

# A New Species of Australian Funnel-web Spider (Mygalomorphae, Atracidae, *Hadronyche*) Redefines the Family Atracidae

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**ABSTRACT.** We describe a new and unusual species of funnel-web spider from the far south coast of New South Wales. *Hadronyche nadgee* sp. nov. has only a single row of cheliceral teeth, a condition unique among known atracids. All *Atrax*, *Illawarra*, and *Hadronyche* species described to date have teeth on both sides of the cheliceral groove. Moreover, a retromarginal row of large teeth has been one of the diagnostic features of the Atracidae. *Hadronyche nadgee* sp. nov. has only a promarginal row. We therefore amend the diagnosis of the family to accommodate this new species, which in all other ways meets the criteria for *Hadronyche* (Atracidae).

## Introduction

Funnel-web spiders are an iconic Australian taxon. Their fame and notoriety can be attributed to a single species, the Sydney funnel-web spider (*Atrax robustus* O. P.-Cambridge, 1877), which has been responsible for many serious envenomations, including numerous deaths prior to the development of an antivenom in 1980 (Nicholson *et al.*, 2006).

In his major revision of funnel-web spiders, Gray (2010) placed this group in a subfamily Atracinae of the family Hexathelidae. Gray recognized three genera—*Atrax* O. P.-Cambridge, 1877; *Hadronyche* L. Koch, 1873; *Illawarra* Gray, 2010—across the 35 atracine species and defined diagnostic characters separating them from their sister group, the Hexathelinae. More recently, a molecular study of all described hexathelid genera and a sample of related mygalomorphs elevated the atracid spiders to family level (Hedin *et al.*, 2018). The remaining hexathelids were

split into several families—Hexathelidae, Porrhothelidae and Macrothelidae. This molecular analysis placed the Actinopodidae, mouse spiders, as the sister group of the Atracidae.

Gray (2010) speculated that there are likely to be many undescribed atracid species. However, since his revision no new species have been published.

We describe here a new funnel-web spider from the far south coast of New South Wales. The species shares a number of morphological characters with some members of the *Hadronyche* species group *lamingtonensis* Gray, 2010. However, it displays several features that distinguish it from those species and indeed all other atracid spiders, prompting a redefinition of the diagnosis for Atracidae.

Only roaming males of this species have been found to date and these were encountered on rainy nights in late Autumn to mid Winter. This habit, together with the relatively small size of the spider, may account for it remaining undiscovered until now.

**Keywords:** Funnel-web spider; Mygalomorphae; Atracidae; *Hadronyche*; taxonomy; new species

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## Materials and methods

All type specimens were collected live on private land, with permission, and preserved within 24 hours in 85–100% ethanol.

Photographs were taken with an Olympus OM-D E-M1 camera either fitted with an Olympus 60 mm f 2.8 macro lens or mounted on a Zeiss Tessovar macrophotography rig. Scale bar sizes were calculated by photographing a stage micrometer at the same magnification as the specimen. All measurements are given in millimetres and are rounded to the nearest 0.05 mm. Spines and cuspules were counted both directly under a Zeiss SR stereomicroscope at 20–50× magnification and from photographic images.

Image processing (cropping, exposure adjustment, focal plane stacking) was done with Adobe Photoshop Lightroom Classic (Adobe Systems Inc., San Jose, CA, USA).

## Notes on descriptions

For ease of comparison, the layout of the species description is based on that used by Gray (2010) in his revision of the family. Measurements of individual body parts were made as shown by Gray (2010: appendix 1). For paired appendages, the left side is used for all measurements and morphological descriptions.

Spines were distinguished from hairs by the following features: thicker; shorter; not as curved. Leg spine counts are given as the total count per leg segment. Most leg spines are ventral or ventrolateral. Any dorsal (d), prolateral (p) or retrolateral (r) spines are given in parentheses after the total count. Patella spine counts include total ventral and prolateral dorsal spines.

## Abbreviations

*Morphology*: ALE, anterior lateral eye; AME, anterior median eye; PLE, posterior lateral eye; PME, posterior median eye; CL, carapace length; CW, carapace width; CFW, clypeal frontal width; CH, carapace height; LL, labium length; LW, labium width; SL, sternum length; SW, sternum width; PLS, posterior lateral spinneret.

*Repository institutions*: Australian Museum, Sydney and Queensland Museum, Brisbane.

*Specimen registration codes*: AMS KS, prefix of Australian Museum, Sydney register numbers; QMS, prefix of Queensland Museum, Brisbane, register numbers.

## Systematics

### Family Atracidae Hogg, 1901

**Included genera**: *Atrax* O. P.-Cambridge, 1877; *Hadronyche* L. Koch, 1873; *Illawarra* Gray, 2010.

**Diagnosis** (modified from Gray, 2010). Atracidae can be distinguished from other mygalomorph spiders by the combination of the following characters: only 2 pairs of spinnerets, a relatively broad embolic shaft, large posterior sternal sigilla, maxillae with coniform anterior lobe, PLS relatively short, fovea a transverse groove.

**Remarks**. In his diagnosis for Atracinae (subsequently elevated to family status by Hedin *et al.*, 2018), Gray (2010: 290) included the character “cheliceret retromargin with row of large teeth”. The absence of teeth on the cheliceret retromargin of *H. nadgee* sp. nov. requires removal of this feature from the diagnosis for family Atracidae.

### *Hadronyche* L. Koch, 1873

*Hadronyche* L. Koch, 1873: 463. Type species by original designation and monotypy, *Hadronyche cerberea* L. Koch, 1873.

**Diagnosis** (from Gray, 2010). Tibia II either unmodified or with a blunt, rounded apophysis or apophyseal swelling; caput moderately to strongly raised and cheliceret paturon robust; male tarsi with two ventral spine rows.

**Remarks**. The 31 existing *Hadronyche* spp. show a substantial degree of diversity. Characters that vary across the genus include: number of cheliceret teeth, particularly in the central row; shape of labium and number of labial cuspules; relative width of palpal patella and femur; shape of apical segment of the PLS; modification of leg II; and shape of tarsi on legs III and IV (Raven, 2000; Gray, 2010). Gray (2010) divided the genus into four species groups based on these and other characters. The most morphologically distinctive of these groups is *lamingtonensis*.

### *Hadronyche nadgee* sp. nov.

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Figs 1–5

**Holotype** male: AMS KS.131058 Wonboyn, New South Wales, 37°14'38"S 149°54'11"E, 9 June 2021. K.-L. Harris & P. Whittington. **Paratypes** (all adult males, same location and collector data as for holotype, but with different dates as follows): AMS KS.131059, AMS KS.131060, QMS 116530, QMS 116531, 22 May 2020; AMS KS.131061, 14 June 2020; AMS KS.131062, 3 June 2021; AMS KS.131063, AMS KS.131064, 9 June 2021.

**Other material examined**: (male) AMS KS.105558, SE Forests National Park, New South Wales, 10 km W of Brogo end of Dorrigo Road, 338 m, 16 June 2006, C. A. Car.



**Figure 1.** *Hadronyche nadgee* sp. nov., male (A, holotype AMS KS.131058; B, C, D, AMS KS.131064): (A) live, dorsal; (B) live and in “play dead” pose, ventral; (C) live, lateral; (D) live and in defensive pose, anterior.

### Diagnosis

CL 3.85–4.80 (male). Small atracine spider. Differs from all other *Hadronyche* spp. in having a single row of 8–10 cheliceral teeth on promargin and no teeth along retromargin (Fig. 3A). Labium with a sparse cluster of cuspules (20–39) over anteroventral two-thirds (Fig. 3D). Females unknown.

### Description (holotype male)

**Size (mm).** Carapace length 4.40, width 3.70. Abdomen length 3.70, width 2.80.

**Colour (live).** Carapace and legs chocolate brown. Chelicerae very dark brown. Abdomen ventrally and laterally pinkish brown. Abdomen dorsally has wide central plum-brown band with numerous small, unpigmented dots arranged in a regular pattern. Abdomen with a thin, even cover of short, dark hairs on all surfaces. (alcohol preserved): Carapace and chelicerae orange-brown, legs yellow-brown. Abdomen ventrally and laterally pale with a broad, plum-coloured, dorsal medial band.

**Carapace.** Longer than wide. Frontal width 3.20, height 2.50. Sparsely haired. Caput strongly raised (CH/CW 0.68) and broad frontally (CFW/CL 0.73). Caput spans the anterior edge of the carapace. Fovea a transverse, procurved groove. Clypeus with cluster of 10–12 short bristles centrally, and

one long bristle between AME. Pleura widest in line with fovea and coxae of leg III. Relative to the carapace width, pleurae are wider than in most other atracids (refer figures in Gray, 2010).

**Eyes.** In rectangular group on low tubercle, in two rows of four. Eye group length 0.60, width 1.20. Diameters: AME 0.30, ALE 0.30, PME 0.20, PLE 0.25.

**Chelicerae.** Robust cheliceral paturon. Cheliceral groove shallow. Single row of 9 cheliceral teeth along promargin (medial) of each paturon. No teeth along retromargin. Cluster of 3 small central teeth at base of groove.

**Maxillae.** Longer than wide. Strong coniform lobe anteromedially. Numerous cuspules (38) in medioventral region.

**Labium.** Wider than long (LL/LW 0.65). Sparse cluster of cuspules (32) over anteroventral two-thirds. Labiosternal sigilla wide and complete.

**Sternum.** Ovoid, longer (2.40) than wide (SW/SL 0.88). Posterior sigillae ovoid. Two anterior pairs of sigillae, smaller and indistinct.

**Palps.** Cymbium bilobed. Subtegulum smaller than tegulum. Middle haematodocha exposed. Embolus shaft weakly curved, medium length, flattened and twisted distally. Bulb length 1.10, width 0.55. Embolus length 0.70, midwidth 0.10.



**Figure 2.** *Hadronyche nadgee* sp. nov., male (A, B, D, holotype AMS KS.131058; C, AMS KS.131062): (A) cephalothorax, chelicerae, proximal segments of palps and legs I–III, dorsal; (B) sternum, leg bases, ventral mouthparts, palps, and chelicerae, ventral; (C) abdomen, fovea, femora legs III–IV, dorsal; (D) carapace, caput, eye group and clypeus, lateral. Scale lines A–C = 1 mm, D = 0.5 mm

Femur thickened distally. Patella much wider than femur. Width of femur 0.60, patella 0.85, tibia 0.75. Length of femur 1.70, patella 1.00, tibia 1.90. Tibia without apophysis. Femur, patella and tibia aspinose.

**Legs.** 412–3. Lengths given in Table 1. Metatarsus I unmodified. Tibia II unmodified. Metatarsus II weakly sinuous, ventrally concave proximally, with slight apophyseal swelling. Tarsi III, IV longer and wider than tarsi I, II. Tarsus IV thickest in the distal mid section. Scopulae on ventral surface of all tarsi. Tarsi III, IV with wide band of thick, bent scopular hairs extending onto metatarsus. Scopulae weaker on tarsi I, II.

**Tarsal claws.** Tip of each tarsus bears 3 claws: a large superior pair and a smaller medial claw. Superior claws of legs I and II each with single row of 7–9 teeth of various sizes. The tooth row sigmoidal, extending from lateral (proximally) to medial edge (distally).

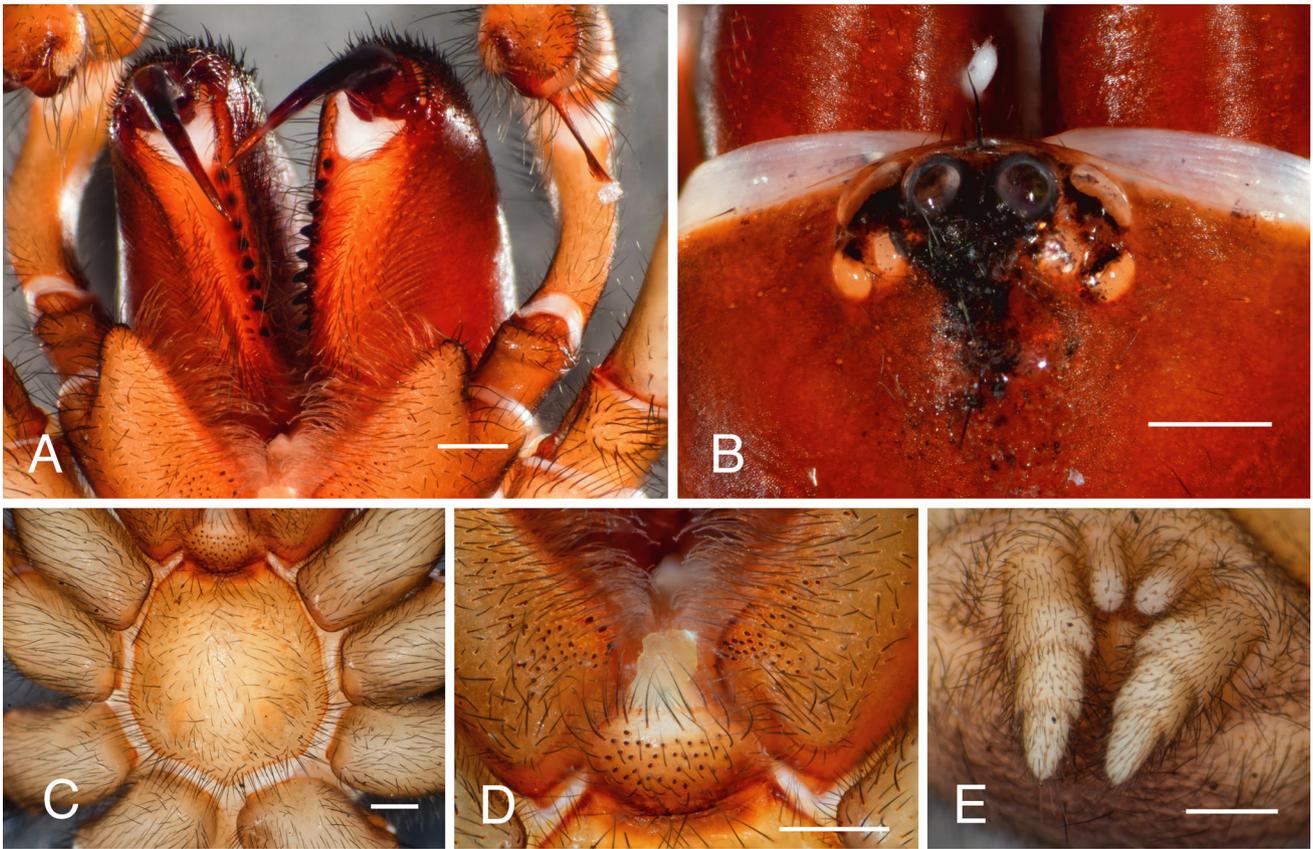
**Trichobothria.** **Leg I:** tibia 8, metatarsus 6, tarsus 6. **Leg II:** tibia 6, metatarsus 5, tarsus 6. **Leg III:** tibia 6, metatarsus 5, tarsus 8. **Leg IV:** tibia 9, metatarsus 7, tarsus 10. **Palps:** cymbium 4, tibia 8.

**Leg spination.** Spines on tarsi of all legs in two rows on either side of the scopula. **Leg I:** femur 0, patella 0, tibia 7, metatarsus 10, tarsus 5. **Leg II:** femur 0, patella 0, tibia 4, metatarsus 9, tarsus 6. **Leg III:** femur 0, patella 31 (p28 r3), tibia 6 (d1 p3 r1), metatarsus 14 (d5 p4), tarsus 7. **Leg IV:** femur 0, patella 12 (p12), tibia 5 (d1 p2), metatarsus 22 (d1 p3), tarsus 29.

**Abdomen.** Two pairs of spinnerets. Lateral pair (PLS) separated by more than width of basal segment, and with short, conical apical segment. PLS segment lengths: total 1.25, basal 0.55, middle 0.30, apical 0.40. PLS apical segment width 0.25. Median spinnerets each comprising a single segment: length 0.40, width 0.20.

**Table 1.** Leg measurements (mm) of *Hadronyche nadgee* sp. nov., holotype (male) AMS KS.131058.

leg	femur	patella	tibia	metatarsus	tarsus	total
I	3.65	1.50	2.55	2.40	1.80	11.90
II	3.40	1.30	2.25	2.55	1.70	11.20
III	3.30	1.55	1.90	2.50	2.00	11.25
IV	3.65	1.65	2.85	3.30	2.40	13.85



**Figure 3.** *Hadronyche nadgee* sp. nov., male (all holotype AMS KS.131058): (A) cheliceral groove teeth, fangs and apical lobes of maxillae, ventral; (B) eyes and clypeus, dorsal; (C) sternum, ventral; (D) labium and base of maxillae, ventral; (E) spinnerets, posteroventral. Scale lines = 0.5 mm.

A summary of morphological data for the nine type specimens, all male and including the holotype, is presented in Table 2.

**Distribution.** “South East Coastal Ranges”, a subregion of the South East Corner IBRA bioregion (Australian Government, 2012).

**Etymology.** The name *nadgee* is a noun in apposition taken from the Nadgee Nature Reserve, the northwestern boundary of which is just 2 km from the type location.

### Comments

All nine type specimens were discovered wandering at or near ground level on wet, cool nights (measured as 11°C on two occasions) in late Autumn and early Winter. The collection site for the holotype and eight paratypes is near the village of Wonboyn, 5 km from the coast in an area of dry sclerophyll forest classed as Lowland Gully Shrub Forest (Keith & Bedward, 1999; Tozer *et al.*, 2010).

Upon collection these spiders were quite passive. When provoked, all except one simply rolled over and adopted a “play dead” pose (Fig. 1B). After a day in captivity, however, they became much more reactive. At the least provocation they would rear back with pedipalps raised and fangs exposed (Fig. 1D). One of the spiders wove a silken retreat overnight within a fold of moistened paper.

The other male (AMS KS.105558) examined was also collected in early Winter, also from a forest environment, but 25 km from the coast.

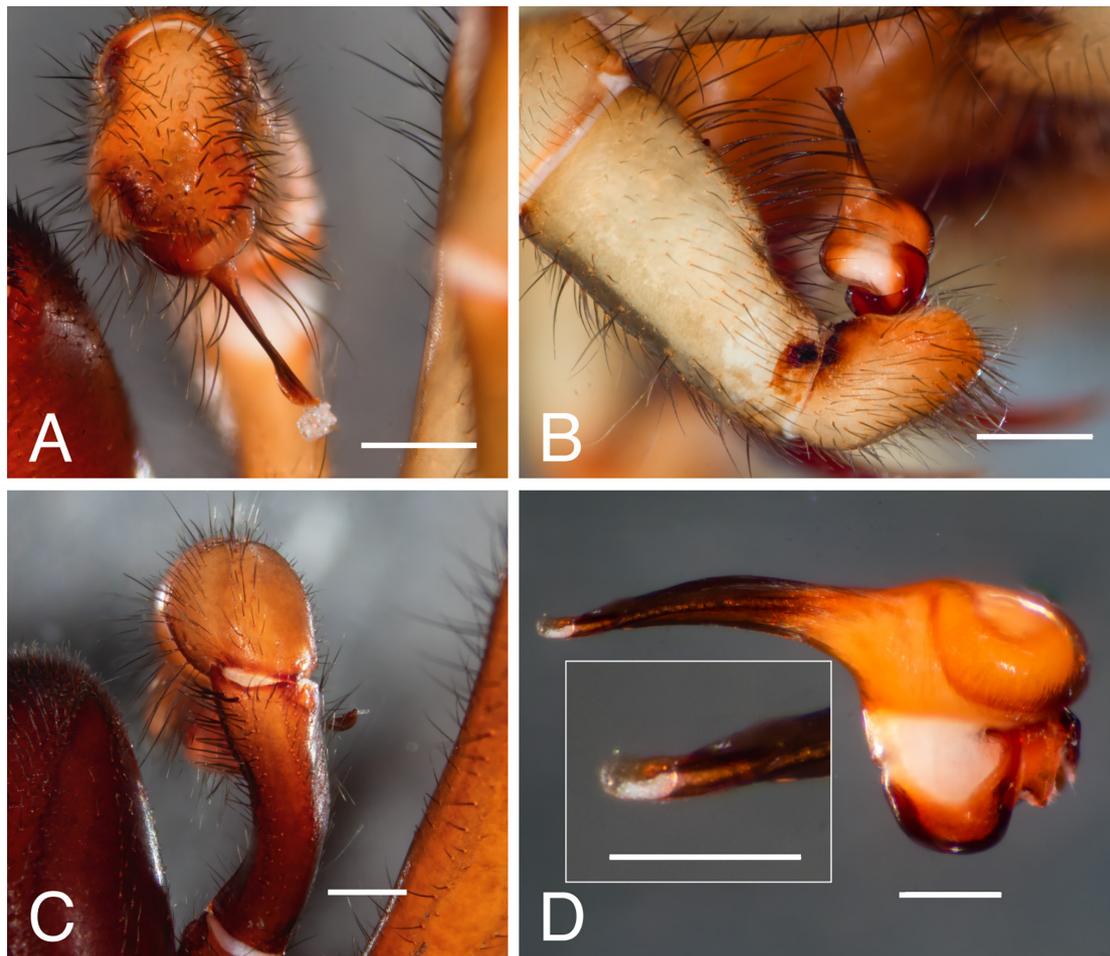
### Discussion

*Hadronyche nadgee* sp. nov. displays most of the diagnostic characters of Atracidae, which in combination exclude it from any of the other mygalomorph families. However, *H. nadgee* differs from all previously described atracid species in one key feature.

All other Atracidae have a cheliceral groove flanked by two rows of large teeth and a middle region of smaller teeth (Gray, 2010). The number of teeth in each row can vary, and in the case of *H. anzses* Raven, 2000 the promarginal row is reduced to just three teeth (Raven, 2000), but in all currently described species there is both a promarginal and a retromarginal row. In *H. nadgee* the retromarginal row is completely absent (Fig. 3A). This difference has led us to redefine the Atracidae by excluding mention of cheliceral teeth from the family diagnosis.

*Hadronyche nadgee* possesses a number of features that justify its placement in *Hadronyche* and separate it from the other atracine genera, *Atrax* and *Illawarra*. Tibia II lacks the modifications (Fig. 5C, D) found in *Atrax* spp. and the third row of spines seen on the ventral side of the tarsi (Fig. 5F) of *Illawarra wisharti* Gray, 2010 (Gray, 2010). In addition, the caput (Fig. 2D) is more strongly raised than in *Atrax* and *Illawarra* spp., although it should be noted that this character shows substantial variation in *H. nadgee* (CH/CW range 0.47–0.68).

*Hadronyche nadgee* possesses a number of morphological features shared by species in the *lamingtonensis* group of *Hadronyche*. These include small body size, short and wide

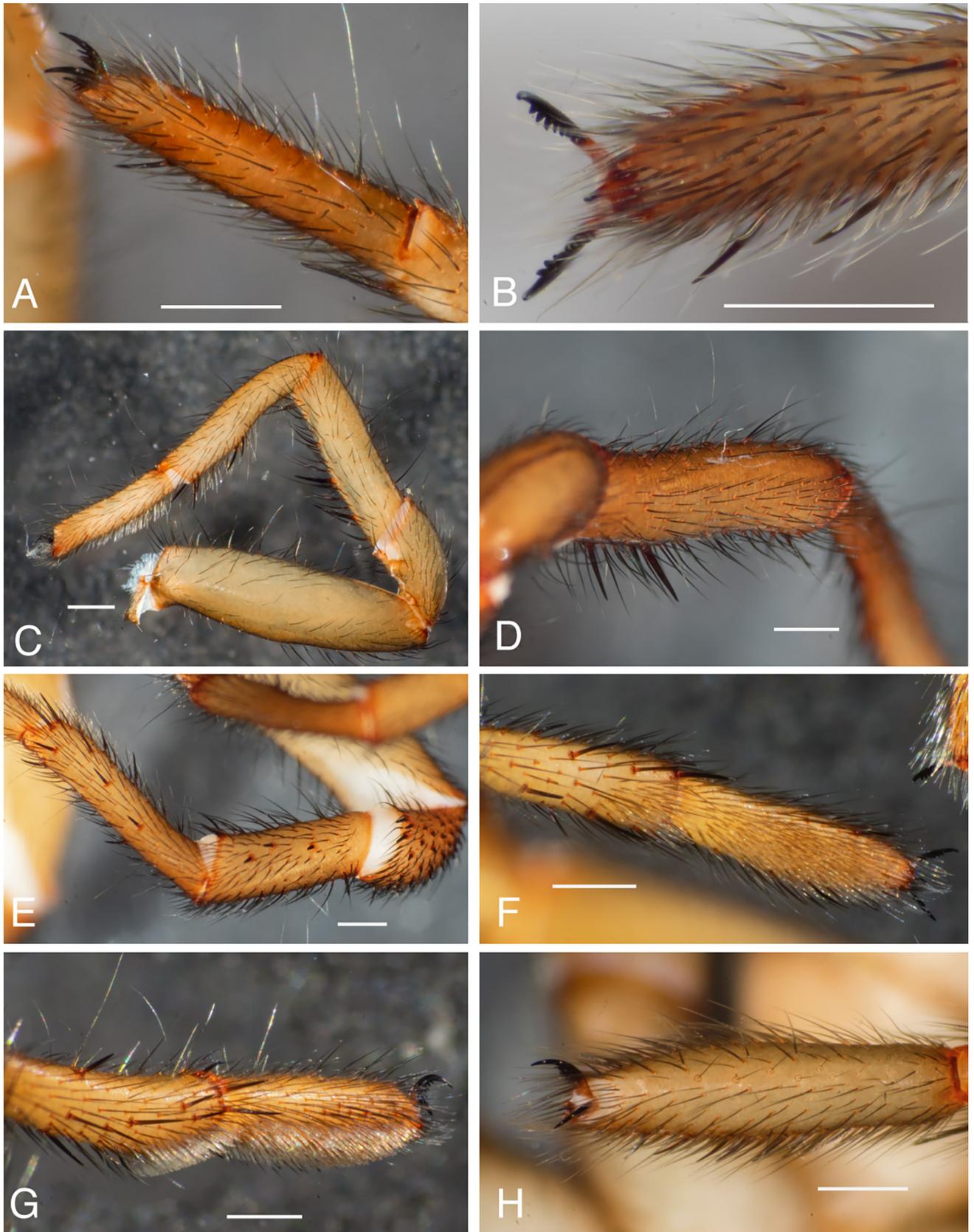


**Figure 4.** *Hadronyche nadgee* sp. nov., male (A, holotype AMS KS.131058; B, AMS KS.131059; C, AMS KS.131062; D, AMS KS.131061): (A) palpal cymbium and bulb, left, anterodorsal; (B) palpal tibia, cymbium and bulb, right retrolateral; (C) palpal femur and patella, right, dorsal; (D) bulb removed from left palp, inset shows distal tip of embolus. Scale lines = 0.5mm, except D and D inset = 0.2 mm.

**Table 2.** Male morphological data—*Hadronyche nadgee* sp. nov. (n = 9).

character	range	mean	character	range	mean	character	ratio	SD
CL	3.85–4.80	4.31	PLSAPW	0.20–0.30	0.26	CW/CL	0.87	0.024
CW	3.40–4.30	3.76	Fe1S	0	0	CH/CW	0.56	0.061
CH	1.85–2.50	2.10	Pa1S	0	0	CFW/CL	0.69	0.022
CFW	2.70–3.30	2.99	Ti1S	3–8	5	SW/SL	0.89	0.048
ChGL	1.05–1.35	1.17	Mt1S	8–11	9	LL/LW	0.64	0.031
ChGPT	8–10	9	Ta1S	4–6	5	PLSAPW/L	0.84	0.168
ChGRT	0	0	Ti2S	2–5	4	PalpTibW/L	0.45	0.046
ChGCT	2–10	5	STC2teeth	8–9	8			
LL	0.50–0.70	0.58	PalpFemS	0	0			
LW	0.80–1.05	0.89	PalpPatS	0	0			
CUSP	20–39	29	PalpTibS	0	0			
SL	2.10–2.70	2.39	PalpTibL	1.50–1.90	1.73			
SW	1.90–2.45	2.12	PalpTibW	0.75–1.00	0.81			
PLSAPL	0.20–0.40	0.32						

**ChGL**, cheliceral groove length; **ChGPT**, cheliceral groove promarginal row teeth number; **ChGRT**, cheliceral groove retromarginal row teeth number; **ChGCT**, cheliceral groove central row teeth number; **CUSP**, labium cuspsule number; **PLSAPL**, posterior lateral spinneret apical segment length; **PLSAPW**, posterior lateral spinneret apical segment width; **Fe1S**, femur I spine number; **Pa1S**, patella I spine number; **Ti1S**, tibia I spine number; **Mt1S**, metatarsus I spine number; **Ta1S**, tarsus I spine number; **Ti2S**, tibia II spine number; **STC2teeth**, number of teeth on tarsus II superior claws; **PalpFemS**, male palpal femur spine number; **PalpPatS**, male palpal patella spine number; **PalpTibS**, male palpal tibia spine number; **PalpTibL**, male palpal tibia length; **PalpTibW**, male palpal tibia width.



**Figure 5.** *Hadronyche nadgee* sp. nov., male (A, H, AMS KS.131059; B, F, G, AMS KS.131063; C, AMS KS.131061; D, AMS KS.131064; E, holotype AMS KS.131058): (A) tarsus I, right leg, dorsal; (B) distal tarsus II, ventral; (C) femur, patella, tibia, metatarsus, tarsus, left leg II, prolateral; (D) tibia II, right leg, retrolateral; (E) patella, tibia, metatarsus III, left leg, prolateral; (F) distal metatarsus and tarsus III, left leg, ventral; (G) distal metatarsus and tarsus IV, left leg, prolateral; (H) tarsus IV, right leg, dorsal. Scale lines = 0.5 mm

labium with a low cuspule count (Fig. 3D), shape of tarsi III and IV (Fig. 5F–H) and wide pleurae (Figs 1A, 2A, D)—compare with pleurae in *H. lamingtonensis* (Gray, 2010: fig. 97G) and *H. anzsas* (Raven, 2000: fig. 1A, C). Future molecular studies may help to clarify relationships within this morphologically diverse genus.

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