Two new dionychan spiders from arid western South Africa (Araneae: Prodidomidae, Trochanteriidae)

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Abstract

As part of a biodiversity survey in the arid western interior of South Africa, two new species of dionychan spiders were collected and are described herein. The prodidomid genus *Namundra* Platnick & Bird, 2007, previously known from arid parts of Namibia and Angola, is recorded from South Africa for the first time, and *N. murphyi* **sp. n.** is described from a single female. Scanning electron micrographs, based on juvenile specimens only, detail some aspects of the fine morphology of this enigmatic genus for the first time. A new species of the trochanteriid genus *Platyoides* O. Pickard-Cambridge, 1891, *P. robertsi* **sp. n.**, is described from three females. DNA barcodes (cytochrome oxidase subunit I, COI) are provided for all of the specimens included in this paper.

Keywords: Afrotropical • desert • new species • Succulent Karoo • taxonomy.

Introduction

Despite the efforts of the South African National Survey of Arachnida (SANSA) to identify and sample historically poorly sampled sites in the country (Dippenaar-Schoeman *et al*. 2015; Foord *et al.* 2020), the arid western parts of South Africa remain the most undersampled for spiders (e.g. Foord, Dippenaar-Schoeman & Haddad 2011; Janion-Scheepers *et al.* 2016).

The Succulent Karoo biome dominates the western margin of South Africa, extending along the southern interior of the country, and flanks large parts of the Nama Karoo biome that dominates the arid western half of South Africa (Mucina & Rutherford 2006). The Succulent Karoo is one of three global biodiversity hotspots found in South Africa, and is the only entirely arid hotspot on the planet (Myers *et al.* 2000). It contains a highly endemic flora (and, indeed, fauna) that is uniquely dominated by dwarf leaf-succulent shrubs, although a variety of other plant forms may also be common (Mucina *et al.* 2006). In contrast, the Desert biome is only found in a small part of the extreme northwest of the country, along the lower Orange River that forms the border with southern Namibia (Mucina & Rutherford 2006). It is characterized by extremely variable rainfall that rarely exceeds 70 mm per year, and is dominated by leaf-succulent chamaephytes in the western parts, and grasses and shrubs in the eastern parts (Jürgens 2006).

During 2021, a field study was undertaken to sample in five degree-square grids along a latitudinal gradient in the arid western interior of South Africa, which fall within the poorly sampled Desert and Succulent Karoo biomes (Mucina & Rutherford 2006). During summer (January) and winter (July) sampling, more than 300 species of spiders were collected. In this paper, a new species each of *Namundra* Platnick & Bird, 2007 (Prodidomidae) and of *Platyoides* O. Pickard-Cambridge, 1891 (Trochanteriidae) are described from that material.

Namundra is a small genus recently described for four species from Namibia and southern Angola, making it the only African representative of the predominantly Australian subfamily Molycriinae (Platnick & Bird 2007), based on the widely separated and anteriorly displaced anterior lateral spinnerets. Both Molycriinae and Prodidominae were included as subfamilies in Gnaphosidae based on the morphological phylogeny of Azevedo *et al.* (2018), although *Namundra* was not included in their analyses. Subsequently, Rodrigues & Rheims (2020) transferred the genus to Prodidominae (Gnaphosidae) and excluded it from Molycriinae, based on comprehensive morphological phylogenetic analyses. Their paper also included the first detailed studies of the fine somatic and spinneret morphology of *Namundra*, as part of comparisons with other prodidomid genera. Prodidominae (including *Namundra*) was then restored to family rank again by Azevedo *et al.* (2022).

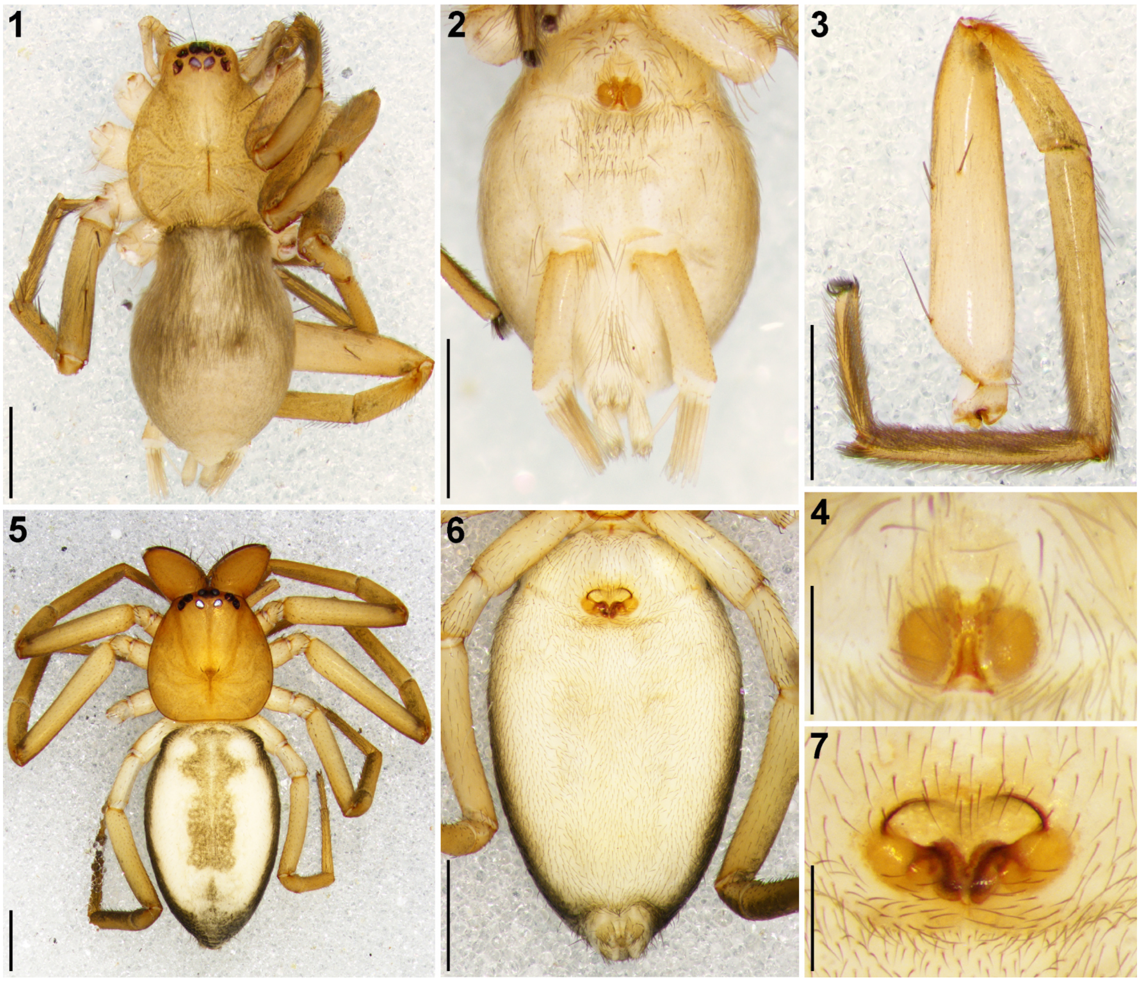
The new species of *Namundra* described herein extends the range of the genus into South Africa, more than 600 km south of its previously known range (Platnick & Bird 2007; Rodrigues & Rheims 2020).

In contrast, *Platyoides* is far more diverse, with 16 species described from the Afrotropical Region, predominantly in southern Africa and the Indian Ocean islands, with a peculiar outlier in the Canary Islands (World Spider Catalog 2022). The genus was revised by Platnick (1985), with three Madagascan species subsequently described by Andriamalala & Ubick (2007). The richest fauna is recorded from South Africa, with nine species, and the present contribution adds a further species, representing the first of its kind to be recorded from arid western South Africa (Dippenaar-Schoeman *et al.* 2010, 2020).

Material and methods

The material examined in this study is deposited in the National Collection of Arachnida at the Agricultural Research Council in Pretoria, South Africa (NCA). Field collected specimens were initially preserved in 99% ethanol to facilitate DNA barcoding (COI, cytochrome oxidase subunit I), and were subsequently transferred to 70% ethanol for long-term preservation. Material preparation for barcoding was done by removing one or two legs from each specimen, and tissues were submitted to the Canadian Centre for DNA Barcoding (CCDB). All four type specimens sequenced successfully (Table 1), and the sequences have been uploaded to the SPIZA project on the Barcode of Life Data Systems (BOLD).

For morphological descriptions, specimens were examined using a Nikon SMZ800 stereomicroscope, with digital photographs taken of the habitus and genitalia using a cou-



Figs. 1–7: *Namundra murphyi* sp. n. holotype female (1–4) and *Platyoides robertsi* sp. n. holotype female (5–7). **1, 5** habitus, dorsal view; **2, 6** abdomen, ventral view; **3** leg IV, prolateral view; **4, 7** epigyne, ventral view. Scale bars = 1 mm (1–3, 5–6); 0.25 mm (4, 7).

pled Nikon DS-L3 camera system. Digital images were stacked using Combine ZM software (Hadley 2008) to increase the depth of field. Epigynes were dissected using 0-size insect pins and cleared in a pancreatin solution (Álvarez-Padilla & Hormiga 2007) overnight to remove soft tissue, and then illustrated. All measurements are in millimetres (mm).

Material for scanning electron microscopy was prepared by placing the two juvenile *Namundra murphyi* sp. n. specimens in fresh 100% ethanol overnight, after which they were critical point dried in carbon dioxide and stuck onto aluminium stubs using double-sided tape. The material was sputter coated with iridium and then examined in a Jeol JSM-IT200 scanning electron microscope.

Voucher code	Specimen	Locality	Sex	BOLD accession number	Sequence length
Namundra murphyi sp. n.					
NCA 2021/482	Holotype	Richtersveld	♀	SPIZA868-21	658bp
Platyoides robertsi sp. n.					
NCA 2021/462	Holotype	Richtersveld	♀	SPIZA861-21	658bp
NCA 2021/462	Paratype	Richtersveld	♀	SPIZA862-21	658bp
NCA 2021/926	Paratype	Akkerendam	♀	SPIZA1162-21	658bp

Table 1: Specimen data for individual DNA barcodes (cytochrome oxidase subunit I) of *Namundra murphyi* sp. n. and *Platyoides robertsi* sp. n., accessioned in the SPIZA project of the Barcode of Life Data Systems (BOLD).

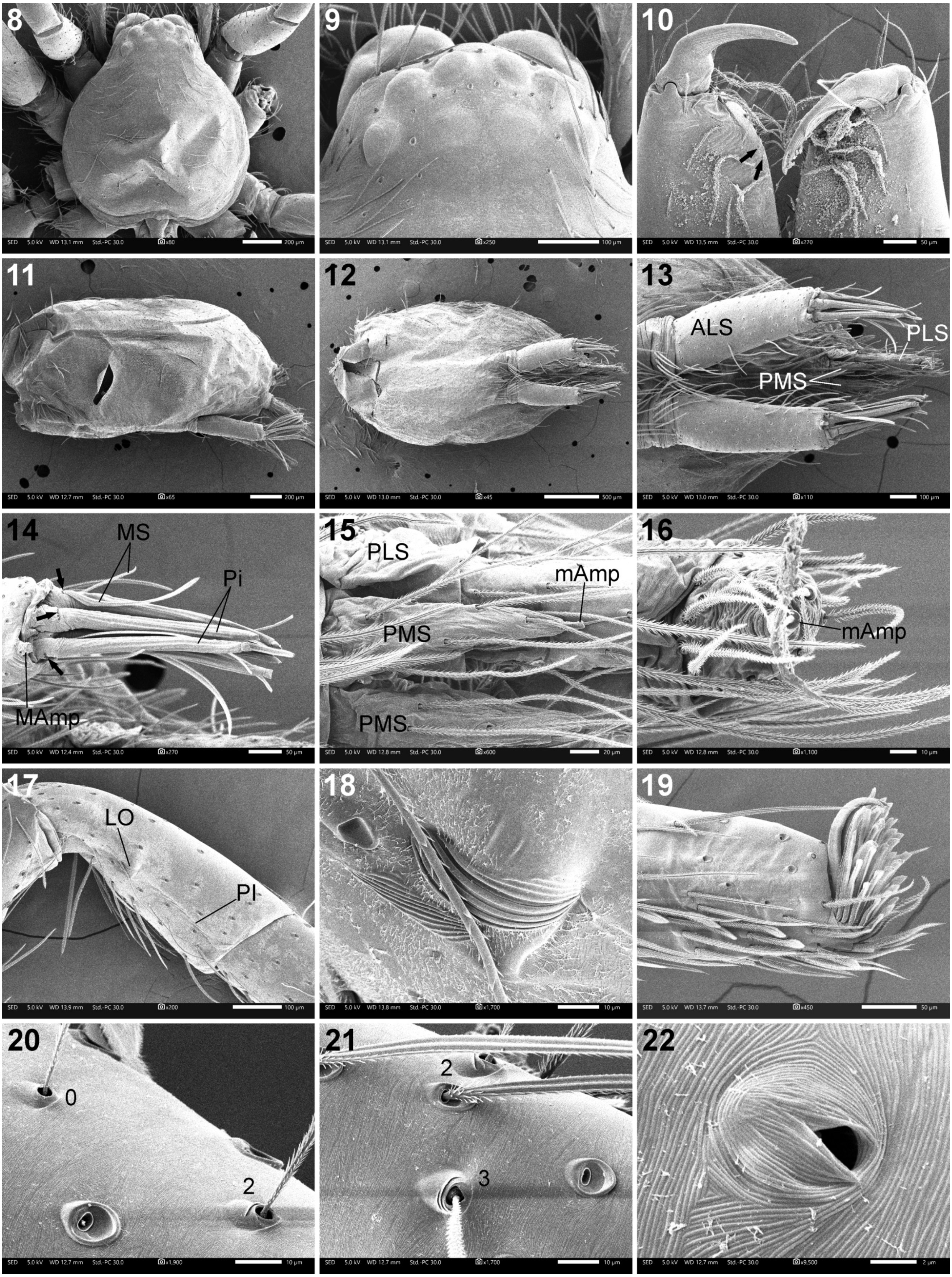
Abbreviations used in the descriptions: AL = abdomen length, ALE = anterior lateral eye(s), AME = anterior median eye(s), AW = abdomen width, CL = carapace length, CW = carapace width, MOQ = median ocular quadrangle, PLE = posterior lateral eye(s), PME = posterior median eye(s), ST I = primary spermatheca, ST II = secondary spermatheca, TL = Total length. The format of leg spination follows Bosselaers & Jocqué (2000), with the following abbreviations: do = dorsal, pl = prolateral, plv = prolateral ventral, rl = retrolateral, rlv = retrolateral ventral, vt = ventral terminal. The distribution map was prepared using SimpleMappr (Shorthouse 2010).

Prodidomidae Simon, 1884

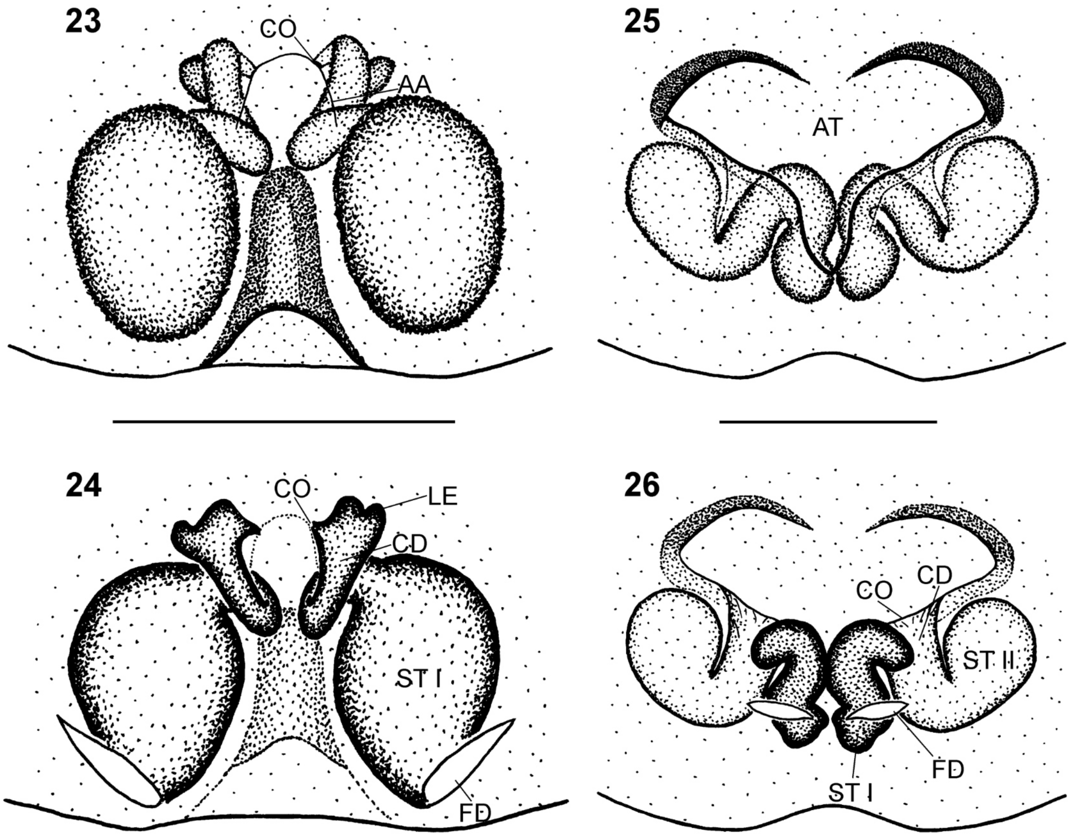
Namundra Platnick & Bird, 2007

Namundra murphyi sp. n. (Figs. 1–4, 8–24)

Type material: Holotype ♀ (NCA, 2021/482), SOUTH AFRICA, Northern Cape, Richtersveld National Park, Akkedis Pass, 28°10.577′S 17°02.069′E, 645 m, under



Figs. 8–22: Scanning electron micrographs of *Namundra murphyi* sp. n. juveniles. **8** carapace, dorsal view; **9** eye region, dorsal view; **10** chelicerae, posteroventral view, arrows indicate two small denticles on retromargin; **11** abdomen, lateral view; **12** same, ventral view; **13** spinnerets, ventral view, indicating anterior lateral spinneret (ALS), posterior median spinneret (PMS) and posterior lateral spinneret (PLS); **14** distal end of ALS, arrows indicate insertion of modified setae (MS) on piriform gland spigots (Pi), and single major ampullate gland spigot base (MAmp); **15** PMS, with single distal minor ampullate gland spigot (mAmp); **16** distal end of PLS, with single mAmp; **17** patellar indentation (PI) and lyriform organ (LO), patella IV, retrolateral view; **18** same, enlargement of LO; **19** distal end of tarsus IV, retrolateral view; **20** tarsus I, trichobothria at ⅓ tarsus length with no (0) or two (2) ridges; **21** same, trichobothria at ⅔ tarsus length with two (2) or three (3) ridges; **22** same, tarsal organ.



Figs. 23–26: *Namundra murphyi* sp. n. holotype female (23, 24) and *Platyoides robertsi* sp. n. paratype female (25, 26). **23–24** epigynes, ventral view; **25–26** same, dorsal view. AA = anterior atrium, AT = atrium, CD =copulatory duct, CO = copulatory opening, FD = fertilization duct, LE = lateral extension of copulatory duct, ST I = primary spermatheca, ST II = secondary spermatheca. Scale bars = 0.25 mm.

rocks, west-facing slope, 09 July 2021, C. Haddad, R. Booysen & M. Vickers.

Additional material: 2 juveniles (SEM preparations), same locality as holotype, Akkedis Pass, 28°10.772′S 17°02.173′E, 600 m, under rocks, west-facing slope, 08 January 2021, C. Haddad, R. Booysen, R. Christiaan & A. Stander.

Etymology: This species is named in honour of John Murphy (1922–2021), in recognition of his considerable contributions to describing the morphology of spiders, particularly Gnaphosoidea.

Diagnosis: Females of *N. murphyi* sp. n. can be distinguished from congeners by the very indistinct, weakly sclerotized, subtriangular anterior atrium, and the short copulatory ducts that are directed posteriorly along the longitudinal axis of the epigyne, with a posterior loop before entering the spermathecae (Figs. 4, 23–24). In congeners, the anterior atrium is distinct and the copulatory ducts are long and transversely orientated, with a lateral loop (see Platnick & Bird 2007: figs. 7–14).

Distribution: Only known from the type locality (Fig. 27).

Habitat: The three sampled specimens were collected beneath large rocks in boulder fields on the west-facing slope of a mountain, approximately 100 m up from the valley floor, in Succulent Karoo vegetation (Fig. 28).

Description of holotype female (NCA 2021/482): Habitus (Fig. 1): carapace and chelicerae creamy yellow; carapace broad, slightly longer than wide (Fig. 8); eye region narrow, anterior and posterior eye rows recurved in dorsal view, with PME flattened and subrectangular (Figs. 1, 9); carapace sparsely covered in short, straight, yellow brown setae, with erect long bristles on posterior declivity. Endites and labium creamy yellow, labium slightly darker; chelicerae with only two tiny retromarginal denticles (Fig. 10); sternum cream, margins brown; sternum rebordered, nearly round, anterior margin straight, posterior end extending between posterior coxae. Legs with coxae, trochanters and femora cream, remaining segments creamy yellow; all legs densely covered in fine grey setae (Figs. 17, 19); patellae with narrow indentation, with proximal lyriform organ (Figs. 17–18); metatarsi and tarsi with dense ventral scopulae (Figs. 3, 19); tarsi (examined only in juveniles) with simple smooth tarsal claws, dense claw tufts (Fig. 19), trichobothria with variable number of ridges (Figs. 20–21), and round tarsal organ with teardrop-shaped opening (Fig. 22). Abdomen pale grey dorsally (Fig. 1) and ventrally (Fig. 2), dorsum densely covered in long adpressed dark grey and yellow setae; venter with less dense and shorter setae; anterior lateral spinnerets displaced far anteriorly (Figs. 2, 11–12). Measurements: CL 2.03, CW 1.74, AL 2.79, AW 1.82, TL 2.32. Eye diameters and interdistances: AME 0.12, ALE 0.13, PME 0.15, PLE 0.13, AME-AME 0.03, AME-

Fig. 27: Distribution of *Namundra murphyi* sp. n. (yellow circle) and *Platyoides robertsi* sp. n. (green triangles) in South Africa.

ALE 0.02, PME-PME 0.02, PME-PLE 0.11, ALE-PLE 0.06; MOQ: anterior width 0.26, posterior width 0.27, length 0.30. Leg measurements: I 2.27, 1.19, 1.93, 1.67, 1.00 = 8.06; II 2.30, 1.16, 1.90, 1.58, 0.97 = 7.91; III 2.13, 0.93, 1.80, 1.38, 0.83 = 7.07; IV 2.32, 1.20, 1.97, 1.63, 0.99 = 8.11. Leg spination: femora: I do 2, II do 2, III pl 1 do 2, IV pl 1 do 2; patellae: spineless; tibiae: I spineless, II plv 1, III plv 3 vt 2, IV spineless; metatarsi: I, II and IV spineless, III pl 1 vt 1; palp: femur pl 1 do 3 short spines, patella pl 1 do 1, tibia pl 2 rl 2 plv 2, tarsus pl 1 rl 1 plv 3 rlv 3. Epigyne with very indistinct, weakly sclerotized anterior atrium; posteromedian septum distinct; copulatory openings small, situated anterolaterally in atrium (Figs. 4, 23); copulatory ducts short, directed posteriorly along longitudinal axis of epigyne, converging slightly before posterior loop, looping ventrally then anteriorly before entering ST I along their anteromesal margin; copulatory ducts with lateral expansion immediately after copulatory opening; ST I large, oval (Fig. 24).

Trochanteriidae Karsch, 1879

Platyoides O. Pickard-Cambridge, 1891

Platyoides robertsi sp. n. (Figs. 5–7, 25–26)

Type material: Holotype ♀ (NCA, 2021/462), SOUTH AFRICA, Northern Cape, Richtersveld National Park, Akkedis Pass, 28°10.577′S 17°02.069′E, 645 m, under rocks, west-facing slope, 09 July 2021, C. Haddad, R. Booysen & M. Vickers. Paratypes: 1♀ (NCA, 2021/462), together with the holotype; 1♀ (NCA, 2021/926), SOUTH AFRICA, Northern Cape, Calvinia, Akkerendam Nature Reserve, 31°24.453′S 19°46.922′E, 1220 m, under rocks, west-facing slope, 17 January 2021, C. Haddad, R. Booysen & A. Stander.

Etymology: The species is named in honour of Michael Roberts (1945–2020) and his excellent illustrations that improved our knowledge of the morphology of many spiders, particularly Gnaphosoidea.

Diagnosis: *Platyoides robertsi* sp. n. has an epigyne most similar to that of *P. pictus* Pocock, 1902, particularly the paired, laterally curved anterolateral ridges of the epigyne, but the extent of the sclerotized structures in the epigynal field is almost twice as broad as long (Figs. 7, 25), while as broad as long in *P. pictus* (Platnick 1985: fig. 39). Further, the anterolateral ridges of the epigynal atrium have a generally anteromedian orientation (Figs. 7, 25), while directed posteromedially in *P. pictus* (Platnick 1985: fig. 39). Lastly, the spermathecae touch mesally and are clearly separated from the epigastric furrow by a distance almost equal to their length (Fig. 26), while clearly separated from each other and positioned close to the epigastric furrow in *P. pictus* (Platnick 1985: fig. 40).

Distribution: Only known from two isolated localities in western South Africa (Fig. 27). A juvenile *Platyoides* sampled at the Namaqua National Park (30°10′S 17°45′E), located between the two confirmed localities, might possibly also belong to this species.

Habitat: The three sampled specimens were collected under rocks on the west-facing slopes of mountains in Succulent Karoo vegetation (Figs. 28–29). The aforementioned juvenile *Platyoides* was collected from leaf litter on the eastern slope of a mountain.

Description of holotype female (NCA 2021/462): Habitus (Fig. 5): carapace and chelicerae pale yellow brown, with faint black mottling; carapace almost as broad as long, strongly dorso-ventrally flattened. Endites and labium pale yellow orange, endites cream distally; sternum cream, with faint black mottling, margins deep reddish brown; coxae, trochanters and femora creamy yellow, patellae and tibiae yellow, metatarsi and tarsi yellow brown, femora to tarsi all with black mottling; legs and palps spineless. Abdomen cream dorsally, with undulating grey marking medially; lateral margins black, except cream anterior; venter cream (Fig. 6). Measurements: CL 2.30, CW 2.17, AL 3.90, AW 2.35, TL 6.18. Eye diameters and interdistances: AME 0.15, ALE 0.13, PME 0.15, PLE 0.12, AME-AME 0.11, AME-ALE 0.10, PME-PME 0.15, PME-PLE 0.24, ALE-PLE 0.11; MOQ: anterior width 0.40, posterior width 0.44, length 0.33. Leg measurements: I 2.07, 1.22, 1.62, 1.28, 0.53 = 6.72; II 2.57, 1.25, 2.06, 1.73, 0.65 = 8.23; III 1.93, 0.83, 1.42, 1.27, 0.51 = 5.96; IV 1.87, 0.66, 1.54, 1.37, 0.57 = 6.01. Epigynal atrium with large recurved anterolateral ridges, orientated anteromesally; posterior margins of atrium oblique, orientated posteromesally, converging near midline in a V (Figs. 7, 25); copulatory openings near middle of posterior atrial margin, broad, entering pale ST II with lateral lobe; short, heavily sclerotized, mesally bent duct connecting ST II to C-shaped ST I, touching mesally; ST I separated from epigastric groove by approximately their length (Fig. 26).

Figs. 28–29: Habitats of *Namundra murphyi* sp. n. (28) and *Platyoides robertsi* sp. n. (28, 29) in South Africa. **28** west-facing slope of Akkedis Pass in the Richtersveld National Park (photo: C. Haddad); **29** west-facing slope of Hantam Mountain in the Akkerendam Nature Reserve (photo: R. Booysen).

Discussion

The two species described in this paper extend the ranges of both genera in southern Africa to include the arid western parts of the Northern Cape Province of South Africa. This part of the country has been historically poorly sampled (e.g. Foord, Dippenaar-Schoeman & Haddad 2011; Janion-Scheepers *et al.* 2016), so discoveries such as these are not entirely surprising, and may be typical for many spider families.

In the current study, aspects of the fine morphology of certain structures of *Namundra* were examined for the first time. In a recent paper also examining the genus, Rodrigues & Rheims (2020) corrected some interpretation errors made in the original description of the genus (Platnick & Bird 2007), particularly regarding tarsal, setal and spinneret morphology. Their phylogenetic results supported the transfer of the genus from Molycriinae to Prodidominae, based on the presence of modified long setae at the bases of the piriform gland spigots, which were also found in the juvenile *Namundra* examined here (Figs. 13–14), amongst other characters. Although the advanced position of the ALS is widespread in Molycriinae, it can also be found in other prodidomid genera (e.g. *Theuma* Simon, 1893 and *Zimiris* Simon, 1882), which was explained by Rodrigues & Rheims (2020) to possibly be a result of the expansion of abdominal segment 3 or reduction of segment 4 during ontogeny.

The SEM work here on juveniles also allowed for some ontogenetic comparisons, considering that the work of Rodrigues & Rheims (2020) was based on adult females. The ALS of juveniles possessed a number of very long piriform gland spigots (Pi), all with extremely long bases and a very short distal shaft, as well as typical prodidomine modified setae (Murphy & Roberts 2015; Rodrigues & Rheims 2020) inserted proximally at the bases of the Pi in groups of four each (Fig. 14). These modified setae are characterized by a finely barbed external surface and smooth internal surface that is in contact with the spigots, and are presumed to serve a protective function (Rodrigues & Rheims 2020). The shaft of the small major ampullate gland spigot of the juvenile was broken off, but the base is clearly visible on the anteromesal margin of the spigot field (Fig. 14). This spigot is visible in Rodrigues & Rheims (2020: fig. 23G), but was not labelled and may have been overlooked. It would appear that the ALS morphology therefore changes little during ontogeny.

The PMS of the juvenile is positioned directly alongside the PLS, and has an elongate, finger-like structure (Figs. 13, 15), which contrasts with the stout form of the adult female PMS (Fig. 2; Rodrigues & Rheims 2020: fig. 21J). The juvenile PMS bears a single slender minor ampullate gland spigot (Fig. 15), while that of the adults additionally includes two large cylindrical gland spigots and at least three aciniform gland spigots (Rodrigues & Rheims 2020: fig. 21J). This indicates considerable changes from juveniles into adults to facilitate the construction of egg sacs by females, using silk produced from the cylindrical glands (Townley & Harms 2020). Last, the PLS of the juvenile is somewhat cylindrical in form, but also with only a single minor ampullate gland spigot present (Fig. 16). This develops to a state with an additional two cylindrical and (probably) four aciniform gland spigots in adult females (Rodrigues & Rheims 2020: fig. 21J).

Tarsal trichobothria of females were indicated to have three ridges on their proximal side (Rodrigues & Rheims 2020: fig. 15J), but the juvenile studied here had quite variable structure. Two trichobothria examined at approximately ⅓ the length of tarsus I had respectively zero and two proximal ridges (Fig. 20), while two trichobothria at ⅔ the length of tarsus I had two and three ridges, respectively (Fig. 21). This would indicate that either this variation was not observed and accounted for in adults by Rodrigues & Rheims (2020), or that there are ontogenetic changes in the structure of the trichobothrial bases. The structure of the tarsal organ was relatively consistent, although the juvenile observed had more distinctive linear integumental ridges (Fig. 22) than the adult (Rodrigues & Rheims 2020: fig. 16J).

These differences observed between juvenile and adult *Namundra* warrant further investigation into ontogenetic changes, not only in other prodidomids, but also more broadly in other dionychan spiders.

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