Acarologia
Open Science in Acarology

Tydeid species from domatia bearing plants from South Africa with the description of two new species of the genus *Afridiolorryia* (Acari: Tydeidae)

Edward A. Ueckermann[a] , Sivuyisiwe Situngu[b] , Nigel P. Baker[c]

[a] Unit for Environmental Sciences and Management, North-West University, Potchefstroom Campus, Potchefstroom, 2520, South Africa.
[b] School of Animal, Plant and Environmental Sciences, University of the Witwatersrand, Johannesburg, South Africa.
[c] Department of Plant and Soil Sciences, Faculty of Natural and Agricultural Sciences, University of Pretoria, Pretoria, South Africa.

Original research

ABSTRACT

The monotypic genus *Afridiolorryia* Kazmierski was collected from the Democratic Republic of the Congo. Two new species belonging to this genus are described here both collected from *Psychotria capensis* (Eckl.) Vatke (Rubiaceae), in the Eastern Cape Province, South Africa. A key to all the species of the genus as well as the Tydeidae species found during this survey is given.

Keywords mites ; Tydeinae ; forest trees ; protective mutualism ; new species
Zoobank http://zoobank.org/F549CFBC-9EC5-4AA0-A467-62B5E50A99C4

Introduction

The remarkable variation in South Africa's topography, climate, altitude and latitude has resulted in a diverse vegetation that is exceptionally rich with 11,690 plant taxa with 968 943 plant species on record in the national database (Powrie *et al.* 2012). As a result, South Africa boasts a wide range of vegetation biomes ranging from deserts to grasslands and forests (Mucina and Rutherford 2006). There are still many gaps and some areas of these biomes are still poorly known against predictions of plant diversity (Robertson & Baker, 2006). However, we have a limited understanding of the diversity of mites associated with plants with domatia in South Africa. Therefore, this paper is the second in a series to fill this knowledge gap and survey mite families associated with leaf domatia bearing plants (Situngu 2017). Leaf domatia are usually inhabited by mites and facilitate a protective mutualism between mites and the host plant (O'Dowd and Pemberton 1998; Norton *et al.* 2000; Romero and Benson 2005). Many studies have shown that these structures play a significant role in influencing mite assemblages found on plants with leaf domatia (Pemberton and Turner 1989; O'Dowd and Willson 1991; Walter and O'Dowd 1992; Walter 1996; Norton *et al.*, 2000; Romero and Benson 2005; Situngu and Barker 2017). Leaf domatia alter the distribution, abundance, and reproduction of mites and the Tydeidae (Acari: Trombidiformes) are always significantly higher in domatia than on vein axils of plants lacking leaf domatia (O'Dowd and Willson 1991; O'Dowd and Pemberton 1998; Norton *et al.* 2000).

Kaźmierski (1996) described the monotypic genus *Afridiolorryia* based on *A. africanus* (Baker, 1965) collected from *Afrocarpus usambarensis* Pilg.C.N Page (Podocarpaceae) in the Democratic Republic of the Congo (Baker, 1965).

Received 07 March 2022
Accepted 03 May 2022
Published 09 May 2022

Corresponding author
Edward A. Ueckermann:
edalbert@lantic.net

Academic editor
Auger, Philippe

https://doi.org/
10.24349/a5f8-6nuj

ISSN 0044-586X (print)
ISSN 2107-7207 (electronic)

Ueckermann E. A. *et al.*

Licensed under
Creative Commons CC-BY 4.0

OPEN ACCESS

How to cite this article Ueckermann E. A. *et al.* (2022), Tydeid species from domatia bearing plants from South Africa with the description of two new species of the genus *Afridiolorryia* (Acari: Tydeidae). **Acarologia 62(2): 497-507. https://doi.org/10.24349/a5f8-6nuj**

The objective of this study is to describe two new species and define the three other species of the family Tydeidae collected from woody species with domatia of the Eastern Cape, South Africa. This is part of a study carried out by the second author.

Material and methods

Field visits were undertaken to various forest types found in the Eastern and the Western Cape provinces periodically starting in January 2013 until October 2015. At each site, we conducted a thorough survey of trees with leaf domatia and herbarium voucher specimens of all the plants sampled were collected to verify the identity of the tree species, and to make sure all host plants were identified to species level. Some of the vouchers are housed at the Schonland Herbarium (GRA) in Grahamstown (now known as Makhanda). From each tree species that was found to possess leaf domatia, 20 leaves were collected and placed in a zip lock bag and stored in a cool backpack while in the field.

The leaves were examined for the presence of mites as soon after collection as possible (usually the same day they were collected) by viewing them under a dissecting microscope. All the mites found inside the domatia and the surrounding leaf blade were collected using a pipette and a drop of alcohol. Some were mounted on a stub and viewed under the Scanning Electron Microscope. Others were stored in a vial with alcohol and sent to the Biosystematics Division of ARC-Plant Health Protection Research for identification. The preserved mites were mounted on microscope slides in PVA and dried in an oven at 45–50 ° Celsius for 24 hours. Line drawings were made from photographs of the specimens taken with a Zeiss Axioskop TM Research microscope equipped with an Axiocam 208 colour camera and a Zen Soft Imaging System with measuring tools. All illustrations were edited using Adobe Illustrator C5. Measurements in micrometers (µm) of the holotype are provided, followed by that of paratype female in parenthesis. For the dorsal setal notations Kaźmierski (1989a) is followed and for the venter, gnathosoma, leg setae and lyrifissures Andre (1981a, b). The taxonomic system of Andre & Fain (2000) is followed. The holotypes and paratypes will be deposited in the National Collection of Arachnida, ARC-Plant Health and Protection Research (NCA-PPRI), Pretoria, South-Africa.

Results and discussion

Family Tydeidae Kramer

Subfamily Tydeinae Kramer sensu André

Genus *Afridiolorryia* Kaźmierski, 1996

Type-species *Lorryia africanus* Baker, 1965

Definition of genus as in Kaźmierski (1996)

Afridiolorryia psychotriae sp. n.

Zoobank: 1E581854-8F13-418E-9B38-C0B2B066CAE2

(Figs.1-2)

Type material

Holotype female and one paratype female, on *Psychotria capensis* (Eckl.) Vatke, Rubiaceae, Kwelerha, 32.84° S, 26.94° E, near East London, 27 September 2014.

Description

Female (n=2)

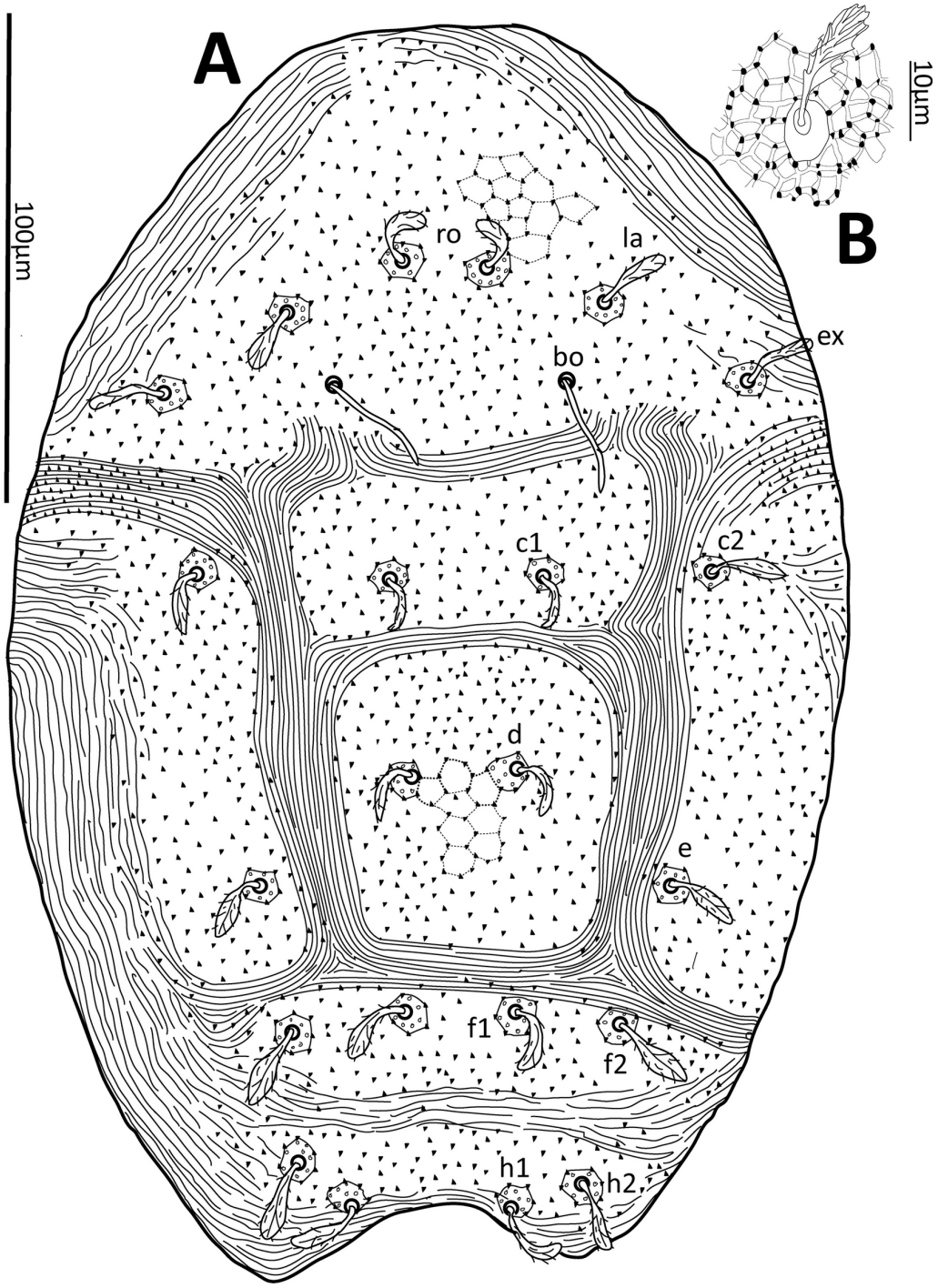


Figure 1 *Afridiolorryia psychotriae* **sp.n.** Female. A – Dorsal view, B – Seta *c2* and detail of the prodorsal reticulation.

Dorsum — Length of idiosoma (excluding gnathosoma), 246 (257), length (including gnathosoma) 294 (296), width 184 (179). Body posteriorly bilobed. Dorsal shield covered with tubercles bordering faint polygonal cells and with 13 pairs of broadly lanceolate to leaflike and serrate setae except for bothridial setae *bo* which is filiform, smooth, rather stout and the longest and pointed distally but do not reach setae *c1*. Prodorsum recurved. Opisthosoma divided into 6 shieldlike areas. Lyrifissures not detectable amongst all the tubercles. Setal lengths: *ro* 15

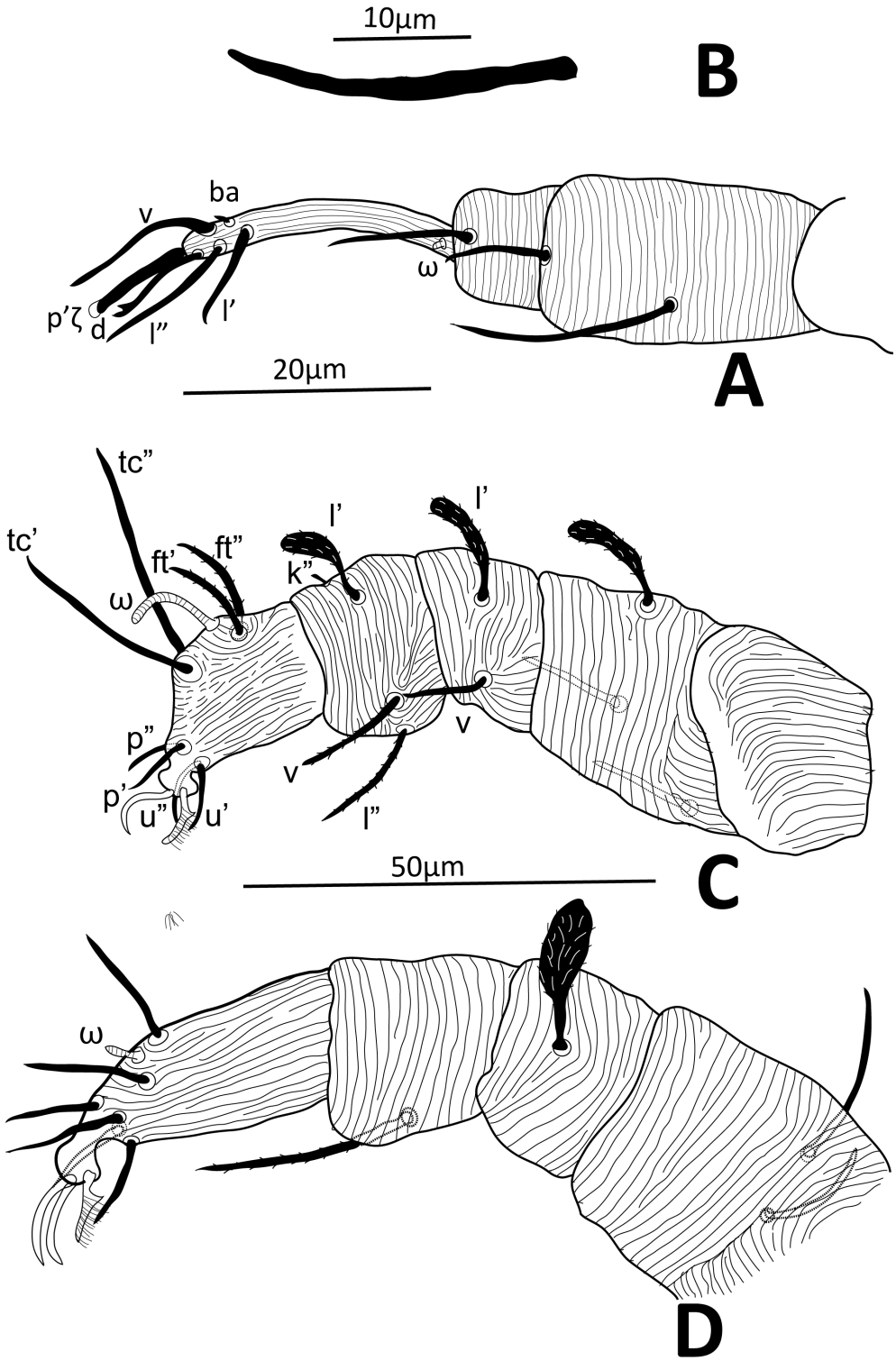


Figure 2 *Afridiolorryia psychotriae* **sp.n.** Female. A – Palp, B – Movable digit, C – Leg I, D – Leg II.

(17), *la* 14 (16), *bo* 29 (27), *ex* 16 (17), *c1* 17, *c2* 16 (15), *d* 17, *e* 16 (16), *f1* 17(16), *f2* 18 (16), *h1* 17 (14), *h2* 15 (15), *ps2* 7 (10) (Fig. 1A-B).

Venter — Anogenital area damaged but with six pairs of genital setae and four pairs of aggenitals and one pair of pseudoanal setae (*ps2*). Venter finely striate and setae also very fine and not all of them distinct. Coxal organ oval. Epimeral formula: 3-1-4-2.

Gnathosoma — Setal pattern of palp (tarsus-genu): 6 (+*ω*)-1-2, tarsus with seta *p'ζ* blunt distally, *d* distally bifurcate and *ba* minute. Movable digit 24 (25) long and palptarsus 28 (26) long and slender, 8-14 times longer than wide, length of palp 45 (48) (femur to tip of tarsus, terminal setae excluded) (Fig. 2A-B).

Legs — Length of legs I-IV as follows (trochanter to empodium): leg I 86 (94), leg II 77 (75), leg III 69 (74) and leg IV 85 (79). All legs with two claws and a hairy empodium, with empodial claws. Solenidion *ωI* 10 (8) long, slender, bent and about half the width of the tarsus, seta *k″* on tibia I minute. Setae *l″* on tibia and genu I scoop like and serrate. Tarsus I with *ft′* and *ft″* slightly serrate and equal in length but shorter than *tc′* and *tc″*. Tarsus II with *ωII*, 4 (4) long. Seta on genu II scoop like and serrate. Leg formulae as follows (tarsus -trochanter): Leg I: 8(1ω)-3(1k)-2-3-0; Leg II: 6(1ω)-1-1-2-0; Leg III: 5-1-1-1-1; Leg IV: 5-1-1-1-0 (Fig. 2 C-D).

Male: Unknown

Etymology

This species is named after the genus name of the host plant.

Remarks

This species differs from the type species *A. africanus* (Baker) in that setae *tc′* and *tc″* and *ft′* and *ft″* on tarsus I are not equal in length and smooth, but *ft′* and *ft″* are shorter and slightly serrate in *A. psychtriae* **sp. n.**, solenidion *ωI* on the tarsus are bend in the new species but straight in *A. africanus*. Seta *l′* on tibia I are scoop like in the new species but long, smooth and simple in *A. africanus*. This species differs from *A. kwelerhaensis* **sp. n.** in that the dorsal setae are similar in shape and length, except setae *bo*, oppose to all setae (*bo* excluded) being long, lanceolate, serrate except for setae *e, f1-2* and *h1-2* which are club-shape and smooth in *A. kwelerhaensis* **sp. n.** The shape of setae *l′* on tibia and genu I, seta on genu II and solenidion *ωI* also differs between the two new species, the leg setae being scoop like and the *ωI* bent in *A. psychotriae* **sp. n.** but broadly lanceolate and *ωI* straight in *A. kwelerhaensis* **sp. n.**

Afridiolorryia kwelerhaensis sp. n.

Zoobank: 3E65ED18-20D7-4AF1-B660-48888AEC98E4

(Figs.3-5)

Type material

Holotype female, on *P. capensis*, Kwelerha, 32.84° S, 26.94° E, near East London, 27 September 2014.

Description

Female (n=2)

Dorsum — Length of idiosoma (excluding gnathosoma), 248, length (including gnathosoma) 296, width 179. Body slightly bilobed posteriorly. Dorsum completely covered with tubercles bordering faint polygonal cells and with 13 pairs of long, lanceolate, serrate setae except for bothridial setae *bo* which is filiform, smooth, rather stout and the longest and pointed distally and setae *e*, *f1-2* and *h1-2* which are club-shape and smooth. Setae *bo* reach pass setae *c1*. Prodorsum recurved. Opisthosoma divided into 5 shieldlike areas. Lyrifissures are camouflaged by the granules. Setal lengths: *ro* 25, *la* 25, *bo* 44, *ex* 28, *c1* 25, *c2* 24, *d* 22, *e* 21, *f1* 18, *f2* 20, *h1* 19, *h2* 16, *ps2* 10 (Fig. 3A-B).

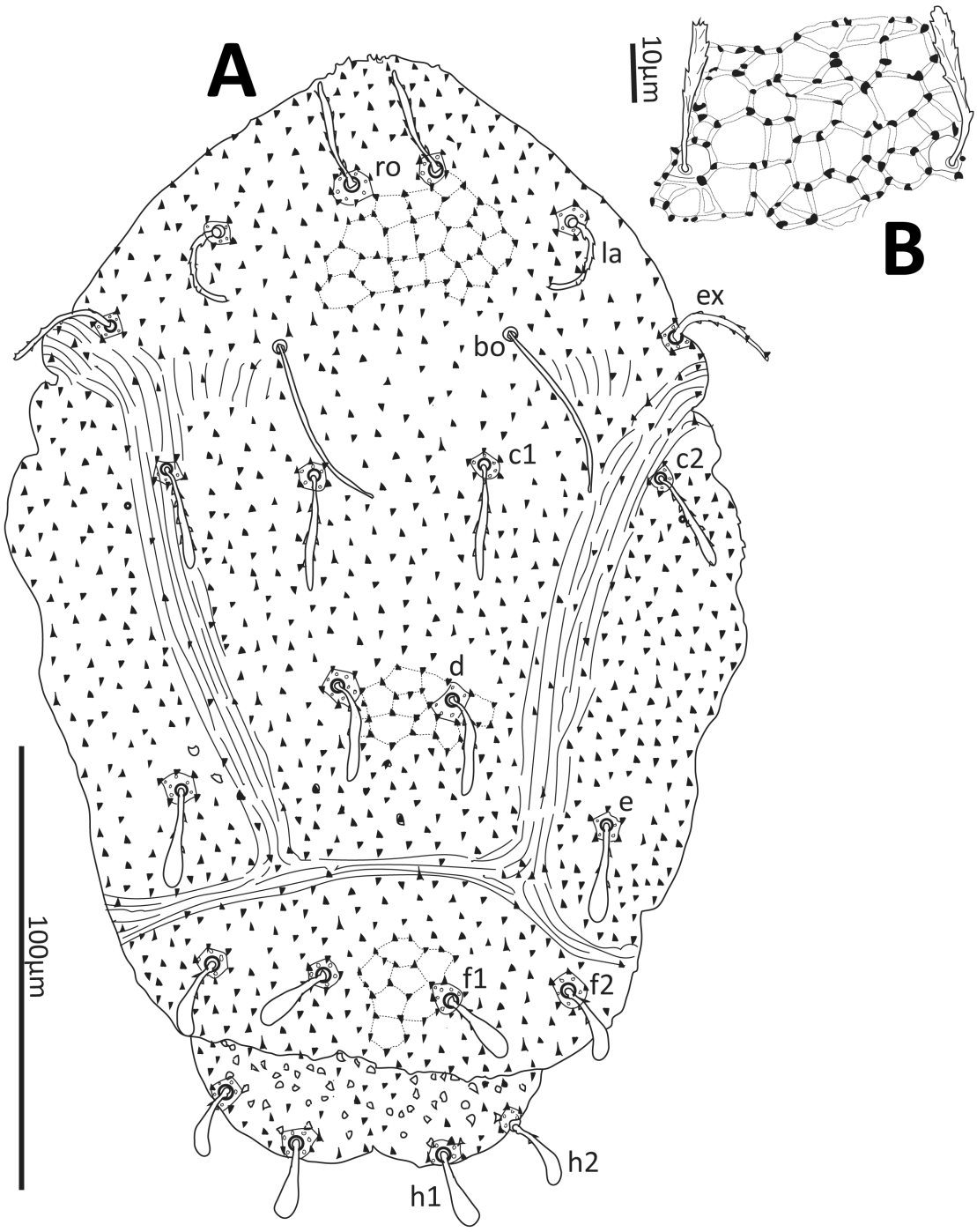


Figure 3 *Afridiolorryia kwelerhaensis* **sp. n.** Female. A – Dorsal view, B – Seta *c1* and detail of the prodorsal reticulation.

Venter — Anogenital area with six pairs of genital setae and four pairs of aggenitals and one pair of pseudoanal setae (*ps2*). Venter finely striate with striae longitudinal between setae *mtα* and *mtβ*. Coxal organ oval. Epimeral formula: 3-1-4-2 (Fig. 4A).

Gnathosoma — Setal pattern of palp (tarsus-genu): 6 (+*ω*)-1-2, tarsus with seta *p'ζ* blunt distally, *d* distally bifurcate and *ba* minute. Movable digit 25 long and palptarsus 27 long and slender, 16 times longer than wide, length of palp 49 (femur to tip of tarsus, terminal setae excluded) (Fig. 4B-C).

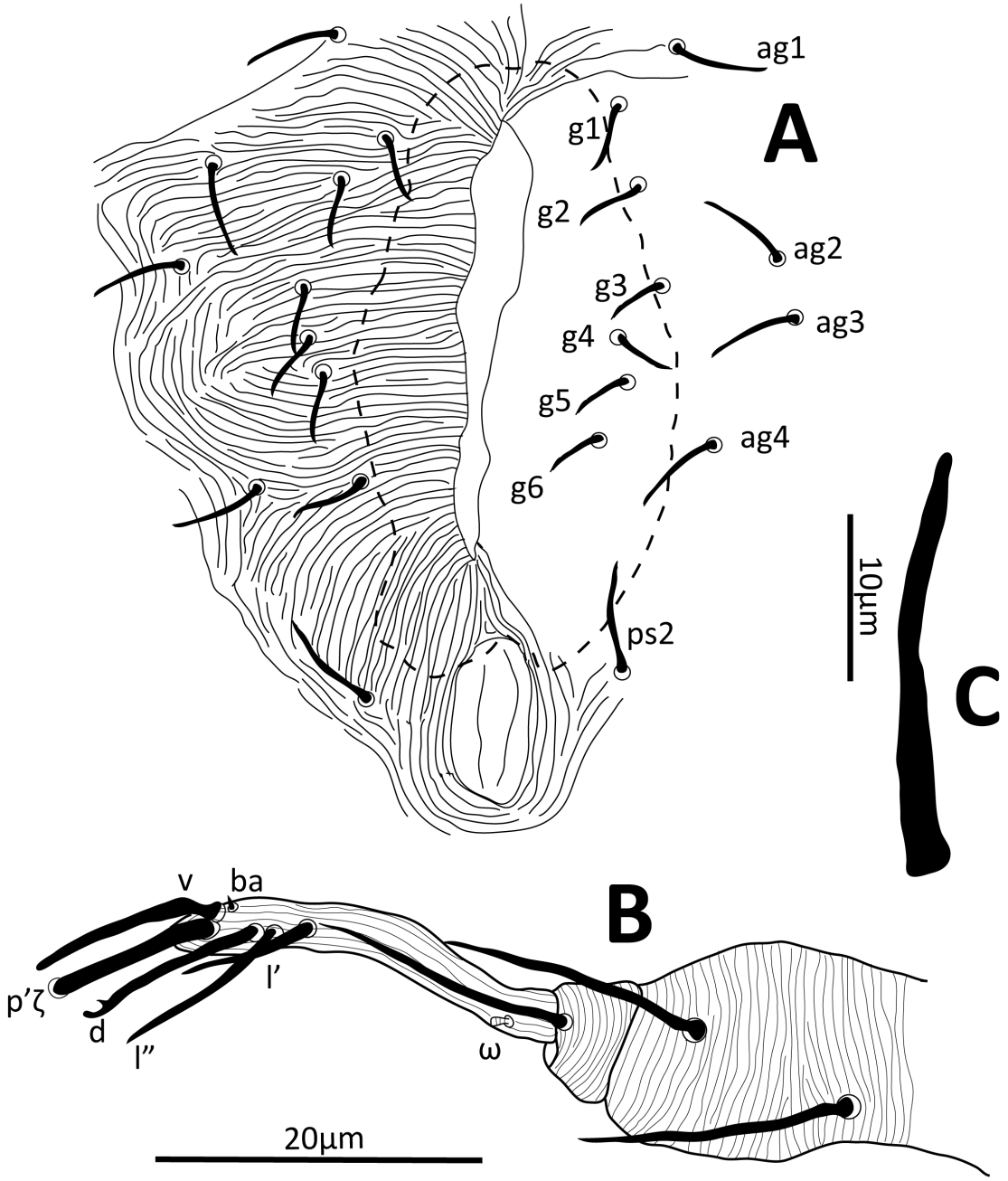


Figure 4 *Afridiolorryia kwelerhaensis* **sp. n.** Female. A – Anogenital area, B – Palp, C – Movable digit.

Legs — Length of legs I-IV as follows (trochanter to empodium): leg I 109, leg II 97, leg III 109 and leg IV 115. All legs with two claws and a hairy empodium, with empodial claws. Solenidion *ωI* 6 long, slender, straight and about half the width of the tarsus, seta *k″* on tibia I minute. Setae *l′* on tibia and genu I broadly lanceolate and serrate. Tarsus I with *ft′* and *ft″* slightly serrate and equal in length but shorter than *tc′* and *tc″*. Tarsus II with *ωII*, 3 long. Seta on genu II stout, curved and serrate. Leg formulae as follows (tarsus -trochanter): Leg I: 8(1ω)-3(1k)-2-3-0; Leg II: 6(1ω)-1-1-2-0; Leg III: 5-1-1-1-1; Leg IV: 5-1-1-1-0 (Fig. 5A-C).

Male: Unknown

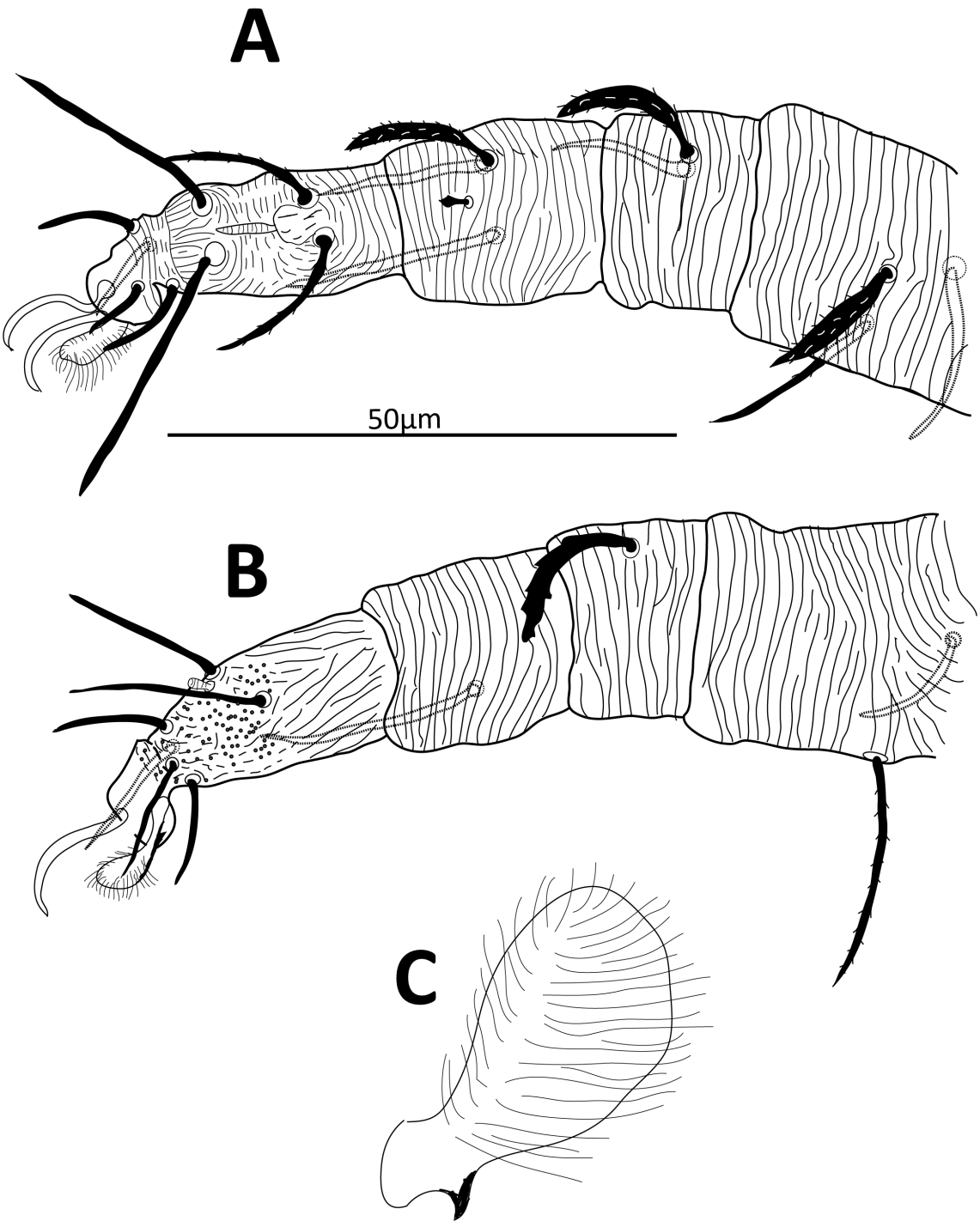


Figure 5 *Afridiolorryia kwelerhaensis* **sp. n.** Female. A – Leg I, B – Leg II, C – Empodial claw.

Etymology

This species is named after the type locality.

Remarks

Differences between the two new species and the type species as discussed under *A. psychotriae* **sp. n.** However, solenidion ωI is also straight as in *A. africnaus* **sp. n.**

Tydeus munsteri Meyer & Ryke

Tydeus munsteri Meyer & Ryke, 1959: 413; Ryke & Meyer, 1960: 266; Meyer & Rodrigues, 1966: 22; Kaźmierski, 1989b: 293; Kaźmierski, 1998: 341; Ueckermann & Grout, 2007: 2362; Da Silva *et al.*, 2016: 38.
Tydeus (*Afrotydeus*) *munsteri* (Meyer & Ryke), Baker, 1970: 165.
Orthotydeus munsteri (Meyer & Ryke), Andre, 1980: 128.

Material examined — 4 ♀ Alexandria Forest, on *Ehretia rigida* (Thunb.) Druce (Boraginaceae), 28 August 2014; 2 ♀ Alexandria Forest, on *Grewia occidentalis* L. (Malvaceae), 28 August 2014; 2 ♀, one ♂, Gunubie, East London, on *G. occidentalis*, 26 September 2014; Kwelerha, East London, on *Rhoicissus digitata* (L.f.) Gilg & M. Brandt (Vitaceae), 27 September 2014; 4 ♀, Stellenbosch, *Tecomaria capensis* (Thunb.) Spach (Bignoniaceae), 11 November 2014; 5 ♀ from Grahamstown, on *Coprosma repens* A. Rich (Rubiaceae), October 2014.

This species is characterized by the following combination of characters: all dorsal setae, except for *ro* and *la*, short and leaf-like and pointed distally, *ex* also appear pointed distally in some specimens. Setae *bo* longest and slightly spatulate distally.

World distribution — South Africa, Eswatini, Mozambique, Florida USA. This species was sampled 28 times since description, present study included (Meyer & Ryke, 1959, Ryke & Meyer, 1960, Meyer & Rodrigues, 1966, Baker, 1970 and Ueckermann & Grout, 2007).

Tydeus grabouwi Meyer & Ryke

Tydeus grabouwi Meyer & Ryke, 1959: 410; Ueckermann & Smith Meyer, 1988: 32; Kaźmierski, 1989b: 293; Kaźmierski, 1998: 344; Ueckermann & Grout, 2007: 2365; Da Silva *et al.*, 2016: 36.

Material examined — 3 ♀ Alexandria Forest, on *Rhoicissus tomentosa* (Lam.) Wild & R.B. Drumm (Vitaceae), 28 August 2014; 4 ♀ Stellenbosch, on *Erhetia* sp. (Boraginaceae), 11 November 2014; 2♀, 2♂ Hogsback, on *Berchellia* sp. (Rubiaceae), 10 October 2014

3♀Alexandria Forest, on *R. tomentosa*, 28 August 2014; 4 ♀ Stellenbosch, on *Erhetia* sp. (Boraginaceae), 11 November 2014; 2♀, 2♂ Hogsback, on *Berchellia* sp. (Rubiaceae), 10 October 2014.

This species can be recognized by having four pairs of lanceolate/clavate setae, *f2, h1–2*, and *ps1*, caudally on opisthosoma.

World distribution — South Africa. This species regularly occurs in samples from the Western and Eastern Cape Provinces.

Orfareptydeus stephani Ueckermann & Grout

Orfareptydeus stephani Ueckermann & Grout, 2007: 2358

Material examined — 3 ♀ Alexandria Forest, on *G. occidentalis* (Malvaceae), 28 August 2014.

The unique chaetotaxy of the leg femora and trochanters, namely 2-1-0-0 and 1-0-0-0, respectively distinguishes this species, the type species of the monotypic genus *Orfareptydeus*.

World distribution —This is the second record of this species after its description and therefore only known from South Africa.

Key to species of the Tydeidae

Key to species of the Tydeidae on plants with leaf domatia in the Eastern Cape and the species of the genus *Afridiolorryia* — Females.

1. Femora I-IV with 3-2-1-1 setae 2
— Femora I-IV with 2-1-0-0 setae . . . . . *Orfareptydeus stephani* Ueckermann & Grout

2. Genua I-IV with 3-2-1-1- setae; tibiae I-IV with 4-2-2-2 setae . . . . . *Tydeus* Koch – 3
— Genua I-IV with 2-1-1-1- setae; tibiae I-IV with 4-1-1-1 setae . . . . . *Afridiolorryia* Kaźmierski – 4

3. All dorsal setae except *bo, ro* and *la* short, leaf-like and pointed . . . . . *T. munsteri* Meyer & Ryke
— Setae *f2*, *h1–2*, and *ps1* lanceolate/clavate . . . . . *T. grabouwi* Meyer & Ryke

4. Solenidion *ωI* straight 5
— Solenidion *ωI* bent . . . . . *A. psychotriae* **sp. n.**

5. Setae *tc′* and *tc″* and *ft′* and *ft″* on tarsus I long, smooth and simple and almost equally long; seta *l′* on tibia I also long smooth and simple . . . . . *A. africanus* (Baker)
— Setae *tc′* and *tc″* and *ft′*and *ft″* on tarsus I not equally long, latter setae shorter and slightly serrate; seta *l′* on tibia I broadly lanceolate and serrate . . . . . *A. kweleraensis* **sp. n.**

Acknowledgements

The authors wish to thank the Centre of Excellence in Tree Health and Biotechnology (CTHB) and the Green Matter Fellowship, for providing funding for the forest visits and offering career development opportunities.

This work is based on the research supported wholly / in part by the National Research Foundation of South Africa (Grant Numbers 126938). Any opinion, findings and conclusions or recommendations expressed in the material are those of the authors and therefore the NRF does not accept any liability in regard thereto.

Declaration of Competing Interest

The authors report no declarations of interest.

References

André, H. 1980. A generic revision of the family Tydeidae (Acari: Actinedida). IV. Generic descriptions, keys and conclusions. Bull. Ann. Soc. r. belge Ent., 116: 103 - 168.

André, H. 1981a. A generic revision of the family Tydeidae (Acari: Actinedida). II. Organotaxy of the idiosoma and gnathosoma. Acarologia, 22 (1): 31-46.

André, H. 1981b. A generic revision of the family Tydeidae (Acari: Actinedida). II. Organotaxy of the legs. Acarologia, 22 (2): 165-178.

André, H., Fain, A. 2000. Phylogeny, ontogeny and adaptive radiation in the superfamily Tydeoidea (Acari: Actinedida), with a reappraisal of morphological characters. Zool.J.Linn.Soc., 130:405-448. https://doi.org/10.1006/zjls.1999.0237

Baker, E.W. 1965. A review of the genera of the family Tydeidae. Advances in Acarology, 2: 95−133.

Baker, E.W. 1970. The genus *Tydeus*: Subgenera and species groups with descriptions of new species (Acarina: Tydeidae). Ann. Entomol. Soc. Am., 63(1): 163 - 177. https://doi.org/10.1093/aesa/63.1.163

Da Silva, G.L., Metzelthin, M.H., Da Silva, O.S. & Ferla, N.J. 2016. Catalogue of the mite family Tydeidae (Acari: Prostigmata) with the world key to the species. Zootaxa, 4135 (1): 1-68. https://doi.org/10.11646/zootaxa.4135.1.1

Kaźmierski, A. 1996. A revision of the subfamilies Pretydeinae and Tydeinae (Acari: Actinedida: Tydeidae). Part III. Seven new genera and some new species of the Tydeinae, with a generic key. Mitt. Hamb. Zool. Mus. Inst., 93: 199-227.

Kaźmierski, A. 1989a. Morphological studies on Tydeidae (Actinedida, Acari). I. Remarks about the segmentation, chaetotaxy and poroidotaxy of idiosoma. Acta Zool. Cracov., 32(4): 69-83.

Kaźmierski, A. 1989b. Revision of the genera Tydeus Koch sensu André, Homeotydeus André and Orthotydeus André with description of a new genus and four new species of Tydeinae (Acari: Actinedida: Tydeidae). Mitt. Hamb. Zool. Mus. Inst., 86: 289-314.
Kaźmierski, A. 1998. Tydeinae of the world: generic relationships, new and redescribed taxa and keys to all species. A revision of the subfamilies Pretydeinae and Tydeinae (Acari: Actinedida: Tydeidae) - part IV. Acta. Zool. Cracov., 42(2): 283-455.
Meyer, M.K.P. (Smith) & Ryke, P.A.J. 1959. New species of mites of the families Tydeidae and Labidostommidae (Acarina: Prostigmata) collected from South African plants. Acarologia, 1(4): 408-420.
Meyer, M.K.P. (Smith) & Rodrigues, M.C. 1966. Acari associated with cotton in southern Africa. Garcia de Orto, 13(3):1-33.
Mucina, L., Rutherford, M.C. 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia. South African National Biodiversity Institute, Pretoria, South Africa.
Norton, A.P., English-Loeb, G., Gadoury, D., Seem, R.C. 2000. Mycophagous mites and foliar pathogens: leaf domatia mediate tritrophic interactions in grapes. Ecology 81(2): 490-499. https://doi.org/10.1890/0012-9658(2000)081[0490:MMAFPL]2.0.CO;2
O'Dowd, D.J., Willson, M.F. 1991. Associations between mites and leaf domatia. TREEree 6: 179-182. https://doi.org/10.1016/0169-5347(91)90209-G
O'Dowd, D.J, Pemberton, R. 1998. Leaf domatia and foliar mite abundance in broadleaf deciduous forest of North Asia. Am. J. Bot. 85: 70-78. https://doi.org/10.2307/2446556
Pemberton, R.W., Turner, C.E. 1989. Occurrence of predatory and fungivorous mites in leaf domatia. Am. J. Bot. 76: 105-112. https://doi.org/10.1002/j.1537-2197.1989.tb11290.x
Powrie, L.W., Rutherford, M.C., Mucina, L., Mangwale, K. 2012: National Vegetation Database of South Africa.In: Dengler, J., Oldeland, J., Jansen, F., Chytrý, M., Ewald, J., Finckh, M., Glöckler, F., Lopez-Gonzalez, G., Peet, R.K., Schaminée, J.H.J. [Eds.]: Vegetation databases for the 21st century, Biodiversity & Ecology 4: 299-299.
Robertson, M.P. and Barker, N.P., 2006. A technique for evaluating species richness maps generated from collections data. South African Journal of Science, 102(1), pp.77-84. https://hdl.handle.net/10520/EJC96492
Romero, G.Q., Benson, W.W. 2005. Biotic interactions of mites, plants and leaf domatia. Curr. Opin. Plant Biol. 8: 436-440. doi:10.1016/j.pbi.2005.05.006 https://doi.org/10.1016/j.pbi.2005.05.006
Ryke, P.A.J. & Meyer, M.K.P. (Smith). 1960. Trombidiform mites (Acarina) associated with citrus in South Africa. S. Afr. J. Sci., 56(11): 263-267.
Situngu, S., Barker, N. 2017. Position, position, position: Mites occupying leaf domatia are not uniformly distributed in the tree canopy. South Afr. J. Bot. 108: 23–28. https://doi.org/10.1016/j.sajb.2016.09.012
Situngu, S. 2017. An investigation of the leaf domatia - mite mutualism in South Africa: insights from Ecological studies. Ph.D. Thesis, Rhodes University, Grahamstown (South Africa).
Ueckermann, E.A. & Meyer, M.K.P. (Smith). 1988. South African Acari. IV. Some mites of the Addo Elephant National Park. Koedoe, 31: 31-51.
Ueckermann, E.A. & Grout, T.G. 2007. Tydeoid mites (Acari: Tydeidae, Edbakerellidae, Iolinidae) occurring on citrus in southern Africa. J. Nat. Hist., 41: 2351-2378. https://doi.org/10.1080/00222930701589921
Walter, D.E., O'Dowd, D.J. 1992. Leaves with domatia have more mites. Ecology 73: 1514-1518. https://doi.org/10.2307/1940694
Walter, D.E. 1996. Living on leaves: mites, tomenta, and leaf domatia. Annu. Rev. Entomol. 41: 101-114. https://doi.org/10.1146/annurev.en.41.010196.000533