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A new species of *Synsphyronus* (Pseudoscorpiones: Garypidae) from Western Australia

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ABSTRACT – A new species of *Synsphyronus*, *S. christopherdarwini*, is described from Charles Darwin Reserve, Western Australia. The species occurs on several granite outcrops where they congregate under exfoliating pieces of granite.

KEYWORDS: taxonomy, morphology, Arachnida, conservation, short-range endemics

INTRODUCTION

The arachnid order Pseudoscorpiones is a cosmopolitan group of small arthropods found in a variety of terrestrial habits. There are 26 Recent families currently recognized, including over 3,400 species in 447 genera (Harvey 2011b). The Australian fauna is diverse with 21 families (Harvey 2011b) represented by numerous undescribed species (Yeates et al. 2004; Harvey, unpublished data). The family Garypidae contains 10 genera and 79 named species (Harvey 2011b). The two largest genera are *Garypus* L. Koch, 1873 (25 species) and *Synsphyronus* Chamberlin, 1930 (30 species). Species of *Garypus* occur in littoral zones in many tropical and temperate regions of the world, including northern Australia (Hoff 1947), and named species of *Synsphyronus* have been recorded from Australia and New Zealand (Harvey 1987, 2011a, 2011b). Many additional unnamed species of *Synsphyronus* are also known from Australia (Harvey, unpublished data), and a new species has been found on the Pacific island of New Caledonia (Harvey 1996). The remaining genera include *Anagarypus* Chamberlin, 1930 with three species from coastal habitats in the Indian Ocean and northern Australia (Chamberlin 1930; Muchmore 1982; Harvey 2011b), and seven genera restricted to Africa and/or Madagascar: *Ammogarypus* Beier, 1962 (3 species), *Elattogarypus* Beier, 1964 (3 species), *Eremogarypus* Beier, 1955 (4 species), *Meiogarypus* Beier, 1955 (1 species), *Neogarypus* Vachon, 1937 (1 species), *Paragarypus* Vachon, 1937 (1 species) and *Thaumastogarypus* Beier, 1947 (8 species) (Harvey 2011b).

This paper reports the discovery of a previously undescribed species of *Synsphyronus* recently collected from Charles Darwin Reserve in the mid-west region of Western Australia that appears to be restricted to the granite outcrops within the reserve.

MATERIAL AND METHODS

The material utilized in the present study is lodged in the Western Australian Museum, Perth (WAM). Terminology and mensuration largely follow Chamberlin (1931), with the exception of the nomenclature of the pedipalps, legs and with some minor modifications to the terminology of the trichobothria (Harvey 1992) and chelicera (Judson 2007).

The specimens were examined by preparing temporary slide mounts by immersing the specimen in 75% lactic acid or in oil of cloves at room temperature for several days, and mounting them on microscope slides with 10 or 12 mm coverslips supported by small sections of 0.25 mm or 0.50 mm diameter nylon fishing line. They were examined with a Leica MZ16 dissecting microscope and a Leica DM2500 compound microscope, and illustrated with the aid of a drawing tube. Measurements were taken at the highest possible magnification using an ocular graticule. After study the specimen was returned to 75% ethanol with the

FIGURE 1 Map of south-western Australia showing known distribution of *Synsphyronus christopherdarwini* sp. nov.

FIGURE 2 Granite outcrop near Robins Dam, Charles Darwin Reserve, type locality of *Synsphyronus christopherdarwini* sp. nov.

dissected portions placed in 12 x 3 mm glass genitalia microvials (BioQuip Products, Inc.).

Family Garypidae Simon, 1879

Genus *Synsphyronus* Chamberlin, 1930

Synsphyronus Chamberlin 1930: 616.

Maorigarypus Chamberlin 1930: 617 (synonymised by Chamberlin 1943: 488).

Idiogarypus Chamberlin 1943: 499 (synonymised by Morris 1948: 37).

TYPE SPECIES

Synsphyronus: *Synsphyronus paradoxus* Chamberlin 1930, by original designation.

Maorigarypus: *Maorigarypus melanochelatus* Chamberlin 1930, by original designation.

Idiogarypus: *Garypus hansenii* With 1908, by original designation.

Synsphyronus *christopherdarwini* sp. nov.

Figures 1, 3–10

MATERIAL EXAMINED

Holotype

Australia: ***Western Australia:*** ♂, Charles Darwin Reserve, granite outcrop near Robins Dam, 29°41'06"S, 116°54'13"E, 4 May 2009, under granite rocks, M.S. Harvey, D. Russell, S. Glasson, C. Darwin (WAM T97806).

Paratypes

Australia: ***Western Australia:*** 5 ♂, collected with holotype (WAM T111379); 1 ♀, collected with holotype (WAM T111380); 8 ♀, collected with holotype (WAM T111381); 1 tritonymph, collected with holotype (WAM T111382).

Other material

Australia: ***Western Australia:*** 2 ♂, 2 ♀, collected with holotype (WAM T97807); 5 ♂, 8 ♀, collected with holotype (WAM T97805, 100% ethanol); 5 ♂, 4 ♀, 1 tritonymph, Charles Darwin Reserve, granite outcrop near St. Joseph Well, 29°40'40"S, 117°01'28"E, 8 May 2009, under granite rocks, M.S. Harvey, B. Barnett, C. Hodge, C. Richard (WAM T97716, 100% ethanol); 1 ♂, same data (WAM T97784); 13 ♂, same data (WAM T110824); 7 ♀, same data (WAM T111376); 3 tritonymphs, same data (WAM T111377); 1 deutonymph, same data (WAM T111378); 1 ♀, Charles Darwin Reserve, 4.8 km E. of White Wells, 29°34'55"S, 117°00'46"E, 4 May 2009, under black light, bucket trap, D. Britton (WAM T97832).

DIAGNOSIS

Synsphyronus christopherdarwini possesses separate metatarsi and tarsi, and a trichobothrial pattern of eight on the fixed chelal finger and three on the movable finger. It differs from other members of the genus sharing these features by the following combination of

FIGURE 3 *Synsphyronus christopherdarwini* sp. nov., holotype male (WAM T97806), dorsal view.

FIGURE 4 *Synsphyronus christopherdarwini* sp. nov., holotype male (WAM T97806), carapace, dorsal view.

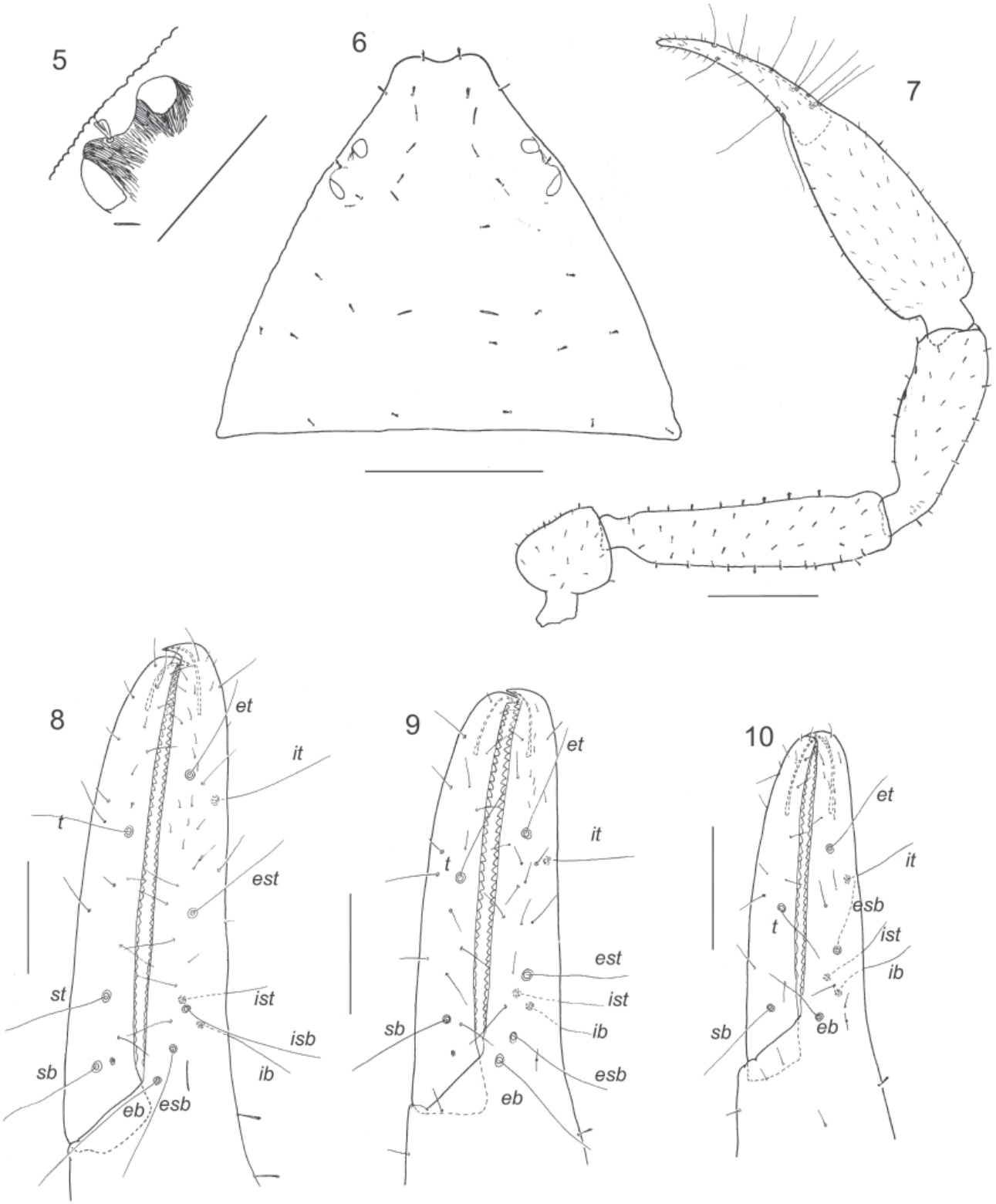

FIGURE 5 *Synsphyronus christopherdarwin*i sp. nov., holotype male (WAM T97806), unless stated otherwise: 5, left eye group; 6, carapace; 7, right pedipalp, dorsal view; 8, left chela, lateral view; 9, left chelal fingers, lateral view, paratype tritonymph (WAM T111382); 10, left chelal fingers, lateral view, deutonymph (WAM T111378). Scale lines = 0.5 mm (Figures 6, 7), 0.2 mm (Figures 5, 8–10).

characters: anterior eye slightly constricted laterally, trichobothrium *st* much closer to *sb* than to *t*, and chela (with pedicel) 1.82–1.93 (♂), 1.73–2.10 (♀) mm in length. *Synsphyronus christopherdarwini* keys to couplet 15, sharing a distinctly pedicellate pedipalpal femur with *S. attiguus* Harvey, 1987, from which it differs in its slightly larger size and [e.g. *S. absitus*, pedipalpal chela (with pedicel) 1.43–1.66 (♂), 1.63–1.81 mm (♀) in length] and more slender pedipalpal chela [*S. absitus*, 3.43–4.38 (♂), 3.58–3.64 (♀) x longer than broad].

DESCRIPTION

Adults

Colour of sclerotized portions generally dark yellow-brown; tergites II–X with paired darker patches; anterior and lateral regions of carapace dark, median and posterior areas pale yellow-brown. Waxy epicuticle. Setae generally aligned perpendicularly from body, each seta quadricarinate. Most cuticular surfaces roughened, but not granulate.

Chelicera: with 5 setae on hand and 1 subdistal seta on movable finger, all setae acuminate; setae *sbs* and *bs* shorter than others; 2 dorsal lyrifissures and 1 ventral lyrifissure; galea of ♂ and ♀ unbranched; rallum of 3 blades, the most distal blade with several serrations on leading edge, other blades smooth; serrula exterior with 19 (♂, ♀) blades; lamina exterior present.

Pedipalp (Figure 7): trochanter 1.43 (♂), 1.30 (♀), femur 3.83–4.19 (♂), 3.75–4.42 (♀), patella 2.76–2.92 (♂), 2.74–3.14 (♀), chela (with pedicel) 4.04–4.33 (♂), 3.77–4.23 (♀), chela (without pedicel) 3.89–4.13 (♂), 3.64–3.96 (♀), hand 2.08–2.28 (♂), 1.89–2.19 (♀) x longer than broad, movable finger 0.86–1.02 (♂), 0.83–1.02 (♀) x longer than hand. Fixed chelal finger with 8 trichobothria, movable chelal finger with 3 trichobothria (Figure 8): *eb*, *esb* and *isb* situated basally in straight row, *est* submedially, *et* subdistally, *ib* and *ist* basally in diagonal row, and *it* subdistally, well posterior to *et*; *t* situated subdistally, *st* situated much closer to *sb* than to *t*; patch of microsetae present on external margin of fixed chelal finger near *et*. Venom apparatus present in both chelal fingers, venom ducts long, terminating in nodus ramosus midway between *et* and tip of finger in fixed finger and distal to *t* in movable finger. Chelal teeth retrorse and acute distally, becoming rounded basally; fixed finger with *ca.* 59 (♂), 55 (♀) teeth; movable finger with *c.* 50 (♂), 48 (♀) teeth; accessory teeth absent.

Carapace (Figure 6): 0.84–0.90 (♂), 0.79–0.86 (♀) x longer than broad; anterior margin slightly indented medially; subtriangular; with 2 pairs of rounded corneate eyes (Figure 5) situated *ca.* one-third carapace length from anterior margin; anterior eye slightly constricted laterally; with *ca.* 29 (♂, ♀) setae, including 2 near anterior margin and 6 near posterior margin; with numerous lyrifissures; without furrows.

Coxal region: manducatory process rounded, with 3 apical acuminate setae; medial maxillary lyrifissure situated submedially; chaetotaxy of coxae I–IV: ♂, 3: 4: 7: 7; ♀, 5: 6: 7: 13.

Legs: junction between femora and patellae I and II slightly oblique to long axis; junction between femora and patellae III and IV very angulate; femora III and IV much smaller than patellae III and IV; femur + patella of leg IV 3.88 (♂), 4.13 (♀) x longer than broad; metatarsi and tarsi not fused and without tactile seta; subterminal tarsal setae arcuate and acute; arolium much longer than claws, not divided.

Abdomen: tergites I–XI with median suture line in anterior half of each tergite (Figure 1); sternites V–X with medial suture line in anterior half of each sternite. Tergal chaetotaxy: ♂ 6: 8: 10: 11: 9: 9: 10: 12: 10: 9: 4: 1; ♀ 6: 6: 9: 11: 11: 12: 11: 14: 12: 10: 6: 2; uniseriate; all setae quadricarinate. Sternal chaetotaxy: ♂ 9: (0) 5 [4+2] (0): (0) 6 (0): 4: 6: 9: 10: 10: 9: 4: 2; ♀ 7: (0) 7 (0): (0) 7 (0): 4: 9: 10: 12: 12: 10: 9: 2; uniseriate; all setae quadricarinate except for setae on sternites II–IV and medial setae on sternites V–IX, which are acuminate. Spiracles without helix. Anal plates (tergite XII and sternite XII) situated within sternite XI, surrounded by slightly raised rim. Pleural membrane wrinkled-plicate; without any setae.

Genitalia: male: lateral apodeme laterally extended and distally broadened; anterior apodeme acute; a pair of acute dorsal apodemes; lateral rod very broad ventrally and with a blunt, anterior projection; ejaculatory canal atrium large and cup-shaped. Female: with one pair of lateral cribriform plates and 2 pairs of median cribriform plates.

Dimensions: Male: holotype (WAM T97806) followed by five other males (where applicable): Body length 3.45 (3.37–3.84). Pedipalps: trochanter 0.560/0.392, femur 1.270/0.360 (1.242–1.391/0.300–0.332), patella 1.025/0.360 (0.955–1.078/0.336–0.450), chela (with pedicel) 1.854/0.428 (1.820–1.925/0.437–0.450), chela (without pedicel) 1.760 (1.743–1.856), hand length 0.971 (0.905–1.024), movable finger length 0.900 (0.851–0.922). Chelicera 0.338/0.163, movable finger length 0.193. Carapace 1.052/1.245 (1.018–1.120/1.160–1.240); eye diameter, anterior 0.050, posterior 0.074. Leg I: femur 0.261/0.183, patella 0.360/0.198, tibia 0.399/0.122, metatarsus 0.190/0.090, tarsus 0.170/0.082. Leg IV: femur + patella 0.970/0.250, tibia 0.611/0.149, metatarsus 0.232/0.108, tarsus 0.195/0.092.

Female: paratype (WAM T11380) followed by eight other females (where applicable): Body length 4.00 (4.31). Pedipalps: trochanter 0.570/0.438, femur 1.380/0.312 (1.150–1.415/0.293–0.362), patella 1.048/0.361 (0.900–1.104/0.327–0.400), chela (with pedicel) 2.000/0.478 (1.732–2.103/0.459–0.530), chela (without pedicel) 1.876 (1.674–2.025), hand length 1.040 (0.869–1.110), movable finger length 0.908 (0.889–1.022). Chelicera 0.357/0.185, movable finger length 0.233. Carapace 1.140/1.414 (1.098–1.227/1.280–1.474); eye diameter, anterior 0.040, posterior 0.069. Leg I: femur 0.320/0.163, patella 0.398/0.190, tibia 0.455/0.123, metatarsus 0.230/0.088, tarsus 0.171/0.080. Leg IV: femur + patella 1.032/0.250, tibia 0.696/0.141, metatarsus 0.275/0.109, tarsus 0.215/0.096.

Tritonymph

Colour mostly as for adults, but generally paler.

Chelicera: with 5 setae on hand and 1 on movable finger; galea unbranched.

Pedipalp: trochanter 1.36, femur 3.93, patella 2.64, chela (with pedicel) 3.73, chela (without pedicel) 3.57, hand (without pedicel) 1.87 times longer than broad, and movable finger 0.99 times longer than hand (without pedicel). Fixed chelal finger with 7 trichobothria, movable chelal finger with 2 trichobothria (Figure 9): *eb*, *ist* and *ib* situated basally; *est* situated medially; *et* distally; *it* subdistally; *t* subdistally.

Carapace: 0.91 times longer than broad; with 2 pairs of corneate eyes, anterior pair slightly constricted, posterior pair rounded; with 2 setae near anterior margin and 4 near posterior margin; without furrows.

Legs: much as in adults except metatarsi and tarsi fused.

Abdomen: tergal chaetotaxy: 6: 6: 6: 8: 9: 9: 9: 10: 10: 10: 4: 2. Sternal chaetotaxy: 0: (0) 3 (0): (0) 3 (0): 5: 4: 7: 7: 8: 8: 6: 2.

Dimensions (mm): paratype (WAM T111382): Body length 3.1. Pedipalps: trochanter 0.452/0.332, femur 0.946/0.241, patella 0.727/0.275, chela (with pedicel) 1.436/0.385, chela (without pedicel) 1.374, hand length 0.720, movable finger length 0.723. Carapace 0.875/0.960.

Deutonymph

Colour generally as for tritonymphs, but paler.

Chelicera: with 5 setae on hand and 1 on movable finger; galea unbranched.

Pedipalp: trochanter 1.20, femur 3.28, patella 2.22, chela (with pedicel) 3.34, chela (without pedicel) 3.28, hand (without pedicel) 1.71 times longer than broad, and movable finger 1.04 times longer than hand (without pedicel). Fixed chelal finger with 6 trichobothria, movable chelal finger with 2 trichobothria (Figure 10): *eb*, *ist* situated basally; *est* situated medially; *et* distally; *it* subdistally; *sb* basally; *t* submedially.

Carapace: 0.95 times longer than broad; with 2 pairs of corneate eyes, anterior pair slightly constricted, posterior pair rounded; with 2 near anterior margin and 4 near posterior margin; without furrows.

Legs: much as in adults except metatarsi and tarsi completely fused.

Abdomen: tergal chaetotaxy: 4: 4: 4: 6: 6: 6: 6: 6: 6: 6: 4: 2. Sternal chaetotaxy: not determined (specimen in poor condition).

Dimensions (mm): (WAM T111378): Body length 2.5. Pedipalps: trochanter 0.318/0.265, femur 0.682/0.208, patella 0.510/0.230, chela (with pedicel) 1.140/0.331, chela (without pedicel) 1.086, hand length 0.565, movable finger length 0.590. Carapace 0.711/0.750.

ETYMOLOGY

This species is named for Christopher Darwin whose generosity has secured the Charles Darwin Reserve as a permanent biological refuge, and who assisted in the collection of the type specimens.

REMARKS

Synsphyronus christopherdarwini has been found at two granite outcrops within Charles Darwin Reserve in Western Australia (Figures 1, 2) where they congregate under exfoliating granite slabs. A third granite outcrop on the reserve was searched thoroughly in May 2009, but no *Synsphyronus* specimens were located. A female specimen was also taken in a bucket trap underneath a black light (UV) 4.8 km E. of White Wells Station, situated within the Reserve. It is highly likely that this specimen was attached to a flying insect that was attracted to the light, and may suggest the capacity for dispersal. Sampling of numerous other habitats, including leaf litter, under tree bark (several species of eucalypt trees) and in soil, within the Reserve in May 2009 failed to yield specimens of *S. christopherdarwini*, suggesting that it is an obligate granite inhabitant like many other species of *Synsphyronus* (Harvey 1987, 2011a). Detailed surveys of Mount Gibson, some 30 km east-north-east of Charles Darwin Reserve, in 2005 failed to locate this species of *Synsphyronus*, although *S. mimulus* Chamberlin, 1943 was found at several locations. These data suggest that *S. christopherdarwini* may represent a short-range endemic species (Harvey 2002; Harvey *et al.* 2011) which may be restricted to Charles Darwin Reserve.

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[1] This paper was erroneously dated as having been published in 2010, but the issue did not appear until 2011, as stated on the front cover of the journal.