Yalata Bush Blitz

Spiders

22nd Nov – 3rd Dec 2021

Submitted: 30th June 2022

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Female Blind Cave Spider, *Troglodiplura beirutpakbarai* Harvey & Rix, 2020, in its natural cave environment. Photo: S. Milner

Nomenclature and taxonomy used in this report is consistent with:

The Australian Faunal Directory (AFD)

http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/home

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List of contributors

List of contributors to this report.			
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Abstract

The Yalata Bush Blitz expedition revealed some intriguing and important spider finds. New species were collected during above ground surveys and from surveys conducted within caves, one of which, a species of tube web spider (*Ariadna*: Segestriidae) is being included in a taxonomic revision of the family.

In addition to new species, important finds were made of an elusive, enigmatic and vulnerable species of blind cave spider, *Troglodiplura beirutpakbarai* Harvey & Rix, 2020, which was previously only known from fragments of exoskeleton and juveniles. Additionally, new records of blind cave spiders were collected from two new cave systems, and whilst molecular analysis is needed to determine whether they are con-specific to *T. beirutpakbarai*, this was a scientifically important find.

Surveys of the cave systems provided evidence as to the likely high value of these caves for invertebrate endemism and diversity and also of their conservation vulnerability, with a number of key threats identified, including predation by foxes, disturbance by humans, and climate change driven changes to humidity, water availability, and temperature.

1. Introduction

Historical surveys for spiders have occurred in the broad survey area encompassed by the Yalata Bush Blitz expedition, with around 60 species recorded on Atlas of Living Australia (ALA) (Atlas of Living Australia – Open access to Australia's biodiversity data (ala.org.au), accessed 15 June 2022). These records are from a combination of individual collection events and dedicated surveys of the broad area.

Although a relatively broad range of taxonomic groups have been recorded from the area, there are omissions, which are likely to occur in the area, and these formed the focus of a component of spider surveys in this exhibition, including targeted surveys for salt-lake specialist species, particularly for members of the families Segestriidae and Dictynidae.

Most of the cave systems of the Nullarbor Plains have not been well sampled for spider taxa, however the presence in the caves of a number of interesting spider species has been recognised (for example Gray, 1973, Richards, 1971), including the enigmatic, intriguing and elusive Blind Cave Spiders (family Anamidae, genus *Troglodiplura*). *Troglodiplura* is endemic to the Nullarbor Plain (South Australia and Western Australia) and are the only troglobiotic mygalomorph spiders know in Australia. They are large spiders and have several adaptations for a cave existence, including complete eye loss and elongate legs and pedipalps. Five species are currently described from the Nullarbor Plains (Harvey *et al.* 2020), one of which *Troglodiplura beirutpakbarai* Harvey & Rix 2020, occurs in SA and is from a cave in the Nullarbor Regional Reserve. Prior to this expedition, the only material known for *T. beirutpakbarai* was juvenile spiders and fragments of exoskeleton, whilst the other four species are only known from fragments of exoskeleton. Few living specimens have ever been observed. Each of the currently known species of *Troglodiplura* are only known from, and believed to be confined to single cave systems. This means they are highly vulnerable to threatening processes that impact the cave environment, such as climate change and also to predation by feral animals, such as foxes and human disturbance, including potentially, collection for the pet trade.

Given the paucity in biological surveys of caves in the Nullarbor, it is likely more undescribed species exist. However, given the illusive nature of these spiders, and the fact that no live adults of most species have ever been seen, pre-survey expectations of finding more specimens were hopeful, but not high.

During the Yalata Bush Blitz expedition, spider surveys were divided into two main components; a) above ground surveys covering an array of different habitat types and survey methods, in order to collect a diverse range of taxa and attempt to fill specific record gaps and b) surveys of a selection of caves in the Nullarbor Plains, to attempt to collect data on *Troglodiplura* and to collect material of other cave inhabiting spiders.

2. Methods

2.1 Site selection

Survey sites were selected based upon two broad criteria, and mirroring the two components of the surveys outlined in the Introduction; 1. Opportunistic sampling of a range of habitat types to obtain a diverse array of spider fauna and 2. Targeted surveying of habitats for focal groups, including salt lakes and cave systems.

Opportunistic sampling covered a broad range of habitats at different sites, including grassland, mallee, sand dunes, coastal vegetation, above ground surveys of the Nullarbor Plain and included a range of microhabitats, including leaf litter, from within and under logs and under rocks, from burrows in the ground, from vegetation including the tree canopy, and from beneath bark and within crevices in bark.

Site selection for focal taxa was directed by specific attributes of that habitat, for example for the salt-lake surveys, a lake was selected that had sufficient dry edge that would not be inundated by water during the period that the pitfall raps were out. Given there had been a lot of rain in the period preceding the Bush Blitz expedition, this limited potential sites to few.

The cave in which *Troglodiplura beirutpakbarai* was known from was a priority for surveys, Other cave sites were selected based on accessibility and on having features that matched those of the cave in which *T. beirutpakbarai* is known, such as presence of water, extent of the cave and entrance type.

Within a cave, as much of the cave was surveyed as was possible, including any distinct microclimates and light / dark zones. Sites for pitfall traps and ramp traps were selected to give a broad covering of these different microclimates and light zones.

The caving team; Steve Milner, Andrew Stempel, Jess Marsh, Matt Shaw. Photo: Steve Milner

2.2 Survey techniques

Opportunistic sampling was largely conducted by hand, turning over logs and rocks, digging out burrows, spotlighting at night, or by sweeping of vegetation.

One clear, slightly warmer night on the Nullarbor Plain was highly productive for cursorial spiders.

Salt lakes were sampled by hand, by turning over logs and rocks on the edge of the salt lake, digging up burrows and collecting specimens moving across the ground. One line of six pitfall traps were set up at one site, the traps were traps dug into the surface of the salt-lake so that the lip of the cup was flush

with the surface, and with a drift line running between them. Pitfall traps contained propylene glycol and were checked daily.

Cave surveys were conducted by hand. Rocks were turned over but not where this would disturb culturally sensitive areas. Crevices, cave walls and cave floor were searched by hand. Pitfall traps and ramp traps were used in caves. However, soon after *Troglodiplura* was recollected within Cave N253 all pitfall traps were removed, so as to prevent the possibility of over collecting. At all times, minimal disturbance was practised in order to preserve the vulnerable cave ecosystem and with the exception of techniques needed for collecting, in accordance with the strict guidelines set out by the Australian Speleological Foundation.

Most of the spider material was hand-collected by J. Marsh. Additional material was contributed by: E. Fagan-Jeffries, B. Parslow and E. Beaver, collected through sweep netting of vegetation and tree canopies; the vertebrate pitfall trap team at standard survey sites led by Dave Armstrong; spiders on vegetation collected by Tracy Spokes and Tim Hammer of the herbarium team; and the cave survey team consisting of J. Marsh, M. Shaw, A. Stempel, and S. Milner.

Accessing caves. Photo: J. Marsh

2.2.1 Methods used at standard survey sites

Hand searches were conducted at the standard survey sites, including digging up burrows, searching under logs and rocks and opportunistically collecting specimens observed moving through the habitat.

A large number of spiders were collected in vertebrate pitfall traps by D. Armstrong.

2.3 Identifying the collections

Most of the material collected in this study was identified using published scientific literature, or from knowledge of the author (J. Marsh).

Published literature used to identify material:

Baehr, B., & Jocqué, R. (2001); Baehr, (2004); Gray (1973); Gray & Thompson (2001); Hirst, (1990); Hirst, (1993); Marsh et al., (2018); Raven et al., (2001); Raven & Stumkat (2003); Raven (2009); Raven (2015); Richards, (1971); Ricahrdson et al., (2019).

Detailed molecular methods will be used for *Troglodiplura* to test whether there are additional species present in addition to *Troglodiplura beirutpakbarai*.

3. Results and Discussion

Appendix 1 lists all spiders recorded during the Bush Blitz. Collections made during this Bush Blitz will result in 318 specimens being added to public collections and an equivalent number of records added to publicly accessible databases.

3.1 Un-named or not formalised taxa

For many species of spider, it is not possible to identify juveniles based on morphology and therefore juveniles were classified to family in this study, but not taken any further.

The following taxa with mature representatives, were classified to family, or genus and all specimens classified to morphospecies. The remainder of taxa were identified to species.

Table 1. Putatively un-named or not formalised taxa

Taxon	Comment
Anamidae, *Aname*	
Araneidae	
Cheiracanthiidae	
Dictynidae	
Gnaphosidae, Drassodinae	
Linyphiidae, *Erigone*	
Lycosidae, Lycosinae, genus1	
Miturgidae, genus1	
Miturgidae, genus2	
Miturgidae, genus3	
Miturgidae, *Miturga*	
Oxyopidae, *Oxyopes*	
Prodidomidae, *Cryptoerithus*	
Salticidae, *Cytaea*	
Salticidae, *Margaromma*	
Salticidae, *Simaethula*	
Sparassidae, Deleninae, genus1	

Sparassidae, *Holconia*	
Stiphidiidae	
Theridiidae, *Dipoena*	
Theridiidae, genus1	
Zodariidae, *Asteron*	

3.2 Putative new species (new to science)

In this report, 'putative new species' means an unnamed species that, as far as can be ascertained, was identified as a new species as a direct result of this Bush Blitz.

Low vegetation, coastal habitat in which the putative new species *Ariadna* sp. BBY19 was collected; burrow belonging to the species. Photos: J. Marsh.

Table 2. Putative new species (new to science)	
Species	**Comment**
Ariadna sp. "Bush Blitz Yalata" *Ariadna sp. BBY19*	This is an undescribed species of Tube-web spider (*Ariadna*: Segestriidae). Two specimens of were collected during the Yalata Bush Blitz. Currently there are 47 species of *Ariadna* recorded from Australia, with 22 of these from SA, all of which were described by Jessica Marsh, the lead author of this report. The species found on the Yalata Bush Blitz expedition will be included in a taxonomic revision of the family.
Genus2 sp. BBY10 "sp1pale"	Two species of Miturgidae were collected from within caves, which represent new species. Generic placement is uncertain. A monotypic genus of similar, but blind, cave spiders, *Janusia* Gray, 1973 has been recorded from caves in the Nullarbor. *Janusia* was originally placed in Miturgidae, but has since been moved to Ctenidae and differs from these spiders by not having leg scopulae and having three tarsal claws. A lack of modern systematic revisions of this diverse group of miturgids and closely related families means the generic placement of the two new species awaits more detailed

	research, including examination of *Janusia* type material.
Genus2 sp. BBY27 "pale cave2"	As above

3.3 Exotic and pest species

Table 3. Exotic and pest species recorded			
Exotic/pest species	**Location sighted/observed**	**Indication of abundance**	**Comments**
Fox, *Vulpes vulpes*	Caves systems	Some caves had a high density of burrows and scats	There is some evidence of the role of fox predation in the decline of mygalomorph spider populations (discussed in Rix et al., 2017) and foxes are likely to pose a substantial threat to spider species, such as *Troglodiplura spp.*

3.4 Threatened species

Table 4. Threatened species			
Species	**Listing status and level (EBPC, State/Territory)**	**Location sighted/observed**	**Indication of abundance**
None			

3.5 Range extensions

Table 5. Range extensions or significant infill in distribution records for species			
Species	**Location sighted/observed**	**Distance from nearest known record (km)**	**Comments**
None			

3.6 Genetic information

All specimens have been stored in 100% DNA safe ethanol, allowing for molecular analyses.

4. Information on species lists

For many species of spider, it is not possible to identify juveniles based on morphology and therefore juveniles were classified to family in this study, but not taken any further. However, all samples have been stored in 100% ethanol, thereby allowing future molecular analyses, if needed.

For some taxa, for example the family Theridiidae, a lack of modern taxonomic revisions and the large diversity of the group, most of which is undescribed, meant that species level identification was not possible. Where this was the case, specimens were classified to morphospecies.

5. Information for land managers

The cave systems surveyed in this expedition are highly important and also highly vulnerable centres of diversity and endemism. During these surveys a range of threats to these systems were recorded, including the presence of foxes in many of the accessible caves (including a high density of fox holes and scats in some), and disturbance to and damage of cave structures by humans. Large spiders, like species of *Troglodiplura,* are likely highly vulnerable to predation by foxes, to disturbance by humans, including collection for the pet trade, and to changes in the temperature, availability of water, and humidity of the caves caused by climate change. Cave adapted species, such as those belonging to *Troglodiplura* are of special significance, both as members of a unique, vulnerable and interesting fauna, but also as indicators of the health of the general cave environment.

More research and collections are needed in caves, especially in those with similar environmental parameters to *Troglodiplura*-inhabited caves.

6. Other significant findings

The successful detection of *Troglodiplura beirutpakbarai* Harvey & Rix, 2020 by the caving team, provided the first record of mature specimens of this species, which had previously been known from fragments of exoskeleton and juvenile specimens. Whilst collection of specimens of this species was conservative, so as not to detrimentally impact the species, the team collected and preserved high quality material for molecular analysis and mature females for morphological analysis.

A mature female and some juvenile *Troglodiplura* were collected from two new cave systems by A. Stempel and S. Milner. Prior to this Bush Blitz expedition, *Troglodiplura* in SA was only known from one cave, the remaining four species being from WA caves. Given each of the currently described species of *Troglodiplura* is only known from a single cave system (Harvey *et al.,* 2020), it is likely that these specimens represent new species. However, due to morphological conservatism of female mygalomorphs generally, the current lack of male *Troglodiplura,* and because it is not possible to identify juveniles to species based on morphology, putative new species will need confirmation by molecular analyses. These finds are scientifically important, potentially resulting in the description of new enigmatic and vulnerable species, and allowing the testing of relationships between different cave populations or species, and between above ground and cave dwelling relatives.

In addition to collecting specimens, the survey team collected and recorded ecological data for the species, and environmental data, such as temperature and humidity of the caves in which *Troglodiplura spp.* were located, providing important information to assist in prioritising caves for future surveys and in providing data to better understand the ecology of the species and to determine likely threats that may impact them and to assess their extinction risk.

Troglodiplura sp. BBY25 A new cave record for *Troglodiplura* in South Australia, and possibly a new species, photo: S. Milner

7. Conclusions

The Yalata Bush Blitz expedition has revealed some intriguing and important spider finds. New species were collected during surveys conducted above ground and from within cave systems, providing further evidence of the high levels of, largely undocumented, diversity associated with these areas, and of the importance of Bush Blitz expeditions for species discovery.

Surveys of the cave systems indicate their importance as centres of invertebrate diversity and endemism, and also of their vulnerability, and hence conservation importance. There are many hundreds of caves in the Nullarbor Plains, most of which have had no biological surveys. As evidenced by the Yalata Bush Blitz expedition, the potential for undiscovered and often endemic species in these cave systems is high; as is the likelihood of ongoing threats impacting the persistence of species.

Acknowledgements

I would like to acknowledge Bush Blitz for funding these surveys.

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Appendix 1. List of spiders recorded during the Yalata Bush Blitz						
Family	***Species***	**Common name**	**Putative new species**	**Threatened (EPBC Act)**	**Threatened (State/ Territory**	**Exotic/ pest**
Anamidae	*Aname sp. BBY11*	Wishbone spider	No	No	No	No
Anamidae	*Aname sp. BBY13*	Wishbone spider	No	No	No	No
Anamidae	*Aname sp. BBY6 "cave fragments"*	Wishbone spider	No	No	No	No
Anamidae	*Troglodiplura beirutpakbarai*	Blind cave spider	No	No	No	No
Anamidae	*Troglodiplura sp. BBY25*	Blind cave spider	likely	No	No	No
Anamidae	*Troglodiplura sp. BBY26*	Blind cave spider	likely	No	No	No
Araneidae	Araneidae gen. sp. BBY47	Orb weaving spider	No	No	No	No
Araneidae	Araneidae gen. sp. BBY48	Orb weaving spider	No	No	No	No
Araneidae	*Dolophones*	Wraparound spider	No	No	No	No
Cheiracanthiidae	Cheiracanthidae gen. sp. BBY39	Sac spider	No	No	No	No
Cheiracanthiidae	Cheiracanthidae sp "BBY16 salt-lake"		No	No	No	No
Corinnidae	*Battalus diadens*	Swift ant spider	No	No	No	No
Corinnidae	*Nucastia culburra*	Swift ant spider	No	No	No	No
Corinnidae	*Nyssus albopuncatus*	Swift ant spider	No	No	No	No
Desidae	*Badumna insignis*	Black house spider	No	No	No	No
Desidae	*Phyganoporus candidus*	Foliage web spider	No	No	No	No
Dictynidae	Genus sp. BBY28 "salt lake"	Salt lake dictynid	No	No	No	No
Gnaphosidae	*Ceryerda sp.*	Ground spider	No	No	No	No
Gnaphosidae	Drassodinae gen. sp. BBY37	Ground spider	No	No	No	No
Idiopidae	*Blakistonia sp.*	Spiny-legged trapdoor spider	No	No	No	No
Lamponidae	*Lamponina asperrima*	White-tailed spider	No	No	No	No
Lamponidae	*Lamponina asperrima*	White-tailed spider	No	No	No	No
Linyphiidae	*Erigone sp. BBY9*	Money spider	No	No	No	No
Linyphiidae	Linyphiinae gen. sp. BBY40	Money spider	No	No	No	No
Lycosidae	*Dingosa*	Wolf spider	No	No	No	No
Lycosidae	*Dingosa simsoni*	Wolf spider	No	No	No	No
Lycosidae	*Hoggicosa wolodymyri*	Wolf spider	No	No	No	No
Lycosidae	Lycosinae gen. sp. BBY33	Wolf spider	No	No	No	No
Lycosidae	Lycosinae gen. sp. BBY44	Wolf spider	No	No	No	No
Lycosidae	Lycosinae gen. sp. BBY45	Wolf spider	No	No	No	No
Lycosidae	*Tasmanicosa ramosa*	Wolf spider	No	No	No	No
Miturgidae	genus1 sp. BBY14	Prowling spider	No	No	No	No
Miturgidae	Genus2 sp. BBY10 "sp1pale”	Prowling spider	Yes	No	No	No

Family	*Species*	Common name	Putative new species	Threatened (EPBC Act)	Threatened (State/ Territory	Exotic/ pest
Miturgidae	Genus2 sp. BBY27 "pale cave2"	Prowling spider	Yes	No	No	No
Miturgidae	Genus2 sp. BBY27 "pale cave2"	Prowling spider	No	No	No	No
Miturgidae	genus2 sp. BBY8 "pale cave"	Prowling spider	No	No	No	No
Miturgidae	*Miturga sp. BBY7*	Prowling spider	No	No	No	No
Oxyopidae	*Oxyopes sp. BBY22*	Lynx spider	No	No	No	No
Oxyopidae	*Oxyopes sp. BBY24*	Lynx spider	No	No	No	No
Oxyopidae	*Oxyopes sp. BBY25*	Lynx spider	No	No	No	No
Pholcidae	*Pholcitrichocyclus nullarbor*	Cellar spider	No	No	No	No
Prodidomidae	*Cryptoerithus sp. BBY3*	Long spinneret ground spider	No	No	No	No
Salticidae	*Cytaea* sp. BBY31	Jumping spider	No	No	No	No
Salticidae	*Margaromma* cf. sp. BBY32	Jumping spider	No	No	No	No
Salticidae	*Myrmarachne sp. BBY23*	Jumping spider	No	No	No	No
Salticidae	*Simaethula sp. BBY30*	Jumping spider	No	No	No	No
Segestriidae	*Ariadna sp. BBY19*	Tube-web spider	Yes	No	No	No
Sparassidae	Deleninae genus sp. BBY36	Huntsman	No	No	No	No
Sparassidae	*Holconia sp. BBY34*	Huntsman	No	No	No	No
Sparassidae	*Isopeda leishmanni*	Huntsman	No	No	No	No
Sparassidae	*Neosparassus sp.*	Badge huntsman	No	No	No	No
Stiphidiidae	*Stiphidiidae gen. sp. BBY21 "cave'*	Sheetweb spider	No	No	No	No
Theridiidae	*Dipoena sp. BBY12*	Comb-footed spider	No	No	No	No
Theridiidae	*Genus sp "BBY18 black salt-lake2"*	Comb-footed spider	No	No	No	No
Theridiidae	*Genus sp. BBY1 "black salt lake"*	Comb-footed spider	No	No	No	No
Theridiidae	*Genus sp. BBY2 "white salt lake"*	Comb-footed spider	No	No	No	No
Theridiidae	*Latrodectus hasselti*	Redback	No	No	No	No
Theridiidae	Theridiidae gen. sp. BBY38	Comb-footed spider	No	No	No	No
Zodariidae	*Asteron sp BBY5*	Ant spider	No	No	No	No
Zodariidae	Holasteron pusillum	Ant spider	No	No	No	No
Zodariidae	Holasteron sp. BBY41	Ant spider	No	No	No	No
Zodariidae	Pentasteron cf. intermedium	Ant spider	No	No	No	No
Zodariidae	*Zodariidae gen. sp. BBY42*	Ant spider	No	No	No	No
Zodariidae	Zodariidae gen. sp. BBY43	Ant spider	No	No	No	No
Zodariidae	Zodariidae gen. sp. BBY46	Ant spider	No	No	No	No