 116°04′E (AM KS33310); 2 ♀♀, Tenterden, 34°22′S 117°34′E (AM KS33528); 2 ♀♀, Walpole-Nornalup National Park, Two Road, 11.1 km at 282°W from Walpole, 34°57′56″S 116°36′24″E (ZMUC 12316, 12318). **NEW ZEALAND**: ***North Island***: **Northland**: 1 ♀, Kaimaumau, 34°55′S 173°14′E (MONZ AS.0014091); 1 ♀, Kaikohe, near, 35°24′S 173°52′E (LUNZ); 1 ♀, Hukatere, ; 36°10.6′S 174°10.0′E (OMNZ IV26443). **Auckland**: 5 ♀♀, Waiheke Island, 36°47′S 175°00′E (MONZ AS.001404); 1 ♀, Hillsborough, 36°55′30″S 174°45′00″E (NZAC). **Bay of Plenty**: 1 ♂, Rotorua, 38°09′S 176°16′E (OMNZ IV26452). **Hawkes Bay**: 1 ♀, Napier Airport, 39°28′S 176°52′E (MONZ AS.001406); 4 ♀♀, Puketapu Hill, 39°30′S 176°48′E (OMNZ IV26444–6, IV26462); 1 ♀, Napier, 39°30′S 176°54′E (OMNZ IV26449); 1 ♀, Taradale, 39°32′S 176°50′E (OMNZ IV26451); 1 ♂, Waiohiki, 39°33.3′S 176°50.4′E (OMNZ IV26464); 1 ♀, Ngaruroro River mouth, 39°34′S 176°55′E (OMNZ IV26447). **Wanganui**: 1 ♀, Foxton, 40°28′S 175°17′E (OMNZ IV26463). **Wellington**: 1 ♀, Paraparaumu, 40°54′20″S 175°00′20″E (MONZ AS.001403). ***South Island***: **Nelson**: 3 ♀, Cawthron, 41°16.3′S 173°17.6′E (OMNZ IV26468–9); 1 ♀, Nelson, 41°16′S 173°17′E (OMNZ IV26461); 1 ♀, Stoke, 41°19′S 173°14′E (OMNZ IV26473); 1 ♂, Sherry Valley, 41°28S 172°42′E (OMNZ IV26470). **Marlborough**: 1 ♀, Blenheim, 41°31′S 173°57′E (MONZ AS.001407); 1 ♀, Blenheim, foot of Wither Hills, 41°32′S 174°00′E (MONZ AS.001405); 1 ♀, Blenheim, Leitrim St, 41°31′30″S 173°56′30″E (NZAC). **Kaikoura**: 1 ♀, Kaikoura 42°24′S 173°41′E (OMNZ IV26472). **North Canterbury**: 1 ♀, Rangiora, 43°18′43″S 172°35′27″E (MONZ AS.001402). **Mid Canterbury**: 1 ♀, Avonhead, Christchurch, 43°31′S 172°33′E (AgR 9420); 1 ♀, same locality (LUNZ); 1 ♀, Sockburn, Christchurch, 43°32.6′S 172°32.4′E (OMNZ IV264601); 1 ♂, Christchurch, 43°32′S 172°39′E (OMNZ IV26459); 1 ♀, same locality (OMNZ IV26471); 1 ♀, Spreydon, Christchurch, 43°33′S 172°36′E (LUNZ); 1 ♀, Hawkin's Ford, 43°35′S 172°07′E (OMNZ IV26467); 1 ♀, Lyttelton Harbour (listed in DONDALE 1966 as *Araneus heroine*), 43°36′S 172°43′E (BMNH 1924.III.1.437); 1 ♀, Rolleston, 43°36′S 172°22′E (LUNZ). **Central Otago**: 1 ♀, Tara Hills Research Station, 44°31.6′S 169°53.4′E (OMNZ IV26442); 1 ♀, Alexandra, 45°15′S 169°24′E (OMNZ IV26457); 1 ♀, Lookout, Alexandra, 45°15.2′S 169°24.5′E (OMNZ IV26458). **Unknown locality**: 2 ♀♀, 1 ♂, (OMNZ IV26453–4, IV26456).

10. Appendix C: Material examined of *Backobourkia collina* (Keyserling)

AUSTRALIA: ***New South Wales***: 1 ♀, Broken Hill, 31°58′S 141°27′E (SAM NN25807); 1 ♀, Bullabong, near Broken Hill, 31°58′S 141°27′E (AM KS33313); 2 ♂♂, Euglo State Forest, 33°29′S 147°15′E (AM KS58984, KS58988); 1 ♀, Round Hill, 32°58′S 146°09′E (AM KS50282); 1 ♀, St Gorges Basin, 35°05′S 150°35′E (AM KS22677); 1 ♀, Sydney, 33°53′S 151°13′E (BMNH 1915.3.5.1239) (paralectotype of *Epeira annulata* (= *B. heroine*). ***Northern Territory***: 2 ♀♀, Alice Springs, 23°42′S 133°52′E (AM KS41023, KS45094); 1 ♀, Bitter Springs, near river, 23°33′S 134°27′E (SAM NN25510); 1 ♀, Boggy Hole, Finke Gorge National Park, 24°09′S 132°52′E (SAM NN25524); 1 ♀, Hermannsburg, 23°56′S 132°46′E (SAM NN25599); 1 ♂, Illamurta Spring, 24°18′30″S 132°41′10″E (SAM NN25620); 6 ♀♀, same locality (SAM NN25614–9); 31 ♀♀, 1 juv., Kulgera, 25°50′S 133°18′E (WAM T77422); 1 ♀, Mereenie Bluff, 23°39′S 131°57′E (NMV K9828); 4 ♀♀, Old Andado Station, 25°24′S 135°17′E (SAM NN25713–6); 1 ♀, Ormiston Gorge, 23°37′S 132°44′E (QM S53452); 1 ♂, same locality (QM S69344); 1 ♀, same locality (AM KS56969); 2 ♀♀, between Roper River and Mt Isa, (no exact location) (NMV K10346, K10348); 1 ♀, Ruby Gap Gorge, 23°28′50″S 134°59′00″E (SAM NN25752); 1 ♀, Tableland Highway, 73 km N Brunette Downs, 18°00′S 135°56′E (QM S17272); 2 ♀♀, Tempe Downs Station, E of, 24°26′28″S 132°44′00″E (SAM NN25580–1); 1 ♂, Tempe Downs Station, E of, 24°26′S 132°44′E (SAM NN25582); 2 ♀♀, Tennant Creek, 19°39′S 134°11′E (QM S80465); 1 ♀, Top Spring, Kilgour River, 16°53′S 136°02′E (NMV K10349). ***Queensland***: 2 ♀♀, Astrebba National Park, 24°13′05″S 140°34′48″E (QM S69865); 1 ♀, Barcaldine, 23°33′S 145°17′E (QM S3082); 1 ♀, Birdsville, 25°53′S 139°21′E (QM S83989); 1 ♀, Birdsville, 71 km E, 25°53′S 140°10′E (SAM NN25506); 1 ♀, Bowen, 20°00′S 148°14′E (ZMH, Rack (1961)-catalog 221) (paralectotype of *Epeira annulata* (= *B. heroine*); 1 ♀, Bruce Highway, 31 km N Rockhampton, 23°45′S 150°30′E (NMV K10358); 1 ♀, 1 juv., Canary Station, SE Boulia, 22°54′S 139°54′E (QM S83993); 3 ♀♀, 2 juv., Cluny Station, 24°31′S 139°35′E (QM S83996); 1 ♂, Cunnamulla, 28°06′S 145°43′E (NMV K10337); 1 ♀, Doomadgee Mission, 17°56′S 138°49′E (SAM NN25568); 1 ♀, Dunraven Station, New Hughenden, 20°51′S 144°12′E (QM S83992); 2 ♂♂, Elizabeth Creek crossing, 1 km W Wrotham Park Station, 16°29′S 144°09′E (QM S33713); 1 ♂, Emerald, 10 mi N, 23°31′S 148°09′E (QM S83987); 2 ♀a, Ethabuka Station, 23°46′S 138°28′E (QM S35208, S57211); 1 ♀, Georgetown, 18°14′S 143°20′E (NMV K10361); 1 ♂, Hamilton Hotel, 4 mi N, on road to Warenda, 22°41′S 140°35′E (QM S83985); 1 ♀, Isisford, 24°16′S 144°26′E (QM S83994); 6 ♂♂, 4 ♀♀, Jundah, 24°07′S 143°11′E (QM S69361); 1 ♂, 1 juv., Kenniffs Lookout, Mt Moffat, 25°01′S 147°57′E (QM S83991); 1 ♀, near Lake Moondarra, Mt Isa, 20°36′42″S 139°32′55″E (QM S41981); 9 ♀♀, Lake Muncoonie, via Birdsville, 25°13′S 138°39′E (QM S83990); 1 ♀, Leichardt River near Mt Isa, 20°44′S 139°29′E (AM KS45905); 1 ♀, Longreach, 23°27′S 144°15′E (QM S20423); 2 ♀♀, Mt Cameron Station, Winton, 22°59′S 142°34′E (QM S83986); 1 ♀, same locality (QM S83984); 1 ♀, Mt Isa area, 20°44′S 139°29′E (AM KS30245); 1 ♀, Norman River, 20 km SSE Normanton, 17°51′S 141°08′E (NMV K10338); 1 ♀, Oodatra Pt, Glenormiston, 22°55′S 138°48′E (QM S83988); 1 ♂, Peak Downs, 22°15′S 148°11′E (QM S83998); 1 ♀, Pentland, 20°31′S 145°24′E (QM S80402); 1 ♀, Sandringham Station, 24°03′S 139°04′E (AM KS45908); 1 ♀, Springsure, 27°07′S 148°05′E (QM W652); 1 ♀, Tambo-Springsure, 24°53′S 146°15′E (QM S48493); 2 ♀♀, Thargomindah, Jumbo Bore, 'Morley', 27°59′S 143°49′E (QM S69908). ***South Australia***: 1 ♀, no exact locality (SAM NN11540); 3 ♀♀, 1 juv., labelled "MK01 24A", no exact locality (SAM NN11541–3); 2 ♀♀, labelled "MK01 602A", no exact locality (SAM NN11547); 1 ♀, labelled "MK02", no exact locality (SAM NN11546); 1 ♀, labelled "MK02 32B", no exact locality (SAM NN11557);1 ♀, Abminga, 26°08′S 134°51′E (SAM NN25094); 3 ♀♀, Algebuckina Waterhole, Neales River, 27°54′S 135°49′E (SAM NN25096–8); 1 ♂, Amata, 37 km ESE, 26°14′07″S 131°30′00″E (SAM NN11555); 1 ♂, 4 juv., Anna Creek Bore, 3 km SSW, 29°01′S 136°15′E (SAM NN25264); 1 ♀, Anna Creek, 3 km S Anna Creek Bore, 29°02′S 136°16′E (SAM NN25265); 1 ♀, Appreetinna Creek, 160 km N, 27°46′S 134°14′E (WAM T75839); 1 ♀, Arcoona Creek, 1 km W Sambot Waterhole, Gammon Ranges National Park, 30°24′S 138°52′E (SAM NN25841); 1 ♀, Balcanoona, 30°33′S 139°18′E (SAM NN25243); 1 ♂, 1 juv., Balcanoona Homestead, 6.4 km SSW, Gammon Ranges, 30°33′S 139°15′E (SAM NN24730); 1 ♀, adjacent Beautiful Valley Caravan Park, near Wilmington, 32°39′S 138°06′E (SAM NN24713); 1 ♀, Benagerie, 31°24′S 140°24′E (SAM NN24773); 1 ♀, Birdsville-Marree Track, Mount Gason, 27°23′S 138°40′E (AM KS3055); 1 ♀, Boree Homestead, Fowlers Bay, 31°52′S 148°19′E (SAM NN25070); 2 ♀♀, Brachina Creek, 31°20′S 138°38′E (SAM NN25244–5); 1 ♀, Bunyeroo Creek, ABC Range, 31°23′S 138°23′E (SAM NN25080); 1 ♂, Callamurra Waterhole, Coopers Creek, near Innamincka, 27°42′S 140°51′E (QM S83997); 1 ♀, 5 juv., Casuarina Dam, Taylorville Station, 33°53′10″S 140°18′32″E (SAM NN25288); 1 ♀, Christmas Creek, Mt Crispe, 26°24′S 135°27′E (NMV K9825); 1 ♂, Clifton Hill Outstation, ruins, 26°31′S 139°26′E (SAM NN25447); 1 ♂, Clifton Hills Outstation, near ruins, 26°31′S 139°26′E (SAM NN24747); 2 ♀♀, Clifton Hill Ruins and camp, between, 26°31′S 139°26′E (SAM NN25099–100); 1 ♀, Coober Pedy, 100 km N, 28°17′S 134°09′E (SAM NN25269); 2 ♂♂, Coongie Lakes, 27°12′S 140°10′E (SAM NN25448–9); 6 ♀♀, Cooper Creek, 28°23′S 137°41′E (SAM NN25101–6); 1 ♀, Cooper Creek, Birdsville Track, 28°35′S 138°43′E (QM S83995); 1 ♀, Cooper Creek, Innamincka, 27°44′47″S 140°43′58″E (SAM NN25842); 1 ♀, Coopers Creek, camp, 28°23′S 137°41′E (SAM NN25840); 1 ♀, Cowarie Station, 32 km W, 27°45′S 138°00′E (AM KS3056); 3 ♀♀, Cullyamurra Waterhole, 27°42′S 140°51′E (SAM NN25266–8); 1 ♂, same locality (SAM NN25844); 3 ♂♂, 3 ♀♀, Dalhousie Ponds, 26°28′S 135°29′E (WAM T75858); 1 ♀, Durkin Outstation, 30°16′S 133°44′E (SAM NN25827); 1 ♀, Eringa Waterhole, 26°17′S 134°43′E (SAM NN25270); 1 ♀, Eringa Waterhole, new homestead, 26°17′S 134°43′E (SAM NN25271); 1 ♀, Finke River, 40 km E Abminga, 26°04′S 135°23′E (AM KS3054); 1 ♀, Francis Swamp Mound Spring, 29°06′S 136°18′E (SAM NN25107); 1 ♀, Glendambo, 50 km S 31°25′S 135°44′E (SAM NN25249); 1 ♀, Granite Downs, 26°56′S 133°29′E (SAM NN25828); 1 ♀, Granite Downs Station, near Oodnadatta, 26°56′S 133°29′E (SAM NN25108); 1 ♀, Hermit Hill Springs, 29°34′S 137°25′E (SAM NN24750); 1 ♀, 4 juv., same locality (SAM NN25272); 2 ♂♂, Indulkana, 28 km NW, 26°51′07″S 133°03′48″E (SAM NN11553–4); 2 ♀♀, Kalamurina Station, 4 km W White Bull Yard, 27°53′32″S 137°53′00″E (SAM NN25436–7); 1 ♀, Kalladeina Bore, 27°42′S 139°07′E (SAM NN25273); 1 ♀, Koonchera Waterhole, 72 mi S Birdsville, 26°41′S 139°30′E (NMV K9826); 1 ♀, Lake Dam, 1.6 km WNW, South Gap, 31°46′05″S 137°36′41″E

(SAM NN25291); 1 ♂, Lake Dam, near Lake Frome, 30°37′S 139°52′E (SAM NN25471); 2 ♀♀, Lake Dam, near Lake Frome, 30°37′S 139°52′E (SAM NN25289–90); 1 ♀, Lake Eyre, 19°30′S 137°10′E (SAM NN25833); 1 ♀, Lake Frome, 20 km E, 30°37′S 140°10′E (SAM NN25295); 3 ♀♀, Lake Frome, near, 30°37′S 139°52′E (SAM NN25292–4); 2 ♀♀, Lake Toonoowaranie, Innamincka Regional Reserve, 27°04′55″S 140°09′36″E (SAM NN25806, NN25843); 1 ♀, Laura, W of, 33°12′S 138°11′E (SAM NN25084); 1 ♂, Mimili, 28 km ENE, 26°54′50″S 132°56′54″E (SAM NN11552); 3 ♀♀, 4 juv., same locality (SAM NN11549–51); 1 ♀, 3 juv., Mitchell Nob, 12.5 km E, 26°08′S 131°57′E (SAM NN25064); 2 ♂♂, same locality (SAM NN25388–9); 1 ♀, Mt Crawford Forest, 34°43′S 138°56′E (SAM NN25826); 1 ♀, Mt Farview, Kolay Hut, Paney Station, 32°19′S 135°41′E (SAM NN25252); 3 ♀♀, 1 juv., Mt Farview, slopes, 32°34′36″S 135°35′E (SAM NN25253–5); 1 ♀, Mt Lindsay, 35 km SSW, 27°20′S 129°40′E (SAM NN11556); 1 ♀, Mt Toodina, sandhills nearby, no exact locality (SAM NN25110); 3 ♀♀, Muckera, 30°02′S 130°03′E (SAM NN25830–2); 1 ♀, Mungeranie boredrain, 28°01′S 138°40′E (SAM BB25274); 2 ♀♀, Nappyalla, 35°20′S 139°07′E (SAM NN24670, NN25153); 1 ♀, Ngarutjara, 26°14′S 131°47′E (SAM NN25065); 1 ♂, same locality (SAM NN25391); 1 ♀, Nullarbor Plain, 31°23′S 130°08′E (SAM NN25287); 1 ♀, Olympic Dam, ca. 10 km N, on Borefield Road, 30°20′49″S 136°55′20″E (SAM NN25251); 1 ♀, Oodnadatta, 27°32′S 135°26′E (SAM NN24757); 1 ♀, 1 juv., Ooldea, 30°27′S 131°50′E (SAM NN25258–9); 1 ♀, Para Hills, 34°48′S 138°39′E (SAM NN25059); 1 ♀, Paradise Creek, 40 km S Marree, 33°27′S 139°10′E (SAM NN25109); 1 ♀, Poole Creek, 42 km W Marree (Alberrie Creek), 29°37′S 137°37′E (SAM NN25275); 1 ♂, Poontana Creek, 30°11′S 139°58′E (SAM NN24761); 1 ♂, Purni Bore, 26°17′S 136°06′E (WAM T75851); 1 ♀, same locality (SAM NN25276); 1 ♀, 3 juv., Sandy Creek, 34°36′S 138°49′E (SAM NN25825); 1 ♂, Scrubby Peak, 32°31′S 135°19′E (SAM NN25419); 1 ♀, Serpentine Lakes, E side, 28°30′32″S 129°00′00″E (SAM NN25260); 3 ♂♂, 6 ♀♀, 2 juv., Simpson Desert, 26°02′S 137°11′E (WAM T75743); 2 ♀♀, Simpson Desert, 25°22′S 138°39′E (AM KS3052); 1 ♀, Simpson Desert, 25°37′S 138°55′E (AM KS3053); 1 ♂, Simpson Desert Recreation Reserve, 61.3 km NNE Dalhousie Springs, Purni Bore, 26°17′05″S 136°05′53″E (SAM NN25277); 1 ♀, Simpson Desert Recreational Reserve, 83 km E Purni Bore, 26°19′25″S 136°55′30″E (SAM NN25278); 1 ♀, Sinclair Gap, salt lake, 33°07′35″S 137°03′15″E (SAM NN25240); 1 ♀, Strathearn Homestead, 31°44′S 140°20′E (SAM NN25161); 1 ♀, Strzelecki Track, S of Lyndhurst, 30°17′S 138°20′E (NMV K9827); 1 ♀, 1 juv., Strzelecki Desert, 4 km S Lake Appadare, Lake Hope channel, 28°15′28″S 139°12′03″E (SAM NN25800); 1 ♀, same locality (SAM NN25803); 2 ♀♀, 3 juv., same locality, 28°15′28″S 139°12′03″E (SAM NN25801–2); 6 ♀♀, 3 juv., Strzelecki Desert, near Kirrakirrinna Waterhole, 28°31′S 138°51′E (SAM NN25834–9); 1 ♀, Tallaringa boundary at Mabel Creek Station, 28°59′S 133°49′E (SAM NN25261); 1 ♂, Tarcoola, 30°42′S 134°34′E (SAM NN24673); 1 ♀, Tea Tree Gully, Adelaide, 34°49′S 138°43′E (SAM NN25061); 1 ♀, Toolache, 28°23′S 140°50′E (SAM NN25829); 1 ♀, Vokes Hill Corner, 28°34′S 130°41′E (SAM NN25262); 1 ♀, Vokes Hill Corner, 41 km W, 28°32′S 130°16′E (SAM NN25263); 1 ♀, Wartaru, 1 km NE, 27°02′25″S 129°52′17″E (SAM NN11547); 1 ♀, Wayville, Rose Terrace, 34°56′S 138°35′E (SAM NN25060); 1 ♀, Weetootla Well, Gammon Ranges National Park, 30°29′S 139°15′E (SAM NN25248); 2 ♀♀, Wynbring, 30°33′S 133°32′E (SAM NN25092–3); 1 ♂, Yelpawaralinna Waterhole, 27°07′S 138°42′E (SAM NN25452). ***Western Australia***: 1 ♀, 2 juv., SW Australia, no exact locality (SAM NN25753); 1 ♂, 10 Mile Hill, 31°38′10″S 116°25′56″E (WAM T74883); 1 ♀, 1 juv., Ashburton River, 23°23′S 117°02′E (WAM T75857); 1 ♀, Barn Hill, 18°21′57″S 122°02′23″E (WAM T84386); 1 ♀, Barrow Island, 'Tiger Cage', 20°48′20″S 115°25′52″E (WAM T88931); 1 ♀, Barrow Island, current airport front office, 20°51′58″S 115°24′22″E (WAM T88891); 1 ♀, Barrow Island, former ODE camp, 20°48′52″S 115°22′32″E (WAM T88913); 1 ♀, Barrow Island, Gorgon Project footprint, 20°47′59″S 115°27′00″E (WAM T88811); 2 ♀♀, Barrow Island, Gorgon Project footprint, 20°47′51″S 115°26′27″E (WAM T88810); 1 ♀, Barrow Island, Gorgon Project footprint, 20°47′38″S 115°27′27″E (WAM T88796); 1 ♂, Barrow Island, Gorgon Project footprint, 20°47′59″S 115°26′25″E (WAM T88874); 1 ♂, Barrow Island, Gorgon Project footprint, 20°47′03″S 115°27′33″E (WAM T88866); 1 ♂, Barrow Island, Gorgon Project footprint, 20°47′32″S 115°27′26″E (WAM T88865); 1 ♀, Barrow Island, Gorgon Project footprint, 20°47′03″S 115°27′33″E (WAM T88818); 1 ♂, Barrow Island, near barge landing (CO2 data well site), 20°47′05″S 115°23′38″E (WAM T89129); 1 ♀, same locality (WAM T88953); 2 ♀♀, Barrow Island, old administration building, 20°49′09″S 115°23′40″E (WAM T88949); 2 ♀♀, Barrow Island, old drill workshop, 20°49′55″S 115°25′13″E (WAM T88945); 1 ♀, Barrow Island, old dump on South Road, 20°50′29″S 115°23′23″E (WAM T88940); 3 ♀♀, Barrow Island, storage area (old airport), 20°47′34″S 115°25′27″E (WAM T88895); 1 ♀, Barrow Island, storage area (old airport), 20°47′52″S 115°25′56″E (WAM T88900); 1 ♀, Barrow Island, terminal tanks, 20°46′45″S 115°27′43″E (WAM T88972); 1 ♀, Bay of Rest, N side, North-West Cape, 22°18′S 114°08′E (WAM T75796); 1 ♀, Boolathana Station, 24°24′48″S 113°45′48″E (WAM T75779); 1 ♂, same locality (WAM T75801); 2 ♀♀, same locality (WAM T75781); 1 ♀, Boolathana Station, 24°24′50″S 113°44′43″E (WAM T75872); 1 ♀, Boolathana Station, 24°24′49″S 113°42′24″E (WAM T75780); 1 ♀, Booylgoo Spring, 27°44′S 119°59′E (WAM 26/650); 1 ♀, Broome, Army headquarters, 17°58′S 122°14′E (WAM T75852); 1 ♀, Bungabiddy Rockhole, 24°39′S 128°45′E (WAM T75869); 1 ♂, Bush Bay, 25°06′49″S 113°43′52″E (WAM T75812); 1 ♀, Cadjebut Gorge, 21°31′35″S 119°08′57″E (WAM T75765); 1 ♀, Cadjebut Pool, 21°32′08″S 119°09′00″E (WAM T75760); 1 ♂, Cane River Crossing, Peedamulla Road, 21°46′06″S 115°24′26″E (SAM NN25298); 2 ♀♀, Canning Stock Route, No. 23 Well, 23°05′S 123°13′E (WAM T75860); 2 ♀♀, Canning Well Track (no exact locality), 22°22′S 121°18′E (NMV K9830); 1 ♂, Cape Cuvier, Quobba Station, 24°13′27″S 113°27′41″E (WAM T75803); 1 ♂, Cape Cuvier, Quobba Station, 24°13′24″S 113°30′13″E (WAM T75813); 1 ♀, Cape Range, near Secret Garden (1 km at 299°), 21°55′S 114°04′E (WAM T75795); 2 ♀♀, Carnegie Camp, 0.5 km W Carnegie Homestead, 25°48′S 122°58′E (WAM T75786, T75866); 1 ♀, Carnegie, 60 mi N, 24°47′S 122°58′E (WAM T75753); 1 ♀, Cashmere Downs Station, 28°58′S 119°34′E (WAM T75806); 1 ♀, Cloudbreak Mining Lease, Chichester Range, 22°17′39″S 119°22′25″E (WAM T82783); 1 ♀, Clune's Property off Chintapee Road, E of Geraldton, 28°45′11″S 114°51′37″E (WAM T75848); 1 ♂, Coral Bay/Learmonth Road, 22°14′S 114°04′E (WAM T75877); 1 ♀, Crossing Pool, Millstream National Park, 21°34′40″S 117°05′13″E (SAM NN25299); 1 ♀, De Gray River, near Callawa, 20°38′S 120°30′E (WAM T75874); 1 ♀, Deepdale, 31 km W of Mesa A, 21°40′12″S 115°53′24″E (WAM T77562); 1 ♀, Delambre Island, Dampier Archipelago, 20°26′S 117°05′E (WAM T75805); 2 ♀♀, Denham, 25°55′S 113°32′E (WAM T75837, T75844); 1 ♂, 1 juv., Denham, 21 km NE, 25°45′S 113°42′E (WAM T75808); 1 ♀, Drysdale River Station, 15°42′S 126°23′E (WAM T75828); 1 ♀, Drysdale River Station, Mt McCrann, 15°51′S 125°57′E (WAM

T75804); 1 ♀, Durba Hills, Canning Stock Route, 23°48′S 122°28′E (WAM T75748); 1 ♀, Ebano Spring, Mingenew-Morawa Road, 29°10′S 115°39′E (WAM T87183); 1 ♀, Eneabba, R.G.C. Mineral Sands, 29°50′S 115°15′E (WAM T75756); 1 ♂, Eneabba, R.G.C. Mineral Sands, 29°56′S 115°17′E (WAM T75814); 4 ♀♀, Faure Island, 25°52′18″S 113°55′9″E (WAM T67866); 1 ♀, Faure Island, homestead area, 25°53′46″S 113°54′32″E (WAM T67867); 1 ♀, Faure Island, North-South Track, 25°51′07″S 113°53′36″E (WAM T67868); 1 ♀, Faure Island, Shark Bay, 15 km SE Monkey Mia, 25°51′20″S 113°51′41″E (SAM NN25300); 1 ♀, Gallery Hill, 21°40′03″S 119°02′27″E (WAM T75763); 1 ♀, 1 juv., Gary Junction, 99 km E on track to WA/NT border, 22°55′S 126°10′E (WAM T75846); 1 ♀, 3 juv., Geraldton, 28°46′S 114°37′E (AM KS108612); 1 ♀, 1 juv., Gibson Desert, 24°34′01″S 126°15′16″E (WAM T81519–20); 1 ♀, Giles Weather Station, 25°02′S 128°18′E (WAM T75817); 3 ♀♀, Glen Cummins Gorge, 25°02′S 128°18′E (WAM T75849); 2 ♀♀, Glenayle Camp, 0.5 km N homestead, 25°16′S 122°02′E (WAM T75875, T75778); 2 ♀♀, Goongarrie, 29°55′S 121°15′E (WAM T75834); 2 ♀♀, same locality (WAM T75830); 2 ♀♀, Great Sandy Desert, 20°16′S 121°45′E (WAM T75826); 2 ♀♀, Greys Camp, Rudall River, near Larry Creek, 22°36′S 122°23′E (WAM T75754); 1 ♀, 4 juv., Hamelin Pool, 26°24′01″S 114°09′54″E (SAM NN25301); 1 ♀, Harding Dam, 3 km N, 20°58′S 117°06′E (WAM T75794); 19 ♀♀, 6 juv., Irrunytju Rockhole, 26°07′S 128°58′E (WAM T75744); 1 ♀, Kalbarri, 27°42′45″S 114°10′12″E (WAM T75880); 1 ♀, Lake Disappointment, 23°32′S 122°36′E (WAM T75836); 1 ♀, Lake Goorly, NW, 29°56′08″S 116°53′9″E (WAM T74873); 1 ♀, Lake Mackay, 22°26′47″S 128°27′33″E (WAM T84389); 2 ♀♀, Leinster, N of, 27°54′22″S 120°38′41″E (SAM NN25306–7); 1 ♀, Lorna Glen Station, 26°00′05″S 121°33′48″E (WAM T65379); 2 ♀♀, Lyons River, 24°28′S 117°14′E (WAM T75855); 1 ♀, 1 juv., Manberry, S of, 24°08′07″S 114°03′01″E (SAM NN25308); 2 ♂♂, 1 ♀, 3 juv., same locality (SAM NN25309–11); 2 ♀♀, 9 juv., Mardathuna Station, 24°30′41″S 114°38′14″E (WAM T75785); 1 ♂, 1 juv., same locality (WAM T75807); 2 ♀♀, same locality (WAM T75873, T75784); 2 ♀♀, Mardathuna Station, 24°26′36″S 114°30′42″E (WAM T75870); 1 ♀, same locality (WAM T75783); 1 ♂, 1 ♀, Mardathuna Station, 24°25′43″S 114°30′01″E (WAM T75811); 2 ♀♀, Mesa Campground, Cape Range National Park, 22°10′S 113°55′E (SAM NN25304–5); 1 ♀, Miling, 30°29′S 116°21′E (WAM T75842); 1 ♀, Mt Cooper, 6 km NE, 26°11′S 127°57′E (WAM T75818); 1 ♂, Mt Magnet, 7 km S 28°10′S 117°50′E (WAM T75856); 1 ♂, Nerren Nerren Station, 27°00′22″S 114°32′29″E (WAM T75810); 1 ♂, Nerren Nerren Station, 27°03′28″S 114°36′25″E (WAM T75809); 1 ♀, Nita Downs Station, 19°05′S 121°41′E (WAM T75867); 1 ♀, No. 31 Well, Canning Stock Route, 22°31′S 124°25′E (WAM T75775); 1 ♂, No. 36 Well, Canning Stock Route, 22°09′S 125°17′E (WAM T75815); 4 ♀♀, P.N.C. Camp, Canning Stock Route, 22°55′S 123°10′E (WAM T75876); 2 ♀♀, 2 juv., Pardoo, W of, 4 km S turnoff, 20°15′10″S 119°33′47″E (SAM NN25313–4); 1 ♂, Pilbara region, 300 m W of Dewa Downs Homestead, 22°53′21″S 118°28′36″E (AM KS90761); 2 ♂♂, 2 ♀♀, Pioneer Creek, 23°43′S 132°48′E (WAM T75850); 1 ♀, Point Salvation, 7–8 km WNW, 28°12′S 123°36′E (WAM T75847); 1 ♀, Rudall River camp, 22°19′S 122°56′E (WAM T75797); 1 ♀, Rudall River West, at campsite, 22°10′S 122°59′E (WAM T75862); 1 ♀, Sandstone and Millrose Stations, between, 28°07′S 120°15′E (WAM T73541); 1 ♂, 1 juv., Skink Hole, 6N82, Nullarbor, 31°28′S 127°55′E (WAM 93/2370–1); 1 ♂, South Yardie Well, 22°25′S 113°46′E (WAM T75845); 1 ♀, Sturt Meadows Station, 28°30′S 120°55′E (WAM T75859); 1 ♀, Talgarno, 19°10′S 121°33′E (NMV K10386); 1 ♂, Telfer, SW of, 21°46′S 122°14′E (WAM T75878); 1 ♀, Thangoo Homestead, 18°05′S 122°28′E (WAM T75824); 1 ♀, Thylacine Hole, 6N63, nearby, Nullarbor Region, 31°41′S 127°43′E (WAM 96/80); 1 ♀, 1 juv., Tim Ealey Hill, 21°35′20″S 118°59′00″E (WAM T75764); 1 ♀, Tjingkukatjatjarra Pool, Rudall River, 22°30′00″S 122°05′00″E (WAM T75835); 1 ♀, Warburton Ranges area, 26°06′S 126°39′E (WAM T75771); 1 ♀, 2 juv., West Hamersley National Park, 22°34′S 118°03′E (WAM T75861); 1 ♀, Whim Creek, 20°51′S 117°50′E (WAM T75782); 1 ♂, Wiluna, 30 km S 26°55′S 120°13′E (WAM T75854); 1 ♀, Windy Corner, ca. 100 km N, Garry Junction Track, 22°46′S 125°09′E (WAM T75802); 1 ♂, 2 juv., Wittenoom Gorge, 22°18′S 118°20′E (WAM T75853); 2 ♀♀, Woodstock Homestead, 21°37′S 118°57′E (WAM T75758, T75766); 1 ♀, Woodstock Homestead, 21°37′20″S 118°57′12″E (WAM T75762); 1 ♀, Woodstock Station, 21°36′25″S 119°01′50″E (WAM T75838); 1 ♀, Woodstock Station, 21°37′01″S 118°57′13″E (WAM T75761); 1 ♀, Woodstock Station, 21°36′35″S 119°01′17″E (WAM T75759); 1 ♀, Woodstock Station, 21°37′00″S 119°01′24″E (WAM T75757); 1 ♂, Woodstock Station, 21°37′01″S 118°57′13″E (WAM T75767); 1 ♀, Woodstock Station, 21°36′35″S 118°57′44″E (WAM T75768); 2 ♀♀, Woodstock Station, 18 km E, 21°41′52″S 119°05′9″E (SAM NN25296–7); 1 ♀, Yardie Creek, Cape Range National Park, 22°19′13″S 113°48′47″E (SAM NN25315); 1 ♀, Yule River, 20°42′S 118°19′E (AM KS50322); 2 ♀♀, Yundamindra, Breakaway Country, 29°17′S 122°19′E (WAM T75831); 1 ♀, 1 juv., Zuytdorp Nature Reserve, 27°15′28″S 114°9′02″E (WAM T75865).